Bottom Ash Pond
Periodic Safety Factor Assessment
General James Gavin Power Plant
Cheshire, Ohio
S&ME Project No. 26170100

PREPARED FOR:

Gavin Power, LLC
7397 St. Rt. 7 N.
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PREPARED BY:

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October 13, 2026

October 13, 2026

Gavin Power, LLC
7397 St. Rt. 7 N.
Cheshire, OH 45620

Attention: Ms. De Vann S. Sago

Reference: **Periodic Safety Factor Assessment**
Bottom Ash Pond Complex
General James Gavin Power Plant, Cheshire, Ohio
S&ME Project No. 26170100

Dear Ms. Sago:

S&ME, Inc. (S&ME) has completed a Periodic Safety Factor Assessment of the Bottom Ash Pond at the Gavin Power Plant in Cheshire, Ohio. This assessment was carried out to fulfill the requirements of 40 CFR § 257.73(e). S&ME, Inc. previously prepared the Initial and first Periodic Safety Factor Assessment for this CCR unit.

Sincerely,

S&ME, Inc.

Daniel J. Tobergte, PE
Project Engineer
Registration No. 87825

STATE OF OHIO
DANIEL J. TOBERGTE
E-87825
10/13/26
REGISTERED
PROFESSIONAL ENGINEER

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1.0 Introduction

In accordance with the Federal coal combustion residuals (CCR) Regulations as codified in Subpart D of Part 257 of Title 40 of the Code of Federal Regulations, this report has been prepared to fulfill the requirements of 40 CFR § 257.73(e) Periodic safety factor assessments. Included in this report is a background of the safety factor assessment, a description of the current conditions and operation of the CCR unit, and a discussion of the four specific items indicated in the Regulations as summarized in Section 4.0 of this report.

Throughout this report, the CCR unit is identified as the "Bottom Ash Pond" which is separate from the "Reclaim Pond", even though both comprise the "Gavin Bottom Ash Pond" per the ODNR Dam Inventory Sheet we currently have on file (2022). As discussed below, this report addresses the Bottom Ash Pond.

1.1 Background

In response to the national regulations for disposal of CCR from electric facilities formally published by the US Environmental Protection Agency (EPA) in April of 2015, American Electric Power, the owner of the Gavin Power Plant at that time, solicited the services of S&ME to develop the Initial Safety Factor Assessment report (December, 2015) for the CCR unit based on record drawings, the Bottom Ash Pond Investigation Report prepared by BBC&M Engineering, Inc. (2009, 2010), and the conditions of the unit at that time.

In October 2021, at the request of Gavin Power LLC, S&ME developed the first Periodic Safety Factor Assessment for the CCR unit, which consisted of a re-evaluation of the original seepage and stability analyses of the embankments. Based on the conditions of the CCR unit at the time of the first Periodic Safety Factor Assessment, the stability analyses used for the Initial Safety Factor Assessment were determined to be still applicable.

This Periodic Safety Factor Assessment includes an evaluation of the CCR unit representing the current conditions. As discussed in Sections 1.2 and 3.0 of this report, all CCR has been removed from the Bottom Ash Pond, the Bottom Ash Pond no longer receives plant flows, and the spillway conduit between the Bottom Ash Pond and the Reclaim Pond is no longer in service. The seepage and stability analyses presented in the previous 2021 Periodic Safety Factor Assessment have been reviewed and updated as indicated in this report.

In addition to this Periodic Safety Factor Assessment, S&ME has also prepared the Periodic Hazard Potential Classification Assessment (40 CFR § 257.73(a)(2)), the Periodic Structural Stability Assessment (40 CFR § 257.73(d)), and the Periodic Inflow Design Flood Control System Plan (40 CFR § 257.82(c)) under separate cover.

The elevations presented in this study refer to the North American Vertical Dam of 1988 (NAVD88).

1.2 Location and Geologic Conditions

The Gavin Power Plant, as shown in Figure 1-1, is located along the Ohio River, approximately 10 miles north of Gallipolis, Ohio, in Cheshire – Gallia County, Ohio. The Bottom Ash Pond, which was put into service in 1974, is located immediately south, and downstream, of the generating plant and consists of an upground earthen embankment structure. The Reclaim Pond is situated adjacent to the Bottom Ash Pond at the northeast corner.

The Bottom Ash Pond and Reclaim Pond share a common berm system and are separated by an earthen dike. The total length of the exterior embankment is 6,550 feet and the embankment varies in height, as measured above the exterior grade, from 28 to 39 feet. The pond is completely isolated from exterior surface water inflow. The original construction drawings indicate that the inboard and outboard slopes were designed with 2H:1V slope angles. The embankment was constructed as a homogenous dam.

Figure 1-1 – Gavin Plant



The natural soils beneath the Bottom Ash Pond generally include a laterally extensive, predominantly fine-grained separation layer composed primarily of clay and silt, with localized occurrences of fine sand. The separation layer is underlain by coarser-grained glacial outwash consisting predominantly of medium- to coarse-grained sand and gravel, which comprises the alluvial aquifer. Based on available geologic information and site-specific boring and monitoring well data, the alluvial aquifer extends to the underlying bedrock surface, which occurs at variable depths but is generally approximately 60 feet below natural ground surface beneath the Bottom Ash Pond.

1.3 Historic Investigations

In 2009, Mr. Rowland, one of the undersigned engineers, when in the employment of BBC&M Engineering, Inc., completed a subsurface investigation and geotechnical assessment of the Bottom Ash Pond embankments. This assessment, dated June 16, 2009, concluded that the embankment exhibited adequate factors of safety against slope failure under steady-state seepage and seismic loading conditions relative to typical US Army Corps of Engineers requirements. In 2010, BBC&M Engineering, Inc. performed a follow up geotechnical evaluation. As part of this work, the initial exploration was supplemented with additional borings and laboratory testing, and the updated slope stability analyses were updated and additional failure modes were examined, including rapid drawdown. A report documenting the additional geotechnical analysis, dated April 26, 2010, was submitted as an addendum to the 2009 report. The boring logs and laboratory test results from these investigations are included in Appendices I and II of this report.

2.0 Approach

Since S&ME previously completed the Initial and first Periodic Safety Factor Assessments for the Bottom Ash Pond embankments, the focus of this periodic update was to compare the current pond configuration, operation, and data collected from the site over the past five years to determine if the analyses performed as part of these previous assessments are still valid, and to update as necessary. To this end, the following tasks were completed by S&ME:

1. S&ME reviewed previously conducted assessment work, as well as available historic construction documents.

2. S&ME visited the site along with personnel from Gavin Power, LLC. The site visit was not a formal inspection, but rather to understand the current condition of the embankments. Additionally, the current operation of the pond complex was discussed with plant staff.

3. S&ME reviewed information developed for the pond complex since the Initial Safety Factor Assessment was completed including:

    - 2021 – 2025 Annual Inspection Reports; these reports include a record of observations made through the years as well as the available results of the piezometers installed within the pond embankments (note the 2024 and 2025 inspection reports did not include piezometer readings).
    - 2025 Annual Groundwater Monitoring and Corrective Action Report, dated January 31, 2026, which focused on groundwater quality but included data concerning the location of the groundwater table beneath the pond.

4. S&ME reviewed a site survey prepared by Burns & McDonnell in 2023, comparing it to the topographic and bathymetric survey prepared for the pond complex dated March 31, 2020 used to prepare the previous Periodic Safety Factor Assessment.

5. S&ME reviewed the latest seismic data for the site, as published by the United States Geological Survey (USGS).

3.0 Information Review and Site Visit

This Periodic Safety Factor Assessment for the Bottom Ash Pond is based on observations made and discussions regarding the operations and modifications with plant personnel during our site visit on June 5, 2026, a targeted review of historic documents related to the Bottom Ash Pond available on the facility's CCR website (namely, the Annual Engineering Inspection Reports over the past five years and the latest Annual Groundwater Monitoring and Corrective Action Report), and our past history with the Bottom Ash Pond including previously completed subsurface investigations and stability analyses of the embankments and the following pertinent documents in our files:

- Grading and Fence Plan, 1974 (Dr. No. 12-014-9)
- Excavation Plan, Not dated (Dr. No. MHD-SK-012887)
- Sections, 1971 (Dr. No. 12-3015-3)
- Principal Spillway conduit and Impact Basin, 1973 (DWG No. 670 C 205 R1)
- Principal Spillway Plan and Sections, 1973 (DWG No. 670 C 201 R2)
- Principal Spillway Floating Platform and Skimmer, 1973 (DWG No. 670 C206)
- Reclaim Pond Outlet Structure – Plan and Profile, 1994 (DWG No. 12-30408-2)
- Modification of Bottom Ash Complex Pond & Outfall Pipe, 1994 (DWG 12-30401-2)
- Bottom Ash Pond Complex Pond Outfall – Plan and Profile, 1994 (DWG 12-30407-1)
- Bottom Ash Pond Investigation, BBC&M Engineering, Inc., July, 2009
- Assessment of Dam Safety Final Report, Clough Harbour, & Assoc., September, 2009
- Addendum to Bottom Ash Pond Investigation, BBC&M Engineering, Inc. April, 2010

Additionally, S&ME used the latest site survey information obtained in 2023 by Burns & McDonnell depicting the topography of the Bottom Ash Pond following the removal of the CCR during the same year.

On June 5, 2026, the undersigned S&ME Project and Senior Engineers met with the Plant Superintendent and the Environmental Process Owner for Water of Gavin Power at the plant and conducted a site visit at the Bottom Ash Pond. The participants discussed and observed the current operations of the Bottom Ash and Reclaim Ponds, as well as changes or modifications to the ponds since the previous Periodic Structural Stability Assessment report (October 2021). Note that although the site visit was not a formal inspection, visual observations of the Bottom Ash Pond did not reveal dam safety concerns.

The most significant changes to the CCR unit since the previous Periodic Safety Factor Assessment include the current operation and condition of the Bottom Ash Pond and the Reclaim Pond. Per the Plant Superintendent, pumping of plant flows has ceased and approximately 1.5 million cubic yards of CCR material was removed from the Bottom Ash Pond in 2023. The removal of CCR was evidenced by the exposure of the underlying clay soil during removal operations. At the time of our site visit, ash was not apparent across the exposed surface of the Bottom Ash Pond as viewed from the embankment crest. Additionally, the plant flows which historically were discharged into the Bottom Ash Pond along the north embankment are currently being diverted to above-ground temporary water treatment structures prior to being discharged into the Reclaim Pond. As such, the Reclaim Pond

is currently used as an equalization basin before either the water is recirculated to the plant or discharged to the Ohio River at the NPDES outfall via a 30-inch Spirolight HDPE pipe situated near the toe of the north embankment. The spillway pipe between the Bottom Ash Pond and the Reclaim Pond has been taken out of service.

The Plant Superintendent reported that the only flow that currently enters the Bottom Ash Pond is direct rainfall, and that the water collected within the Bottom Ash Pond is removed when the depth of water reaches approximately three feet. This water is pumped out of the Bottom Ash Pond and into the Reclaim Pond using a 6-inch diesel pump rated at 800 gallons per minute with a float intake. Pumping typically occurs about 2 weeks after a rain event to allow any soil particles eroded from the inside face of the embankments to settle prior to pumping.

A comparison of the cross-sectional geometries between the recent site survey topography and the topographical information used for the previous Periodic Structural Stability Assessment indicates that the inboard slopes currently maintain the horizontal to vertical ratio of approximately 2:1 indicated on the record drawings. The main difference between the recent site survey and the survey used for the previous Periodic Structural Stability Assessment is the apparent decrease in crest width after removal of the CCR material, limited to the west and south embankments. The decrease was measured to be up to approximately 5 feet in the horizontal dimension, corresponding to a crest width of at least 20 feet in some areas. As such, although there is a difference between the surveys before and after removal of CCR, the embankment cross section appears to still align with the record drawings.

4.0 Slope Stability Analyses

In support of the Initial Safety Factor Assessment, S&ME completed slope stability analyses of the Bottom Ash Pond embankments which were re-evaluated for the first Periodic Safety Factor Assessment. The analysis was performed for the critical cross-sections that are anticipated to be most susceptible of all cross-sections to structural failure based on appropriate engineering considerations. In accordance with the requirements of 40 CFR § 257.73(e)(1), the following loading conditions and minimum factors of safety were considered for the analysis:

i. Static Factor of Safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
ii. Calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40
iii. The calculated seismic factor of safety must equal or exceed 1.00
iv. For dikes constructed of soils susceptible to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

4.1 Limit Equilibrium Analyses

4.1.1 Overview

The Initial and first Periodic Safety Factor Assessments discussed the study of one cross section on each side of the four-sided embankment. The subsurface information for each section was determined from borings and observation wells performed at those times. The groundwater information was determined from 2025 Annual Groundwater Monitoring and Corrective Action Report for the facility dated January 31, 2026, as discussed in more detail in Section 4.1.2. This Periodic Safety Factor Assessment includes an updated cross section geometry for one critical cross section as discussed further in Section 4.1.2. The Plan of Borings and soil boring logs from the previous Periodic Safety Factor Assessment have been included as Appendix I of this report. The summary of laboratory testing is included as Appendix II of this report.

4.1.2 Discussion of Information Obtained Since the Previous Assessment

Embankment Performance

The Initial and 2021 Periodic Safety Factor Assessments yielded acceptable factors of safety against slope failure for the embankments surrounding the Bottom Ash Pond. Since the previous Periodic Safety Factor Assessment, annual inspections of the CCR unit embankments were performed by Environmental Resources Management, Inc. Two items of note include erosion rills along the inboard embankment slopes and an area of shallow slope movement, both of which were observed during our site visit, which are further discussed in this section. Aside from these features, the embankments appeared to be in acceptable condition with suitable vegetation along the outboard slopes.

The shallow slope movement mentioned in the 2024 and 2025 annual inspection reports consists of a tension crack and hummocky ground along an approximately 30-foot-stretch of the west embankment outboard slope situated within the southern portion of the embankment. Although not defined as a specific topic for Periodic Structural Stability Assessments per federal regulations, S&ME agrees with the discussion in the annual inspection reports such that the movement is considered shallow based on the visual features and will need to be repaired prior to use of the pond for retention of materials/fluids. At this time, it is the opinion of S&ME that the movement does not pose an immediate threat to the embankment; however this condition should be considered for repair sooner rather than later to prevent erosion of the soils beneath the turf veneer during rain events.

The erosion rills that have formed along the inboard slopes of all embankments have become significant and will need to be filled in with suitable material prior to using the pond to store fluids/materials. Note that the rills are expected to increase in size over time and it is recommended to address the rills sooner rather than later.

Embankment Geometry

As indicated in Section 3.0 of this report, the geometry of the embankment appears to have been slightly modified during the CCR removal operations such that the embankment width has decreased by up to five feet at some locations along the west and south embankments but the horizontal to vertical ratio of the slope has remained the same. The Initial and first Periodic Safety Factor Assessment reports include the evaluation of two

cross sections – the west and south embankments, with the lower factors of safety determined for the south embankment cross section (labeled "Section B") in the previous assessment reports. As such, the same cross section "Section B" from the 2021 assessment was used for this assessment but modified such that the embankment width was shortened by 5 feet and the bottom of pond near the inboard slope was lowered to the bottom elevation of the cross section (~El. 550 feet). The soil parameters and soil stratigraphy remained the same as there was no change to these properties. The location of the "Section B" cross section from the 2021 Periodic Safety Factor Assessment is indicated in the Cross Section Location Plan included in Appendix IV of this report. Note that the inboard slope and bottom of pond at this location was generalized such that the inboard slope extends to the approximate bottom of pond elevation.

Operating Pool

As indicated in Section 3.0 of this report, the pond no longer stores CCR material or other plant flows and only stores stormwater runoff which is reportedly maintained at a depth of less than three feet by means of pumping to the Reclaim Pond. Based on the recent site survey, it appears that the water level within the pond is currently at approximately El. 553.0 feet. Note that a normal pool of El. 555.0 feet was used in the Periodic Inflow Flood Control System Plan for purposes of calculating a stage-storage curve prior to a PMF event.

Historically, the normal pool ranged between El. 573.0 feet and El. 578.5 feet with an average around El. 577.5 feet. The normal pool assumed for the Initial Safety Factor Assessment was at El. 578.0; as such, the initial seepage and stability analyses were consistent with the operations of the pond. Although the pond no longer stores water at these elevations, the stability analyses for this Periodic Safety Factor Assessment considered the same pool elevations assuming that if the pond were to be used again in the future, that a spillway with the same invert and hydraulic characteristics would be utilized.

Groundwater Information

Since the completion of the Initial Safety Factor Assessment, a series of groundwater monitoring wells have been installed around the perimeter of the Bottom Ash Pond. While the primary purpose of these wells is to obtain groundwater quality data, the wells also provide information on the elevation of the groundwater table beneath the pond which is useful for slope stability analyses. This data is summarized in the 2025 Annual Groundwater Monitoring and Corrective Action Report for the facility dated January 31, 2026. This report suggests that the groundwater table is influenced by the water level in the Ohio River. Figures 5-1 and 5-2 in the 2025 Annual Groundwater Monitoring and Corrective Action Report indicate that the elevation of the groundwater table ranges from a high of El. 542.0 to El. 540.0 (but has historically been as high as El. 547.5 feet as indicated in the previous assessment report) on the west and south sides of the pond (location of the stability analysis cross-sections). These groundwater elevations correspond to the historic piezometer readings, as indicated in the following table.

Table 4-1 – Piezometer Readings

Boring	*4/14/09*	*4/16/09*	*4/17/09*	*4/20/09*
GV-PZ-BAP-0901				541.2'
GV-PZ-BAP-0902		537.8'	541.3'	540.7'
GV-PZ-BAP-0903	545.4'		548.6'	545.0'
GV-PZ-BAP-0904			542.3'	

Elevation Datum: NAD27 / NGVD29

Additionally, the water elevations measured in these piezometers, as summarized in the annual inspection reports from 2021 to 2023, varied between approximately El. 543 feet and El. 540 feet, with the majority of the readings around El. 541 feet. Based on this, it would appear that the piezometer information collected prior to CCR removal is consistent with the data used to complete the original assessment.

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) Resource Conservation and Recovery Act Subtitle D (258) *Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* (EPA/600/R-95/051) dated 1995. The site was classified as "Soft" (per the guidance document) based on the average shear wave velocity range correlated to the average field N-values indicated in Table 20.3-1 of ASCE 7-10 and the depth of bedrock located at approximately 60 feet below the grades surrounding the embankment. The base rock peak ground acceleration (PGA) was estimated to be 0.054g 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). The free field peak ground acceleration was estimated to be 0.12g using Figures 4.4 and 4.5 in the guidance document (Seed and Idriss, 1982; Idriss, 1990; Kavazanjian and Matasović, 1994). The peak acceleration at the top of the embankment was estimated to be 0.12g using Figure 4.6 (Singh and Sun, 1995) in the guidance document. 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 of the guidance document (Kavazanjian and Matasović, 1995). This maximum acceleration at the base of the embankment was estimated to be 0.12g and was used as the seismic coefficient for the pseudo-static stability analysis. A summary of the seismic coefficient calculations is provided in Appendix III.

Conclusions

Based on our understanding of the current conditions of the Bottom Ash Pond, the stability analysis was updated for this Periodic Safety Factor Assessment. Although the water level within the pond is no longer maintained at the normal pool level during the operation of the CCR unit prior to 2023, our seepage and stability analyses consider the same normal pool level of El. 578.0 feet as used in the previous assessments. Likewise, a surcharge pool equal to 142 pounds per square foot was re-used based on the assumption that the pond, if decided to be used again for storage of fluids/materials, will have a spillway with the same invert elevation and hydraulic characteristics to that which existed prior to 2023.

4.1.3 *Phreatic Surface*

Prior to performing the limit equilibrium stability analyses, seepage analyses were performed to develop a better understanding of the likely phreatic surface within the embankment and foundation. The models were calibrated by adding additional total head boundary conditions within the subsurface to best model the groundwater table as observed in the historic piezometers and observation wells. In addition, the pool level within the pond is maintained well below the crest for operational purposes. As is apparent based on the piezometer readings, the phreatic surface is located well within the embankment and well below the outboard slope face.

4.1.4 *Shear Strength Parameters*

The shear strength parameters developed for the embankment fill and alluvial layers for use with the pseudo-static seismic analysis were evaluated in consideration of the laboratory testing results. In accordance with NRCS practice, 80 percent of the CU strength values (USACE R-Envelope) were used as recommended for impervious soils, defined by soils exhibiting a coefficient of permeability less than $1x10^{-4}$ cm/sec. Critical failure surfaces were located through a deterministic search, with no limitations on failure depth or failure surface location. The results are based on the historic pool levels and the groundwater measurements recorded from the observation wells.

Table 4-2 - Shear Strength Parameters

Material Description	γ_{wet} *(pcf)*	*Total*		*Effective*		*Reference*
		ϕ	c (psf)	ϕ'	c' (psf)	
Roadway Fill	125	34°	0	34°	0	NAVFAC
Cohesive Embankment Fill	125	17.3°†	1,430†	32°	100	CU-2 Triaxial Test (BBCM, 2010)
Upper Alluvium	125	11°†	800†	27.9°	470	CU-3 Triaxial Test (BBCM, 2010)
Lower Alluvium	125	18°†	250†	34.5°	0	CU-4 Triaxial Test (BBCM, 2010)
Loose to Med. Dense Glacial Outwash Sand and Gravel	120	32°	0	32°	0	SPT and Grain Size Correlations

† 80% of value used for pseudo-static slope stability analysis

As indicated in Section 4.1.2, slope movement appears to have occurred along an approximate 30-foot-long section of the southern portion of the west outboard embankment. Based on the observations made during our site visit, S&ME believes this movement to be generally superficial and not a deep-seated failure of the type that would compromise the integrity of the embankment. As such, it is the opinion of S&ME that the soil strength values indicated in Table 4-2, which were used for the Initial and previous Periodic Safety Factor Assessments, are still valid. Note that S&ME recommends that Gavin continue to monitor the movement including but not limited to widening of the crack, development of a head scarp, or bulging at or near the base of the movement area. It is understood that this movement will be repaired prior to the pond resumption of storing fluids/materials. Refer to Appendix III of this report for a justification of the soil parameters.

4.2 Liquefaction Potential of Embankment Soils

S&ME revised the liquefaction potential of the embankment soils based on updated assessment protocols. As the embankment is classified as a fine-grained material, representative soil samples were selected for laboratory testing consisting of water content determinations, Atterberg limits index tests, and particle size distribution analyses. The results of these laboratory tests were evaluated based on individual criteria indicating liquefaction-susceptible soils (Boulanger & Idriss, 2008; Bray & Sancio, 2006), as follows:

- Plasticity index of less than 7,
- Fines content (percent of particle sizes smaller than 0.075mm by weight) less than 50%, and
- Ratio of water content to liquid limit greater than 0.85.

Laboratory testing results from 24 samples were available from the 2009 and 2010 investigation for evaluation of the screening criteria. Of the 24 samples, 14 samples contained data to check all three screening criteria, and 12 samples contained data to check two screening criteria. Based on the results of the screening, no sample met all 3 criteria; therefore, these embankment fill soils can be considered non-liquefiable. A table depicting this evaluation is included in Appendix IV.

4.3 Summary of Results

A summary of the computed safety factors for the critical cross-section is provided in Table 5-1. Also included 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 4-3 – Safety Factor Summary

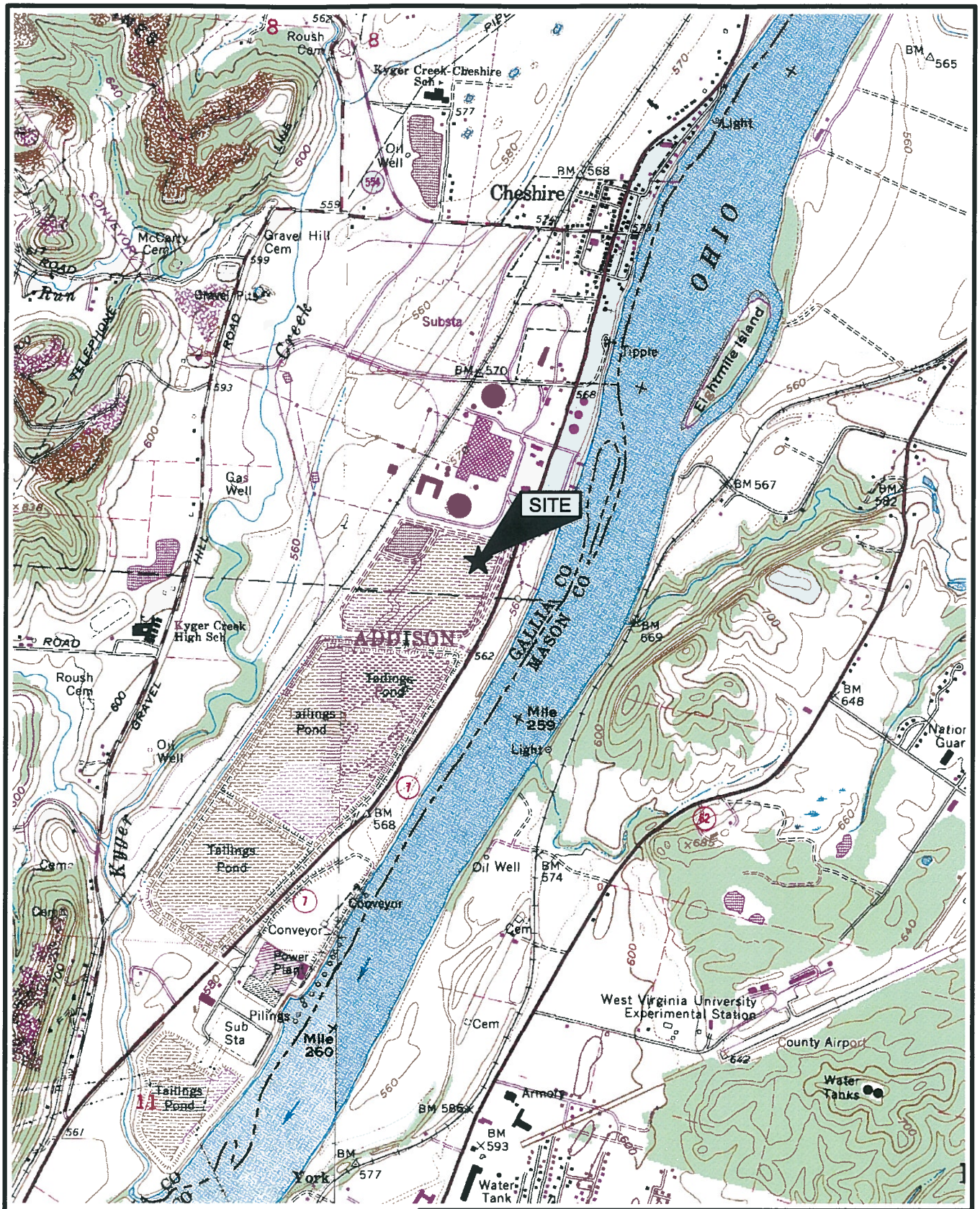
Analysis Case	Minimum Safety Factor	Computed Safety Factor
Long-term, maximum storage pool	1.50	1.76
Maximum surcharge pool	1.40	1.76
Pseudo-static seismic loading	1.00	1.17
Embankment Liquefaction	1.20	Non-liquefiable

5.0 Certification

Based on our previous investigations and current assessment of the Bottom Ash Pond facility, S&ME certifies that this assessment meets the requirements of paragraph (e)(1) of 40 CFR § 257.73 for the critical cross-section of the embankment. Note that if Gavin Power decides to store fluids/material in the pond in the future, the stability should be re-evaluated based on the anticipated conditions during the life of the pond.

Appendices

Appendix I –Site Investigation Figures





USGS Mapping:
CHESHIRE QUADRANGLE
ADDISON QUADRANGLE

VICINITY MAP

Gavin Generating Plant
Bottom Ash Pond Investigation
Cheshire, Ohio

Project: 011-11497-014	Drawn By: MTR	
Drawing Date: 6-04-2009	Approved By: MGR	
Last Updated: 6-4-2009	Scale: 1" = 2000'	1:1

BBC&M
SOLUTIONS TO BUILD ON
Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-8471
Dayton (937) 424-1011

PLATE 1

Images: ~Addison Ohio Quad Map.tif ~Cheshire Ohio Quad Map.tif ~gallia.tif
Xrefs:
File Last Updated: Jun 04, 2009
Plot Info: 6-4-2009 @ 1:42pm By: MRomanello
BBC&M Filename: I:\DEPTS\CADD\Drawings\Projects\011-11497-014\011-11497-014 VMap.dwg Layout: V-Map

DWG. NO. PLATE 2

COOLING TOWER

RECIRCULATION POND

BOTTOM ASH POND
POOL ON 3/27/09 EL. 577.9

B-500
B-501
B-502
B-503
B-504
B-505
B-506
B-507
B-508

GV-BAP-0907
GV-BAP-0908
GV-BAP-0905
GV-BAP-0911
GV-BAP-0906
GV-BAP-0909
GV-BAP-0910
GV-PZ-BAP-0901
GV-PZ-BAP-0902
GV-PZ-BAP-0903
GV-PZ-BAP-0904

T\CREST EL. 599.43
T\CREST EL. 594.17
T\CREST EL. 599.90
T\CREST EL.598.95

HAUL ROAD
SERVICE ROAD
STATE RT. 7
OHIO RIVER

BORING	NORTHING	EASTING	ELEVATION
GV-PZ-BAP-0901	339254.1	2106965.4	593.98
GV-PZ-BAP-0902	339323.7	2106865.5	567.75
GV-PZ-BAP-0903	338496.5	2107509.7	598.56
GV-PZ-BAP-0904	338376.6	2107504.2	559.80
GV-BAP-0905	338988.5	2108768.0	599.97
GV-BAP-0906	338947.0	2108876.5	569.53
GV-BAP-0907	339926.3	2108424.5	599.43
GV-BAP-0908	340056.0	2108453.1	570.49
GV-BAP-0909	339695.8	2107210.7	588.6
GV-BAP-0910	338380.4	2107102.6	562.2
GV-BAP-0911	338338.9	2107909.4	565.4
GV-BAP-0912	338959.0	2108957.0	565.9

REFERENCE: AEP GAVIN DRAWINGS

DATUM: NAD 27/NGVD 29 OHIO SOUTH

SCALE IN FEET
0 100 200

LEGEND

- 570 EXISTING GRADE CONTOUR (2 FT. INTERVAL)
- EXISTING WATER SURFACE (AT TIME OF SURVEY)
- FENCE LINE
- EXISTING VEGETATION
- GV-BAP-0908 BORING NUMBER AND LOCATION (BBCM 2009 SUPPLEMENTAL INVESTIGATION)
- GV-PZ-BAP-0901 BORING NUMBER AND LOCATION (BBCM 2009 INVESTIGATION)
- B-500 BORING NUMBER AND LOCATION (APPROXIMATE) PRECONSTRUCTION INVESTIGATION

PROJECT NUMBER:	011-11497-014	DRAWN BY:	TJM
DRAWING DATE:	5-22-2009	ENGINEER:	MTR
LAST UPDATED:	4-16-2010	APPROVED BY:	MGR
		SCALE:	1" = 100'

BBCM SOLUTIONS TO BUILD ON
Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-6471
Dayton (937) 424-7011

DATE	NO.	DESCRIPTION	APPD.
4/16/10	1	ADDENDUM TO INVESTIGATION	MGR
		REVISIONS	

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A.E.P.

GAVIN PLANT

CHESHIRE OHIO

BOTTOM ASH POND INVESTIGATION

PLAN OF BORINGS

DWG. NO. PLATE 2

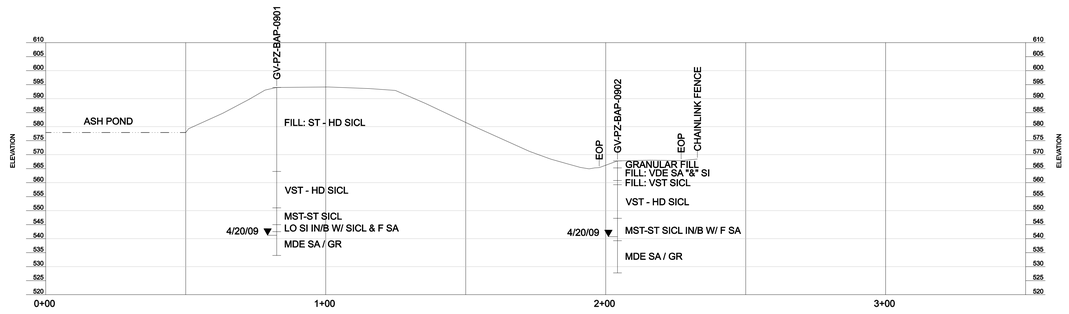
SCALE: CIVIL ENGINEERING
DR:
CH:
ENGR:
PROJ. ENGR.:
APPROVED BY:
DATE:

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

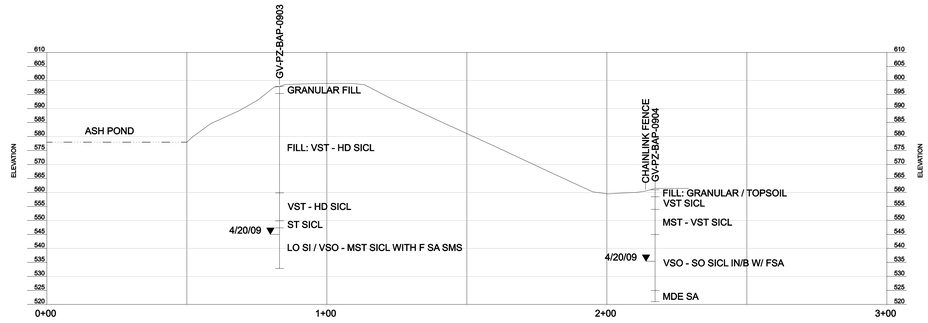
I050694

SYSTEM DATE - DD-MMM-YYYY
SYSTEM TIME - HOUR:MINUTE

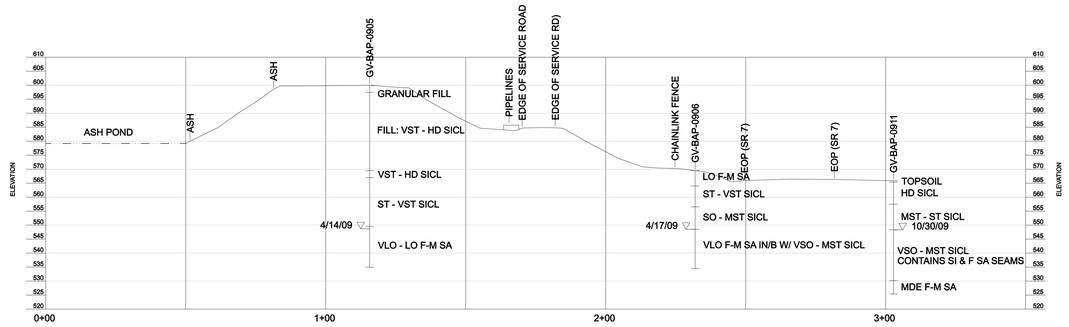
DWG. NO. PLATE 3



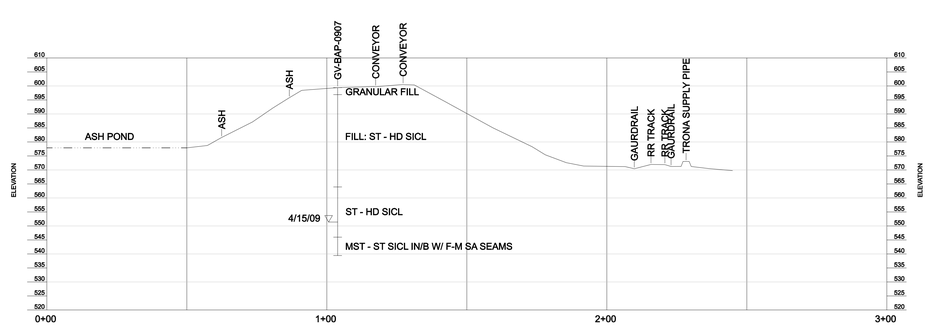
SECTION 'A'
Borings BAP-0901 & BAP-0902



SECTION 'B'
Borings BAP-0903 & BAP-0904

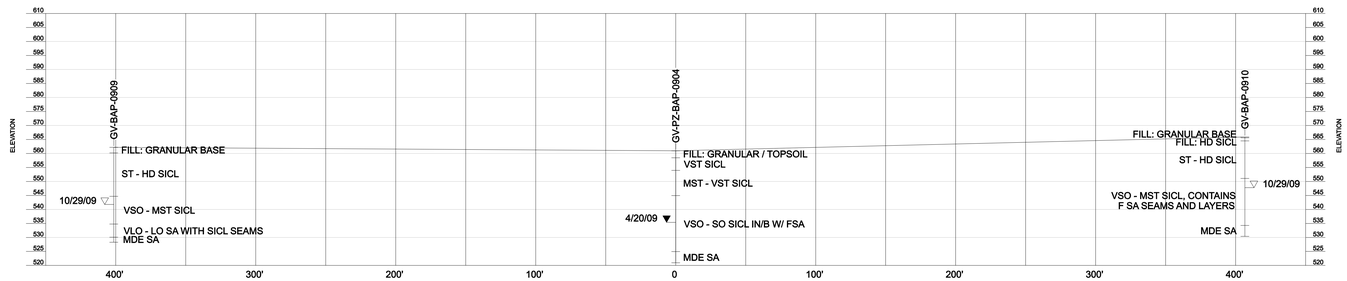


SECTION 'C'
Borings BAP-0905 & BAP-0906



SECTION 'D'
Boring BAP-0907

HORIZONTAL
SCALE IN FEET
0 20 40



PROFILE #1
Borings BAP-0904, BAP-0909, & BAP-0910

HORIZONTAL
SCALE IN FEET
0 40 80

LEGEND

4/20/09 ▼	OBSERVATION WELL READING: ELEVATION AND DATE
4/3/09 ▽	SEEPAGE ENCOUNTERED DURING DRILLING
V.SO / SO	SOFT / VERY SOFT
M.ST	M. STIFF
ST / V.ST	STIFF / VERY STIFF
HD	HARD
V.LO / LO	VERY LOOSE / LOOSE
M.DE	MEDIUM DENSE
DE / V.DE	DENSE / VERY DENSE
ORG	ORGANIC
- - - - -	EXISTING WATER SURFACE (AT TIME OF INVESTIGATION)

ELEVATION DATUM: NAD 27/NGVD 29 OHIO SOUTH

DATE	NO.	REVISIONS	APPD.
4/16/10	1	ADDENDUM TO INVESTIGATION	MGR

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A.E.P.
GAVIN PLANT
CHESHIRE OHIO

BOTTOM ASH POND
INVESTIGATION
SUBSURFACE
CROSS SECTIONS

DWG. NO. PLATE 3

SCALE:	CIVIL ENGINEERING
DR:	
CH:	
ENGR:	
PROJ ENGR:	
DATE:	

APPROVED BY

PROJECT NUMBER:	011-11497-014	DRAWN BY:	TJM
DRAWING DATE:	6-4-2009	ENGINEER:	MTR
LAST UPDATED:	4-16-2010	APPROVED BY:	MGR
		SCALE:	1" = 20'

BBCM
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Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-6471
Dayton (937) 424-1011

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

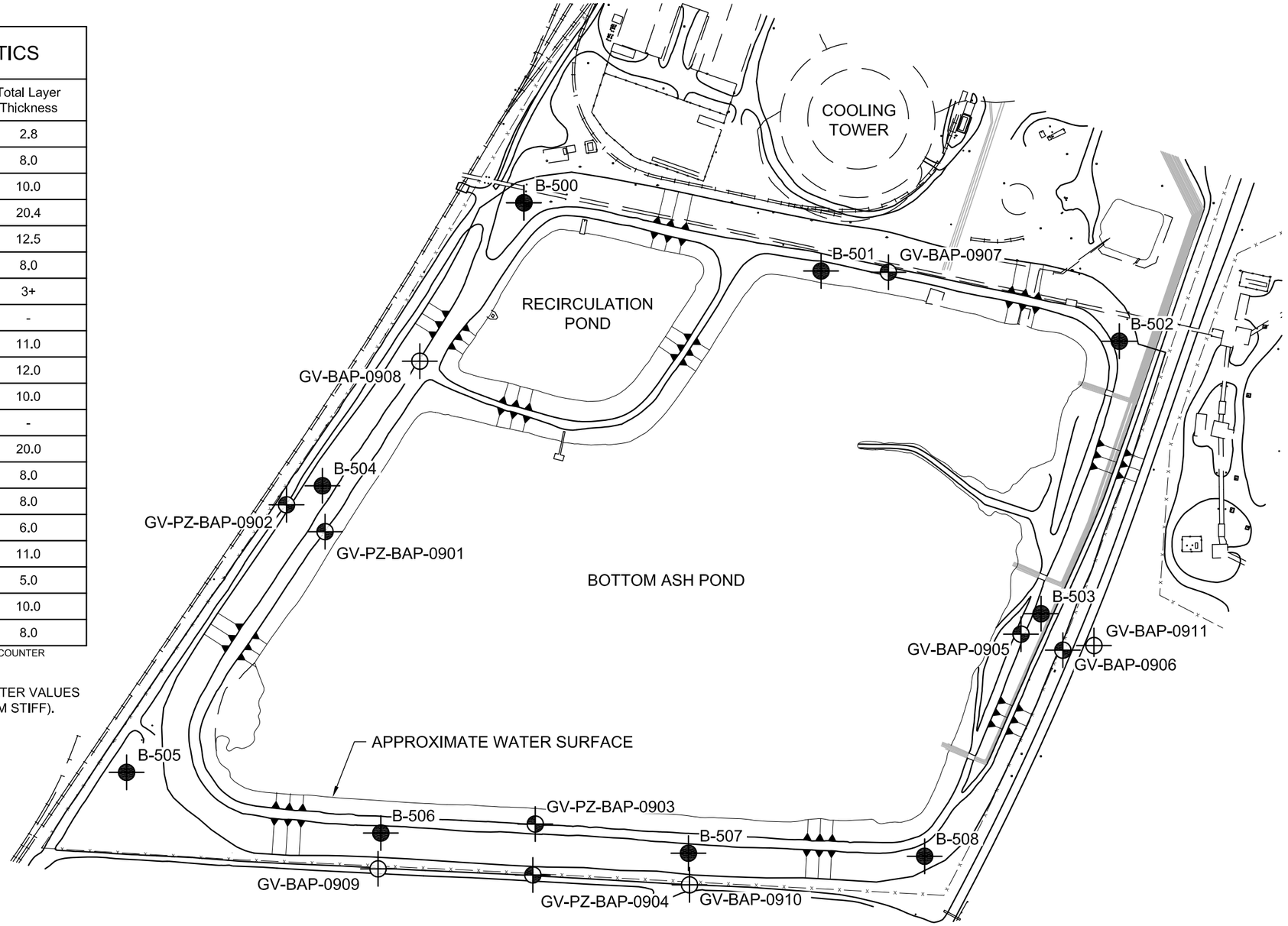
SYSTEM DATE: DD-MMM-YYYY
SYSTEM TIME: HOUR:MINUTE

IOS0694

'LOWER ALLUVIUM' CHARACTERISTICS			
Boring	Depth to Top of Layer*	Top of Layer Elevation	Total Layer Thickness
GV-PZ-BAP-0901	19.1	545.1	2.8
GV-PZ-BAP-0902	12.0	547.3	8.0
GV-PZ-BAP-0903	11.5	548.1	10.0
GV-PZ-BAP-0904	14.0	543.8	20.4
GV-BAP-0905	20.0	549.5	12.5
GV-BAP-0906	13.0	556.5	8.0
GV-BAP-0907	17.4	542.4	3+
GV-BAP-0908	-	-	-
GV-BAP-0909	17.5	542.2	11.0
GV-BAP-0910	13.5	550.4	12.0
GV-BAP-0911	17.5	548.4	10.0
B-500	-	-	-
B-501	8.0	555	20.0
B-502	10.0	558	8.0
B-503	15.0	555	8.0
B-504	10.0	553	6.0
B-505	13.0	550	11.0
B-506	14.0	547	5.0
B-507	24.0	542	10.0
B-508	16.0	553	8.0

*DEPTH TO TOP OF LAYER IS DEPTH BELOW NATURAL GROUND SURFACE ENCOUNTER

'LOWER ALLUVIUM' LAYER DEFINED BY HAND PENETROMETER VALUES RANGING FROM 0.0 TSF TO 1.0 TSF (VERY SOFT TO MEDIUM STIFF).



LEGEND

GV-BAP-0908 — BORING LOCATION BBCM 2009 SUPPLEMENTAL INVESTIGATION

GV-BAP-0901 — BORING LOCATION BBCM 2009 INVESTIGATION

B-500 — BORING LOCATION PRECONSTRUCTION INVESTIGATION

0 300 600

SCALE IN FEET

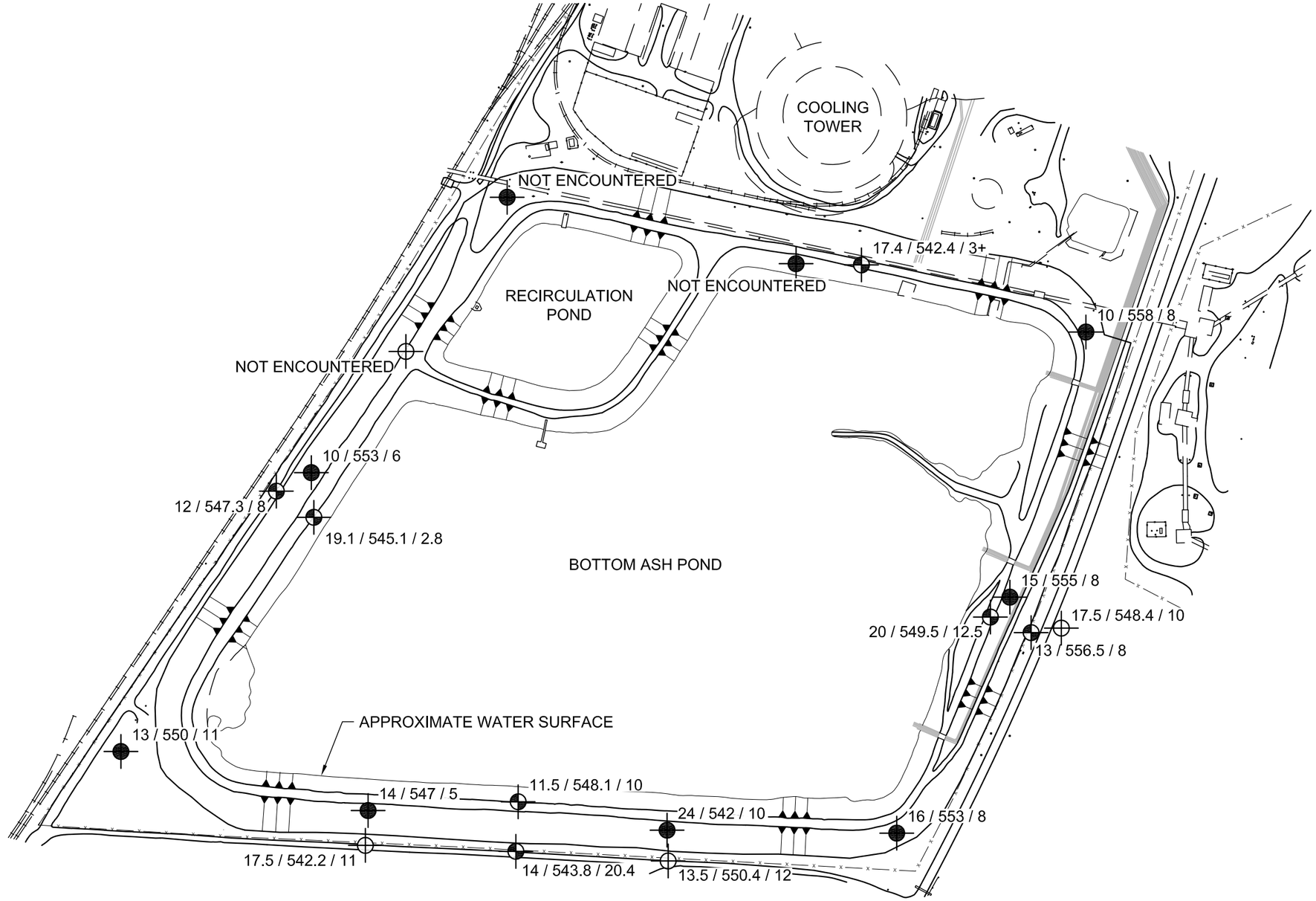
LOWER ALLUVIUM SUBSURFACE CHARACTERIZATION

Supplemental Geotechnical Investigation
AEP Gavin Plant Bottom Ash Pond
Cheshire, Ohio

Project: 011-11497-014	Drawn By: MTR	
Drawing Date: 10-07-2009	Approved By: MGR	
Last Updated: 1-21-2010	Scale: 1" = 300'	1:1

BBCM SOLUTIONS TO BUILD ON
Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-8471
Dayton (937) 424-1011

Images: ~Gavin Aerial.jpg
Xrefs:
File Last Updated: Jan 21, 2010
Plot Info: 1:28-2010 @ 6:00pm By: MRomanello
BBC&M Filename: I:\DEPTS\CADD\Drawings\Projects\011-11497-014\Isopach Map.dwg Layout: POB



LEGEND

DEPTH BELOW NATURAL GROUND SURFACE TO 'LOWER' ALLUVIUM LAYER

10 / 545 / 12

ELEVATION OF TOP OF LOWER ALLUVIUM LAYER

THICKNESS OF 'LOWER' ALLUVIUM LAYER

BORING LOCATION
BBCM 2009 SUPPLEMENTAL INVESTIGATION

BORING LOCATION
BBCM 2009 INVESTIGATION

BORING LOCATION
PRECONSTRUCTION INVESTIGATION

0 300 600

SCALE IN FEET

LOWER ALLUVIUM SUBSURFACE CHARACTERIZATION

Supplemental Geotechnical Investigation
AEP Gavin Plant Bottom Ash Pond
Cheshire, Ohio

Project: 011-11497-014	Drawn By: MTR	
Drawing Date: 10-07-2009	Approved By: MGR	
Last Updated: 1-28-2010	Scale: 1" = 300'	1:1

BBCM
SOLUTIONS TO BUILD ON
Columbus (614) 793-2226
Cleveland (216) 901-1000
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Images: ~Gavin Aerial.jpg
Xrefs:
File Last Updated: Jan 28, 2010
Plot Info: 1-28-2010 @ 6:03pm By: MRomanello
BBC&M Filename: I:\DEPTS\CADD\Drawings\Projects\011-11497-014\Isopach Map.dwg Layout: ISOPACH MAP

Appendix II –Boring Logs and Laboratory Testing Results

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

 - Blocked-in "SAMPLES" column indicates sample was attempted and recovered within this depth interval.

 - Sample was attempted within this interval but not recovered.

2/5/9 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches. The raw “blowcount” or “N” is equal to the sum of the second and third 6-inch increments of penetration. Addition of one of the following symbols indicates the use of a split-barrel other than the 2" O.D. sampler:

2S - 2½"O.D. split-barrel sampler

3S - 3" O.D. split-barrel sampler

N_{60} - Corrected Blowcount = [(BBCM Drill Rod Energy Ratio) / (0.60 Standard)] X N_{raw}

P - Shelby tube sampler, 3" O.D., hydraulically pushed.

R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.

50-2" - Number of blows (50) to drive a split-barrel sampler a certain number of inches (2), other than the normal 6-inch increment.

SD - Split-barrel sampler (S) advanced by weight of drill rods (D),

SH - Split-barrel sampler (S) advanced by combined weight of rods and drive hammer (H).

SOIL DESCRIPTIONS

All soils have been classified basically in accordance with the Unified Soil Classification System, but this system has been augmented by the use of special adjectives to designate the approximate percentages of minor components as follows:

Adjective	Percent by Weight
trace	1 to 10
little	11 to 20
some	21 to 35
"and"	36 to 50

The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot (N_{60})
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

LOG OF BORING NO. GV-PZ-BAP-0901
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **594.0** DATE: **4/9/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **64.8'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT) 10 20 30 40	TEST RESULTS
	0						ROOTMAT - 12 INCHES		
593.0									
		1		3 / 3 / 8	15	80	FILL: Very-stiff to hard brown mottled with dark-brown silty clay, trace fine to medium sand, few pockets of silt, organic silt and silty clay, few roots near top of stratum, damp.		H=4.5+
		2		4 / 6 / 8	19	100			H=4.5+
	5	3		4 / 7 / 10	23	80			H=4.5+
		4		10 / 10 / 12	30	93			H=4.0
			P						
		5				60			G H=4.0
		6		3 / 4 / 6	14	100			H=2.5-3.75
	10	7		5 / 7 / 8	21	73			H=3.5-3.75
		8		2 / 4 / 6	14	87			H=3.75
		9		2 / 4 / 6	14				H=3.0-4.0
	15	10		6 / 8 / 9	23	73			H=2.0-2.5
		11		2 / 5 / 6	15	87			LL=53% H=2.75-3.5 G
576.0									
		12		2 / 3 / 5	11	73	FILL: Stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, trace fine gravel, few roots near middle of stratum, few to many pockets of silt near bottom of stratum, damp.		H=2.5-4.5
			P						
	20	13							G H=3.5
		14		2 / 4 / 7	15	87			H=2.0-2.75
		15		4 / 7 / 9	22	100			H=1.75-2.5
	25								

WATER LEVEL: ▽ **53.4** ▼ **52.8**
WATER NOTE: **Inside HSA** **Inside Well**
DATE: **4/9/09** **4/20/09**

SYMBOLS USED TO INDICATE TEST RESULTS
G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)
H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 7**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0901
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **594.0** DATE: **4/9/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **64.8'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	25	16		9 / 14 / 17	42	80	FILL: Stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, trace fine gravel, few roots near middle of stratum, few to many pockets of silt near bottom of stratum, damp.		H=4.5+
		17		5 / 10 / 4	19	100			H=4.5+ G
		18		7 / 11 / 10	29	100			H=4.5+
564.2		19A		10 / 12 / 16	38	100			H=4.5+
563.8	30	19B				57	Hard gray mottled with dark-gray organic silty clay, trace fine to medium sand, damp.		H=4.5+
		20		5 / 10 / 14	33	100	Very-stiff to hard dark-brown mottled with brown silty clay, trace to some fine sand, trace medium to coarse sand, few to many lenses of silt, few seams of fine sand, damp becoming wet at 46.0'.		H=4.5+
		21		6 / 10 / 14	33	100			H=3.0-4.5 G
	35	22		3 / 6 / 9	21	100			H=3.0-4.5
		23		3 / 6 / 8	19	100			H=2.25-2.75
	40	24		2 / 5 / 6	15	100			H=1.5-2.75
551.0									
		25		2 / 3 / 5	11	100	Stiff brown mottled with dark-brown clayey silt, some fine sand, trace medium sand, many lenses of silt, damp.		H=1.5-2.0 G
548.5	45								
		26		1 / 2 / 3	7	100	Medium-stiff to stiff brown mottled with dark-brown silty clay, little fine sand, many lenses and seams of silt and fine sand, wet.		H=0.75-1.5
545.1		27A		2 / 3 / 3	8	100			H=0.75-1.5
	50	27B				100	Loose brown and gray mottled with dark-brown silt interbedded with silty clay and fine sand,		

WATER LEVEL: ▽ **53.4** ▼ **52.8**
WATER NOTE: **Inside HSA** **Inside Well**
DATE: **4/9/09** **4/20/09**

SYMBOLS USED TO INDICATE TEST RESULTS
G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)
H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0901
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **594.0** DATE: **4/9/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **64.8'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	50						trace medium sand, wet.		
542.3		28A		2 / 2 / 7	12	100			G
		28B				100	Medium-dense brown and gray fine sand, trace medium sand, little to some fine gravel, trace silt, few seams of silty clay, contains zones of fine to coarse gravel, wet.		
		29		8 / 9 / 12	29	80			G
	55								
		30		6 / 11 / 15	36	53			
		31		7 / 14 / 20	46	100			
	60								
		32		10 / 38 / 50-3"R		53			
529.2	65						- Encountered water at 52.0' and 55.5'. - Boring location and elevation surveyed by AEP. - Drilled 5' additional feet on April 20, 2009 and installed observation well. See separate well log.		
	70								
	75								

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

WATER LEVEL: ▽ **53.4** ▼ **52.8**

WATER NOTE: **Inside HSA** **Inside Well**

DATE: **4/9/09** **4/20/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : **0.82**

Last Calibration Date : **11/19/07**

Drill Rig Number : **D50**

LOG OF BORING NO. GV-PZ-BAP-0902
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **567.8** DATE: **4/15/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	0						ROADWAY GRANULAR BASE - 30 INCHES	
565.3								
		1		25/40/37	105	100	FILL: Very-dense gray and gray-black fine to coarse sand, little fine gravel (coal fragments), some to "and" silt, dry to damp.	
	5	2		18/26/24	68	100		
		3		10/12/11	31	100		
560.8								
		4		2/5/7	16	73	FILL: Very-stiff gray mottled with brown and dark-brown silty clay, some fine to coarse sand, trace fine gravel, moist.	H=3.0
559.3								
		5		2/6/10	22	87	Very-stiff to hard brown mottled with gray silty clay, little to some fine to medium sand, trace coarse sand, desiccated near bottom of stratum, moist.	H=3.5-4.5
	10							
		6		3/5/10	21	100		H=4.5+
		7		2/5/6	15	100		H=3.0-4.5
	15							
		8		3/5/7	16	100		H=3.0-3.5
		9		3/5/7	16	100		H=2.0-2.5 G
547.3	20							
		10		2/2/5	10	100	Medium-stiff to stiff brown mottled with gray silty clay, interbedded with fine to medium sand, trace coarse sand, trace fine gravel seams near bottom of stratum, moist to wet.	H=1.0-1.5
		11		1/2/5	10	100		H=0.5-1.5 G
	25							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ 29.0 ▼ 30.0
WATER NOTE: Inside HSA Inside Well
DATE: 4/15/09 4/16/09

SYMBOLS USED TO INDICATE TEST RESULTS
G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves
H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0902
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **567.8** DATE: **4/15/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	25	12		SH / 2 / 4	8	80	Medium-stiff to stiff brown mottled with gray silty clay, interbedded with fine to medium sand, trace coarse sand, trace fine gravel seams near bottom of stratum, moist to wet.		H=0.5-0.75
539.3									
		13		1 / 3 / 2	7	80	Loose brown fine to coarse sand, trace fine gravel, interbedded with very-soft silty clay, wet.		
	30								
536.8		14		2 / 4 / 10	19	80	Medium-dense brown fine to coarse sand, little fine gravel, trace silt, wet.		G
		15		4 / 6 / 7	18	47			
	35								
		16		3 / 4 / 9	18	93			
		17		4 / 6 / 11	23	80			
527.8	40						- Encountered seepage at 27.0'. - Encountered water at 29.0'. - Boring location and elevation surveyed by AEP. - Borehole converted to observation well upon completion. See separate well log.		
	45								
	50								

WATER LEVEL: ▽ **29.0** ▼ **30.0**

WATER NOTE: **Inside HSA** **Inside Well**

DATE: **4/15/09** **4/16/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

JOB: 011.11497.014

PLATE 11

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0903
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **598.6** DATE: **4/10/09 - 4/13/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	0						FILL: Cinders, dark-gray fine to medium sand, trace coarse sand, trace fine gravel, little silt, dry.	10 20 30 40	
		1		2 / 1 / 2	4	53			
596.1							FILL: Very-stiff to hard brown and dark-brown mottled with gray silty clay, trace fine to coarse sand, contains zones with trace fine gravel, contains pockets of bottom ash, few pockets of silt near bottom of stratum, damp becoming moist at 21.0'.		
		2		2 / 2 / 5	10	60			H=1.25-3.5
	5	3		3 / 4 / 5	12	87			H=4.0-4.5
		4		P		13			
		5		6 / 7 / 9	22	100			H=4.0
	10	6		3 / 4 / 5	12	73			H=2.0-4.0
		7		5 / 7 / 9	22	67			H=2.5-3.0
		8		5 / 6 / 7	18	73			H=2.0-3.0
		9		2 / 4 / 6	14	60			H=1.5-2.5
	15								LL=52%
		10		4 / 7 / 10	23	67			H=2.5-3.5 G
		11		3 / 4 / 6	14	73			H=1.5-2.0
		12A		4 / 5 / 7	16				H=2.0-2.5
		12B							
		12C							H=1.75-2.5
	20	13		4 / 6 / 8	19	73			H=2.5-3.0
		14		3 / 5 / 7	16	100			H=2.5
		15		3 / 6 / 9	21	87			H=2.5-3.5
573.9		16A		5 / 6 / 8	19	100			H=3.5-4.0
	25	16B				100			H=4.5+

WATER LEVEL: ▽ **60.3** ▼ **53.2**
WATER NOTE: **Inside HSA** **Inside Well**
DATE: **4/13/09** **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0903
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **598.6** DATE: **4/10/09 - 4/13/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	25	17		9 / 14 / 14	38	33	FILL: Very-stiff to hard brown mottled with dark-brown and gray silty clay, trace fine to coarse sand, slightly organic, thin seam of gray mottled with dark-gray silt at top of stratum, moist.		H=3.0-4.0
		18		3 / 7 / 10	23	93			H=3.5-4.0
		19		7 / 12 / 13	34	80			H=2.75-3.5
568.1	30	20		3 / 6 / 9	21	100	FILL: Hard brown silty clay intermixed with gray organic silt, trace fine to medium sand, moist.		H=3.5-4.5
565.6		21		3 / 6 / 10	22	80	FILL: Hard brown mottled with dark-brown and gray silty clay, trace fine to coarse sand, trace fine gravel, moist.		H=2.5-3.5 G
	35	22		4 / 9 / 13	30	100			H=3.0-4.5
559.6		23A		4 / 9 / 11	27	100			H=3.0-4.0
		23B				100	Stiff to hard brown mottled with dark-brown and gray silty clay, trace fine to medium sand, few lenses of silt and seams of fine sand near bottom of stratum, moist.		H=4.5+
	40	24		4 / 6 / 9	21	100			LL=53% H=2.0-3.5 G
		25		2 / 6 / 9	21	100			H=2.0-4.0
	45	26		2 / 5 / 8	18	100			H=2.0-2.5
550.6		27		1 / 4 / 5	12	100	Stiff brown mottled with dark-brown and gray silty clay, few lenses of silt and fine sand, moist.		H=1.0-1.75
	50								

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

WATER LEVEL: ▽ **60.3** ▼ **53.2**
WATER NOTE: **Inside HSA** **Inside Well**
DATE: **4/13/09** **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS
G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)
H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 13**

LOG OF BORING NO. GV-PZ-BAP-0903
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **598.6** DATE: **4/10/09 - 4/13/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
548.1	50							10 20 30 40	
		28		1/3/3	8	100	Loose brown silt interbedded with silty clay, trace to little fine to medium sand, contains seams of fine sand, moist to wet.		H=0.5-1.0
		29		1/2/3	7	100			H=0.0-0.5
543.1	55								
		30		SH/2/3	7	100	Very-soft to medium-stiff brown mottled with gray and dark-gray silty clay, trace to little fine sand, few lenses of silt and fine sand, contains decayed vegetation, wet.		H=0.8 G
		31		2/5/3	11	100			H=0.2-0.4
538.1	60								
		32		1/5/6	15	100	Medium-dense brown and gray fine sand interbedded with silty clay and silt, trace fine to medium sand, wet.		
535.6									
		33		3/4/6	14	100	Medium-dense gray silt interbedded with silty clay, little fine sand, few seams of fine sand, wet.		H=1.5
533.6	65								
							- Encountered water at 55.3'. - Boring location and elevation surveyed by AEP. - Borehole converted to observation well upon completion. See separate well log.		
	70								
	75								

WATER LEVEL: ▽ **60.3** ▼ **53.2**

WATER NOTE: **Inside HSA** **Inside Well**

DATE: **4/13/09** **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0904
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **559.8** DATE: **4/16/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	0						TOPSOIL - 12 INCHES	
558.8								
		1		24 / 36 / 14	68	67	FILL: Very-dense gray fine to coarse gravel "and" fine to coarse sand, some silt, dry.	
557.8							Very-stiff gray mottled with brown and brown mottled with gray silty clay, little to some fine to coarse sand, trace fine gravel, dry.	
		2		3 / 5 / 8	18	80		H=2.0-3.0
		3		2 / 3 / 5	11	80		H=2.25-2.75
	5							
		4		4 / 4 / 6	14	100		H=2.5-3.0
552.8								
		5		SH / 2 / 3	7	87	Medium-stiff to stiff brown mottled with gray silty clay, trace fine to coarse sand, moist.	H=0.50-1.0 G
		6	P					
	10							
548.8								
		7		3 / 4 / 7	15	100	Stiff to very-stiff brown mottled with gray and dark-brown silty clay, little to some fine to medium sand, trace coarse sand, dry.	H=2.5-3.25
		8		2 / 3 / 4	10	80		H=1.5-2.5
	15							
543.8								
		9		SH=14" / 2	2	100	Very-soft to soft brown mottled with gray silty clay, interbedded with fine to medium sand, contains fine to medium sand seams and lenses, damp to moist becoming wet.	H=0.25-0.5
		10		SH / SH / 1	1	87		H=0.0
	20							
		11		SR / 2 / 2	5	67		H=0.0
536.3								
		12		SH / 1 / 3	5	73	Very-soft to stiff gray silty clay, interbedded with fine to medium sand and silt seams/thin layers, wet.	H=0.25-1.0
	25							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ 23.1 ▼ 17.5
WATER NOTE: Inside HSA Inside Well
DATE: 4/16/09 4/17/09

SYMBOLS USED TO INDICATE TEST RESULTS
G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)
H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 15**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-PZ-BAP-0904
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **559.8** DATE: **4/16/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	25						Very-soft to stiff gray silty clay, interbedded with fine to medium sand and silt seams/thin layers, wet.	10 20 30 40	
		13		SH / SH / 2	2	80			
		14		SH / 2 / 2	5	67			H=1.0-1.25 G
	30								
		15A		3 / 9 / 5	19	100			
		15B				75			H=1.5
		16		1 / 2 / 9	15	80			
	35								
523.4		17A		1 / 6 / 10	22	100			
		17B				55	Medium-dense brown fine to coarse sand, little to some fine to coarse gravel, trace silt, wet.		
		18		9 / 6 / 10	22	87			
519.8	40						- Encountered water at 21.0' - Boring location and elevation surveyed by AEP. - Borehole converted to observation well on 4/17/09. See separate well log.		
	45								
	50								

WATER LEVEL: ▽ **23.1** ▼ **17.5**

WATER NOTE: **Inside HSA** **Inside Well**

DATE: **4/16/09** **4/17/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014

PLATE 16

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0905
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **600.0** DATE: **4/14/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	0						FILL: Medium-dense bottom ash.	
		1		4 / 6 / 5	15	100		H=4.0-4.5+
597.5							FILL: Very-stiff to hard brown mottled with gray silty clay, trace to some fine sand, trace medium to coarse sand, contains zones with trace fine gravel, dry to damp becoming moist at 16.0'.	
		2		6 / 7 / 8	21	100		H=4.0-4.5+
	5	3		4 / 4 / 6	14	73		H=3.5-4.0
		4		4 / 6 / 7	18	80		H=2.5-3.25
		5		2 / 3 / 5	11	80		H=2.5-2.75
		6		3 / 4 / 5	12	100		H=2.0-2.5
	10	7		7 / 7 / 8	21	87		H=2.0-4.0
		8		3 / 4 / 7	15	100		H=3.25-4.0 G
		9		3 / 4 / 7	15	87		H=1.5-3.0
	15	10		7 / 8 / 9	23	33		H=2.0-2.5
		11		2 / 4 / 7	15	87		H=3.0-4.5
		12		3 / 5 / 7	16	100		H=3.0-3.5
	20	13		6 / 9 / 12	29	67		H=2.75-4.0
		14		P		100		H=3.5 G
		15		5 / 7 / 8	21	87		H=3.5-4.5
	25	16		3 / 5 / 7	16	67		H=4.5+

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ **57.5** ▼
WATER NOTE: **Inside HSA**
DATE: **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation
Q - Uncon Comp
T - Triax Comp
C - Consol.
} See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 17**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0905
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **600.0** DATE: **4/14/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	25						FILL: Very-stiff to hard brown mottled with gray silty clay, trace to some fine sand, trace medium to coarse sand, contains zones with trace fine gravel, dry to damp becoming moist at 16.0'.	
		17		7 / 8 / 9	23	67		H=3.75-4.25 G
		18		4 / 6 / 8	19	100		H=3.0-4.5+
		19		8 / 11 / 13	33	100		H=4.0-4.5
569.5	30							
		20		2 / 4 / 7	15	100	Very-stiff to hard dark-brown mottled with gray silty clay, some fine to medium sand, trace coarse sand, moist.	H=2.0-4.0
567.0								
		21		2 / 4 / 6	14	100	Very-stiff brown silty clay "and" fine to coarse sand, moist.	H=2.5-4.0 G
564.5	35							
		22		2 / 2 / 4	8	100	Stiff brown clayey silt, some fine sand, trace medium sand, moist.	H=1.0 G
562.0								
		23		2 / 4 / 5	12	100	Stiff to very-stiff brown mottled with gray silty clay, trace fine to coarse sand, contains lenses of silt near bottom of stratum, moist.	H=2.0-2.5
	40							
		24		4 / 5 / 7	16	100		H=1.5-2.0
		25		2 / 3 / 4	10	100		H=1.0-2.0 G
	45							
		26		1 / 2 / 4	8	100		H=1.0-1.5
		27		1 / 2 / 3	7	100		H=1.0-1.5
	50							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ **57.5** ▼
WATER NOTE: **Inside HSA**
DATE: **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation
Q - Uncon Comp
T - Triax Comp
C - Consol.
} See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 18**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0905
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **600.0** DATE: **4/14/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **65.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
549.5	50								
		28		1 / 1 / 2	4	100	Very-loose brown fine to medium sand, trace coarse sand, some silt, contains seams of brown silt and seams of silty clay, wet.		H=0.5
		29		1 / 1 / 1	3	100			G
	55								
		30 ▽		SH / SH / 4	5	100			
		31		2 / 2 / 2	5	100			
	60								
		32		2 / 2 / 6	11	100			
537.0									
536.1		33A		2 / 3 / 5	11	100	Loose to medium-dense gray fine to medium sand, trace silt, iron oxide stains, wet.		
		33B				100	Loose to medium-dense gray silt interbedded with fine sand and silty clay seams, wet.		
535.0	65						- Encountered water at 51.3'. - Boring location and elevation surveyed by AEP. - Boring backfilled with grout upon completion.		
	70								
	75								

WATER LEVEL: ▽ **57.5** ▼

WATER NOTE: **Inside HSA**

DATE: **4/14/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

JOB: 011.11497.014

PLATE 19

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0906
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **569.5** DATE: **4/17/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **35.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT) 10 20 30 40	TEST RESULTS
	0						TOPSOIL - 12 INCHES		
568.5									
		1		3 / 2 / 3	7	33	Loose brown fine to medium sand, some silty clay, dry.		H=1.0-1.5
		2		1 / 3 / 4	10	53			H=1.0-1.25
	5	3		1 / 2 / 4	8	100			H=1.0-1.75
564.0									
562.5		4		2 / 4 / 5	12	80	Very-stiff brown silty clay, some fine to medium sand, trace coarse sand, dry.		H=2.25-3.75 G
		5		3 / 4 / 6	14	100	Stiff to hard brown mottled with gray silty clay, trace fine to medium sand, dry.		H=3.25-4.0
		6		3 / 5 / 7	16	100			H=3.0-3.75
	10								
		7		1 / 2 / 4	8	100			H=1.5-2.5
556.5									
		8		SH / 1 / 2	4	87	Soft to medium-stiff brown mottled with gray silty clay, trace to little fine to medium sand, many silt lenses near bottom of stratum, dry becoming damp.		H=0.5-0.75
	15								
		9		SH / 2 / 3	7	93			H=0.25-0.75
		10		SH / 1 / 1	3	100			H=0.25 G
	20								
548.5									
		11		SH / SH / 1	1	67	Very-loose brown fine to medium sand, interbedded with very-soft to medium-stiff silty clay, wet.		H=0.0
		12		SH / 1 / 3	5	47			
	25								

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

WATER LEVEL: ▽ **21.2** ▼
WATER NOTE: **Inside HSA**
DATE: **4/17/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014 -CONTINUED- **PLATE 20**

LOG OF BORING NO. GV-BAP-0906
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **569.5** DATE: **4/17/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **35.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler, 3" O.D. Shelby Tube Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	25						Very-loose brown fine to medium sand, interbedded with very-soft to medium-stiff silty clay, wet.	10 20 30 40	
		13	SH	2/3	7				
		14		1/1/2	4	100			G
	30								
		15	SH	1/2	4	87			H=0.5
		16		1/2/2	5	80			H=0.75
534.5	35						- Encountered seepage at 18.5'. - Encountered water at 21.0'. - Boring location and elevation surveyed by AEP. - Boring backfilled with grout upon completion.		
	40								
	45								
	50								

WATER LEVEL: ▽ **21.2** ▼

WATER NOTE: **Inside HSA**

DATE: **4/17/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82
Last Calibration Date : 11/19/07
Drill Rig Number : D50

JOB: 011.11497.014

PLATE 21

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0907
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **599.4** DATE: **4/14/09 - 4/15/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **60.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT) 10 20 30 40	TEST RESULTS
	0						FILL: Medium-dense bottom ash.		
		1		9 / 9 / 11	27	100			H=4.0-4.5+
596.9									
		2		7 / 8 / 11	26	100	FILL: Very-stiff to hard brown mottled with gray silty clay, trace fine to coarse sand, trace fine gravel, iron oxide stains near top of stratum, dry to damp.		H=4.0-4.5+
		3		3 / 5 / 7	16	100			H=3.5-4.5+
	5								
		4		6 / 8 / 8	22	100			H=1.0-2.0
592.4									
		5		2 / 3 / 6	12	100	FILL: Stiff to hard brown mottled with gray silty clay, some fine sand, trace medium to coarse sand, trace fine gravel, damp becoming moist at 17.5'.		H=2.0-3.5
		6		3 / 5 / 6	15	100			H=3.0-3.5
	10								
		7		6 / 7 / 8	21	100			H=3.0-3.5
		8		2 / 5 / 6	15	80			H=2.5-3.5
		9		2 / 4 / 5	12	73			H=2.5-3.5 G
	15								
		10		5 / 7 / 6	18	87			H=2.0-3.5
		11		3 / 4 / 6	14	80			H=1.5-2.5
				P					G
		12							H=2.0-2.5
	20								
		13		2 / 4 / 5	12	87			H=2.5-3.5
		14		2 / 2 / 6	11	67			H=2.0-2.5
		15		6 / 7 / 9	22	7			H=2.5-4.0
		16		2 / 4 / 6	14	100			H=2.0-3.5
	25								

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **Inside HSA**

DATE: **4/15/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0907
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **599.4** DATE: **4/14/09 - 4/15/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **60.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	25	17		8 / 11 / 11	30	100	FILL: Stiff to hard brown mottled with gray silty clay, some fine sand, trace medium to coarse sand, trace fine gravel, damp becoming moist at 17.5'.		H=2.5-3.5
		18		3 / 5 / 7	16	100			H=2.0-4.0
		19		2 / 5 / 6	15	100			H=3.5-4.5
	30	20		3 / 5 / 6	15	100			H=2.0-3.5
		21		4 / 7 / 8	21	100			H=3.5-4.5 G
563.9	35	22		4 / 7 / 10	23	100	Very-stiff to hard brown mottled with gray silty clay, trace to little fine to coarse sand, moist.		H=4.5+
		23		4 / 6 / 8	19	100			H=4.5+ G
	40	24		1 / 2 / 5	10	80			H=2.5-4.5
		25		4 / 6 / 11	23	100			H=3.5-4.5
553.4	45	26		2 / 5 / 7	16	100	Stiff to very-stiff brown silty clay, some to "and" fine to coarse sand, contains zone of brown fine to medium sand, moist.		H=2.0-3.5 G
		27		2 / 5 / 6	15	100			H=2.0
	50								

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **Inside HSA**

DATE: **4/15/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0907
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **599.4** DATE: **4/14/09 - 4/15/09**

DRILLING METHOD: **4-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **60.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	50						Stiff to hard brown silty clay, some to "and" fine to coarse sand, contains zone of brown fine to medium sand, moist.		
		28		2 / 2 / 4	8	80			H=1.5-2.0 G
546.4									
		29		1 / 2 / 6	11	67	Stiff brown mottled with gray silty clay interbedded with fine to medium sand and silt seams, iron oxide stains near bottom of stratum, moist.		H=1.0-1.5
	55								
542.4		30		SH / 1 / 2	4	80			H=1.0-1.5
							Loose brown fine to medium sand, interbedded with silt and silty clay seams, iron oxide stains, moist..		
539.9		31A		1 / 2 / 5	10	100			H=0.5-1.0
539.4		31B				100	Medium-stiff gray silty clay "and" fine sand, iron oxide stains, moist.		H=0.5-1.0
	60						- Encountered seepage at 48.0'. - Boring location and elevation surveyed by AEP. - Boring backfilled with grout upon completion.		
	65								
	70								
	75								

WATER LEVEL: ▽ **"Dry"** ▼

WATER NOTE: **Inside HSA**

DATE: **4/15/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.82

Last Calibration Date : 11/19/07

Drill Rig Number : D50

JOB: 011.11497.014

PLATE 24

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0908
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **588.6** DATE: **10/28/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **55.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT / PLASTIC LIMIT / LIQUID LIMIT (10 20 30 40)	TEST RESULTS
588.3	0						ASH/BOILER SLAG		
		01		5 / 5 / 5	14	100	FILL: Very-stiff to hard brown mottled with dark brown silty clay, some fine sand, trace medium to coarse sand, trace fine gravel, damp.		H=3.25-4.5+
		02		2 / 4 / 4	11	87			H=3.75-4.5
	5	03		3 / 4 / 5	13	93			H=3.5
		04		P					T H=3.5
	10								G
		05		3 / 3 / 6	13	100			H=3.25-4.5
575.6							FILL: Very-stiff to hard brown mottled with gray and dark-brown silty clay, some fine sand, trace medium to coarse sand, trace fine gravel, few lenses of silt.		
		06		2 / 4 / 5	13	100			H=3.25-4.5
	15								G
		07		3 / 4 / 6	14	100			H=3.25-4.5+
		08		5 / 8 / 11	27	100			H=4.5+
	20								
		09		4 / 6 / 7	18	100			H=4.5+
		10		P					H=4.5+
563.6	25								

WATER LEVEL: ▽ **50.1** ▼
WATER NOTE: **Inside HSA**
DATE: **10/28/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

JOB: 011.11497.014 -CONTINUED- **PLATE 25**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0908
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **588.6** DATE: **10/28/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **55.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	25								
562.7		11A		4 / 6 / 9	21	100	Dark-gray silt, trace fine to coarse sand, trace fine gravel, slightly organic, damp.		H=4.5+
		11B					Hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, trace fine gravel, damp.		H=4.5+
559.5		12A		2 / 3 / 4	10	100			H=4.5+
		12B					Hard dark-brown mottled with gray and brown and gray silty clay, trace fine sand, few lenses of silt, damp.		H=4.5+
	30								
556.9		13A		3 / 7 / 9	23	100			H=4.5+ G
		13B					Very-stiff to hard brown silty clay, little fine sand, few lenses of silt, damp.		H=4.5+
		14		3 / 6 / 8	20	100			H=4.5+
		15		3 / 6 / 7	18	100			H=3.1-3.4
553.1	35								
		16		3 / 5 / 7	17	100	Very-stiff to hard brown mottled with gray and dark-brown silty clay, little fine sand, few lenses of fine sand and silt, moist.		H=4.3
		17		3 / 3 / 7	14	100			H=2.7-3.3
550.1									
		18		2 / 3 / 4	10	100	Stiff to very-stiff brown mottled with dark-brown and gray silty clay interbedded with fine sand and silt, some fine sand, trace medium to coarse sand, trace fine gravel, moist becoming wet.		H=1.8 G
	40								
		19		2 / 3 / 3	9	100			H=2.0
547.1									
		20		1 / 3 / 5	11	100	Stiff to very-stiff brown silty clay, little to some fine to medium sand, few lenses of fine sand and silt near top of stratum, moist becoming wet.		H=2.4-3.1
			P						
		21							H=1.5
543.0	45								
		22A		4 / 5 / 4	13	100	Medium-dense brown and dark-brown fine sand, trace medium sand, trace silt, few silty clay seams.		
		22B							
540.9		23A		7 / 11 / 9	28	100	Medium-dense brown and dark-brown fine to coarse sand, some fine gravel, trace silt.		
		23B							
			3						
	50								

WATER LEVEL: ▽ 50.1 ▼
WATER NOTE: Inside HSA
DATE: 10/28/09

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0908
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **588.6** DATE: **10/28/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **55.0'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
	50	24		6 / 9	21	93	Medium-dense brown and dark-brown fine to coarse sand, some fine gravel, trace silt.	10 20 30 40	
		25		1 / 2 / 7	13	53			
		26		WR / 2 / 8	14	100			
533.6	55						- Encountered seepage at 39.5'. - Encountered water at 46.1'. - Boring backfilled with cement-bentonite grout upon completion. - Boring location and elevation surveyed by AEP.		
	60								
	65								
	70								
	75								

WATER LEVEL: ▽ **50.1** ▼
WATER NOTE: **Inside HSA**
DATE: **10/28/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

JOB: 011.11497.014

PLATE 27

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0909
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **562.2** DATE: **10/29/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **33.9'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
	0						ROADWAY GRANULAR BASE - 29 INCHES		
		01A		21 / 49 / 41	128				
559.7									
559.2							Hard brown clayey silt, trace fine to coarse sand, slightly organic, damp.		
		02		2 / 4 / 4	11		Very-stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, damp.		H=4.2-4.5+
		03		3 / 4 / 4	11				
	5								
		04		2 / 2 / 3	7				H=3.25-3.5
									G
		05		2 / 2 / 3	7				H=2.75-3.25
			P						
	10	06							H=2.5
		07		1 / 3 / 5	11				H=2.25-2.5
549.7									
		08		2 / 3 / 4	10		Stiff to very-stiff brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, few lenses of silt, moist.		G H=1.75-2.25
		09		1 / 3 / 3	9				H=1.5-2.25
	15								
546.2									
			P				Medium-stiff to stiff brown mottled with dark-brown silty clay, trace fine to medium sand, few lenses of silt, moist.		T H=0.75
544.7		10							
				WH-18"			Soft to medium-stiff brown silty clay, interbedded with silt, little fine sand, trace medium sand, wet.		G
		11							H=0.5-0.75
542.7									
	20			WH / 1 / 2			Very-soft to soft brown silty clay interbedded with silt, trace fine sand, few lenses of fine sand, wet.		G
		12 ▽			4				H=0.25
		13							H=0.25
				WH-18"					
		13A							H=0.25
538.6					4				
		13B		WH / 1 / 2			Soft to medium-stiff gray mottled with dark-gray and brown silty clay, little to some fine sand, few lenses of silt and fine sand, wet.		H=0.75
	25	14							H=1.75-

WATER LEVEL: ▽ **20.4** ▼
WATER NOTE: **Inside HSA**
DATE: **10/29/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0909
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **562.2** DATE: **10/29/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **33.9'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	25						Soft to medium-stiff gray mottled with dark-gray and brown silty clay, little to some fine sand, few lenses of silt and fine sand, wet.	1.25
		15		WH / WH / 1	1			H=0.75 G
534.8		16A		WH / 2 / 3	7		Loose brown fine sand, trace medium sand, little silt, wet.	H=0.75
534.3		16B						
		16C						H=0.75 G
533.6		17A		1 / 4 / 3	10		Soft gray silty clay, trace fine sand, wet.	
		17B					Very-loose to loose gray fine sand, trace medium sand, little silt, wet.	H=0.3
	30							
		18		WR / WH / 1	1			
530.1		19A		WR / 3 / 9	17		Medium-dense to very-dense brown fine to medium sand, and fine to coarse gravel, trace coarse sand, trace silt, wet.	
		19B						
528.3		20		5 / 11 / 30	58			
	35						- Encountered water at 20.4'. - Boring backfilled with cement-bentonite grout upon completion. - Boring location and elevation surveyed by AEP.	
	40							
	45							
	50							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ **20.4** ▼
WATER NOTE: **Inside HSA**
DATE: **10/29/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation Q - Uncon Comp T - Triax Comp C - Consol.	See Separate Curves	H - Penetrometer (tsf) W - Unit Dry Wt (pcf) D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

JOB: 011.11497.014 **PLATE 29**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0910
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **565.4** DATE: **10/29/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **35.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT)	TEST RESULTS
565.1	0						GRAVEL - 3 INCHES	10 20 30 40	
564.0		1		30 / 12 / 10	31	27	FILL: Hard brown silty clay, intermixed with dark-gray silt, trace fine to coarse sand, slightly organic, damp.		H=4.5+
		2		4 / 5 / 6	16	57	Very-stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand, few lenses of silt.		H=3.75
	5	3		4 / 5 / 4	13	53			H=2.5-2.75
		4		P					
		5		4 / 5 / 5	14	100			H=2.5-3.25
	10	6		P					H=2.75
553.4		7		2 / 3 / 4	10	100	Stiff to very-stiff dark-brown mottled with brown and gray silty clay, trace fine to medium sand, few lenses of silt, moist.		H=1.8-2.3
550.6		8		2 / 2 / 4	9	100			H=1.7-2.2
	15	9		1 / 1 / 2	4	100	Medium-stiff to stiff brown silty clay, some fine sand, trace medium sand, few lenses and seams of silt, moist.		H=0.75-1.25 G
548.4									
		10		P			Soft to medium-stiff brown clayey silt, "and" fine sand, trace medium to coarse sand, few lenses of fine sand and silt.		H=0.7-1.1 T G
546.0		11		WH / 1 / 1	3	100	Very-soft to soft brown mottled with dark-brown silty clay, some fine sand, trace medium sand, few lenses and seams of fine sand, many lneses of silt near top of stratum, wet.		H=0.5
	20	12		WH / 1 / 1	3	100			H=0.25-0.5 G
543.4		13		WH / 1 / 1	3	100	Very-loose brown fine sand interbedded with silty clay, trace medium to coarse sand, wet.		H=0.2-0.3
541.9		14		WH-18"		100	Soft brown mottled with gray and dark-brown silty clay, trace to little fine to medium sand, few lenses of fine sand.		H=0.25-0.3 G
	25								

WATER LEVEL: ▽ **2.5** ▼

WATER NOTE: **Inside HSA**

DATE: **10/29/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf), W - Unit Dry Wt (pcf), D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85

Last Calibration Date : 02/17/09

Drill Rig Number : ATV 550X

JOB: 011.11497.014 -CONTINUED- **PLATE 30**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0910
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **565.4** DATE: **10/29/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **35.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
	25	15A		WH-18"		100	Soft brown mottled with gray and dark-brown silty clay, trace to little fine to medium sand, few lenses of fine sand.	H=-0.3
539.2		15B						H=0.25-0.5
		16A		WH / 2 / 3	7	100	Very-soft to medium-stiff gray mottled with brown clayey silt interbedded with silt and fine sand, trace medium to coarse sand, wet.	H=0.0-0.6
537.8		16B						G
537.6		16C		WH / 1 / 1	3	100	Medium-stiff brown silty clay, trace fine sand, wet.	H=0.75
		17A						
536.0		17B					Very-loose gray fine sand, trace medium sand, trace to little silt, wet.	H=0.2
	30	18		WH / 2 / 2	6	100	Very-soft to soft gray silty clay, trace fine sand, few seams of silt and fine sand, wet.	H=0.25
534.1		19A		WH		100		G
533.8		19B		/ 4 / 7	16		Decayed wood with fine sand seams.	
		19C					Medium-dense orange-brown and dark-brown fine to medium sand, trace coarse sand, trace fine gravel, trace silt.	
		20		3 / 6 / 7	18	60		
		21		4 / 7 / 8	21	100		
529.9	35						- Encountered water at 19.4'. - Boring backfilled with cement-bentonite grout upon completion. - Boring location and elevation surveyed by AEP.	
	40							
	45							
	50							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ 2.5 ▼
WATER NOTE: Inside HSA
DATE: 10/29/09

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation Q - Uncon Comp T - Triax Comp C - Consol.	See Separate Curves	H - Penetrometer (tsf) W - Unit Dry Wt (pcf) D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

JOB: 011.11497.014 **PLATE 31**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0911
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **565.9** DATE: **10/30/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	NATURAL CONSISTENCY INDEX / NATURAL MOISTURE CONTENT (PLASTIC LIMIT — LIQUID LIMIT; 10 20 30 40)	TEST RESULTS
565.4	0						TOPSOIL/ROOTMAT - 6 INCHES		
		1		5 / 8 / 9	24		Hard brown mottled with dark-brown silty clay, trace fine to coarse sand, dry becoming damp.		H=4.5+
		2		5 / 6 / 8	20				H=4.5+
	5	3		5 / 6 / 6	17				H=4.5+
		4		6 / 9 / 8	24				H=4.5+
557.5		5		4 / 5 / 5	14				H=4.0-4.5+
		6		2 / 2 / 4	9		Medium-stiff to stiff brown silty clay, some to "and" fine sand, damp becoming moist.		H=1.5-2.25
	10	7		P					H=0.9
552.9		8		2 / 3 / 3	9		Stiff brown mottled with dark-brown silty clay, some fine sand, trace medium to coarse sand, few lenses of silt, moist.		H=1.5
		9		1 / 2 / 4	9				H=1.25-1.75
	15	10		P					H=1.25
548.3		11		WR / WH / 2	3		Soft to medium-stiff brown mottled with dark-brown silty clay, trace to little fine sand, trace medium sand, few lenses of silt, wet.		H=0.75 G
	20	12		WH / 2 / 2	6				H=0.3-0.5
544.3		13A		WH-18"					
		13B					Very-soft to soft gray mottled with brown silty clay, little fine sand, trace medium sand, many lenses of silt, wet.		H=0.1-0.2 G
		14		WR / WH / 3	4				H=0.0-0.3
541.9		15A		WH / 1 / 3	6		Medium-stiff to stiff gray mottled with brown silty clay, little fine sand, many lenses of silt,		H=0.6-1.2
	25								

WATER LEVEL: ▽ 29.5 ▼
WATER NOTE: Inside HSA
DATE: 10/30/09

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. (See Separate Curves)

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

LOG OF BORING NO. GV-BAP-0911
AEP GAVIN PLANT BOTTOM ASH POND
CHESHIRE, OHIO

BBCM

LOCATION: **See Plate 2 of Appendix A** ELEVATION: **565.9** DATE: **10/30/09**

DRILLING METHOD: **3-1/4" I.D. Hollow-stem Auger** COMPLETION DEPTH: **40.5'**

SAMPLER(S): **2" O.D. Split-barrel Sampler**

ELEV.	DEPTH, FEET	SAMPLE NUMBER	SAMPLE	SAMPLE EFFORT	N_{60}	SAMPLE REC-%	DESCRIPTION	TEST RESULTS
540.7	25	15B		WH / WH / 2	3		wet. Very-soft brown mottled with dark-brown silty clay interbedded with silt and fine sand, trace medium sand, wet.	H=0.2 G
538.9		16		WH / 1 / 2	4		Very-loose gray, brown, and red-brown silt interbedded with silty clay, trace fine sand, few seams of fine sand, wet.	H=0.3-0.4
537.4		17		WH / 1 / 2	4		Medium-stiff gray silty clay, interbedded with silt and fine sand, contains decayed vegetation, wet.	H=0.6-0.8
535.7	30	▽18		WH / 1 / 2	4			
		19A		WH / 2 / 2	6		Very-loose to loose gray silt interbedded with silty clay and fine sand, trace medium sand, wet.	H=0.1
532.9		19B		WR / WH / 2	3			H=0.1 G
		20		WH / 1 / 2	4		Medium-stiff gray clayey silt, trace fine sand, few lenses of silt and fine sand, wet.	H=0.8
530.2	35	21		WH / 1 / 2	4			H=0.6
		22A		WH / 1 / 7	11			
		22B		WH / 2 / 5	10		Medium-dense brown fine to medium sand, trace coarse sand, trace fine gravel, trace silt, wet.	
		23		2 / 3 / 7	14			
		24A		6 / 6 / 12	26			
525.4	40	24B						
		25					- Encountered seepage at 17.6'. - Boring backfilled with cement-bentonite grout upon completion. - Boring location and elevation surveyed by AEP.	
	45							
	50							

NATURAL CONSISTENCY INDEX
NATURAL MOISTURE CONTENT
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40

WATER LEVEL: ▽ **29.5** ▼
WATER NOTE: **Inside HSA**
DATE: **10/30/09**

SYMBOLS USED TO INDICATE TEST RESULTS

G - Gradation, Q - Uncon Comp, T - Triax Comp, C - Consol. } See Separate Curves

H - Penetrometer (tsf)
W - Unit Dry Wt (pcf)
D - Relative Dens (%)

Drill Rod Energy Ratio : 0.85
Last Calibration Date : 02/17/09
Drill Rig Number : ATV 550X

JOB: 011.11497.014 **PLATE 33**

2009 NEW DEFAULT BORING LOG-W/ N60 111497014.GPJ BBCM.GDT 3/16/10

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
							Hydrometer																cohesive	non/cohes	wall rigid	wall flexible					
						sieve	short	long	standard	modified	uncons. undrain	consolid undrain w/pores	drained	drained	undrain	residual															
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%			
BAP-0901	4.75	19																													
BAP-0901	7.50	20	41	22	19	*		*				*									104.4									*	
BAP-0901	12.75	23	48	23	25																										
BAP-0901	17.25	22	53	25	28	*		*																							
BAP-0901	19.75	21	42	22	20	*		*				*									105.6		*			*				*	
BAP-0901	20.50	22										*									104.8										
BAP-0901	26.75	16	34	17	17	*		*																							
BAP-0901	31.75	18	38	20	18																										
BAP-0901	34.25	15	29	18	11	*		*																							
BAP-0901	39.25	18	26	18	8																										
BAP-0901	44.25	23	30	21	9	*		*																							
BAP-0901	46.75	25																													
BAP-0901	49.45	29	24	19	5																										
BAP-0901	51.35					*																									
BAP-0901	54.25					*																									
BAP-0902	7.75	20	41	20	21																										
BAP-0902	11.75	18	35	20	15																										
BAP-0902	19.25	22	32	21	11	*		*																							
BAP-0902	24.25					*																									
BAP-0902	26.75	30	21	16	5																										

SUM.REG 11149701 4.GPJ BBCM.GDT 6/2/09

BBCM
SOLUTIONS TO BUILD ON

TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 6/2/09

PLATE 1

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
							Hydrometer																cohesive	non/cohes	wall rigid	wall flexible					
						sieve	short	long	standard	modified	uncons. undrain	consolid undrain w/pores	drained	drained	undrain	residual															
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%			
BAP-0902	31.75					*																									
BAP-0903	4.75	23	38	21	17																										
BAP-0903	5.60																													*	
BAP-0903	8.25	20																													
BAP-0903	11.25	22	42	21	21																										
BAP-0903	15.75	23	52	24	28	*		*																							
BAP-0903	21.75	21	30	18	12																										
BAP-0903	27.75	19	41	22	19																										
BAP-0903	34.25	19	44	22	22	*		*																							
BAP-0903	41.75	24	53	22	31	*		*																							
BAP-0903	46.75	22	38	19	19																										
BAP-0903	51.75	25	24	19	5																										
BAP-0903	56.75	25	35	19	16	*		*																							
BAP-0904	4.75	24	44	22	22																										
BAP-0904	7.75	30	43	26	17	*		*																							
BAP-0904	11.75	23	42	20	22																										
BAP-0904	16.75	26																													
BAP-0904	19.25	28	30	20	10																										
BAP-0904	24.25	29	32	19	13	*																									
BAP-0904	29.25					*																									

SUM REG 11149704.GPJ BBCM.GDT 6/2/09

BBCM
SOLUTIONS TO BUILD ON

TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 6/2/09

PLATE 2

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
							Hydrometer																cohesive	non/cohes	wall rigid	wall flexible					
						sieve	short	long	standard	modified	uncons. undrain	consolid undrain w/ pores	drained	drained	undrain	residual															
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%			
BAP-0904	34.25	29	32	19	13																										
BAP-0905	4.75	18	38	20	18																										
BAP-0905	12.25	20	43	23	20	*		*																							
BAP-0905	15.25	22	44	24	20																										
BAP-0905	19.75	21																													
BAP-0905	21.25	21	40	23	17	*		*													108.0		*			*			*		
BAP-0905	26.25	18	39	19	20	*		*																							
BAP-0905	29.25	20																													
BAP-0905	31.75	17	29	18	11																										
BAP-0905	34.25					*																									
BAP-0905	36.75	19	28	18	10	*		*																							
BAP-0905	43.75	25	42	21	21	*		*																							
BAP-0905	49.25	28	38	22	16																										
BAP-0905	54.25					*																									
BAP-0906	6.25	18	35	20	15	*		*																							
BAP-0906	9.25	23	45	22	23																										
BAP-0906	14.25	25	33	21	12																										
BAP-0906	19.25	27	34	21	13	*		*																							
BAP-0906	29.25					*																									
BAP-0907	4.75	22	41	21	20																										

SUM.REG 11149704.GPJ BBCM.GDT 6/2/09

BBCM
SOLUTIONS TO BUILD ON

TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 6/2/09

PLATE 3

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
							Hydrometer															cohesive	non/cohes	wall rigid	wall flexible					
						sieve	short	long	standard	modified	uncons. undrain	consolid undrain w/ pores	drained	drained	undrain	residual														
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%			
BAP-0907	9.25	17	34	18	16																									
BAP-0907	13.75	18	32	16	16	*		*																						
BAP-0907	17.75	20	35	20	15	*		*				*								107.5									*	
BAP-0907	18.25	21										*								108.4										
BAP-0907	26.25	20	41	20	21																									
BAP-0907	34.25	19	52	24	28	*		*																						
BAP-0907	39.25	21	47	24	23	*		*																						
BAP-0907	44.75	19	40	20	20																									
BAP-0907	47.25	18	31	17	14	*		*																						
BAP-0907	51.75	20	32	18	14	*																								
BAP-0907	56.75	24	31	18	13																									

BBCM Solutions To Build On

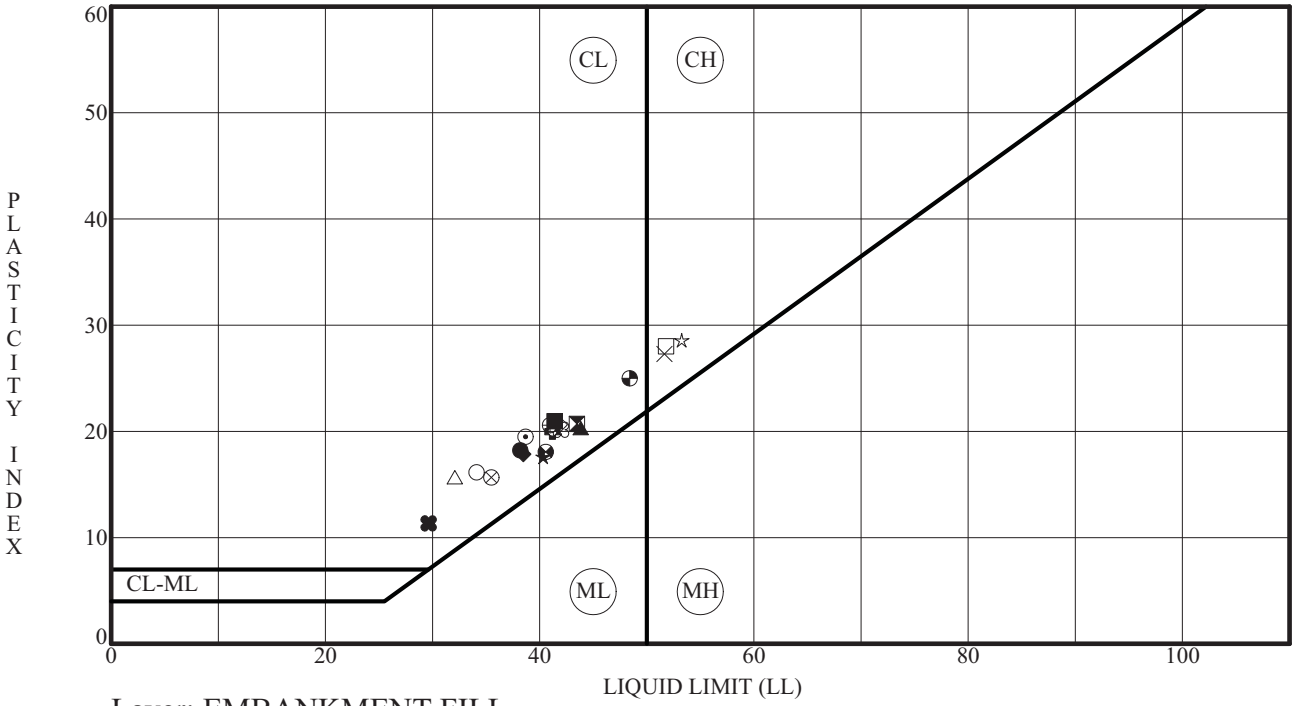
TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 6/2/09

SUM REG 11149704.GPJ BBCM.GDT 6/2/09

PLATE 4

ATTERBERG LIMITS' RESULTS



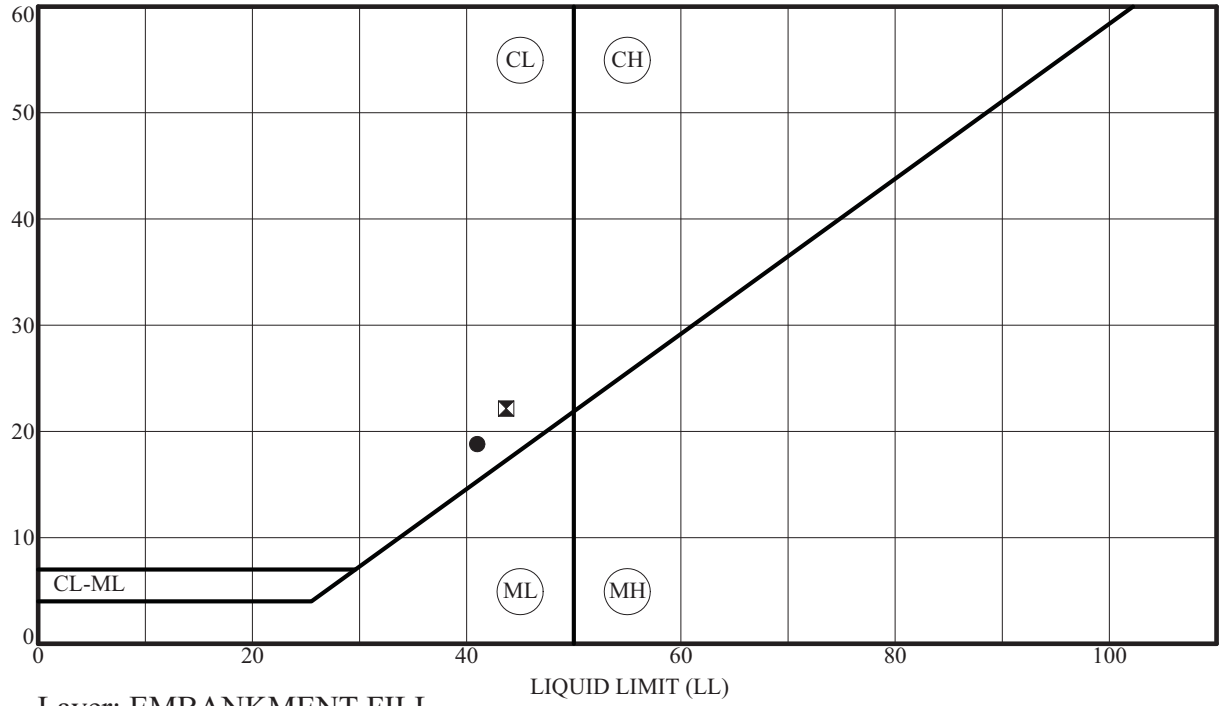
Layer: EMBANKMENT FILL

	Specimen Id.	Depth	MC	LL	PL	PI	Fines	ASTM Classification
●	BAP-0905	4.75	18	38	20	18		
⊠	BAP-0905	12.25	20	43	23	20	95.9	LEAN CLAY CL
▲	BAP-0905	15.25	22	44	24	20		
★	BAP-0905	21.25	21	40	23	17	89.2	LEAN CLAY CL
⊙	BAP-0905	26.25	18	39	19	20	88.9	LEAN CLAY CL
✿	BAP-0907	4.75	22	41	21	20		
○	BAP-0907	9.25	17	34	18	16		
△	BAP-0907	13.75	18	32	16	16	75.6	LEAN CLAY with SAND CL
⊗	BAP-0907	17.75	20	35	20	15	80.6	LEAN CLAY with SAND CL
⊕	BAP-0907	26.25	20	41	20	21		
□	BAP-0907	34.25	19	52	24	28	88.3	FAT CLAY CH
⊛	BAP-0901	7.50	20	41	22	19	91.8	LEAN CLAY CL
◒	BAP-0901	12.75	23	48	23	25		
☆	BAP-0901	17.25	22	53	25	28	93.1	FAT CLAY CH
⁂	BAP-0901	19.75	21	42	22	20	91.2	LEAN CLAY CL
■	BAP-0902	7.75	20	41	20	21		
◆	BAP-0903	4.75	23	38	21	17		
◇	BAP-0903	11.25	22	42	21	21		
×	BAP-0903	15.75	23	52	24	28	93.8	FAT CLAY CH
✖	BAP-0903	21.75	21	30	18	12		

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/9/09

ALPI-REG 111497014.GPJ BBCM.GDT 6/9/09

ATTERBERG LIMITS' RESULTS



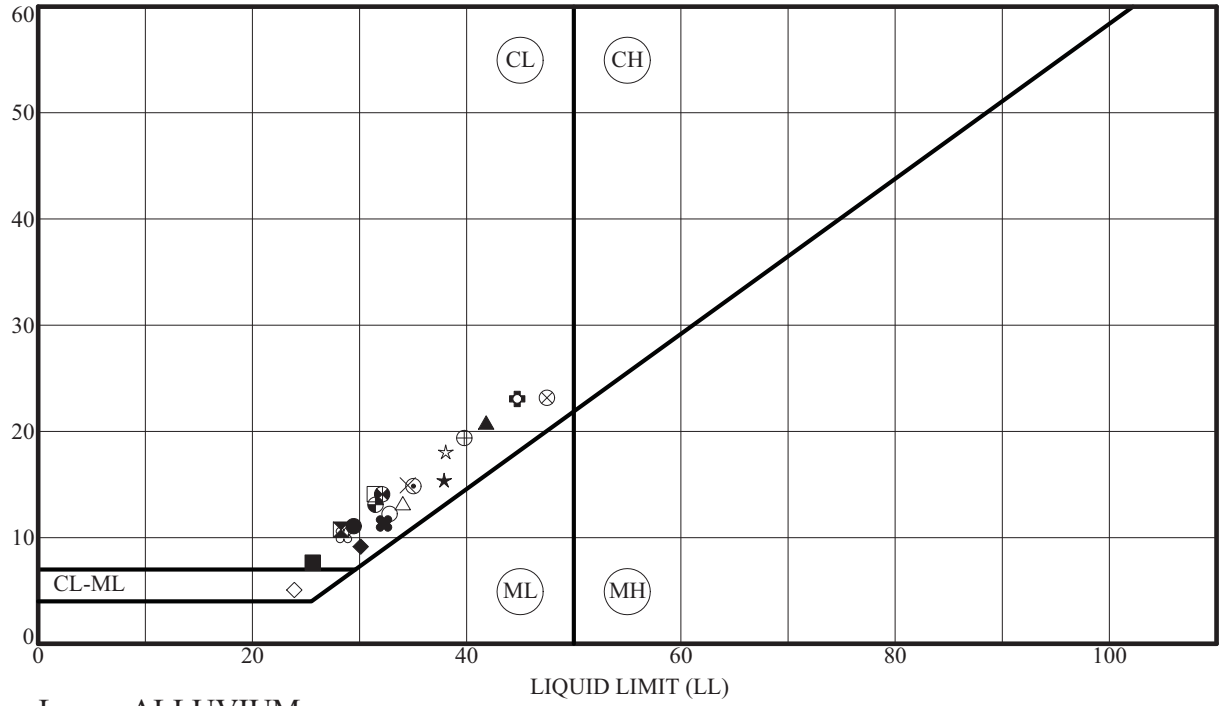
Layer: EMBANKMENT FILL

	Specimen Id.	Depth	MC	LL	PL	PI	Fines	ASTM Classification
●	**BAP-0903**	**27.75**	**19**	**41**	**22**	**19**		
⧓	**BAP-0903**	**34.25**	**19**	**44**	**22**	**22**	**88.4**	**LEAN CLAY CL**

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/9/09

ALPI-REG 111497014.GPJ BBCM.GDT 6/9/09

ATTERBERG LIMITS' RESULTS



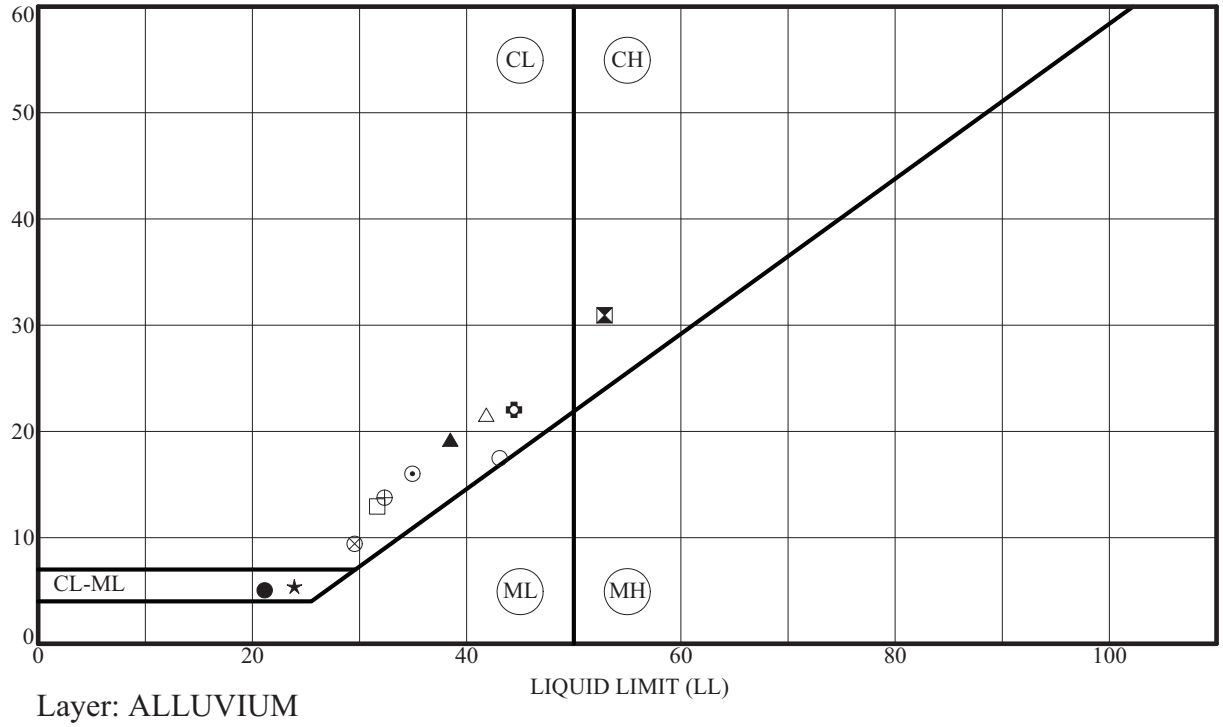
Layer: ALLUVIUM

	Specimen Id.	Depth	MC	LL	PL	PI	Fines	ASTM Classification
●	BAP-0905	31.75	17	29	18	11		
⊠	BAP-0905	36.75	19	28	18	10	66.3	SANDY LEAN CLAY CL
▲	BAP-0905	43.75	25	42	21	21	96.5	LEAN CLAY CL
★	BAP-0905	49.25	28	38	22	16		
⊙	BAP-0906	6.25	18	35	20	15	75.4	LEAN CLAY with SAND CL
✿	BAP-0906	9.25	23	45	22	23		
○	BAP-0906	14.25	25	33	21	12		
△	BAP-0906	19.25	27	34	21	13	87.1	LEAN CLAY CL
⊗	BAP-0907	39.25	21	47	24	23	92.4	LEAN CLAY CL
⊕	BAP-0907	44.75	19	40	20	20		
□	BAP-0907	47.25	18	31	17	14	69.1	SANDY LEAN CLAY CL
⊛	BAP-0907	51.75	20	32	18	14	69.0	SANDY LEAN CLAY CL
◒	BAP-0907	56.75	24	31	18	13		
☆	BAP-0901	31.75	18	38	20	18		
⁂	BAP-0901	34.25	15	29	18	11	67.9	SANDY LEAN CLAY CL
■	BAP-0901	39.25	18	26	18	8		
◆	BAP-0901	44.25	23	30	21	9	77.2	LEAN CLAY with SAND CL
◇	BAP-0901	49.45	29	24	19	5		
×	BAP-0902	11.75	18	35	20	15		
✖	BAP-0902	19.25	22	32	21	11	88.8	LEAN CLAY CL

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/9/09

ALPI-REG 111497014.GPJ BBCM.GDT 6/9/09

ATTERBERG LIMITS' RESULTS



Layer: ALLUVIUM

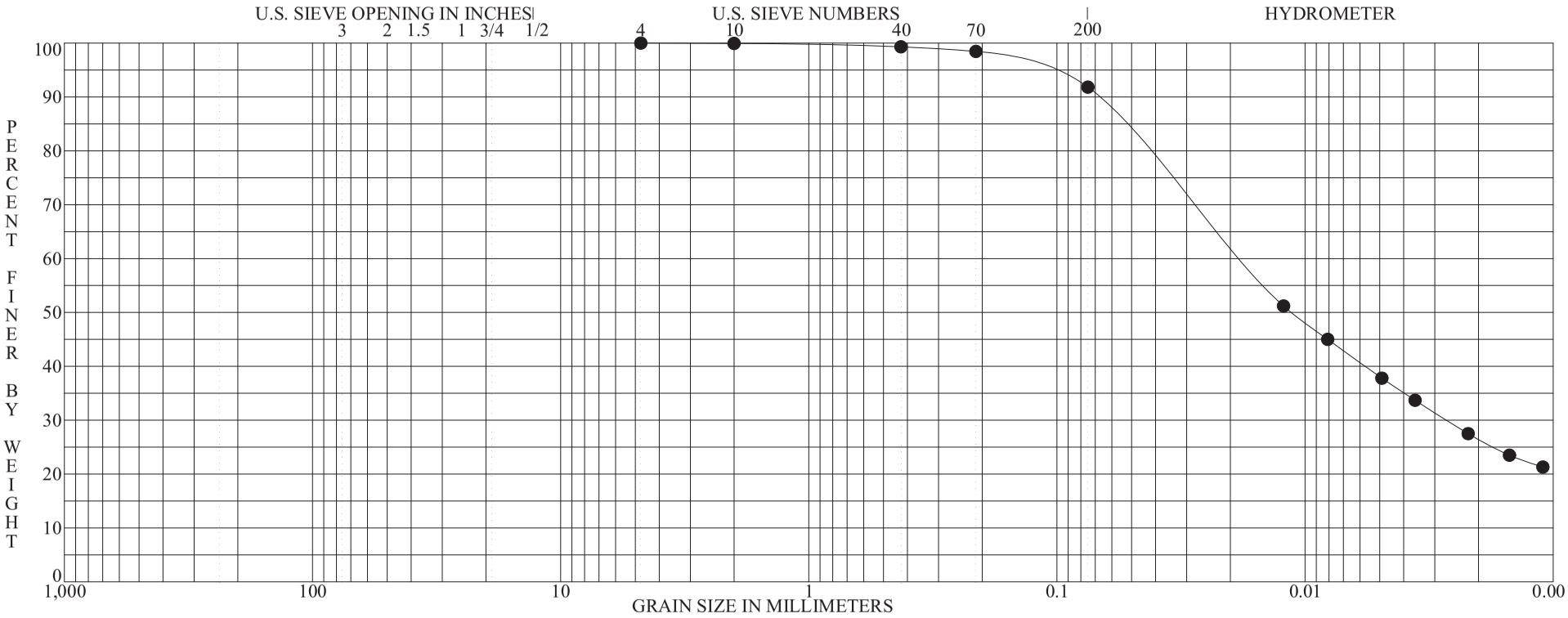
	Specimen Id.	Depth	MC	LL	PL	PI	Fines	ASTM Classification
●	**BAP-0902**	**26.75**	**30**	**21**	**16**	**5**		
⊠	**BAP-0903**	**41.75**	**24**	**53**	**22**	**31**	**92.9**	**FAT CLAY CH**
▲	**BAP-0903**	**46.75**	**22**	**38**	**19**	**19**		
★	**BAP-0903**	**51.75**	**25**	**24**	**19**	**5**		
⊙	**BAP-0903**	**56.75**	**25**	**35**	**19**	**16**	**86.8**	**LEAN CLAY CL**
✿	**BAP-0904**	**4.75**	**24**	**44**	**22**	**22**		
○	**BAP-0904**	**7.75**	**30**	**43**	**26**	**17**	**96.2**	**LEAN CLAY CL**
△	**BAP-0904**	**11.75**	**23**	**42**	**20**	**22**		
⊗	**BAP-0904**	**19.25**	**28**	**30**	**20**	**10**		
⊕	**BAP-0904**	**24.25**	**29**	**32**	**19**	**13**	**76.4**	**LEAN CLAY with SAND CL**
□	**BAP-0904**	**34.25**	**29**	**32**	**19**	**13**		

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/9/09

ALPI-REG 111497014.GPJ BBCM.GDT 6/9/09

GRN-REG

BBCM



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-5 II 7.0' to 7.9'**	**Hard brown and dark-brown silty clay, trace fine to medium sand.**	**20**	**41**	**22**	**19**		

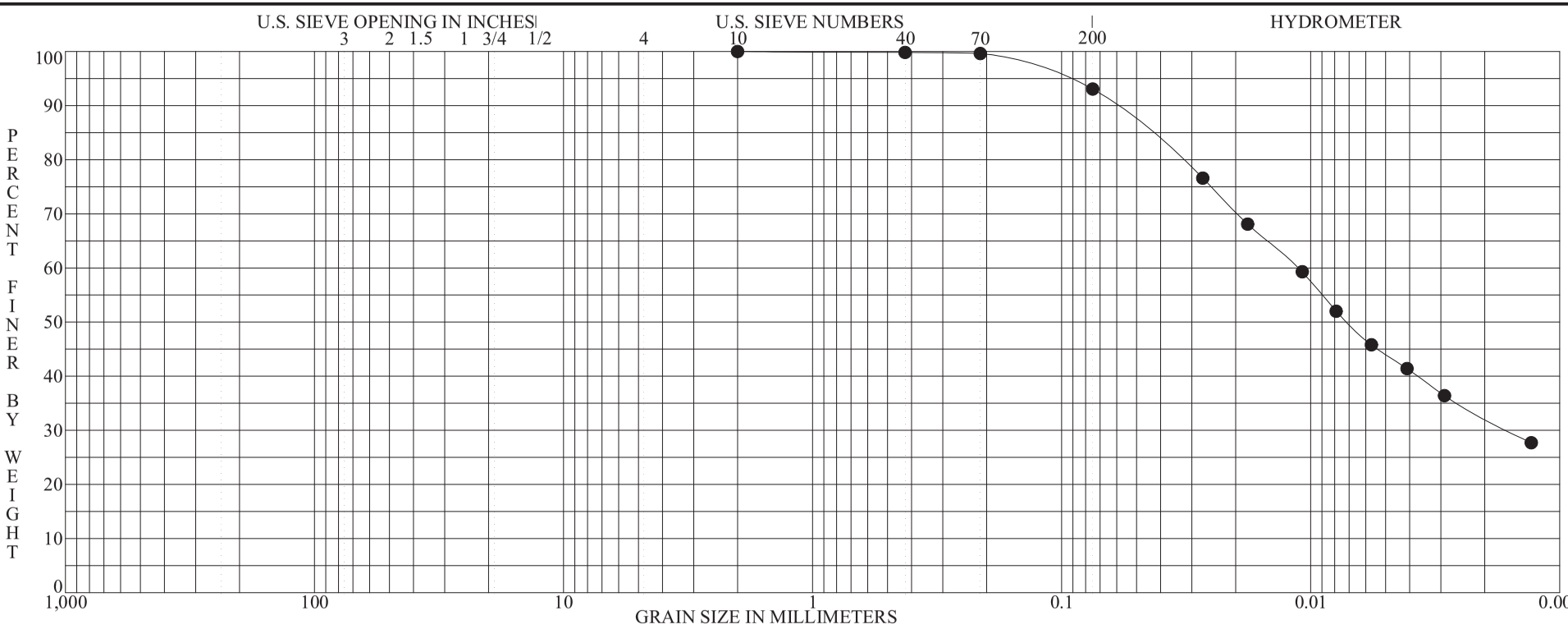
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-5 II 7.0' to 7.9'**	**4.7500**	**0.1232**	**0.0181**	**0.0113**		**0.0**	**8.2**	**53.7**	**38.1**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 9

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-11 16.5' to 17.8'**	**Brown mottled with dark-brown silty clay, trace fine to medium sand, few lenses of silt and gray organic silt.**	**22**	**53**	**25**	**28**		

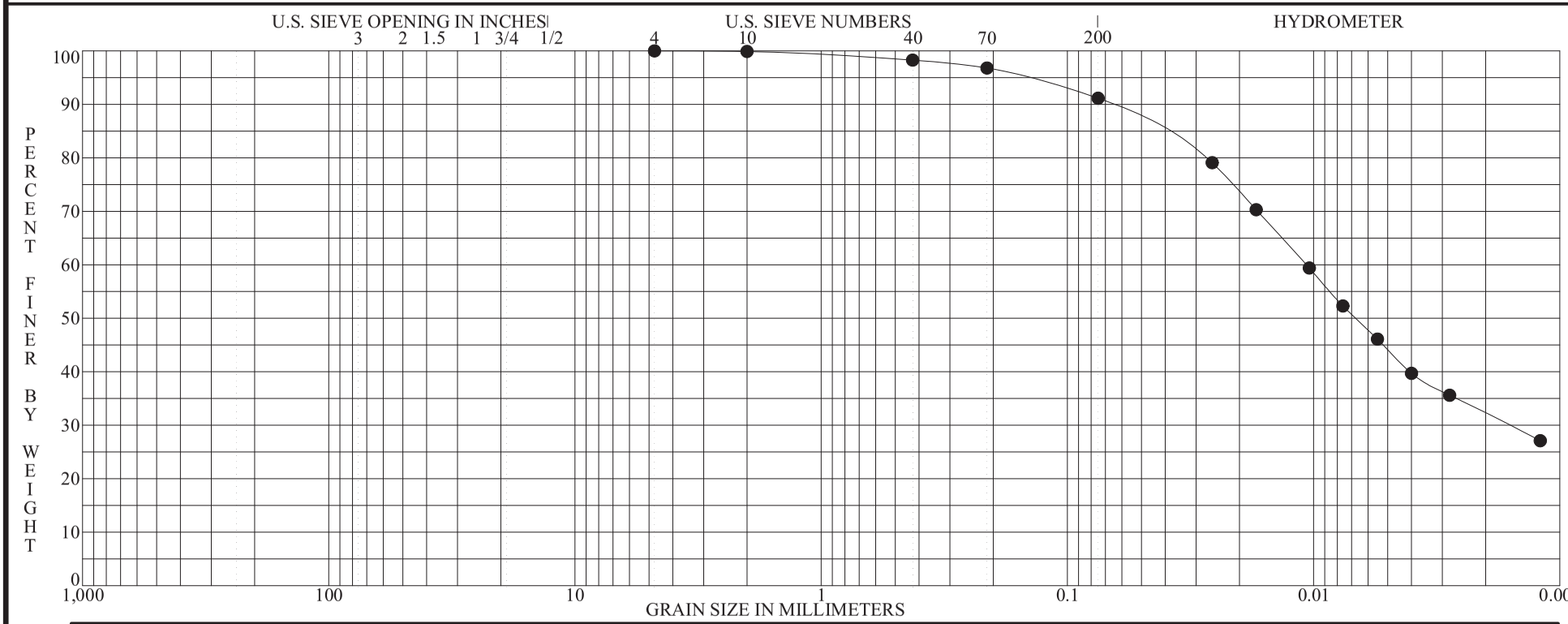
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-11 16.5' to 17.8'**	**2.0000**	**0.1018**	**0.0112**	**0.0071**		**0.0**	**6.9**	**49.0**	**44.1**

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 10

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

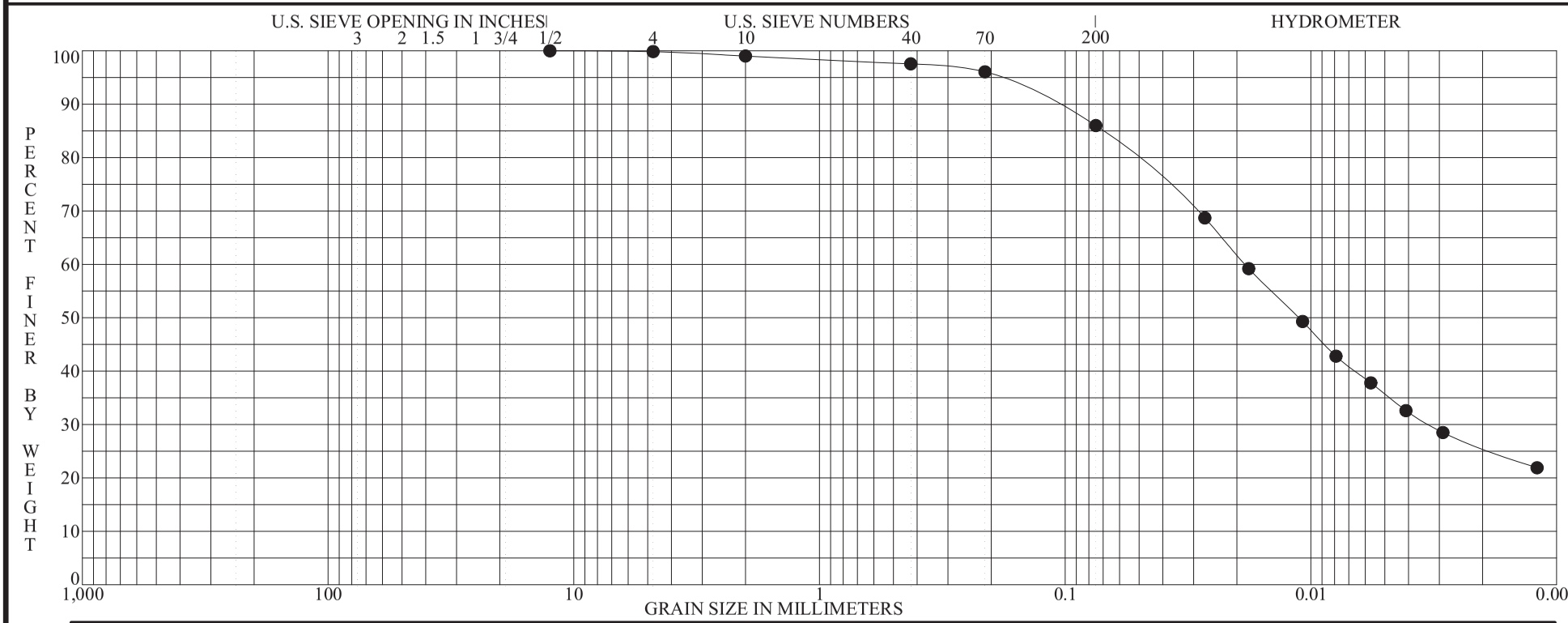
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-13 I 19.5' to 21.5'**	**Stiff to Hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand.**	**21**	**42**	**22**	**20**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-13 I 19.5' to 21.5'**	**4.7500**	**0.1522**	**0.0107**	**0.0067**		**0.0**	**8.8**	**47.0**	**44.2**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 11



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-17 26.0' to 27.5'**	**Brown mottled with gray and dark-brown silty clay, little fine sand, trace medium to coarse sand, trace fine gravel.**	**16**	**34**	**17**	**17**		

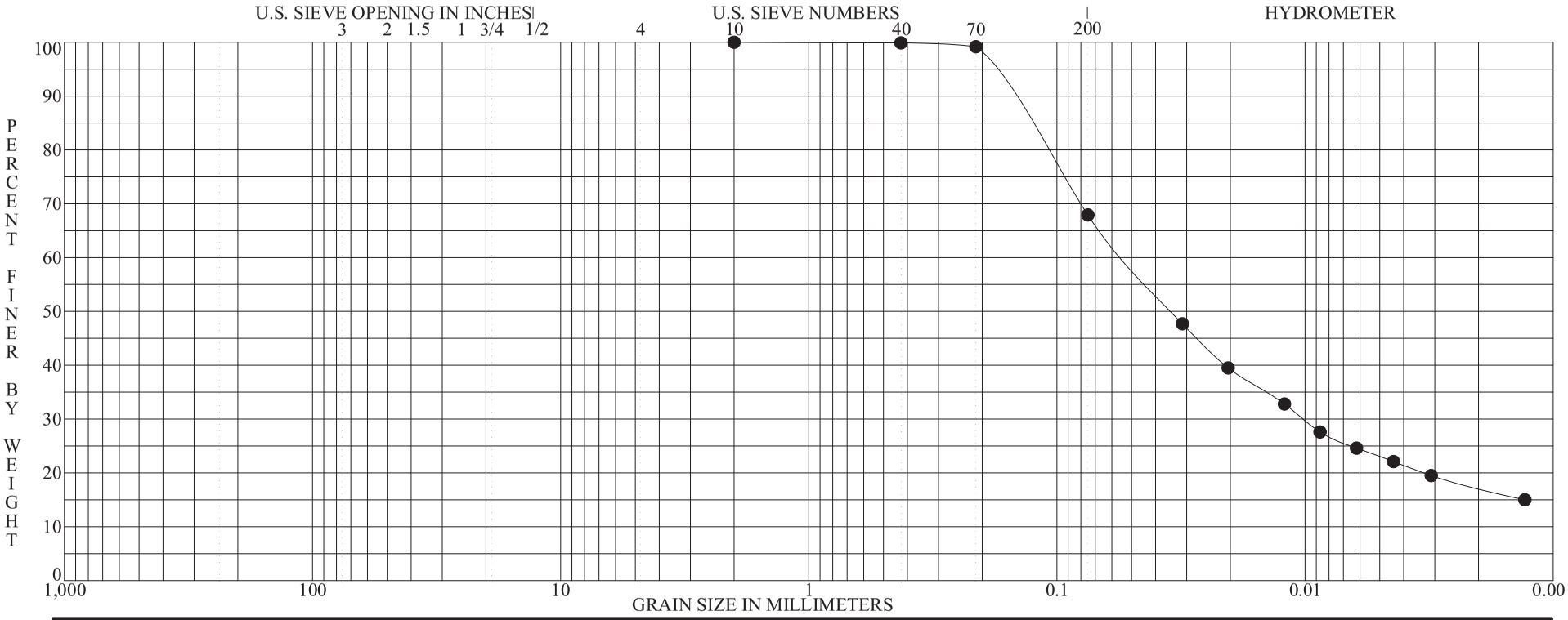
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-17 26.0' to 27.5'**	**12.5000**	**0.1899**	**0.0185**	**0.0112**		**0.1**	**13.9**	**50.3**	**35.7**

ASTM D422

GRADATION CURVE

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-21 33.5' to 35.0'**	**Brown silty clay, some fine sand, trace medium sand, few lenses of silt.**	**15**	**29**	**18**	**11**		

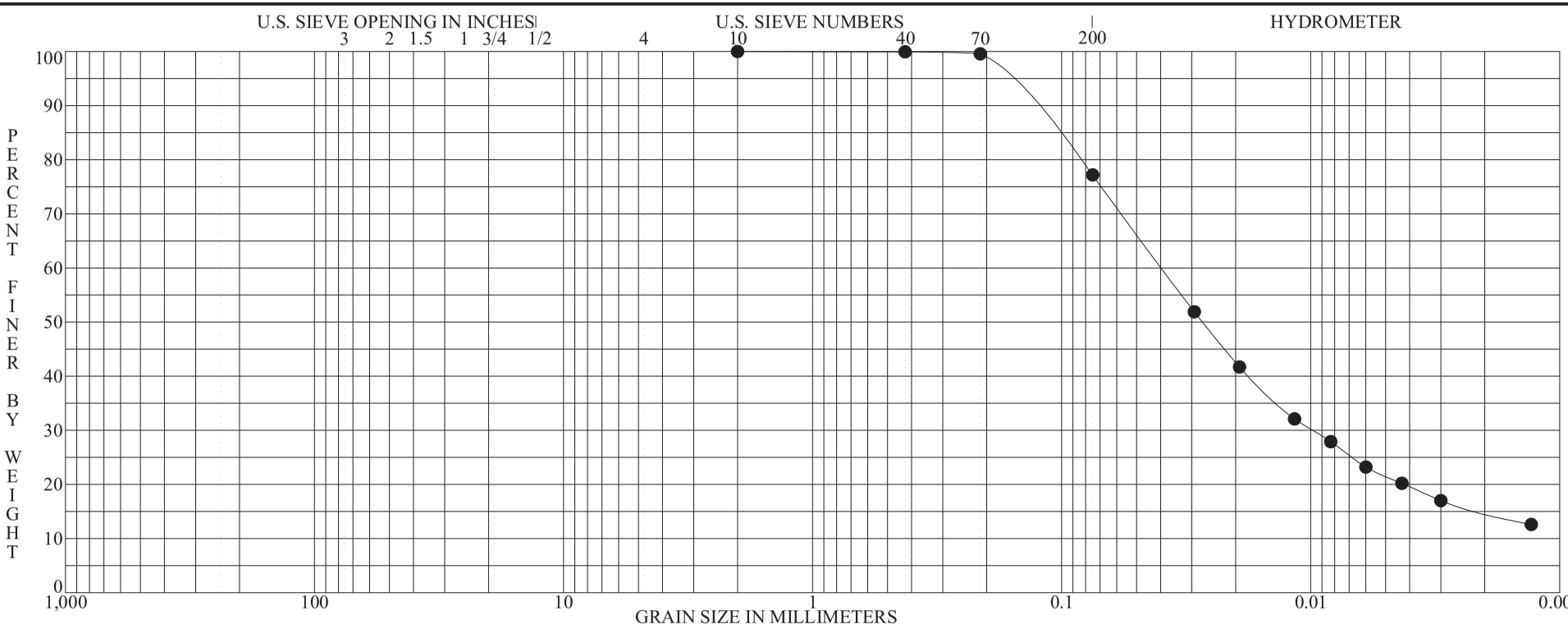
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-21 33.5' to 35.0'**	**2.0000**	**0.1845**	**0.0532**	**0.0345**		**0.0**	**32.1**	**44.9**	**23.0**

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 13

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-25 43.5' to 45.0'**	**Brown motled with dark-brown clayey silt, some fine sand, trace medium sand.**	**23**	**30**	**21**	**9**		

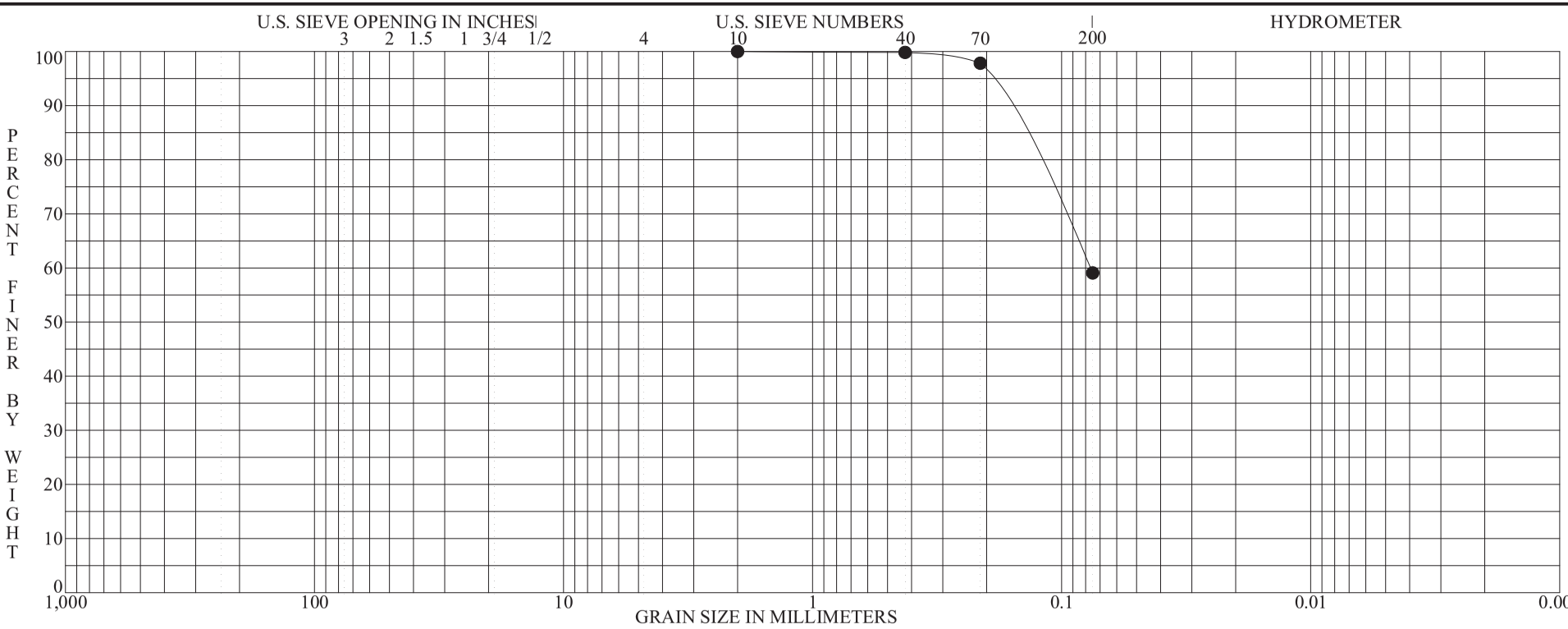
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-25 43.5' to 45.0'**	**2.0000**	**0.1714**	**0.0396**	**0.0271**		**0.0**	**22.8**	**55.6**	**21.6**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 14

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-28A 51.0' to 51.7'**	**Gray mottled with brown silt inter-bedded with fine sand and silty clay, trace medium sand.**						

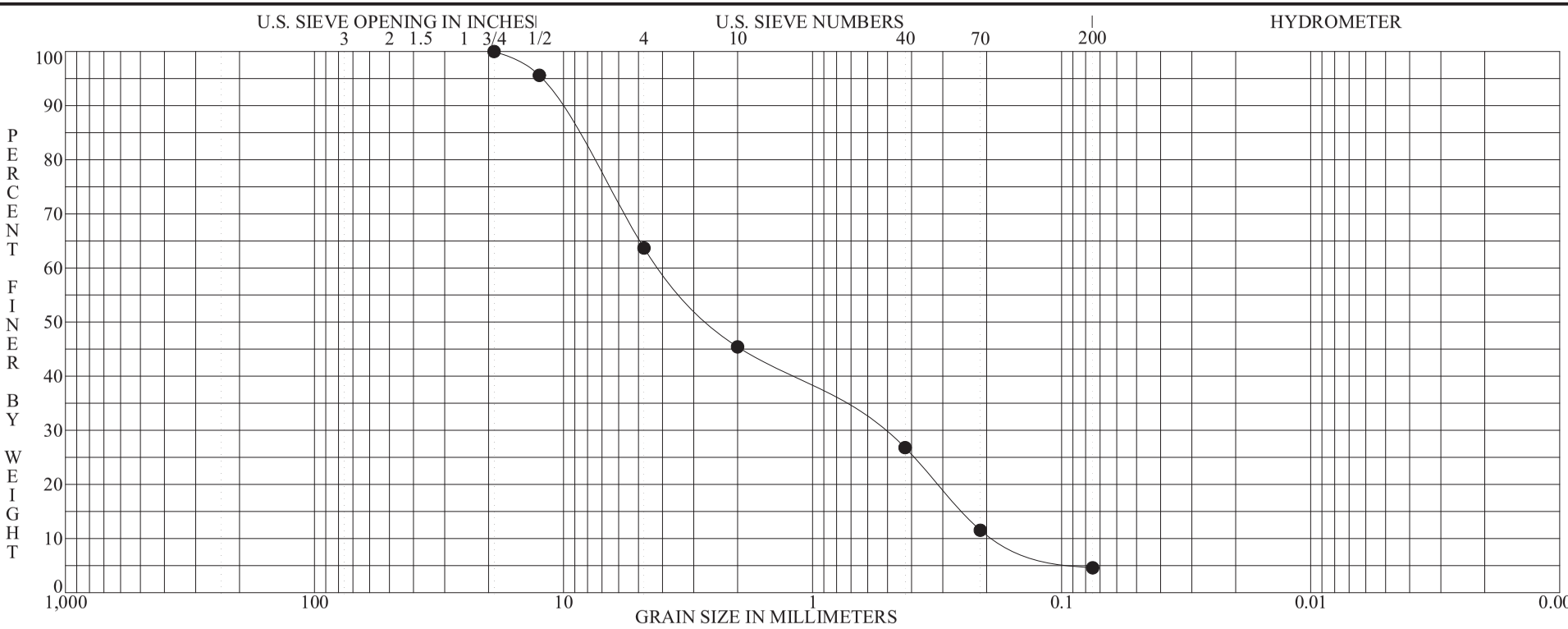
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-28A 51.0' to 51.7'**	**2.0000**	**0.1965**	**0.0769**			**0.0**	**40.9**	**59.1**	

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 15

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

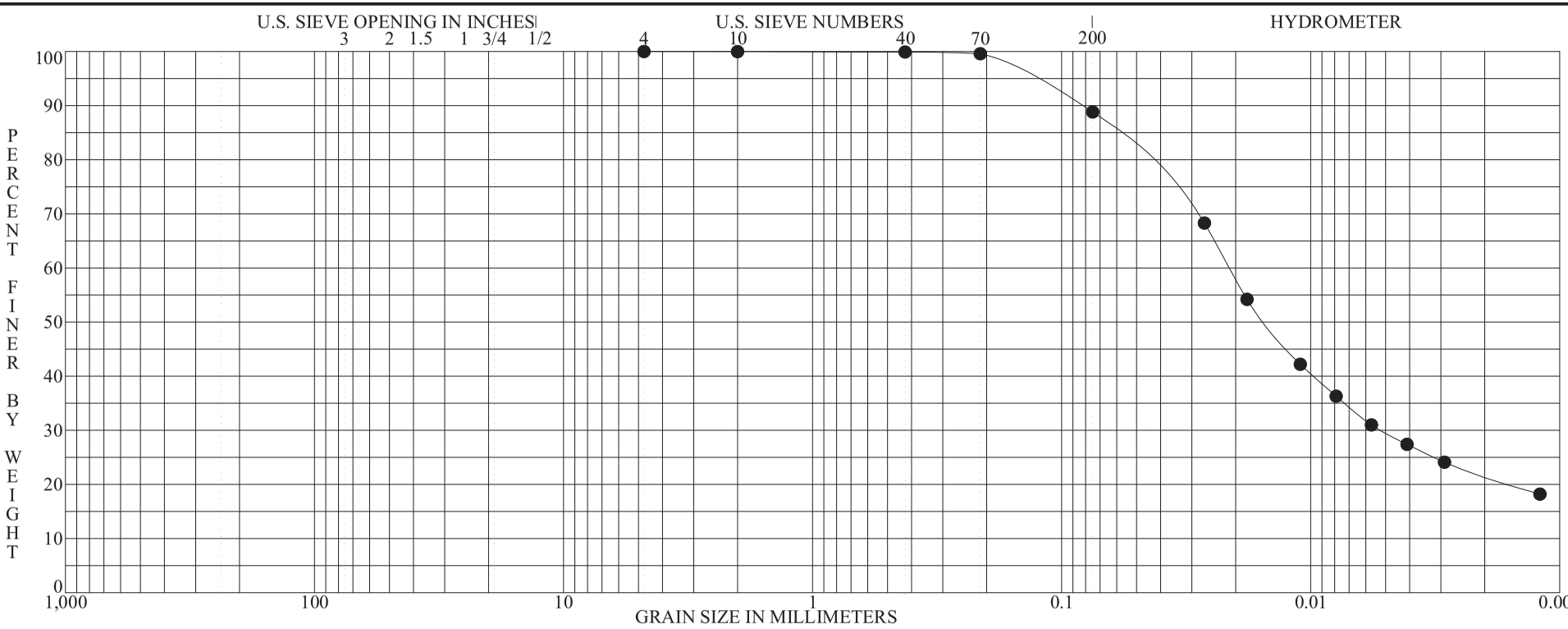
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0901 S-29 53.5' to 54.7'**	**Brown and gray fine to coarse sand, "and" fine gravel, trace silt.**					**0.457**	**23.667**

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0901 S-29 53.5' to 54.7'**	**19.0000**	**12.2747**	**3.9909**	**2.4852**	**0.1686**	**36.3**	**59.1**	**4.6**	

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 16



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0902 S-9 18.5' to 20.0'**	**Brown mottled with gray silty clay, little fine to coarse sand, desiccation.**	**22**	**32**	**21**	**11**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0902 S-9 18.5' to 20.0'**	**4.7500**	**0.1360**	**0.0212**	**0.0152**		**0.0**	**11.2**	**59.3**	**29.6**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/2/09

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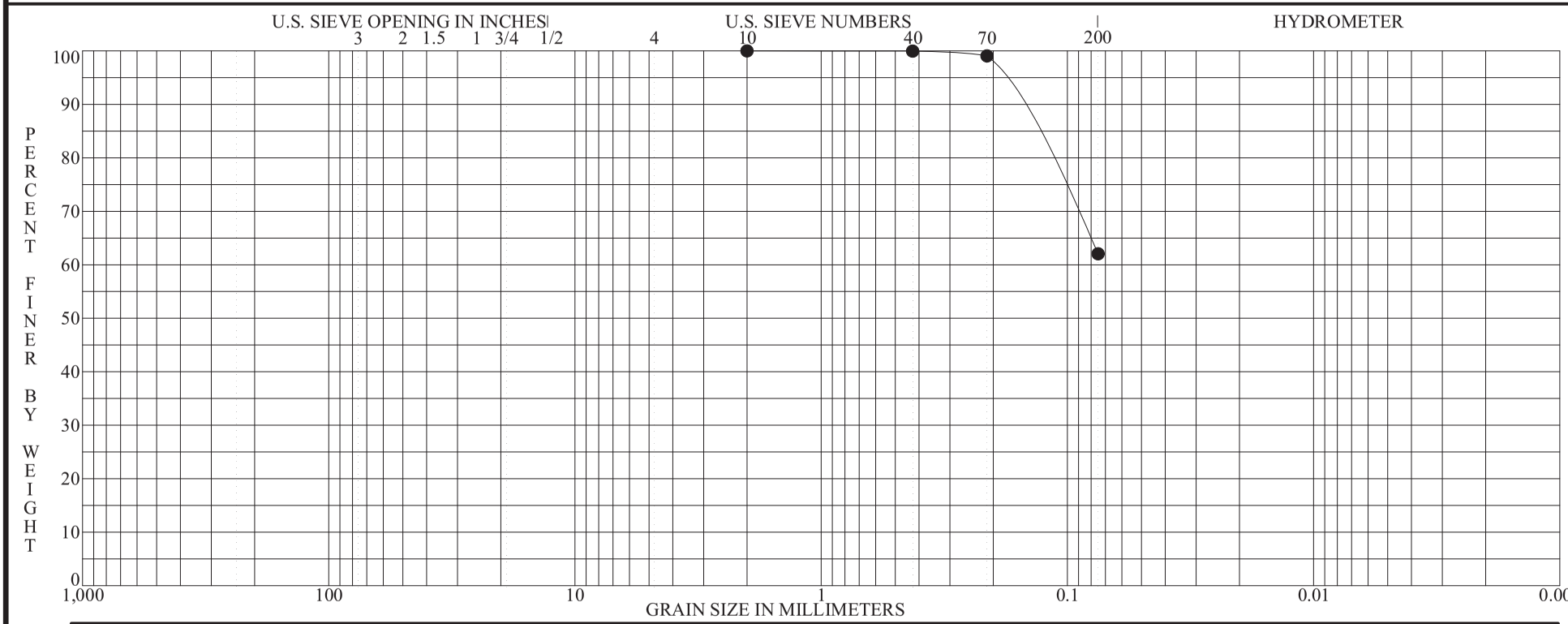
GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

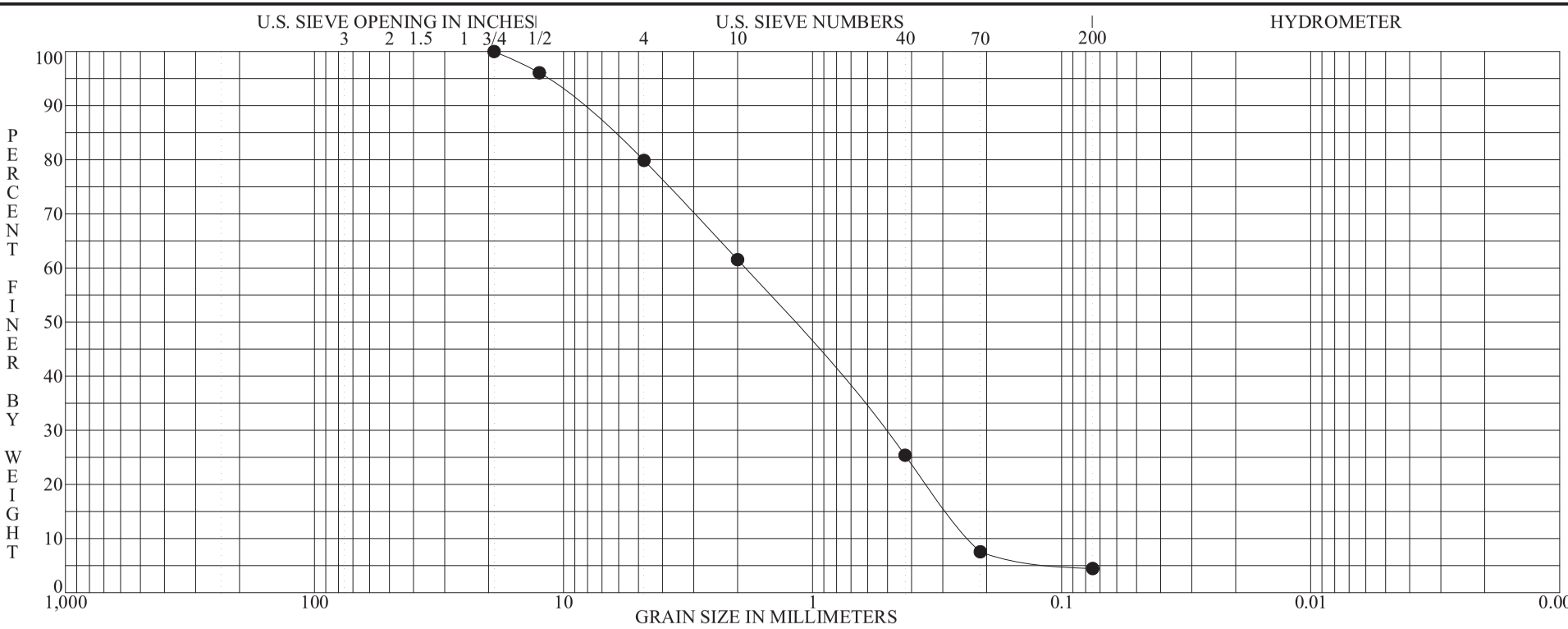
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0902 S-11 23.5' to 25.0'**	**Brown silty clay interbedded with fine to medium sand.**						

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0902 S-11 23.5' to 25.0'**	**2.0000**	**0.1891**				**0.0**	**37.9**	**62.1**	

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 18



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

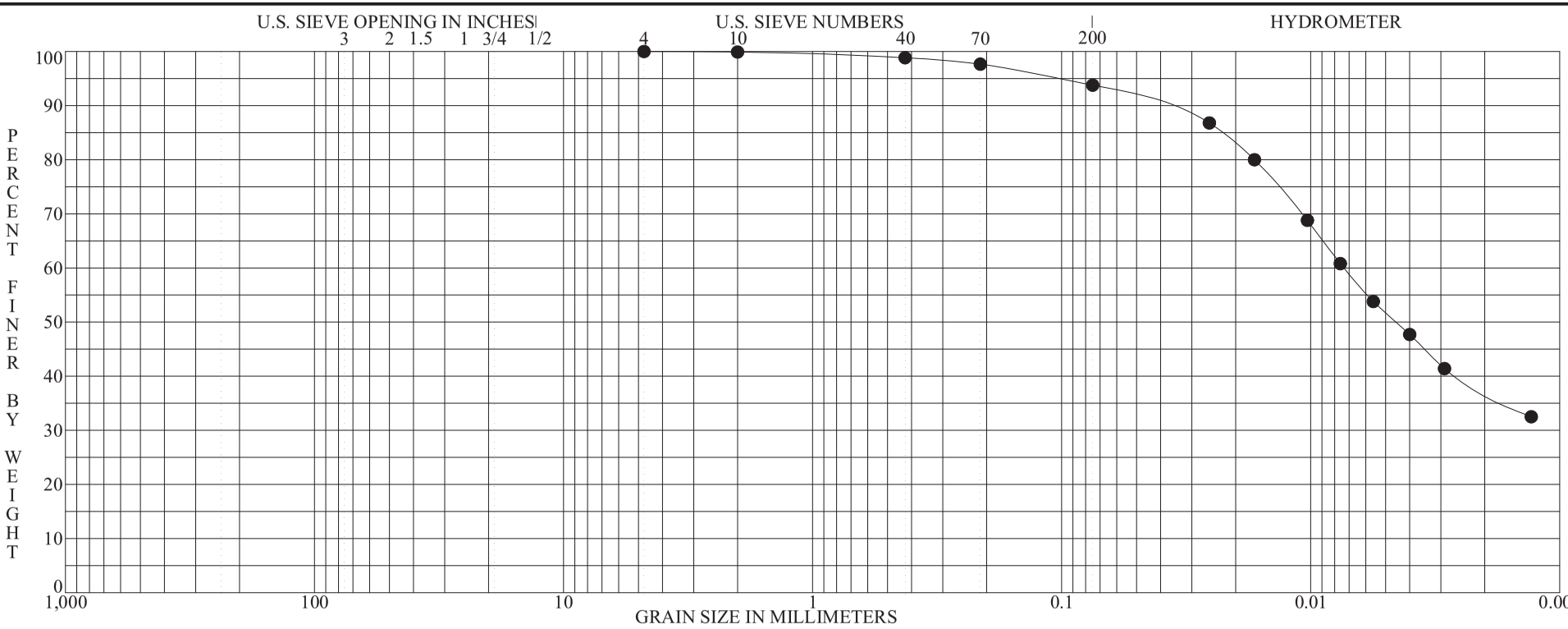
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0902 S-14 31.0' to 32.2'**	**Brown fine to coarse sand, little fine gravel, trace silt.**					**0.614**	**8.024**

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0902 S-14 31.0' to 32.2'**	**19.0000**	**11.7255**	**1.8722**	**1.2198**	**0.2333**	**20.1**	**75.4**	**4.4**	

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

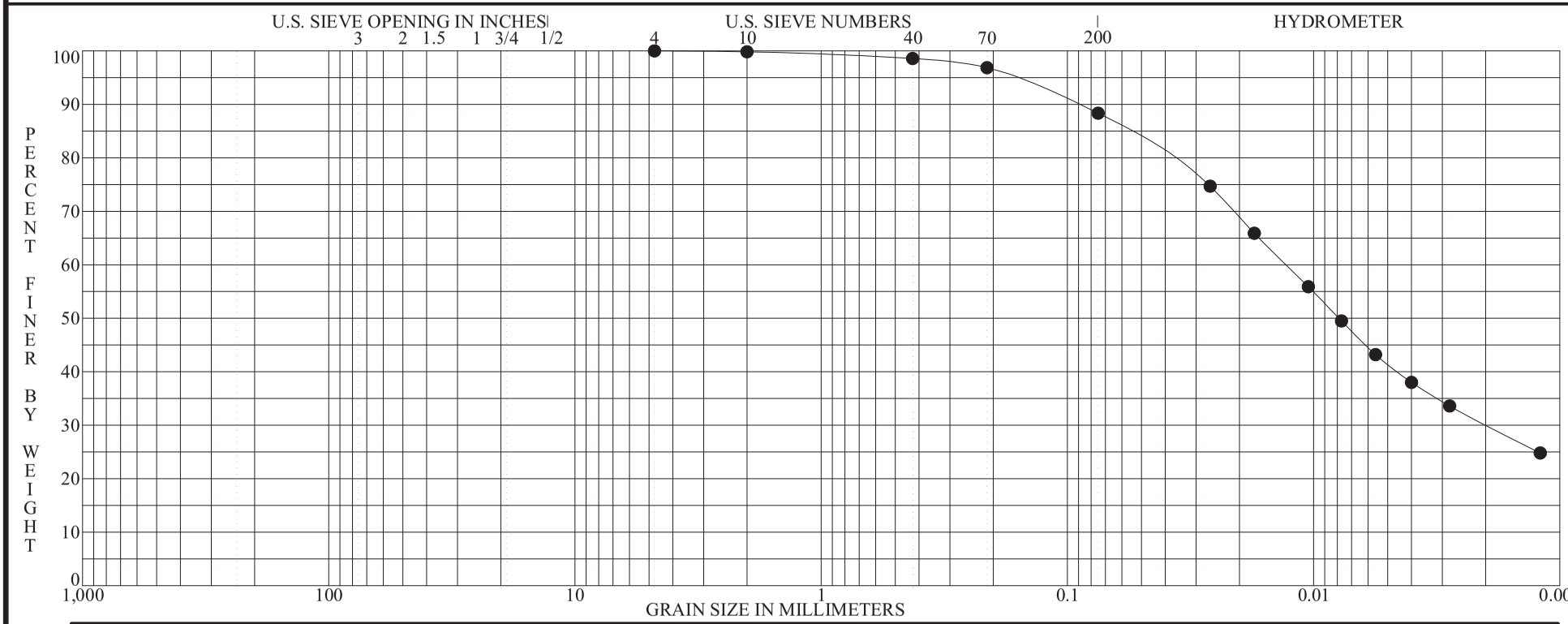
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0903 S-10 15.0' to 16.0'**	**Brown mottled with dark-gray and gray silty clay, trace fine to coarse sand.**	**23**	**52**	**24**	**28**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0903 S-10 15.0' to 16.0'**	**4.7500**	**0.1039**	**0.0073**	**0.0045**		**0.0**	**6.2**	**42.0**	**51.7**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 20



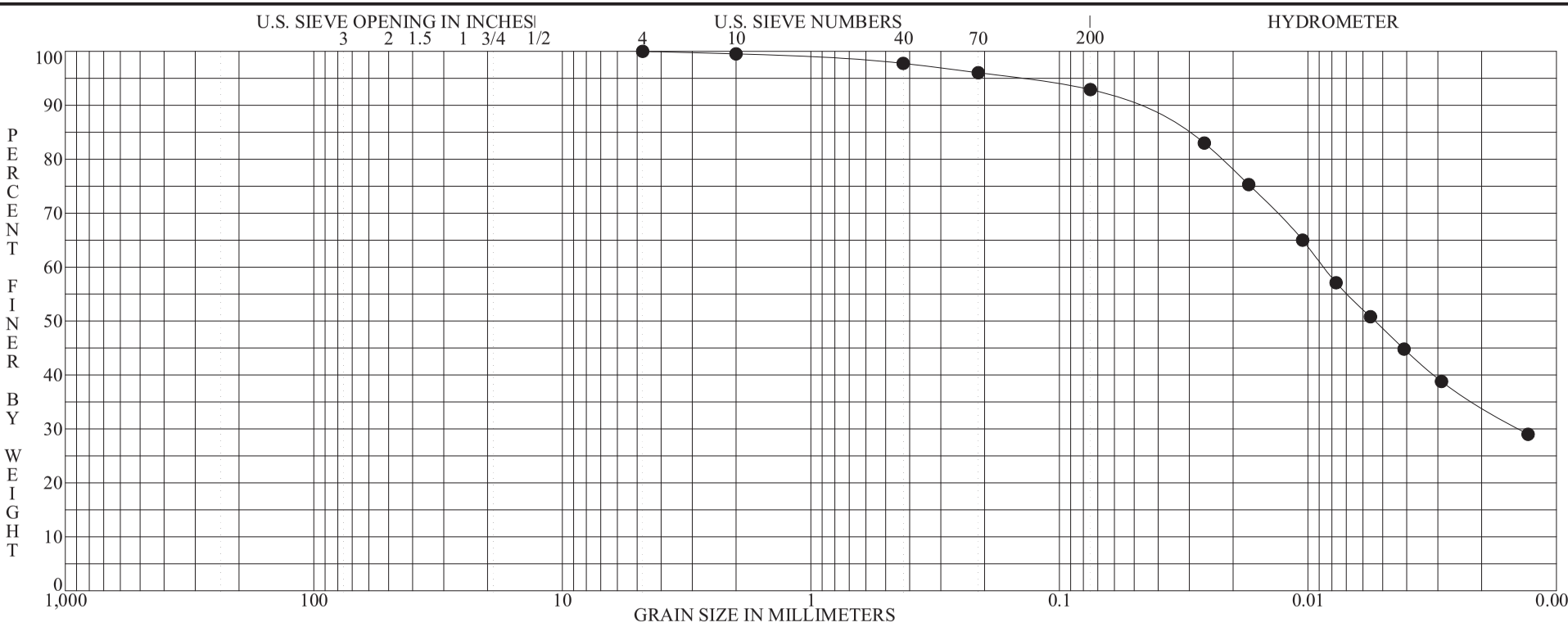
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0903 S-21 33.5' to 34.7'**	**Brown mottled with dark-brown and gray silty clay, little fine to coarse sand.**	**19**	**44**	**22**	**22**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0903 S-21 33.5' to 34.7'**	**4.7500**	**0.1689**	**0.0129**	**0.0079**		**0.0**	**11.6**	**46.9**	**41.4**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0903 S-24 41.0' to 42.5'**	**Brown mottled with dark-brown and gray silty clay, trace fine to coarse sand.**	**24**	**53**	**22**	**31**		

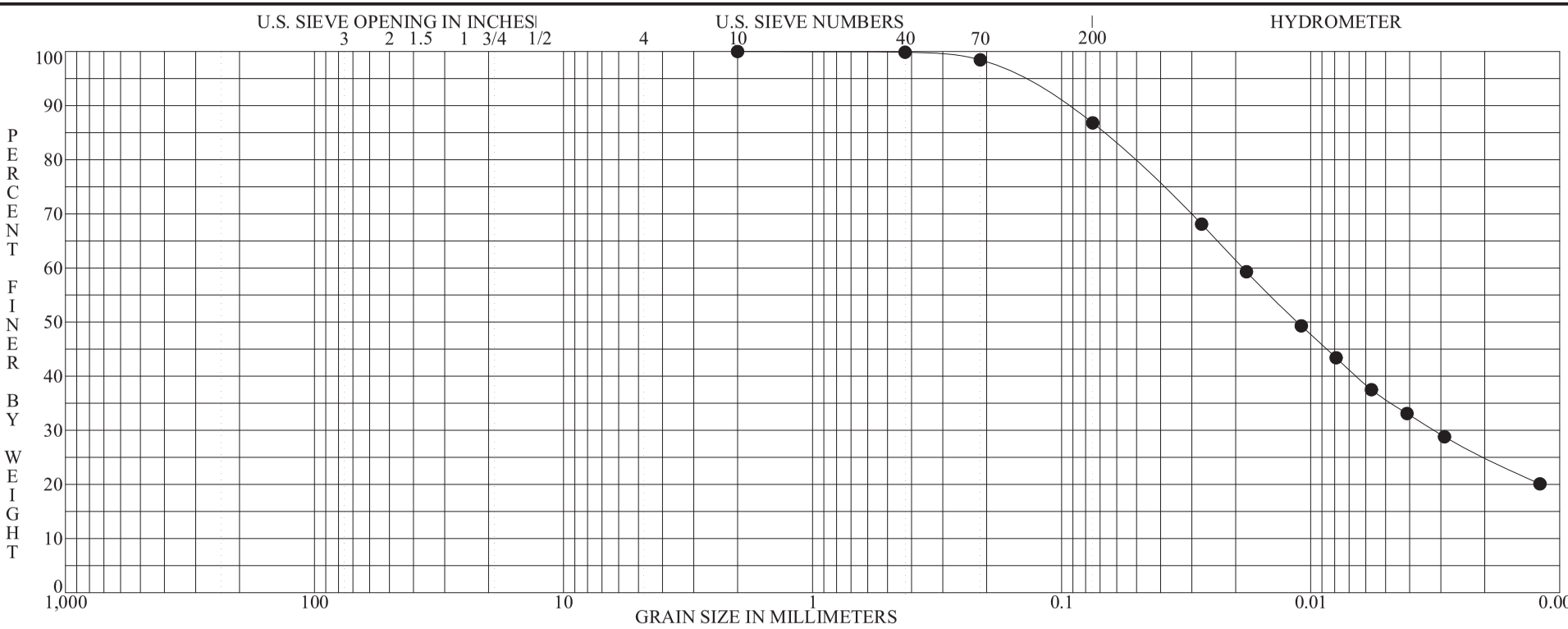
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0903 S-24 41.0' to 42.5'**	**4.7500**	**0.1501**	**0.0086**	**0.0054**		**0.0**	**7.1**	**44.3**	**48.6**

ASTM D422

GRADATION CURVE

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0903 S-30 56.0' to 57.5'**	**Brown mottled with gray and red-brown silty clay, little fine sand, trace medium sand, few lenses of silt and fine sand.**	**25**	**35**	**19**	**16**		

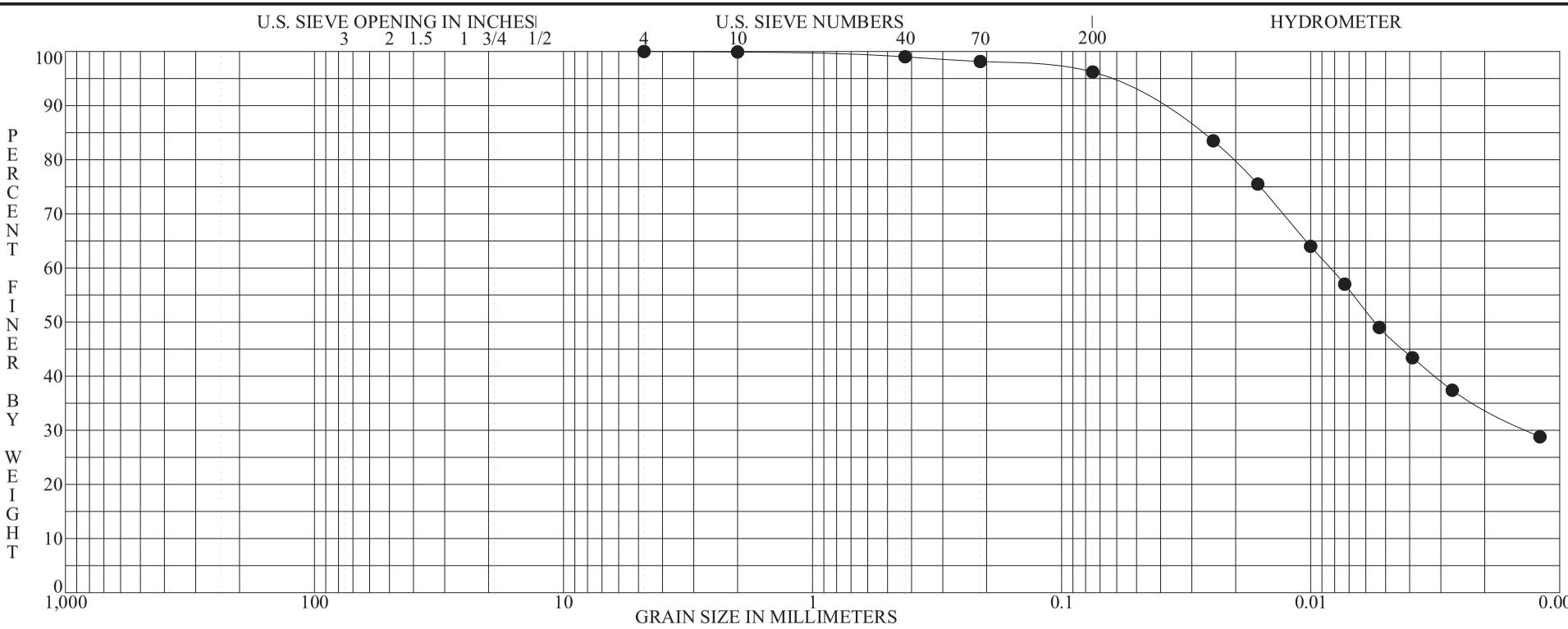
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0903 S-30 56.0' to 57.5'**	**2.0000**	**0.1557**	**0.0187**	**0.0113**		**0.0**	**13.2**	**51.1**	**35.8**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/2/09

PLATE 23



	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0904 S-5 7.0' to 8.3'**	**Brown mottled with gray silty clay, trace fine to coarse sand.**	**30**	**43**	**26**	**17**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0904 S-5 7.0' to 8.3'**	**4.7500**	**0.0674**	**0.0084**	**0.0055**		**0.0**	**3.8**	**48.3**	**47.9**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/2/09

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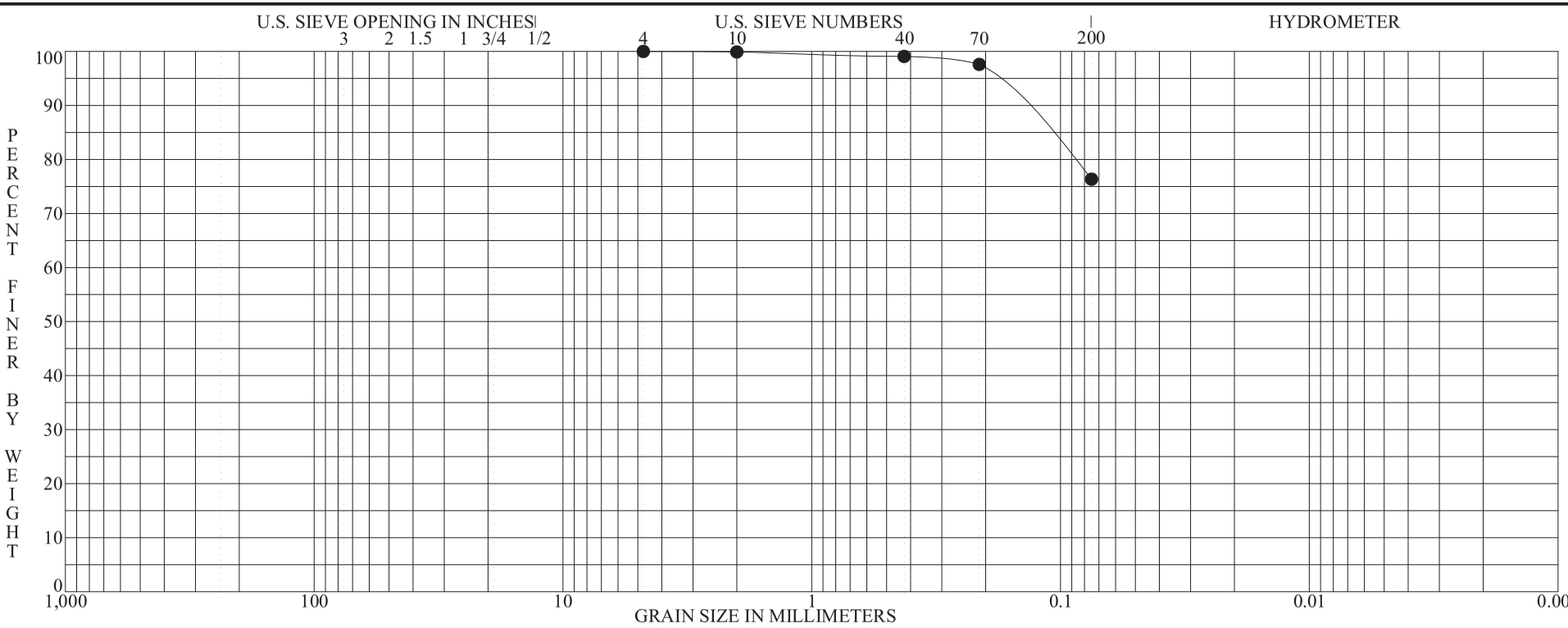
GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0904 S-12 23.5' to 24.6'**	**Gray silty clay, some fine sand, trace medium to coarse sand, contains silt and fine to medium sand lenses.**	**29**	**32**	**19**	**13**		

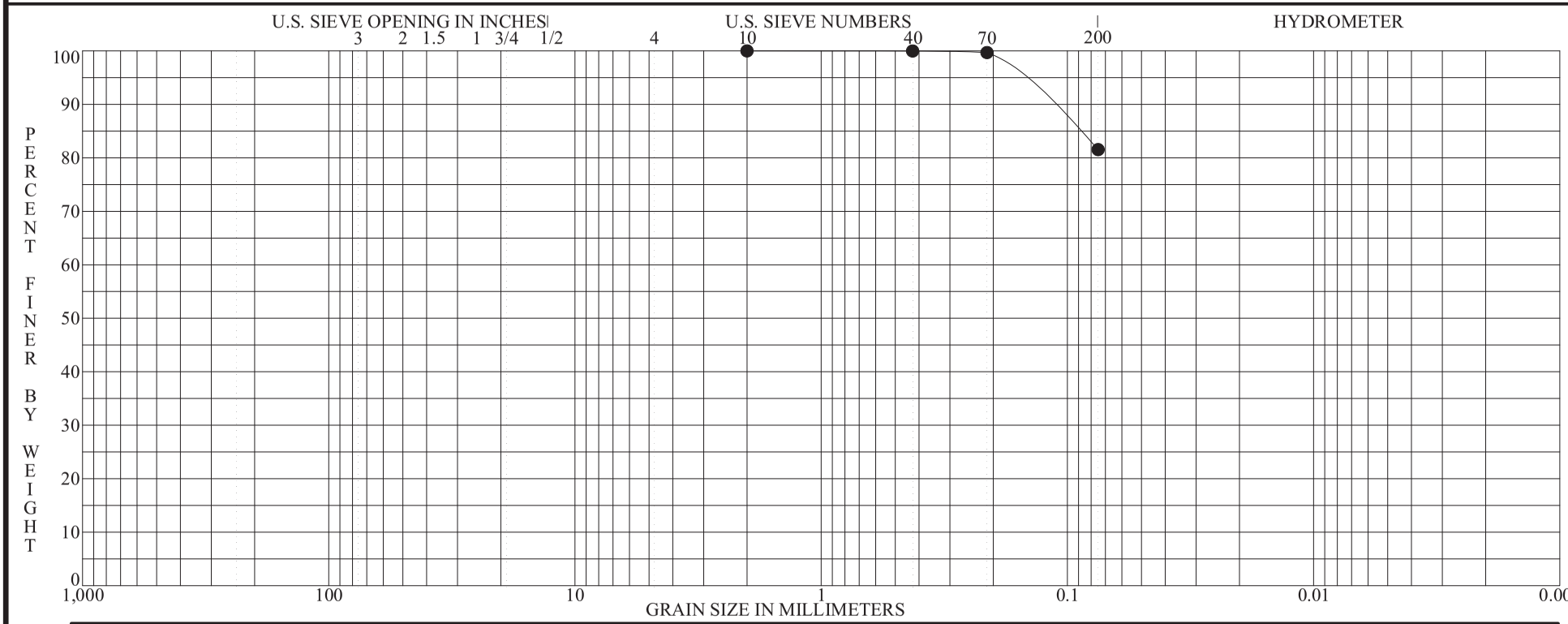
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0904 S-12 23.5' to 24.6'**	**4.7500**	**0.1866**				**0.0**	**23.6**	**76.4**	

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 25

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0904 S-14 28.5' to 29.5'**	**Gray silty clay, little fine to medium sand.**						

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0904 S-14 28.5' to 29.5'**	**2.0000**	**0.1621**				**0.0**	**18.5**	**81.5**	

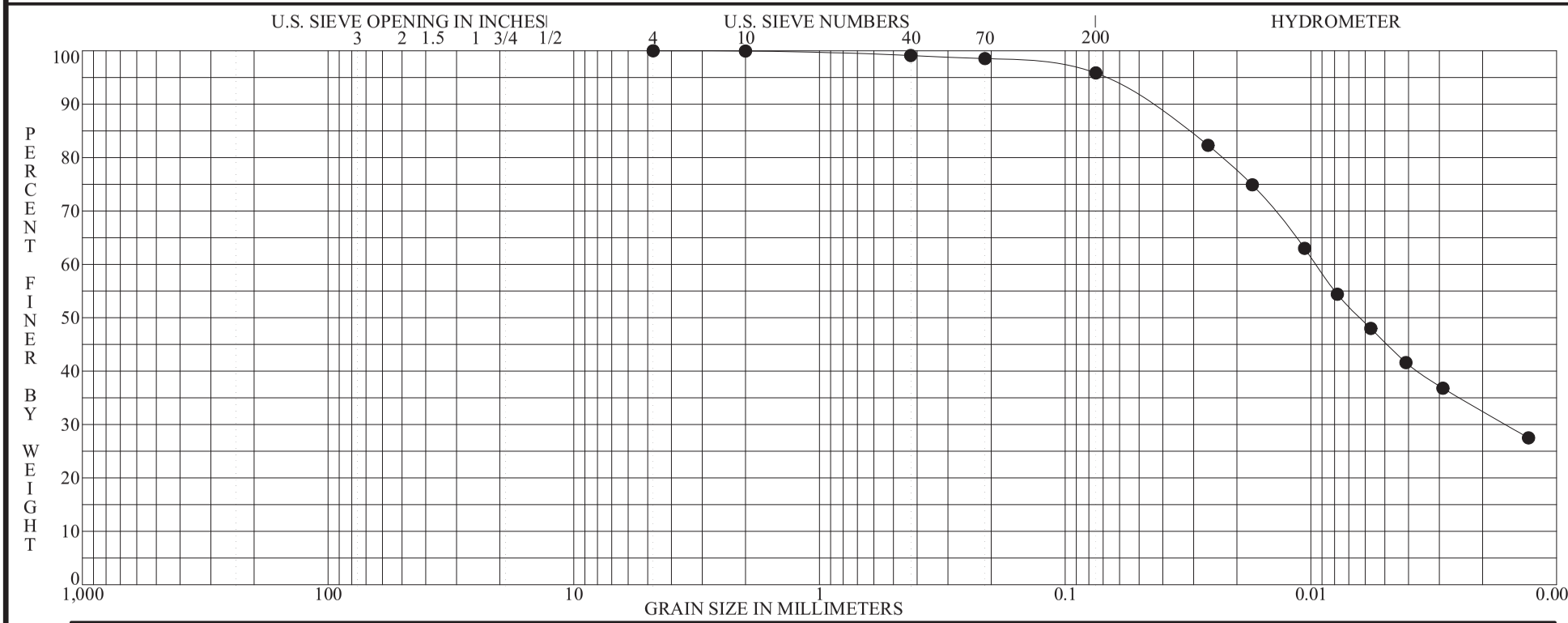
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/2/09

PLATE 26

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 S-8 11.5' to 13.0'**	**Brown mottled with gray silty clay, trace fine to coarse sand.**	**20**	**43**	**23**	**20**		

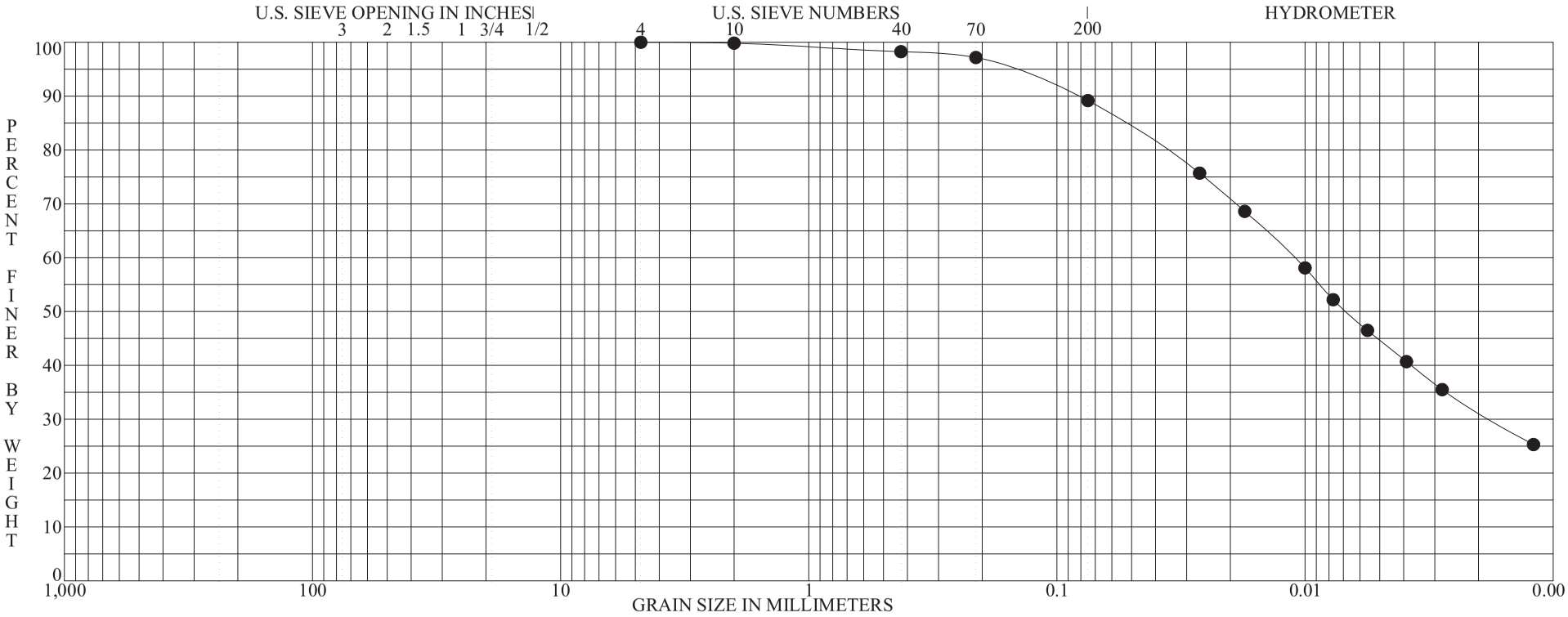
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 S-8 11.5' to 13.0'**	**4.7500**	**0.0701**	**0.0095**	**0.0063**		**0.0**	**4.1**	**50.4**	**45.5**

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 27

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 ST-14 II 20.5' to 22.0'**	**Brown, dark-brown and gray silty clay, little fine to coarse sand.**	**21**	**40**	**23**	**17**		

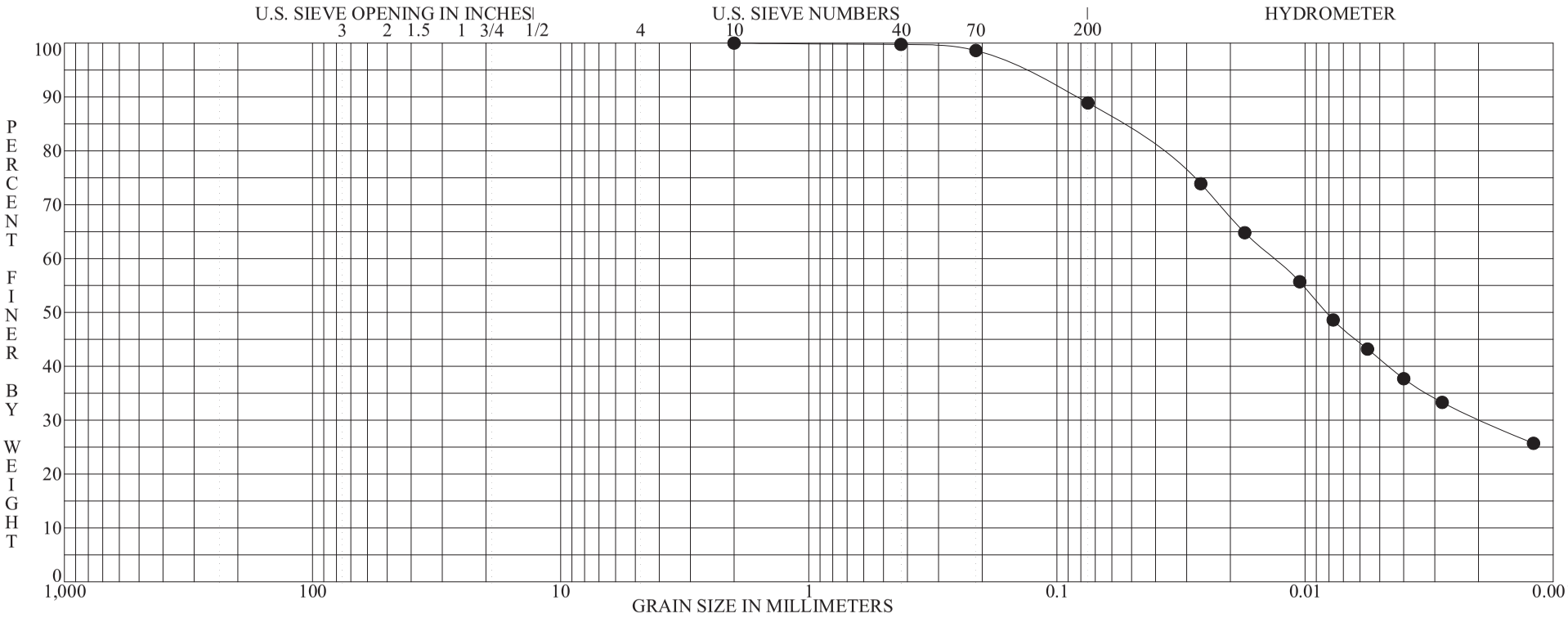
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 ST-14 II 20.5' to 22.0'**	**4.7500**	**0.1599**	**0.0111**	**0.0068**		**0.0**	**10.8**	**44.5**	**44.7**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 28

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 S-17 25.5' to 26.5'**	**Brown mottled with dark-brown and gray silty clay, little fine to medium sand.**	**18**	**39**	**19**	**20**		

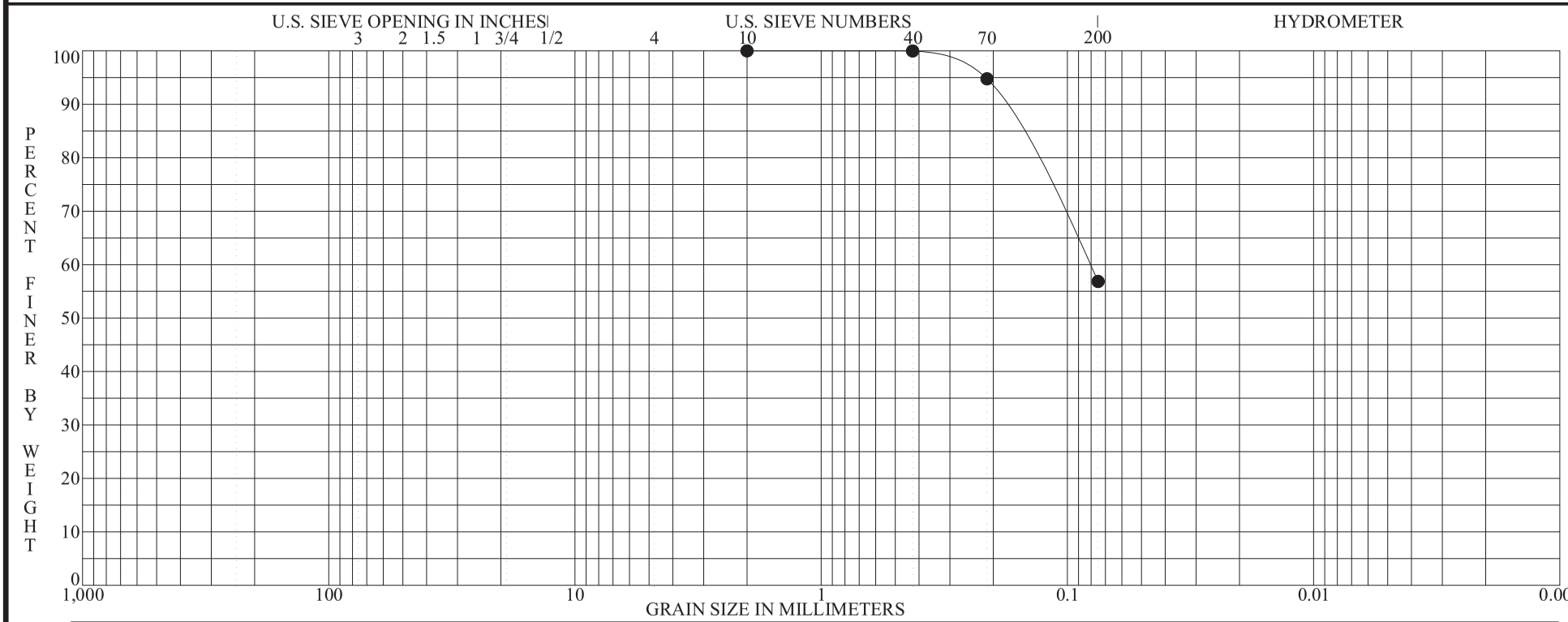
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 S-17 25.5' to 26.5'**	**2.0000**	**0.1439**	**0.0134**	**0.0082**		**0.0**	**11.1**	**47.5**	**41.3**

ASTM D422

GRADATION CURVE

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 29



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 S-21 33.5' to 35.0'**	**Brown silty clay, "and" fine to coarse sand.**						

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 S-21 33.5' to 35.0'**	**2.0000**	**0.2185**	**0.0818**			**0.0**	**43.1**	**56.9**	

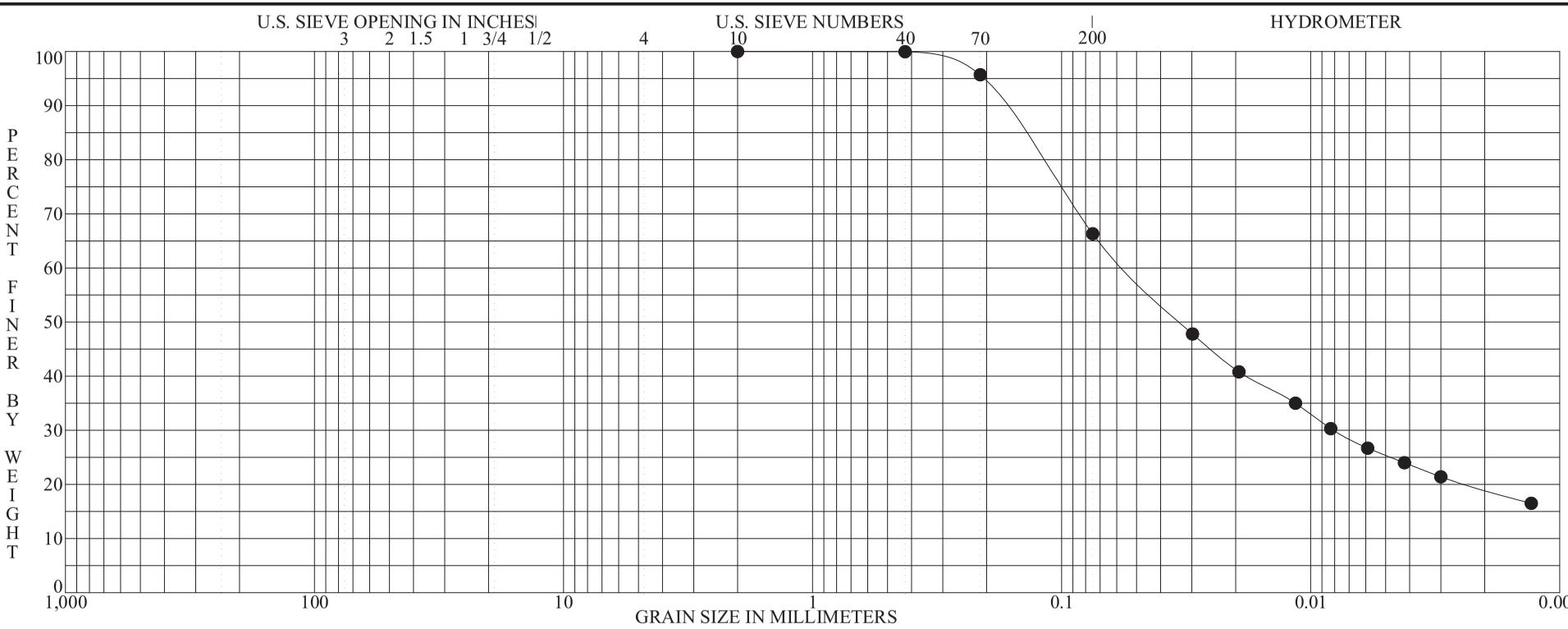
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 6/2/09

GRN-REG

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 S-22 36.0' to 37.5'**	**Brown clayey silt, some fine sand, trace medium sand.**	**19**	**28**	**18**	**10**		

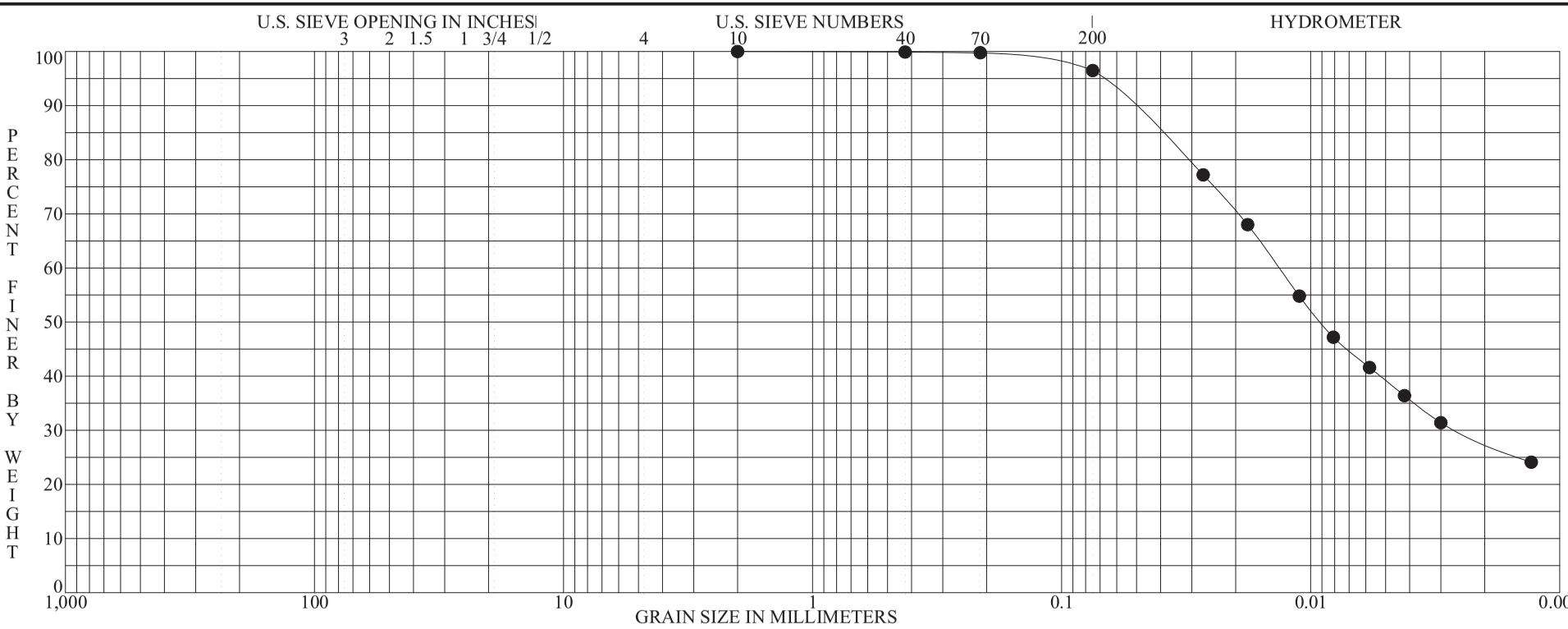
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 S-22 36.0' to 37.5'**	**2.0000**	**0.2068**	**0.0548**	**0.0333**		**0.0**	**33.7**	**40.9**	**25.4**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 31

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

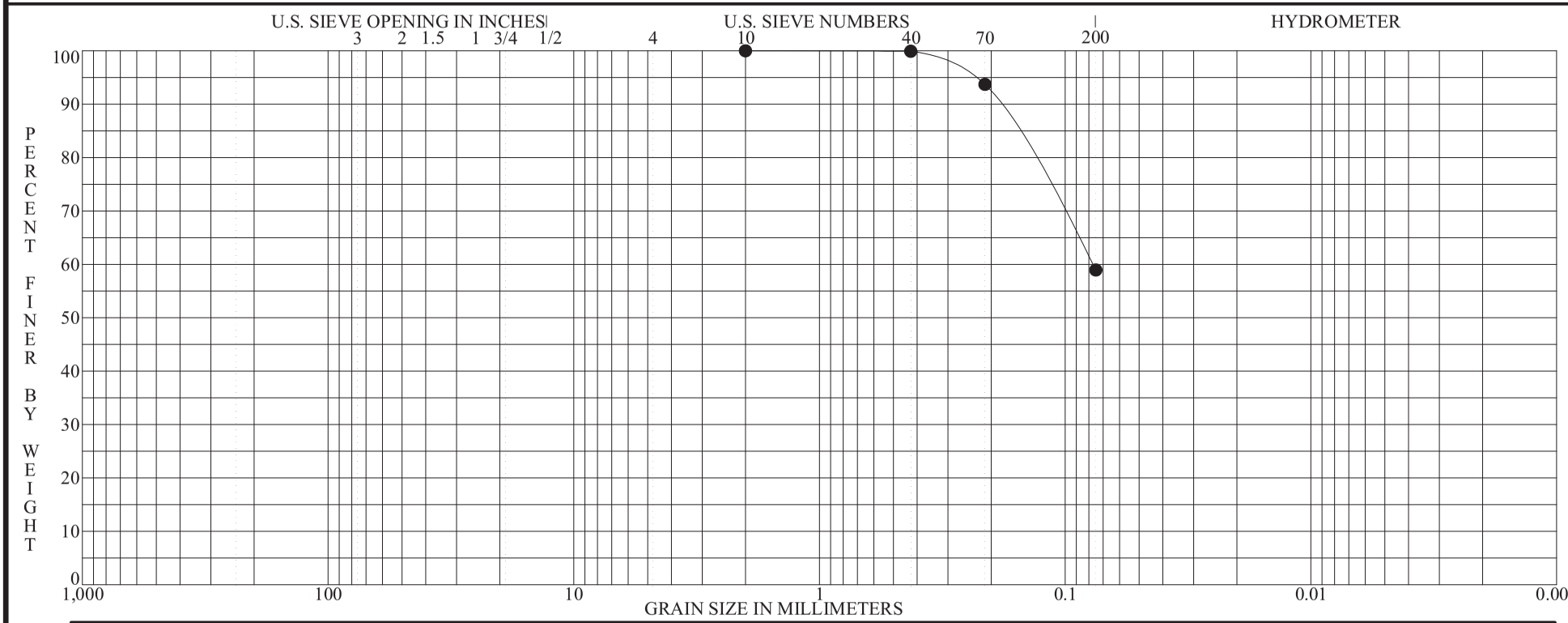
	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0905 S-25 43.0' to 45.0'**	**Brown mottled with gray silty clay, trace fine to medium sand, contains few silt lenses..**	**25**	**42**	**21**	**21**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0905 S-25 43.0' to 45.0'**	**2.0000**	**0.0693**	**0.0134**	**0.0091**		**0.0**	**3.5**	**57.3**	**39.2**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 32



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

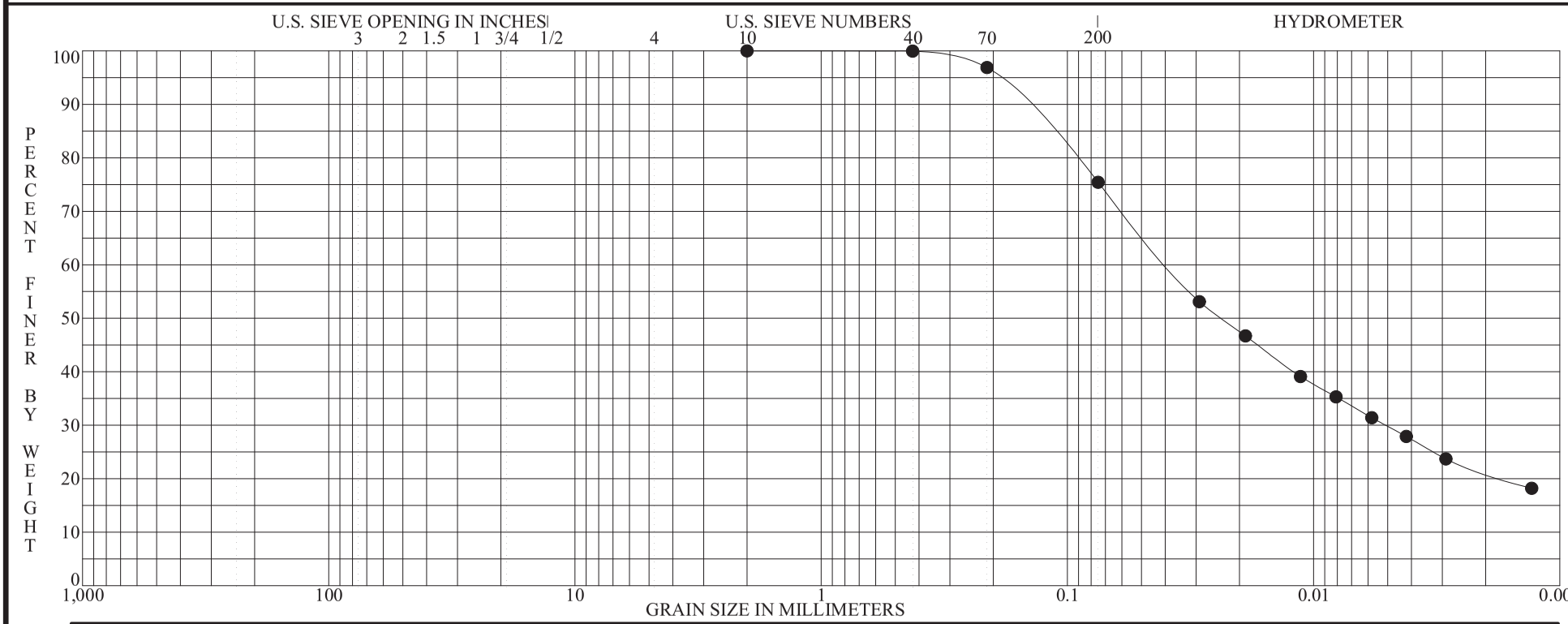
Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
● **BAP-0905 S-29 53.5' to 55.0'**	**Brown silt, "and" fine to coarse sand.**						

Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **BAP-0905 S-29 53.5' to 55.0'**	**2.0000**	**0.2447**	**0.0774**			**0.0**	**41.1**	**58.9**	

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0906 S-4 5.5' to 6.7'**	**Brown silty clay, some fine sand, trace medium sand.**	**18**	**35**	**20**	**15**		

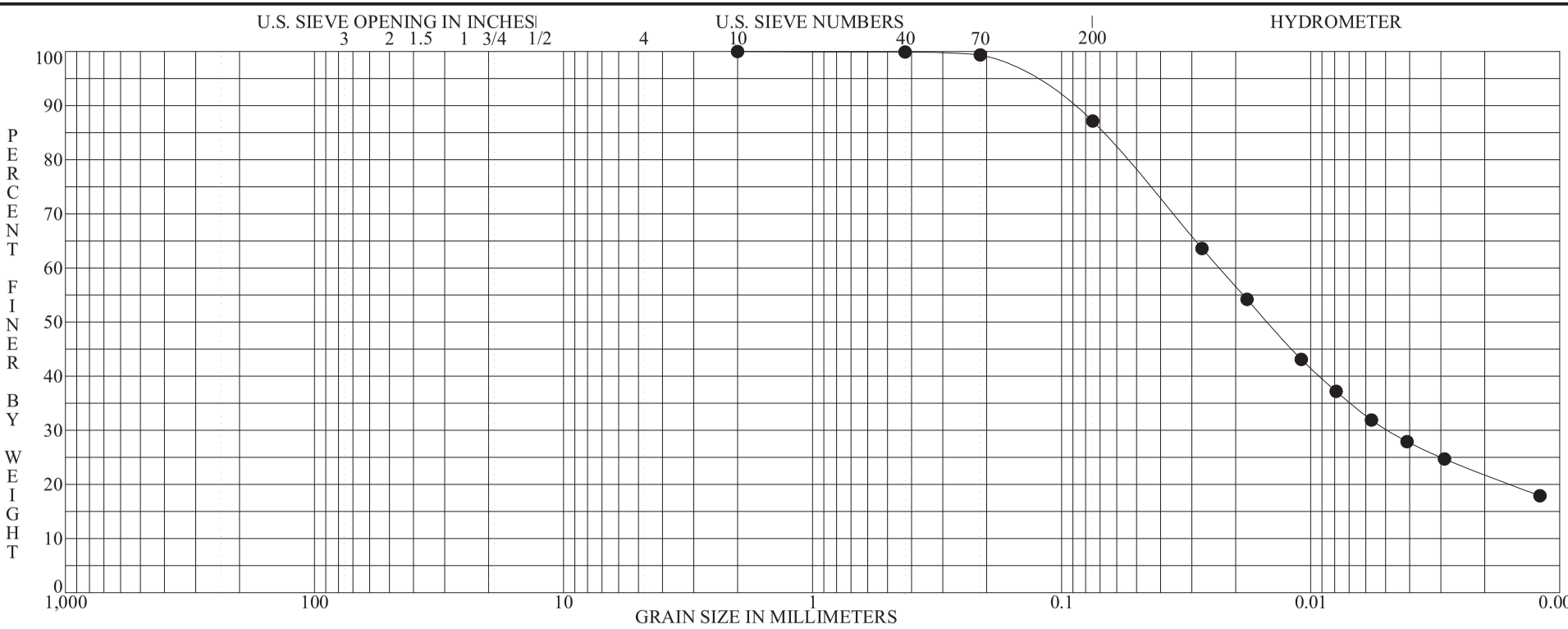
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0906 S-4 5.5' to 6.7'**	**2.0000**	**0.1934**	**0.0390**	**0.0236**		**0.0**	**24.6**	**45.6**	**29.8**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 34

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0906 S-10 18.5' to 20.0'**	**Brown silty clay, little fine to medium sand, contains many silt lenses.**	**27**	**34**	**21**	**13**		

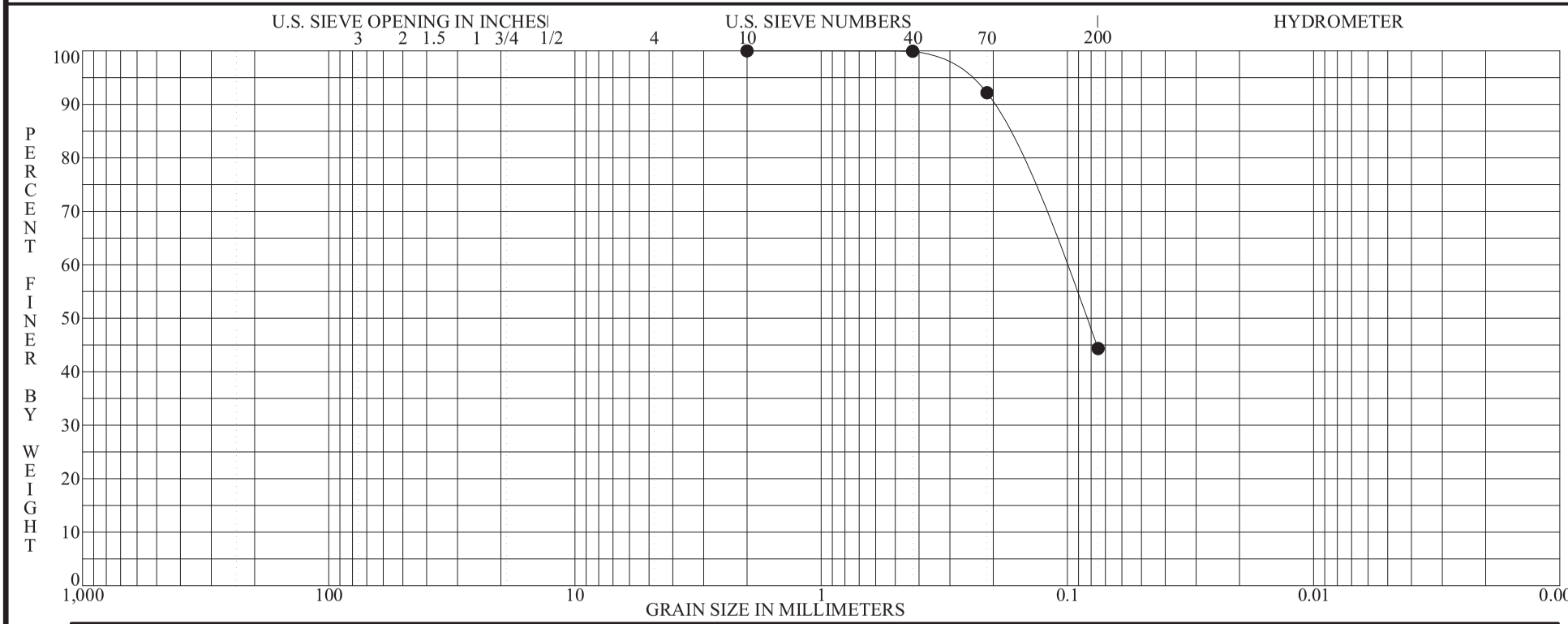
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0906 S-10 18.5' to 20.0'**	**2.0000**	**0.1462**	**0.0233**	**0.0149**		**0.0**	**12.9**	**56.8**	**30.3**

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 35

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0906 S-14 28.5' to 30.0'**	**Brown fine sand, trace medium sand, "and" silty clay.**						

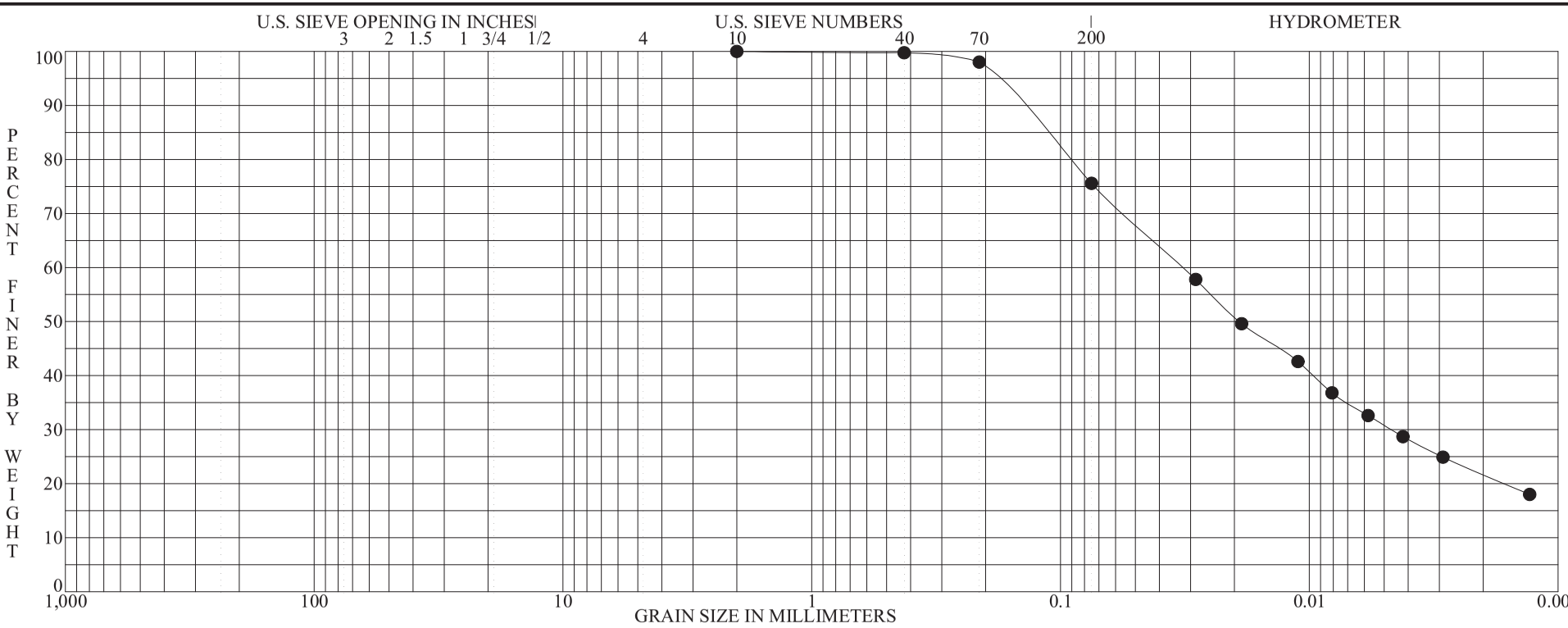
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0906 S-14 28.5' to 30.0'**	**2.0000**	**0.2729**	**0.1054**	**0.0848**		**0.0**	**55.7**	**44.3**	

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 36

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-9 13.0' to 14.1'**	**Brown mottled with gray silty clay, some fine sand, trace medium sand.**	**18**	**32**	**16**	**16**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-9 13.0' to 14.1'**	**2.0000**	**0.1842**	**0.0322**	**0.0191**		**0.0**	**24.4**	**44.8**	**30.8**

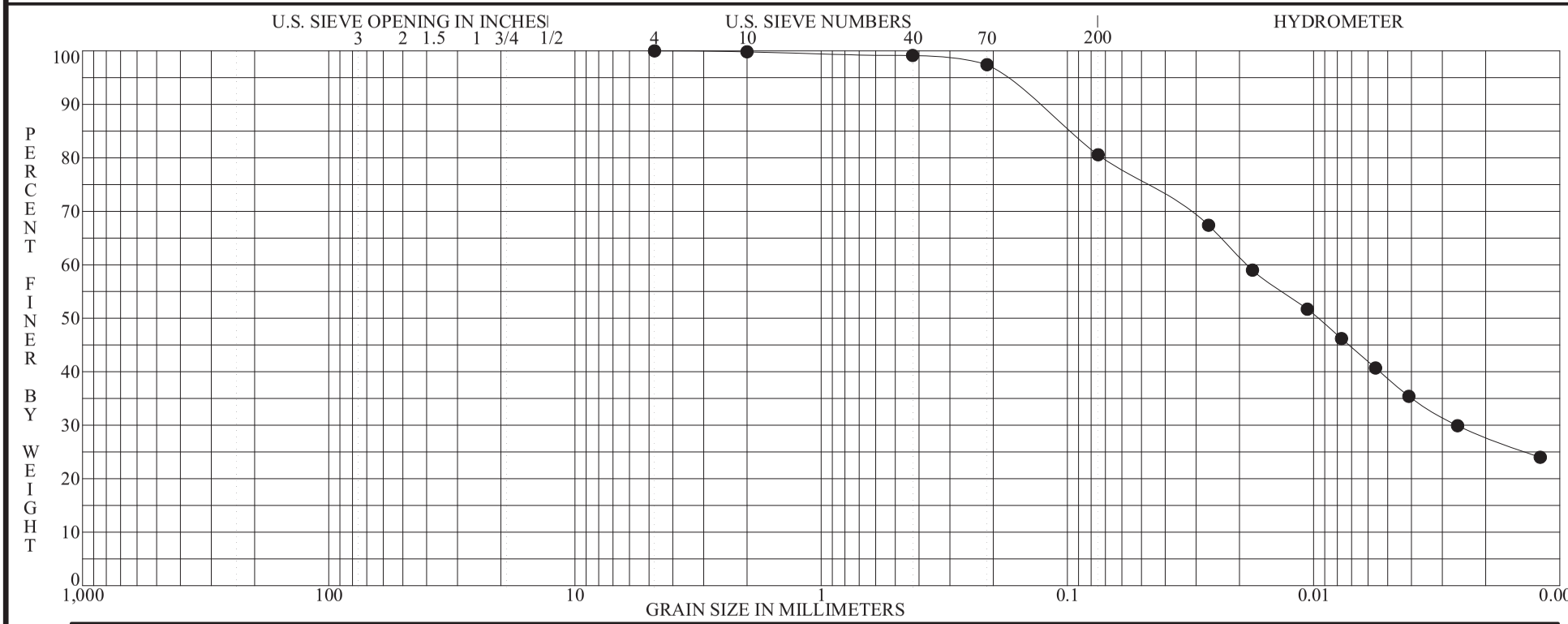
ASTM D422

GRADATION CURVE

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 37

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-12 I 17.5' to 19.1'**	**Brown mottled with gray silty clay, little fine to coarse sand.**	**20**	**35**	**20**	**15**		

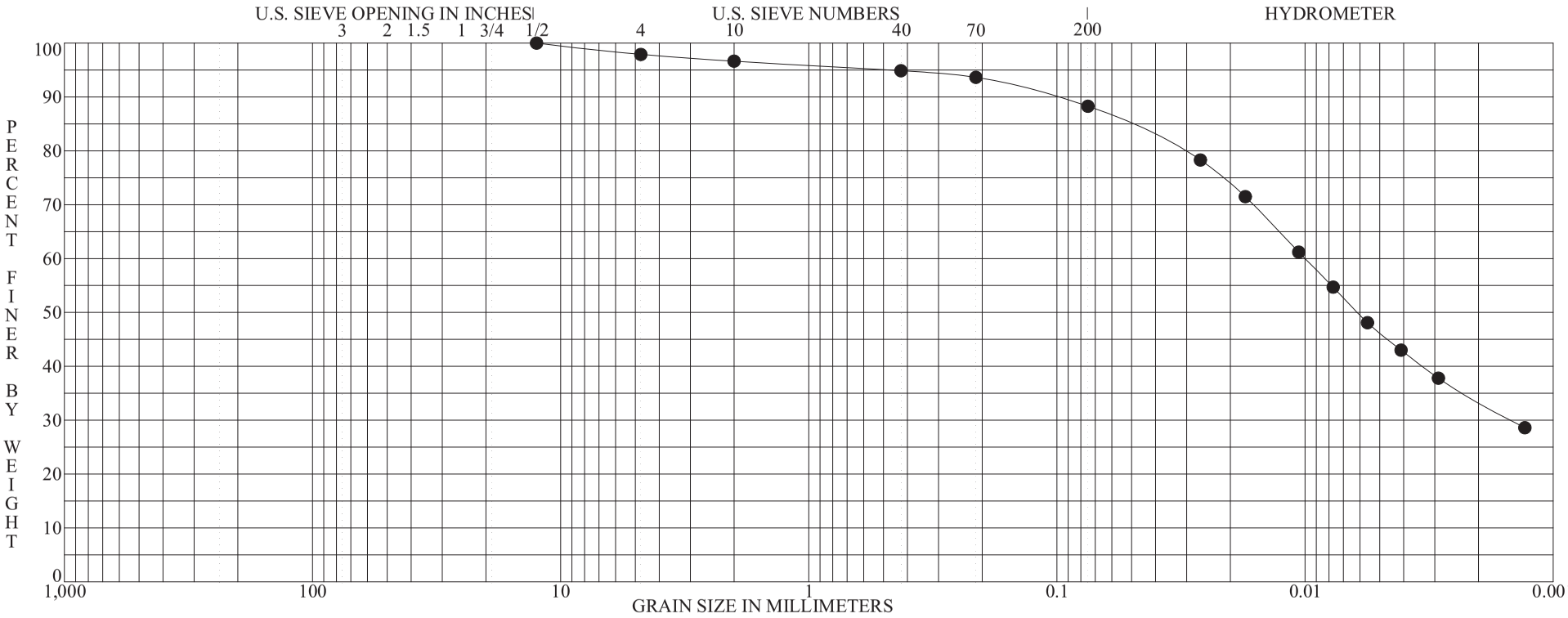
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-12 I 17.5' to 19.1'**	**4.7500**	**0.1826**	**0.0186**	**0.0096**		**0.0**	**19.4**	**41.8**	**38.8**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 38

BBCM



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-21 33.5' to 35.0'**	**Brown mottled with gray silty clay, trace fine to coarse sand, trace fine gravel.**	**19**	**52**	**24**	**28**		

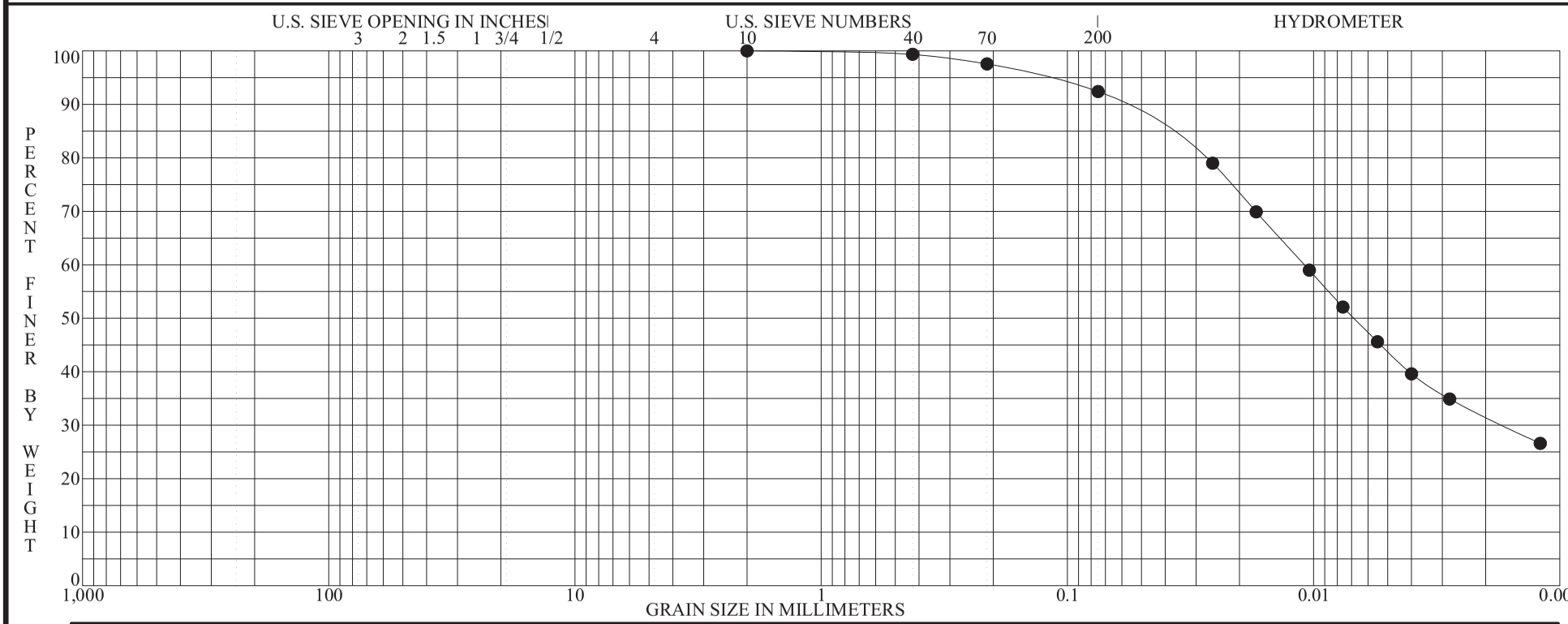
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-21 33.5' to 35.0'**	**12.5000**	**0.4745**	**0.0100**	**0.0061**		**2.1**	**9.6**	**42.0**	**46.2**

ASTM D422

GRADATION CURVE

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-23 38.5' to 40.0'**	**Brown mottled with dark-brown silty clay, trace fine to medium sand.**	**21**	**47**	**24**	**23**		

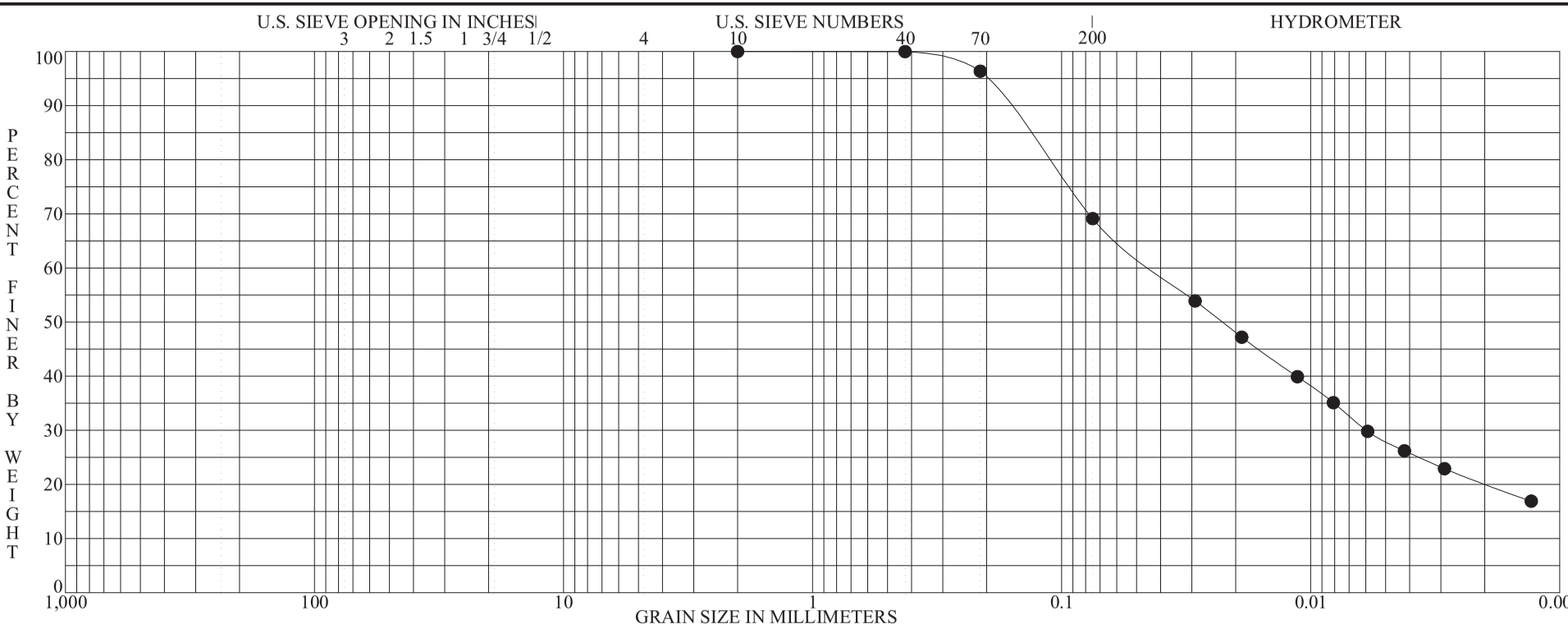
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-23 38.5' to 40.0'**	**2.0000**	**0.1265**	**0.0109**	**0.0068**		**0.0**	**7.6**	**48.6**	**43.8**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 40

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-26 46.5' to 48.0'**	**Brown silty clay, some fine sand, trace medium sand.**	**18**	**31**	**17**	**14**		

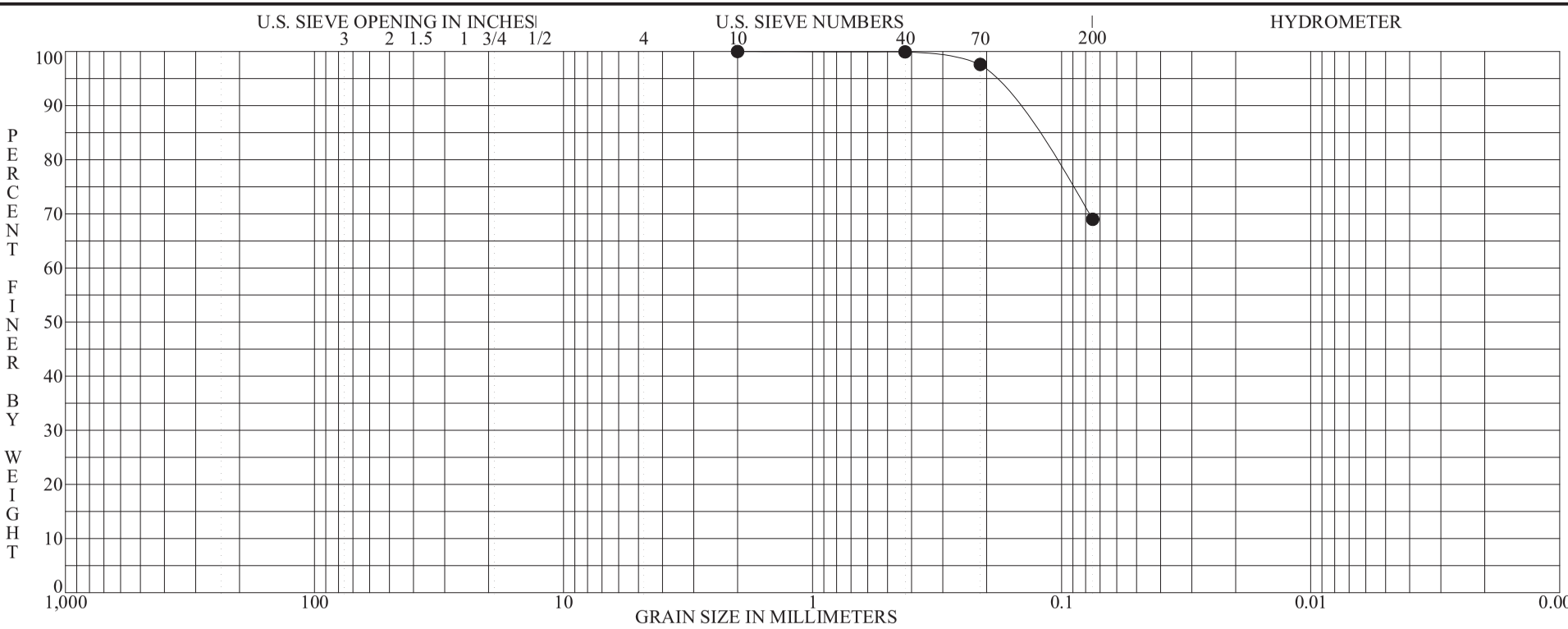
	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-26 46.5' to 48.0'**	**2.0000**	**0.2012**	**0.0425**	**0.0226**		**0.0**	**30.9**	**41.1**	**28.0**

ASTM D422 | **GRADATION CURVE**

PROJECT: GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION: CHESHIRE, OHIO
JOB NO.: 011.11497.014 DATE: 6/2/09

PLATE 41

GRN-REG



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BAP-0907 S-28 51.0' to 52.2'**	**Brown silty clay, some fine to coarse sand.**	**20**	**32**	**18**	**14**		

	Specimen Identification - Depth	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BAP-0907 S-28 51.0' to 52.2'**	**2.0000**	**0.1928**				**0.0**	**31.0**	**69.0**	

ASTM D422 | **GRADATION CURVE**

PROJECT: **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION: **CHESHIRE, OHIO**
JOB NO.: **011.11497.014** DATE: **6/2/09**

PLATE 42

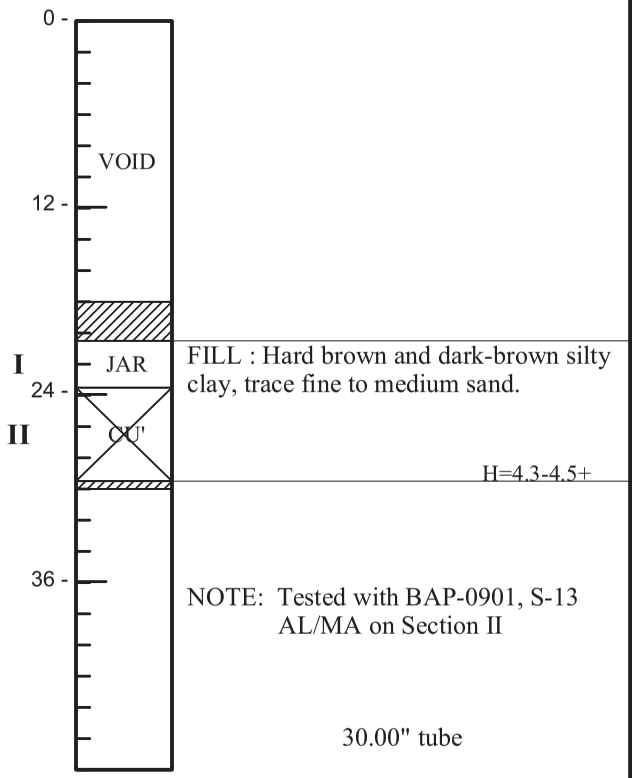
SHELBY TUBE LOG 111497014.GPJ BBCM.GDT 6/2/09

JOB NUMBER : **011.11497.014**
PROJECT : **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION : **CHESHIRE, OHIO**

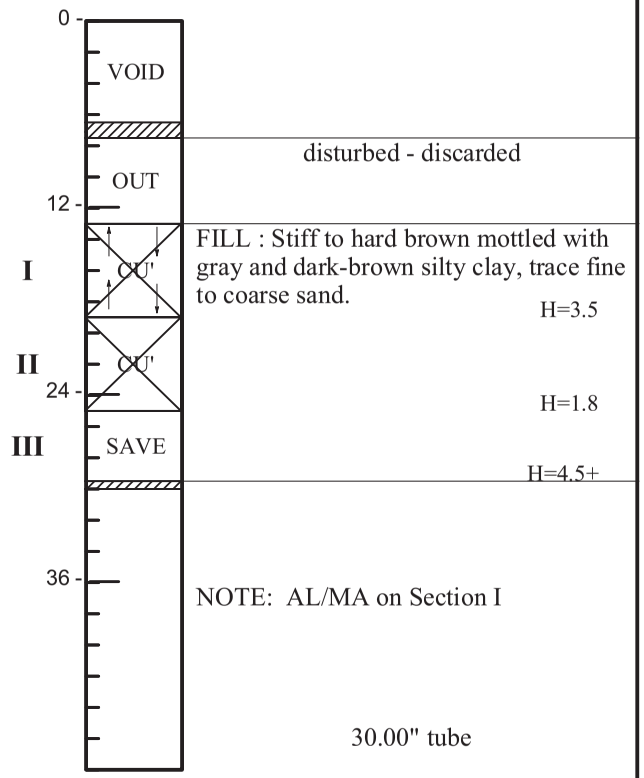
BBCM

LABORATORY LOG OF SHELBY TUBES

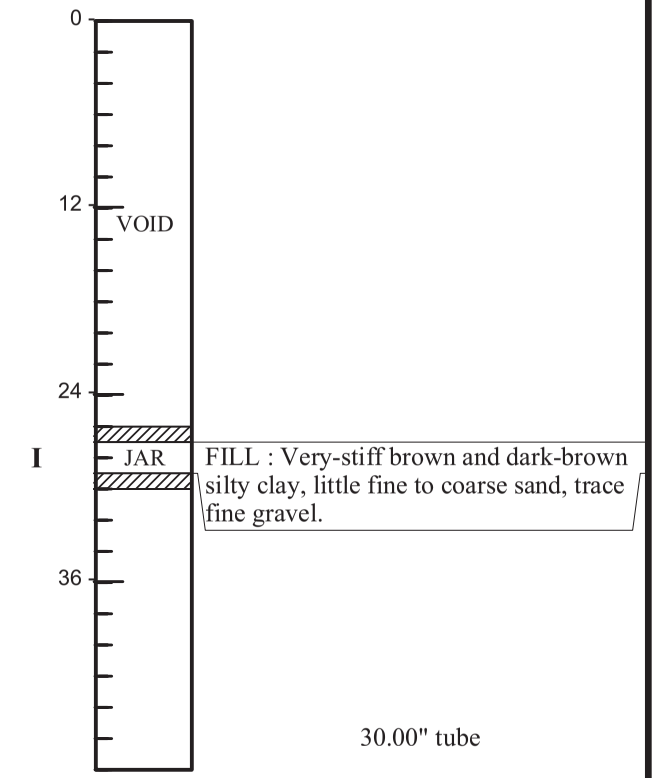
Boring : **BAP-0901** Sample : **5**
Depth : **7.0' to 7.9'** Recovery : **9.00"**



Boring : **BAP-0901** Sample : **13**
Depth : **19.5' to 21.5'** Recovery : **16.50"**



Boring : **BAP-0903** Sample : **4**
Depth : **5.5' to 5.7'** Recovery : **2.00"**



LEGEND

- Consolidation, Incremental
- Swelling, Test
- Wax
- C R S - Consolidation, C R S
- P P - Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
SL - Shrinkage Limit
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

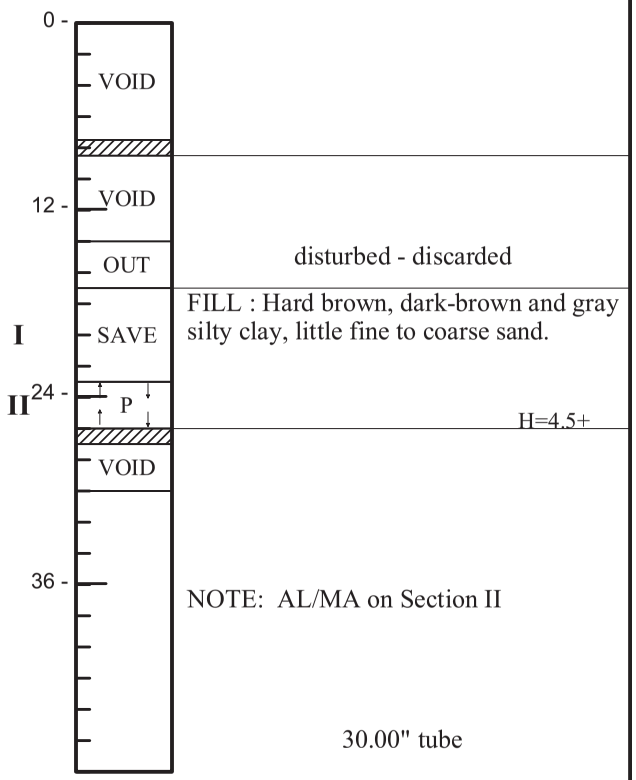
PLATE 43

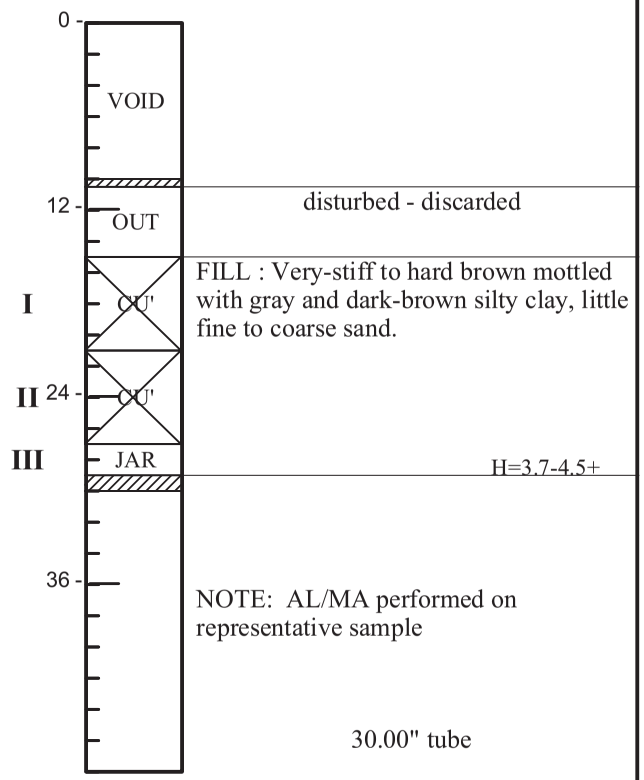
JOB NUMBER : **011.11497.014**
PROJECT : **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION : **CHESHIRE, OHIO**

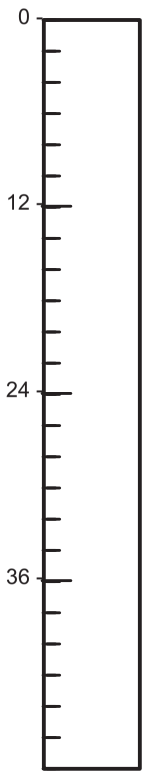
BBCM

LABORATORY LOG OF SHELBY TUBES

Boring : **BAP-0905**	Sample : **14**	Boring : **BAP-0907**	Sample : **12**	Boring :	Sample :
Depth : **20.5' to 22.0'**	Recovery : **9.00"**	Depth : **17.5' to 19.1'**	Recovery : **14.00"**	Depth :	Recovery :







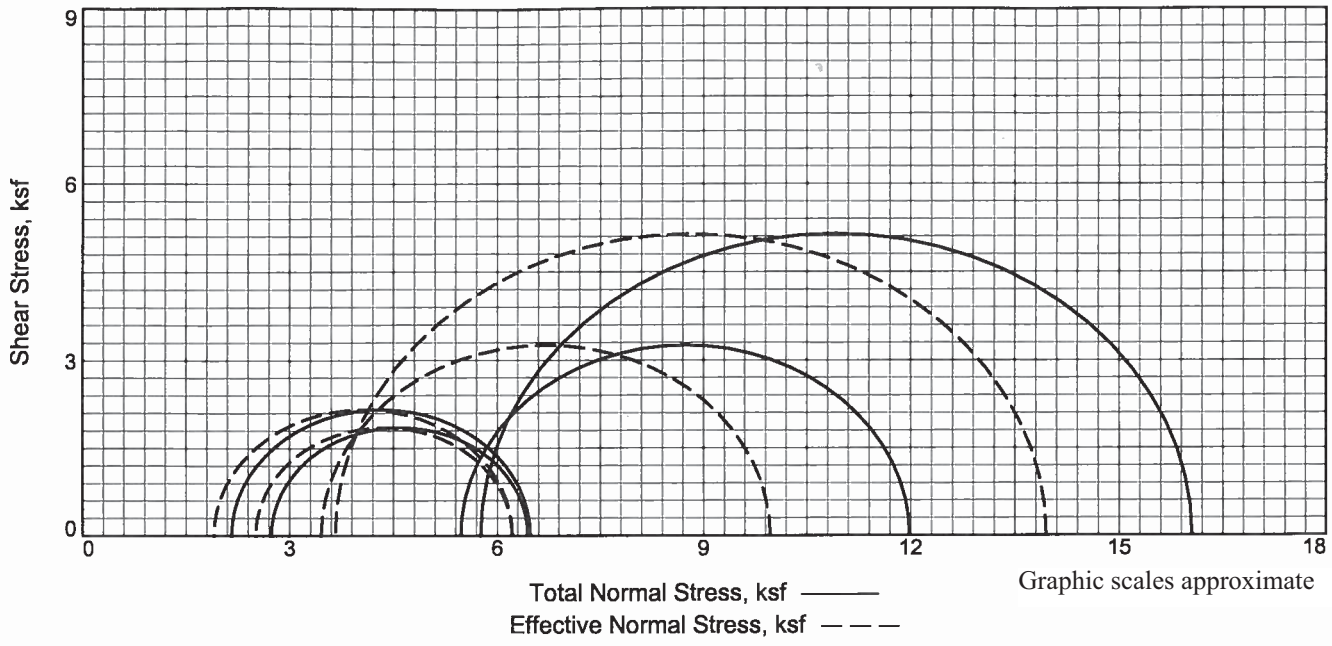
LEGEND

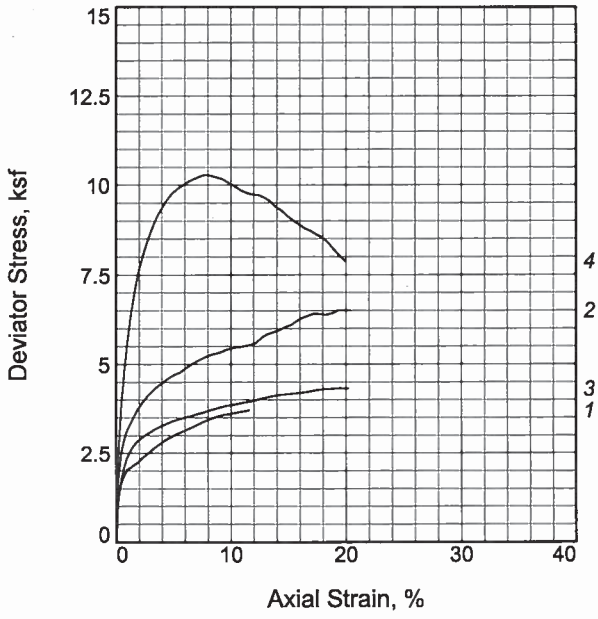
- Consolidation, Incremental
- Swelling, Test
- Wax
- C R S - Consolidation, C R S
- P P - Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
SL - Shrinkage Limit
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

SHELBY TUBE LOG 111497014.GPJ BBCM.GDT 6/2/09

PLATE 44





Sample No.		1	2	3	4
Initial	Water Content, %	21.0	21.9	19.9	20.7
	Dry Density, pcf	105.6	104.8	107.6	109.2
	Saturation, %	95.1	97.0	94.7	99.7
	Void Ratio	0.5967	0.6080	0.5672	0.5719
	Diameter, in.	2.87	2.89	2.88	2.85
	Height, in.	5.60	5.59	5.59	5.59
At Test	Water Content, %	21.0	21.1	21.0	21.2
	Dry Density, pcf	107.7	106.9	110.1	113.1
	Saturation, %	100.5	98.9	106.8	112.6
	Void Ratio	0.5648	0.5762	0.5306	0.5183
	Diameter, in.	2.86	2.88	2.85	2.81
	Height, in.	5.55	5.51	5.55	5.54
Strain rate, in./min.		0.00	0.00	0.01	0.01
Back Pressure, ksf		5.8	5.8	5.8	5.8
Cell Pressure, ksf		8.5	11.2	7.9	11.5
Fail. Stress, ksf		3.7	6.5	4.3	10.3
Total Pore Pr., ksf		6.0	7.8	6.0	7.9
Ult. Stress, ksf		3.7	6.5	4.3	7.9
Total Pore Pr., ksf		6.0	7.7	6.0	8.6
$\bar{\sigma}_1$ Failure, ksf		6.2	10.0	6.2	13.9
$\bar{\sigma}_3$ Failure, ksf		2.5	3.5	1.9	3.7

Type of Test:
CU with Pore Pressures

Sample Type: Shelby Tube

Description: FILL : Stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse

LL= 41 **PL=** 22 **PI=** 19

Assumed Specific Gravity= 2.7

Remarks:

Client: AEP

Project: GAVIN PLANT ASH POND INVESTIGATION
CHESHIRE, OHIO

Location: BAP-0901 & BAP-0907

Sample Number: S5II,S13II,S12I&II **Depth:** 7.0-21.5

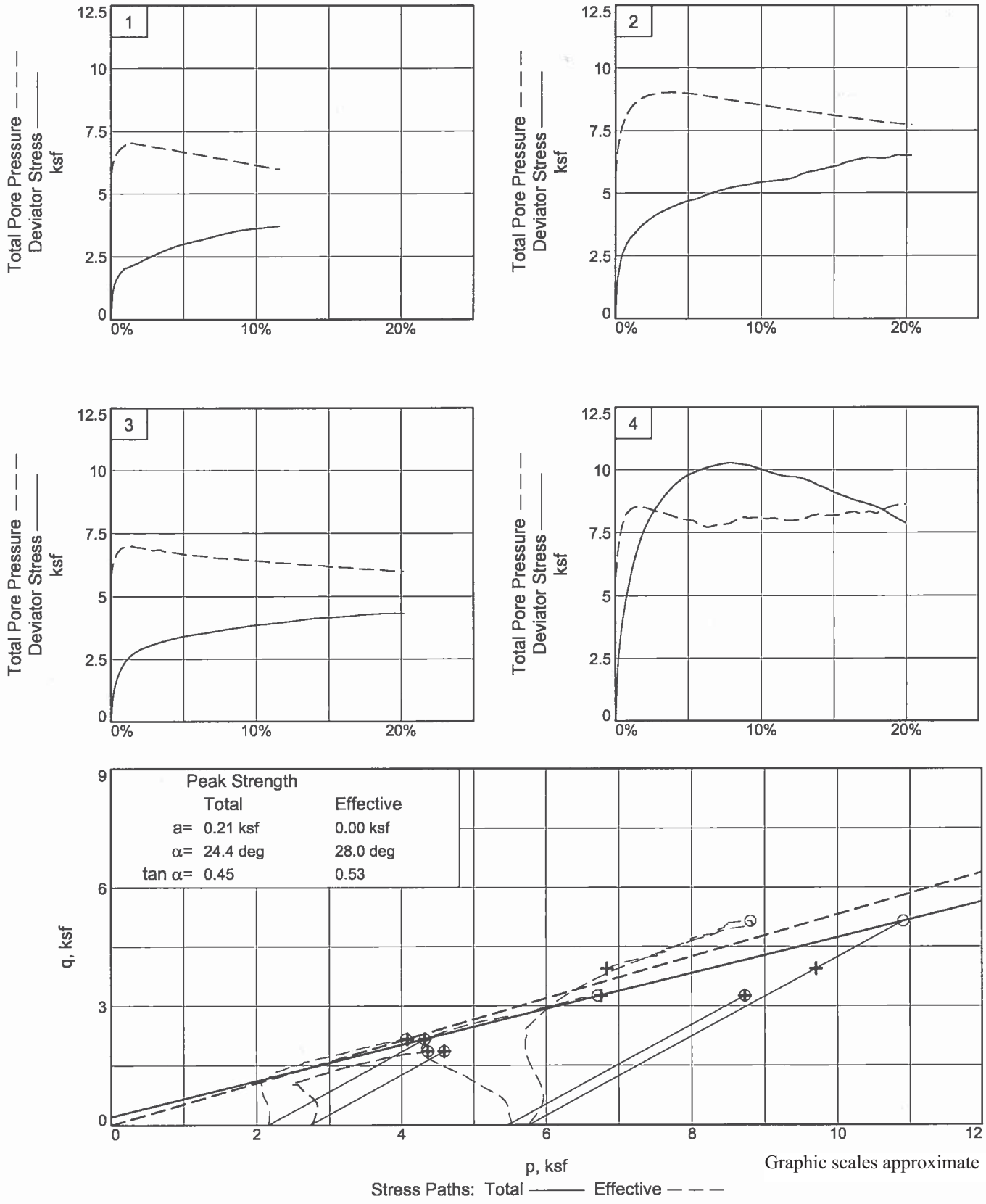
Proj. No.: 011.11497.014 **Date Sampled:** 5/12/09

TRIAXIAL SHEAR TEST REPORT

BBC&M Engineering, Inc.

Figure 1

Tested By: PJM **Checked By:** JJ

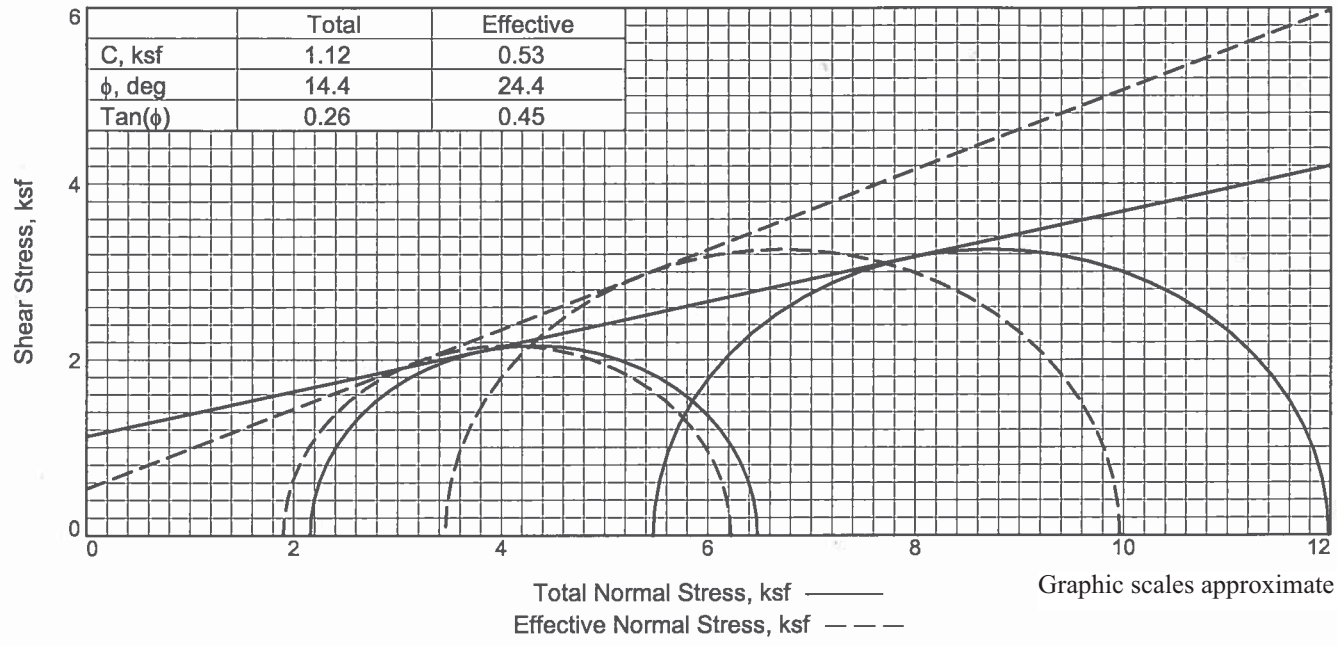


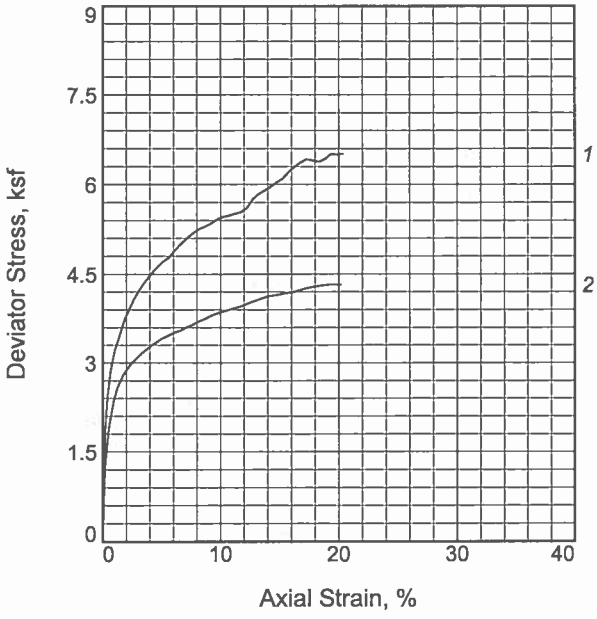
Client: AEP
Project: GAVIN PLANT ASH POND INVESTIGATION
Location: BAP-0901 & BAP-0907 **Depth:** 7.0-21.5 **Sample Number:** S5II,S13II,S12I&II
Project No.: 011.11497.014 **Figure** 2

BBC&M Engineering, Inc.

Tested By: PJM **Checked By:** JJ

PLATE 46





Sample No.		1	2
Initial	Water Content, %	21.9	19.9
	Dry Density, pcf	104.8	107.6
	Saturation, %	97.0	94.7
	Void Ratio	0.6080	0.5672
	Diameter, in.	2.89	2.88
	Height, in.	5.59	5.59
At Test	Water Content, %	21.1	21.0
	Dry Density, pcf	106.9	110.1
	Saturation, %	98.9	106.8
	Void Ratio	0.5762	0.5306
	Diameter, in.	2.88	2.85
	Height, in.	5.51	5.55
Strain rate, in./min.		0.00	0.01
Back Pressure, ksf		5.76	5.76
Cell Pressure, ksf		11.23	7.92
Fail. Stress, ksf		6.51	4.32
Total Pore Pr., ksf		7.78	6.02
Ult. Stress, ksf		6.51	4.32
Total Pore Pr., ksf		7.73	6.00
$\bar{\sigma}_1$ Failure, ksf		9.97	6.22
$\bar{\sigma}_3$ Failure, ksf		3.46	1.90

Type of Test:
CU with Pore Pressures
Sample Type: Shelby Tube
Description: FILL : Stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse
LL= 41 **PL=** 22 **PI=** 19
Assumed Specific Gravity= 2.7
Remarks:

Client: AEP

Project: GAVIN PLANT ASH POND INVESTIGATION
CHESHIRE, OHIO
Location: BAP-0901 & BAP-0907
Sample Number: S-13 II, S-12 I **Depth:** 17.5-21.5
Proj. No.: 011.11497.014 **Date Sampled:** 5/12/09

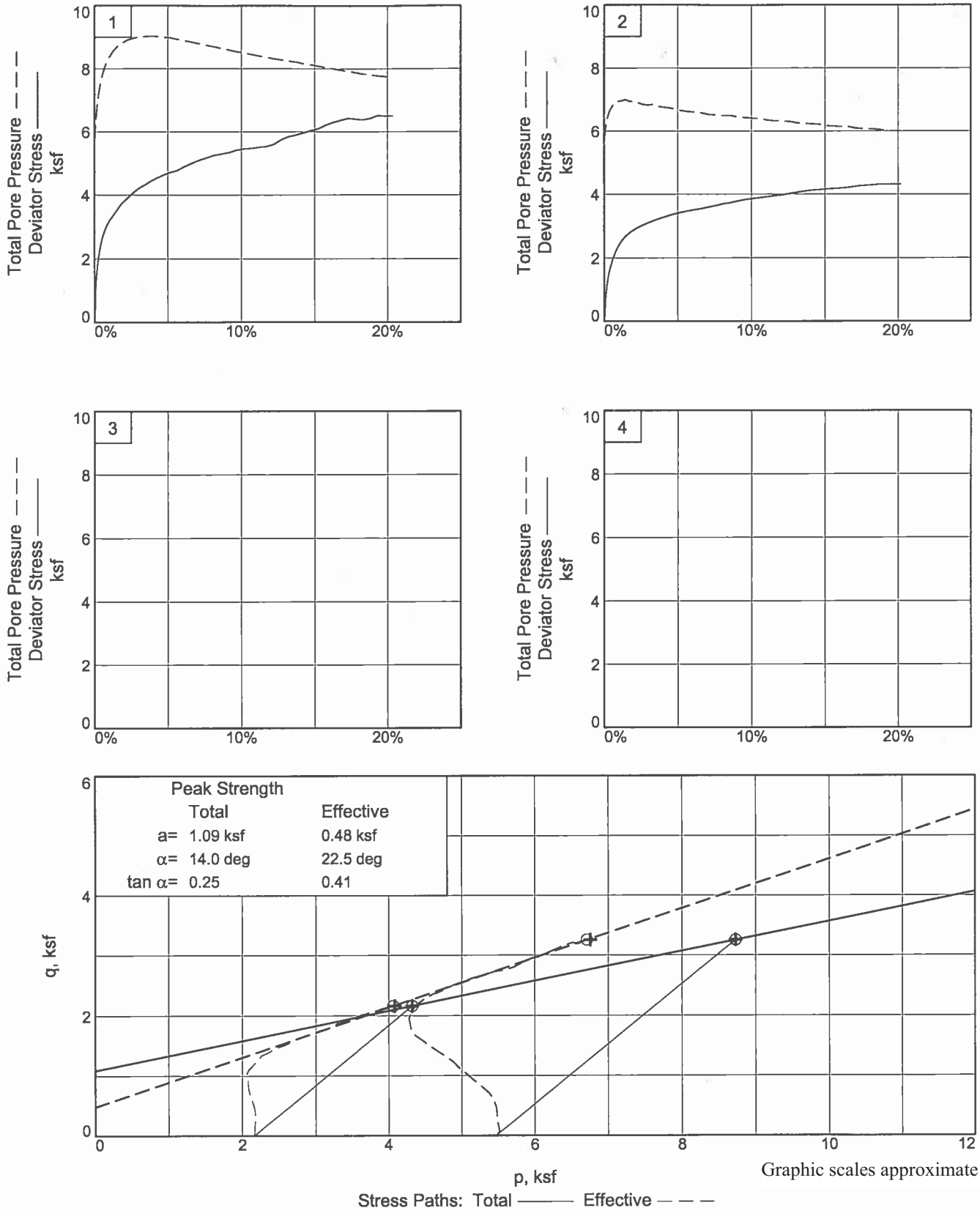
TRIAXIAL SHEAR TEST REPORT

BBC&M Engineering, Inc.

Figure 1

Tested By: PJM **Checked By:** JJ

PLATE 47



Client: AEP

Project: GAVIN PLANT ASH POND INVESTIGATION

Location: BAP-0901 & BAP-0907 **Depth:** 17.5-21.5 **Sample Number:** S-13 II, S-12 I

Project No.: 011.11497.014 **Figure** 2

BBC&M Engineering, Inc.

Tested By: PJM **Checked By:** JJ

PLATE 48

PERMEABILITY TEST DATA AND COMPUTATION SHEET

((ASTM D-5084) FALLING HEAD, METHOD C)

BBCM SOLUTIONS TO BUILD ON

Job Number:	011.11497.014	Date:	5/7-8/2009	Maximum Dry Density:	
Project Name:	Gavin Plant Ash Pond Investigation	Boring:	BAP-0905	Optimum Moisture Content:	
Project Location:	Cheshire, Ohio	Sample:	ST-14 Sec. II	% Compaction.:	
Tested By:	PJM	Depth:	20.5' to 22.0'	Optimum +/-:	
Remarks:				Natural:	X
Material:	FILL : Hard brown, dark-brown and gray silty clay, little fine to coarse sand.			Remolded:	

Sample:

Initial Length:	2.8858 in = 7.330 cm
Final Ave. Length (L):	2.9026 in = 7.373 cm
Diameter:	2.8760 in = 7.31 cm
Area (A):	6.496 sq in = 41.91 sq cm
Volume (V):	18.747 cu in = 307.21 cu cm
Wet Wt.:	640.82 grams
Unit Wet Wt.:	130.23 pcf
Unit Dry Wt.:	107.97 pcf

Test Conditions:

Chamber Pressure:	62 psi
Back Pressure:	58 psi
Confining Pressure:	4 psi
Temp. @ Start:	22.5 °C
Temp. @ End:	22.2 °C
Average Temp.:	22.4 °C
B Parameter:	0.96

Moisture Content:

	Before Test	After Test
Pan No. =	H	H
Wet Wt. + Pan =	640.82	646.05
Dry Wt. + Pan =	531.29	531.29
Wt. of Pan =		
Wt. of Dry Soil =	531.29	531.29
Wt. of Water =	109.53	114.76
% Moisture =	20.62	21.60
% SATURATION	**99.18**	**102.26**

Pipette Pressures During Test:

Top Pipette:	60 psi	= 4220.3 cm
Bottom Pipette:	58 psi	= 4079.6 cm

S.G.(est) = 2.7000

Pipette:

Area (a): 0.3435 sq in = 0.8725 sq cm

Calculations:

$$k = \frac{a \cdot L}{2 \cdot A \cdot \Delta t} \ln\left(\frac{h_1}{h_2}\right)$$

where:

- k = Hydraulic Conductivity
- a = Pipette Cross-Sectional Area
- L = Length of Sample
- A = Sample Cross-Sectional Area
- Δt = Time Interval ($t_2 - t_1$)
- h_1 = Head Loss Across Permeameter/Specimen at t_1
- h_2 = Head Loss Across Permeameter/Specimen at t_2
- ln = Natural Logarithm (Base e = 2.71828)

Date	Time Readings	Time Interval Δt Seconds	Top Pipette cc	Hydraulic Head Headwater H_1 cm	Bottom Pipette cc	Hydraulic Head Tailwater H_2 cm	Head Loss $h = H_1 - H_2$ cm	$\ell n (h_1/h_2)$	Temp. Corr. Permeability k cm/sec
5/7/2009	10:09 AM	0.00	49.20	4091.22	1.10	4287.03	-195.81	–	–
5/7/2009	11:10 AM	3,660	49.10	4091.33	1.20	4286.91	-195.58	0.00117	2.322E-08
5/7/2009	1:44 PM	9,240	48.80	4091.68	1.50	4286.57	-194.89	0.00352	2.766E-08
5/7/2009	2:50 PM	3,960	48.65	4091.85	1.60	4286.45	-194.60	0.00147	2.696E-08
5/7/2009	4:19 PM	5,340	48.50	4092.02	1.80	4286.22	-194.20	0.00206	2.804E-08
5/8/2009	8:22 AM	57,780	47.00	4093.74	3.50	4284.28	-190.54	0.01907	2.394E-08

Time Weighted Average, k [cm/sec] **= 2.476E-08**

PERMEABILITY TEST DATA AND COMPUTATION SHEET

((ASTM D-5084) FALLING HEAD, METHOD C)

BBCM SOLUTIONS TO BUILD ON

Job Number:	**011.11497.014**	Date:	**5/18-19/2009**	Maximum Dry Density:	
Project Name:	**Gavin Plant Ash Pond Investigation**	Boring:	**BAP-0901**	Optimum Moisture Content:	
Project Location:	**Cheshire, Ohio**	Sample:	**ST-13 Sec. I**	% Compaction.:	
Tested By:	**PJM**	Depth:	**19.5' to 21.5'**	Optimum +/-:	
Remarks:				Natural:	
Material:	**FILL: Stiff to hard brown mottled with gray and dark-brown silty clay, trace fine to coarse sand.**			Remolded:	

Sample:

Initial Length:	5.6045 in = 14.235 cm
Final Ave. Length (L):	5.5595 in = 14.121 cm
Diameter:	2.8725 in = 7.30 cm
Area (A):	6.481 sq in = 41.81 sq cm
Volume (V):	36.320 cu in = 595.18 cu cm
Wet Wt.:	1217.04 grams
Unit Wet Wt.:	127.66 pcf
Unit Dry Wt.:	104.36 pcf

Test Conditions:

Chamber Pressure:	62 psi
Back Pressure:	58 psi
Confining Pressure:	4 psi
Temp. @ Start:	20.5 °C
Temp. @ End:	21.0 °C
Average Temp.:	20.8 °C
B Parameter:	0.97

Pipette Pressures During Test:

Top Pipette: 60 psi = 4220.3 cm

Bottom Pipette: 58 psi = 4079.6 cm

Pipette:

Area (a): 0.3435 sq in = 0.8725 sq cm

Moisture Content:

	Before Test	After Test
Pan No. =		
Wet Wt. + Pan =	1217.04	1217.79
Dry Wt. + Pan =	994.93	994.93
Wt. of Pan =		
Wt. of Dry Soil =	994.93	994.93
Wt. of Water =	222.11	222.86
% Moisture =	22.32	22.40
% SATURATION	**97.98**	**100.43**
S.G.(est) =	2.7000	

Calculations:

$$k = \frac{a \cdot L}{2 \cdot A \cdot \Delta t} \ln\left(\frac{h_1}{h_2}\right)$$

where:

- k = Hydraulic Conductivity
- a = Pipette Cross-Sectional Area
- L = Length of Sample
- A = Sample Cross-Sectional Area
- Δt = Time Interval ($t_2 - t_1$)
- h_1 = Head Loss Across Permeameter/Specimen at t_1
- h_2 = Head Loss Across Permeameter/Specimen at t_2
- ln = Natural Logarithm (Base e = 2.71828)

Date	Time Readings	Time Interval Δt Seconds	Top Pipette cc	Hydraulic Head Headwater H_1 cm	Bottom Pipette cc	Hydraulic Head Tailwater H_2 cm	Head Loss $h = H_1 - H_2$ cm	$\ell n (h_1/h_2)$	Temp. Corr. Permeability k cm/sec
5/18/2009	9:19 AM	0.00	35.10	4107.38	36.25	4246.74	-139.36	–	–
5/18/2009	10:52 AM	5,580	34.95	4107.55	36.30	4246.68	-139.13	0.00165	4.270E-08
5/18/2009	2:32 PM	13,200	34.90	4107.61	36.40	4246.57	-138.96	0.00124	1.356E-08
5/18/2009	4:16 PM	6,240	34.80	4107.72	36.50	4246.45	-138.73	0.00165	3.829E-08
5/18/2009	7:40 PM	12,240	34.50	4108.07	36.55	4246.39	-138.33	0.00290	3.424E-08
5/19/2009	7:55 AM	44,100	34.30	4108.30	37.10	4245.76	-137.47	0.00623	2.046E-08

Time Weighted Average, k [cm/sec] **= 2.430E-08**

PLATE 50

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
						sieve	Hydrometer		standard	modified	uncons. undrain	consolid undrain w/ pores	drained	drained	undrain	residual						cohesive	non/cohes	wall rigid	wall flexible					
							short	long																						
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%			
BAP-0908	8.75	21										*								107.7										
BAP-0908	9.25	21										*								108.6										
BAP-0908	9.75	21										*								108.1										
BAP-0908	10.25	20	37	21	16	*		*																					*	
BAP-0908	14.25	19	34	19	15	*		*																						
BAP-0908	21.75	16																												
BAP-0908	24.50																												*	
BAP-0908	31.35	18	33	19	14	*		*																						
BAP-0908	39.25	21	30	17	13	*		*																						
BAP-0908	44.50																												*	
BAP-0909	6.25	28	49	26	23	*		*																						
BAP-0909	10.00																												*	
BAP-0909	11.75	24				*		*																						
BAP-0909	16.25	28										*								95.4										
BAP-0909	16.75	27										*								96.4										
BAP-0909	17.25	27										*								97.2										
BAP-0909	17.75	27	34	21	13	*		*																					*	
BAP-0909	18.75	28	33	18	15	*		*																						
BAP-0909	26.25	42	33	19	14	*		*																						
BAP-0909	28.20	34	41	20	21	*		*																						

SUM REG 11149701 4.GPJ BBCM.GDT 1/7/10

PLATE 1

BBCM
SOLUTIONS TO BUILD ON

TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT FLY ASH DAM INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 1/7/10

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	ROCK CORE	SHELBY TUBE	CBR
						sieve	Hydrometer short	Hydrometer long	standard	modified	unconsol. undrain	consolid undrain w/ pores	drained	drained	undrain	residual						cohesive	non/cohes rigid wall		flexible wall					
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%			
BAP-0910	8.75	24																											
BAP-0910	11.00																											*	
BAP-0910	15.75	24	31	16	15	*		*																					
BAP-0910	17.25	27										*								87.6									
BAP-0910	17.75	26										*								97.7									
BAP-0910	18.25	27										*								94.5									
BAP-0910	18.75	28	24	19	5	*		*																				*	
BAP-0910	21.25	29	30	17	13	*		*																					
BAP-0910	24.25	31	32	17	15	*		*																					
BAP-0910	27.05	30	26	18	8	*		*																					
BAP-0910	30.25	35	40	21	19	*		*																					
BAP-0911	9.25	19	32	19	13																								
BAP-0911	11.00																											*	
BAP-0911	17.00																											*	
BAP-0911	18.75	26	35	19	16	*		*																					
BAP-0911	22.05	28	33	17	16	*		*																					
BAP-0911	26.25	30				*		*																					
BAP-0911	32.25	32				*		*																					

SUM REG 111497014.GPJ BBCM.GDT 1/7/10

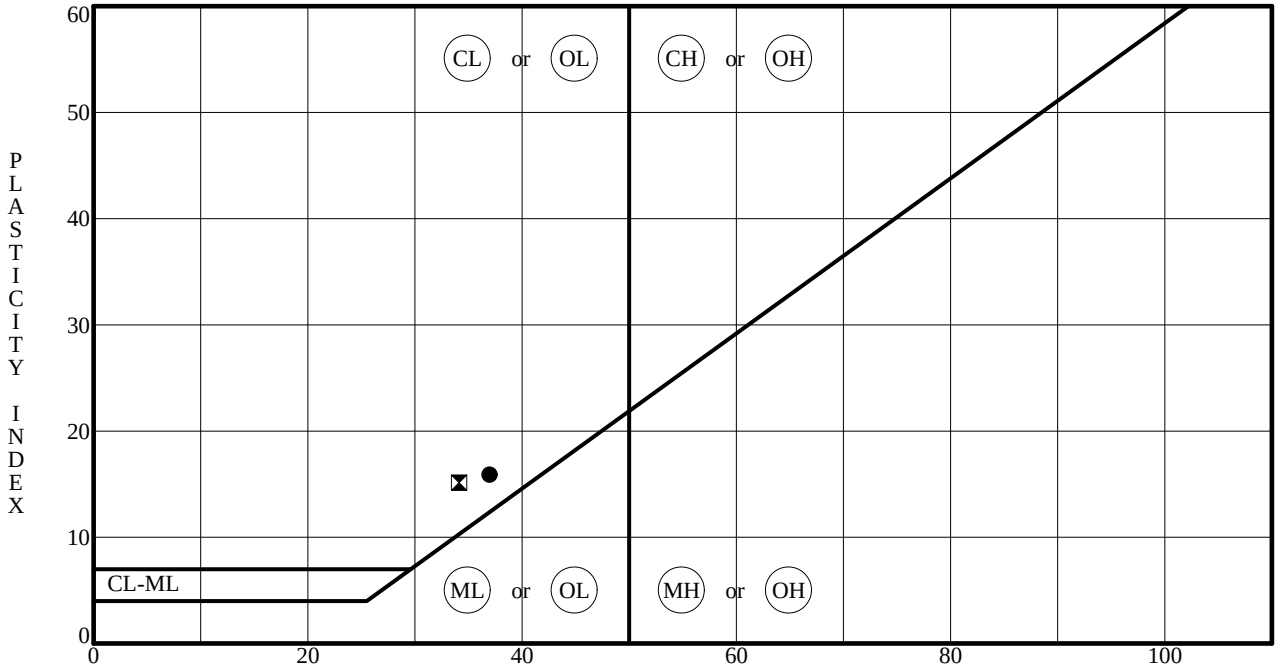
BBCM SOLUTIONS TO BUILD ON

TESTING SUMMARY - STANDARD

PROJECT GAVIN PLANT FLY ASH DAM INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 DATE 1/7/10

PLATE 2

ATTERBERG LIMITS' RESULTS



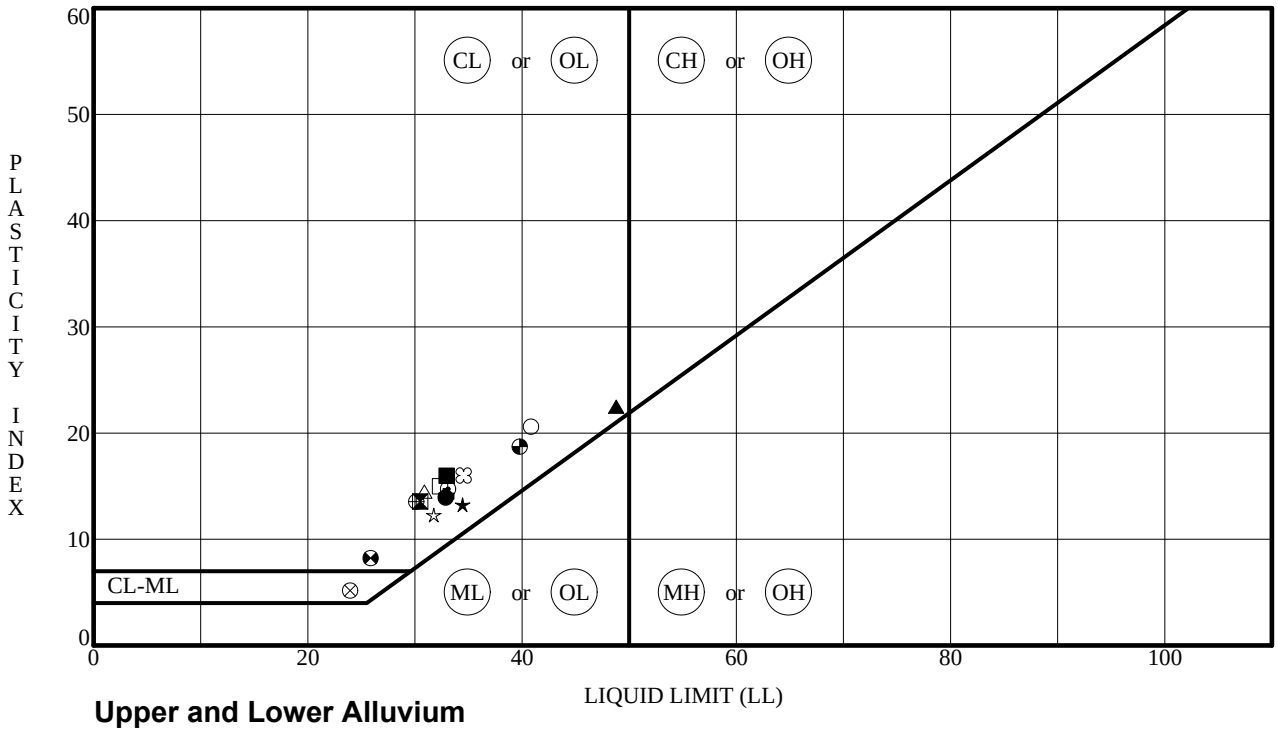
ALPIEPA

Embankment Fill

	Specimen Id.	Pt. ID	MC	LL	PL	PI	.002mm	ASTM Classification
●	**BAP-0908**	**10.25**	**20**	**37**	**21**	**16**	**25.4**	**LEAN CLAY with SAND CL**
⧓	**BAP-0908**	**14.25**	**19**	**34**	**19**	**15**	**25.6**	**LEAN CLAY with SAND CL**

PROJECT GAVIN PLANT FLY ASH DAM INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/7/10

ATTERBERG LIMITS' RESULTS



ALPIEPA

Upper and Lower Alluvium

	Specimen Id.	Pt. ID	MC	LL	PL	PI	.002mm	ASTM Classification
●	**BAP-0908**	**31.35**	**18**	**33**	**19**	**14**	**23.9**	**LEAN CLAY CL**
⧓	**BAP-0908**	**39.25**	**21**	**30**	**17**	**13**	**16.8**	**LEAN CLAY with SAND CL**
▲	**BAP-0909**	**6.25**	**28**	**49**	**26**	**23**	**33.4**	**LEAN CLAY CL**
★	**BAP-0909**	**17.75**	**27**	**34**	**21**	**13**	**22.5**	**LEAN CLAY CL**
⊙	**BAP-0909**	**18.75**	**28**	**33**	**18**	**15**	**19.4**	**LEAN CLAY with SAND CL**
✿	**BAP-0909**	**26.25**	**42**	**33**	**19**	**14**	**18.5**	**LEAN CLAY with SAND CL**
○	**BAP-0909**	**28.20**	**34**	**41**	**20**	**21**	**27.5**	**LEAN CLAY with SAND CL**
△	**BAP-0910**	**15.75**	**24**	**31**	**16**	**15**	**19.3**	**SANDY LEAN CLAY CL**
⊗	**BAP-0910**	**18.75**	**28**	**24**	**19**	**5**	**14.3**	**SANDY SILTY CLAY CL-ML**
⊕	**BAP-0910**	**21.25**	**29**	**30**	**17**	**13**	**18.1**	**SANDY LEAN CLAY CL**
□	**BAP-0910**	**24.25**	**31**	**32**	**17**	**15**	**22.2**	**LEAN CLAY with SAND CL**
⊠	**BAP-0910**	**27.05**	**30**	**26**	**18**	**8**	**15.9**	**SANDY LEAN CLAY CL**
◔	**BAP-0910**	**30.25**	**35**	**40**	**21**	**19**	**25.1**	**LEAN CLAY CL**
☆	**BAP-0911**	**9.25**	**19**	**32**	**19**	**13**		
⊠	**BAP-0911**	**18.75**	**26**	**35**	**19**	**16**	**21.0**	**LEAN CLAY with SAND CL**
■	**BAP-0911**	**22.05**	**28**	**33**	**17**	**16**	**22.1**	**LEAN CLAY with SAND CL**

PROJECT GAVIN PLANT FLY ASH DAM INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/7/10

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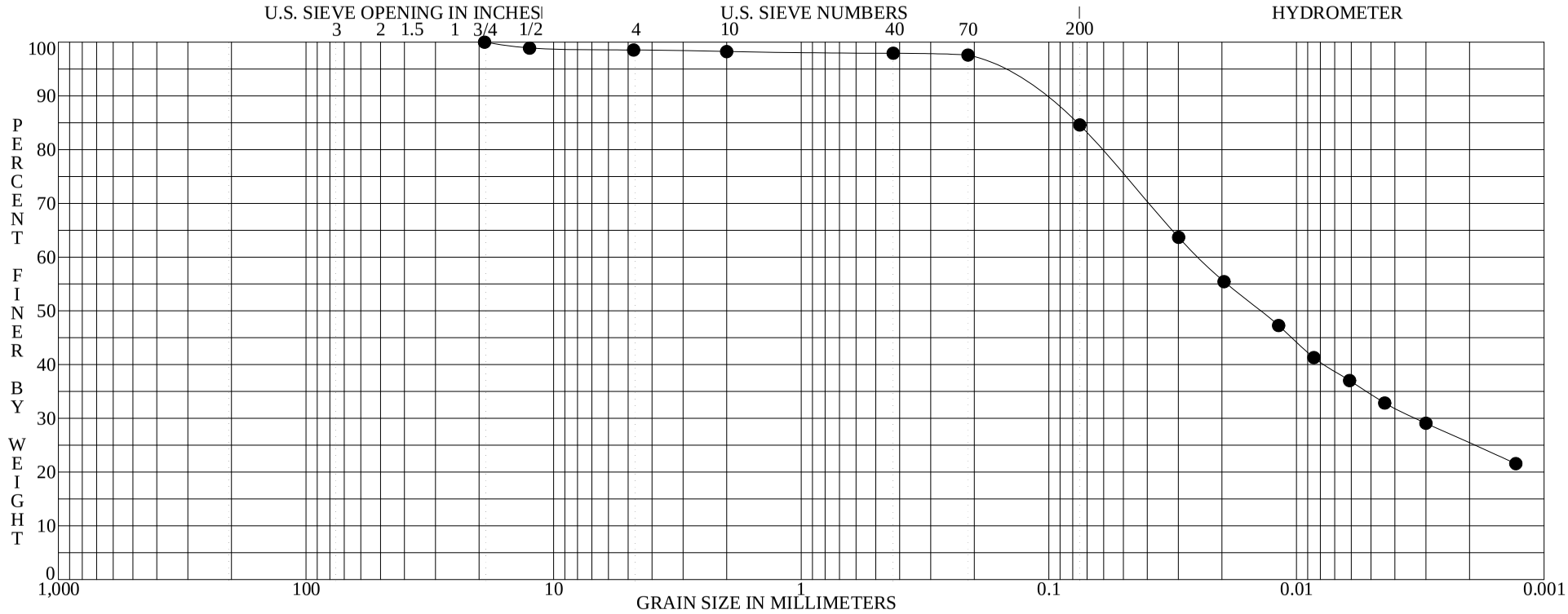


BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0908 S-4 IV 8.5' to 10.2'**	**LEAN CLAY with SAND CL**	**20**	**37**	**21**	**16**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0908 S-4 IV 8.5' to 10.2'**	**19.0000**	**0.1722**	**0.0248**	**0.0140**		**1.5**	**13.9**	**59.2**	**25.4**

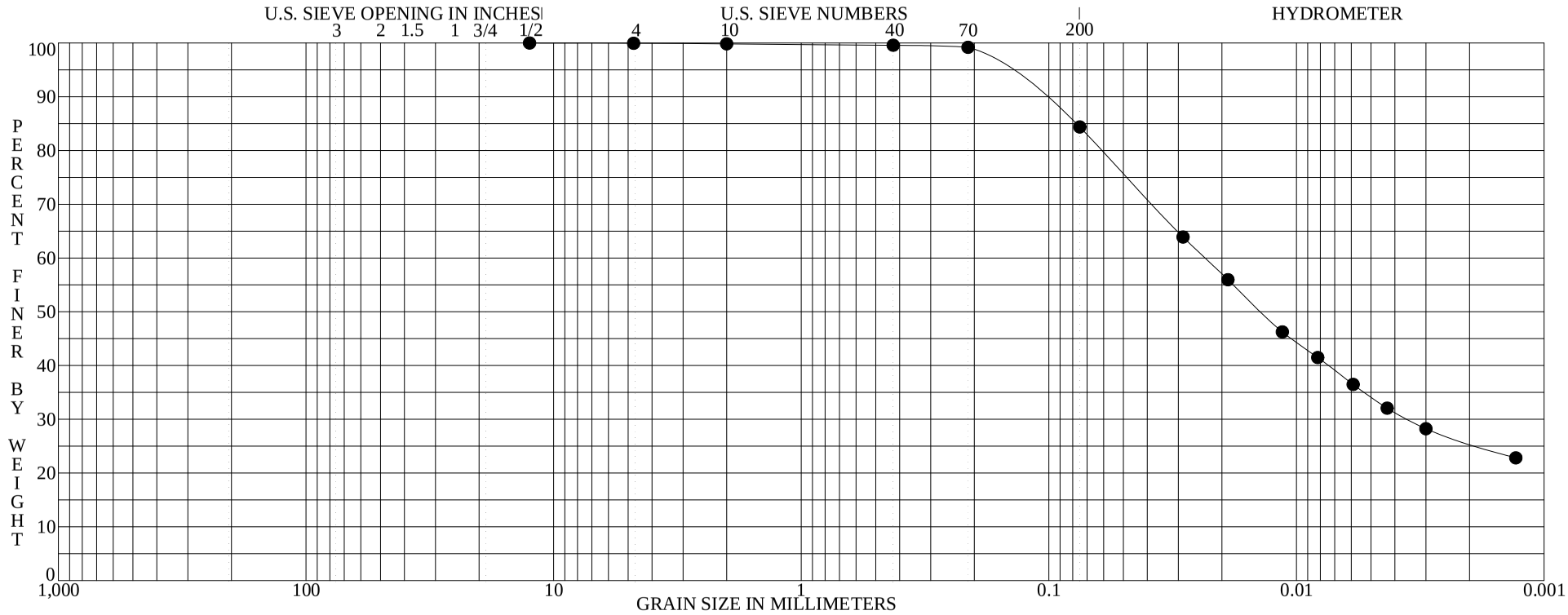
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 5

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0908 S-6 13.5' to 15.0'**	**LEAN CLAY with SAND CL**	**19**	**34**	**19**	**15**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0908 S-6 13.5' to 15.0'**	**12.5000**	**0.1579**	**0.0234**	**0.0139**		**0.0**	**15.6**	**58.8**	**25.6**

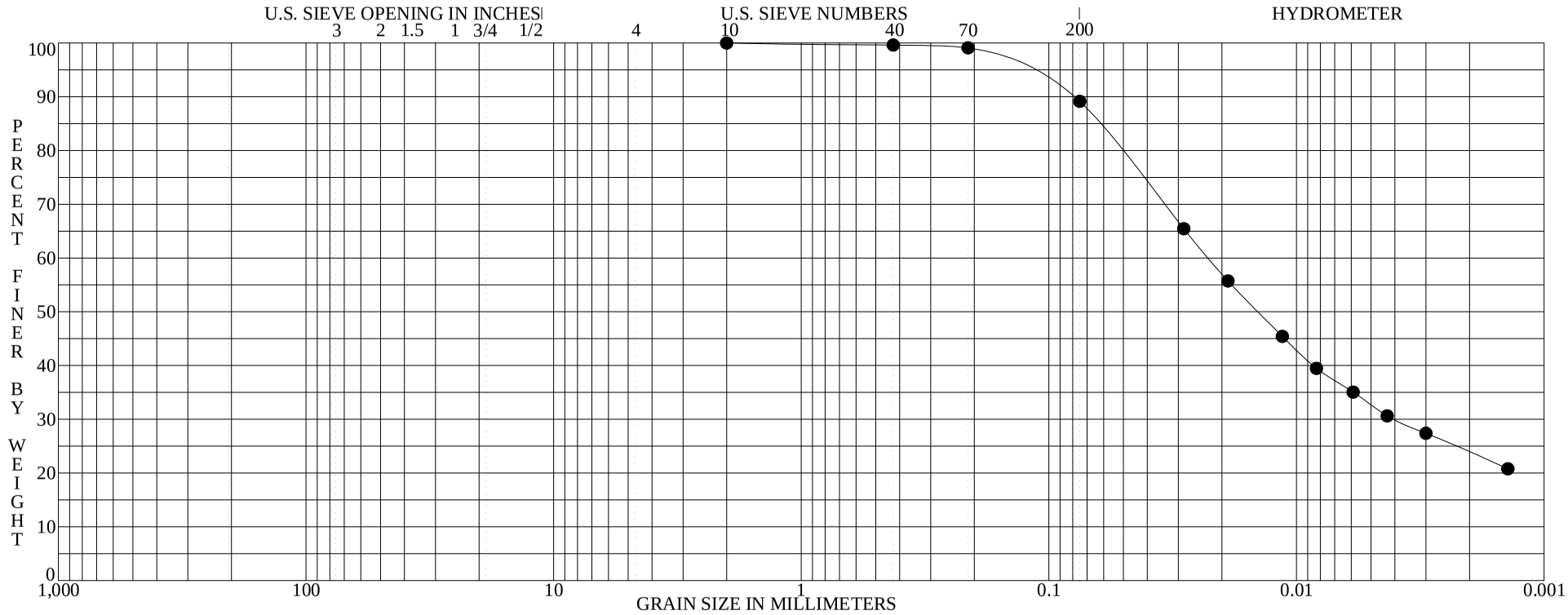
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 6

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0908 S-13A 31.0' to 31.7'**	**LEAN CLAY CL**	**18**	**33**	**19**	**14**		

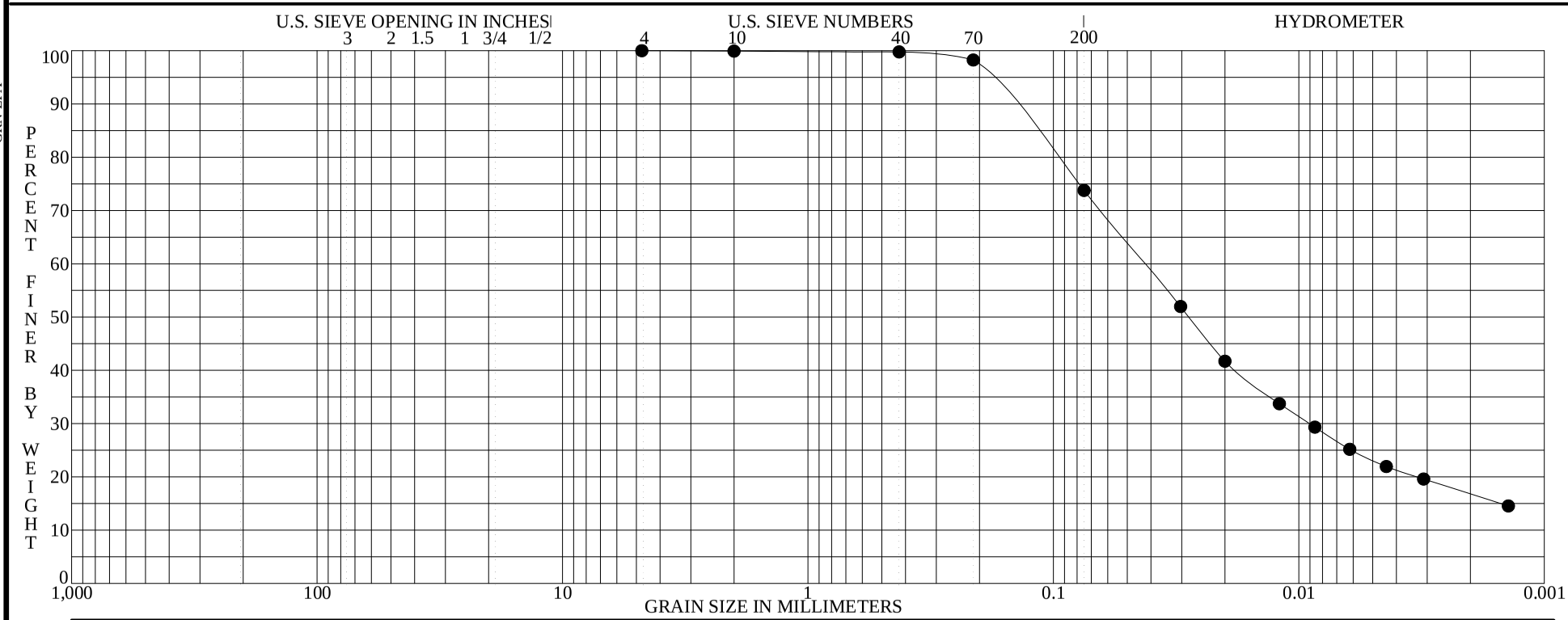
Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0908 S-13A 31.0' to 31.7'**	**2.0000**	**0.1381**	**0.0226**	**0.0143**		**0.0**	**10.9**	**65.3**	**23.9**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 7



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0908 S-18 38.5' to 40.0'**	**LEAN CLAY with SAND CL**	**21**	**30**	**17**	**13**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0908 S-18 38.5' to 40.0'**	**4.7500**	**0.1846**	**0.0423**	**0.0280**		**0.0**	**26.2**	**57.0**	**16.8**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

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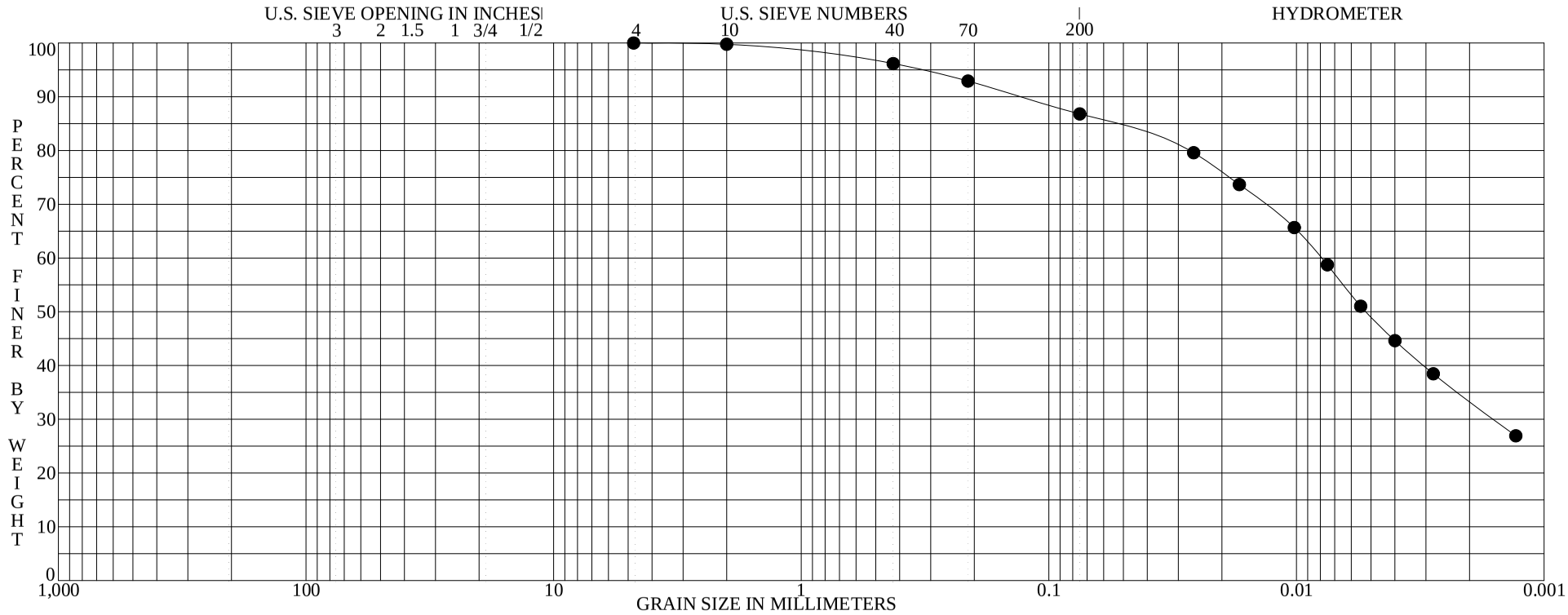


BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0909 S-4 5.5' to 6.4'**	**LEAN CLAY CL**	**28**	**49**	**26**	**23**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0909 S-4 5.5' to 6.4'**	**4.7500**	**0.3306**	**0.0079**	**0.0052**		**0.0**	**13.2**	**53.4**	**33.4**

ASTM D422

GRADATION CURVE

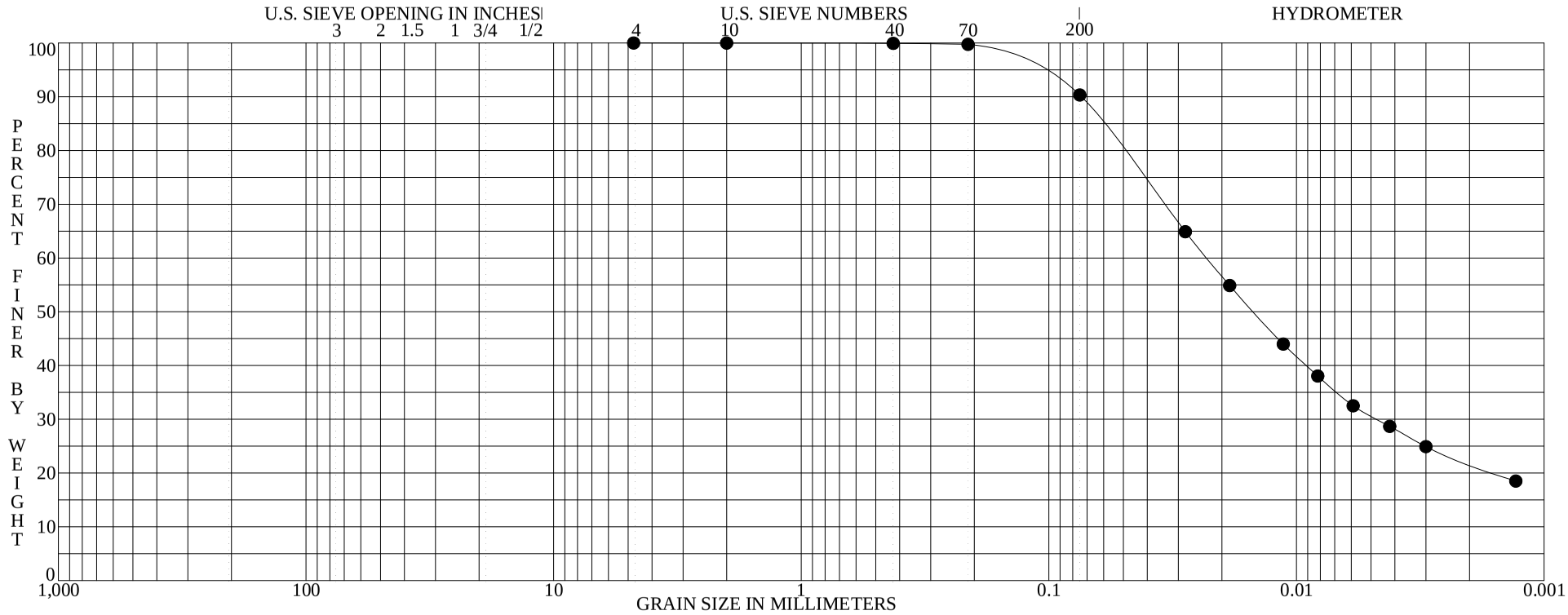
PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION

LOCATION CHESHIRE, OHIO

JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 9

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0909 S-7 11.0' to 12.5'**		**24**					

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0909 S-7 11.0' to 12.5'**	**4.7500**	**0.1255**	**0.0230**	**0.0149**		**0.0**	**9.7**	**68.5**	**21.8**

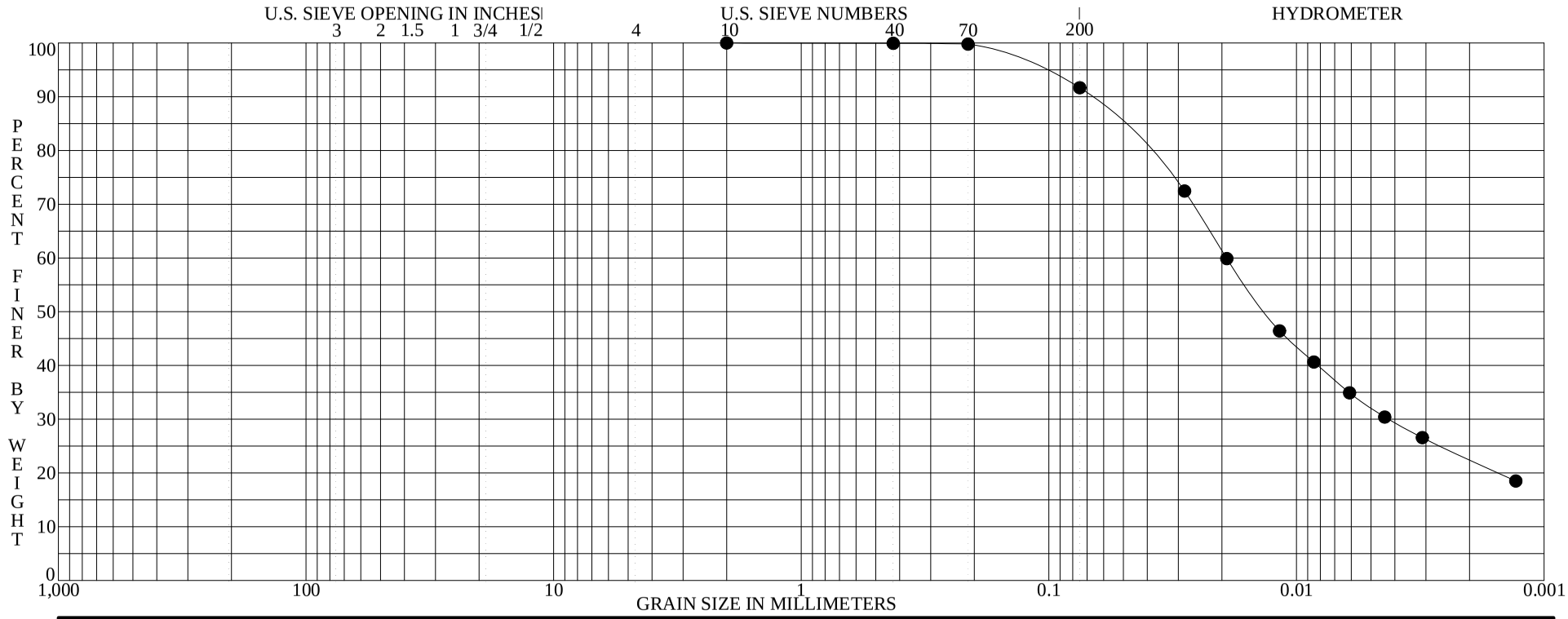
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 10

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0909 S-10 IV 16.0' to 18.0'**	**LEAN CLAY CL**	**27**	**34**	**21**	**13**		

Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0909 S-10 IV 16.0' to 18.0'**	**2.0000**	**0.1147**	**0.0192**	**0.0133**		**0.0**	**8.3**	**69.2**	**22.5**

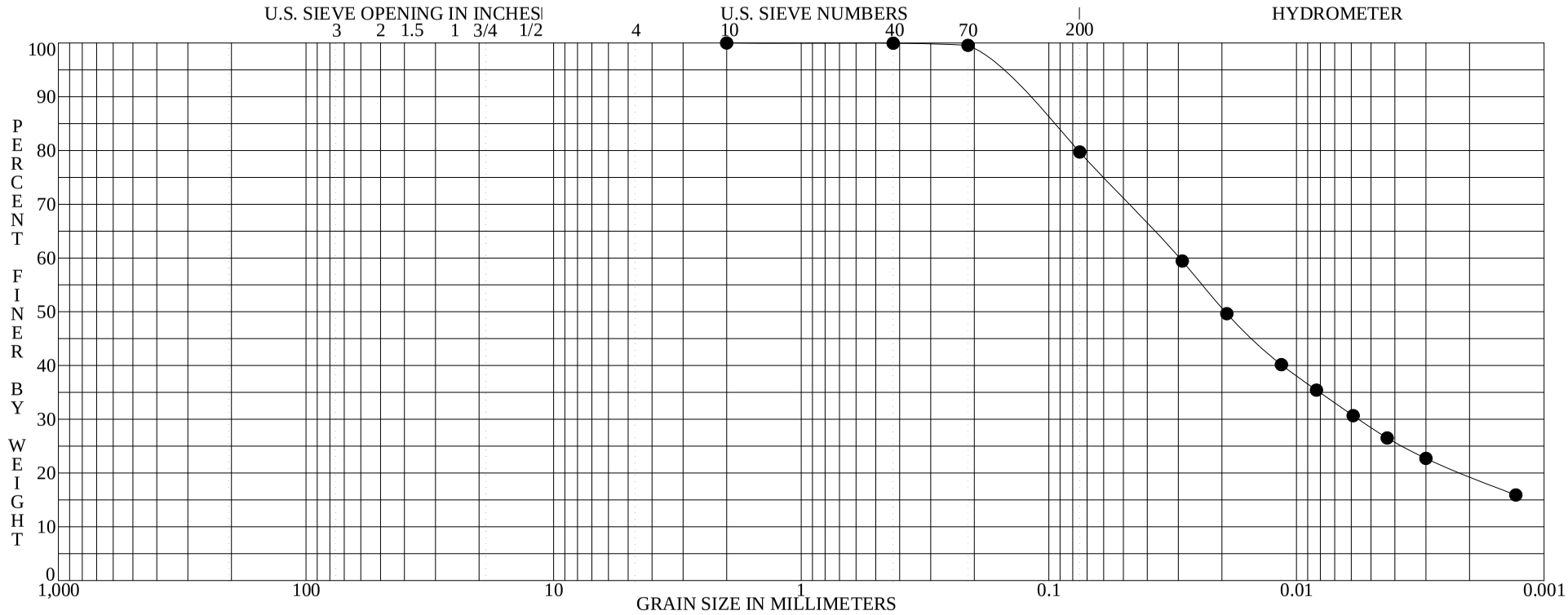
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 11

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0909 S-11 18.0' to 19.5'**	**LEAN CLAY with SAND CL**	**28**	**33**	**18**	**15**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0909 S-11 18.0' to 19.5'**	**2.0000**	**0.1669**	**0.0297**	**0.0194**		**0.0**	**20.3**	**60.3**	**19.4**

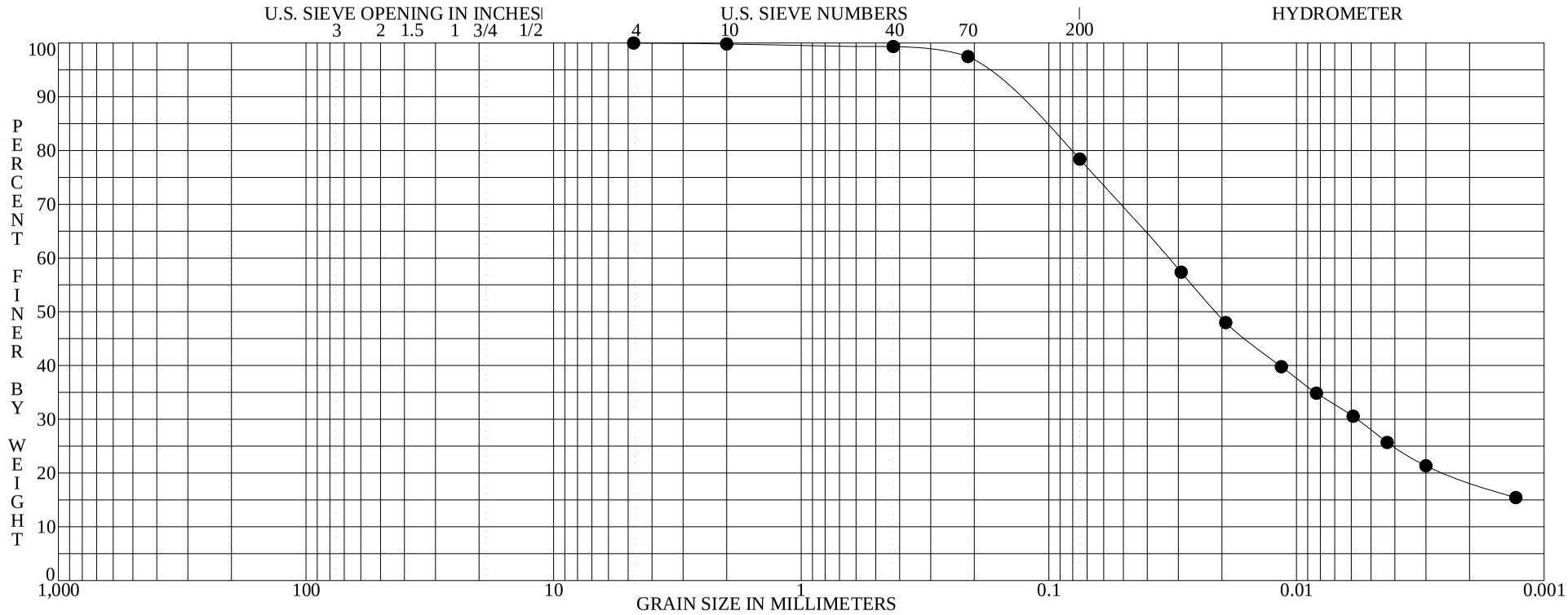
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 12

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0909 S-15 25.5' to 26.6'**	**LEAN CLAY with SAND CL**	**42**	**33**	**19**	**14**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0909 S-15 25.5' to 26.6'**	**4.7500**	**0.1852**	**0.0329**	**0.0211**		**0.0**	**21.6**	**59.9**	**18.5**

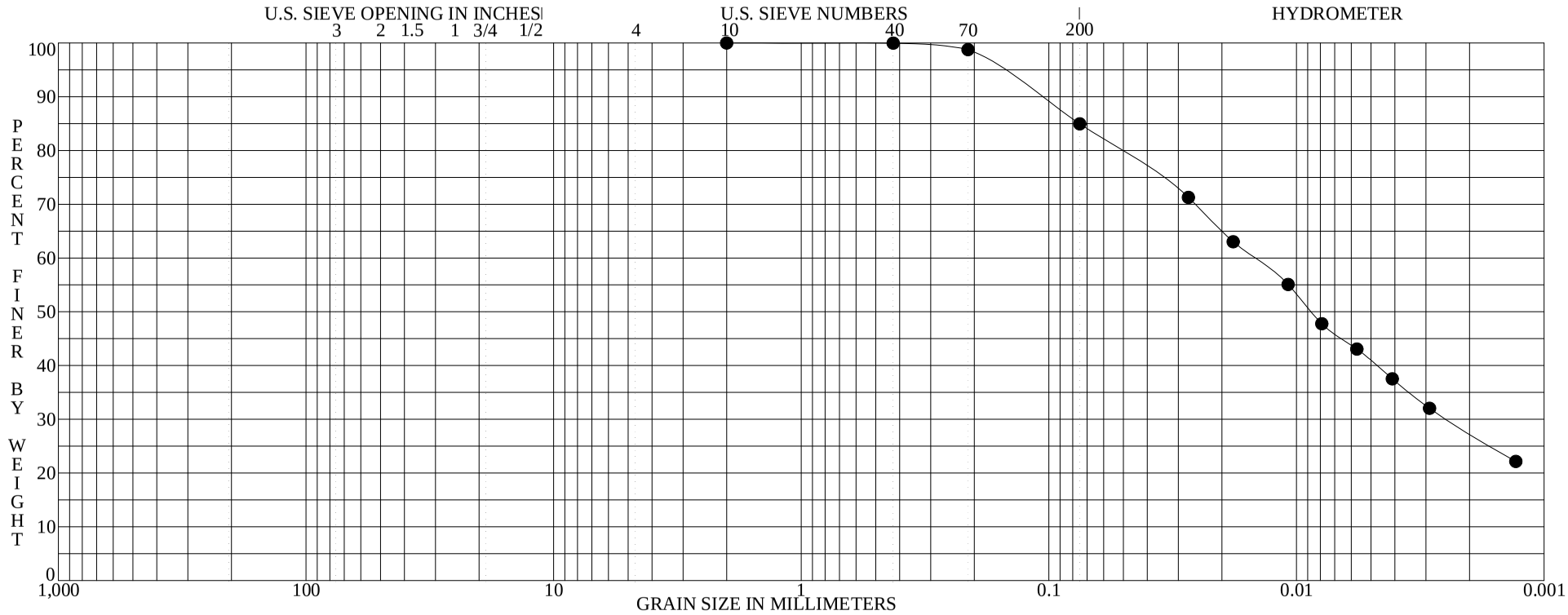
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 13

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0909 S-16C 27.9' to 28.5'**	**LEAN CLAY with SAND CL**	**34**	**41**	**20**	**21**		

Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0909 S-16C 27.9' to 28.5'**	**2.0000**	**0.1596**	**0.0148**	**0.0087**		**0.0**	**15.0**	**57.5**	**27.5**

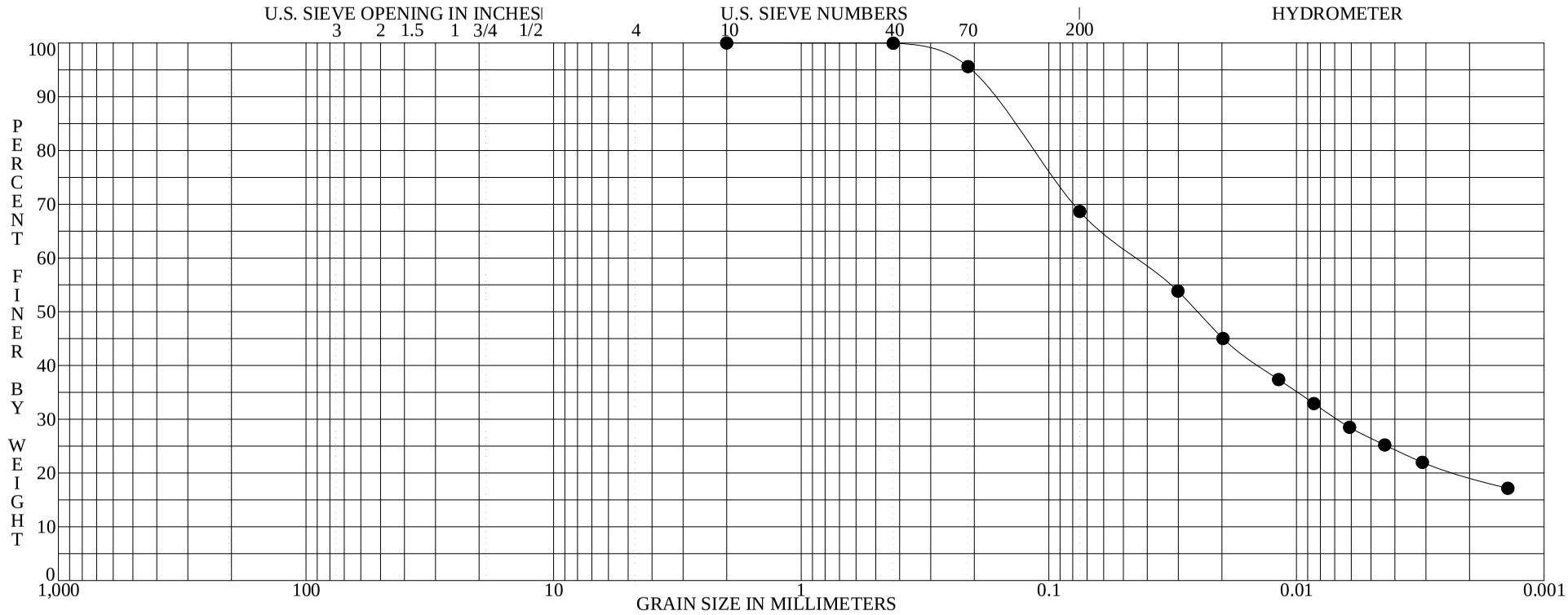
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 14

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0910 S-9 15.0' to 16.5'**	**SANDY LEAN CLAY CL**	**24**	**31**	**16**	**15**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0910 S-9 15.0' to 16.5'**	**2.0000**	**0.2071**	**0.0440**	**0.0251**		**0.0**	**31.3**	**49.3**	**19.3**

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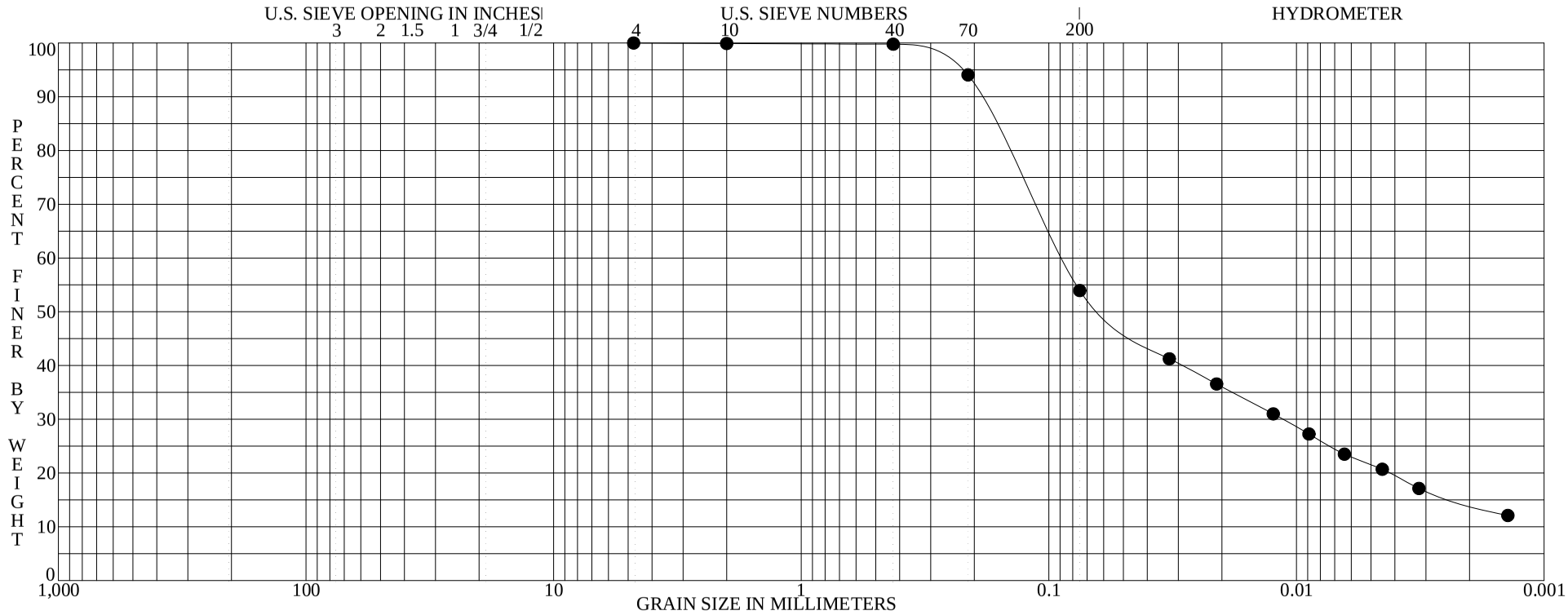
GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 15

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0910 S-10 IV 17.0' to 19.0'**	**SANDY SILTY CLAY CL-ML**	**28**	**24**	**19**	**5**		

Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0910 S-10 IV 17.0' to 19.0'**	**4.7500**	**0.2374**	**0.0877**	**0.0579**		**0.0**	**46.1**	**39.7**	**14.3**

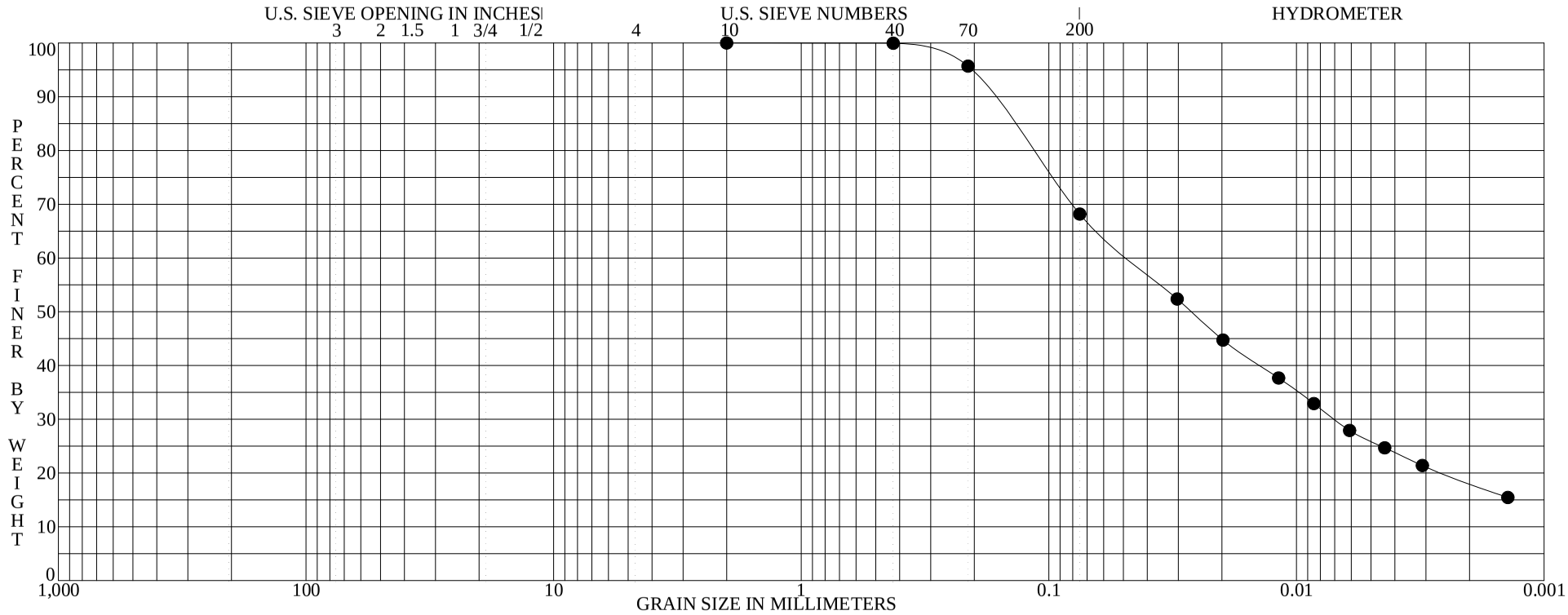
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 16

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0910 S-12 20.5' to 22.0'**	**SANDY LEAN CLAY CL**	**29**	**30**	**17**	**13**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0910 S-12 20.5' to 22.0'**	**2.0000**	**0.2064**	**0.0469**	**0.0265**		**0.0**	**31.8**	**50.1**	**18.1**

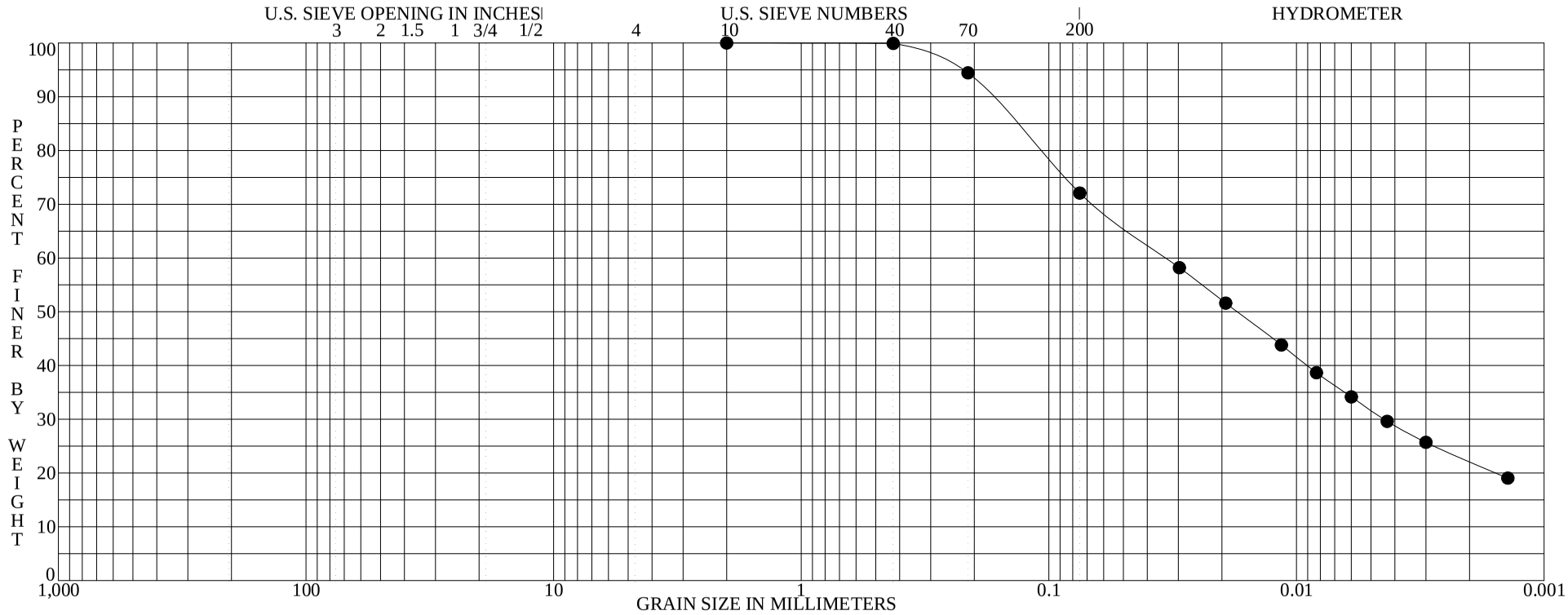
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 17

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0910 S-14 23.5' to 25.0'**	**LEAN CLAY with SAND CL**	**31**	**32**	**17**	**15**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0910 S-14 23.5' to 25.0'**	**2.0000**	**0.2273**	**0.0335**	**0.0173**		**0.0**	**27.9**	**49.9**	**22.2**

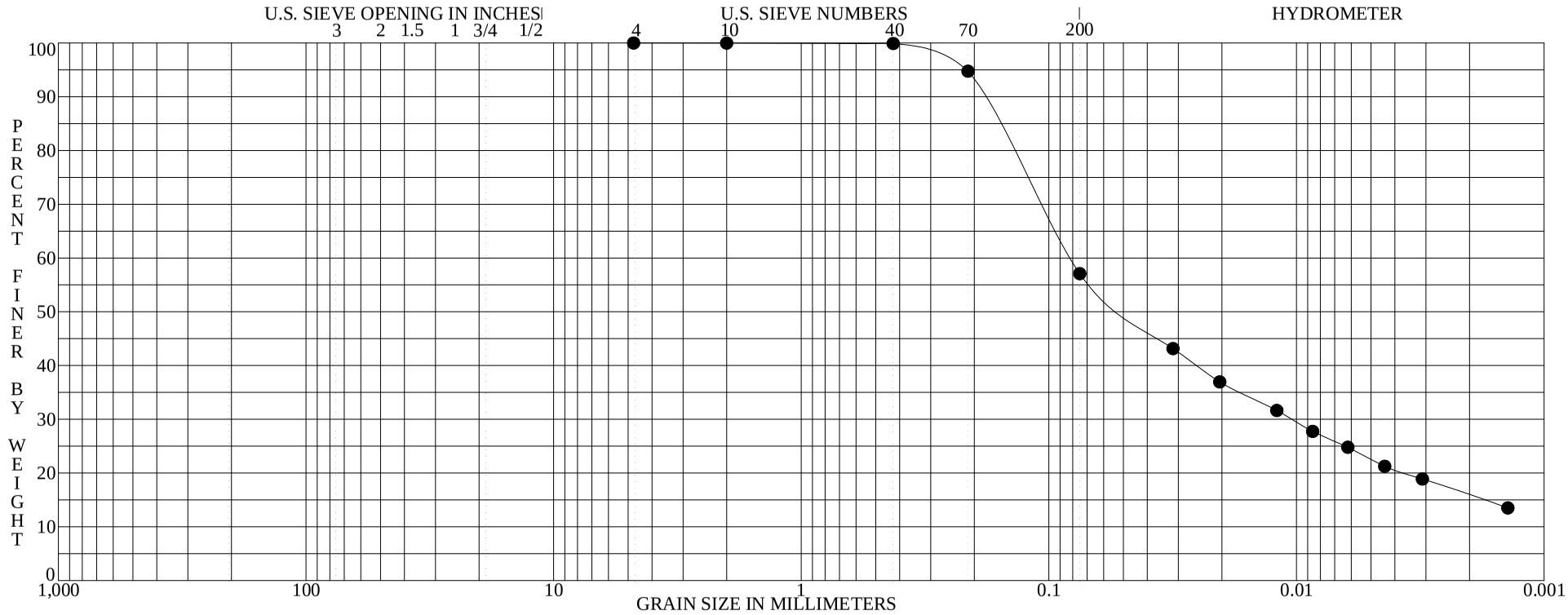
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 18

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0910 S-16A 26.5' to 27.6'**	**SANDY LEAN CLAY CL**	**30**	**26**	**18**	**8**		

Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0910 S-16A 26.5' to 27.6'**	**4.7500**	**0.2190**	**0.0813**	**0.0482**		**0.0**	**42.9**	**41.2**	**15.9**

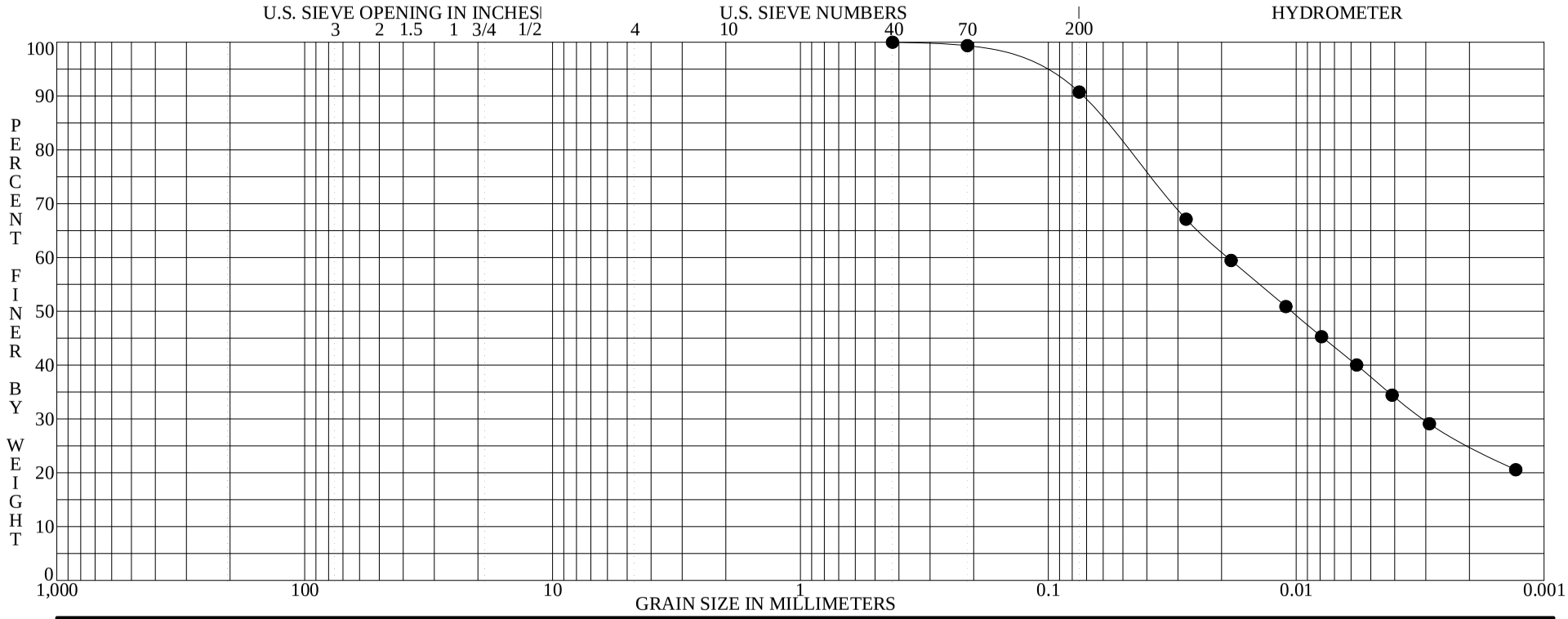
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 19

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0910 S-18 29.5' to 31.0'**	**LEAN CLAY CL**	**35**	**40**	**21**	**19**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0910 S-18 29.5' to 31.0'**	**0.4250**	**0.1252**	**0.0189**	**0.0104**		**0.0**	**9.3**	**65.6**	**25.1**

ASTM D422 | **GRADATION CURVE**

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
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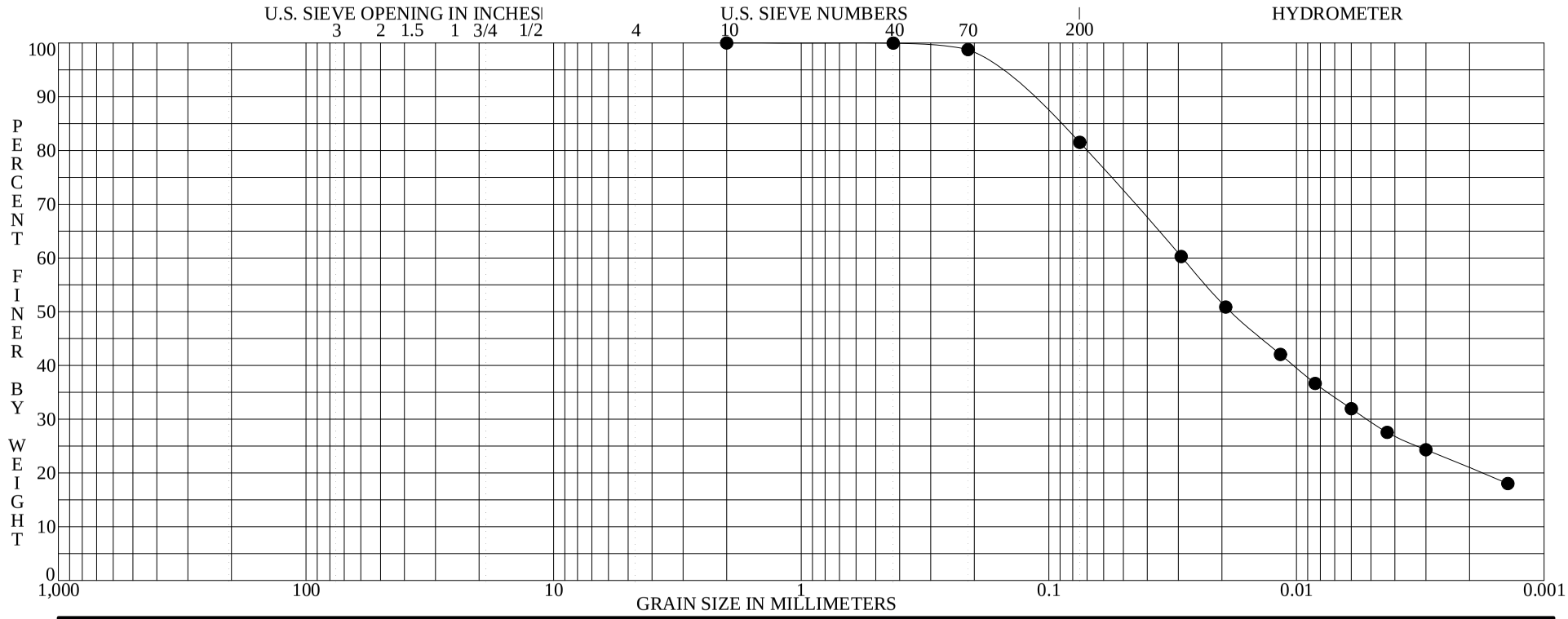
PLATE 20

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0911 S-11 18.0' to 19.5'**	**LEAN CLAY with SAND CL**	**26**	**35**	**19**	**16**		

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0911 S-11 18.0' to 19.5'**	**2.0000**	**0.1689**	**0.0289**	**0.0184**		**0.0**	**18.5**	**60.6**	**21.0**

ASTM D422

GRADATION CURVE

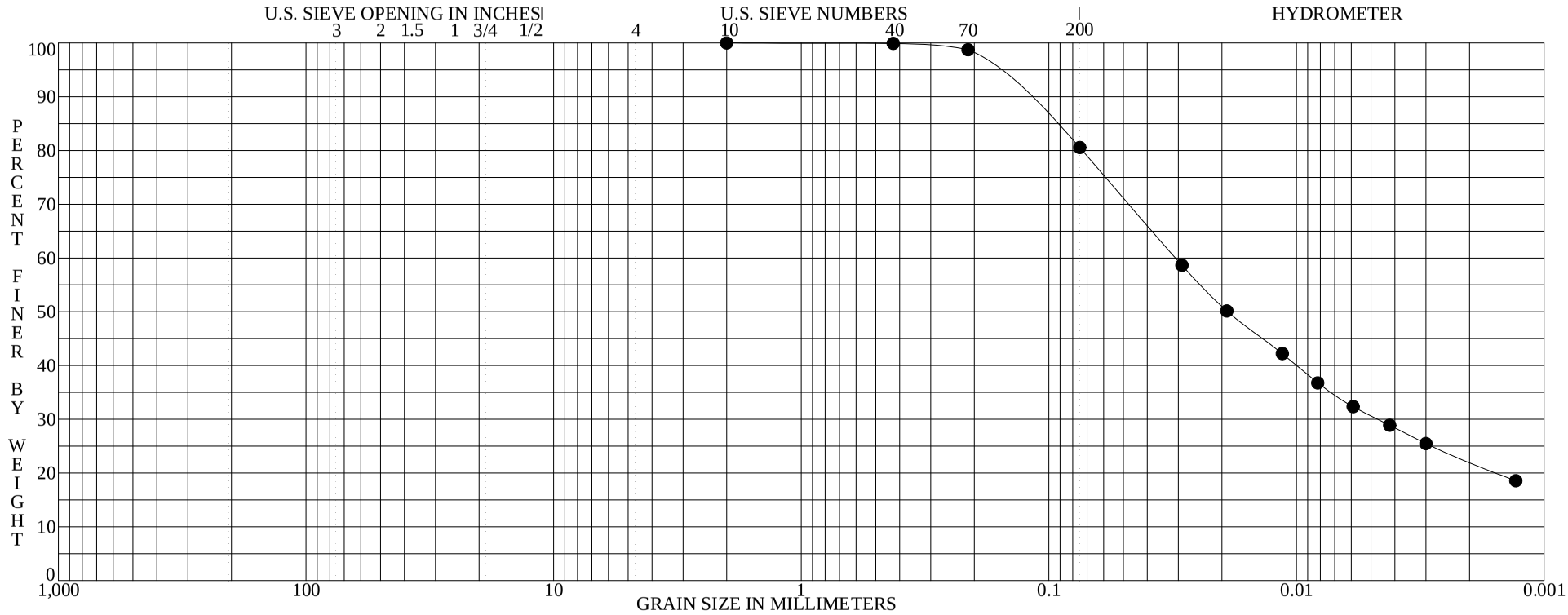
PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION

LOCATION CHESHIRE, OHIO

JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 21

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
● **GV-BAP-0911 S-13B 21.6' to 22.5'**	**LEAN CLAY with SAND CL**	**28**	**33**	**17**	**16**		

Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **GV-BAP-0911 S-13B 21.6' to 22.5'**	**2.0000**	**0.1712**	**0.0307**	**0.0189**		**0.0**	**19.4**	**58.4**	**22.1**

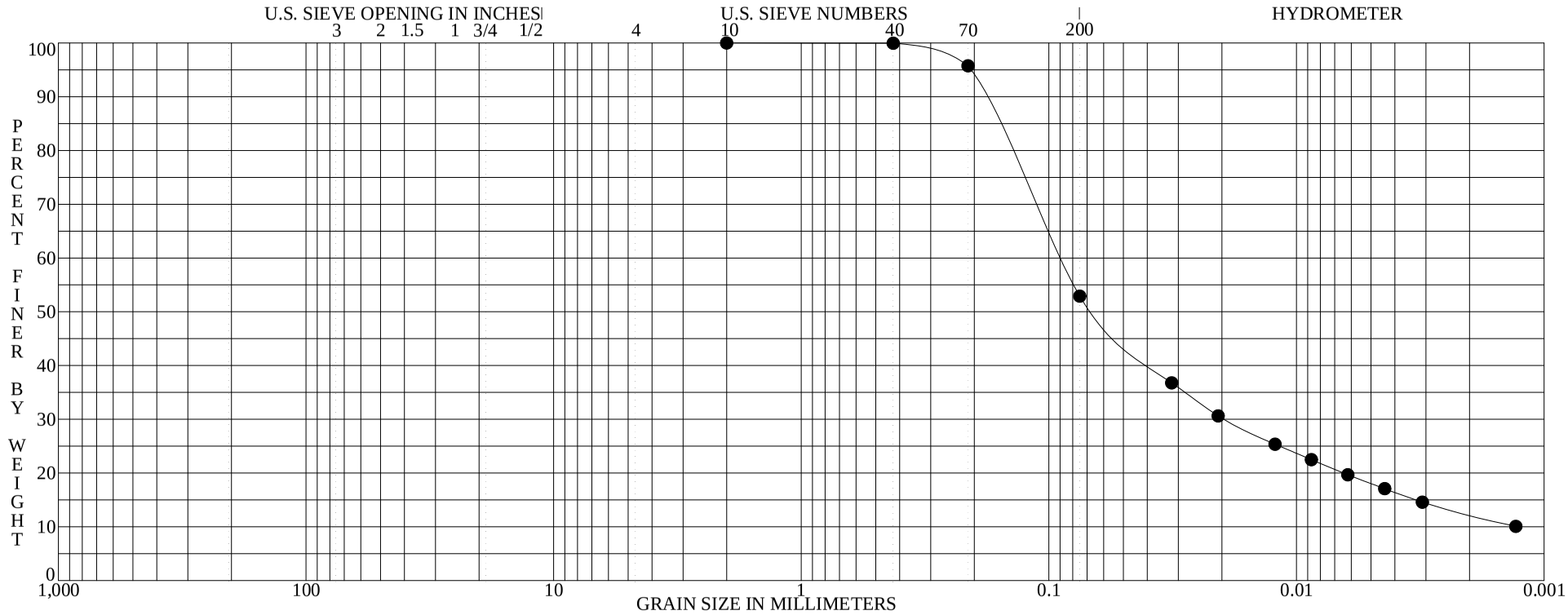
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 22

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0911 S-16 25.5' to 27.0'**		**30**					

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0911 S-16 25.5' to 27.0'**	**2.0000**	**0.2081**	**0.0891**	**0.0643**		**0.0**	**47.1**	**40.6**	**12.3**

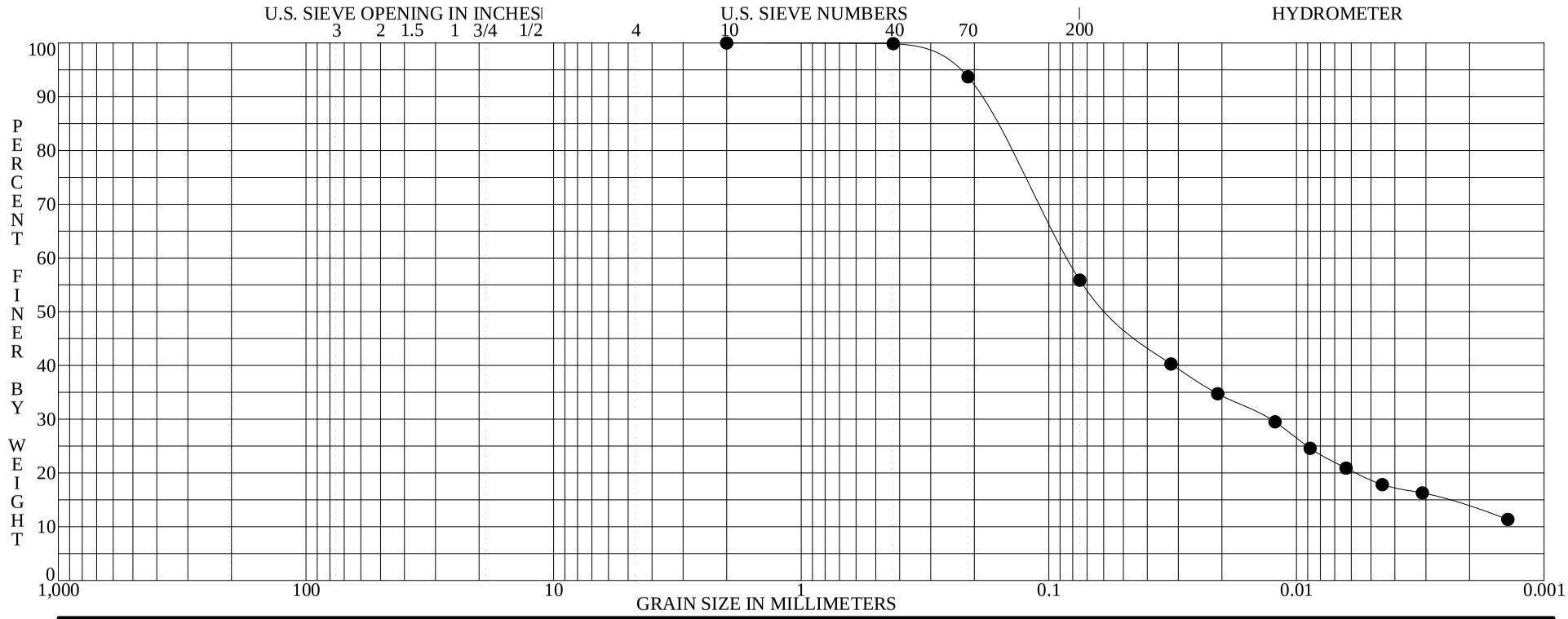
ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 23

GRN-EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	**GV-BAP-0911 S-20 31.5' to 33.0'**		**32**					

	Specimen Identification	D100	D95	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**GV-BAP-0911 S-20 31.5' to 33.0'**	**2.0000**	**0.2452**	**0.0840**	**0.0545**		**0.0**	**44.1**	**42.3**	**13.6**

ASTM D422

GRADATION CURVE

PROJECT GAVIN PLANT BOTTOM ASH POND INVESTIGATION
LOCATION CHESHIRE, OHIO
JOB NO. 011.11497.014 **DATE** 1/28/10

PLATE 24

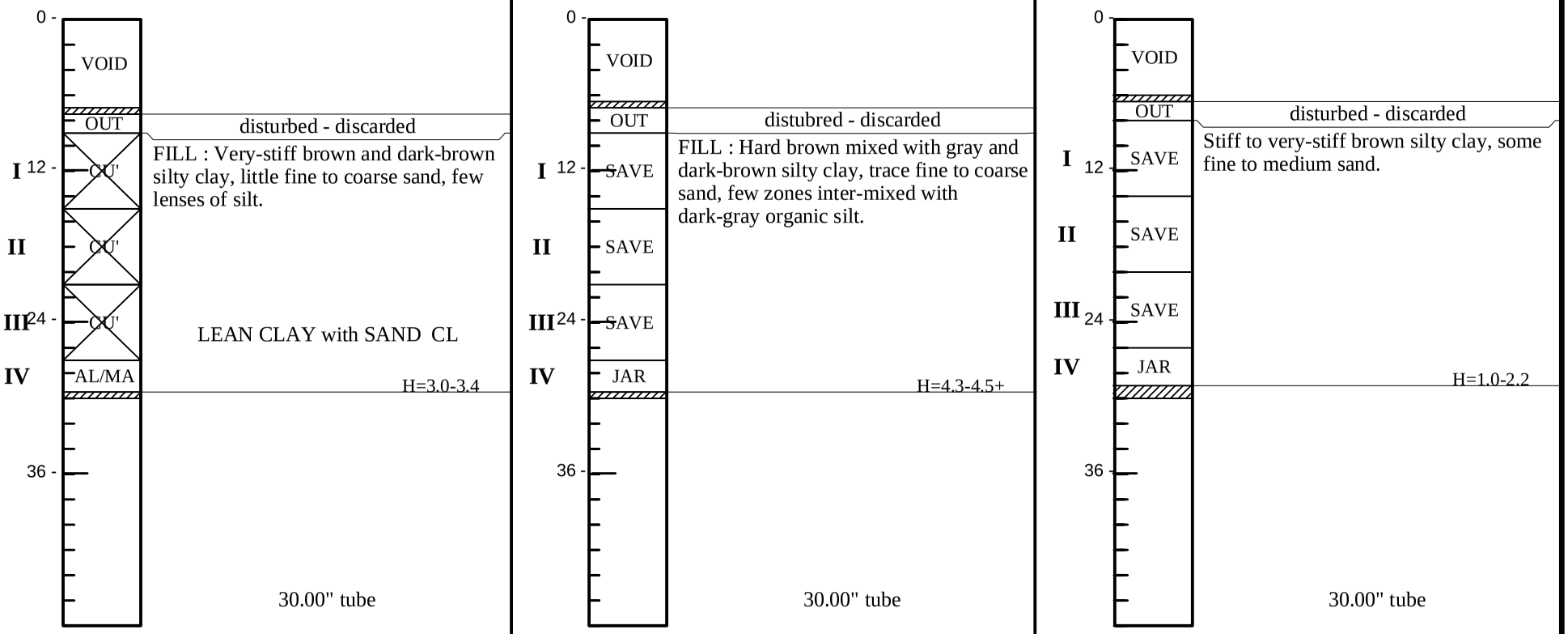
SHELBY TUBE LOG 111497014.GPJ BBCM.GDT 1/28/10

JOB NUMBER : **011.11497.014**
PROJECT : **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION : **CHESHIRE, OHIO**

BBCM

LABORATORY LOG OF SHELBY TUBES

Boring : **GV-BAP-0908** Sample : **4**	Boring : **GV-BAP-0908** Sample : **10**	Boring : **GV-BAP-0908** Sample : **21**
Depth : **8.5' to 10.2'** Recovery : **20.50"**	Depth : **23.5' to 25.4'** Recovery : **20.50"**	Depth : **43.5' to 45.5'** Recovery : **21.00"**



LEGEND

- Consolidation, Incremental
- Swelling, Test
- Wax
- C R S — Consolidation, C R S
- P | P — Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
SL - Shrinkage Limit
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

PLATE 25

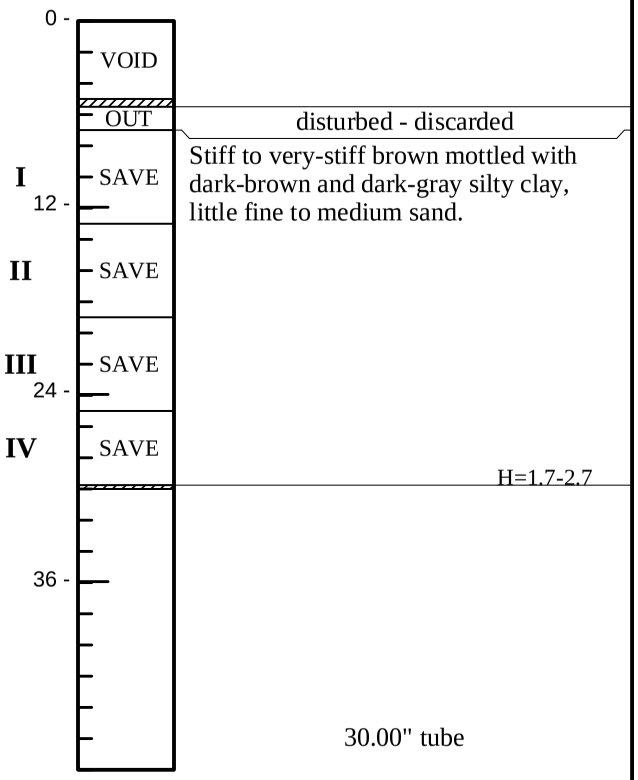
SHELBY TUBE LOG 111497014.GPJ BBCM.GDT 1/28/10

JOB NUMBER : **011.11497.014**
PROJECT : **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION : **CHESHIRE, OHIO**

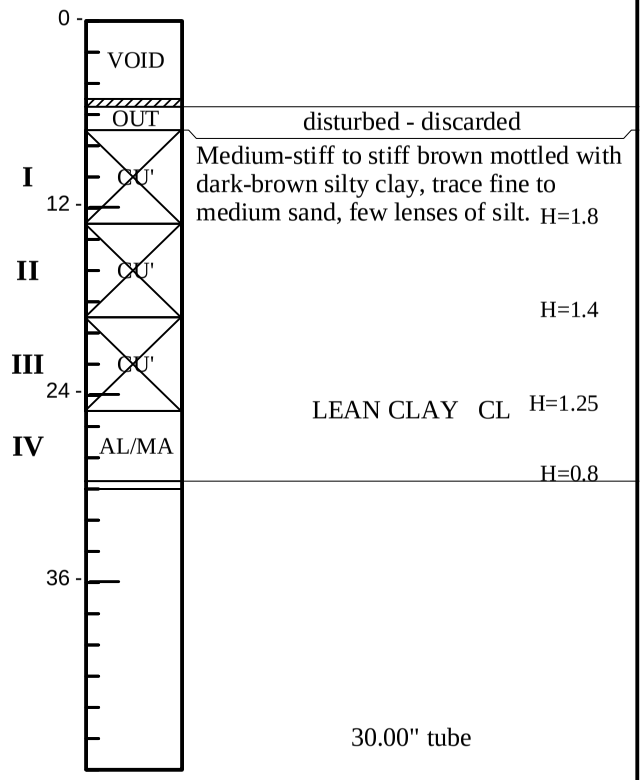
BBCM

LABORATORY LOG OF SHELBY TUBES

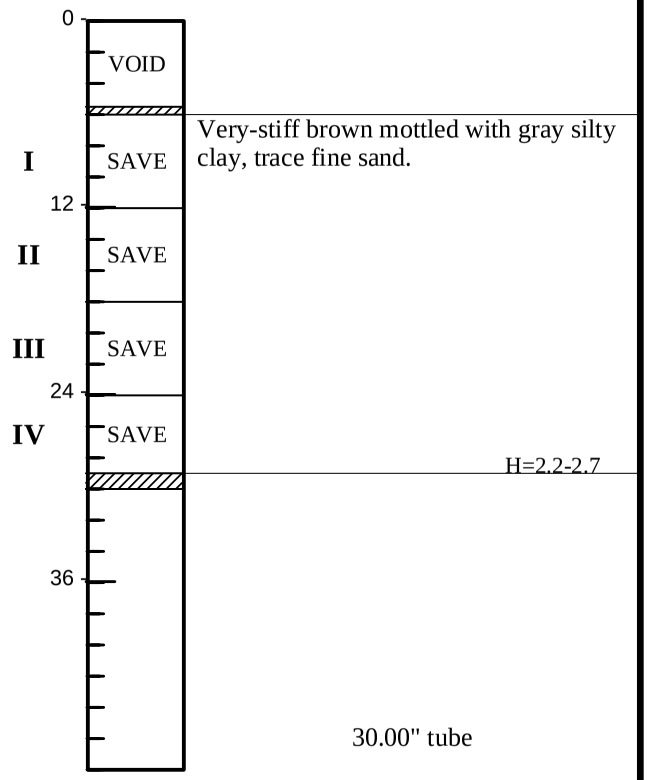
Boring : **GV-BAP-0909** Sample : **6**
Depth : **9.0' to 11.0'** Recovery : **22.75"**



Boring : **GV-BAP-0909** Sample : **10**
Depth : **16.0' to 18.0'** Recovery : **22.50"**



Boring : **GV-BAP-0910** Sample : **6**
Depth : **10.0' to 12.0'** Recovery : **23.00"**



LEGEND

- Consolidation, Incremental
- Swelling, Test
- Wax
- C R S - Consolidation, C R S
- P | P - Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
SL - Shrinkage Limit
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

PLATE 26

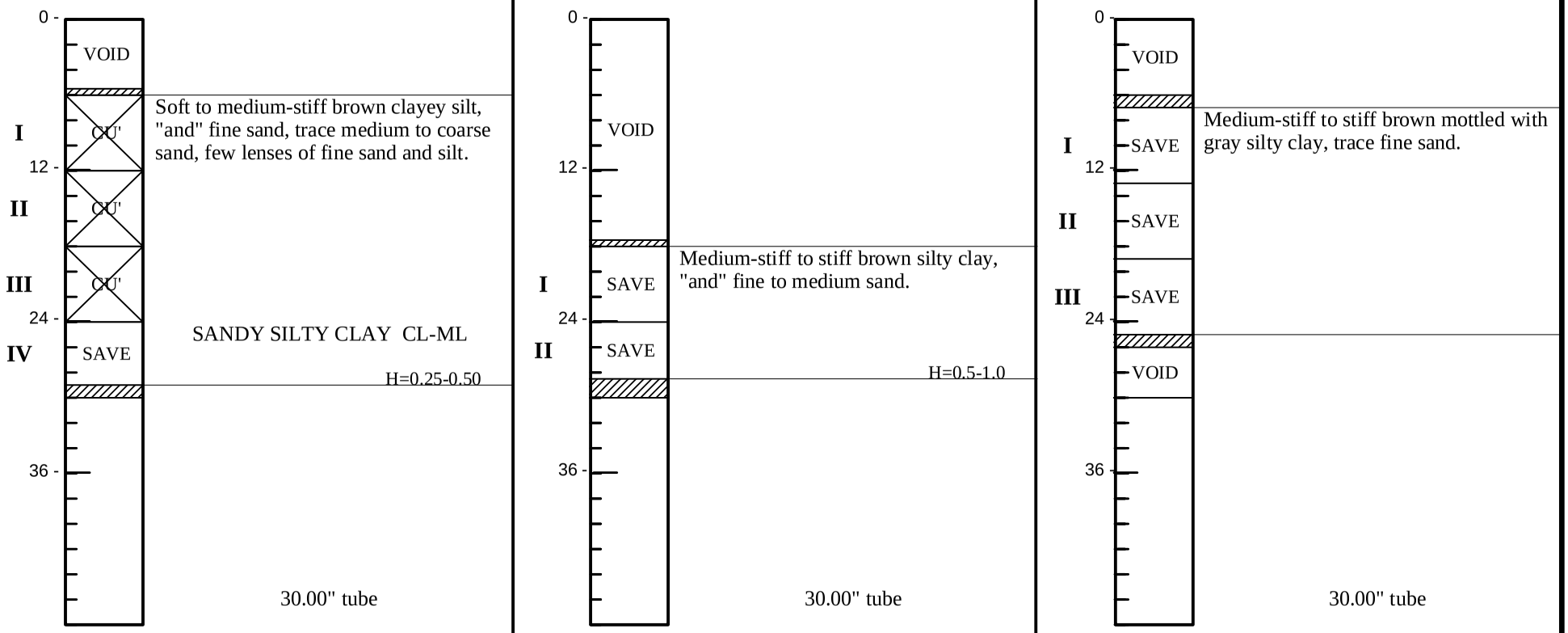
SHELBY TUBE LOG 111497014.GPJ BBCM.GDT 1/28/10

JOB NUMBER : **011.11497.014**
PROJECT : **GAVIN PLANT BOTTOM ASH POND INVESTIGATION**
LOCATION : **CHESHIRE, OHIO**

BBCM

LABORATORY LOG OF SHELBY TUBES

Boring : **GV-BAP-0910** Sample : **10**	Boring : **GV-BAP-0911** Sample : **7**	Boring : **GV-BAP-0911** Sample : **10**
Depth : **17.0' to 19.0'** Recovery : **23.00"**	Depth : **10.5' to 11.5'** Recovery : **10.50"**	Depth : **16.0' to 17.6'** Recovery : **18.00"**

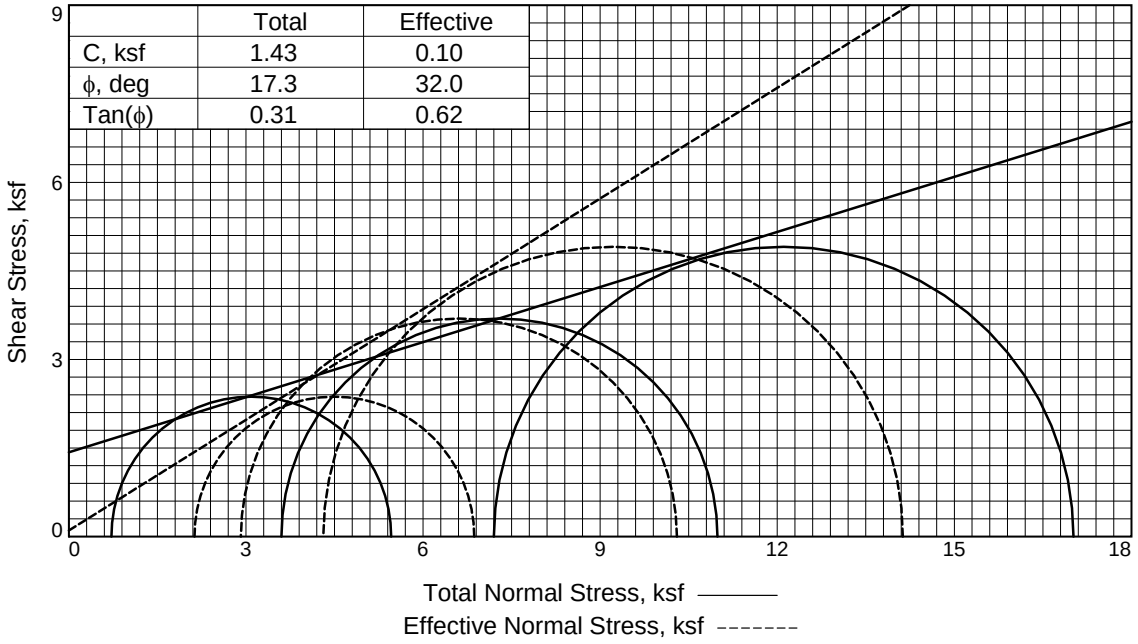


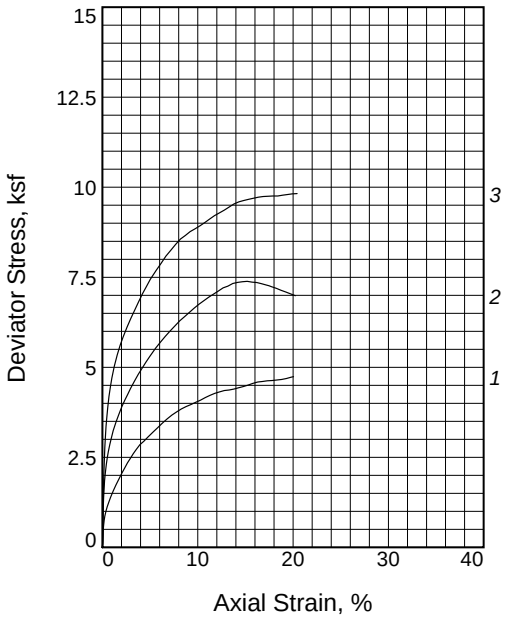
LEGEND

- Consolidation, Incremental
- Swelling, Test
- Wax
- C R S — Consolidation, C R S
- P | P — Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
SL - Shrinkage Limit
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

PLATE 27





Sample No.		1	2	3
Initial	Water Content, %	20.7	20.7	20.6
	Dry Density, pcf	107.7	108.5	108.1
	Saturation, %	95.8	97.7	96.4
	Void Ratio	0.5933	0.5817	0.5884
	Diameter, in.	2.88	2.87	2.88
	Height, in.	5.60	5.59	5.59
At Test	Water Content, %	21.6	20.3	19.0
	Dry Density, pcf	108.4	111.5	113.3
	Saturation, %	101.8	103.5	101.4
	Void Ratio	0.5842	0.5393	0.5148
	Diameter, in.	2.87	2.85	2.84
	Height, in.	5.60	5.53	5.48
Strain rate, in./min.		0.01	0.02	0.02
Eff. Cell Pressure, ksf		0.7	3.6	7.2
Fail. Stress, ksf		4.7	7.4	9.8
Total Pore Pr., ksf		7.2	9.3	11.9
Strain, %		20.0	15.2	19.9
Ult. Stress, ksf		4.7	7.0	9.8
Total Pore Pr., ksf		7.2	9.4	11.9
Strain, %		20.0	20.2	20.4
$\bar{\sigma}_1$ Failure, ksf		6.9	10.3	14.1
$\bar{\sigma}_3$ Failure, ksf		2.1	2.9	4.3

Type of Test: CU with Pore Pressures

Sample Type: Shelby Tube

Description: FILL : Very-stiff brown and dark-brown silty clay, little fine to coarse

LL= 37 **PL=** 21 **PI=** 16

Assumed Specific Gravity= 2.75

Remarks: ASTM : LEAN CLAY with SAND CL

Client: AEP

Project: GAVIN PLANT ASH POND INVESTIGATION
CHESHIRE, OHIO

Location: GV-BAP-0908

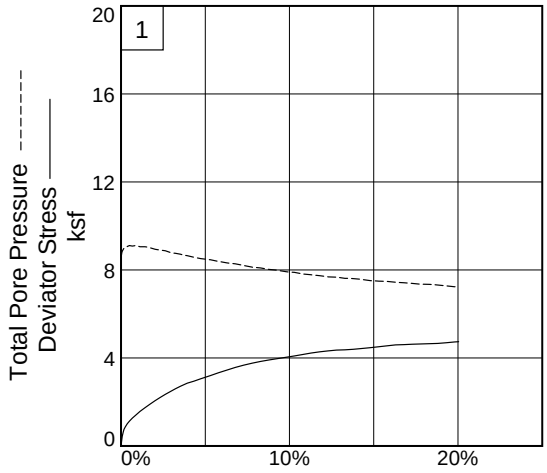
Sample Number: S-4 I,II,III **Depth:** 8.5' to 10.2'

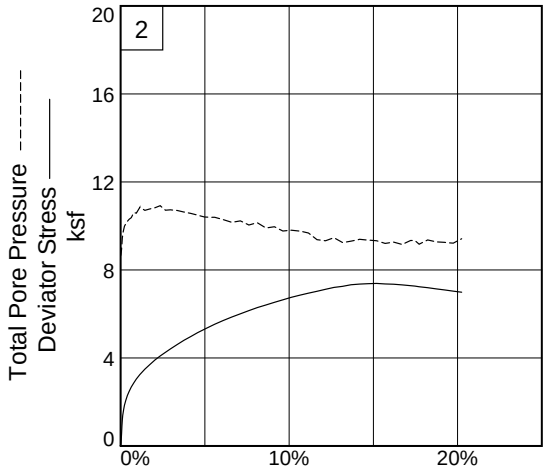
Proj. No.: 011.11497.014 **Date Sampled:** 12/21-29/09

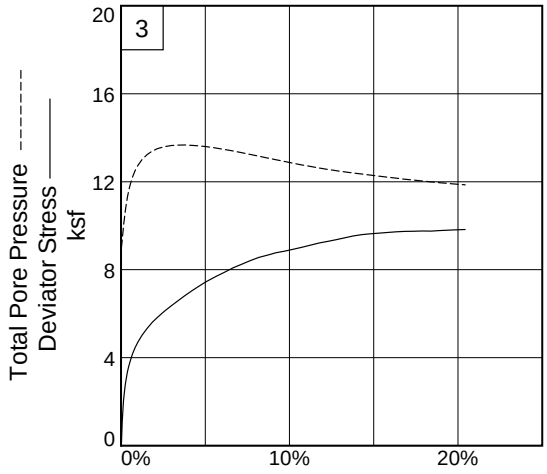
TRIAXIAL SHEAR TEST REPORT
BBC&M Engineering, Inc.
Dublin, Ohio

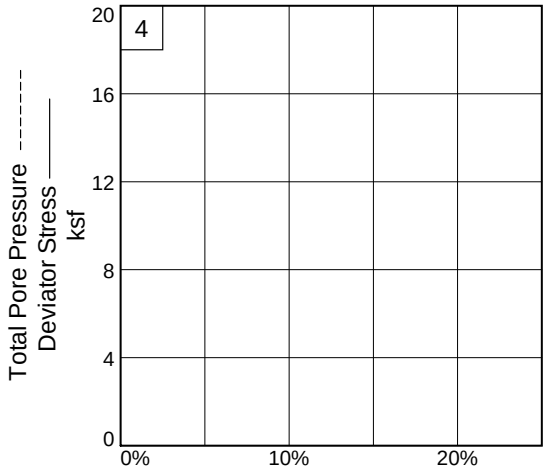
Figure 1 **CU-2**

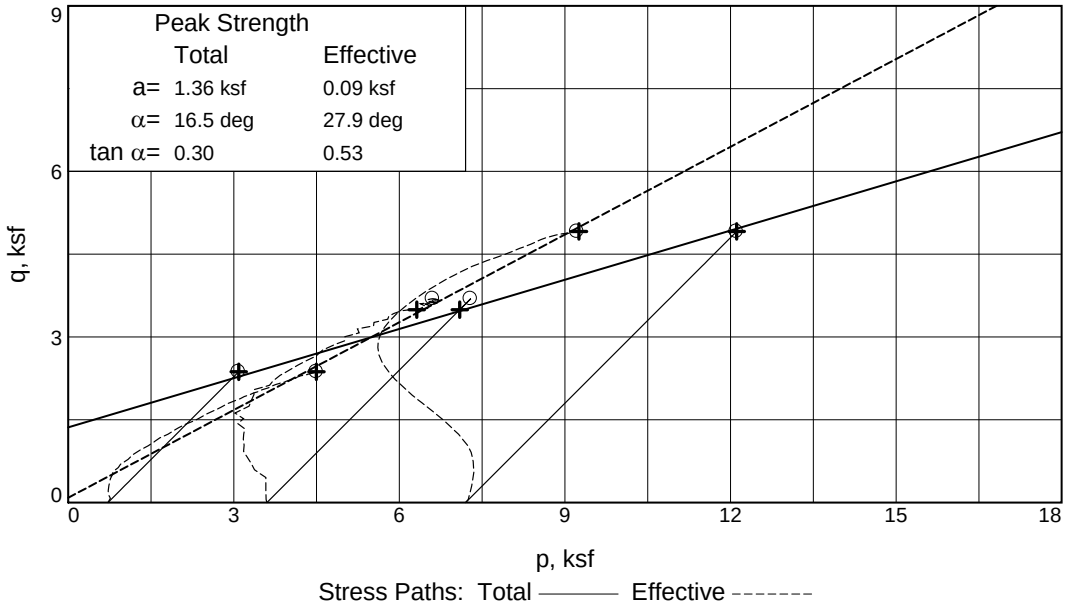
Tested By: JJ **Checked By:** JJ











Client: AEP

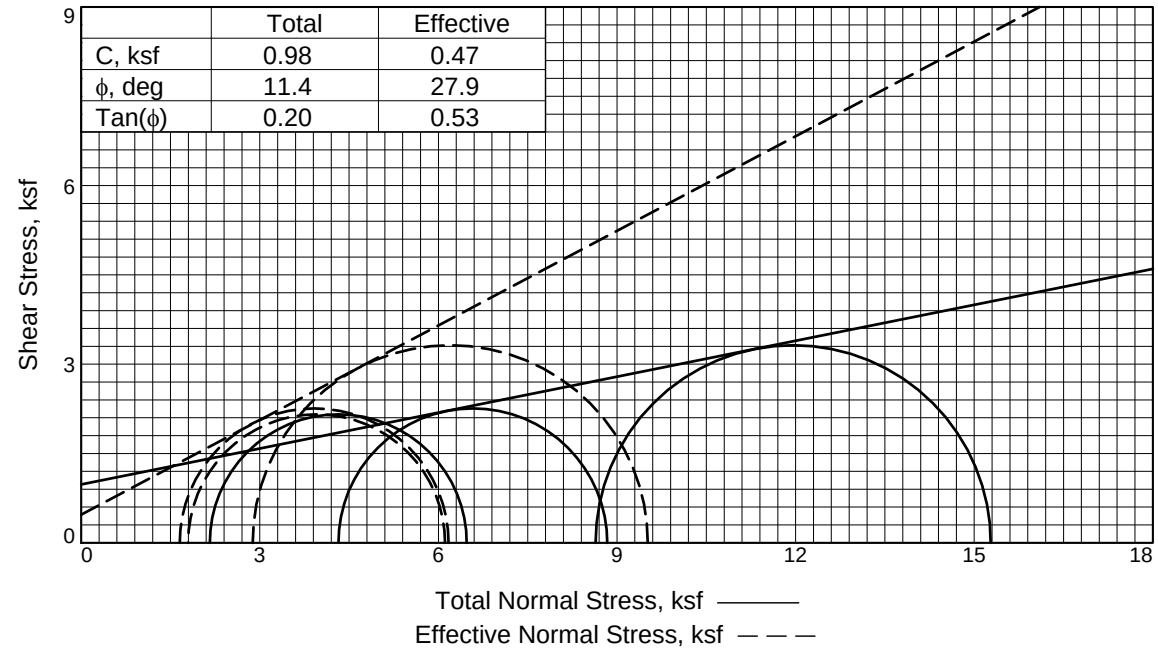
Project: GAVIN PLANT ASH POND INVESTIGATION

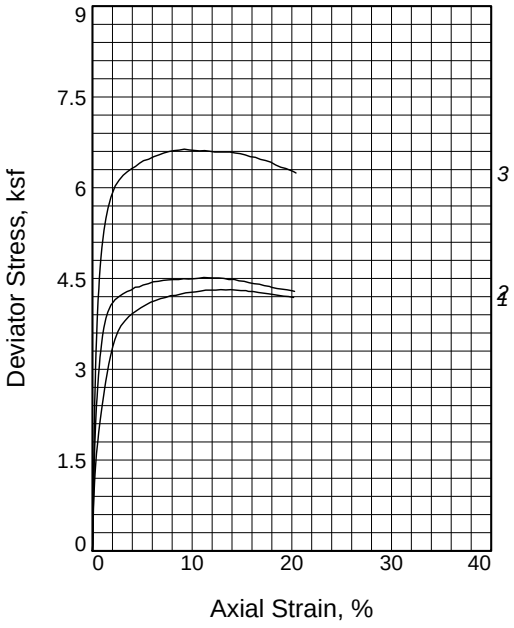
Location: GV-BAP-0908 **Depth:** 8.5' to 10.2' **Sample Number:** S-4 I,II,III

Project No.: 011.11497.014 **Figure** 2

BBC&M Engineering, Inc.

Tested By: JJ **Checked By:** JJ





Sample No.		1	2	3
Initial	Water Content, %	28.1	27.3	27.5
	Dry Density, pcf	95.4	96.5	97.2
	Saturation, %	96.8	96.1	98.6
	Void Ratio	0.7996	0.7798	0.7667
	Diameter, in.	2.86	2.87	2.86
	Height, in.	5.60	5.59	5.60
At Test	Water Content, %	28.2	27.2	25.2
	Dry Density, pcf	97.2	99.3	103.2
	Saturation, %	101.1	102.7	104.4
	Void Ratio	0.7661	0.7294	0.6638
	Diameter, in.	2.84	2.85	2.80
	Height, in.	5.56	5.52	5.49
Strain rate, in./min.		0.02	0.02	0.02
Eff. Cell Pressure, ksf		2.16	4.32	8.64
Fail. Stress, ksf		4.32	4.52	6.64
Total Pore Pr., ksf		6.12	8.42	11.52
Strain, %		13.9	11.2	9.2
Ult. Stress, ksf		4.19	4.29	6.24
Total Pore Pr., ksf		5.96	8.46	11.17
Strain, %		20.2	20.3	20.4
$\bar{\sigma}_1$ Failure, ksf		6.11	6.17	9.52
$\bar{\sigma}_3$ Failure, ksf		1.80	1.66	2.88

Type of Test:
CU with Pore Pressures
Sample Type: Shelby Tube
Description: Medium-stiff to stiff brown mottled with dark-brown silty clay, trace
LL= 34 **PL=** 21 **PI=** 13
Assumed Specific Gravity= 2.75
Remarks: ASTM : LEAN CLAY CL

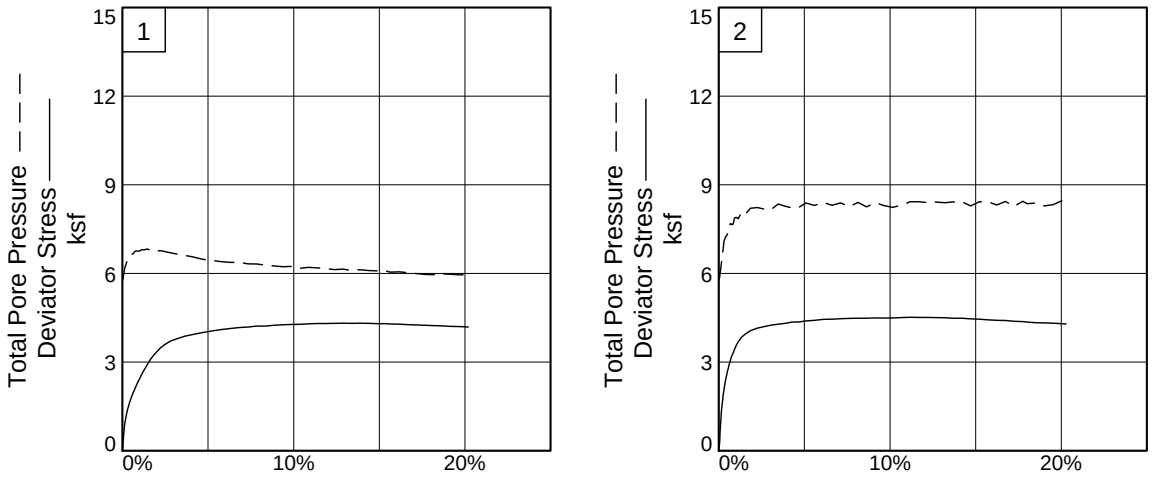
Client: AEP

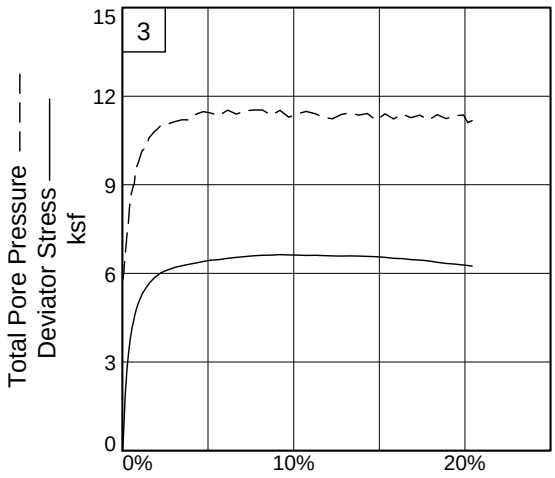
Project: GAVIN PLANT ASH POND INVESTIGATION
CHESHIRE, OHIO
Location: GV-BAP-0909
Sample Number: S-10 I,II,III
Proj. No.: 011.11497.014 **Date Sampled:** 12/9-16/09

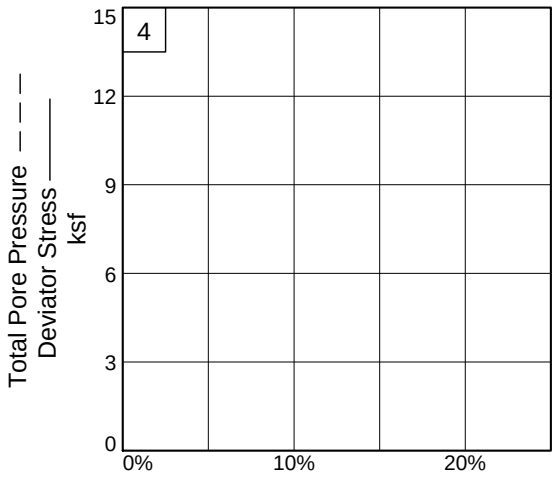
TRIAXIAL SHEAR TEST REPORT
BBC&M Engineering, Inc.
Dublin, Ohio

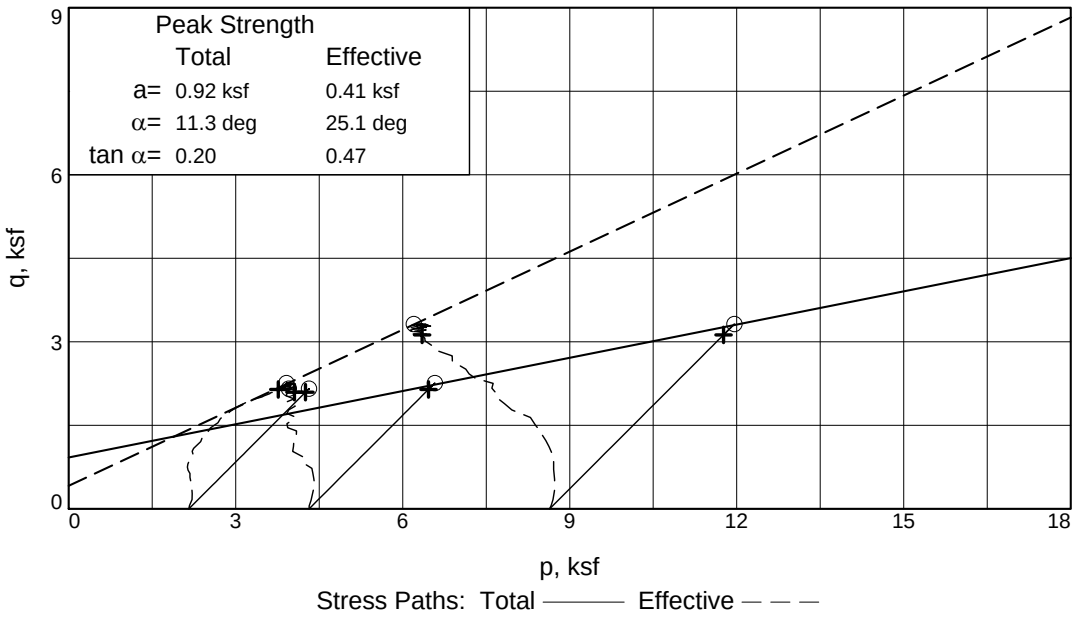
Figure 1 **CU-3**

Tested By: JJ **Checked By:** JJ





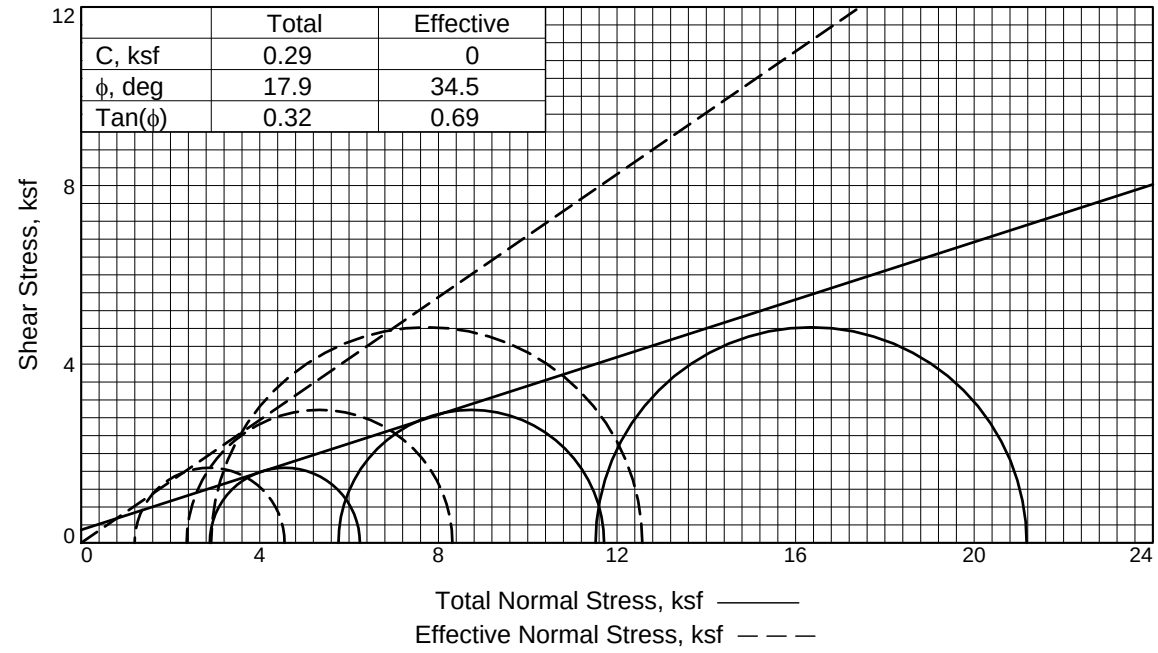


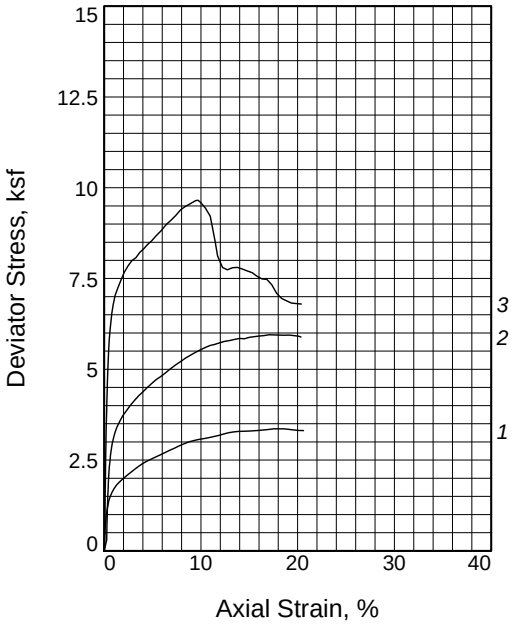


Client: AEP
Project: GAVIN PLANT ASH POND INVESTIGATION
Location: GV-BAP-0909 **Depth:** 16.0' to 18.0' **Sample Number:** S-10 I,II,III
Project No.: 011.11497.014 **Figure** 2

BBC&M Engineering, Inc.

Tested By: JJ **Checked By:** JJ





Sample No.		1	2	3
Initial	Water Content, %	26.9	25.9	27.1
	Dry Density, pcf	87.6	97.6	94.5
	Saturation, %	80.2	98.6	95.8
	Void Ratio	0.8877	0.6946	0.7511
	Diameter, in.	2.90	2.87	2.91
	Height, in.	5.61	5.62	5.57
At Test	Water Content, %	24.3	21.3	21.5
	Dry Density, pcf	98.7	104.7	104.0
	Saturation, %	95.1	97.0	96.4
	Void Ratio	0.6770	0.5808	0.5914
	Diameter, in.	2.77	2.80	2.80
	Height, in.	5.46	5.53	5.47
Strain rate, in./min.		0.01	0.02	0.02
Eff. Cell Pressure, ksf		2.9	5.8	11.5
Fail. Stress, ksf		3.4	6.0	9.7
Total Pore Pr., ksf		7.4	9.2	14.4
Strain, %		17.5	17.0	9.7
Ult. Stress, ksf		3.3	5.9	6.8
Total Pore Pr., ksf		7.4	9.1	15.5
Strain, %		20.6	20.3	20.4
$\bar{\sigma}_1$ Failure, ksf		4.6	8.3	12.6
$\bar{\sigma}_3$ Failure, ksf		1.2	2.4	2.9

Type of Test: CU with Pore Pressures

Sample Type: Shelby Tube

Description: Soft to medium-stiff brown clayey silt, "and" fine sand, trace medium

LL= 28 **PL=** 23 **PI=** 5

Assumed Specific Gravity= 2.65

Remarks: ASTM : SANDY SILTY CLAY CL-ML

Client: AEP

Project: GAVIN PLANT ASH POND INVESTIGATION
CHESHIRE, OHIO

Location: GV-BAP-0910

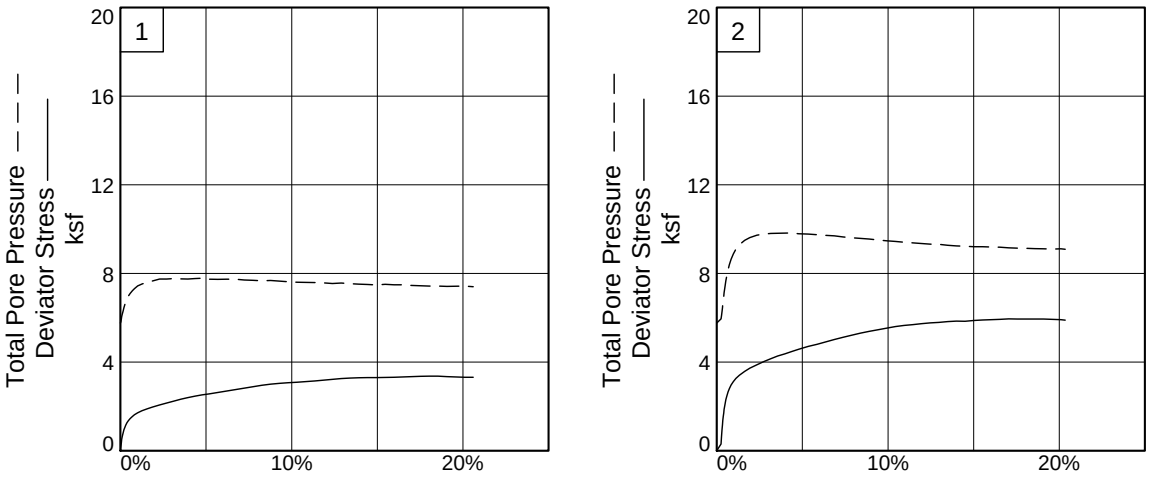
Sample Number: S-10 I,II,III

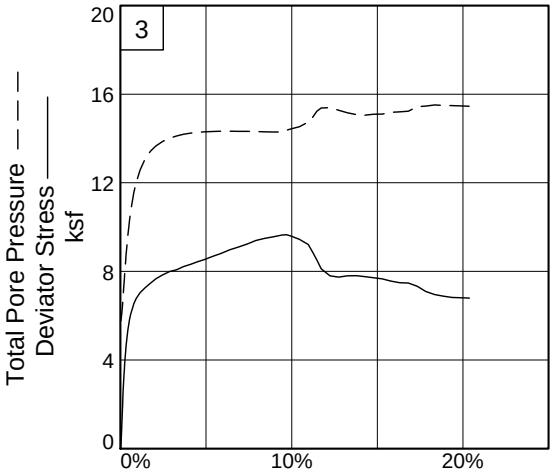
Proj. No.: 011.11497.014 **Date Sampled:** 12/17-28/09

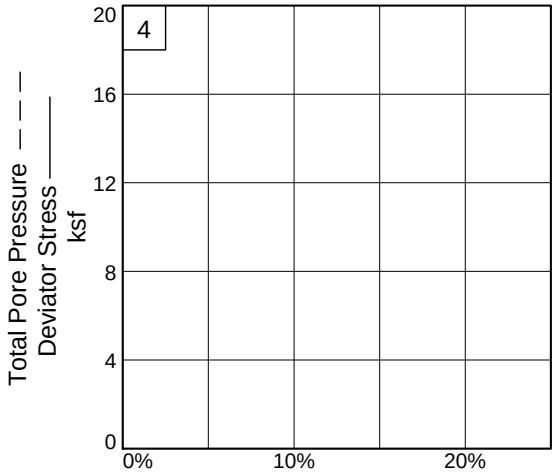
TRIAXIAL SHEAR TEST REPORT
BBC&M Engineering, Inc.
Dublin, Ohio

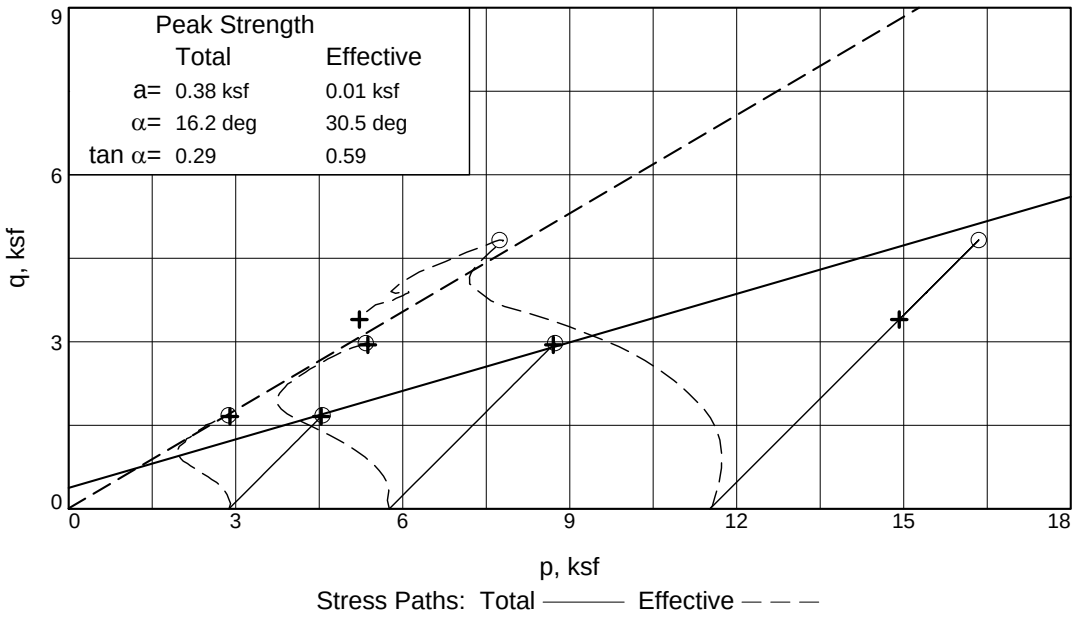
Figure 1 **CU-4**

Tested By: JJ **Checked By:** JJ







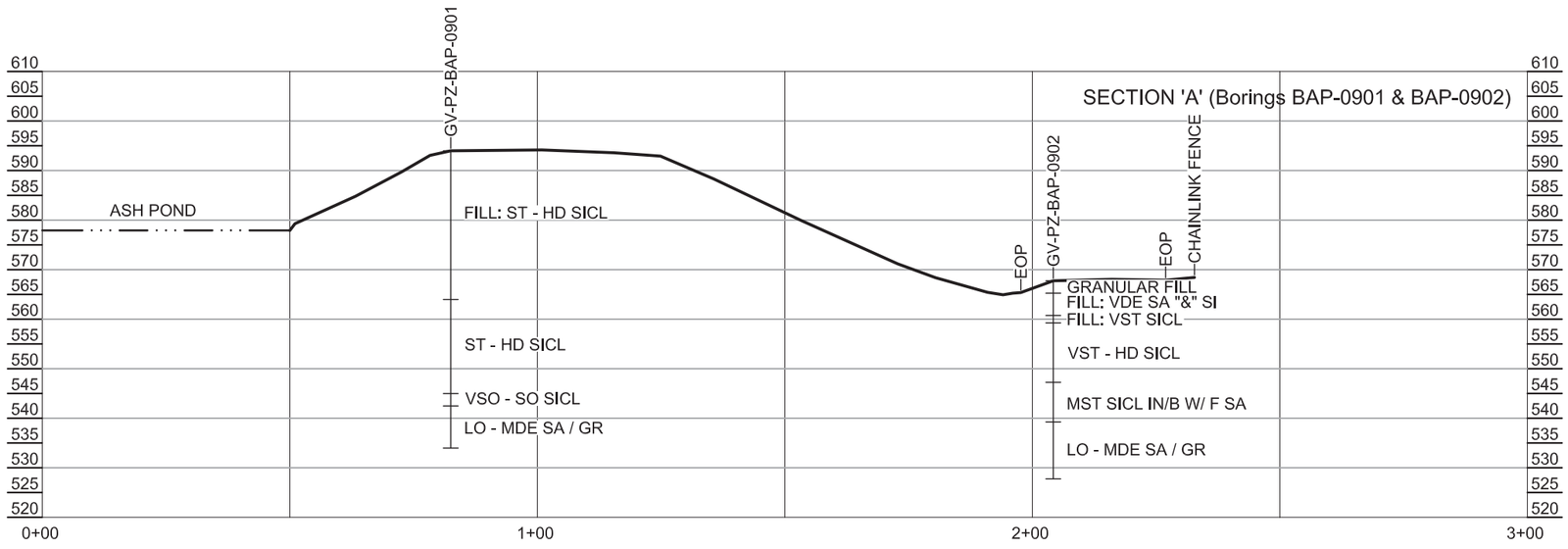


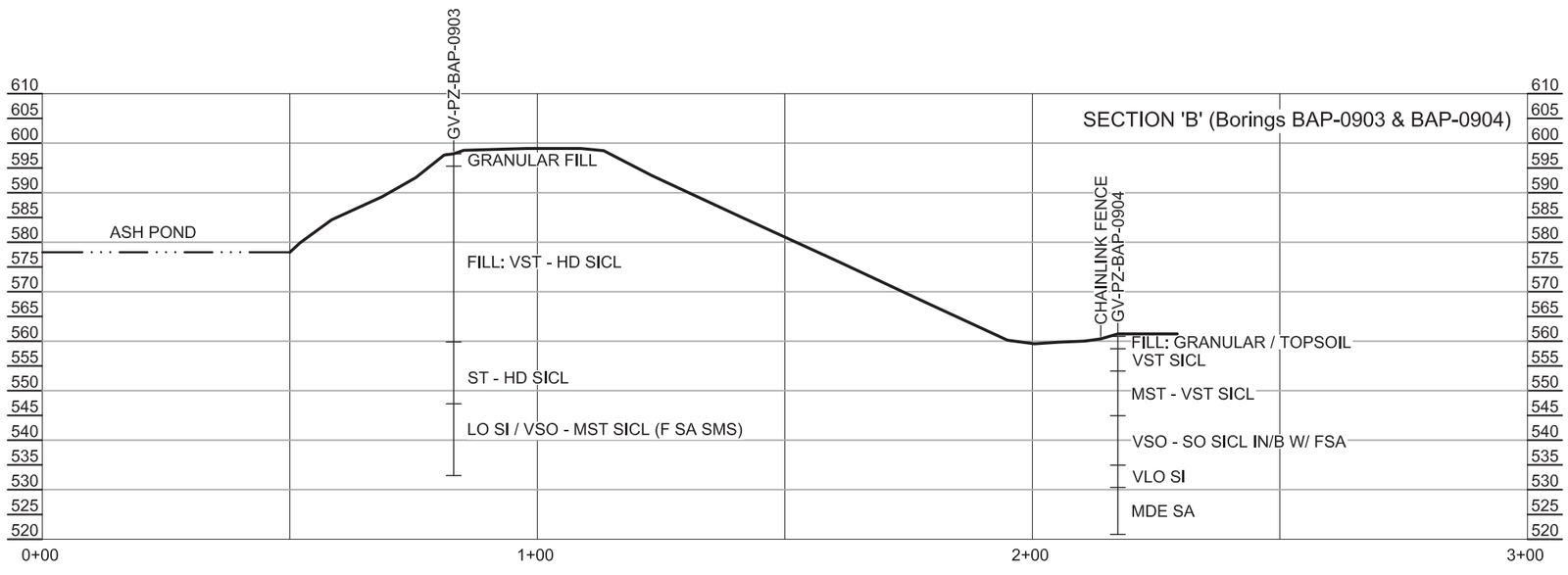
Client: AEP
Project: GAVIN PLANT ASH POND INVESTIGATION
Location: GV-BAP-0910 **Depth:** 17.0' to 19.0' **Sample Number:** S-10 I,II,III
Project No.: 011.11497.014 **Figure** 2

BBC&M Engineering, Inc.

Tested By: JJ **Checked By:** JJ

Appendix III – Soil Parameter Justification





DATUM: NAD27 / NGVD 29

SUBSURFACE SECTIONS A & B

Gavin Plan Ash Pond Investigation
Chesire, Ohio

Project: 011-11497-014	Drawn By: MTR	
Drawing Date: 5-5-2009	Approved By: MGR	
Last Updated: 6-3-2009	Scale: 1" = 30'	1:1

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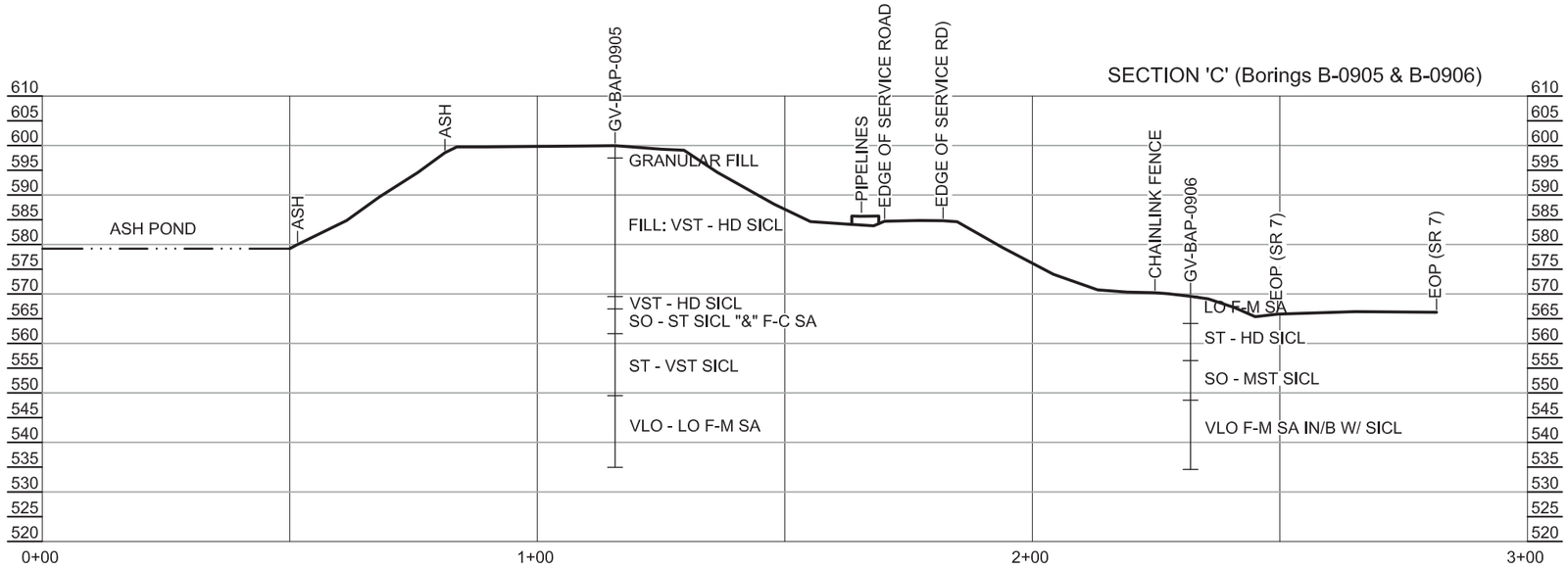
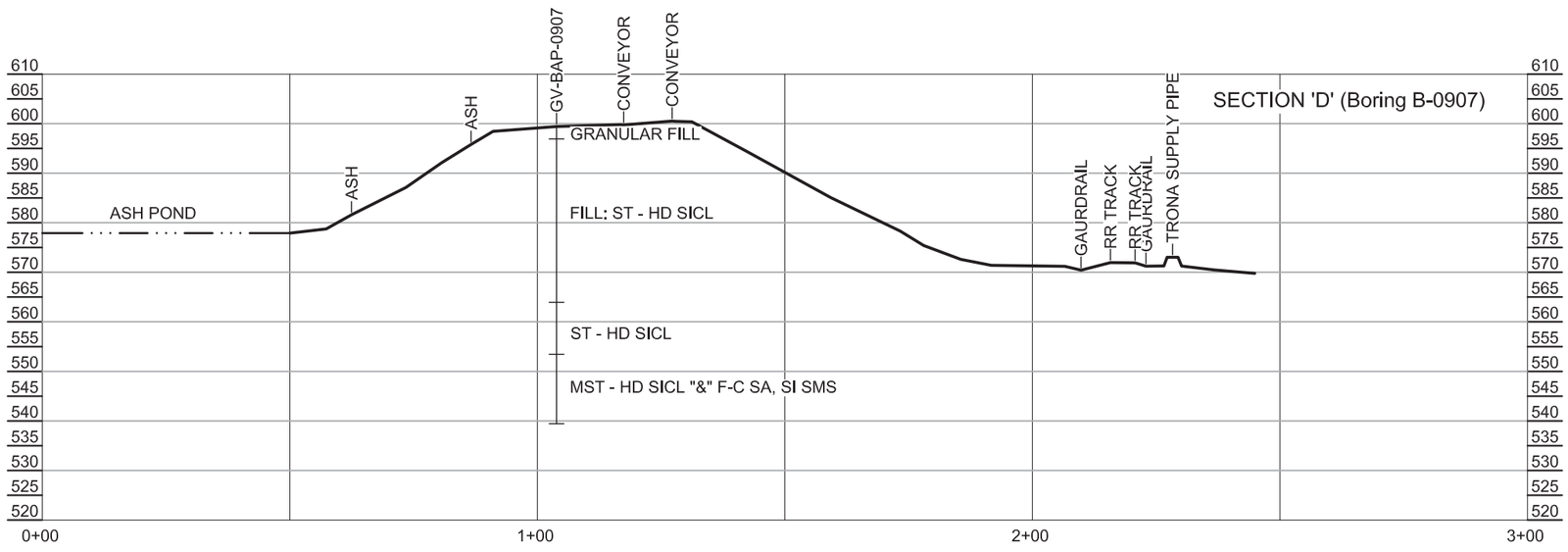
Images: ~Gavin Aerial.jpg ~Gavin Site Plan.JPG
Xrefs: ~Gavin Ash Pond.dwg
File Last Updated: Jun 03, 2009
Plot Info: 6-4-2009 @ 9:19am By: MRomanello
BBC&M Filename: I:\DEPTS\CADD\Drawings\Projects\011-11497-014\EaglePoint\011-11497-014 BASE.dwg Layout: Sec A-B





DATUM: NAD27 / NGVD 29

SUBSURFACE SECTIONS C & D

Gavin Plan Ash Pond Investigation
Chesire, Ohio

Project: 011-11497-014	Drawn By: MTR	
Drawing Date: 5-5-2009	Approved By: MGR	
Last Updated: 6-3-2009	Scale: 1" = 30'	1:1

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Images: ~Gavin Aerial.jpg ~Gavin Site Plan.JPG
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File Last Updated: Jun 03, 2009
Plot Info: 6-4-2009 @ 9:21am By: MRomanello
BBC&M Filename: I:\DEPTS\CADD\Drawings\Projects\011-11497-014\EaglePoint\011-11497-014 BASE.dwg Layout: Sec C-D

Layer: EMBANKMENT FILL

BORING NUMBER	SAMPLE DEPTH	NATURAL MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	GRAVEL	SAND	SILT	CLAY .002 mm	SILT/CLAY	USCS CLASSIFICATION
			%	%	%	%	%	%	%	%	
BAP-0901	4.75	19									
BAP-0901	7.5	20	41	22	19	0	8	65	27	92	LEAN CLAY CL
BAP-0901	12.75	23	48	23	25						
BAP-0901	17.25	22	53	25	28	0	7	61	32	93	FAT CLAY CH
BAP-0901	19.75	21	42	22	20	0	9	59	32	91	LEAN CLAY CL
BAP-0901	20.5	22									
BAP-0901	26.75	16	34	17	17	0	14	60	26	86	LEAN CLAY CL
BAP-0902	7.75	20	41	20	21						
BAP-0903	4.75	23	38	21	17						
BAP-0903	5.6										
BAP-0903	8.25	20									
BAP-0903	11.25	22	42	21	21						
BAP-0903	15.75	23	52	24	28	0	6	57	37	94	FAT CLAY CH
BAP-0903	21.75	21	30	18	12						
BAP-0903	27.75	19	41	22	19						
BAP-0903	34.25	19	44	22	22	0	12	58	30	88	LEAN CLAY CL
BAP-0905	4.75	18	38	20	18						
BAP-0905	12.25	20	43	23	20	0	4	63	32	95	LEAN CLAY CL
BAP-0905	15.25	22	44	24	20						
BAP-0905	19.75	21									
BAP-0905	21.25	21	40	23	17	0	11	58	31	89	LEAN CLAY CL
BAP-0905	26.25	18	39	19	20	0	11	59	30	89	LEAN CLAY CL
BAP-0905	29.25	20									
BAP-0907	4.75	22	41	21	20						
BAP-0907	9.25	17	34	18	16						
BAP-0907	13.75	18	32	16	16	0	24	54	22		LEAN CLAY with SAND CL
BAP-0907	17.75	20	35	20	15	0	19.4	41.8	38.8		LEAN CLAY with SAND CL
BAP-0907	26.25	20	41	20	21						
BAP-0907	34.25	19	52	24	28	2	10	55	34		FAT CLAY CH

Sample Size	29	28	23	23	23	12	12	12	12	9
Minimum	4.75	16	30	16	12	0	4	42	22	86
Maximum	34.25	23	53	25	28	2	24	65	39	95
Mean	16.59	20	41.1	21	20	0	11	58	31	91
Median	15.75	20	41.0	21	20	0	11	59	32	91
Mode	4.75	20	41.0	22	20	0	11	59	32	89
Std Dev	-	1.8	6.1	2.4	4.1	0.6	5.7	5.8	4.6	3.0

PLATE 3

Layer: ALLUVIUM SILT AND CLAY

BORING NUMBER	SAMPLE DEPTH	NATURAL MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	GRAVEL	SAND	SILT	CLAY .002 mm	SILT/CLAY	USCS CLASSIFICATION
			%	%	%	%	%	%	%	%	
BAP-0901	31.75	18	38	20	18						
BAP-0901	34.25	15	29	18	11	0	32	51	17	68	SANDY LEAN CLAY CL
BAP-0901	39.25	18	26	18	8						
BAP-0901	44.25	23	30	21	9	0	23	62	15	77	LEAN CLAY with SAND CL
BAP-0901	46.75	25									
BAP-0901	49.45	29	24	19	5						
BAP-0902	11.75	18	35	20	15						
BAP-0902	19.25	22	32	21	11	0	11	67	22	89	LEAN CLAY CL
BAP-0902	24.25					0	38			62	
BAP-0902	26.75	30	21	16	5						
BAP-0903	41.75	24	53	22	31	0	7	59	34	93	FAT CLAY CH
BAP-0903	46.75	22	38	19	19						
BAP-0903	51.75	25	24	19	5						
BAP-0903	56.75	25	35	19	16	0	13	62	25	87	LEAN CLAY CL
BAP-0904	4.75	24	44	22	22						
BAP-0904	7.75	30	43	26	17	0	4	62	34	96	LEAN CLAY CL
BAP-0904	11.75	23	42	20	22						
BAP-0904	16.75	26									
BAP-0904	19.25	28	30	20	10						
BAP-0904	24.25	29	32	19	13	0	24			76	LEAN CLAY with SAND CL
BAP-0904	29.25					0	18			82	
BAP-0904	34.25	29	32	19	13						
BAP-0905	31.75	17	29	18	11						
BAP-0905	34.25					0	43			57	
BAP-0905	36.75	19	28	18	10	0	34	47	19	66	SANDY LEAN CLAY CL
BAP-0905	43.75	25	42	21	21	0	4	69	28	97	LEAN CLAY CL
BAP-0905	49.25	28	38	22	16						
BAP-0906	6.25	18	35	20	15	0	25	54	21	75	LEAN CLAY with SAND CL
BAP-0906	9.25	23	45	22	23						
BAP-0906	14.25	25	33	21	12						
BAP-0906	19.25	27	34	21	13	0	13	65	22	87	LEAN CLAY CL
BAP-0907	39.25	21	47	24	23	0	8	61	32	93	LEAN CLAY CL
BAP-0907	44.75	19	40	20	20						
BAP-0907	47.25	18	31	17	14	0	31	49	20	69	SANDY LEAN CLAY CL
BAP-0907	51.75	20	32	18	14	0	31			69	SANDY LEAN CLAY CL
BAP-0907	56.75	24	31	18	13						

Sample Size	36	33	31	31	31	17	17	12	12	17
Minimum	4.75	15	21	16	5	0	4	47	15	57
Maximum	56.75	30	53	26	31	0	43	69	34	97
Mean	32.14	23	34.6	20	15	0	21	59	24	79
Median	34.25	24	33.0	20	14	0	23	62	22	77
Mode	34.25	18	32.0	20	13	0	13	62	22	-
Std Dev	-	4.2	7.4	2.1	6.0	0.0	12.4	7.2	6.5	12.6

PLATE 4

Gavin Plan Bottom Ash Pond Investigation
Chesire, Ohio
BBCM Engineering

INDEX TESTING SUMMARY

Layer: LO-MDE SAND / GRAVEL

BORING NUMBER	SAMPLE DEPTH	NATURAL MOISTURE CONTENT	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX %	GRAVEL %	SAND %	SILT %	CLAY .002 mm %	SILT/CLAY %	USCS CLASSIFICATION
BAP-0901	51.35					0	41			59	
BAP-0901	54.25					36	59			5	POORLY GRADED SAND with GRAVEL SP
BAP-0902	31.75					20	75			4	POORLY GRADED SAND with GRAVEL SP
BAP-0905	54.25					0	41			59	
BAP-0906	29.25					0	56			44	

Sample Size	5	-	-	-	-	5	5	-	-	5
Minimum	29	-	-	-	-	0	41	-	-	4
Maximum	54	-	-	-	-	36	75	-	-	59
Mean	44	-	-	-	-	11	54	-	-	34
Median	51	-	-	-	-	0	56	-	-	44
Mode	54.25	-	-	-	-	0	41	-	-	59
Std Dev	12.6	-	-	-	-	16.3	14.2	-	-	27.8

PLATE 5

BBCM SOLUTIONS TO BUILD ON
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Project/Proposal No. 011.11497.014 Calculated By MTR Date 5-29-09
Project/Proposal Name GAVIN PLANT ASH POND Checked By MGR Date 6-3-09
Subject STRENGTH & PERM. PARAMETERS Sheet 1 of 5

The shear strength values estimated from the following correlations were updated based on results of consolidated-undrained triaxial tests performed as part of the 2010 Follow-Up Investigation.

ONLY DRAINED STRENGTH PARAMETERS ARE REQUIRED FOR STABILITY ANALYSIS SINCE POND IN SERVICE SINCE 1974 +/-

+ DRAINED STRENGTH PARAMETERS
FOR EMBANKMENT FILL & ALLUVIUM LAYERS, ESTIMATE THE EFFECTIVE ANGLE OF INTERNAL FRICTION, ϕ', FROM THE FOLLOWING METHODS:

1) CORRELATIONS TO LL, CLAY SIZED FRACTION, AND OVERBURDEN STRESS DEVELOPED BY STARK ET AL. FOR FULLY SOFTENED FRICTION ANGLE.

2) RELATIONSHIP BETWEEN ϕ' AND PLASTICITY INDEX (TERZAGHI, PECK AND MESRI, 1996)

3) CORRELATION TO CLAY SIZED FRACTION FOR NORMALLY CONSOLIDATED CLAY (DISSERTATION BY G.A. HALL, UVU, 1974)

WHERE $\phi'_{NC} = 36 - 0.2665\,(\%\ \text{CLAY})$

4) FOR EMBANKMENT FILL ONLY, A 3PT CU TRIAXIAL TEST WAS PERFORMED ON AN UNDISTURBED SAMPLE.

5) FOR FILL SOILS, ESTIMATE DRAINED STRENGTH VALUES FROM NAVFAC DESIGN MANUAL 7.2 USING TABLE 1 - 'TYPICAL PROPERTIES OF COMPACTED SOILS'

+ GRANULAR FOUNDATION LAYERS (GLACIAL OUTWASH SAND & GRAVEL)
ESTIMATE ϕ' BASED SPT CORRELATIONS AND GRAIN SIZE ANALYSIS

1) $\phi' = \sqrt{15.4\,(N_{60})} + 20°$ (HANTANAKA AND UCHIDA, 1996)

2) COMPARE EQN 1) WITH TYPICAL VALUES ESTABLISHED BY SCHNEIDER ET. AL.

TABLE 7.1 Relative Density of Cohesionless Soils

Relative Density Designation	γ_{moist} (pcf)	*Approximate Relative Density, %*	*N_{60} Standard Penetration Resistance*	*Approximate Angle of Friction of Soil ϕ, degrees*
Very loose	70–100	0–5	0–4	25–28
Loose	90–115	5–30	4–10	28–30
Medium	110–130	30–60	10–30	30–36
Dense	110–140	60–85	30–50	36–41
Very dense	130–150	>85	Over 50	>41

PLATE 6

+ PERMEABILITY

- EMBANKMENT FILL
  PERMEABILITY BASED ON FLEX WALL PERMEABILITY TEST PERFORMED ON UNDISTURBED SAMPLE. ESTIMATE PERM. SLIGHTLY GREATER THAN TEST RESULTS TO ACCOUNT FOR PERM ON MACRO SCALE.

- ALLUVIUM SILT & CLAY
  ESTIMATE PERMEABILITY BASED ON TYPICAL PUBLISHED VALUES USING SOIL DESCRIPTIONS & GRAIN SIZE ANALYSIS

- GRANULAR FOUNDATION LAYERS
  ESTIMATE PERMEABILITY USING TYPICAL PUBLISHED VALUES BASED ON RELATIVE DENSITY AND GRAIN SIZE ANALYSIS

  AS A GUIDE, USE $K = (100\ D_{10})^2$ cm/sec ($cm \times 10^{-4}$/sec)
  (HAZEN)

+ LAYER: COHESIVE EMBANKMENT FILL:

DESCRIPTIONS: STIFF TO HARD BROWN MOTTLED WITH GRAY SILTY CLAY, TRACE TO LITTLE FINE TO COARSE SAND, TR FINE GRAVEL

HAND PENETROMETER: H = 1.25 TO 4.5+ tsf

INDEX TESTING:

	MC	LL	PI	% CLAY (@.002 mm)
MODE VALUE:		41	20	32

- STRENGTH PARAMETER:

1) STARK CORRELATION FOR SECANT FULLY SOFTENED FRICTION ANGLE:

HEIGHT OF FILL RANGES BETWEEN 30 – 40 FT.
OBSERVATION WELL READINGS BELOW FILL. CONSIDER FAILURE SURFACES FROM 15' TO 40



$\therefore \sigma_{v_o}' = 15\text{ FT} \times 125\text{ pcf} = 1875\text{ psf} = 90\text{ kPa}$
$\sigma_{v_o}' = 40\text{ FT} \times 125\text{ pcf} = 5000\text{ psf} = 240\text{ kPa}$

✓ FOR CORRELATION, CONSIDER BOTH $\sigma_{v_o}' = 50$ kPa AND 100 kPa TO ACCOUNT FOR PROBABLE DEPTH OF FAILURE SURFACE
RESULTS: $\phi_{FS}' = 29°$ (SEE CORRELATION THIS APPENDIX)

2) USING GRAPH OF ϕ' VRS PI, FOR PI = 20, $\phi' = 31°$
(SEE GRAPH THIS APPENDIX)

3) $\phi_{AIC}' = 36 - 0.2665(\%\text{ CLAY})$
$= 36 - 0.2665(32\%)$ } HALL THESIS

$\phi_{AIC}' = 27.5°$

4) BASED ON RESULTS OF CU TRIAXIAL TEST, $\phi' = 24.4°$ & $C' = 530$ psf
(SEE DISCUSSION IN TEXT & PLATES THROUGH OF APP.

5) NAVFAC TABLE 1. FOR INORGANIC CLAY FILL OF LOW TO MED PLASTICITY
$\phi' = 28°$ & COHESION (SATURATED) = 270 psf (SEE TABLE THIS APPENDIX)

DESIGN STRENGTH VALUE: BASED ON RESULTS, USE $\phi' = 28$ AND $C' = 100$ psf

- PERMEABILITY: FROM FLEX WALL PERM TEST, $K = 2.5 \times 10^{-8}$ cm/sec
USE $K_v = 1 \times 10^{-7}$ cm/s TO ACCOUNT FOR PERMEABILITY ON A MACRO SCALE.
ANISOTROPIC CONDITIONS: SET $K_H/K_v = 5$ DUE TO STRATIFICATIONS AS A RESULT OF COMPACTING FILL IN LAYERS.

+ LAYER: ALLUVIUM SILT & CLAY

DESCRIPTION: STIFF TO HARD SILTY CLAY CONTAINING ZONES AND/OR THIN SEAMS OF
1) SOFT TO STIFF CLAYEY SILT
2) LOOSE SILT
3) VERY LOOSE TO LOOSE FINE TO MICA SAND

HAND PENETROMETER: 1.0 - 4.5+ tsf ON SILTY CLAY SAMPLES
0.25 - 1.0 tsf ON CLAYEY SILT SAMPLES

INDEX TESTING

	MC	LL	PI	% CLAY
MODAL VALUE	18	32	13	22

- STRENGTH PARAMETER

1) STARK CORRELATION
DEPTH OF ALLUVIUM LAYER RANGES FROM 30' - 58' BELOW CREST TO 0 TO 35' BELOW GROUND SURFACE @ TOE.

CONSIDER BOTH $\sigma_{v_0}' = 100$ KPa & $\sigma_{v_0}' = 400$ KPa FOR STRENGTH CORRELATION.

RESULTS: $\phi_{FS}' = 28°$ (SEE CORRELATION THIS APPENDIX)

2) TERZAGHI, PECK & MESRI ϕ' VRS PI GRAPH (SEE GRAPH THIS APPENDIX)

RESULTS $\phi' = 32°$

3) $\phi'_{NC} = 36 - 0.2665$ (% CLAY)
$= 36 - 0.2665(22\%)$ $\phi'_{NC} = 30°$ } HALL THESIS

DESIGN STRENGTH PARAMETER: BASED ON RESULTS FROM ALL 3 CORRELATION METHODS, USE $\phi' = 29°$

- PERMEABILITY: USE $K_v = 1 \times 10^{-5}$ cm/s BASED ON PRESENCE OF COARSE GRAINED SEAMS/ZONES

ANISOTROPIC CONDITIONS: SET $K_H/K_v = 2$ BASED ON NATURAL STRATIFICATION

+ LAYER: LOOSE TO MED. DENSE GLACIAL OUTWASH SAND & GRAVEL

- DESCRIPTION: LOOSE TO MED DENSE BROWN AND GRAY FINE TO COARSE SAND, TRACE TO SOME FINE TO COARSE GRAVEL TRACE SILT

- N_{60} RANGE:

		FRICTION ANGLE EQN 72	FRICTION ANGLE TABLE 7-1
LOW	3	26.7°	27°-28°
HIGH	46	46.6°	40-41°
AVG	15	35°	31°-32°

USE $\phi' = 32°$

- PERMEABILITY: D_{10} SIZE ON SIEVED SAMPLES: D_{10} = 0.1686
0.2333
< 0.0774
< 0.0848

USING HAZEN CORRELATION,

$K = (100 \cdot 0.2333)^2$ in/sec = $5.4 E^{-2}$ cm/sec

$K = (100 \cdot 0.1686)^2$ in/sec = $2.8 E^{-2}$ cm/sec

USE $K_V = 1.0 \times 10^{-3}$ cm/sec ✓

+ LAYER: ROADWAY FILL

- DESCRIPTION: GRANULAR ROADWAY BASE FOR SECTION B (NO SAMPLING)

FOR SECTION A, 2-3' OF GRANULAR ROADWAY BASE OVER VERY DENSE GRAY / GRAY-BLACK SAND "AND" SILT. *

* LAYER EXTRAPOLATED AS FILL MATERIAL BENEATH RR EMBANKMENT.

N_{60} RANGE: 31 - 105

FROM NAVFAC TABLE 1, $\phi' = 34°$, $C' = 0$, $K = 5 \times 10^{-5}$ cm/sec
FOR SILTY SANDS
(SEE TABLE THIS APPENDIX)

BBCM SOLUTIONS TO BUILD ON

DRAINED SHEAR STRENGTH PARAMETER CORRELATION

Project No: 011-11497-014 Date: 5/29/09
Project: Gavin Plant Bottom Ash Pond Investigation

Reference:
Drained Shear Strength Parameters for Analysis of Landslides. Timothy D. Stark; Hangseok Choi; and Sean McCone. Journal of Geotechnical Engineering, May 2005. pp 575 - 588

Purpose:
Estimate effective stress, or drained, shear strength parameters of cohesive soils through emperical correlations using laboratory index testing and the effective normal stress. Secant residual and secant fully softened friction angles can be estimated from charts developed by Stark et al.

Laboratory Data

Soil Layer: Embankment Fill

Statistical Results from 4 Borings

	PI	LL	MC	% Passing #200 Sieve (.075 mm)	Clay Sized Fraction (.002 mm)
Number in Statistical Sample	22	22	27	9	11
Minimum	12	30	16	86	22
Maximum	28	53	23	95	37
Mean	20.2	41.4	20.2	90.8	30.3
Median	20	41	20	91	31
Mode	20	41	20	89	32
Std Dev	4.1	6.1	1.9	3.0	4.1
Design Value	*20*	41	-	-	32

Adjustment Factor for ASTM Derived Values

$$\frac{\textit{ball-milled derived LL}}{\textit{ASTM derived LL}} = .003\,(\text{ASTM derived LL}) + 1.23$$

LL_{ASTM} = 41
LL_{BM} = 55.5

$$\frac{\textit{ball-milled derived CF}}{\textit{ASTM derived CF}} = 0.0003\,(\text{ASTM derived CF})2 - 0.037(\text{ASTM derived CF}) + 2.254$$

CF_{ASTM} = 32
CF_{BM} = 44.1

where: LL = Liquid Limit
CF = Clay-sized Fraction

Soil Layer: Embankment Fill

LL_{BM} = 55.5

CF_{BM} = 44.1

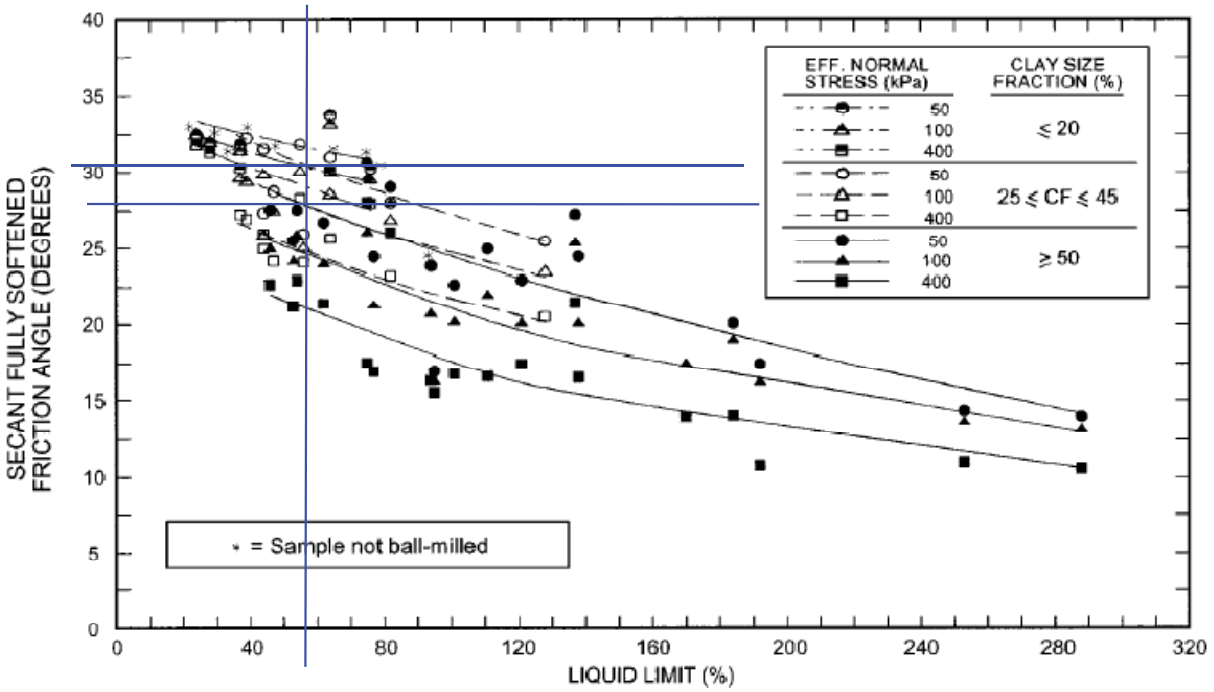


Fig. 5. Secant fully softened friction angle relationships with liquid limit, clay-size fraction, and effective normal stress

Secant Fully Softened Friction Angle

Clay Sized Fraction, %	Effective Normal Stress	*50 kPa*	*100 kPa*
	24 ≤ CF ≤ 45	31°	28°
	≥ 50	-	-

Design Friction Angle Value	29°

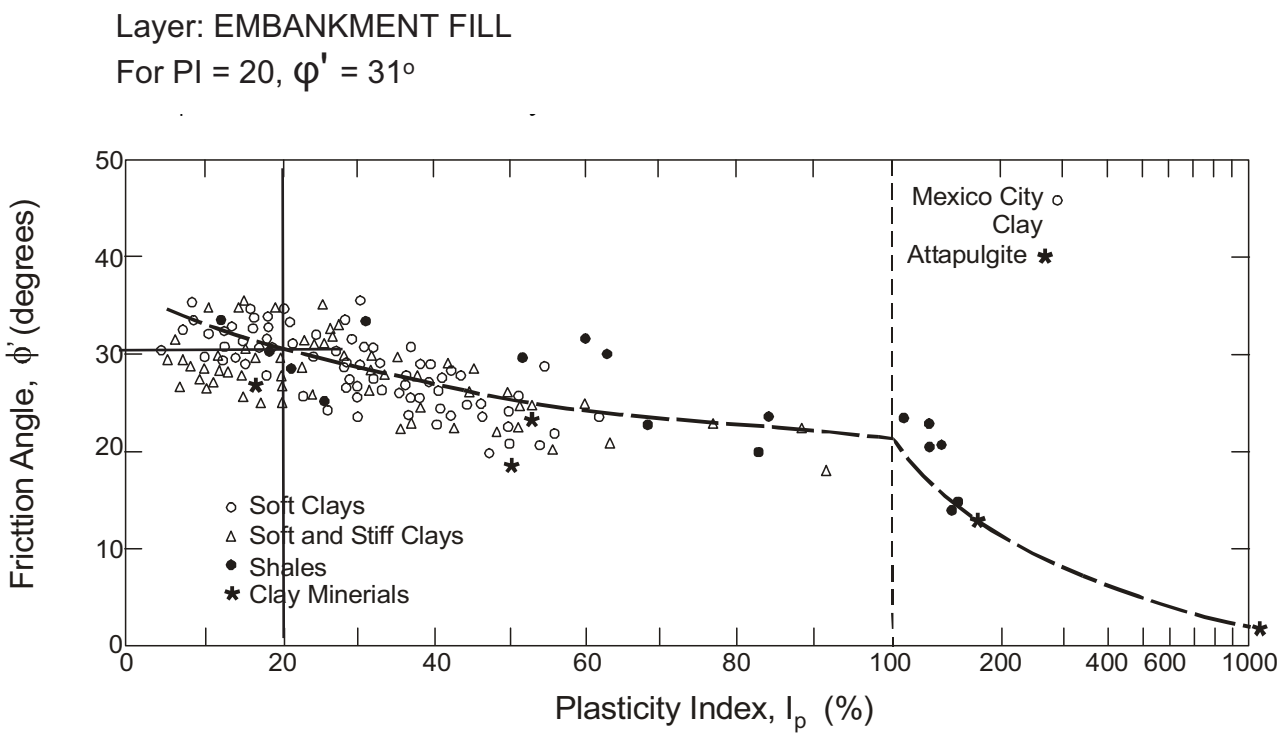


Figure 74. Relationship between ϕ′ and PI (Terzaghi, Peck, and Mesri, 1996).

BBCM SOLUTIONS TO BUILD ON

DRAINED SHEAR STRENGTH PARAMETER CORRELATION

Project No: 011-11497-014 Date: 5/29/09
Project: Gavin Plant Bottom Ash Pond Investigation

Reference:
Drained Shear Strength Parameters for Analysis of Landslides. Timothy D. Stark; Hangseok Choi; and Sean McCone. Journal of Geotechnical Engineering, May 2005. pp 575 - 588

Purpose:
Estimate effective stress, or drained, shear strength parameters of cohesive soils through emperical correlations using laboratory index testing and the effective normal stress. Secant residual and secant fully softened friction angles can be estimated from charts developed by Stark et al.

Laboratory Data

Soil Layer: Alluvium Silt and Clay

Statistical Results from 7 Borings

	PI	LL	MC	% Passing #200 Sieve (.075 mm)	Clay Sized Fraction (.002 mm)
Number in Statistical Sample	31	31	33	17	12
Minimum	5	21	15	57	15
Maximum	31	53	30	97	34
Mean	14.7	34.6	23.2	79	24.1
Median	14	33	24	77	22
Mode	13	32	18	-	22
Std Dev	6.0	7.4	4.2	12.6	6.5
Design Value	*13*	32	-	-	22

Adjustment Factor for ASTM Derived Values

$$\frac{\textit{ball-milled derived LL}}{\textit{ASTM derived LL}} = .003\,(\text{ASTM derived LL}) + 1.23$$

LL_{ASTM} = 32
LL_{BM} = 42.4

$$\frac{\textit{ball-milled derived CF}}{\textit{ASTM derived CF}} = 0.0003\,(\text{ASTM derived CF})2 - 0.037(\text{ASTM derived CF}) + 2.254$$

CF_{ASTM} = 22
CF_{BM} = 34.9

where: LL = Liquid Limit
CF = Clay-sized Fraction

Soil Layer: Alluvium Silt and Clay

LL_{BM} = 42.4

CF_{BM} = 34.9

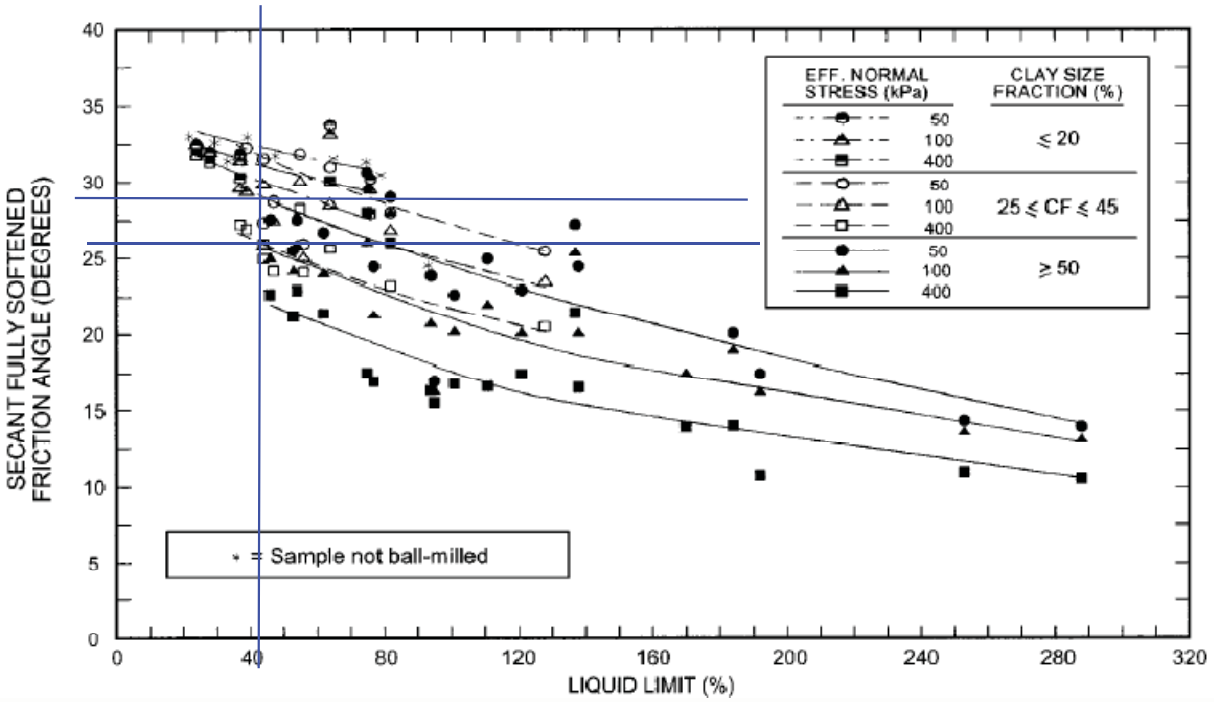


Fig. 5. Secant fully softened friction angle relationships with liquid limit, clay-size fraction, and effective normal stress

Secant Fully Softened Friction Angle

Clay Sized Fraction, %	Effective Normal Stress		
		100 kPa	*400 kPa*
	24 ≤ CF ≤ 45	29°	26°
	≥ 50	-	-
Design Value			28°

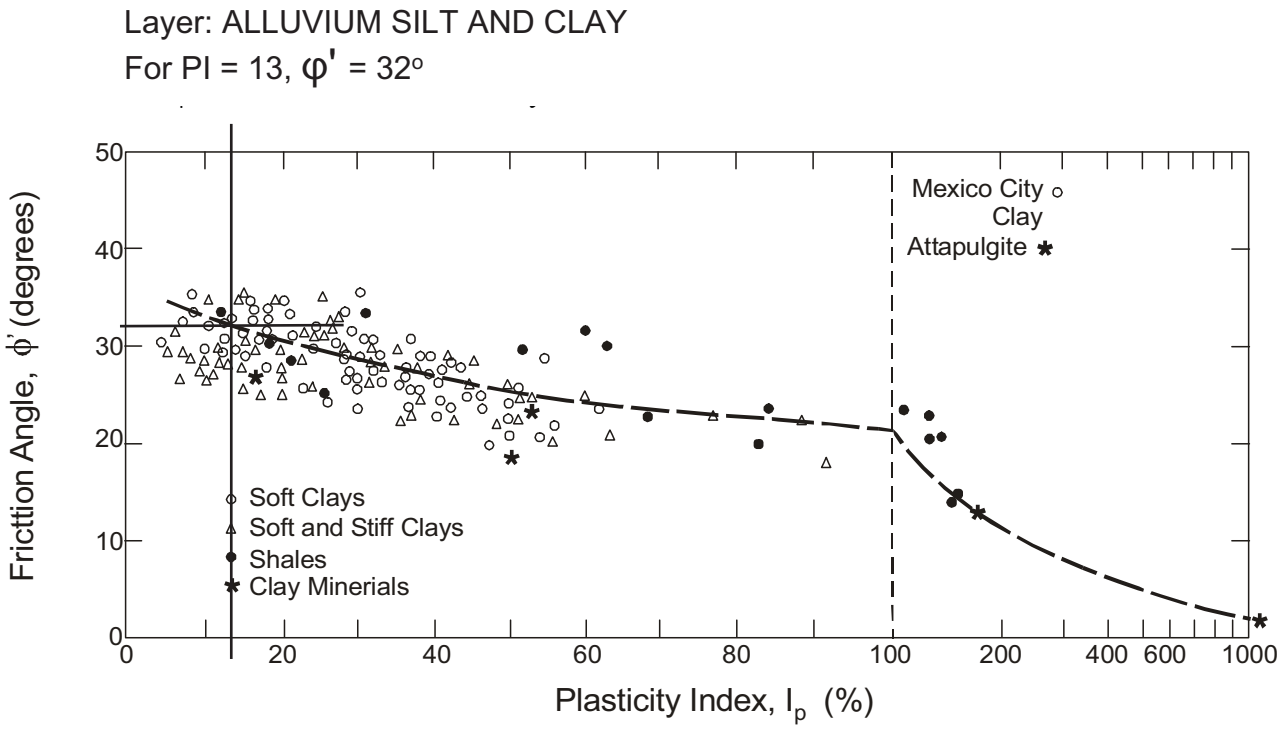


Figure 74. Relationship between ϕ′ and PI (Terzaghi, Peck, and Mesri, 1996).

TABLE 1
Typical Properties of Compacted Soils

Group Symbol	Soil Type	Range of Maximum Dry Unit Weight, pcf	Range of Optimum Moisture, Percent	Typical Value of Compression		Typical Strength Characteristics				Typical Coefficient of Permeability ft./min.	Range of CBR Values	Range of Subgrade Modulus k lbs/cu in.
				At 1.4 tsf (20 psi)	At 3.6 tsf (50 psi)	Cohesion (as compacted) psf	Cohesion (saturated) psf	ϕ (Effective Stress Envelope Degrees)	Tan ϕ			
				Percent of Original Height								
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	.....	.....	>34	>0.67	$>10^{-8}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	.....	.....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	$5 \times >10^{-5}$	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	$2 \times >10^{-6}$	5 - 30	100 - 300
SC	Clayey sands, poorly graded sand-clay-mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	$5 \times >10^{-7}$	5 - 20	100 - 300
ML	Inorganic silts and clayey silts.	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	$>10^{-5}$	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay.	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	$5 \times >10^{-7}$	.....	
CL	Inorganic clays of low to medium plasticity.	95 - 120	24 - 12	1.3	2.5	1800	270	28	0.54	$>10^{-7}$	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	$5 \times >10^{-7}$	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	$>10^{-7}$	15 or less	50 - 150
OH	Organic clays and silty clays	65 - 100	43 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	25 - 100

Roadway Fill

Embankment Fill

Notes:

1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical strength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
   (..) indicates insufficient data available for an estimate.

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Seismic parameters obtained August, 2026

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 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

39.951971

Time Horizon

Return period in years

2475

Longitude

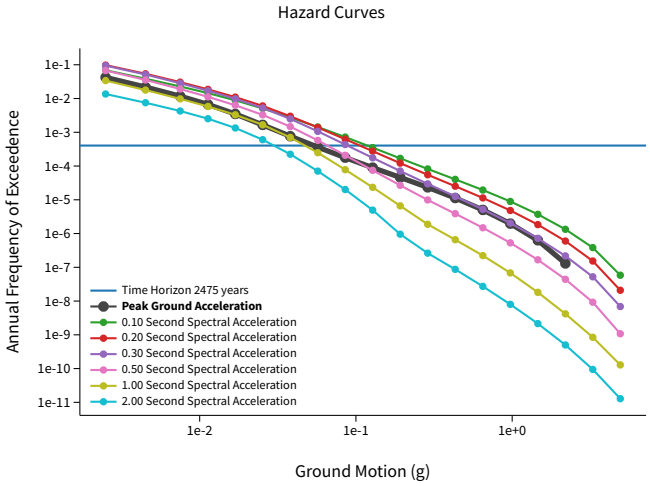
Decimal degrees, negative values for western longitudes

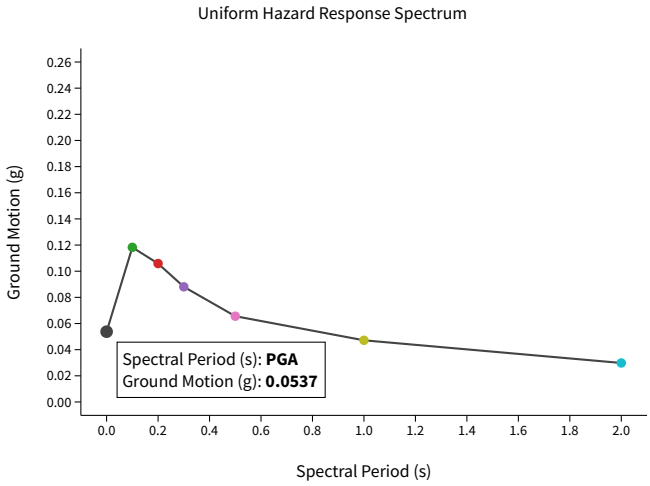
-82.585655

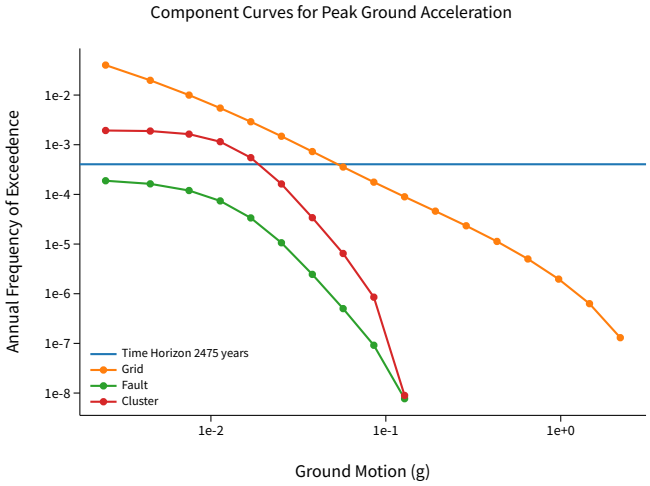
Site Class

760 m/s (B/C boundary)

Hazard Curve





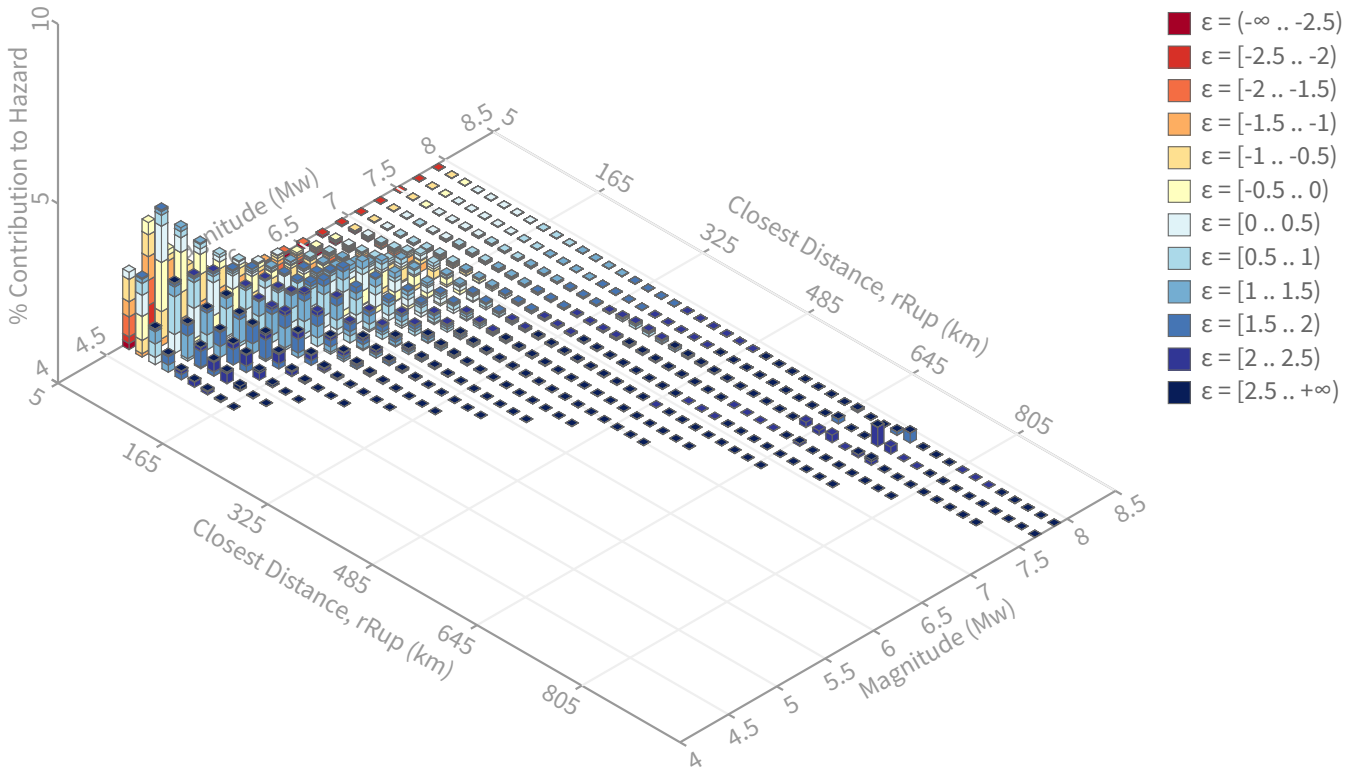


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.053746492 g

Recovered targets

Return period: 2481.5408 yrs
Exceedance rate: 0.00040297545 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 2.32 %

Mean (over all sources)

m: 5.77
r: 110.96 km
ε_0: 0.22 σ

Mode (largest m-r bin)

m: 4.9
r: 30.54 km
ε_0: -0.13 σ
Contribution: 3.78 %

Mode (largest m-r-ε_0 bin)

m: 4.89
r: 30.31 km
ε_0: -0.24 σ
Contribution: 1.37 %

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							26.93
PointSourceFinite: -82.586, 40.109		18.01	5.16	-1.45	82.586°W	40.109°N	360.00	2.16
PointSourceFinite: -82.586, 40.199		27.65	5.23	-0.72	82.586°W	40.199°N	360.00	1.66
PointSourceFinite: -82.586, 40.289		37.39	5.31	-0.28	82.586°W	40.289°N	360.00	1.51
PointSourceFinite: -82.586, 40.424		52.01	5.44	0.16	82.586°W	40.424°N	360.00	1.18
PointSourceFinite: -82.586, 40.334		42.27	5.35	-0.11	82.586°W	40.334°N	360.00	1.08
PointSourceFinite: -82.586, 41.144		130.08	5.97	0.79	82.586°W	41.144°N	360.00	1.05
USGS Adaptive Smoothing Zone 1 (opt)	Grid							26.80
PointSourceFinite: -82.586, 40.109		18.01	5.16	-1.45	82.586°W	40.109°N	360.00	2.16
PointSourceFinite: -82.586, 40.199		27.65	5.23	-0.72	82.586°W	40.199°N	360.00	1.66
PointSourceFinite: -82.586, 40.289		37.39	5.31	-0.28	82.586°W	40.289°N	360.00	1.51
PointSourceFinite: -82.586, 40.424		52.01	5.44	0.16	82.586°W	40.424°N	360.00	1.18
PointSourceFinite: -82.586, 40.334		42.27	5.35	-0.11	82.586°W	40.334°N	360.00	1.08
PointSourceFinite: -82.586, 41.144		130.08	5.97	0.79	82.586°W	41.144°N	360.00	1.04
SSCn Fixed Smoothing Zone 1 (opt)	Grid							17.80
PointSourceFinite: -82.586, 40.109		18.01	5.16	-1.45	82.586°W	40.109°N	360.00	1.20
USGS Fixed Smoothing Zone 1 (opt)	Grid							17.70
PointSourceFinite: -82.586, 40.109		18.01	5.16	-1.45	82.586°W	40.109°N	360.00	1.20
USGS Fixed Smoothing Zone 2 (opt)	Grid							2.37
SSCn Fixed Smoothing Zone 7 (opt)	Grid							2.02
USGS Adaptive Smoothing Zone 2 (opt)	Grid							1.67
SSCn Adaptive Smoothing Zone 7 (opt)	Grid							1.41
SSCn New Madrid	Cluster							1.25

Seismic Site Classification (EPA, 1995)

Project: Gavin BAP
Location: Cheshire - Gallia Co, OH
Proj. No.: 26170100
Date: 8/26/2026

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

Note: This site class determination considers soils below bottom of embankment. If boring terminated prior to 100ft depth below bottom of embankment, the lowest layer encountered is assumed to extend to top of bedrock (approx. 60ft below surrounding ground surface) underlain by bedrock (N=100) extending to 100ft below surrounding ground surface.

GV-PZ-BAP-0901				GV-PZ-BAP-0902				GV-PZ-BAP-0903				GV-PZ-BAP-0904				GV-PZ-BAP-0905			
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
31.0	33.5	33	*0.08*	8.5	11.0	22	*0.11*	38.5	41.0	27	*0.09*	2.5	4.0	18	*0.08*	30.5	33.0	15	*0.17*
33.5	36.0	33	*0.08*	11.0	13.5	21	*0.12*	41.0	43.5	21	*0.12*	4.0	5.5	11	*0.14*	33.0	35.5	14	*0.18*
36.0	38.5	21	*0.12*	13.5	16.0	15	*0.17*	43.5	46.0	21	*0.12*	5.5	7.0	14	*0.11*	35.5	38.0	8	*0.31*
38.5	41.0	19	*0.13*	16.0	18.5	16	*0.16*	46.0	48.0	18	*0.11*	7.0	11.0	7	*0.57*	38.0	41.0	12	*0.25*
41.0	43.5	15	*0.17*	18.5	20.5	16	*0.13*	48.0	50.5	12	*0.21*	11.0	13.5	15	*0.17*	41.0	43.5	16	*0.16*
43.5	46.0	11	*0.23*	20.5	23.5	10	*0.30*	50.5	53.5	8	*0.38*	13.5	16.0	10	*0.25*	43.5	46.0	10	*0.25*
46.0	48.5	7	*0.36*	23.5	26.0	10	*0.25*	53.5	55.5	7	*0.29*	16.0	18.5	2	*1.25*	46.0	48.5	8	*0.31*
48.5	51.0	8	*0.31*	26.0	28.5	8	*0.31*	55.5	58.5	7	*0.43*	18.5	21.0	1	*2.50*	48.5	50.5	7	*0.29*
51.0	53.5	12	*0.21*	28.5	31.0	7	*0.36*	58.5	60.5	11	*0.18*	21.0	23.5	5	*0.50*	50.5	53.5	4	*0.75*
53.5	56.0	29	*0.09*	31.0	33.5	19	*0.13*	60.5	63.0	15	*0.17*	23.5	25.0	5	*0.30*	53.5	56.0	3	*0.83*
56.0	58.5	36	*0.07*	33.5	36.0	18	*0.14*	63.0	98.5	14	*2.54*	25.0	28.5	2	*1.75*	56.0	58.5	5	*0.50*
58.5	65.0	46	*0.14*	36.0	38.5	18	*0.14*	98.5	138.5	100	*0.40*	28.5	31.0	5	*0.50*	58.5	61.0	5	*0.50*
65.0	91.0	50	*0.52*	38.5	68.5	23	*1.30*					31.0	33.5	19	*0.13*	61.0	63.0	11	*0.18*
91.0	131.0	100	*0.40*	68.5	108.5	100	*0.40*					33.5	36.5	15	*0.20*	63.0	90.5	11	*2.50*
												36.5	38.5	22	*0.09*	90.5	130.5	100	*0.40*
												38.5	62.5	22	*1.09*				
												62.5	102.5	100	*0.40*				
Avg. N =			*35*	Avg. N =			*25*	Avg. N =			*20*	Avg. N =			*10*	Avg. N =			*13*

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

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

Consider average shear wave velocity of **<600 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)

Site classifies as "**Soft**".

Seismic Site Classification (EPA, 1995)

Project: Gavin BAP
Location: Cheshire - Gallia Co, OH
Proj. No.: 26170100
Date: 8/26/2026

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

Note: This site class determination considers soils below bottom of embankment. If boring terminated prior to 100ft depth below bottom of embankment, the lowest layer encountered is assumed to extend to top of bedrock (approx. 60ft below surrounding ground surface) underlain by bedrock (N=100) extending to 100ft below surrounding ground surface.

GV-PZ-BAP-0906				GV-PZ-BAP-0907				GV-PZ-BAP-0908				GV-PZ-BAP-0909				GV-PZ-BAP-0910			
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
0.0	2.5	7	*0.36*	35.5	38.5	23	*0.13*	25.0	29.0	21	*0.19*	0.0	4.0	11	*0.36*	0.0	2.5	31	*0.08*
2.5	4.0	10	*0.15*	38.5	41.0	19	*0.13*	29.0	31.0	10	*0.20*	4.0	5.5	11	*0.14*	2.5	4.0	16	*0.09*
4.0	5.5	8	*0.19*	41.0	43.5	10	*0.25*	31.0	32.5	23	*0.07*	5.5	7.0	7	*0.21*	4.0	8.0	13	*0.31*
5.5	7.0	12	*0.13*	43.5	46.0	23	*0.11*	32.5	34.0	20	*0.08*	7.0	11.0	7	*0.57*	8.0	12.0	14	*0.29*
7.0	8.5	14	*0.11*	46.0	48.5	16	*0.16*	34.0	35.5	18	*0.08*	11.0	12.5	11	*0.14*	12.0	13.5	10	*0.15*
8.5	11.0	16	*0.16*	48.5	51.0	15	*0.17*	35.5	37.0	17	*0.09*	12.5	14.0	10	*0.15*	13.5	15.0	9	*0.17*
11.0	13.0	8	*0.25*	51.0	53.0	8	*0.25*	37.0	38.5	14	*0.11*	14.0	18.0	9	*0.44*	15.0	19.0	4	*1.00*
13.0	16.0	4	*0.75*	53.0	56.0	11	*0.27*	38.5	40.0	10	*0.15*	18.0	19.5	1	*1.50*	19.0	20.5	3	*0.50*
16.0	18.5	7	*0.36*	56.0	57.5	4	*0.38*	40.0	41.5	9	*0.17*	19.5	22.5	4	*0.75*	20.5	22.0	3	*0.50*
18.5	21.0	3	*0.83*	57.5	95.5	10	*3.80*	41.5	45.5	11	*0.36*	22.5	25.5	4	*0.75*	22.0	23.5	3	*0.50*
21.0	23.5	1	*2.50*	95.5	135.5	100	*0.40*	45.5	47.0	13	*0.12*	25.5	27.0	1	*1.50*	23.5	26.5	1	*3.00*
23.5	26.0	5	*0.50*					47.0	49.0	28	*0.07*	27.0	28.5	7	*0.21*	26.5	28.0	7	*0.21*
26.0	28.5	7	*0.36*					49.0	51.5	21	*0.12*	28.5	30.0	10	*0.15*	28.0	29.5	3	*0.50*
28.5	30.0	4	*0.38*					51.5	53.5	13	*0.15*	30.0	31.5	1	*1.50*	29.5	31.0	6	*0.25*
30.0	33.5	4	*0.88*					53.5	85.0	14	*2.25*	31.5	33.0	17	*0.09*	31.0	32.5	16	*0.09*
33.5	60.0	5	*5.30*					85.0	125.0	100	*0.40*	33.0	60.0	58	*0.47*	32.5	34.0	18	*0.08*
60.0	100.0	100	*0.40*									60.0	100.0	100	*0.40*	34.0	60.0	21	*1.24*
																60.0	100.0	100	*0.40*
Avg. N =			*7*	Avg. N =			*17*	Avg. N =			*22*	Avg. N =			*11*	Avg. N =			*11*

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

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

Consider average shear wave velocity of <600 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)

Site classifies as "Soft".

Seismic Site Classification (EPA, 1995)

Project: Gavin BAP
Location: Cheshire - Gallia Co, OH
Proj. No.: 26170100
Date: 8/26/2026

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

Note: This site class determination considers soils below bottom of embankment. If boring terminated prior to 100ft depth below bottom of embankment, the lowest layer encountered is assumed to extend to top of bedrock (approx. 60ft below surrounding ground surface) underlain by bedrock (N=100) extending to 100ft below surrounding ground surface.

GV-PZ-BAP-0911																			
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
0.0	2.5	24	*0.10*	34.5	36.0	11	*0.14*												
2.5	4.0	20	*0.08*	36.0	37.5	10	*0.15*												
4.0	5.5	17	*0.09*	37.5	39.0	14	*0.11*												
5.5	7.0	24	*0.06*	39.0	60.0	26	*0.81*												
7.0	8.5	14	*0.11*	60.0	100.0	100	*0.40*												
8.5	12.5	9	*0.44*																
12.5	14.0	9	*0.17*																
14.0	18.0	9	*0.44*																
18.0	19.5	3	*0.50*																
19.5	21.0	6	*0.25*																
21.0	24.0	4	*0.75*																
24.0	25.5	6	*0.25*																
25.5	27.0	3	*0.50*																
27.0	28.5	4	*0.38*																
28.5	30.0	4	*0.38*																
30.0	31.5	6	*0.25*																
31.5	33.0	3	*0.50*																
33.0	34.5	4	*0.38*																
						Avg. N =	*14*			Avg. N =	####			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.

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

Consider average shear wave velocity of <600 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

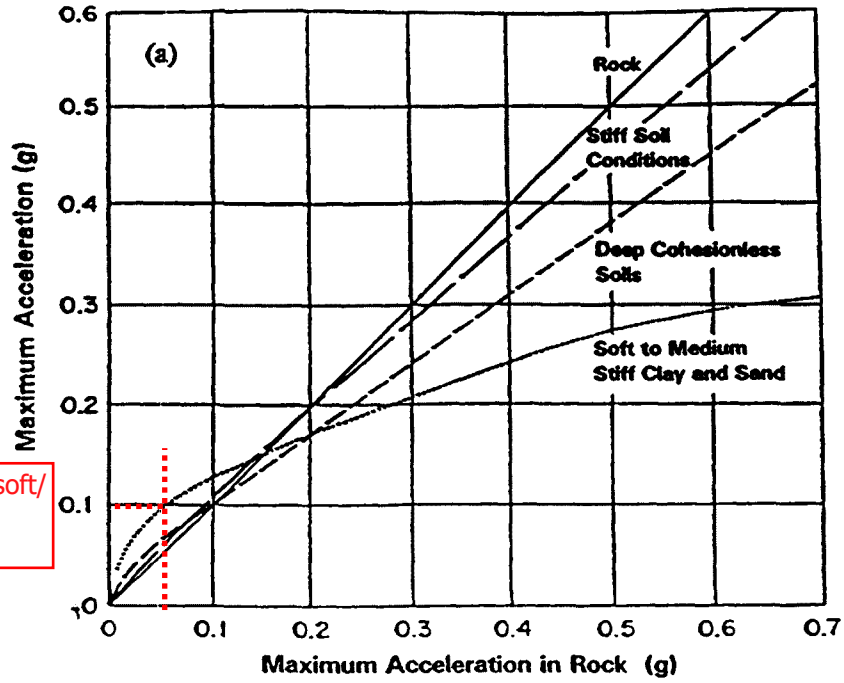
From EPA (1995), Chapter 4, use the average shear wave velocity range to classify the soil.

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)

Site classifies as "Soft".

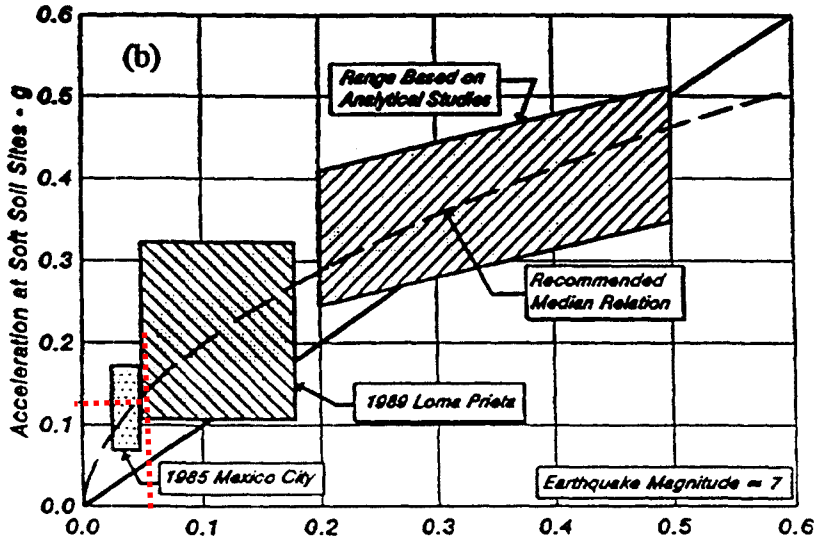
U.S. Environmental Protection Agency. (1995). RCRA Subtitle D (258) seismic design guidance for municipal solid waste landfill facilities (EPA/600/R-95/051).

Based on the Seismic Site Classification generally per ASCE 7-10, consider a "Soft" site classification as defined in EPA/600/R-95/051.



Max acc = 0.10 for soft/ m.stiff to stiff soil conditions

PGA(rock)=0.054g

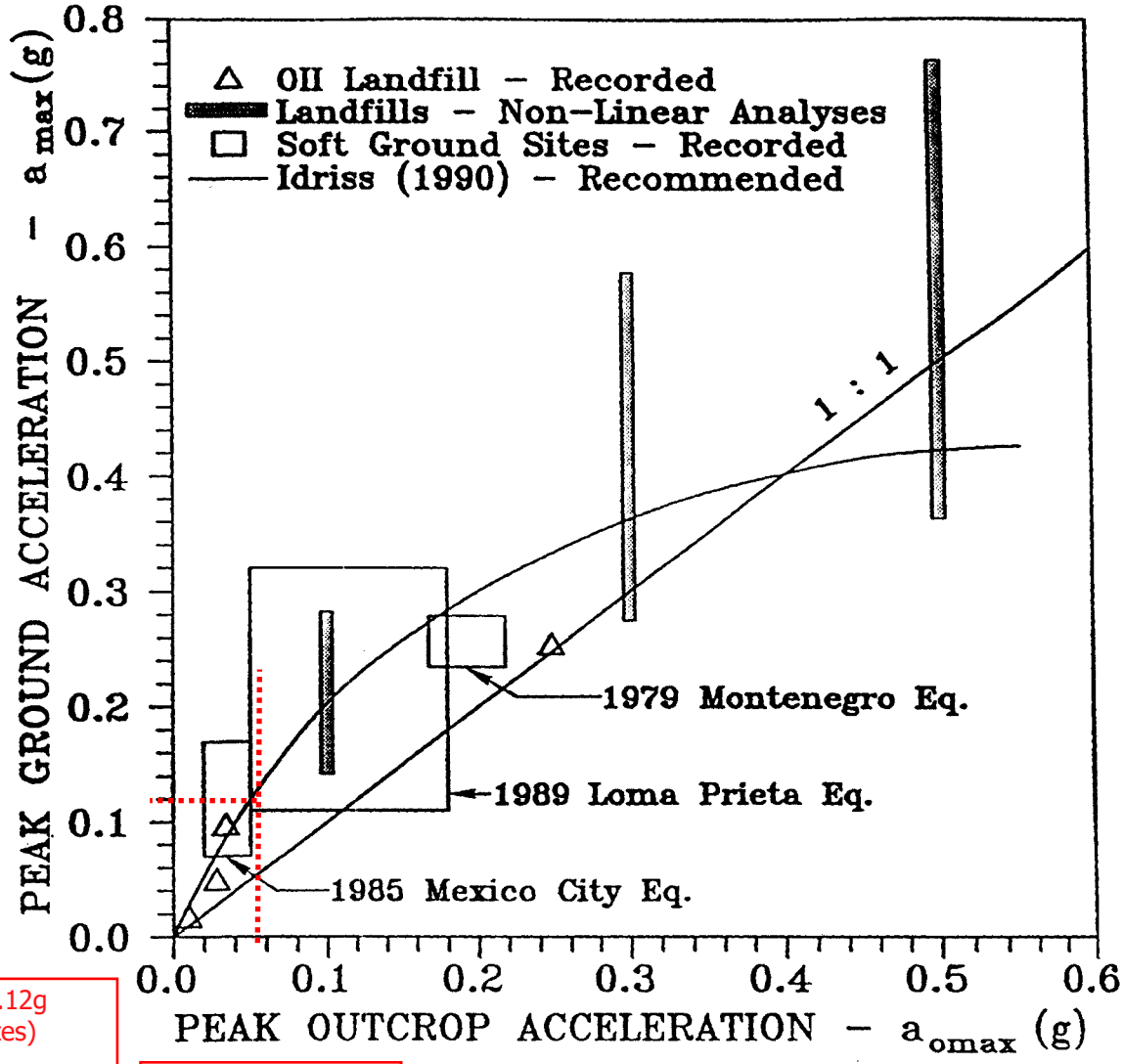


Max acc = 0.12 (avg between rock and soft ground)

PGA(rock)=0.054g

Figure 4.4 Relationship Between Maximum Acceleration on Rock and Other Local Site Conditions: (a) Seed and Idriss (1982); (b) Idriss (1990).

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

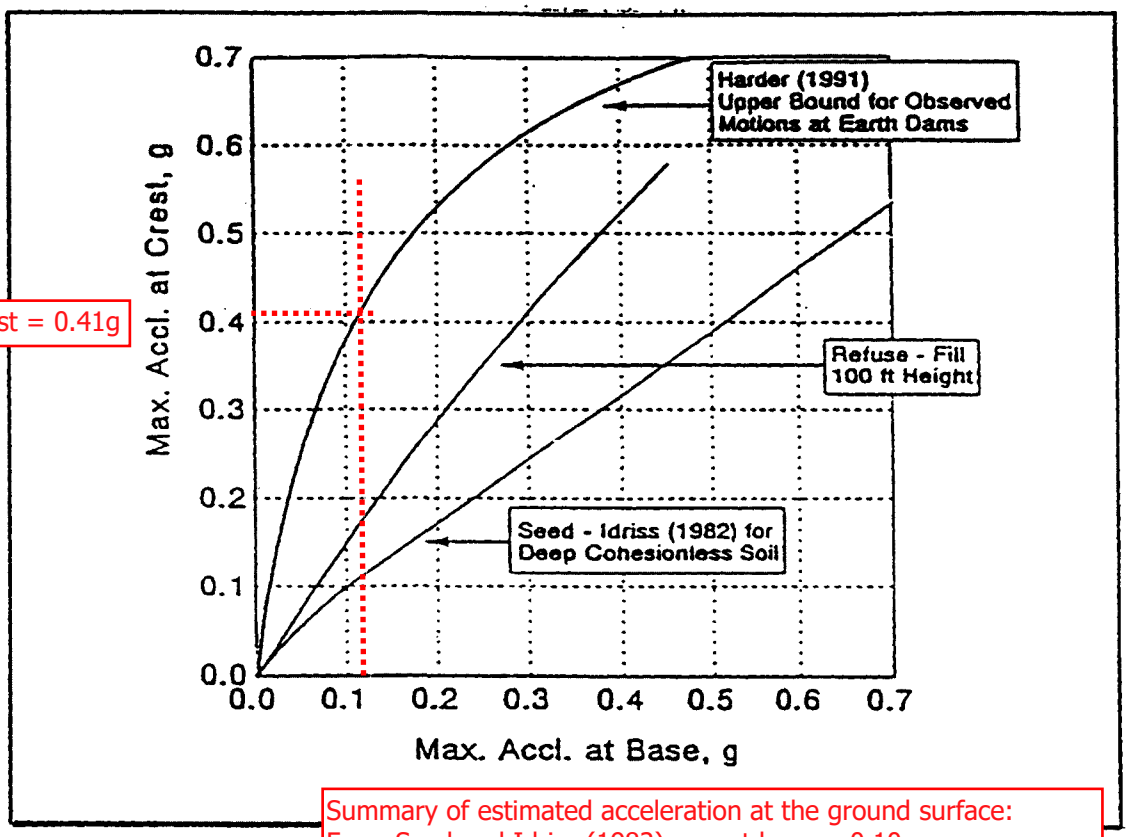


Max acc = 0.12g (deep soil sites)

PGA(rock)=0.054g

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

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



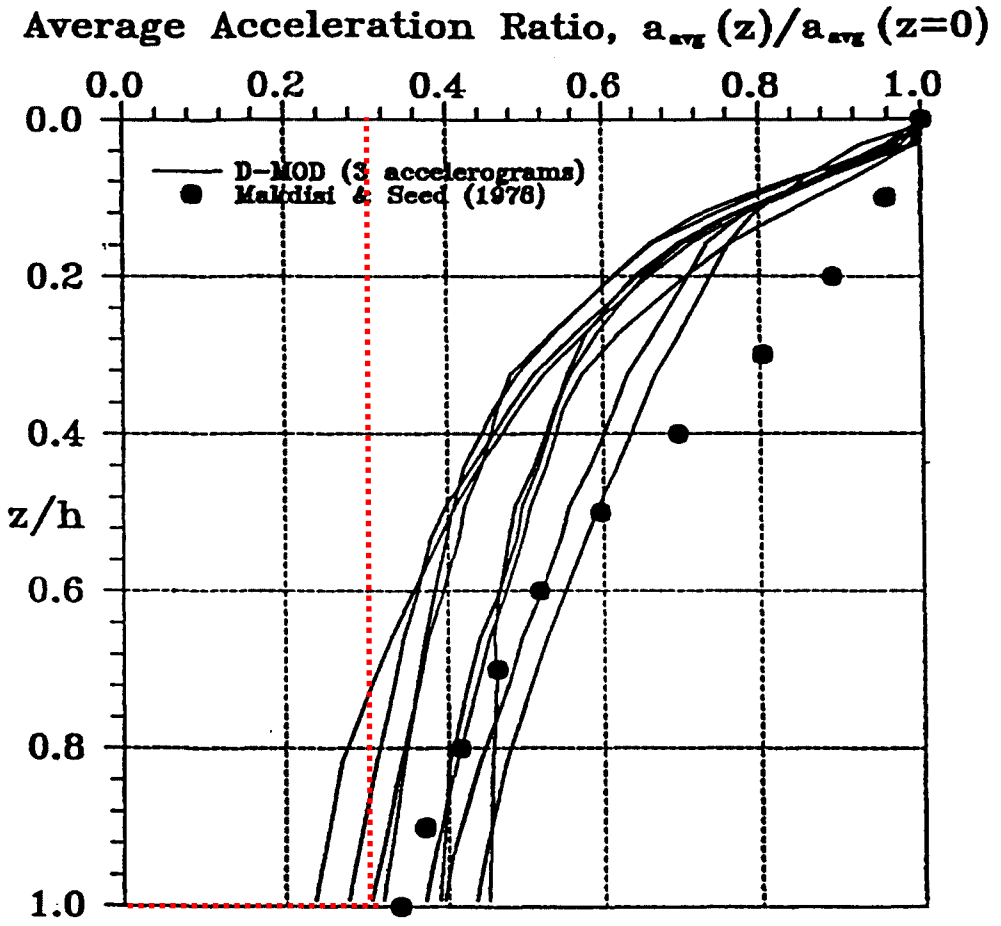
Max acc Crest = 0.41g

Summary of estimated acceleration at the ground surface:
From Seed and Idriss (1982), acc at base = 0.10g.
From Idriss (1990), acc at base = 0.12g.
From Kavazanjian and Matasovic (1994), acc at base = 0.12g.

Use max acc at base = 0.12g.

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 acc. at Crest = 0.41g per Singh and Sun (1995)

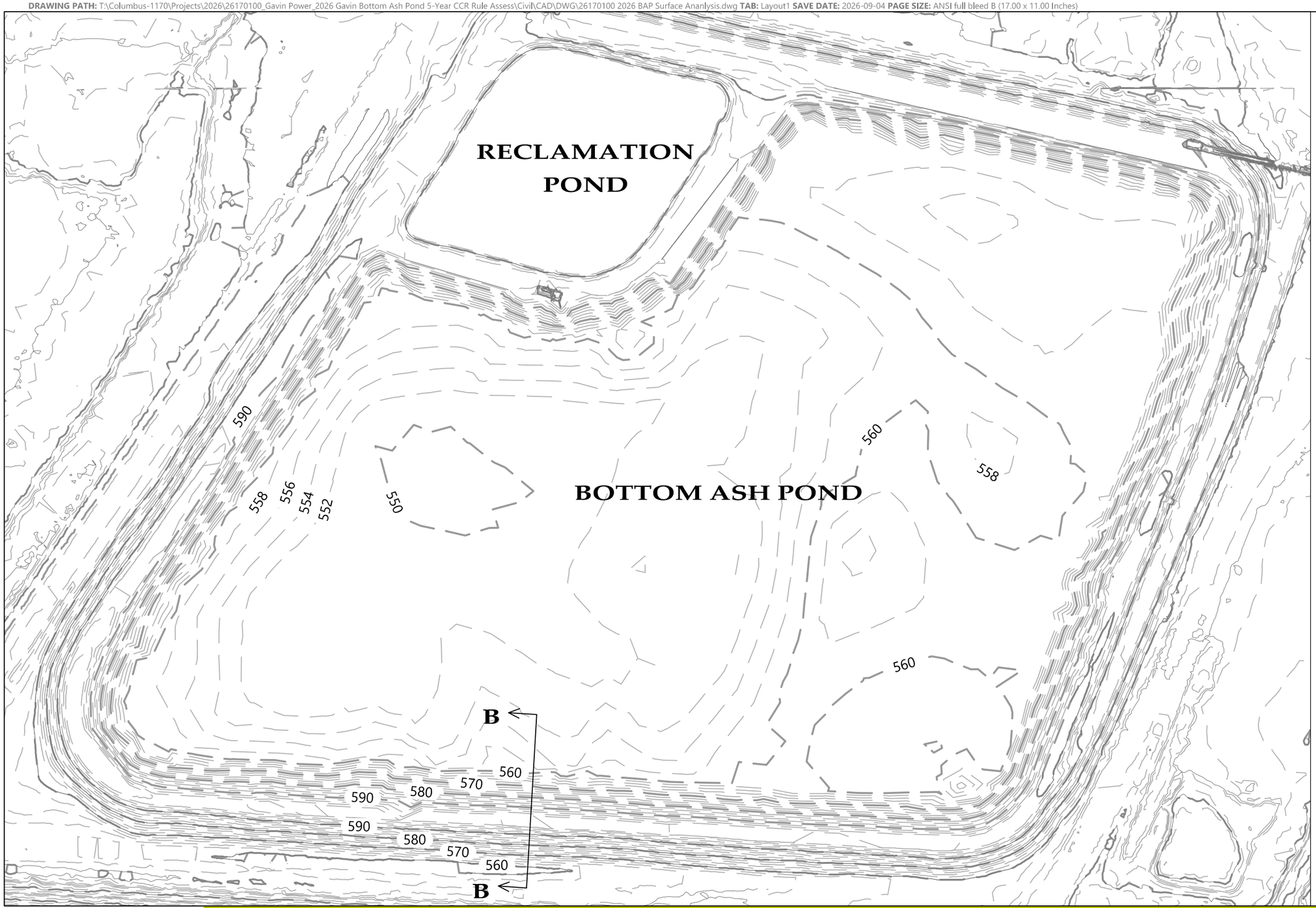
Considering a slip surface extending to the base of the embankment, use z/h = 1.0.
From the Kavazanjian and Matasovic chart with a z/h = 1.0, the average acceleration ratio is 0.3.

peak acceleration at base of embankment is then
0.41 x 0.30 = 0.12g.

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

Appendix IV – Limit Equilibrium & Seismic Analyses

DRAWING PATH: T:\Columbus-1170\Projects\2026\26170100_Gavin Power_2026 Gavin Bottom Ash Pond 5-Year CCR Rule Assess\Civil\CAD\DWG\26170100 2026 BAP Surface Ananlysis.dwg **TAB:** Layout1 **SAVE DATE:** 2026-09-04 **PAGE SIZE:** ANSI full bleed B (17.00 x 11.00 Inches)



N

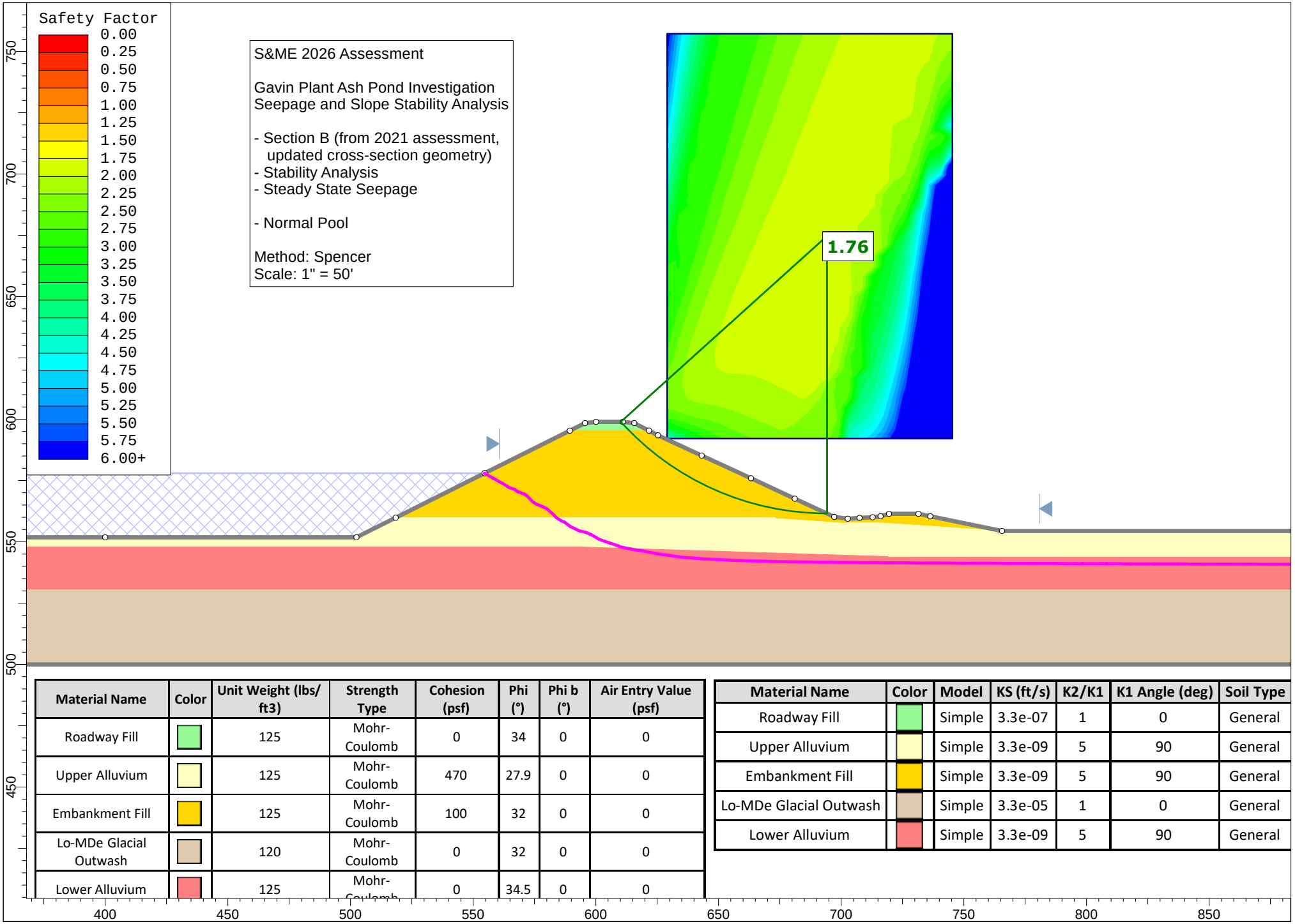
0 100 200

GRAPHIC SCALE (IN FEET)

TOPOGRAPHIC AND BATHYMETRIC SURVEY PERFORMED BY BURNS & MCDONNEL IN 2023, POST REMOVAL OF CCR FROM POND. CONTOURS REFERENCE NAVD88.

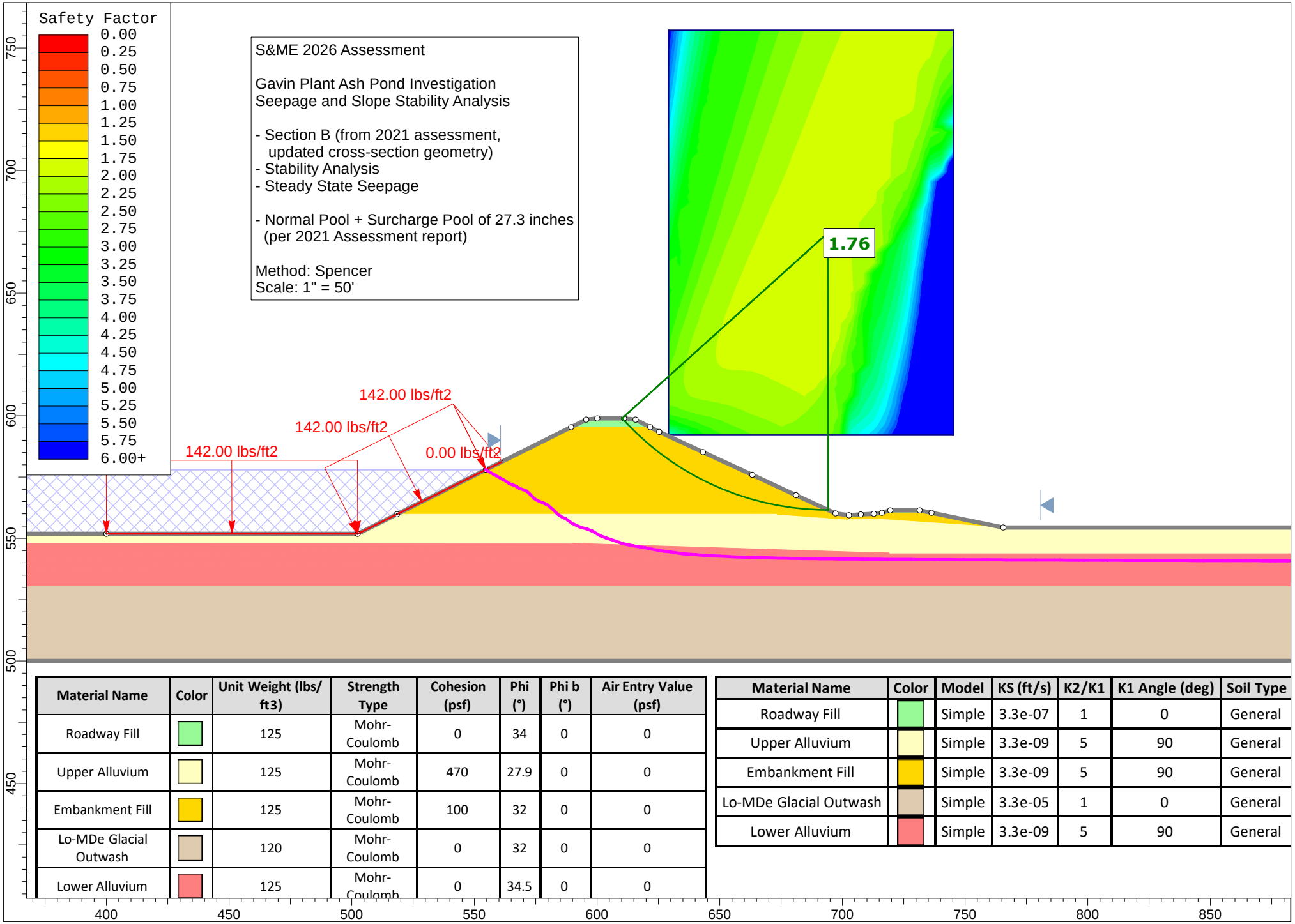
CROSS SECTION LOCATION PLAN

GAVIN PLANT BOTTOM ASH POND
September 4, 2026



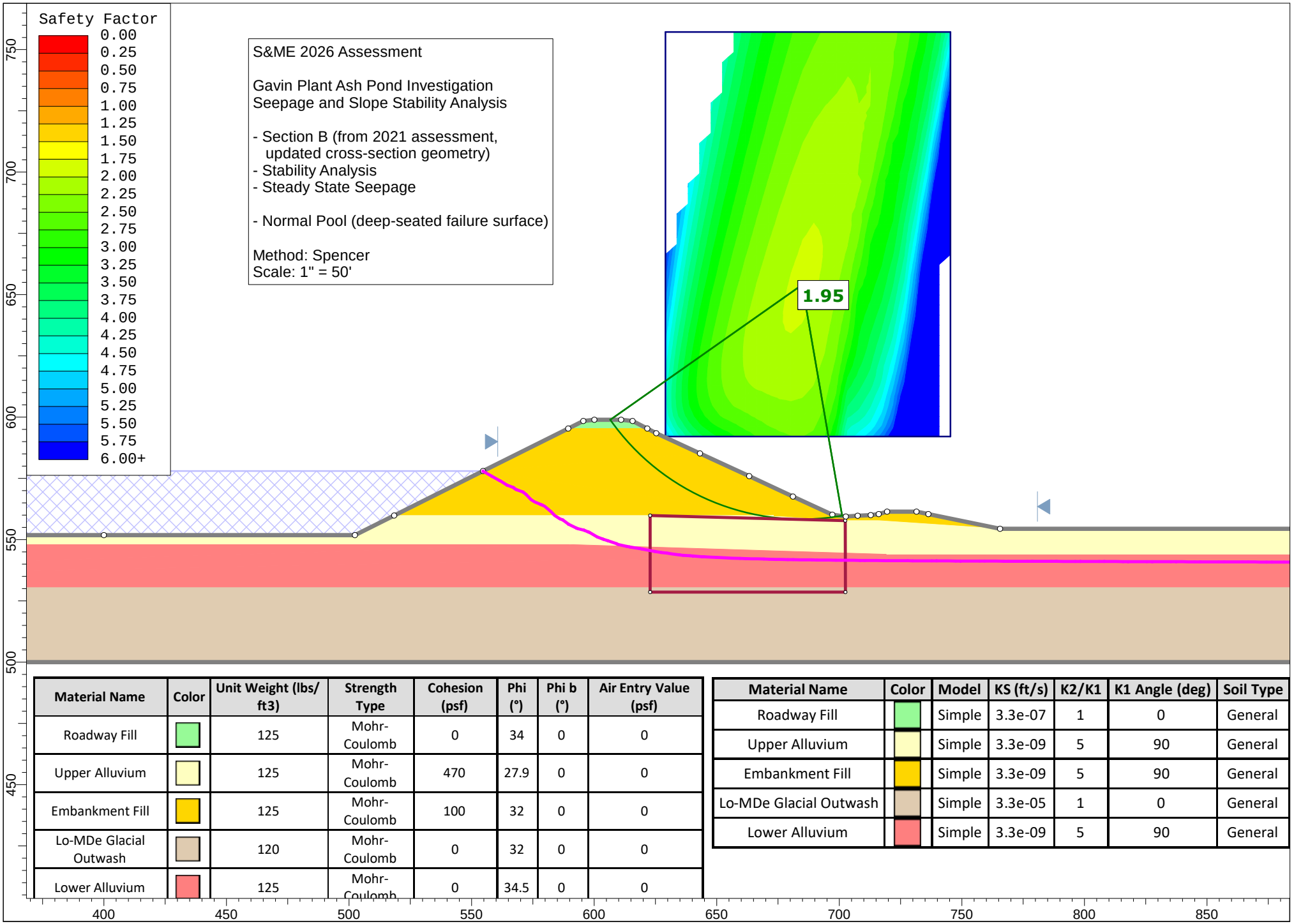
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Phi b (°)	Air Entry Value (psf)
Roadway Fill		125	Mohr-Coulomb	0	34	0	0
Upper Alluvium		125	Mohr-Coulomb	470	27.9	0	0
Embankment Fill		125	Mohr-Coulomb	100	32	0	0
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	0	0
Lower Alluvium		125	Mohr-Coulomb	0	34.5	0	0

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Roadway Fill		Simple	3.3e-07	1	0	General
Upper Alluvium		Simple	3.3e-09	5	90	General
Embankment Fill		Simple	3.3e-09	5	90	General
Lo-MDe Glacial Outwash		Simple	3.3e-05	1	0	General
Lower Alluvium		Simple	3.3e-09	5	90	General



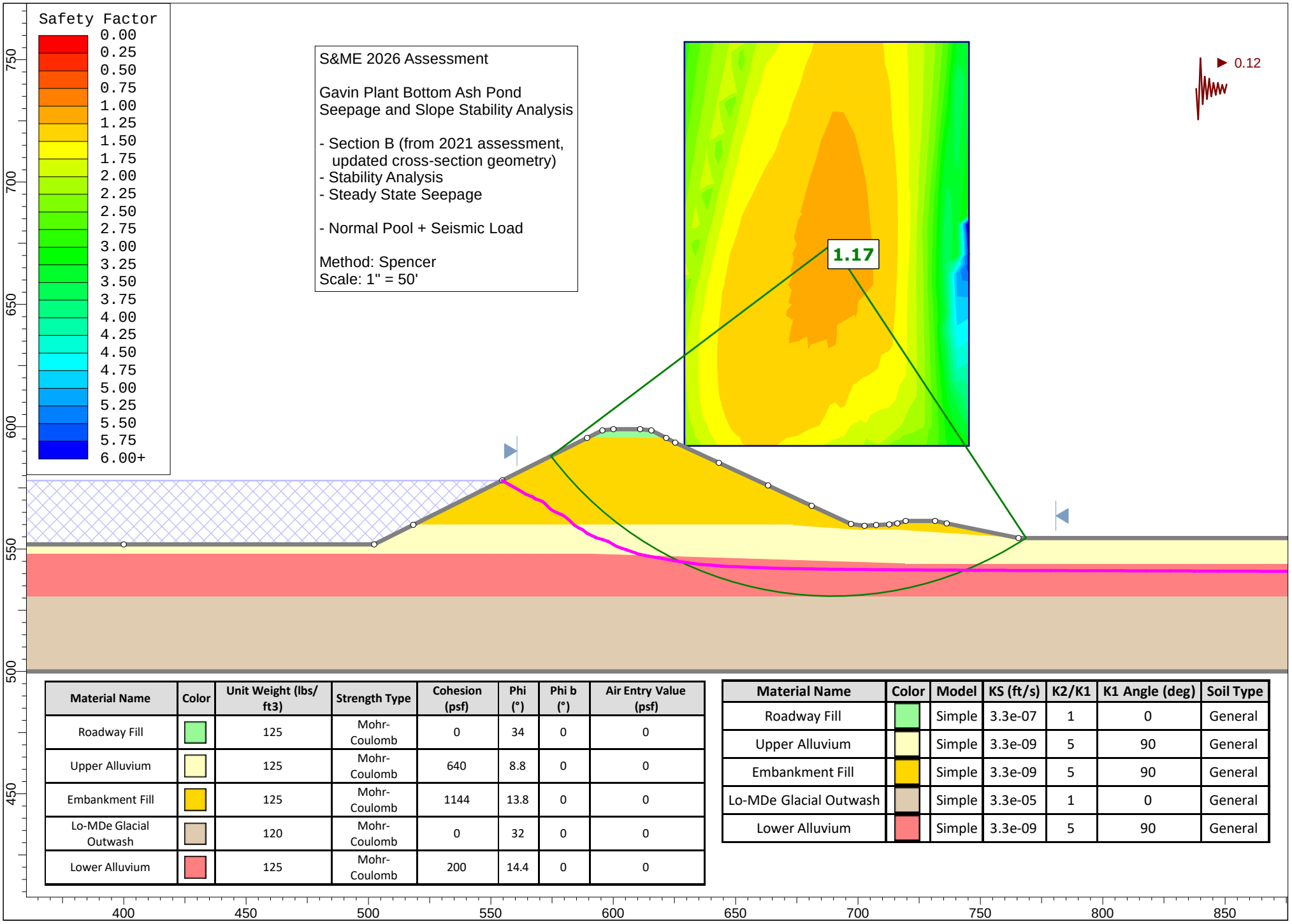
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Phi b (°)	Air Entry Value (psf)
Roadway Fill		125	Mohr-Coulomb	0	34	0	0
Upper Alluvium		125	Mohr-Coulomb	470	27.9	0	0
Embankment Fill		125	Mohr-Coulomb	100	32	0	0
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	0	0
Lower Alluvium		125	Mohr-Coulomb	0	34.5	0	0

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Roadway Fill		Simple	3.3e-07	1	0	General
Upper Alluvium		Simple	3.3e-09	5	90	General
Embankment Fill		Simple	3.3e-09	5	90	General
Lo-MDe Glacial Outwash		Simple	3.3e-05	1	0	General
Lower Alluvium		Simple	3.3e-09	5	90	General



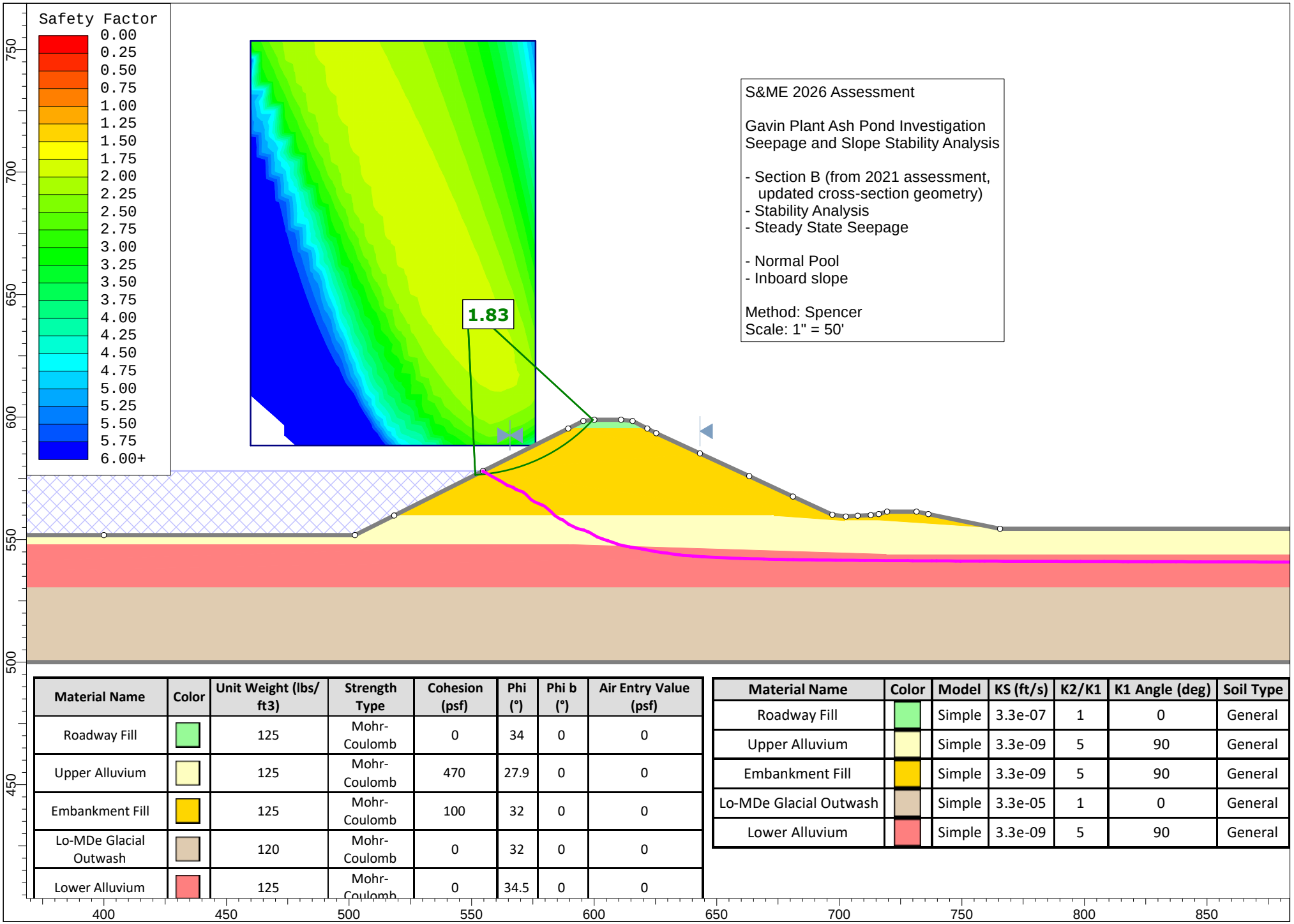
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Phi b (°)	Air Entry Value (psf)
Roadway Fill		125	Mohr-Coulomb	0	34	0	0
Upper Alluvium		125	Mohr-Coulomb	470	27.9	0	0
Embankment Fill		125	Mohr-Coulomb	100	32	0	0
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	0	0
Lower Alluvium		125	Mohr-Coulomb	0	34.5	0	0

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Roadway Fill		Simple	3.3e-07	1	0	General
Upper Alluvium		Simple	3.3e-09	5	90	General
Embankment Fill		Simple	3.3e-09	5	90	General
Lo-MDe Glacial Outwash		Simple	3.3e-05	1	0	General
Lower Alluvium		Simple	3.3e-09	5	90	General



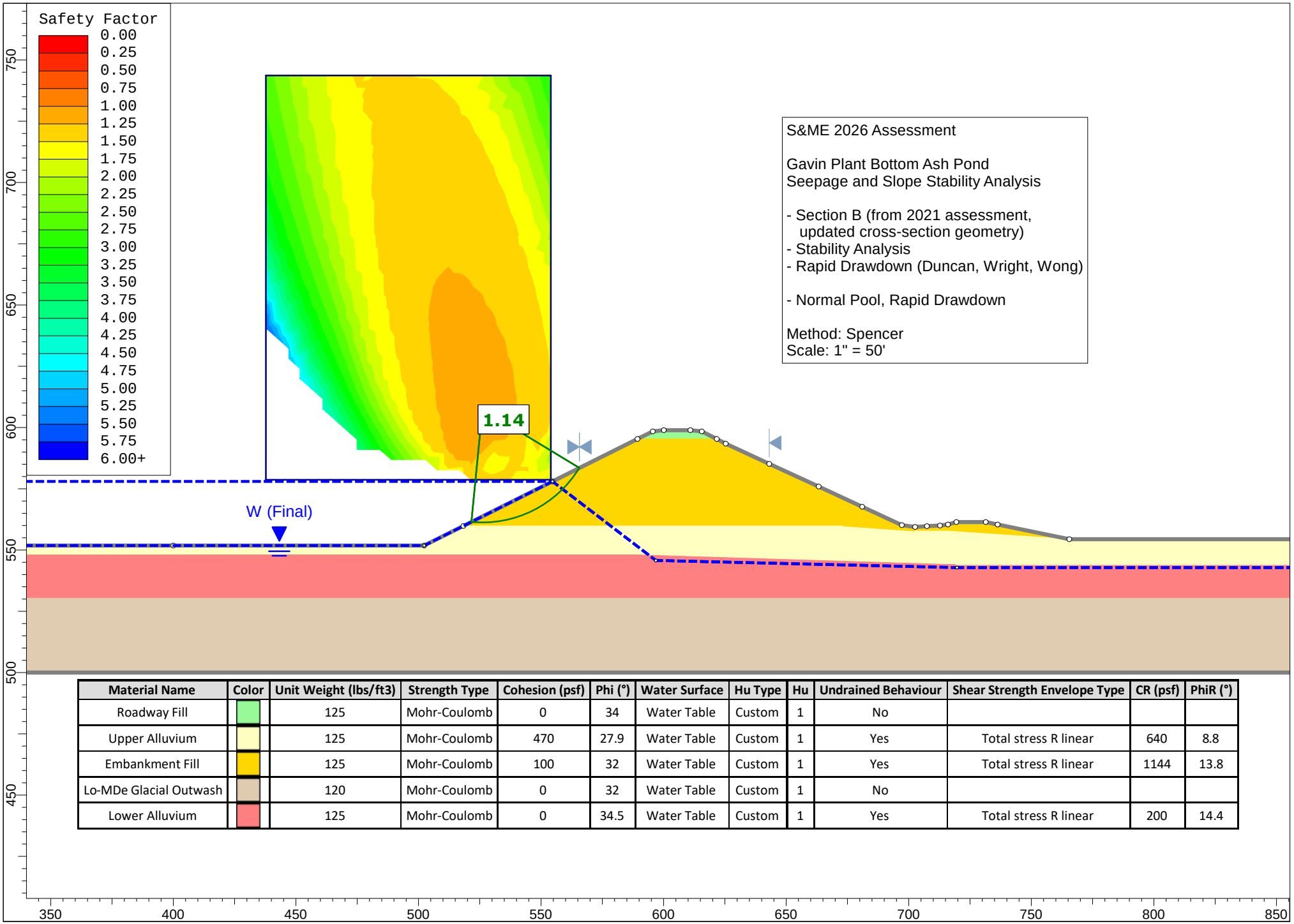
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Phi b (°)	Air Entry Value (psf)
Roadway Fill		125	Mohr-Coulomb	0	34	0	0
Upper Alluvium		125	Mohr-Coulomb	640	8.8	0	0
Embankment Fill		125	Mohr-Coulomb	1144	13.8	0	0
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	0	0
Lower Alluvium		125	Mohr-Coulomb	200	14.4	0	0

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Roadway Fill		Simple	3.3e-07	1	0	General
Upper Alluvium		Simple	3.3e-09	5	90	General
Embankment Fill		Simple	3.3e-09	5	90	General
Lo-MDe Glacial Outwash		Simple	3.3e-05	1	0	General
Lower Alluvium		Simple	3.3e-09	5	90	General



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Phi b (°)	Air Entry Value (psf)
Roadway Fill		125	Mohr-Coulomb	0	34	0	0
Upper Alluvium		125	Mohr-Coulomb	470	27.9	0	0
Embankment Fill		125	Mohr-Coulomb	100	32	0	0
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	0	0
Lower Alluvium		125	Mohr-Coulomb	0	34.5	0	0

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Roadway Fill		Simple	3.3e-07	1	0	General
Upper Alluvium		Simple	3.3e-09	5	90	General
Embankment Fill		Simple	3.3e-09	5	90	General
Lo-MDe Glacial Outwash		Simple	3.3e-05	1	0	General
Lower Alluvium		Simple	3.3e-09	5	90	General



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface	Hu Type	Hu	Undrained Behaviour	Shear Strength Envelope Type	CR (psf)	PhiR (°)
Roadway Fill		125	Mohr-Coulomb	0	34	Water Table	Custom	1	No			
Upper Alluvium		125	Mohr-Coulomb	470	27.9	Water Table	Custom	1	Yes	Total stress R linear	640	8.8
Embankment Fill		125	Mohr-Coulomb	100	32	Water Table	Custom	1	Yes	Total stress R linear	1144	13.8
Lo-MDe Glacial Outwash		120	Mohr-Coulomb	0	32	Water Table	Custom	1	No			
Lower Alluvium		125	Mohr-Coulomb	0	34.5	Water Table	Custom	1	Yes	Total stress R linear	200	14.4

Liquefaction Susceptibility Analysis - Fine Grained Soil Screening

References: A. Boulanger & Idriss (2008)
B. Bray & Sancio (2006)

Project Information

Date:	8/26/2026
Site:	Gavin BAP
Location:	Cheshire - Gallia Co, OH
Project No.:	26170100

Boring	Depth (ft)	USCS	w_c (%)	LL (%)	PL (%)	PI (%)	FC (%)	w_c/LL	Screening Criteria			
									PI<7 [A]	FC<50 [A]	w_c/LL>0.85 [B]	Susceptible?
BAP-0901	7.5	CL	20	41	22	19	91.8	0.49	No	No	No	No
BAP-0901	12.75		23	48	23	25		0.48	No		No	No
BAP-0901	17.25	CH	22	53	25	28	93.1	0.42	No	No	No	No
BAP-0901	19.75	CL	21	42	22	20	91.2	0.50	No	No	No	No
BAP-0902	7.75		20	41	20	21		0.49	No		No	No
BAP-0902	11.75		18	35	20	15		0.51	No		No	No
BAP-0903	4.75		23	38	21	17		0.61	No		No	No
BAP-0903	11.25		22	42	21	21		0.52	No		No	No
BAP-0903	15.75	CH	23	52	24	28	93.8	0.44	No	No	No	No
BAP-0903	21.75		21	30	18	12		0.70	No		No	No
BAP-0903	27.75		19	41	22	19		0.46	No		No	No
BAP-0903	34.25	CL	19	44	22	22	88.4	0.43	No		No	No
BAP-0903	41.75	CH	24	53	22	31	92.9	0.45	No		No	No
BAP-0905	4.75		18	38	20	18		0.47	No		No	No
BAP-0905	12.25	CL	20	43	23	20	95.9	0.47	No	No	No	No
BAP-0905	15.25		22	44	24	20		0.50	No		No	No
BAP-0905	21.25	CL	21	40	23	17	89.2	0.53	No	No	No	No
BAP-0905	26.25	CL	18	39	19	20	88.9	0.46	No	No	No	No
BAP-0907	4.75		22	41	21	20		0.54	No		No	No
BAP-0907	9.25		17	34	18	16		0.50	No		No	No
BAP-0907	13.75	CL	18	32	16	16	75.6	0.56	No	No	No	No
BAP-0907	17.75	CL	20	35	20	15	80.6	0.57	No	No	No	No
BAP-0907	26.25		20	41	20	21		0.49	No		No	No
BAP-0907	34.25	CH	19	52	24	28	88.3	0.37	No	No	No	No
BAP-0908	10.25	CL	20	37	21	16	84.6	0.54	No	No	No	No
BAP-0908	14.25	CL	19	34	19	15	84.4	0.56	No	No	No	No