CTL Engineering, Inc.
2860 Fisher Road, P.O. Box 44548, Columbus, Ohio 43204-3538
Phone: 614/276-8123; Fax: 614/276-6377
Email: ctl@ctleng.com

AN EMPLOYEE OWNED COMPANY

Consulting Engineers • Testing • Inspection Services • Analytical Laboratories

Established 1927

March 29, 2024

Korda
1650 Watermark Dr.
Columbus, Ohio USA 43215

Attention: Ms. Carol A. Boehm PE
Associate / Bridge Engineer

Reference: Structure Foundation Exploration- Final Report
BRO-52-12.43 Bridge Replacement
PID No. 100897
Ripley, Brown County, Ohio
CTL Project No. 22050074COL

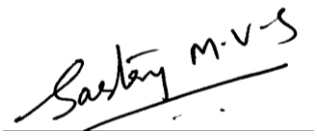
Dear Ms. Boehm:

CTL Engineering, Inc. has completed the Structure Foundation Exploration (SFE) report for the above referenced project. A Final report is being submitted to the design team.

Thank you for the opportunity to work with you on this project. If you have any questions or need further information, please feel free to contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.



Sastry Malladi, P.E.
Project Engineer

STRUCTURE FOUNDATION EXPLORATION
FINAL REPORT

BRO-52-12.43 BRIDGE REPLACEMENT
PID NO. 100897
BROWN COUNTY, RIPLEY, OHIO
CTL PROJECT NO. 22050074COL

PREPARED FOR:

KORDA
1650 WATERMARK DR.
COLUMBUS, OHIO USA 43215

PREPARED BY:

CTL ENGINEERING, INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204
Phone 614-276-8123
Fax 614-276-6377

March 29, 2024

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The project designated as BRO-52-12.43 involves constructing a replacement of existing bridge over Red Oak Creek, just upstream of confluence with the Ohio River at Ripley in Brown County, Ohio. The existing bridge is a 3-span bridge with an overall length of 269.0 feet. It is understood that the proposed structure will be a 3-span bridge of composite continuous galvanized steel beam with reinforced concrete deck and integral abutments and wall type piers.

Four (4) structure test borings (Type E1), identified as B-001-0-22 through B-004-0-22, were originally performed for this project between October 11 and October 17, 2022. To verify the rock depths/elevations near the proposed structure, CTL re-drilled the two (2) abutment borings between December 11 and December 13, 2023. These borings were extended 10 feet into the underlying bedrock. These two borings are designated as B-001-1-22 and B-004-1-22.

The borings generally exhibited layers of gravel and/or stone fragments with sand (A-1-b), fine sand (A-3), coarse and fine sand (A-3a), sandy silt (A-4a), silt (A-4b), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), or clay (A-7-6) extending down to the drilled depths or top of rock.

The most recent borings (B-001-1-22 and B-004-1-22) performed at the abutments exhibited the top of bedrock at an elevation of 416.4. The historic borings performed near the pier locations exhibited the top of bedrock at elevations ranging from 416.83 to 418.83. The bedrock from the current and historic borings was described as limestone.

During drilling, groundwater was encountered at depths ranging from 0.0 to 34.0 feet below grade (elevations 472.4 to 482.9). After completion of drilling, the groundwater depths were measured at depths ranging from 0.0 to 35.0 feet below grade (elevations 471.4 to 482.9).

Based upon the soil and rock information obtained from the current and historic boring data, it is CTL's opinion that the proposed bridge can be supported onto steel piles HP 10x42 driven to refusal in the underlying bedrock. Please refer to the Analyses and Recommendations section for additional information.

II. INTRODUCTION

The project designated as BRO-52-12.43 consists of replacement of the existing bridge over Red Oak Creek, just upstream of confluence with the Ohio River at Ripley in Brown County, Ohio. It is understood that the proposed structure will be a 3-span bridge of composite continuous galvanized steel beam with reinforced concrete deck and integral abutments and wall type piers. This is a Final Structure Foundation Exploration Report.

III. GEOLOGY AND OBSERVATIONS OF THE PROJECT

According to the Ohio Department of Natural Resources, Physiographic Regions of Ohio Map, the site is located within the Outer Bluegrass Region, which is in Blugrass Section of Ohio. The characteristics of the region include moderately high relief dissected plateau of carbonated rocks with caves and other karst features commonly present in the east and thin early drift caps narrow ridges present in the west. According to the physiographic region of Ohio map, the geology of this region includes Ordovician-and Silurian age dolomites, limestone, and calcareous shales with thin pre-Wisconsinian drift on ridges on the west overlain by silt-loam colluvium.

According to the Bedrock Geologic Map of Ohio (2006), the underlying bedrock is mapped as Ordovician age interbedded shale and limestone of the Point Pleasant Formation.

According to the ODNR website, no mapped deep mines are located within the project area. According to ODNR's Karst Interactive Map website, there are no mapped karst features at the site. However, there are several Karst – Suspect features mapped within 0.75-mile radius of the project area.

According to web based mapping from United States Department of Agriculture, Natural Resources Conservation Service, the near-surface soils at the site consist primarily of Nolin silt loam, occasionally flooded (No) and Elkinsville silt loam, 2 to 6 percent slopes (EkB). According to the *Soil Survey of Brown County, Ohio*, these soils are well drained and exhibit moderately high to high permeability.

A most recent site visit was performed on October 5, 2022. US 52 in the vicinity of the bridge is a curbed street section with adjacent sidewalks and guardrail on three of the four bridge corners. The northwest corner does not have a guardrail due to the proximity of a residential driveway within few feet of the forward abutment. The existing bridge is a 3-span structure. Overhead utilities are located near the eastern side if the bridge. No noticeable settlement was observed near the approach slabs of the bridge. Some erosion was noted near the spill through slopes of each abutment.

IV. EXPLORATION

Four (4) structure test borings, identified as B-001-0-22 through B-004-0-22, were drilled for this project between October 11 and October 17, 2022. The borings were extended to depths ranging from of 50.0 to 80.0 feet below grade. To verify the rock depths/elevations near the proposed structure, CTL re-drilled the two (2) abutment borings between December 11 and December 13, 2023. These borings were extended 10 feet into the underlying bedrock. These borings were augered down to the depth of 83.5 feet from ground surface. SPT sampling and rock coring was performed in these borings

from 83.5 feet to borehole termination depths (100 feet below grade). These borings are described as B-001-1-22 and B-004-1-22, respectively.

The borings were performed with a track mounted drill rig utilizing 3.25-inch inside diameter (I.D) hollow stem augers (HSA). Standard Penetration Tests (SPTs) were conducted using a 140-pound automatic hammer, falling 30 inches, to drive 2-inch outside diameter (O.D) split barrel samplers. Rock coring was performed in borings B-001-1-22 and B-004-1-22, using an NQ-size core barrel. The hammer system used was calibrated on November 4, 2022. The energy transfer ratio associated with the automatic SPT hammer was 79.3 percent.

Soil samples obtained were preserved in glass jars, visually classified in the field and laboratory, and tested for natural moisture content. Representative soil samples were subjected to laboratory testing including grain size distribution and Atterberg limits.

Rock from the coring operation was visually classified. The Rock Quality Designation (RQD) and percent core loss values were determined. Representative samples of the recovered rock were subjected to compressive strength testing.

Ground surface elevations, Northings, Eastings, latitude, longitude, Station, and Offset information were provided by personnel from Korda.

Historic core drill information was obtained from the original construction plans, BR-52-129, dated 1939. According to the historic core drill information, the top of rock was encountered between elevations 416.83 to 418.83 feet, and the bedrock was described as limestone. The historic cores are designated as C-001-0-39 to C-004-0-39 and C-001-A-39. All historic core elevations were corrected to the datum shift from National Geodetic Vertical Datum of 1929 (NGVD 29) to North American Vertical Datum of 1988 (NAVD 88).

V. FINDINGS

Boring B-001-0-22 and B-004-0-22 exhibited 2 inches of asphalt overlying 10 to 11 inches of concrete at the surface. Below the surface cover or from the surface, the borings encountered both coarse grained and fine-grained soils extending down to the drilled depths or top of rock. The coarse grained soils were described as gravel and/or stone fragments with sand (A-1-b), fine sand (A-3), coarse and fine sand (A-3a). The fine grained soils were described as sandy silt (A-4a), silt (A-4b), silt and clay (A-6a), silty clay (A-6b), elastic clay (A-7-5), or clay (A-7-6). The soils exhibited the SPT N_{60} values ranging from 8 blows per foot (bpf) to 50 blows for 3 inches of penetration, with natural moisture content values ranging from 9 to 62 percent.

Beneath the soil overburden, borings B-001-1-22 and B-004-1-22 encountered bedrock at a depth 90 feet below grade, with a top of bedrock elevation of 416.4 feet. Rock coring was performed below this depth, and the recovered samples from the rock coring operations were described as limestone. The rock cores exhibited rock quality designation (RQD) values ranging from 52 to 93 percent, with core recovery value of 100 percent.

Unconfined Compressive Strength (UCS) testing was performed on two selected bedrock core samples representative of the bedrock units. Table 1 shows the results of these UCS tests.

Table 1. Rock UCS Results

Boring No.	Elevation	Rock Type	Unit Weight (pcf)	UCS (psi)
B-001-1-22 (Rear Abutment)	414.2-413.7	Gray Limestone	166.4	8,730
B-004-1-22 (Forward Abutment)	414.4-413.9	Gray Limestone	167.2	8,040

During drilling, groundwater was encountered at depths ranging from 0.0 to 34.0 feet below grade (elevations 472.4 to 482.9). After completion of drilling, the groundwater depths were measured at depths ranging from 0.0 to 35.0 feet below grade (elevations 471.4 to 482.9).

Historic core information indicates the presence of clay soil from surface to elevations ranging from 473.03 to 453.83 feet. Underneath the clay layer, coring C-001-0-39 exhibited sand and rotten wood layer between elevation 473.03 and 463.03 feet. Below the clay or sand and rotten wood layer, the historic core information indicated the presence of sand and gravel layers to the top of bedrock. The top of bedrock was encountered between El. 418.83 to 416.83 feet and the bedrock was described as limestone.

VI. ANALYSES AND RECOMMENDATIONS

Based on the soil data obtained from the field and laboratory testing, the following recommendations are provided for the proposed structures.

A. Subgrade Considerations

A subgrade analysis was performed utilizing the subsurface information from the B-001-0-22 and B-004-0-22 and ODOT Geotechnical Design Manual (GDM) Section 600. A copy of the Subgrade Analysis spreadsheet is provided in

Appendix E. A proposed pavement thickness of 1.0 feet was assumed for estimating cut/fill in the Subgrade Analysis spreadsheet.

Based on the requirements outlined in the GDM Section 600, it is estimated that subgrade stabilization will be required within the project limits. The subgrade stabilization may consist of excavate and replace per Item 204. The estimated depth of subgrade stabilization is summarized in Table 2.

The approximate depth of excavate and replace is measured from the top of the proposed pavement subgrade level. It should be noted that the location and depth of subgrade stabilization provided below is only an estimate. The actual depths and horizontal limits of excavate and replace will be determined by the Project Engineer in the field based upon proofrolling.

Table 2. Excavate and Replace Depths

Limits	Average Depth of Excavate and Replace (inches)
Begin Project to Approach Slab Sta. 657+46.21)	12
Approach Slab (Sta. 659+94.34) to End Project	12

As an alternative to excavate and replace indicated in Table 1, chemical stabilization using cement would be an option for this project. According to the Subgrade Analysis spreadsheet, the recommended depth for chemical stabilization is 12 inches.

Subsequent to excavation to the above recommended depth, the exposed soils may exhibit unstable conditions at the time of proofrolling. In such an event, a bridge lift should be placed as outlined in Item 203.05 of the ODOT Construction and Material Specifications.

However, based on the OGE comments, it is understood that the weak soils encountered within the proposed subgrade will be replaced and/or reworked during the construction. Therefore, no subgrade stabilization will be required. It is also understood that chemical (global) stabilization is not an option for short length projects.

The natural moisture content values of the near surface soil samples ranged from 9 to 32 percent, averaging 23 percent. The estimated optimum moisture content (OMC) value was 17 percent. On average, the natural moisture content values were 6 percent higher than the optimum moisture content values.

Group Index values were calculated for the samples tested in the upper 2.5 feet of the proposed subgrade. Group Index values ranged from 0 to 16, averaging 9. This average Group Index value corresponds to an estimated California Bearing Ratio

(CBR) value of 6.0 percent. It is recommended that the approach road for the proposed bridge structure on US 52 can be designed based upon a CBR value of 6.0.

B. Scour Data

For the purpose of scour analysis, the mean particle grain size (D_{50}), critical shear stress (τ_c) and erosion category (EC) of the creek bed materials were determined according to ODOT Geotechnical Design Manual (GDM) Section 1302. The scour data are shown in Table 3.

Table 3. Scour Data

Boring No.	Sample No.	Elevation (feet)	D_{50} (mm)	τ_c (psf)	$D_{50, equiv}$ (mm)	Erosion Category (EC)
B-001-0-22 (Rear Abutment)	SS-5	495.4-493.9	0.0079	0.4429	21.2066	3.775
	SS-6	492.9-491.4	0.0062	0.5269	25.2271	4.017
	SS-8	487.9-486.4	0.0049	1.0272	49.1835	3.867
B-002-0-22 (Pier 1)	SS-3	479.0-477.5	0.0061	0.3131	14.9894	3.823
	SS-4	477.5-476.0	0.0057	0.1770	8.4760	3.775
	SS-7	471.0-469.5	0.0175	0.1986	9.5078	3.484
B-003-0-22 (Pier 2)	SS-3	479.9-478.4	0.0088	0.1128	5.4007	3.670
	SS-4	478.4-476.9	0.0066	0.1595	7.6365	3.725
	SS-5	476.9-475.4	0.0087	0.3857	18.4678	3.867
B-004-0-22 (Forward Abutment)	SS-5	495.4-493.9	0.0219	0.4694	22.4755	3.670
	SS-7	490.4-488.9	0.0279	0.1636	7.8312	3.168

C. Foundation Support

Based upon the soil and rock information obtained from the current and historic boring data, it is CTL's opinion that the proposed bridge can be supported onto steel piles HP 10x42 driven to refusal in the underlying bedrock.

The top of bedrock was encountered at elevation 416.4 feet in borings B-001-1-22 (Rear Abutment) and B-004-1-22 (Forward Abutment). Based on the historic core information in C-002-0-39 and C-004-0-39, the top of rock at Pier 1 and Pier 2 are 418.83 and 416.83 feet, respectively. These top of rock elevations can be utilized as reference, and the proposed piles at the substructure locations can be driven to refusal into the underlying bedrock. Factored structural resistances (Pr) for HP 10x42 pile is shown in Table 3.

Table 3. Factored Structural Resistance

Pile Type	Factored Structural Resistance (P_r) (Kips)
HP10x42	310

Please note that the P_r value provided in Table 3 above assumes the following conditions:

- Pile is axially loaded with negligible moment
- Pile has no appreciable loss of section due to deterioration throughout the life of the structure
- Pile has a steel yield strength of 50-ksi
- a structural resistance factor for H-piles subject to damage due to severe driving conditions ($\varphi c = 0.50$)
- Pile is fully braced along its length

Due to potential for scour, the piles will likely have to stand cantilever over some distance. In this case, a structural analysis for buckling should be performed to determine if the provided P_r value need to be reduced. It is understood that Korda has analyzed the piles for buckling considering the expected scour depths and notified us that piles are not subjected to buckling for the provided Pr value. Therefore, the Pr value provided in table 3, without any reduction can be utilized for the proposed HP 10x42 piles.

Table 4 below shows the estimated pile tip elevations, estimated bottom of pile cap elevations and estimated pile lengths. The pile tip elevations near the rear abutment and forward abutment were estimated as the elevations where rock coring began in B-001-1-22 and B-004-1-22, respectively. The pile tip elevation near the pier locations were estimated from the historic core information. The estimated pile length includes an assumed 2.0 foot embedment into the pile cap for abutments and 1.5 foot embedment into pile caps for the piers. The pile lengths are rounded up to the nearest five-foot segments.

Table 4. Estimated Pile Lengths and Tip Elevations

Boring No.	Bottom of Pile Cap Elevation	Estimated Pile Tip Elevation	Estimated Pile Length (feet)	Order Length (feet)
B-001-1-22 (Rear Abutment)	495.60	416.40	85	90
C-002-0-39 (Pier 1)	473.90	418.83	60	65
C-004-0-39 (Pier 2)	477.35	416.83	65	70
B-004-1-22 (Forward Abutment)	496.30	416.40	85	90

D. Lateral Parameters

Please refer to Appendix F for the Lpile parameters which can be utilized while performing lateral pile analysis.

E. General Construction and Earthwork

1. Site preparation and earthwork should be performed in accordance with the ODOT Construction and Material Specifications and applicable Geotechnical Bulletins.

2. The embankment side slopes should be protected from erosion to limit sloughing and slope failure.

3. Temporary excavations in excess of 4 feet in depth should be sloped or shored according to OSHA requirements.

VII. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can modified, if required.

VIII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

IX. CLOSING

This report has been prepared for the exclusive use by the client for use only on this project. Our services have been performed in accordance with generally accepted Geotechnical Engineering principles and practices. No warranty is either expressed or implied.

CTL Engineering's assignment does not include, nor does this geotechnical report address the environmental aspects of this particular site.

Specific design and construction recommendations have been provided in this report. Therefore, the report should be used in its entirety.

Respectfully Submitted,

CTL ENGINEERING, INC.

Sastry Malladi, P.E
Project Engineer

Shahedur Rahman, P.E
Geotechnical Engineer

APPENDIX A
GEOTECHNICAL PROFILE BRIDGE

PROJECT DESCRIPTION

THE PROJECT DESIGNATED AS BRO-52-12.43 INVOLVES CONSTRUCTING A REPLACEMENT OF EXISTING BRIDGE OVER RED OAK CREEK, JUST UPSTREAM OF CONFLUENCE WITH THE OHIO RIVER AT RIPLEY IN BROWN COUNTY, OHIO.

HISTORIC RECORDS

HISTORIC CORE DRILL INFORMATION WAS OBTAINED FROM THE ORIGINAL CONSTRUCTION PLANS, BR-52-129, DATED 1939. ACCORDING TO THE HISTORIC CORE DRILL INFORMATION, THE TOP OF ROCK WAS ENCOUNTERED BETWEEN EL. 418.83 TO 416.83 FEET AND THE BEDROCK WAS DESCRIBED AS LIMESTONE. THE HISTORIC CORES ARE DESIGNATED AS C-001-0-39 TO C-004-0-39 AND C-001-A-39. ALL HISTORIC CORE ELEVATIONS WERE CORRECTED TO DATUM SHIFT FROM NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29) TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

GEOLOGY

ACCORDING TO THE OHIO DEPARTMENT OF NATURAL RESOURCES, PHYSIOGRAPHIC REGIONS OF OHIO MAP, THE SITE IS LOCATED WITHIN THE OUTER BLUEGRASS REGION, WHICH IS IN BLUGRASS SECTION OF OHIO. THE CHARACTERISTICS OF THE REGION INCLUDE MODERATELY HIGH RELIEF DISSECTED PLATEAU OF CARBONATED ROCKS WITH CAVES AND OTHER KARST FEATURES COMMONLY PRESENT IN THE EAST AND THIN EARLY DRIFT CAPS NARROW RIDGES PRESENT IN THE WEST. ACCORDING TO THE PHYSIOGRAPHIC REGION OF OHIO MAP, THE GEOLOGY OF THIS REGION INCLUDES ORDOVICIAN- AND SILURIAN AGE DOLOMITES, LIMESTONE, AND CALCAREOUS SHALES WITH THIN PRE-WISCONSINIAN DRIFT ON RIDGES ON THE WEST OVERLAIN BY SILT-LOAM COLLUVIUM.

ACCORDING TO THE OHIO DEPARTMENT OF NATURAL RESOURCES, PHYSIOGRAPHIC REGIONS OF OHIO MAP, THE SITE IS LOCATED WITHIN THE OUTER BLUEGRASS REGION, WHICH IS IN BLUGRASS SECTION OF OHIO. ACCORDING TO THE BEDROCK GEOLOGIC MAP OF OHIO (2006), THE UNDERLYING BEDROCK IS MAPPED AS ORDOVICIAN AGE INTERBEDDED SHALE AND LIMESTONE OF THE POINT PLEASANT FORMATION.

ACCORDING TO THE ODNR WEBSITE, NO MAPPED DEEP MINES ARE LOCATED WITHIN THE PROJECT AREA. ACCORDING TO ODNR'S KARST INTERACTIVE MAP WEBSITE, THERE ARE NO MAPPED KARST FEATURES AT THE SITE. HOWEVER, THERE ARE SEVERAL KARST - SUSPECT FEATURES MAPPED WITHIN 0.75-MILE RADIUS OF THE PROJECT AREA.

RECONNAISSANCE

A SITE VISIT WAS PERFORMED BY AN ENGINEER FROM CTL ON OCTOBER 5, 2022. US 52 IN THE VICINITY OF THE BRIDGE IS A CURBED STREET SECTION WITH ADJACENT SIDEWALKS AND GUARDRAIL ON THREE OF THE FOUR BRIDGE CORNERS. THE NORTHWEST CORNER DOES NOT HAVE A GUARDRAIL DUE TO THE PROXIMITY OF A RESIDENTIAL DRIVEWAY WITHIN FEW FEET OF THE FORWARD ABUTMENT. THE EXISTING BRIDGE IS A 3-SPAN STRUCTURE. OVERHEAD UTILITIES ARE LOCATED NEAR THE EASTERN SIDE IF THE BRIDGE. NO NOTICEABLE SETTLEMENT WAS OBSERVED NEAR THE APPROACH SLABS OF THE BRIDGE. SOME EROSION WAS NOTED NEAR THE SPILL THROUGH SLOPES OF EACH ABUTMENT.

SUBSURFACE EXPLORATION

FOUR (4) STRUCTURE TEST BORINGS, IDENTIFIED AS B-001-0-22 THROUGH B-004-0-22, WERE DRILLED FOR THIS PROJECT BETWEEN OCTOBER 11 AND OCTOBER 17, 2022. THE BORINGS WERE EXTENDED TO DEPTHS RANGING FROM OF 50.0 TO 80.0 FEET BELOW GRADE. UPON DISCUSSION WITH ODOT THE BORINGS AT THE LOCATIONS OF B-001-0-22 AND B-004-0-22 WERE REDRILLED BETWEEN DECEMBER 11 AND DECEMBER 13, 2023. THESE BORINGS WERE AUGERED DOWN TO THE DEPTH OF 83.5 FEET FROM GROUND SURFACE AND EXTENDED TO THE DEPTH OF 100 FEET FROM GRADE WITH A 10- FEET OF ROCK CORING INTO THE BEDROCK. THE EXTENDED BORINGS ARE DESCRIBED AS B-001-1-22 AND B-004-1-22, RESPECTIVELY.

THE BORINGS WERE PERFORMED WITH A TRACK MOUNTED DRILL RIG UTILIZING 3.25-INCH HOLLOW STEM AUGERS (HSA). STANDARD PENETRATION TESTS (SPTS) WERE CONDUCTED USING A 140-POUND AUTOMATIC HAMMER, FALLING 30 INCHES, TO DRIVE 2-INCH O.D. SPLIT BARREL SAMPLERS. ROCK CORING WAS PERFORMED IN BORINGS B-001-1-22 AND B-004-1-22, USING AN NQ- SIZE CORE BARREL. THE HAMMER SYSTEM USED WAS CALIBRATED ON NOVEMBER 4, 2022. THE ENERGY TRANSFER RATIO ASSOCIATED WITH THE AUTOMATIC SPT HAMMER WAS 79.3 PERCENT.

EXPLORATION FINDINGS

BORING B-001-0-22 AND B-004-0-22 EXHIBITED 2 INCHES OF ASPHALT OVERLYING 10 TO 11 INCHES OF CONCRETE AT THE SURFACE. BELOW THE SURFACE COVER OR FROM THE SURFACE, THE BORINGS ENCOUNTERED BOTH COARSE GRAINED AND FINE GRAINED SOILS EXTENDING DOWN TO THE DRILLED DEPTHS. THE COARSE GRAINED SOILS WERE DESCRIBED AS GRAVEL AND/OR STONE FRAGMENTS WITH SAND (A-1-b), FINE SAND (A-3), COARSE AND FINE SAND (A-3a). THE FINE GRAINED SOILS WERE DESCRIBED AS SANDY SILT (A-4a), SILT (A-4b), SILT AND CLAY (A-6a), SILTY CLAY (A-6b), ELASTIC CLAY (A-7-5), OR CLAY (A-7-6).

BENEATH THE SOIL OVERBURDEN, THE BORINGS AT B-001-1-22 AND B-004-1-22 ENCOUNTERED BEDROCK AT A DEPTH 90 FEET BELOW GRADE, WITH A TOP OF BEDROCK ELEVATION OF 416.4 FEET. ROCK CORING WAS PERFORMED BELOW THIS DEPTH, AND THE RECOVERED SAMPLES FROM THE ROCK CORING OPERATIONS WERE DESCRIBED AS LIMESTONE.

DURING DRILLING, GROUNDWATER WAS ENCOUNTERED AT DEPTHS RANGING FROM 0.0 TO 34.0 FEET BELOW GRADE (ELEVATIONS 472.4 TO 482.9). AFTER COMPLETION OF DRILLING, THE GROUNDWATER DEPTHS WERE MEASURED AT DEPTHS RANGING FROM 0.0 TO 35.0 FEET BELOW GRADE (ELEVATIONS 471.4 TO 482.9).

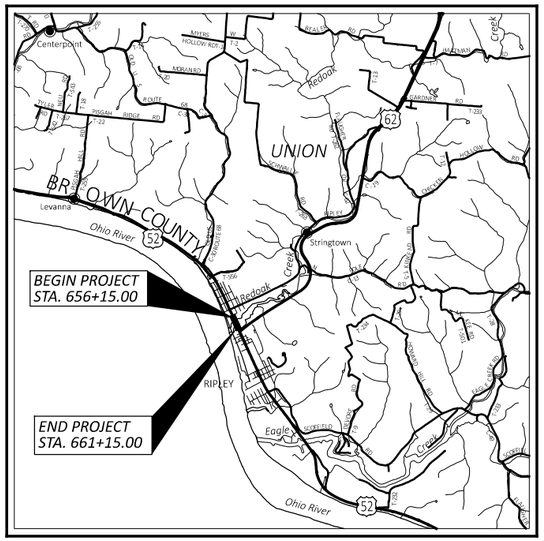
HISTORIC CORE INFORMATION INDICATES THE PRESENCE OF CLAY SOIL FROM SURFACE TO ELEVATIONS RANGING FROM 473.03 TO 453.83 FEET. UNDERNEATH THE CLAY LAYER CORING C-001-0-39 EXHIBITED SAND AND ROTTEN WOOD LAYER BETWEEN ELEVATION 473.03 AND 463.03 FEET. BELOW THE CLAY OR SAND AND ROTTEN WOOD LAYER, THE HISTORIC CORE INFORMATION INDICATED THE PRESENCE OF SAND AND GRAVEL LAYERS TO THE TOP OF BEDROCK. THE TOP OF BEDROCK IS EXHIBITED BETWEEN EL. 418.83 TO 416.83 FEET AND THE BEDROCK WAS DESCRIBED AS LIMESTONE.

SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JULY 2023.

AVAILABLE INFORMATION

THE SOIL, BEDROCK, AND GROUNDWATER INFORMATION COLLECTED FOR THIS SUBSURFACE EXPLORATION THAT CAN BE CONVENIENTLY DISPLAYED ON THE SOIL PROFILE SHEETS HAS BEEN PRESENTED. GEOTECHNICAL REPORTS, IF PREPARED, ARE AVAILABLE FOR REVIEW ON THE OFFICE OF CONTRACT SALES WEBSITE.



LOCATION MAP

SCALE : NOT TO SCALE

PARTICLE SIZE DEFINITIONS

12"	3"	2.0 mm	0.42 mm	0.074 mm	0.005 mm
BOULDERS	COBBLES	GRAVEL	COARSE SAND	FINE SAND	SILT	CLAY
		No. 10 SIEVE	No. 40 SIEVE	No. 200 SIEVE	

RECON. - SM 10/05/2022
DRILLING - CTL ENGINEERING. INC. 10/11/2022 - 10/17/2022
DRAWN - NKS 03/27/2024
REVIEWED - SM 03/27/2024

GEOTECHNICAL PROFILE - BRIDGE

BRIDGE NO. - BRO-52-12.43 OVER READOAK CREEK

DESIGN AGENCY

CTL ENGINEERING
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-6377

DESIGNER N.K.S

REVIEWER SM 03-27-24

PROJECT ID 100897

SUBSET 1 | TOTAL 12

SHEET P.68 | TOTAL 79

BRO-US 52-12.43

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 13:10:51 USER: hp
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LEGEND

	DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
	GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A-1-b	2	5
	FINE SAND	A-3	1	5
	COARSE AND FINE SAND	A-3a	3	6
	SANDY SILT	A-4a	6	9
	SILT	A-4b	3	2
	SILT AND CLAY	A-6a	4	6
	SILTY CLAY	A-6b	4	3
	ELASTIC CLAY	A-7-5	2	0
	CLAY	A-7-6	12	15
		TOTAL	37	51
	LIMESTONE	VISUAL		
XXXXX	PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL		

BORING LOCATION - PLAN VIEW

HISTORIC BORING - PLAN VIEW

DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY.
HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.

WC — INDICATES WATER CONTENT IN PERCENT.

N_{60} — INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.

X/Y/Z/D" — NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT):
X = NUMBER OF BLOWS FOR FIRST 6 INCHES (UNCORRECTED).
Y = NUMBER OF BLOWS FOR SECOND 6 INCHES (UNCORRECTED).
Z/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D" PENETRATION AT REFUSAL.

W — INDICATES FREE WATER ELEVATION.

INDICATES AT COMPLETION WATER ELEVATION.

INDICATES A PLASTIC MATERIAL WITH MOISTURE CONTENT EQUAL TO OR GREATER THAN THE LIQUID LIMIT MINUS 3.

INDICATES A NON-PLASTIC MATERIAL WITH A MOISTURE CONTENT GREATER THAN 25% OR GREATER THAN 19% WITH A WET APPEARANCE.

SS — INDICATES A SPLIT-SPOON SAMPLE.

NP — INDICATES A NON-PLASTIC SAMPLE.

TR — INDICATES A TOP OF ROCK.

	HISTORIC BORING DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
	GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A-1-b	-	-
	COARSE AND FINE SAND	A-3a	-	-
	CLAY	A-7-6	-	-
	LIMESTONE	VISUAL		

BRIDGE SCOUR ANALYSIS

SCOUR SAMPLES

BORING NO.	SAMPLE ID.	ELEVATION (ft.)	D_{50} (mm)	T_C (PSF)	$D_{50,\ equiv}$ (mm)	EROSION CATEGORY (EC)
B-001-0-22 (REAR ABUTMENT)	SS-5	495.4 - 493.9	0.0079	0.4429	21.2066	3.775
	SS-6	492.9 - 491.4	0.0062	0.5269	25.2271	4.017
	SS-8	487.9 - 486.4	0.0049	1.0272	49.1835	3.867
B-002-0-22 (PIER 1)	SS-3	479.0 - 477.5	0.0061	0.3131	14.9894	3.823
	SS-4	477.5 - 476.0	0.0057	0.1770	8.4760	3.775
	SS-7	471.0 - 469.5	0.0175	0.1986	9.5078	3.484
B-003-0-22 (PIER 2)	SS-3	479.9 - 478.4	0.0088	0.1128	5.4007	3.670
	SS-4	478.4 - 476.9	0.0066	0.1595	7.6365	3.725
	SS-5	476.9 - 475.4	0.0087	0.3857	18.4678	3.867
B-004-0-22 (FARWARD ABUTMENT)	SS-5	495.4 - 493.9	0.0219	0.4694	22.4755	3.670
	SS-7	490.4 - 488.9	0.0279	0.1636	7.8312	3.168

BEDROCK TEST SUMMARY

BORING ID	SAMPLE ELEVATION	SAMPLE DEPTH	Qu (PSI)	LITHOLOGY
B-001-1-22	414.2 - 413.7	92.2' - 92.7'	8.730	LIMESTONE
B-004-1-22	414.4 - 413.9	92.0' - 92.5'	8.040	LIMESTONE

GEOTECHNICAL PROFILE - BRIDGE

BRIDGE NO. - BRO-52-12.43 OVER READOAK CREEK

DESIGN AGENCY
GTL ENGINEERING INC
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-6377

DESIGNER N.K.S

REVIEWER SM 03-27-24

PROJECT ID 100897

SUBSET 2 | TOTAL 12

SHEET P.69 | TOTAL 79

BRO-US 52-12.43

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 13:12:34 USER: hp
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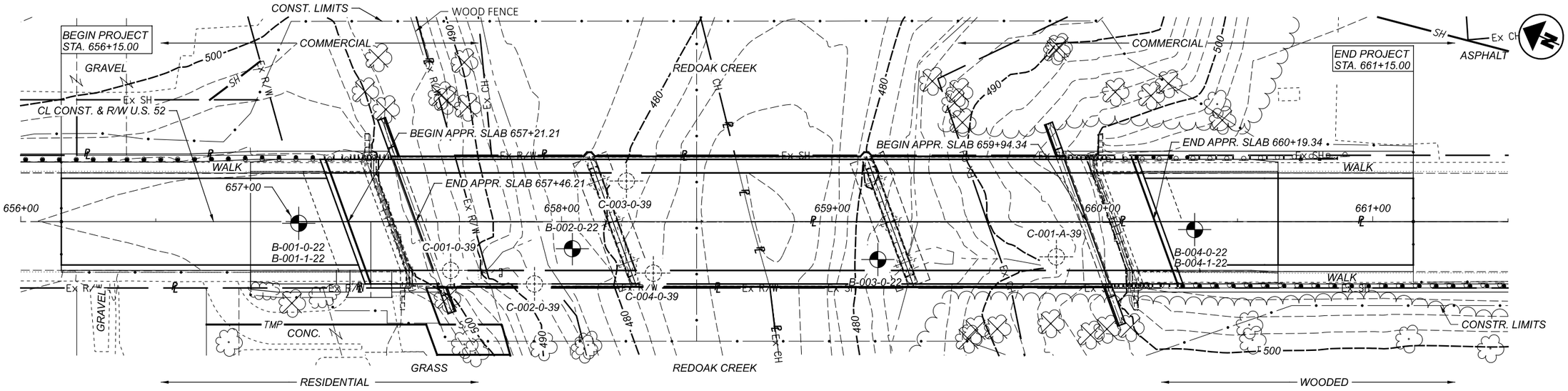
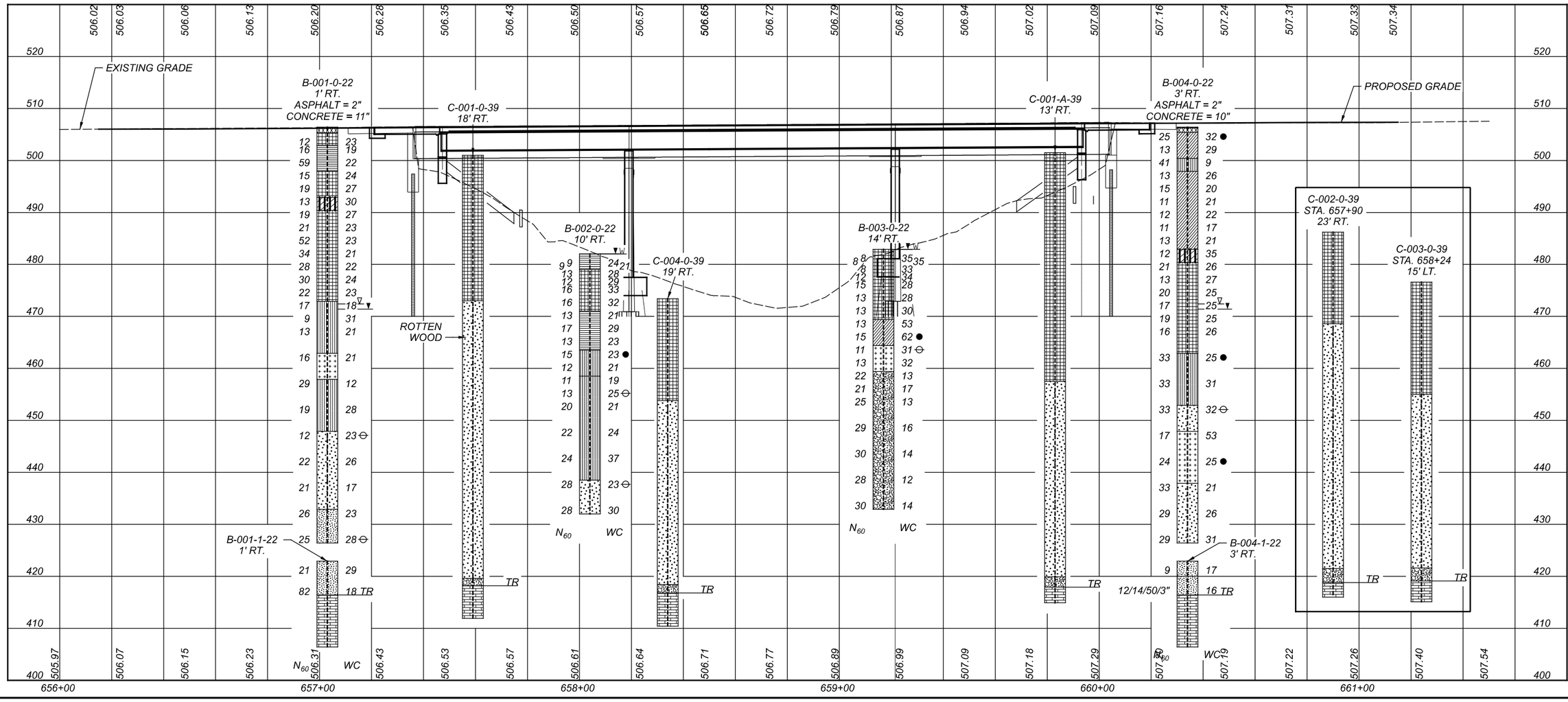


NOTE: SAMPLING FOR BORING B-001-1-22 AND B-004-1-22 WERE PERFORMED AFTER AUGERING DOWN TO 83.5' FROM GROUND SURFACE.



HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - BRIDGE

BRIDGE NO. - BRO-52-12.43 OVER REDOAK CREEK

BRO-52-12.43

MODEL: Plan [Drawing] PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 23:56:41 USER: hp
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DESIGN AGENCY
CTL ENGINEERING INC
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-6377

DESIGNER N.K.S
REVIEWER SM 03-27-24
PROJECT ID 100897
SUBSET 3 TOTAL 12
SHEET P-70 TOTAL 79

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 13:16:40 USER: hp
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PROJECT: BRO-US 52-12.43
TYPE: BRIDGE
PID: 100897 SFN: 0801119
START: 10-11-22 END: 10-11-22

DRILLING FIRM / OPERATOR: CTL / T.MILLER
SAMPLING FIRM / LOGGER: CTL / T.MILLER
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55 #393
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 11-4-22
ENERGY RATIO (%): 79.3

STATION / OFFSET: 657+03, 1' RT.
ALIGNMENT: US 52
ELEVATION: 506.4 (MSL) EOB: 80.0 ft.
LAT / LONG: 38.743716, -83.844041

EXPLORATION ID B-001-0-22
PAGE 1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT, (2")	506.4																	
CONCRETE, (11")	506.2																	
STIFF, DARK BROWN, **CLAY**, "AND" SILT, TRACE SAND, DAMP	505.3		4 4 5	12	67	SS-1	1.25	0	0	4	50	46	45	24	21	23	A-7-6 (13)	
HARD, BROWN, **SILTY CLAY**, SOME GRAVEL, LITTLE SAND, DAMP	502.9		4 6 6	16	100	SS-2	4.25	-	-	-	-	-	-	-	-	19	A-6b (V)	
@6.0'; VERY STIFF			7 28 17	59	67	SS-3	2.00	35	7	7	29	22	39	23	16	22	A-6b (5)	
VERY STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP	497.9		3 5 6	15	100	SS-4	2.25	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
@11.0'; MOIST			4 6 8	19	100	SS-5	2.25	2	2	3	53	40	47	26	21	27	A-7-6 (14)	
STIFF, GRAY, **ELASTIC CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP	492.9		3 4 6	13	100	SS-6	2.00	0	1	1	52	46	59	32	27	30	A-7-5 (19)	
VERY STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, DAMP	490.4		5 6 8	19	100	SS-7	3.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
@18.5'; HARD			4 7 9	21	100	SS-8	4.50	0	0	1	49	50	51	28	23	23	A-7-6 (15)	
@21.0'; BROWN, LITTLE SAND			5 17 22	52	100	SS-9	4.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
			8 13 13	34	100	SS-10	4.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
@26.0'; VERY STIFF, TRACE SAND			8 10 11	28	100	SS-11	4.00	0	1	4	52	43	45	22	23	22	A-7-6 (14)	
@28.5'; STIFF			8 12 11	30	100	SS-12	1.75	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
@31.0'; VERY STIFF			4 6 11	22	100	SS-13	2.75	-	-	-	-	-	-	-	-	23	A-7-6 (V)	
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, MOIST	472.9	▽ 472.4	4 6 7	17	100	SS-14	1.50	1	11	30	41	17	25	17	8	18	A-4a (5)	
@36.0'; MEDIUM STIFF, BROWN, WET			3 3 4	9	100	SS-15	0.50	-	-	-	-	-	-	-	-	31	A-4a (V)	
@38.5'; SOFT, LITTLE GRAVEL, WET			3 4 6	13	100	SS-16	0.25	-	-	-	-	-	-	-	-	21	A-4a (V)	
STIFF, BROWN AND GRAY, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, MOIST	462.9		4 5 7	16	100	SS-17	1.00	3	5	13	56	23	29	19	10	21	A-4b (8)	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WET	457.9		7 12 10	29	100	SS-18	0.50	3	19	18	40	20	27	17	10	12	A-4a (5)	
@53.5'; SOFT			4 6 8	19	100	SS-19	0.25	-	-	-	-	-	-	-	-	28	A-4a (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, WET	447.9		6 5 4	12	100	SS-20	-	0	12	76	8	4	NP	NP	NP	23	A-3a (0)	

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT.GDT - 25-3-24 13:36 - G:\2024\MARCH\25\22050074COL\22050074COL.GPJ

SHEET P-71 | TOTAL 79
SUBSET 4 | TOTAL 12
PROJECT ID: 100897
REVIEWER: SM 03-27-24
DESIGNER: N.K.S
DESIGN AGENCY: GTC ENGINEERING
COLUMBUS, OHIO 43204
PHONE: (614) 276-8577

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-001-0-22

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 13:18:49 USER: hp
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PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 657+03, 1' RT.	START: 10-11-22	END: 10-11-22	PG 2 OF 2	B-001-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, WET *(continued)*	446.4	61																
		62																
		63																
		64	4 7 10	22	100	SS-21	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
		65																
		66																
		67																
		68																
		69	5 6 10	21	100	SS-22	-	-	-	-	-	-	-	-	-	17	A-3a (V)	
		70																
		71																
		72																
		73																
	432.9	74																
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET		75	5 8 12	26	100	SS-23	-	-	-	-	-	-	-	-	-	23	A-3 (V)	
F.S.		76																
		77																
		78																
		79	6 9 10	25	100	SS-24	-	3	18	69	7	3	NP	NP	NP	28	A-3 (0)	
	426.4	EOB 80																

NOTES: CAVED AT ELEVATION 463.9'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

DESIGN AGENCY
GTC ENGINEERING
COLUMBUS, OHIO 43204
PHONE: (614)276-8577

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-001-0-22 CONTINUE

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:43:56 USER: hp
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PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 657+03, 1' RT.	EXPLORATION ID B-001-1-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 422.9 (MSL) EOB: 16.5 ft.	PAGE 1 OF 1
START: 12-11-23 END: 12-12-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743716, -83.844041	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM DENSE, BROWN, **FINE SAND**, WET	422.9	1	9 7 9	21	100	SS-1	-	-	-	-	-	-	-	-	-	29	A-3 (V)	
@417.9' VERY DENSE	416.4	5	14 24 38	82	100	SS-2	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG; RQD 84%, REC 100%.		TR																
@414.2'-413.7'; Compressive Strength= 8,730 PSI		9	75		100	NQ-1											CORE	
		14	93		100	NQ-2											CORE	
	406.4	EOB																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 25-3-24 18:14 - G:\2024\MARCH\25\22050074COL\22050074COL.GPJ

NOTES: SURFACE ELEVATION= 506.39'. AUGERED DOWN TO 83.5' FEET FROM SURFACE TO THE ELEVATION OF 422.89'. CAVED AT ELEVATION 458.4'.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

B-001-1-22

90.0'

100.0'

Run #:	Depth		Recovery		RQD	
NQ-1	90.0'	95.0'	45/60	75%	60/60	100%
NQ-2	95.0'	100.0'	56/60	93%	60/60	100%

BRO-52-12.43, PID 100897

CTL ENGINEERING

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P-73 TOTAL 79	6 TOTAL 12	100897	SM 03-27-24	N.K.S	CTL ENGINEERING

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG AND ROCK CORE PHOTO FOR B-001-1-22

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:28:05 USER: hp
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PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 658+04, 10' RT.	EXPLORATION ID B-002-0-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 482.0 (MSL) EOB: 50.0 ft.	PAGE 1 OF 1
START: 10-17-22 END: 10-17-22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743459, -83.843902	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST	482.0	482.0	3 3 4	9	100	SS-1	1.25	4	3	12	47	34	40	24	16	24	A-6b (10)	
@1.5'; GRAY AND BROWN, "AND" GRAVEL	479.0		4 4 3	9	100	SS-2	1.25	36	9	6	25	24	38	21	17	21	A-6b (5)	
MEDIUM STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, MOIST			3 4 6	13	100	SS-3	0.75	0	1	1	52	46	47	25	22	28	A-7-6 (14)	
@4.5'; SOFT			3 4 5	12	100	SS-4	0.25	0	1	1	51	47	46	25	21	29	A-7-6 (14)	
@6.0'; STIFF			3 4 8	16	100	SS-5	1.00	-	-	-	-	-	-	-	-	33	A-7-6 (V)	
@8.5'; MEDIUM STIFF	471.0		3 5 7	16	100	SS-6	0.50	-	-	-	-	-	-	-	-	32	A-7-6 (V)	
MEDIUM STIFF, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST			4 4 6	13	100	SS-7	0.75	2	9	17	42	30	37	21	16	21	A-6b (10)	
@13.5'; STIFF, WET			4 6 7	17	100	SS-8	1.00	-	-	-	-	-	-	-	-	29	A-6b (V)	
@16.0'; SOFT, LITTLE SAND			3 5 5	13	89	SS-9	0.25	-	-	-	-	-	-	-	-	23	A-6b (V)	
STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, WET	463.5		4 4 7	15	100	SS-10	-	3	10	35	37	15	22	16	6	23	A-4a (3)	
			3 4 5	12	83	SS-11	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
MEDIUM DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET	458.5		3 4 4	11	100	SS-12	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
			4 4 6	13	100	SS-13	-	2	9	39	43	7	NP	NP	NP	25	A-4a (3)	
			4 6 9	20	100	SS-14	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
@33.5'; GRAY			6 7 10	22	100	SS-15	0.25	-	-	-	-	-	-	-	-	24	A-4a (V)	
			5 7 11	24	100	SS-16	0.25	-	-	-	-	-	-	-	-	37	A-4a (V)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	438.5		7 9 12	28	100	SS-17	-	1	18	70	8	3	NP	NP	NP	23	A-3a (0)	
	432.0	EOB	6 10 11	28	100	SS-18	-	-	-	-	-	-	-	-	-	30	A-3a (V)	

NOTES: CAVED AT ELEVATION 467.6'. BRIDGE TO TOP OF GROUND 24.0'; STARTED SAMPLING AT 24.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT.GDT - 25-3-24 13:36 - G:\2024\MARCH\22052050074COL\22050074COL.GPJ

SHEET	TOTAL	SUBSET	TOTAL	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P-74	79	7	12	100897	SM 03-27-23	N.K.S	GTC ENGINEERING

GTC ENGINEERING
CONSULTANTS, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-8377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-002-0-22

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:31:41 USER: hp
D:\Drop Box\CTL 2024\March\Dept 05\COL\Shahed\22050074COL_ODOT\Mod_27.03.24\100897ZL005.dgn

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 659+17, 14' RT.	EXPLORATION ID B-003-0-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 482.9 (MSL) EOB: 50.0 ft.	PAGE 1 OF 1
START: 10-17-22 END: 10-17-22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743171, -83.843744	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
MEDIUM STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, WET	482.9	482.9	2 3 3	8	100	SS-1	0.50	0	1	3	57	39	45	26	19	35	A-7-6 (13)	
@1.5'; TRACE GRAVEL			3 2 4	8	100	SS-2	0.75	1	0	1	55	43	51	28	23	35	A-7-6 (15)	
@3.0'; SOFT, NO GRAVEL			2 3 3	8	100	SS-3	0.25	0	2	3	57	38	44	25	19	33	A-7-6 (12)	
@4.5'; MEDIUM STIFF, TRACE GRAVEL			3 4 5	12	100	SS-4	0.50	1	0	1	55	43	47	27	20	34	A-7-6 (13)	
@6.0'; STIFF, NO GRAVEL			4 6 5	15	100	SS-5	1.50	0	1	7	52	40	48	25	23	28	A-7-6 (15)	
			4 3 7	13	100	SS-6	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	
			3 4 6	13	100	SS-7	0.50	-	-	-	-	-	-	-	-	30	A-7-6 (V)	
STIFF, DARK BROWN, **SILT AND CLAY**, "AND" SAND, TRACE GRAVEL, WET	469.4		4 5 5	13	100	SS-8	1.00	-	-	-	-	-	-	-	-	53	A-6a (V)	
@16.0'; SOFT			3 5 6	15	89	SS-9	0.25	8	24	19	31	18	34	21	13	62	A-6a (4)	
MEDIUM DENSE, GRAY, **SILT**, SOME SAND, TRACE CLAY, WET	464.4		3 3 5	11	100	SS-10	0.25	0	1	24	67	8	NP	NP	NP	31	A-4b (8)	
			3 4 6	13	83	SS-11	-	-	-	-	-	-	-	-	-	32	A-4b (V)	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET	459.4		4 7 10	22	100	SS-12	-	0	56	37	4	3	NP	NP	NP	13	A-1-b (0)	
			7 4 12	21	100	SS-13	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
			5 7 12	25	100	SS-14	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
			5 8 14	29	100	SS-15	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
			6 7 16	30	100	SS-16	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
			7 10 11	28	100	SS-17	-	1	52	37	7	3	NP	NP	NP	12	A-1-b (0)	
	432.9	EOB	6 9 14	30	100	SS-18	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	

NOTES: CAVED AT 466.4'. BRIDGE TO TOP OF WATER 25', STARTED SAMPLING AT 28', 3' OF WATER

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P-75 / TOTAL 79	8 / TOTAL 12	100897	SM 03-27-24	N.K.S	GTC ENGINEERING

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-003-0-22

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:33:40 USER: hp
D:\Drop Box\CTL 2024\March\Dept 05\COL\Shahed\22050074COL_ODOT\Mod_27.03.24\100897ZL006.dgn

PROJECT: BRO-US 52-12.43
TYPE: BRIDGE
PID: 100897 SFN: 0801119
START: 10-12-22 END: 10-13-22

DRILLING FIRM / OPERATOR: CTL / T.MILLER
SAMPLING FIRM / LOGGER: CTL / T.MILLER
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55 #393
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 11-4-22
ENERGY RATIO (%): 79.3

STATION / OFFSET: 660+34, 3' RT.
ALIGNMENT: US 52
ELEVATION: 506.4 (MSL) EOB: 80.0 ft.
LAT / LONG: 38.742890, -83.843552

EXPLORATION ID B-004-0-22
PAGE 1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT, (2")	506.4																	
CONCRETE, (10")	506.2																	
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST	505.4		7 10 9	25	72	SS-1	1.50	7	5	12	45	31	33	20	13	32	A-6a (9)	
			4 4 6	13	78	SS-2	2.00	-	-	-	-	-	-	-	-	29	A-6a (V)	
HARD, DARK GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, DAMP	500.4		7 12 19	41	100	SS-3	-	18	26	20	26	10	27	21	6	9	A-4a (0)	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, MOIST	497.9		3 4 6	13	100	SS-4	4.00	-	-	-	-	-	-	-	-	26	A-6a (V)	
@11.0'; STIFF			4 6 5	15	100	SS-5	1.75	0	0	13	60	27	31	20	11	20	A-6a (8)	
			3 3 5	11	100	SS-6	1.25	-	-	-	-	-	-	-	-	21	A-6a (V)	
@16.0'; SOME SAND			3 4 5	12	100	SS-7	1.50	0	1	20	56	23	30	19	11	22	A-6a (8)	
@18.5'; VERY STIFF, DAMP			3 4 4	11	100	SS-8	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	
@21.0'; STIFF, MOIST			3 4 6	13	100	SS-9	1.50	-	-	-	-	-	-	-	-	21	A-6a (V)	
STIFF, GRAY, **ELASTIC CLAY**, "AND" SILT, TRACE SAND, MOIST	482.9		3 4 5	12	100	SS-10	1.50	0	0	2	55	43	57	33	24	35	A-7-5 (17)	
STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, MOIST	480.4		4 7 9	21	100	SS-11	1.75	-	-	-	-	-	-	-	-	26	A-7-6 (V)	
@28.5'; VERY STIFF			4 4 6	13	100	SS-12	2.50	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
			4 7 8	20	100	SS-13	2.25	0	1	1	54	44	49	25	24	25	A-7-6 (15)	
	▽ 472.4		4 6 7	17	100	SS-14	2.00	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
@36.0'; STIFF			4 6 8	19	100	SS-15	1.75	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
			4 5 7	16	100	SS-16	1.50	-	-	-	-	-	-	-	-	26	A-7-6 (V)	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, WET	462.9		5 11 14	33	100	SS-17	0.50	29	11	19	27	14	28	18	10	25	A-4a (1)	
@48.5'; SOFT			4 11 14	33	100	SS-18	0.25	-	-	-	-	-	-	-	-	31	A-4a (V)	
DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	452.9		6 9 16	33	100	SS-19	-	2	25	62	8	3	NP	NP	NP	32	A-3a (0)	
STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, WET	447.9		4 4 9	17	100	SS-20	1.50	-	-	-	-	-	-	-	-	53	A-4b (V)	

STANDARD ODOT SOIL BORING LOG (11 X 17) - OH DOT.GDT - 25-3-24 13:36 - G:\2024\MARCH\25\22050074COL\22050074COL.GPJ

DESIGNER N.K.S
REVIEWER SM 03-27-24
PROJECT ID 100897
SUBSET 9 TOTAL 12
SHEET P-76 TOTAL 79

DESIGN AGENCY
GEOTECHNICAL ENGINEERING, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-8377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-004-0-22

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:36:12 USER: hp
D:\Drop Box\CTL 2024\March\Dept 05\COL\Shahed\22050074COL_ODOT\Mod_27.03.24\100897ZL007.dgn

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 660+34, 3' RT.	START: 10-12-22	END: 10-13-22	PG 2 OF 2	B-004-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, WET *(continued)*	446.4	61 62 63 64 65 66 67 68	5 6 12	24	100	SS-21	0.25	0	0	1	81	18	26	21	5	25	A-4b (8)	
DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	437.9	69 70 71 72 73	6 12 13	33	94	SS-22	-	-	-	-	-	-	-	-	-	21	A-3a (V)	
@73.5'; MEDIUM DENSE		74 75 76 77 78	11 9 13	29	89	SS-23	-	-	-	-	-	-	-	-	-	26	A-3a (V)	
	426.4 EOB	79 80	6 12 10	29	89	SS-24	-	-	-	-	-	-	-	-	-	31	A-3a (V)	

NOTES: CAVED AT 465.8'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

DESIGN AGENCY
GTC ENGINEERING
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-8377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG B-004-0-22 CONTINUED

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:40:04 USER: hp
D:\Drop Box\CTL 2024\March\Dept 05\COL\Shahed\22050074COL_ODOT\Mod_27.03.24\100897ZL008.dgn

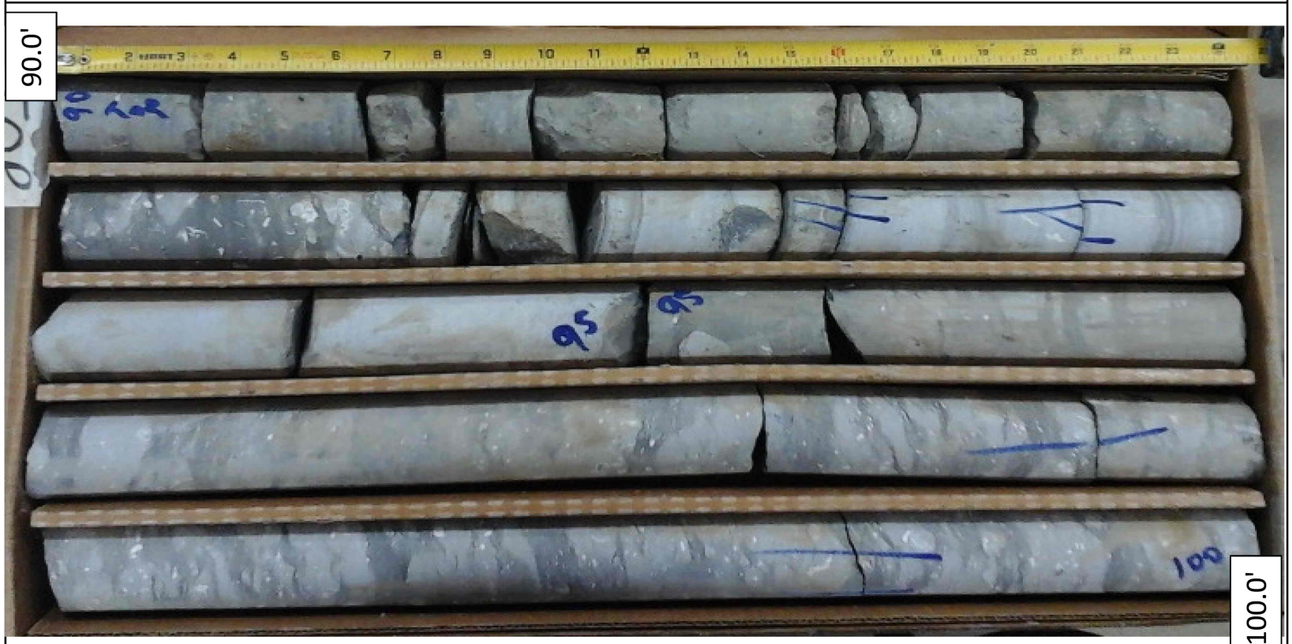
PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 660+34, 3' RT.	EXPLORATION ID B-004-1-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 422.9 (MSL) EOB: 16.5 ft.	PAGE 1 OF 1
START: 12-13-23 END: 12-13-23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.742890, -83.843552	

MATERIAL DESCRIPTION AND NOTES	ELEV. 422.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
LOOSE, BROWN, **FINE SAND**, WET		1	3 4 3	9	100	SS-1	-	-	-	-	-	-	-	-	-	17	A-3 (V)	
	F.S.	2 3 4 5																
@417.9' VERY DENSE	416.4	6	12 14 50/3"	-	93	SS-2	-	-	-	-	-	-	-	-	-	16	A-3 (V)	
		TR																
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG; RQD 72%, REC 100%.		7 8 9 10 11	52		100	NQ-1											CORE	
@414.4'-413.9'; Compressive Strength= 8,040 PSI		12 13 14 15 16	92		100	NQ-2											CORE	
	406.4	EOB																

NOTES: SURFACE ELEVATION= 506.4'. AUGERED DOWN TO 83.5' FEET FROM SURFACE TO THE ELEVATION OF 422.9'.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 25-3-24 18:14 - G:\2024\MARCH\25\22050074COL\22050074COL.GPJ

B-004-1-22



Run #:	Depth		Recovery		RQD	
NQ-1	90.0'	95.0'	31/60	52%	60/60	100%
NQ-2	95.0'	100.0'	55/60	92%	60/60	100%

BRO-52-12.43, PID 100897

CTL ENGINEERING INC

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P-78 / TOTAL 79	11 / TOTAL 12	100897	SM 03-27-24	N.K.S.	CTL ENGINEERING INC

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
BORING LOG AND ROCK CORE PHOTO FOR B-004-1-22

PROJECT NO:	22050074COL
DATE:	1/19/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

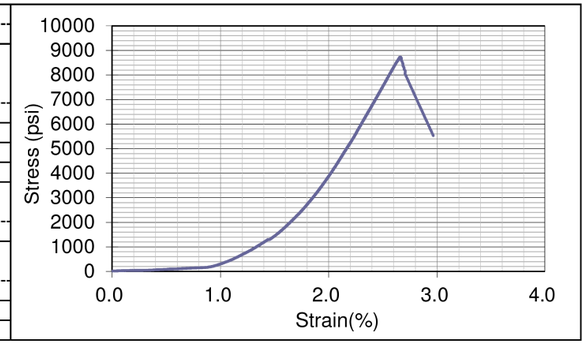
BORING NUMBER	B-001-1-22	TOP DEPTH(FT)	92.2	BOTTOM DEPTH(FT)	92.7
SAMPLE NUMBER	NQ-1	DISTRICT	9	PID NO.	100897
COUNTY	BRO	ROUTE	US-52	SECTION	12.43

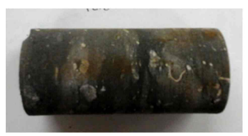
FORMATION	Ordovician Age Point Pleasant Formation
DESCRIPTION	Limestone, Gray, Slightly Weathered, Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.009	1.980
2	4.009	1.976
3	4.008	1.978
AVERAGE	4.009	1.978

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	538.0
UNIT WEIGHT(LBS/FT^3)	166.4

RATE OF LOADING (in/min)
0.09
COMPRESSIVE STRENGTH (PSI)
8,730
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.17
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room





BEFORE TESTING

AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

PROJECT NO:	22050074COL
DATE:	1/19/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

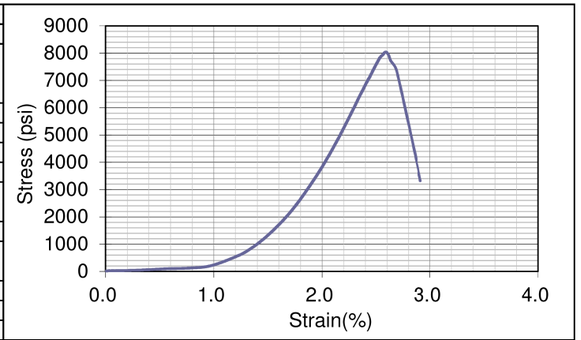
BORING NUMBER	B-004-1-22	TOP DEPTH(FT)	92.0	BOTTOM DEPTH(FT)	92.5
SAMPLE NUMBER	NQ-1	DISTRICT	9	PID NO.	100897
COUNTY	BRO	ROUTE	US-52	SECTION	12.43

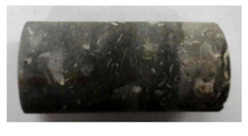
FORMATION	Ordovician Age Point Pleasant Formation
DESCRIPTION	Limestone, Gray, Slightly Weathered, Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.016	1.971
2	4.018	1.972
3	4.017	1.977
AVERAGE	4.017	1.973

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	539.1
UNIT WEIGHT(LBS/FT^3)	167.2

RATE OF LOADING (in/min)
0.10
COMPRESSIVE STRENGTH (PSI)
8,040
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.08
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room





BEFORE TESTING

AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-52-12.43 OVER REDOAK CREEK
COMPRESSIVE STRENGTH TEST RESULT

DESIGN AGENCY

CTL ENGINEERING INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-6377

DESIGNER	N.K.S
REVIEWER	SM 03-27-24
PROJECT ID	100897
SUBSET / TOTAL	12 / 12
SHEET / TOTAL	P.79 / 79

BRO-52-12.43

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 27-03-2024 TIME: 15:42:12 USER: hp
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APPENDIX B
TEST BORING RECORDS

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 657+03, 1' RT.
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 506.4 (MSL) EOB: 80.0 ft.
START: 10/11/22 END: 10/11/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743716, -83.844041

EXPLORATION ID B-001-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV. 506.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
ASPHALT, (2")	506.2																		
CONCRETE, (11")	505.3																		
STIFF, DARK BROWN, **CLAY**, "AND" SILT, TRACE SAND, DAMP	502.9	1																	
		2	4 4 5	12	67	SS-1	1.25	0	0	4	50	46	45	24	21	23	A-7-6 (13)	<100	
		3																	
HARD, BROWN, **SILTY CLAY**, SOME GRAVEL, LITTLE SAND, DAMP		4	4 6 6	16	100	SS-2	4.25	-	-	-	-	-	-	-	-	19	A-6b (V)	-	
		5																	
@6.0'; VERY STIFF	497.9	6																	
		7	7 28 17	59	67	SS-3	2.00	35	7	7	29	22	39	23	16	22	A-6b (5)	-	
		8																	
VERY STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP		9	3 5 6	15	100	SS-4	2.25	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
		10																	
@11.0'; MOIST		11																	
		12	4 6 8	19	100	SS-5	2.25	2	2	3	53	40	47	26	21	27	A-7-6 (14)	-	
	492.9	13																	
STIFF, GRAY, **ELASTIC CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP	490.4	14	3 4 6	13	100	SS-6	2.00	0	1	1	52	46	59	32	27	30	A-7-5 (19)	-	
		15																	
VERY STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, DAMP		16																	
		17	5 6 8	19	100	SS-7	3.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	
		18																	
@18.5'; HARD		19	4 7 9	21	100	SS-8	4.50	0	0	1	49	50	51	28	23	23	A-7-6 (15)	-	
		20																	
@21.0'; BROWN, LITTLE SAND		21																	
		22	5 17 22	52	100	SS-9	4.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)	-	
		23																	
		24	8 13 13	34	100	SS-10	4.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	-	
		25																	
@26.0'; VERY STIFF, TRACE SAND		26																	
		27	8 10 11	28	100	SS-11	4.00	0	1	4	52	43	45	22	23	22	A-7-6 (14)	-	
		28																	
@28.5'; STIFF		29	8 12 11	30	100	SS-12	1.75	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 657+03, 1' RT.	START: 10/11/22	END: 10/11/22	PG 2 OF 3	B-001-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, DAMP *(continued)*	476.4																		
@31.0'; VERY STIFF		31	4 6 11	22	100	SS-13	2.75	-	-	-	-	-	-	-	-	23	A-7-6 (V)	-	
	472.9	32																	
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, MOIST		33																	
		▽ 472.4 34	4 6 7	17	100	SS-14	1.50	1	11	30	41	17	25	17	8	18	A-4a (5)	-	
		35																	
@36.0'; MEDIUM STIFF, BROWN, WET		36	3 3 4	9	100	SS-15	0.50	-	-	-	-	-	-	-	-	31	A-4a (V)	-	
		37																	
@38.5'; SOFT, LITTLE GRAVEL, WET		38																	
		39	3 4 6	13	100	SS-16	0.25	-	-	-	-	-	-	-	-	21	A-4a (V)	-	
	462.9	40																	
STIFF, BROWN AND GRAY, **SILT**, SOME CLAY, LITTLE SAND, TRACE GRAVEL, MOIST		41																	
		42																	
		43																	
		44	4 5 7	16	100	SS-17	1.00	3	5	13	56	23	29	19	10	21	A-4b (8)	-	
	457.9	45																	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WET		46																	
		47																	
		48																	
		49	7 12 10	29	100	SS-18	0.50	3	19	18	40	20	27	17	10	12	A-4a (5)	-	
		50																	
		51																	
		52																	
		53																	
@53.5'; SOFT		54	4 6 8	19	100	SS-19	0.25	-	-	-	-	-	-	-	-	28	A-4a (V)	-	
		55																	
		56																	
		57																	
	447.9	58																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, WET		59	6 5 4	12	100	SS-20	-	0	12	76	8	4	NP	NP	NP	23	A-3a (0)	-	
		60																	
		61																	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 657+03, 1' RT.	START: 10/11/22	END: 10/11/22	PG 3 OF 3	B-001-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, WET *(continued)*	444.3	63																	
		64	4 7 10	22	100	SS-21	-	-	-	-	-	-	-	-	-	26	A-3a (V)	-	
		65																	
		66																	
		67																	
		68																	
		69	5 6 10	21	100	SS-22	-	-	-	-	-	-	-	-	-	17	A-3a (V)	-	
		70																	
		71																	
		72																	
		73																	
	432.9	74	5 8 12	26	100	SS-23	-	-	-	-	-	-	-	-	-	23	A-3 (V)	-	
MEDIUM DENSE, BROWN, **FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET		75																	
F.S.		76																	
		77																	
		78																	
		79	6 9 10	25	100	SS-24	-	3	18	69	7	3	NP	NP	NP	28	A-3 (0)	-	
	426.4	EOB 80																	

NOTES: CAVED AT ELEVATION 463.9'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 657+03, 1' RT.	EXPLORATION ID B-001-1-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 422.9 (MSL) EOB: 16.5 ft.	PAGE 1 OF 1
START: 12/11/23 END: 12/12/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743716, -83.844041	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE, BROWN, **FINE SAND**, WET	422.9	1	9 7 9	21	100	SS-1	-	-	-	-	-	-	-	-	-	29	A-3 (V)	-	
		2																	
		3																	
		4																	
@417.9' VERY DENSE		5	14 24 38	82	100	SS-2	-	-	-	-	-	-	-	-	-	18	A-3 (V)	-	
	416.4	6																	
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG; RQD 84%, REC 100%.		TR 7																	
		8																	
@414.2'-413.7'; Compressive Strength= 8,730 PSI		9	75		100	NQ-1											CORE		
		10																	
		11																	
		12																	
		13																	
		14	93		100	NQ-2											CORE		
		15																	
	406.4	16 EOB																	

NOTES: SURFACE ELEVATION= 506.39'. AUGERED DOWN TO 83.5' FEET FROM SURFACE TO THE ELEVATION OF 422.89'. CAVED AT ELEVATION 458.4'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 658+04, 10' RT.	EXPLORATION ID B-002-0-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 482.0 (MSL) EOB: 50.0 ft.	PAGE 1 OF 2
START: 10/17/22 END: 10/17/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743459, -83.843902	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST	482.0	482.0	3 3 4	9	100	SS-1	1.25	4	3	12	47	34	40	24	16	24	A-6b (10)	-	
@1.5'; GRAY AND BROWN, "AND" GRAVEL		1	4 4 3	9	100	SS-2	1.25	36	9	6	25	24	38	21	17	21	A-6b (5)	-	
MEDIUM STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, MOIST	479.0	2	3 4 6	13	100	SS-3	0.75	0	1	1	52	46	47	25	22	28	A-7-6 (14)	-	
@4.5'; SOFT		3 4	3 4 5	12	100	SS-4	0.25	0	1	1	51	47	46	25	21	29	A-7-6 (14)	-	
@6.0'; STIFF		5 6	3 4 8	16	100	SS-5	1.00	-	-	-	-	-	-	-	-	33	A-7-6 (V)	-	
@8.5'; MEDIUM STIFF	471.0	7 8 9	3 5 7	16	100	SS-6	0.50	-	-	-	-	-	-	-	-	32	A-7-6 (V)	-	
MEDIUM STIFF, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST		10 11	4 4 6	13	100	SS-7	0.75	2	9	17	42	30	37	21	16	21	A-6b (10)	-	
@13.5'; STIFF, WET		12 13 14	4 6 7	17	100	SS-8	1.00	-	-	-	-	-	-	-	-	29	A-6b (V)	-	
@16.0'; SOFT, LITTLE SAND	463.5	15 16 17	3 5 5	13	89	SS-9	0.25	-	-	-	-	-	-	-	-	23	A-6b (V)	-	
STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, WET		18 19	4 4 7	15	100	SS-10	-	3	10	35	37	15	22	16	6	23	A-4a (3)	-	
		20 21 22	3 4 5	12	83	SS-11	-	-	-	-	-	-	-	-	-	21	A-4a (V)	-	
MEDIUM DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET	458.5	23 24	3 4 4	11	100	SS-12	-	-	-	-	-	-	-	-	-	19	A-4a (V)	-	
		25 26 27	4 4 6	13	100	SS-13	-	2	9	39	43	7	NP	NP	NP	25	A-4a (3)	-	
		28 29	4 6 9	20	100	SS-14	-	-	-	-	-	-	-	-	-	21	A-4a (V)	-	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 658+04, 10' RT.	START: 10/17/22	END: 10/17/22	PG 2 OF 2	B-002-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE, BROWN, **SANDY SILT**, TRACE CLAY, TRACE GRAVEL, WET *(continued)*	452.0	31 32 33																	
@33.5'; GRAY		34 35	6 7 10	22	100	SS-15	0.25	-	-	-	-	-	-	-	-	24	A-4a (V)	-	
		36 37 38																	
		39 40	5 7 11	24	100	SS-16	0.25	-	-	-	-	-	-	-	-	37	A-4a (V)	-	
		41 42 43																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	438.5	44 45	7 9 12	28	100	SS-17	-	1	18	70	8	3	NP	NP	NP	23	A-3a (0)	-	
		46 47 48																	
	432.0	EOB 49 50	6 10 11	28	100	SS-18	-	-	-	-	-	-	-	-	-	30	A-3a (V)	-	

NOTES: CAVED AT ELEVATION 467.6'. BRIDGE TO TOP OF GROUND 24.0'; STARTED SAMPLING AT 24.0'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 1/19/24 09:54 - O:\PROJECT\2022\COL-0522050074COL_BRO-52-12-49 BRIDGE REPLACEMENT_KORDA NEMETH ENGINEERING IN

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 659+17, 14' RT.	EXPLORATION ID B-003-0-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 482.9 (MSL) EOB: 50.0 ft.	PAGE 1 OF 2
START: 10/17/22 END: 10/17/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.743171, -83.843744	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, WET	482.9	482.9	2 3 3	8	100	SS-1	0.50	0	1	3	57	39	45	26	19	35	A-7-6 (13)	-	
@1.5'; TRACE GRAVEL		1	3 2 4	8	100	SS-2	0.75	1	0	1	55	43	51	28	23	35	A-7-6 (15)	-	
@3.0'; SOFT, NO GRAVEL		2 3	2 3 3	8	100	SS-3	0.25	0	2	3	57	38	44	25	19	33	A-7-6 (12)	-	
@4.5'; MEDIUM STIFF, TRACE GRAVEL		4 5	3 4 5	12	100	SS-4	0.50	1	0	1	55	43	47	27	20	34	A-7-6 (13)	-	
@6.0'; STIFF, NO GRAVEL		6 7	4 6 5	15	100	SS-5	1.50	0	1	7	52	40	48	25	23	28	A-7-6 (15)	-	
		8																	
		9	4 3 7	13	100	SS-6	1.50	-	-	-	-	-	-	-	-	28	A-7-6 (V)	-	
		10																	
		11																	
		12	3 4 6	13	100	SS-7	0.50	-	-	-	-	-	-	-	-	30	A-7-6 (V)	-	
	469.4	13																	
STIFF, DARK BROWN, **SILT AND CLAY**, "AND" SAND, TRACE GRAVEL, WET		14	4 5 5	13	100	SS-8	1.00	-	-	-	-	-	-	-	-	53	A-6a (V)	-	
		15																	
@16.0'; SOFT		16																	
		17	3 5 6	15	89	SS-9	0.25	8	24	19	31	18	34	21	13	62	A-6a (4)	-	
	464.4	18																	
MEDIUM DENSE, GRAY, **SILT**, SOME SAND, TRACE CLAY, WET		19	3 3 5	11	100	SS-10	0.25	0	1	24	67	8	NP	NP	NP	31	A-4b (8)	-	
		20																	
		21																	
		22	3 4 6	13	83	SS-11	-	-	-	-	-	-	-	-	-	32	A-4b (V)	-	
	459.4	23																	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET		24	4 7 10	22	100	SS-12	-	0	56	37	4	3	NP	NP	NP	13	A-1-b (0)	-	
		25																	
		26																	
		27	7 4 12	21	100	SS-13	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	-	
		28																	
		29	5 7 12	25	100	SS-14	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 659+17, 14' RT.	START: 10/17/22	END: 10/17/22	PG 2 OF 2	B-003-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET *(continued)*	452.9	31																	
		32																	
		33																	
		34	5 8 14	29	100	SS-15	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	-	
		35																	
		36																	
		37																	
		38																	
		39	6 7 16	30	100	SS-16	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	-	
		40																	
		41																	
		42																	
		43																	
		44	7 10 11	28	100	SS-17	-	1	52	37	7	3	NP	NP	NP	12	A-1-b (0)	-	
		45																	
		46																	
		47																	
		48																	
		49	6 9 14	30	100	SS-18	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	-	
	432.9	50 EOB																	

NOTES: CAVED AT 466.4'. BRIDGE TO TOP OF WATER 25', STARTED SAMPLING AT 28', 3' OF WATER

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH BENTONITE GROUT

PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 660+34, 3' RT.	EXPLORATION ID B-004-0-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 506.4 (MSL) EOB: 80.0 ft.	PAGE 1 OF 3
START: 10/12/22 END: 10/13/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.742890, -83.843552	

MATERIAL DESCRIPTION AND NOTES	ELEV. 506.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
ASPHALT, (2")	506.2																		
CONCRETE, (10")	505.4																		
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, MOIST		1	7 10 9	25	72	SS-1	1.50	7	5	12	45	31	33	20	13	32	A-6a (9)	<100	
		2																	
		3																	
		4	4 4 6	13	78	SS-2	2.00	-	-	-	-	-	-	-	-	29	A-6a (V)	-	
		5																	
	500.4	6																	
HARD, DARK GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, DAMP		7	7 12 19	41	100	SS-3	-	18	26	20	26	10	27	21	6	9	A-4a (0)	-	
	497.9	8																	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, MOIST		9	3 4 6	13	100	SS-4	4.00	-	-	-	-	-	-	-	-	26	A-6a (V)	-	
		10																	
@11.0'; STIFF		11																	
		12	4 6 5	15	100	SS-5	1.75	0	0	13	60	27	31	20	11	20	A-6a (8)	-	
		13																	
		14	3 3 5	11	100	SS-6	1.25	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		15																	
@16.0'; SOME SAND		16																	
		17	3 4 5	12	100	SS-7	1.50	0	1	20	56	23	30	19	11	22	A-6a (8)	-	
		18																	
@18.5'; VERY STIFF, DAMP		19	3 4 4	11	100	SS-8	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		20																	
@21.0'; STIFF, MOIST		21																	
		22	3 4 6	13	100	SS-9	1.50	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
	482.9	23																	
STIFF, GRAY, **ELASTIC CLAY**, "AND" SILT, TRACE SAND, MOIST		24	3 4 5	12	100	SS-10	1.50	0	0	2	55	43	57	33	24	35	A-7-5 (17)	-	
	480.4	25																	
STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, MOIST		26																	
		27	4 7 9	21	100	SS-11	1.75	-	-	-	-	-	-	-	-	26	A-7-6 (V)	-	
		28																	
@28.5'; VERY STIFF		29	4 4 6	13	100	SS-12	2.50	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 660+34, 3' RT.	START: 10/12/22	END: 10/13/22	PG 2 OF 3	B-004-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
STIFF, GRAY, **CLAY**, "AND" SILT, TRACE SAND, MOIST *(continued)*	476.4		4 7 8	20	100	SS-13	2.25	0	1	1	54	44	49	25	24	25	A-7-6 (15)	-	
		▽ 472.4	4 6 7	17	100	SS-14	2.00	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	
@36.0'; STIFF			4 6 8	19	100	SS-15	1.75	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	
			4 5 7	16	100	SS-16	1.50	-	-	-	-	-	-	-	-	26	A-7-6 (V)	-	
	462.9																		
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, WET			5 11 14	33	100	SS-17	0.50	29	11	19	27	14	28	18	10	25	A-4a (1)	-	
@48.5'; SOFT			4 11 14	33	100	SS-18	0.25	-	-	-	-	-	-	-	-	31	A-4a (V)	-	
	452.9																		
DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET			6 9 16	33	100	SS-19	-	2	25	62	8	3	NP	NP	NP	32	A-3a (0)	-	
	447.9																		
STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, WET			4 4 9	17	100	SS-20	1.50	-	-	-	-	-	-	-	-	53	A-4b (V)	-	

PID: 100897	SFN: 0801119	PROJECT: BRO-US 52-12.43	STATION / OFFSET: 660+34, 3' RT.	START: 10/12/22	END: 10/13/22	PG 3 OF 3	B-004-0-22

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, WET *(continued)*	444.3	63																	
		64	5 6 12	24	100	SS-21	0.25	0	0	1	81	18	26	21	5	25	A-4b (8)	-	
		65																	
		66																	
		67																	
		68																	
	437.9	69	6 12 13	33	94	SS-22	-	-	-	-	-	-	-	-	-	21	A-3a (V)	-	
DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET		70																	
		71																	
		72																	
		73																	
@73.5'; MEDIUM DENSE		74	11 9 13	29	89	SS-23	-	-	-	-	-	-	-	-	-	26	A-3a (V)	-	
		75																	
		76																	
		77																	
		78																	
		79	6 12 10	29	89	SS-24	-	-	-	-	-	-	-	-	-	31	A-3a (V)	-	
	426.4	EOB 80																	

NOTES: CAVED AT 465.8'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 1/19/24 09:54 - O:\PROJECT\2022\COL-05\220500074COL_BRO-52-12-49 BRIDGE REPLACEMENT_KORDA NEMETH ENGINEERING IN

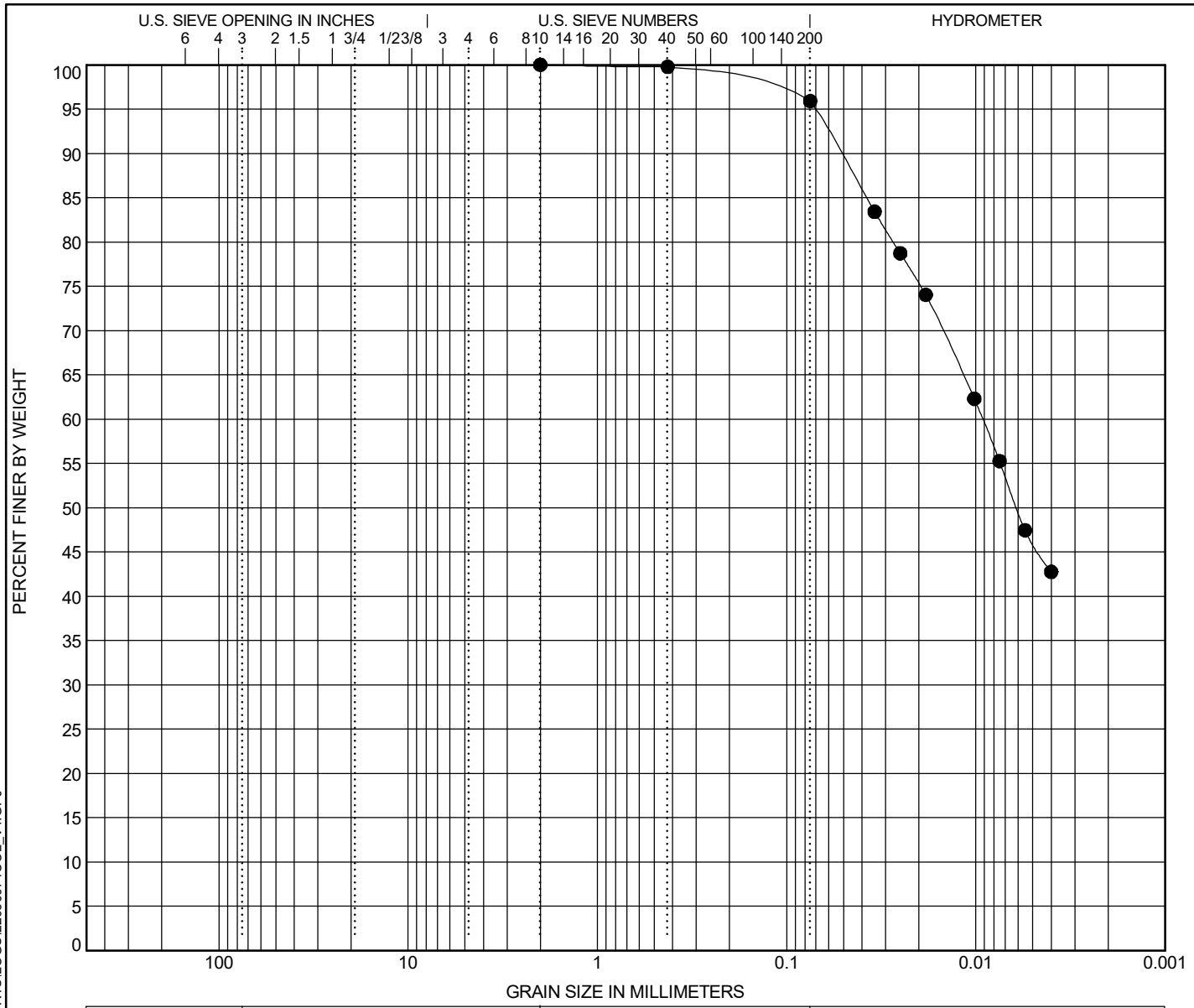
PROJECT: BRO-US 52-12.43	DRILLING FIRM / OPERATOR: CTL / T.MILLER	DRILL RIG: CME 55 #393	STATION / OFFSET: 660+34, 3' RT.	EXPLORATION ID B-004-1-22
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / T.MILLER	HAMMER: CME AUTOMATIC	ALIGNMENT: US 52	
PID: 100897 SFN: 0801119	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 422.9 (MSL) EOB: 16.5 ft.	PAGE 1 OF 1
START: 12/13/23 END: 12/13/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.742890, -83.843552	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
LOOSE, BROWN, **FINE SAND**, WET	422.9	1	3 4 3	9	100	SS-1	-	-	-	-	-	-	-	-	-	17	A-3 (V)	-	
		2																	
		3																	
		4																	
@417.9' VERY DENSE		5	12 14 50/3"	-	93	SS-2	-	-	-	-	-	-	-	-	-	16	A-3 (V)	-	
	416.4	6																	
		TR																	
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG; RQD 72%, REC 100%.		7																	
		8																	
@414.4'-413.9'; Compressive Strength= 8,040 PSI		9	52		100	NQ-1											CORE		
		10																	
		11																	
		12																	
		13																	
		14	92		100	NQ-2											CORE		
		15																	
	406.4	16																	
		EOB																	

NOTES: SURFACE ELEVATION= 506.4'. AUGERED DOWN TO 83.5' FEET FROM SURFACE TO THE ELEVATION OF 422.9'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH BENTONITE GROUT

APPENDIX C
LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**2.0**	**A-7-6(13)**	**23**	**45**	**24**	**21**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**2.0**	**2**	**0.009**	**0.006**			**0**	**0**	**4**	**50**	**46**

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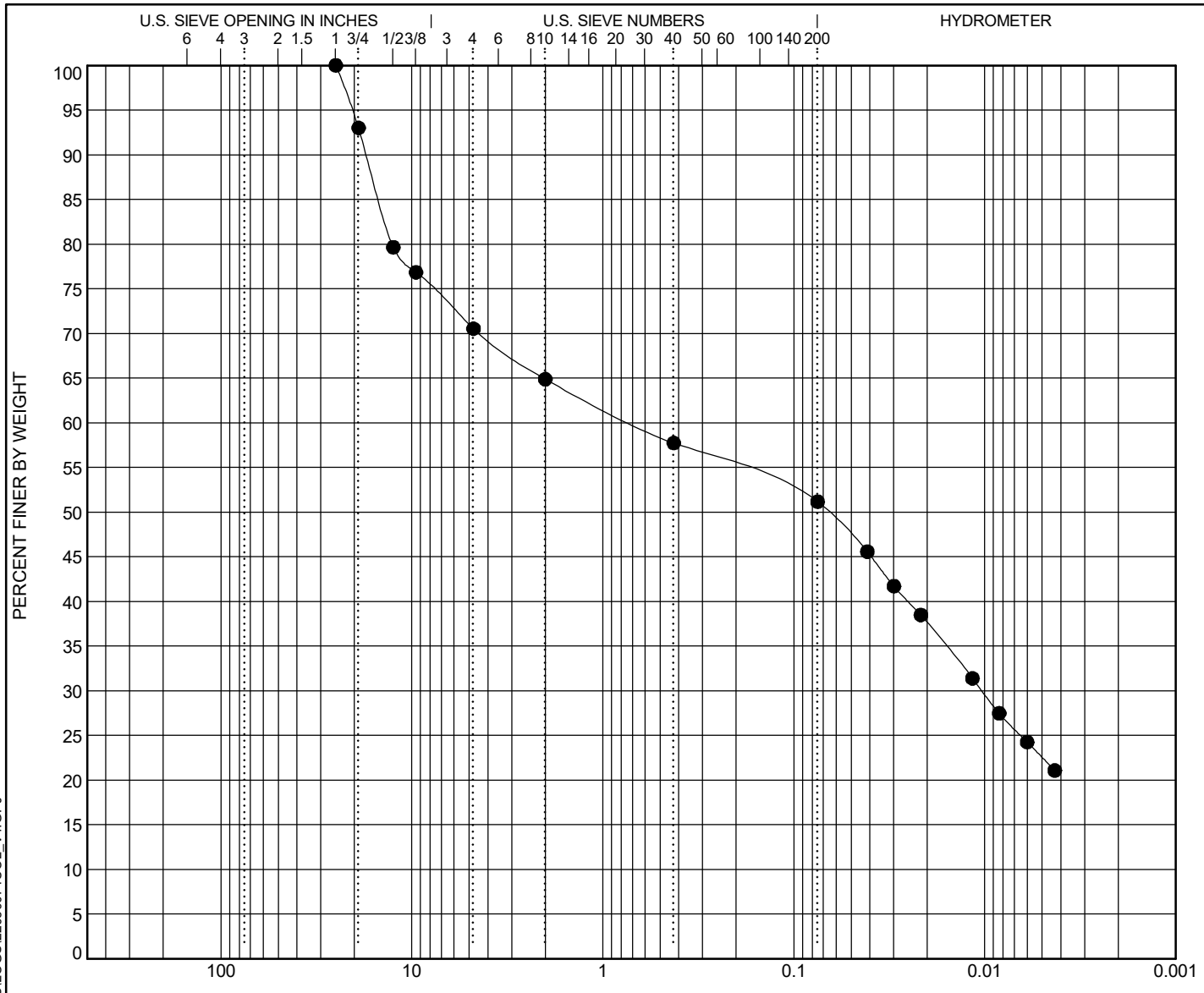
GRAIN SIZE DISTRIBUTION

Project: BRO-52-12.452
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**6.0**	**A-6b(5)**	**22**	**39**	**23**	**16**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**6.0**	**25**	**0.696**	**0.066**	**0.01**		**35**	**7**	**7**	**29**	**22**

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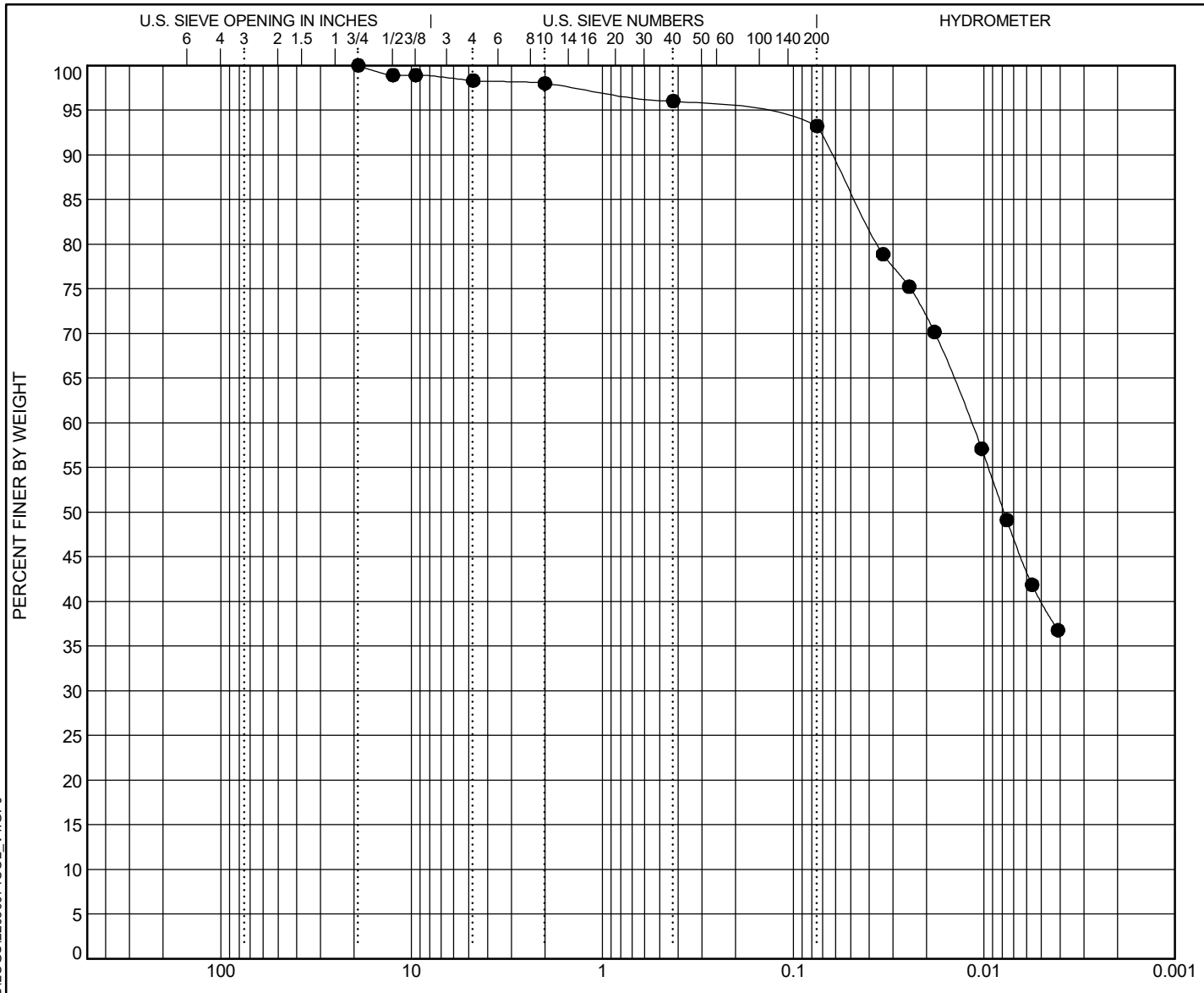

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**11.0**	**A-7-6(14)**	**27**	**47**	**26**	**21**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**11.0**	**19**	**0.012**	**0.008**			**2**	**2**	**3**	**53**	**40**

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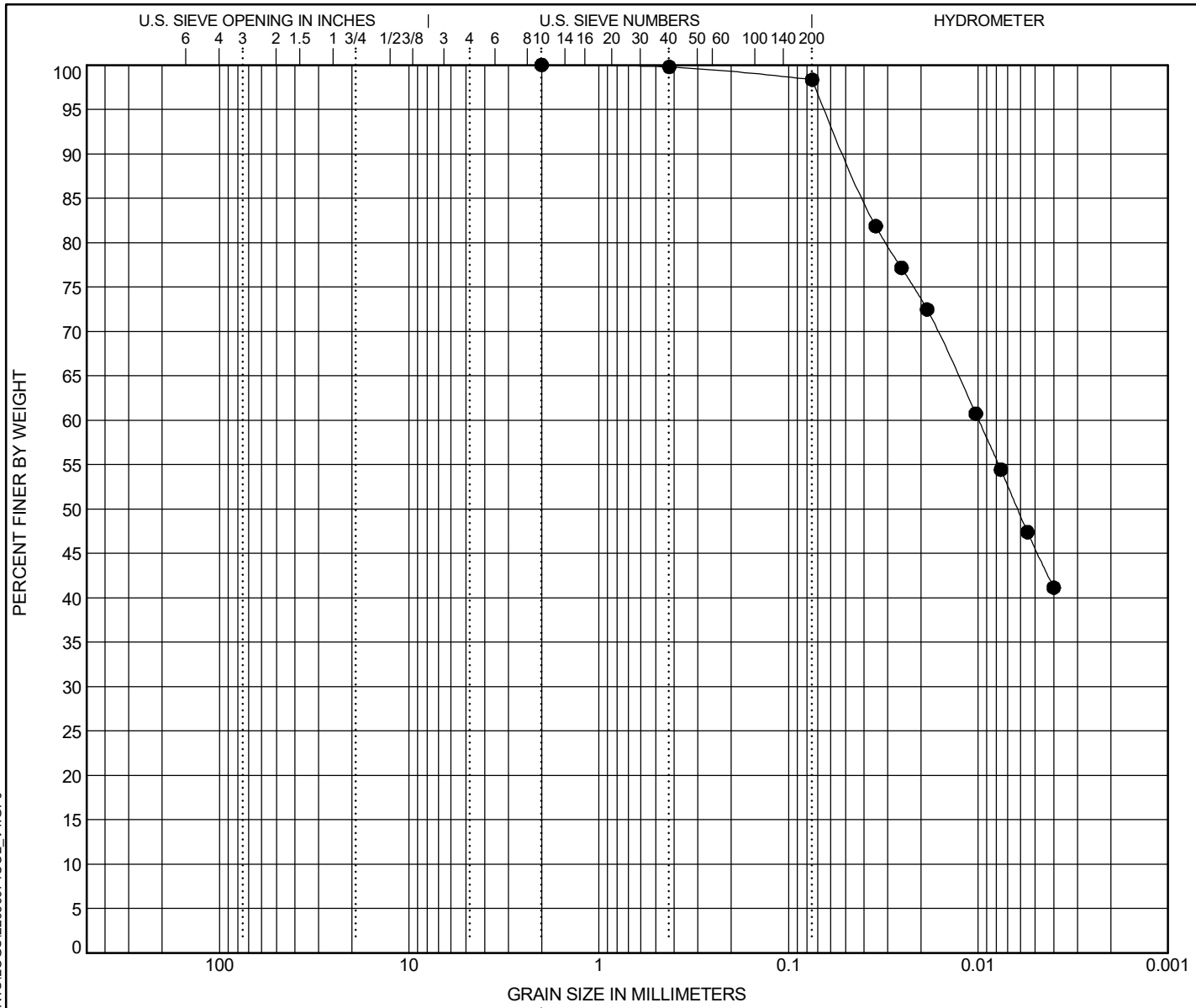

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**13.5**	**A-7-5(19)**	**30**	**59**	**32**	**27**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**13.5**	**2**	**0.01**	**0.006**			**0**	**1**	**1**	**52**	**46**

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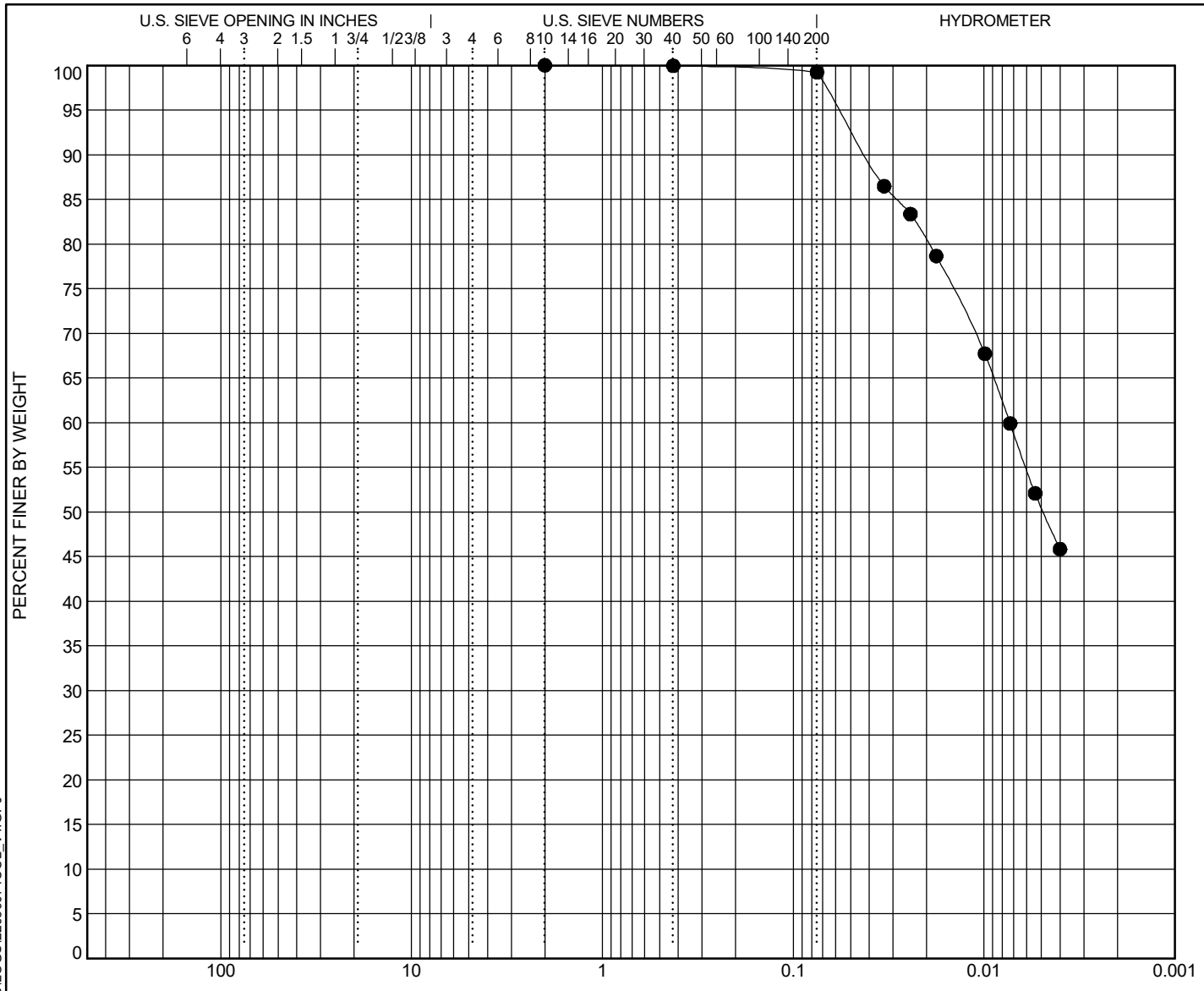

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**18.5**	**A-7-6(15)**	**23**	**51**	**28**	**23**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**18.5**	**2**	**0.007**	**0.005**			**0**	**0**	**1**	**49**	**50**

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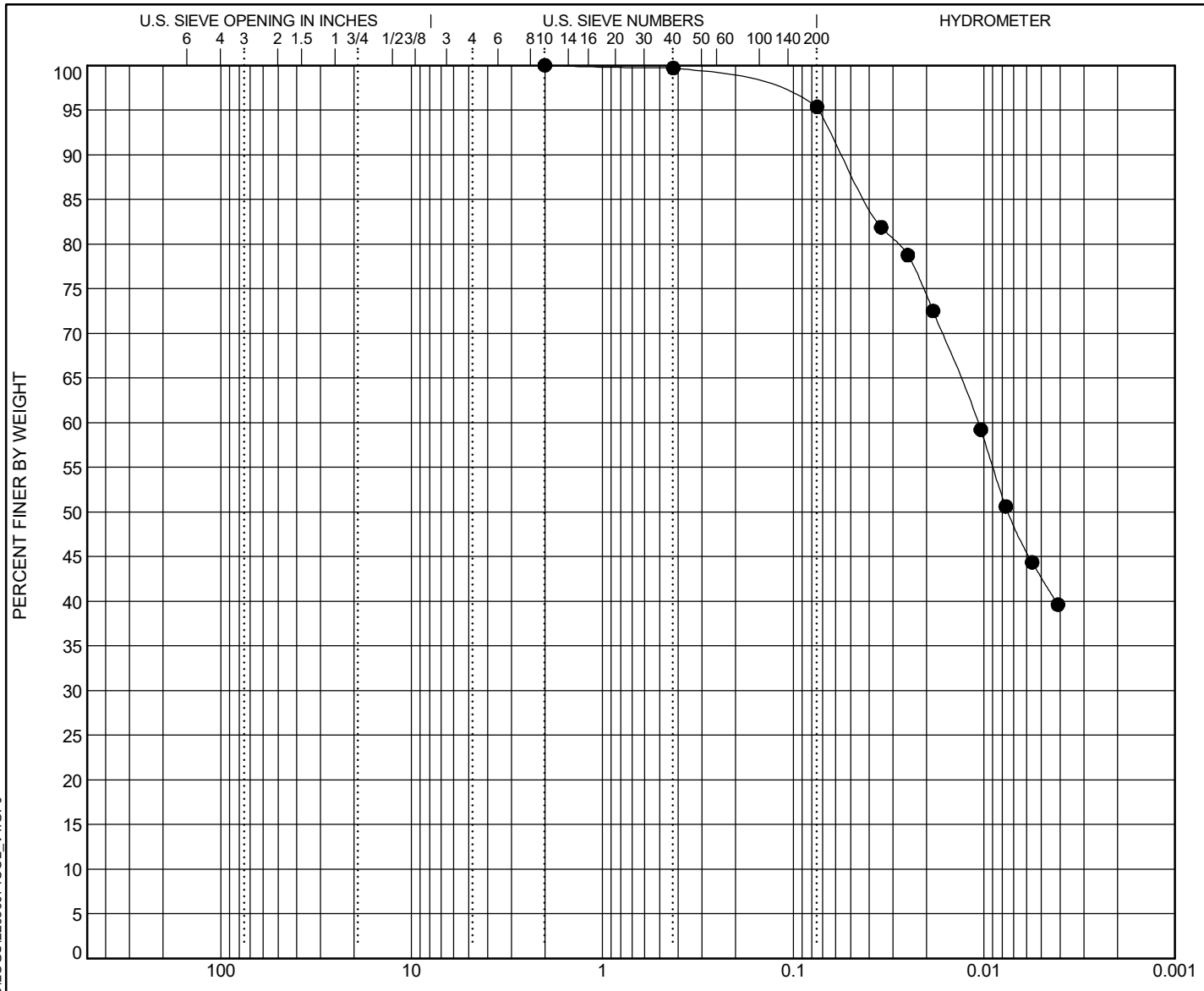

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**26.0**	**A-7-6(14)**	**22**	**45**	**22**	**23**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**26.0**	**2**	**0.011**	**0.007**			**0**	**1**	**4**	**52**	**43**

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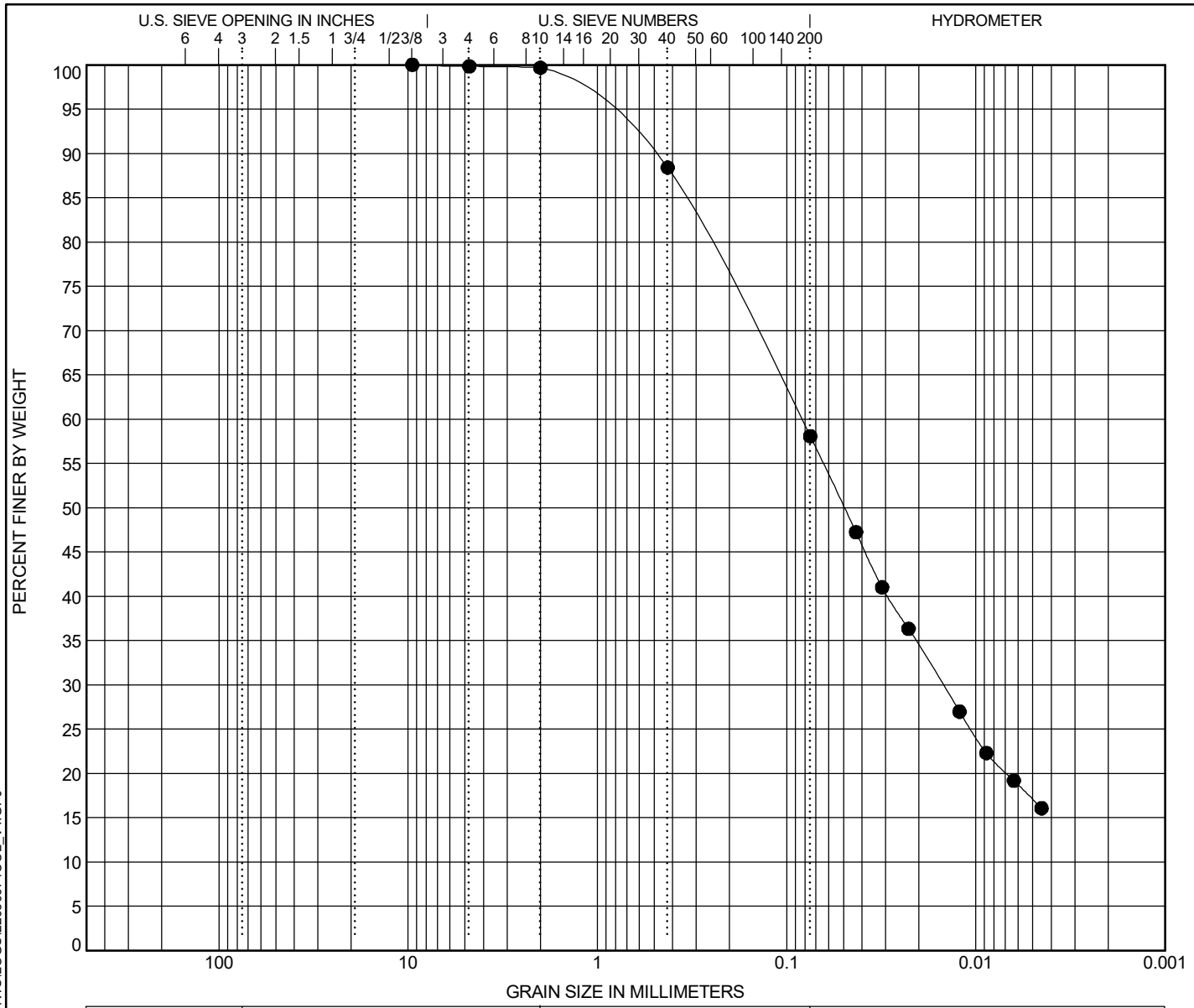

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**33.5**	**A-4a(5)**	**18**	**25**	**17**	**8**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**33.5**	**9.5**	**0.084**	**0.05**	**0.015**		**1**	**11**	**30**	**41**	**17**

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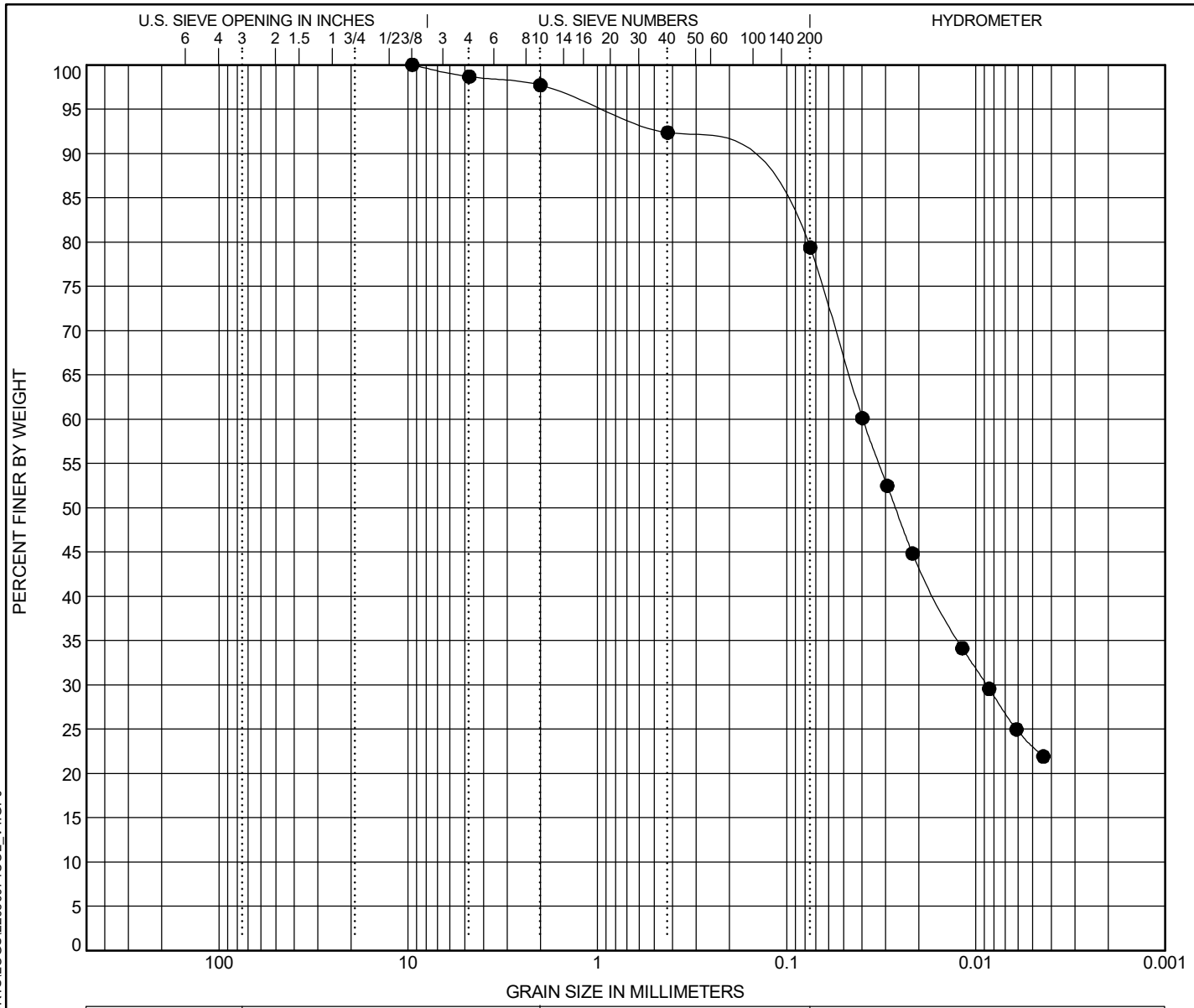

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**43.5**	**A-4b(8)**	**21**	**29**	**19**	**10**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**43.5**	**9.5**	**0.04**	**0.027**	**0.009**		**3**	**5**	**13**	**56**	**23**

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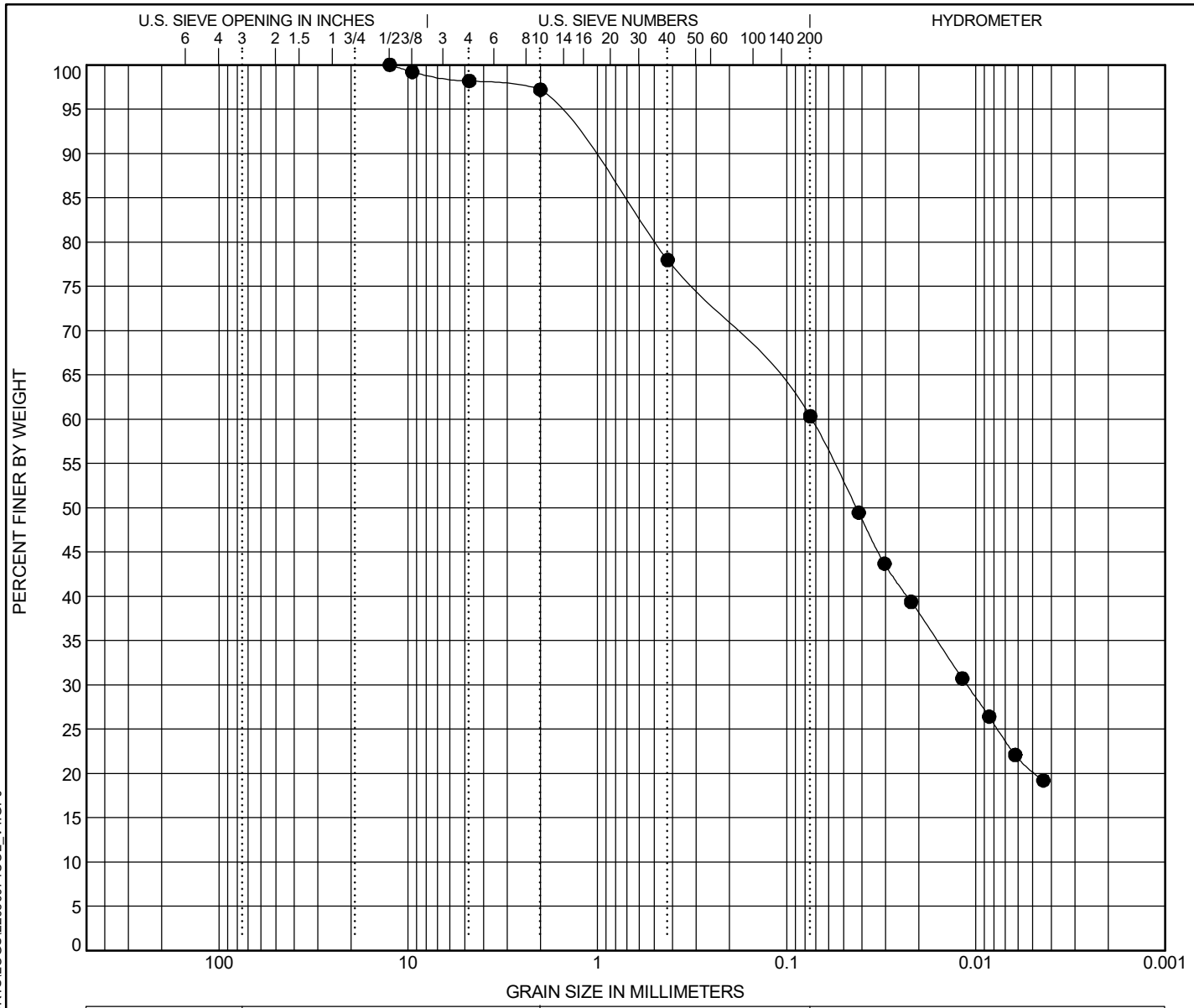

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**48.5**	**A-4a(5)**	**12**	**27**	**17**	**10**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**48.5**	**12.5**	**0.074**	**0.043**	**0.011**		**3**	**19**	**18**	**40**	**20**

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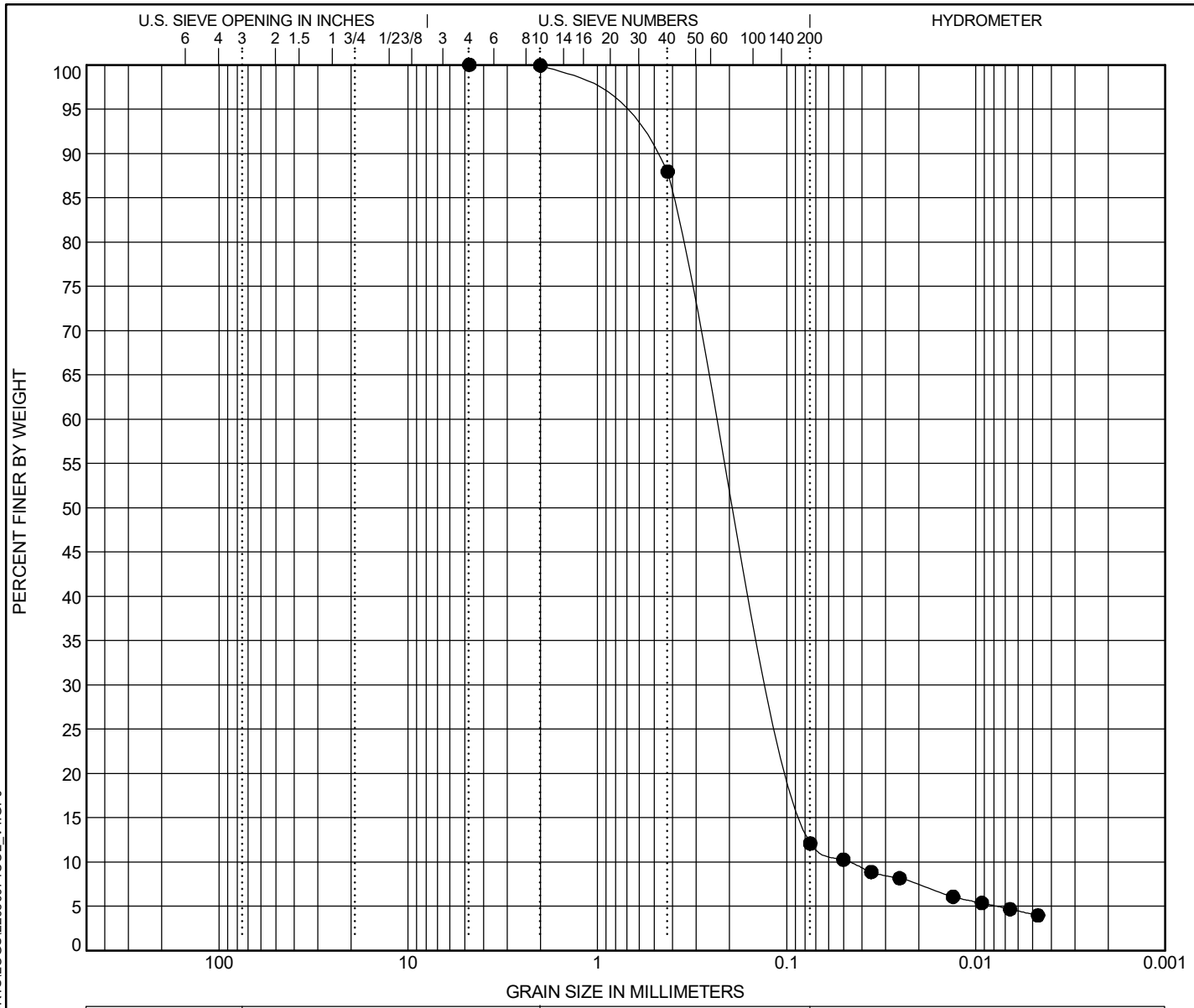

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**58.5**	**A-3a(0)**	**23**	**NP**	**NP**	**NP**	**1.21**	**4.75**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**58.5**	**4.75**	**0.224**	**0.179**	**0.113**	**0.047**	**0**	**12**	**76**	**8**	**4**

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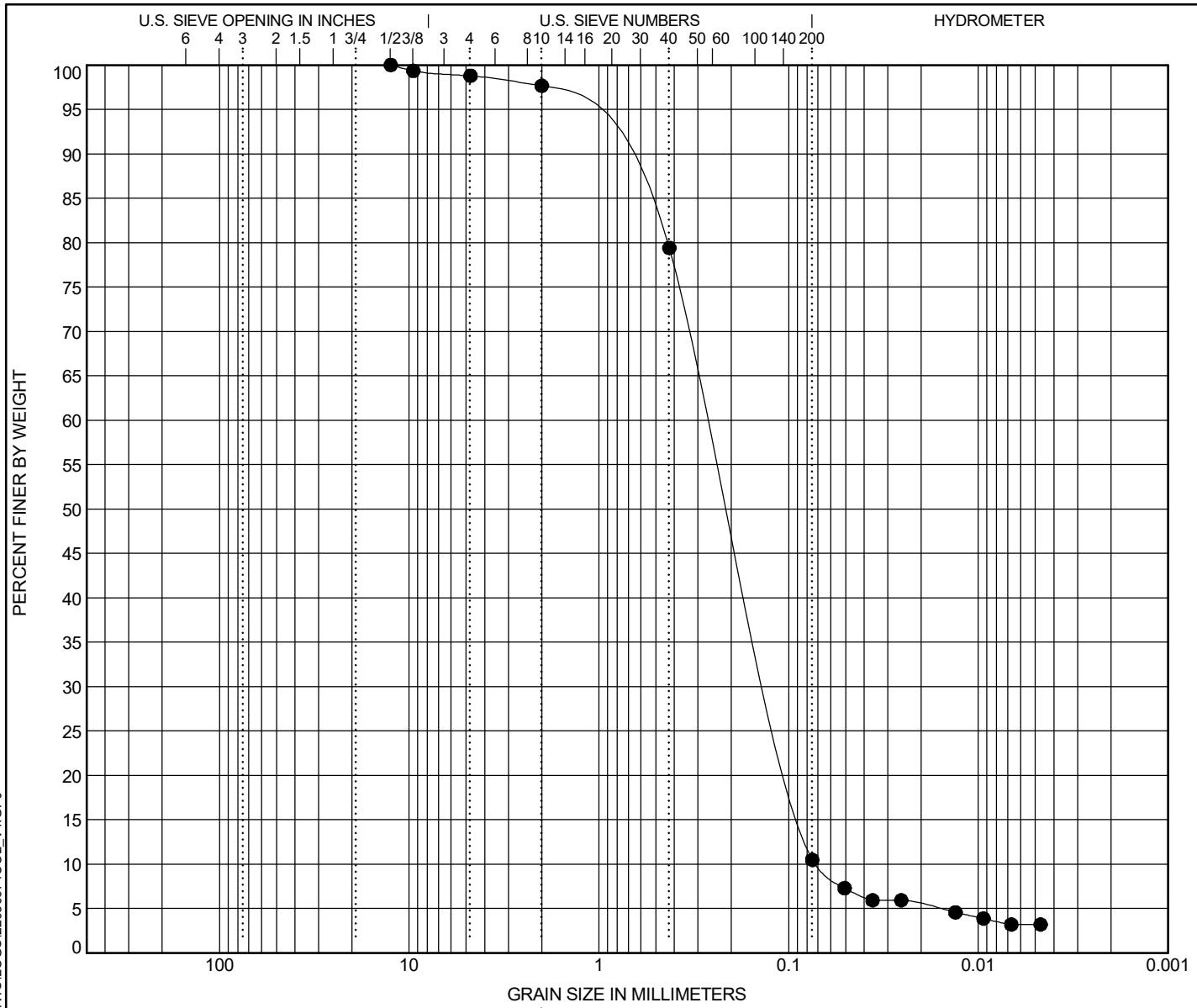

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-22	**78.5**	**A-3(0)**	**28**	**NP**	**NP**	**NP**	**0.81**	**3.68**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-22	**78.5**	**12.5**	**0.261**	**0.203**	**0.123**	**0.071**	**3**	**18**	**69**	**7**	**3**

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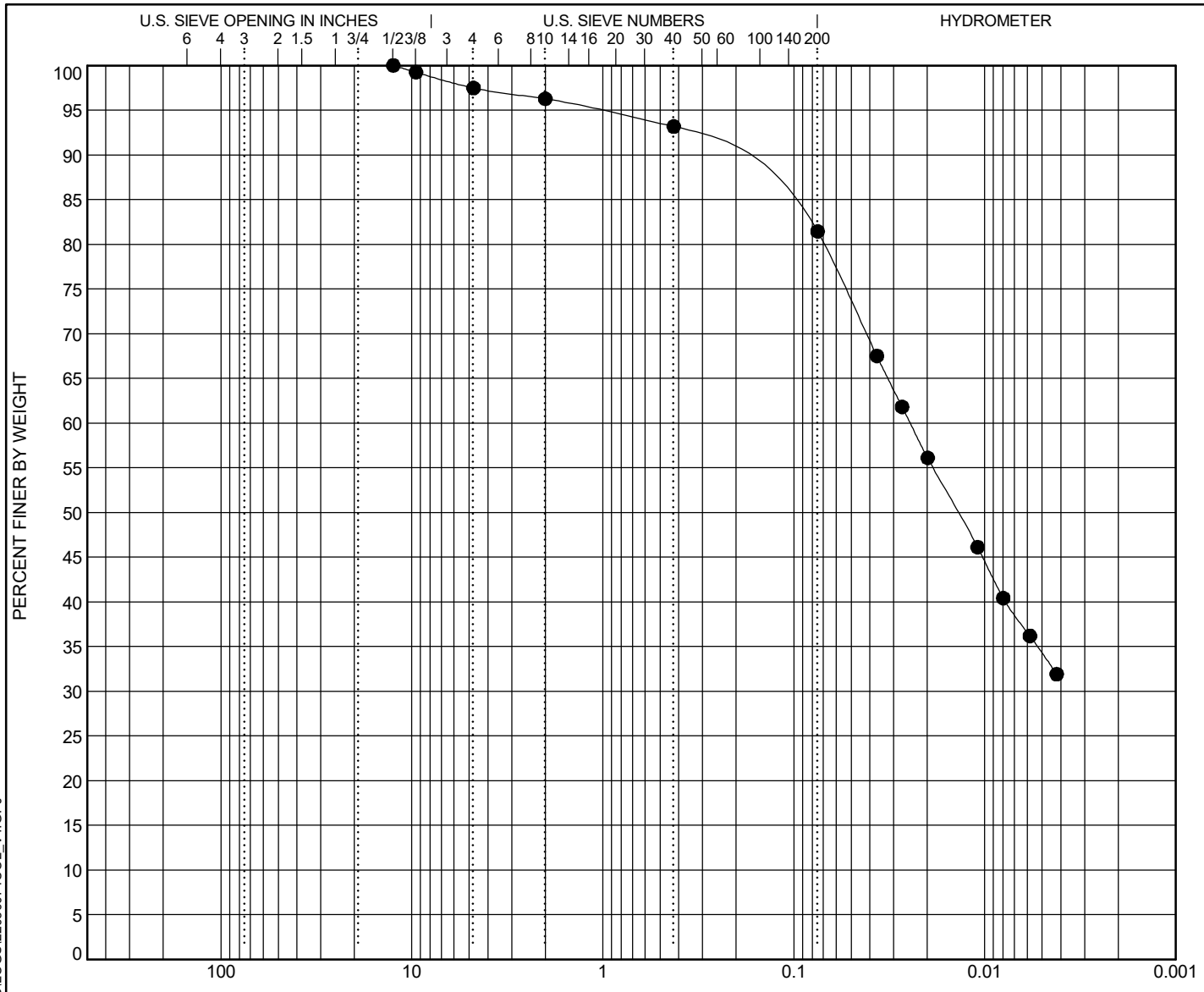
GRAIN SIZE DISTRIBUTION

Project: BRO-52-12.452
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**0.0**	**A-6b(10)**	**24**	**40**	**24**	**16**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**0.0**	**12.5**	**0.025**	**0.014**			**4**	**3**	**12**	**47**	**34**

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GRAIN SIZE DISTRIBUTION

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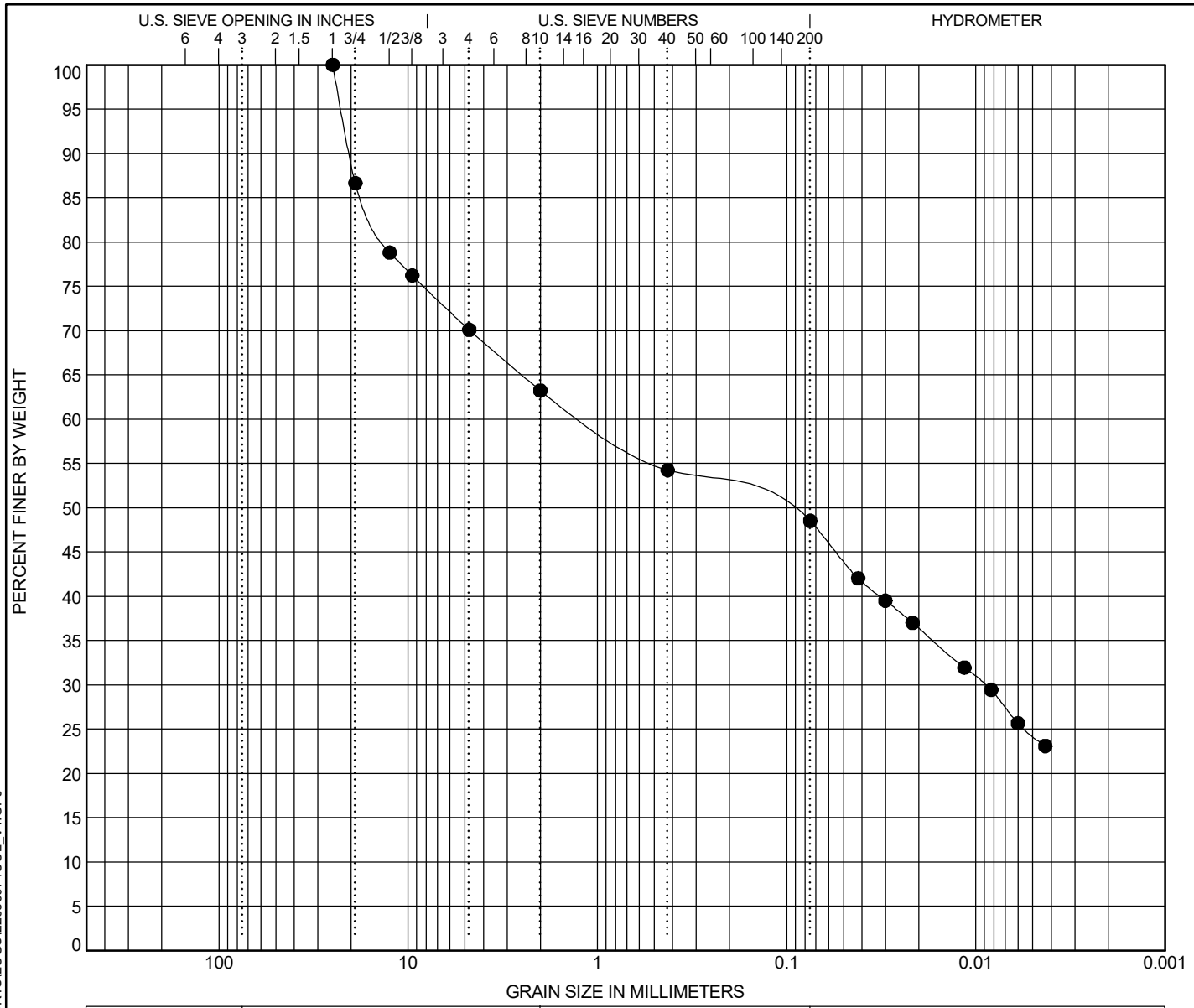
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**1.5**	**A-6b(5)**	**21**	**38**	**21**	**17**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**1.5**	**25**	**1.149**	**0.118**	**0.009**		**36**	**9**	**6**	**25**	**24**

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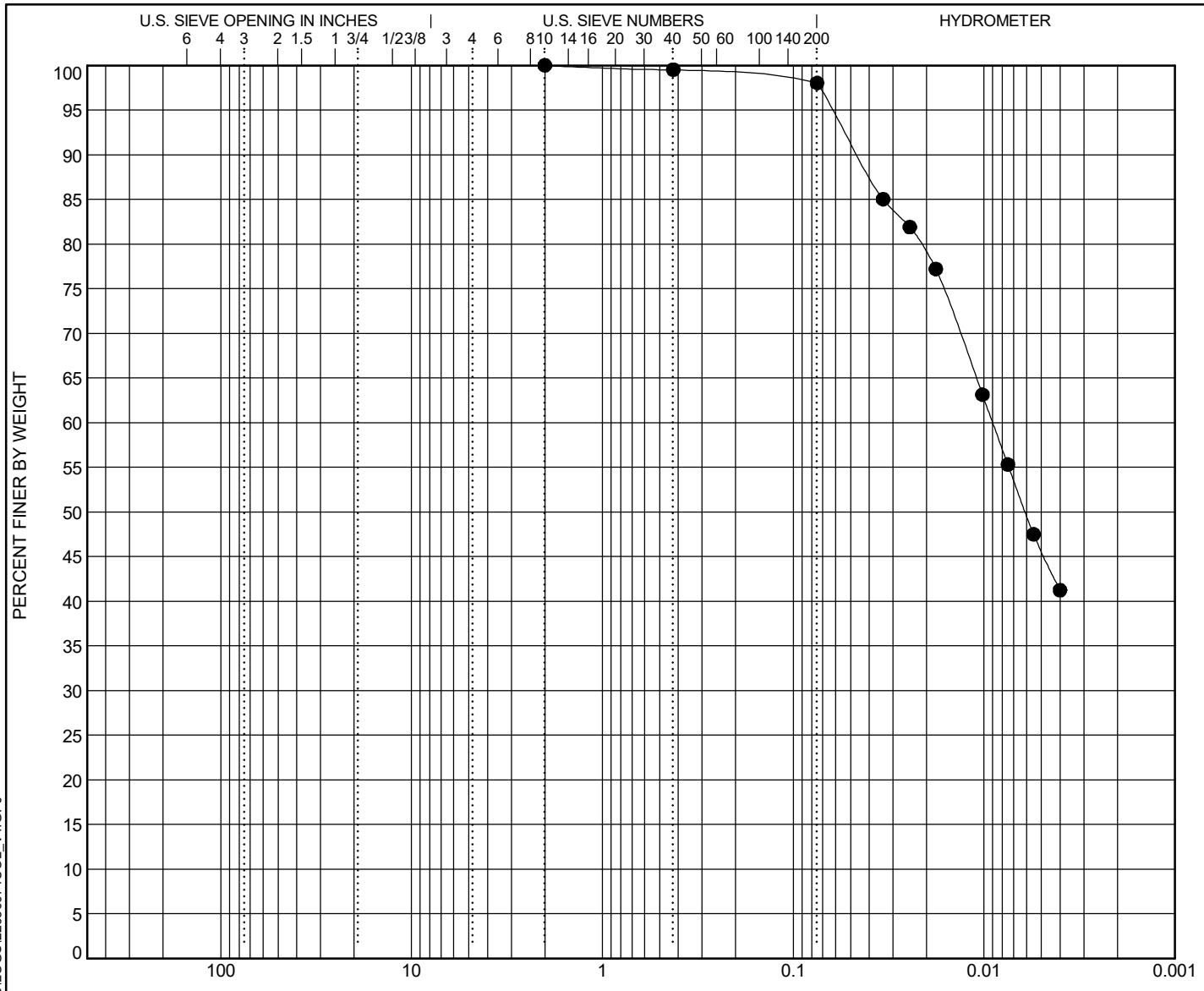

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**3.0**	**A-7-6(14)**	**28**	**47**	**25**	**22**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**3.0**	**2**	**0.009**	**0.006**			**0**	**1**	**1**	**52**	**46**

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GRAIN SIZE DISTRIBUTION

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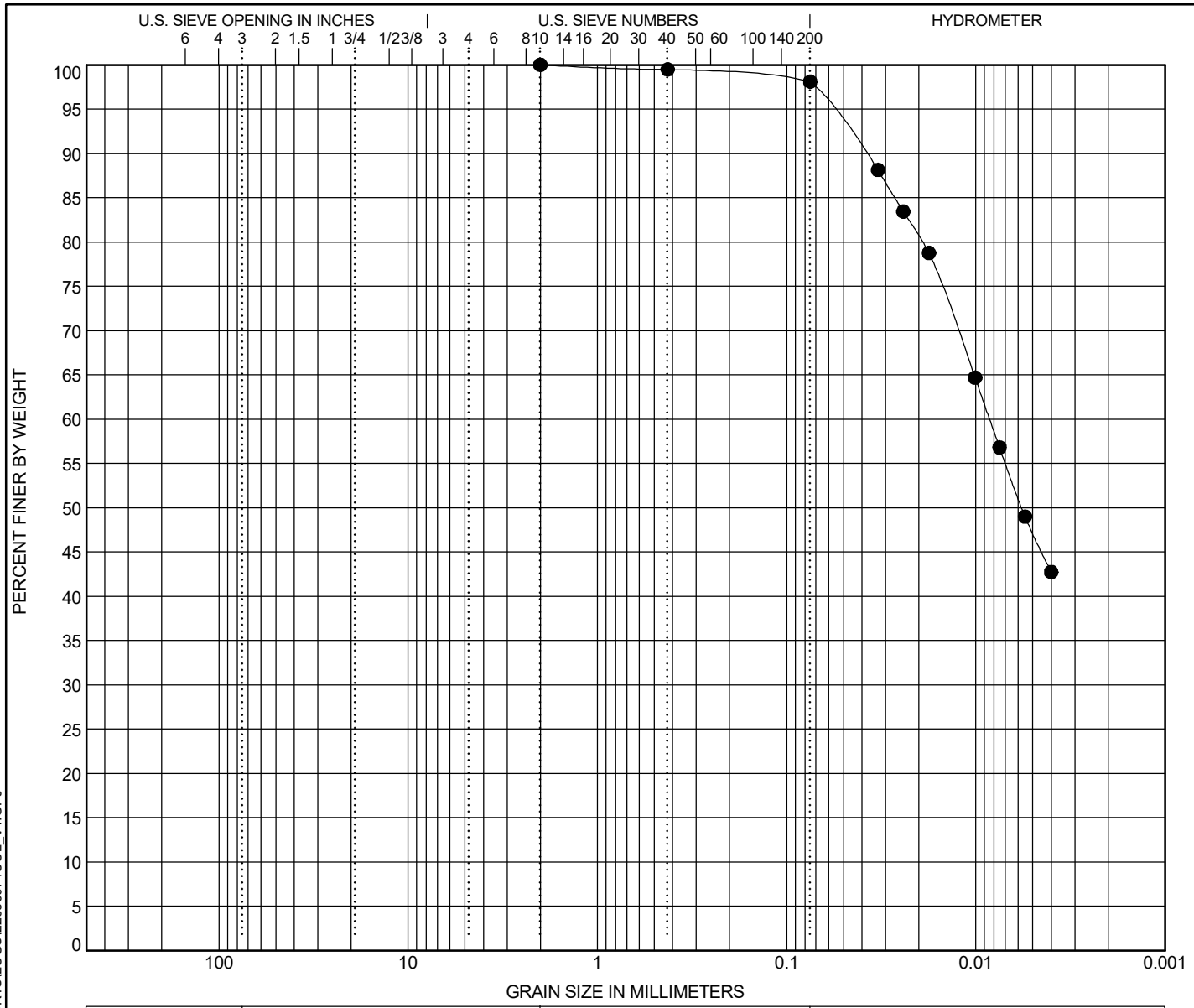
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**4.5**	**A-7-6(14)**	**29**	**46**	**25**	**21**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**4.5**	**2**	**0.008**	**0.006**			**0**	**1**	**1**	**51**	**47**

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GRAIN SIZE DISTRIBUTION

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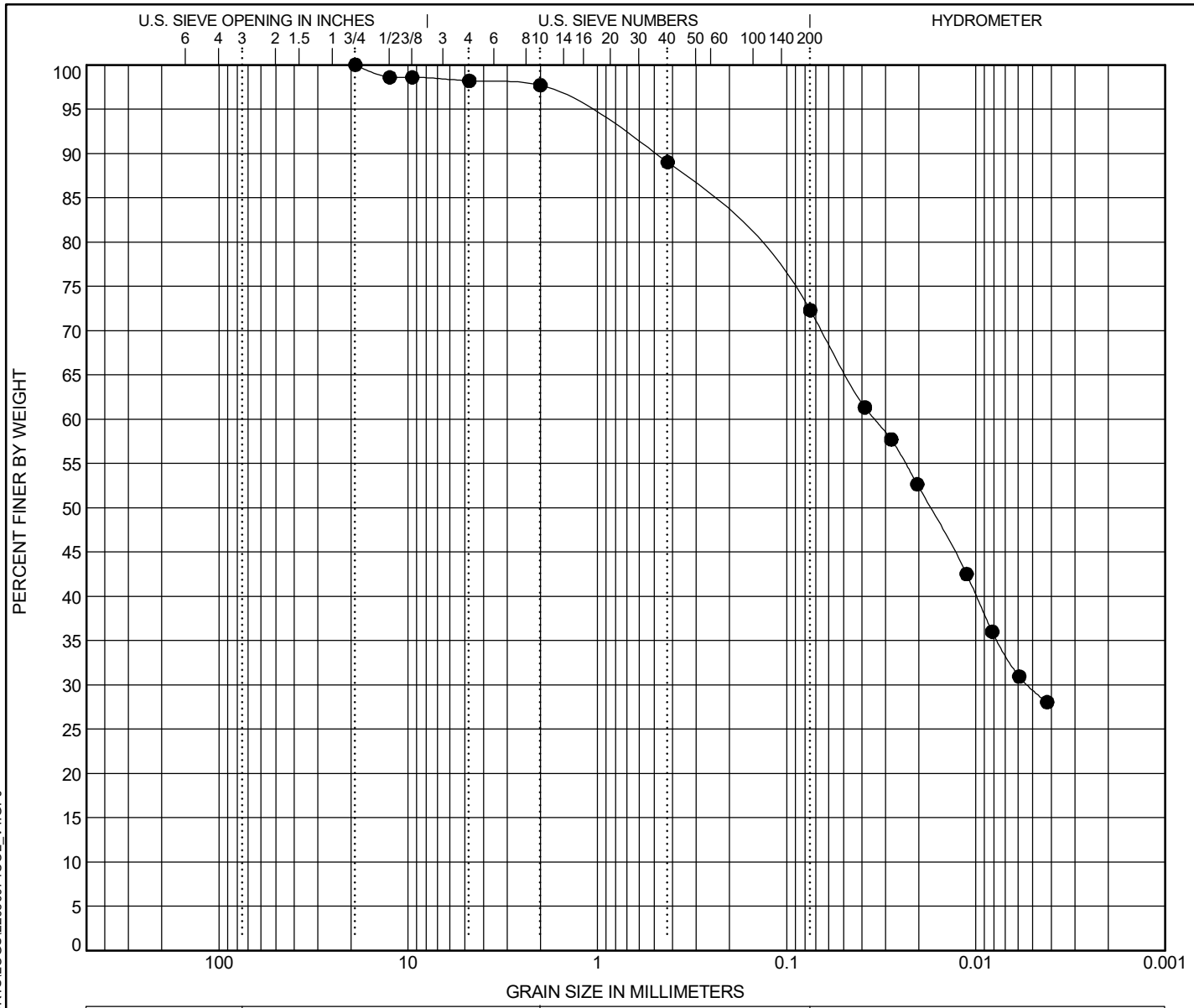
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**11.0**	**A-6b(10)**	**21**	**37**	**21**	**16**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**11.0**	**19**	**0.034**	**0.017**	**0.005**		**2**	**9**	**17**	**42**	**30**

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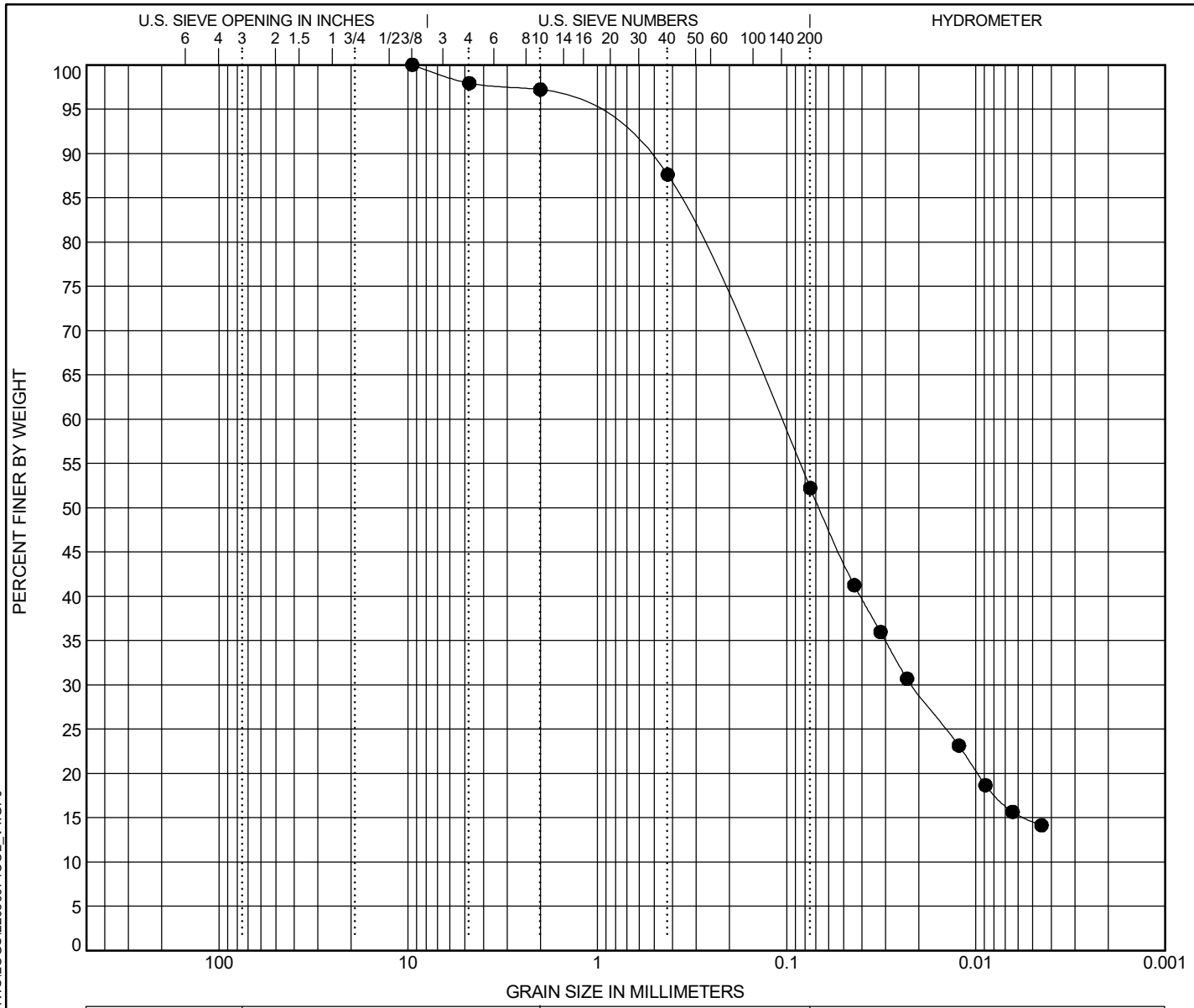

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**18.5**	**A-4a(3)**	**23**	**22**	**16**	**6**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**18.5**	**9.5**	**0.11**	**0.067**	**0.022**		**3**	**10**	**35**	**37**	**15**

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Location:BRO COUNTY
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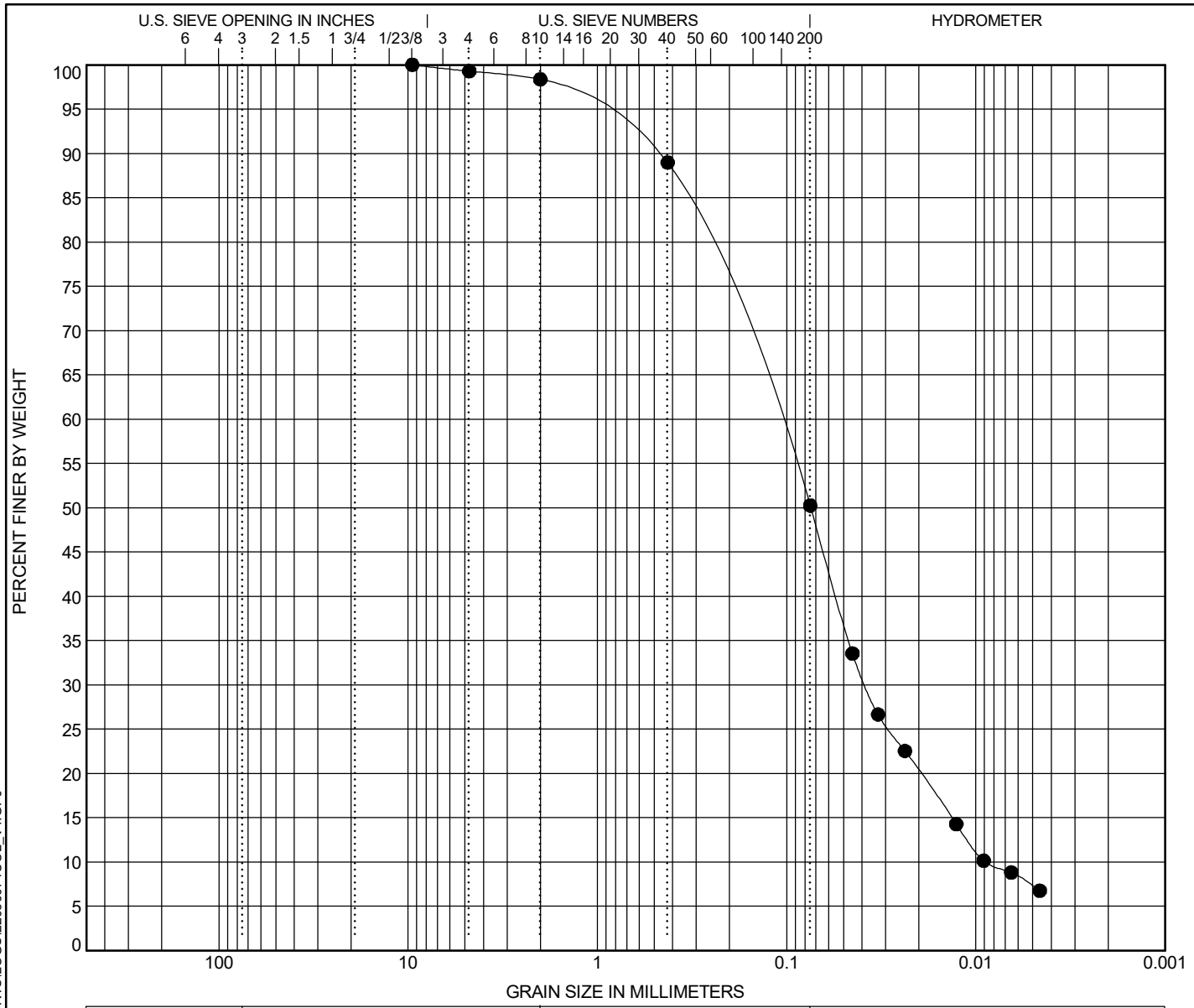

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**26.0**	**A-4a(0)**	**25**	**NP**	**NP**	**NP**	**1.43**	**13.19**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**26.0**	**9.5**	**0.116**	**0.074**	**0.038**	**0.009**	**2**	**9**	**39**	**43**	**7**

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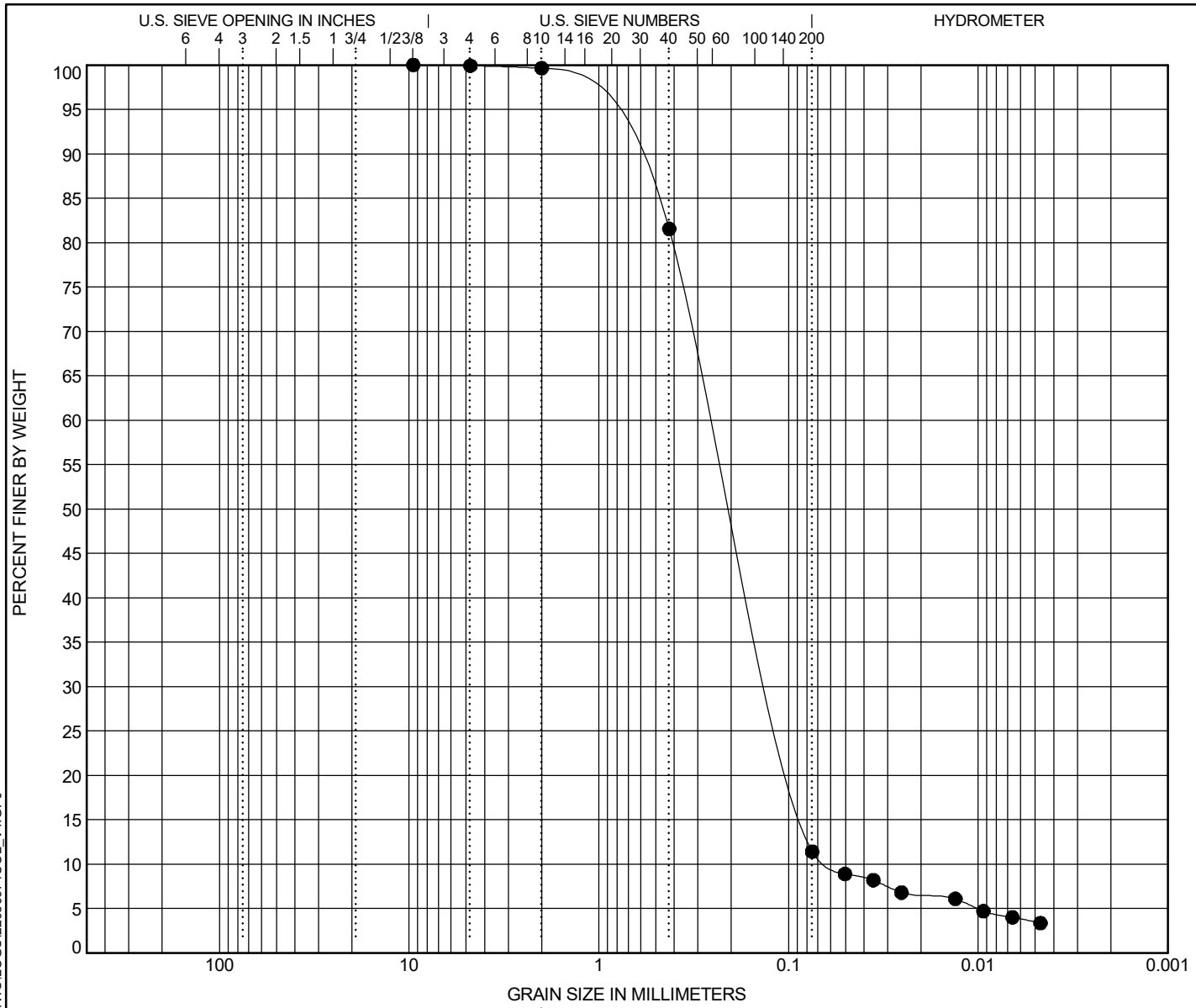

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-22	**43.5**	**A-3a(0)**	**23**	**NP**	**NP**	**NP**	**0.94**	**4.14**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-22	**43.5**	**9.5**	**0.25**	**0.195**	**0.119**	**0.06**	**1**	**18**	**70**	**8**	**3**

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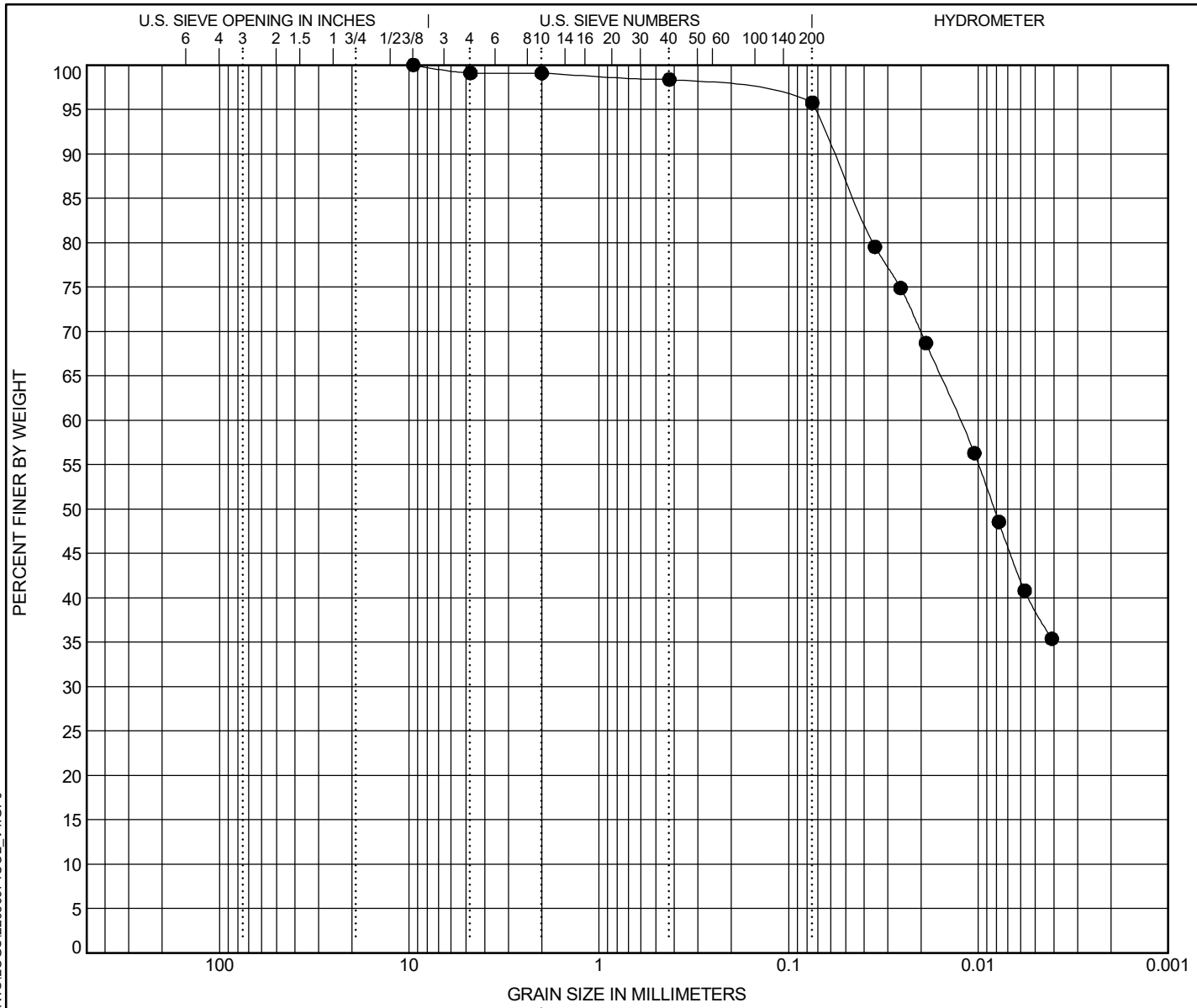

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**0.0**	**A-7-6(13)**	**35**	**45**	**26**	**19**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**0.0**	**9.5**	**0.013**	**0.008**			**0**	**1**	**3**	**57**	**39**

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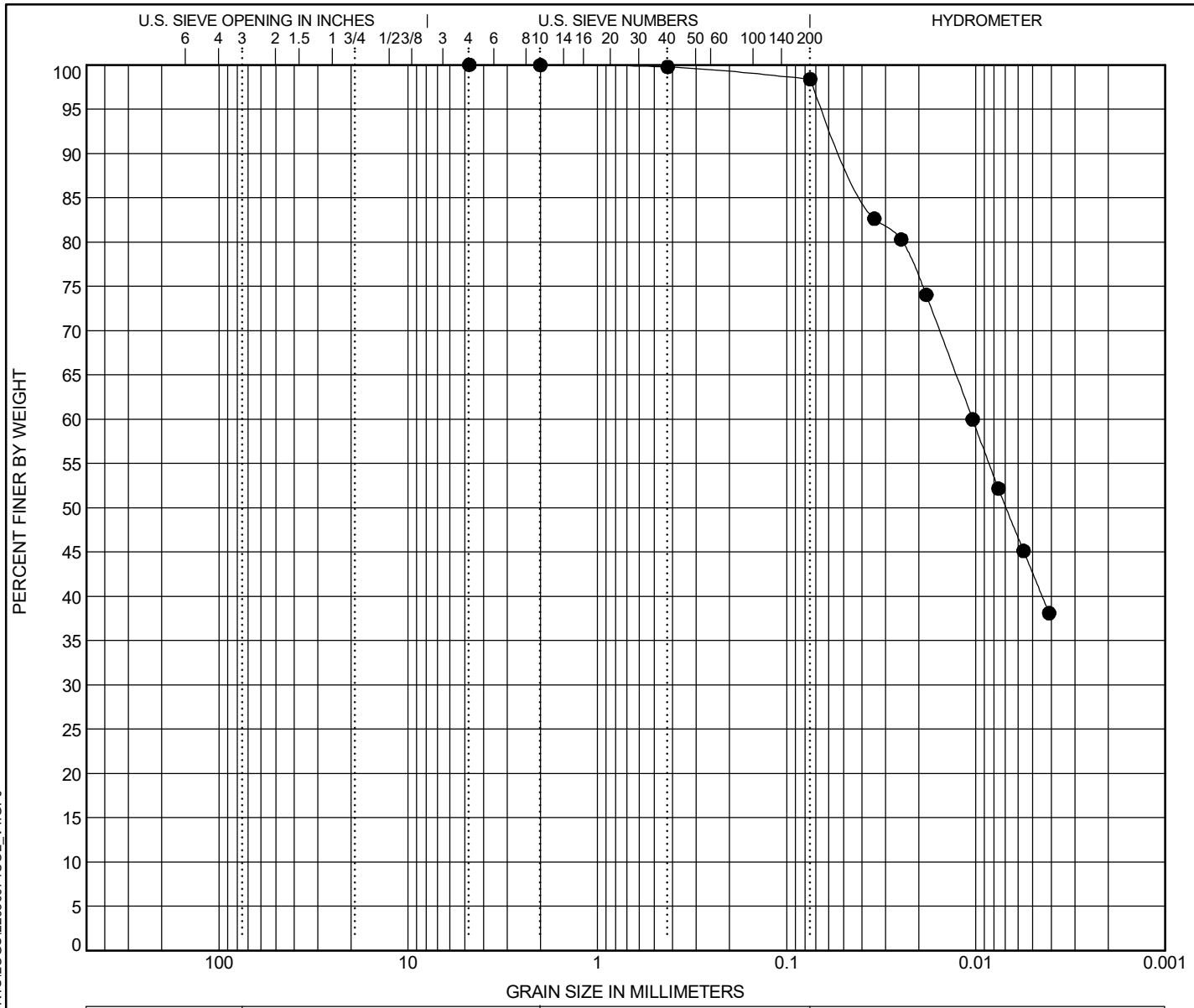

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**1.5**	**A-7-6(15)**	**35**	**51**	**28**	**23**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**1.5**	**4.75**	**0.01**	**0.007**			**1**	**0**	**1**	**55**	**43**

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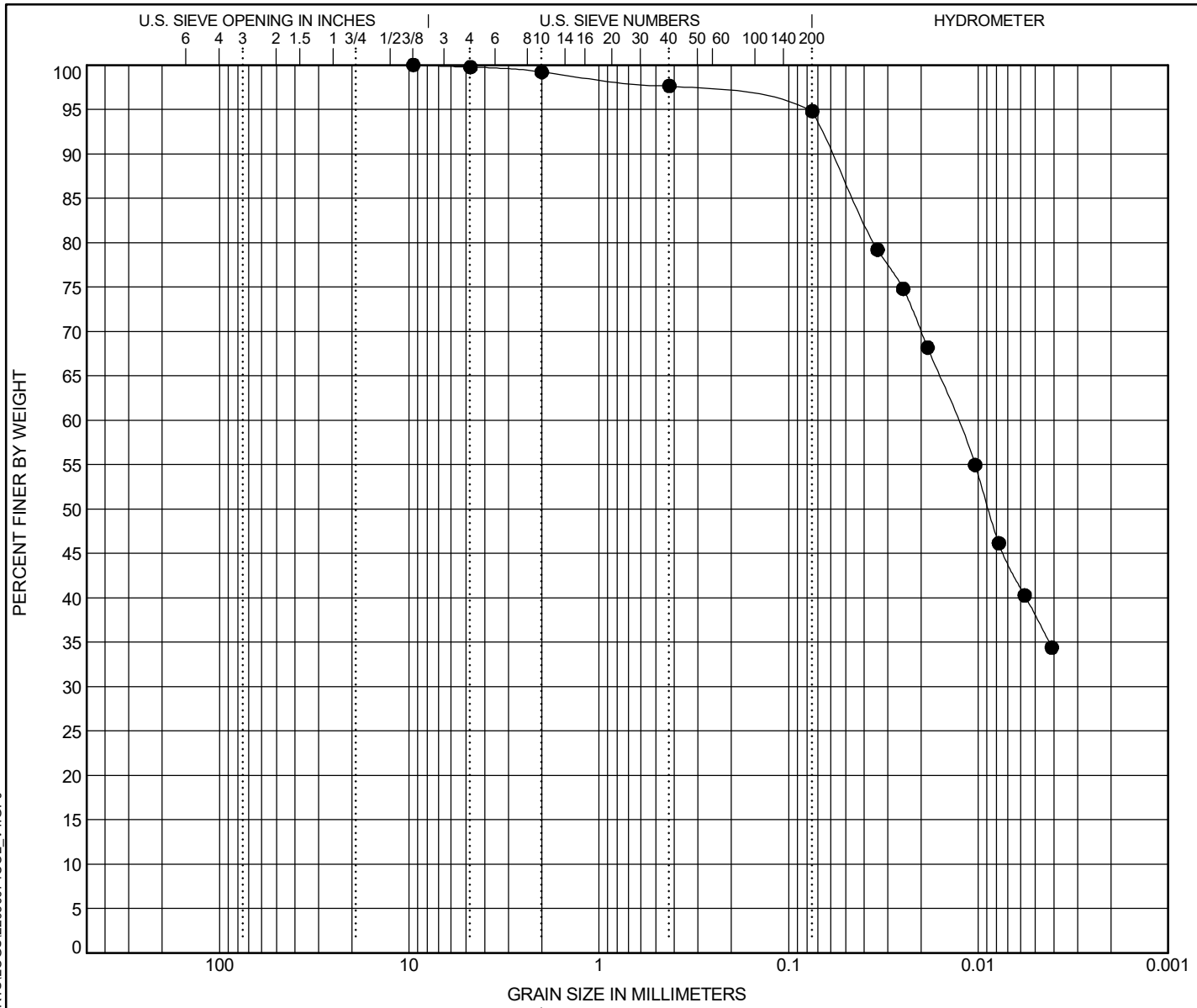

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**3.0**	**A-7-6(12)**	**33**	**44**	**25**	**19**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**3.0**	**9.5**	**0.013**	**0.009**			**0**	**2**	**3**	**57**	**38**

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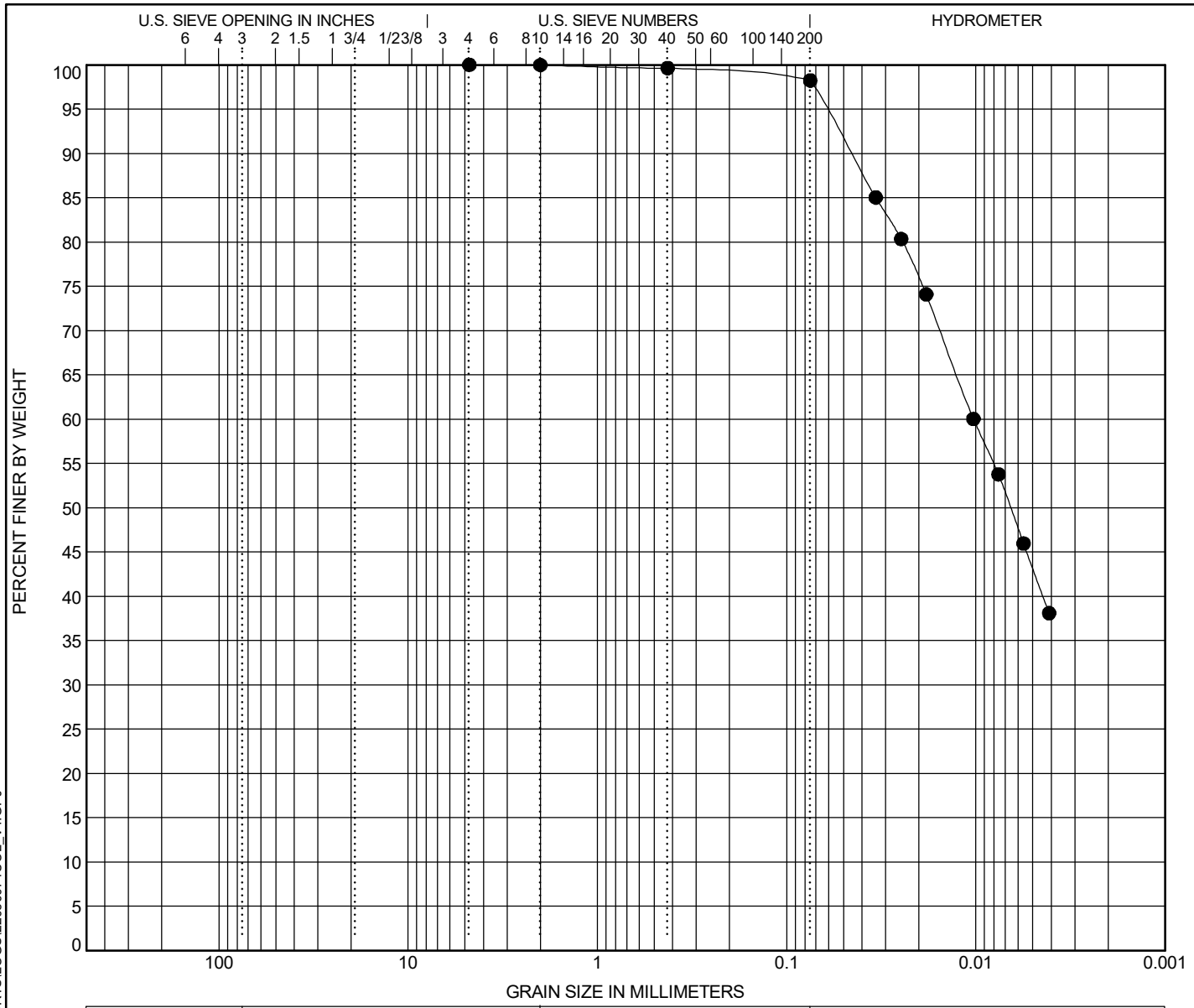
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**4.5**	**A-7-6(13)**	**34**	**47**	**27**	**20**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**4.5**	**4.75**	**0.01**	**0.007**			**1**	**0**	**1**	**55**	**43**

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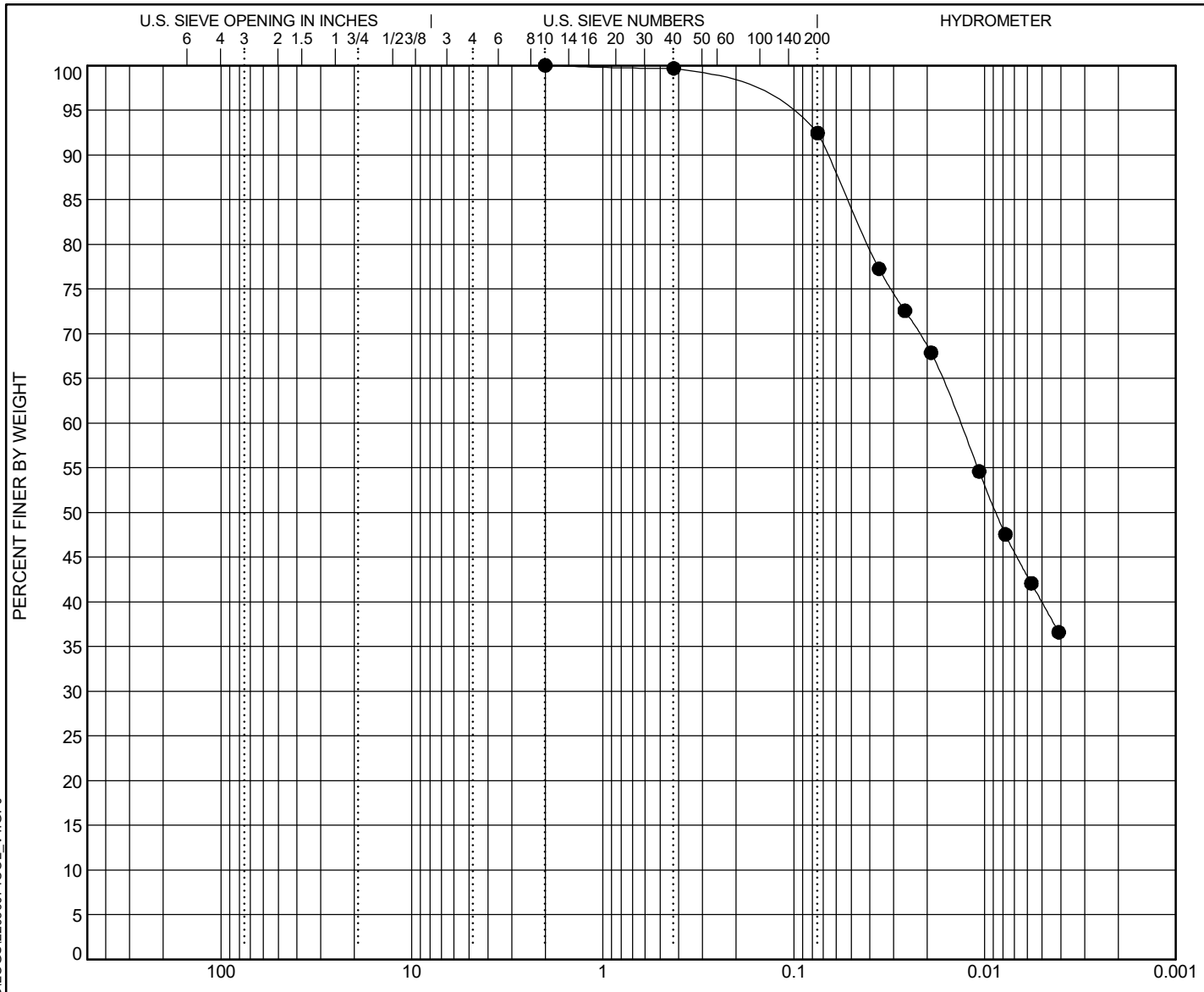

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**6.0**	**A-7-6(15)**	**28**	**48**	**25**	**23**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**6.0**	**2**	**0.014**	**0.009**			**0**	**1**	**7**	**52**	**40**

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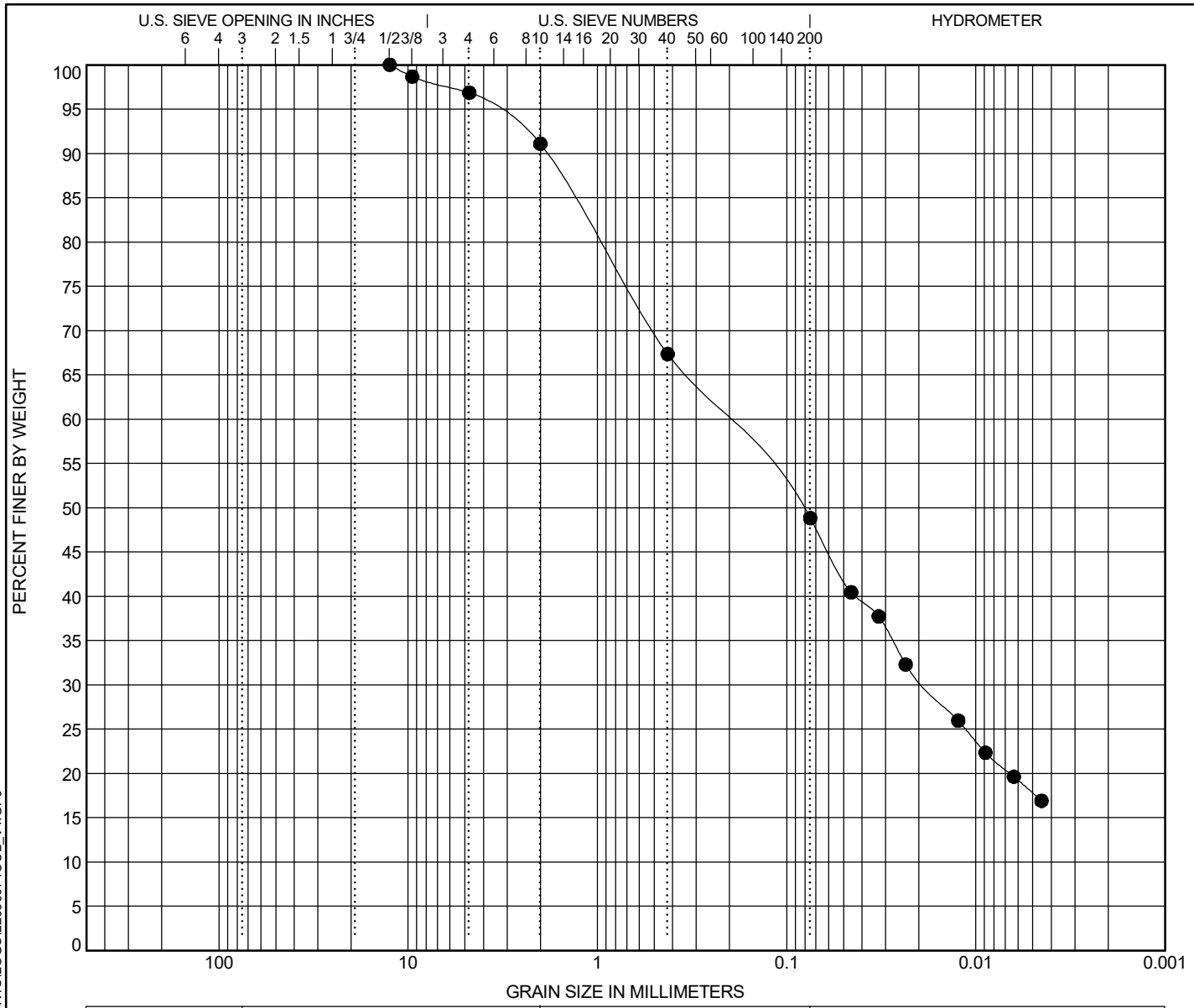

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**16.0**	**A-6a(4)**	**62**	**34**	**21**	**13**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**16.0**	**12.5**	**0.214**	**0.084**	**0.019**		**8**	**24**	**19**	**31**	**18**

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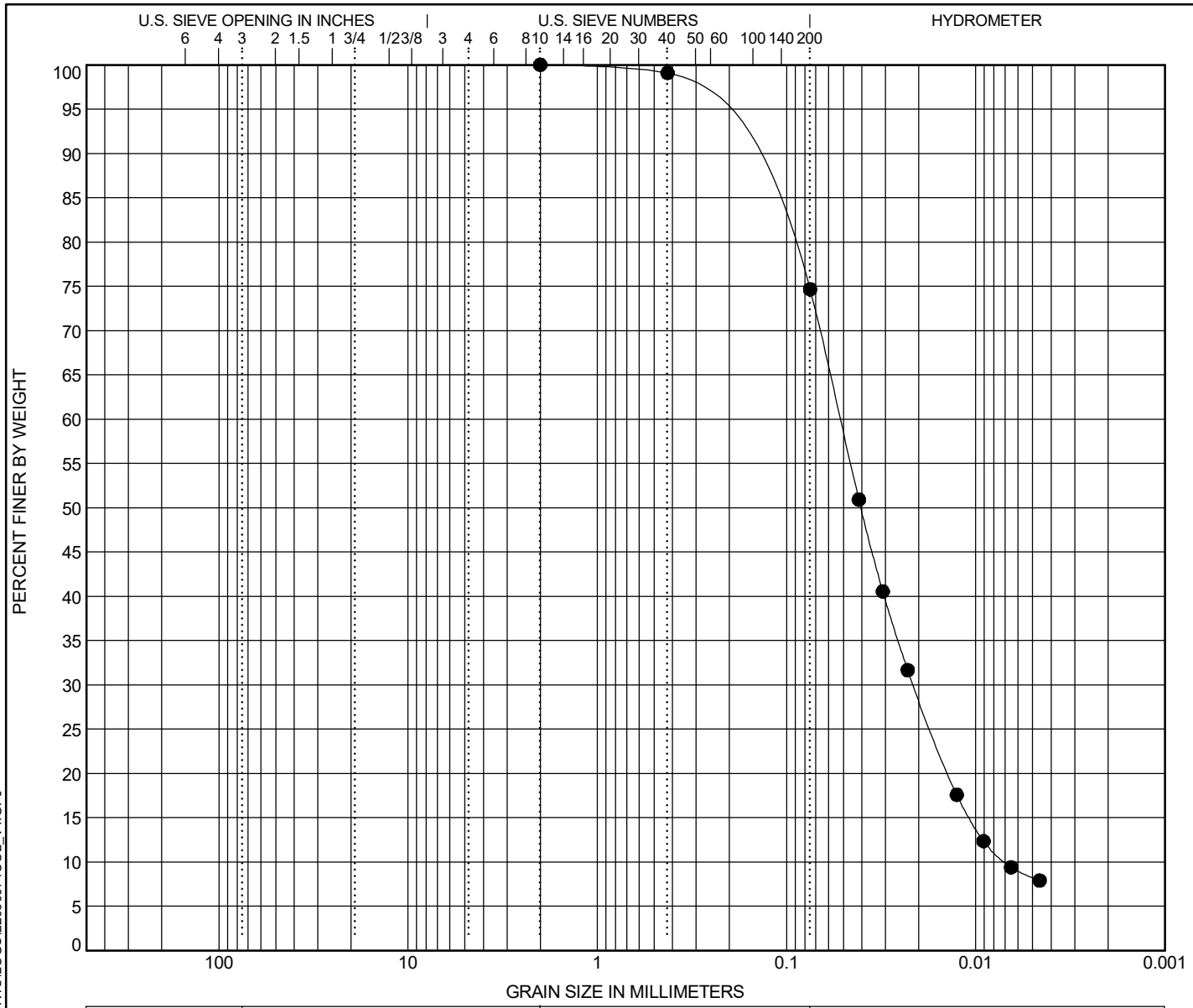

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**18.5**	**A-4b(0)**	**31**	**NP**	**NP**	**NP**	**1.26**	**7.46**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**18.5**	**2**	**0.052**	**0.04**	**0.021**	**0.007**	**0**	**1**	**24**	**67**	**8**

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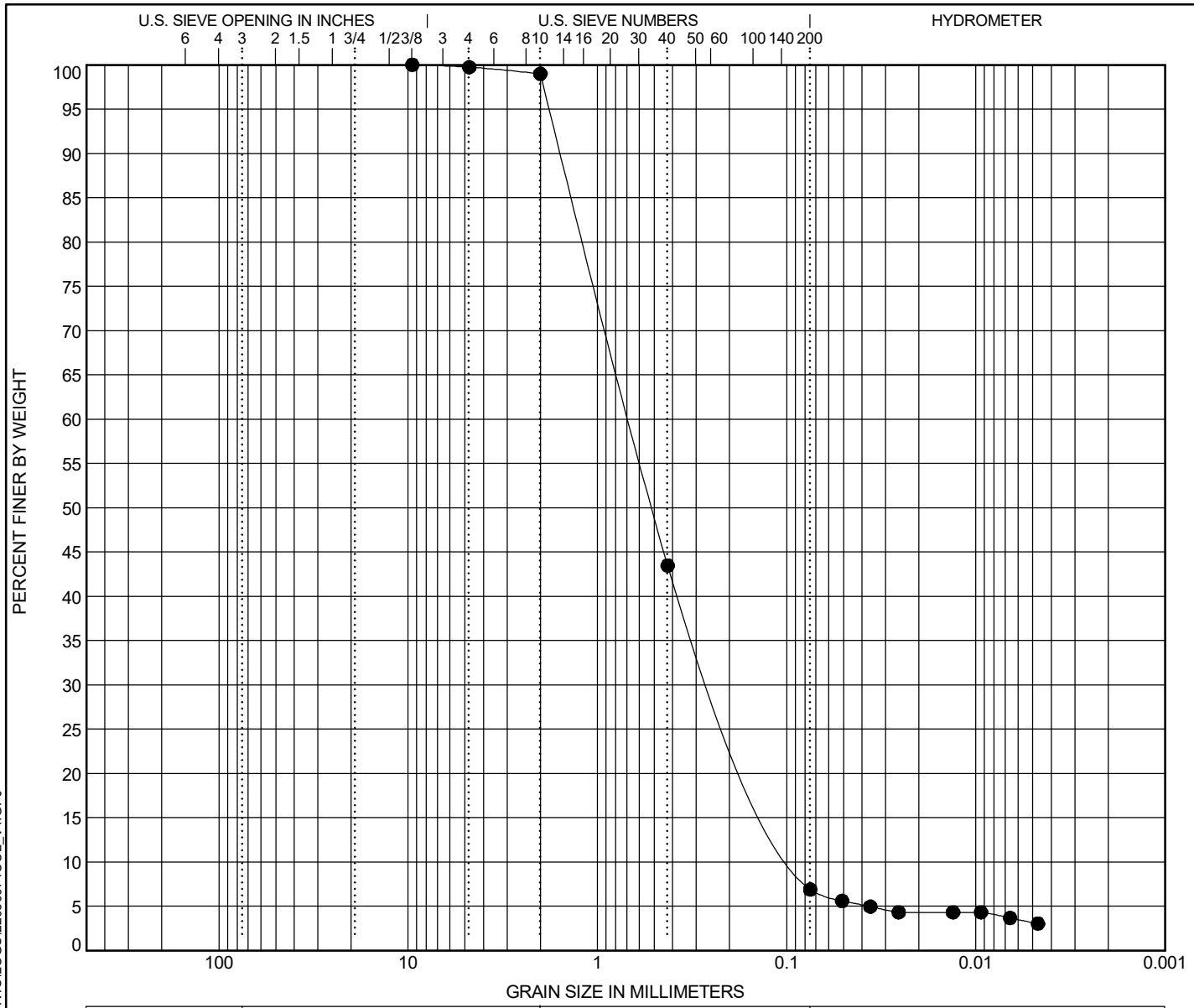

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**23.5**	**A-1-b(0)**	**13**	**NP**	**NP**	**NP**	**0.86**	**7.75**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**23.5**	**9.5**	**0.674**	**0.51**	**0.225**	**0.087**	**0**	**56**	**37**	**4**	**3**

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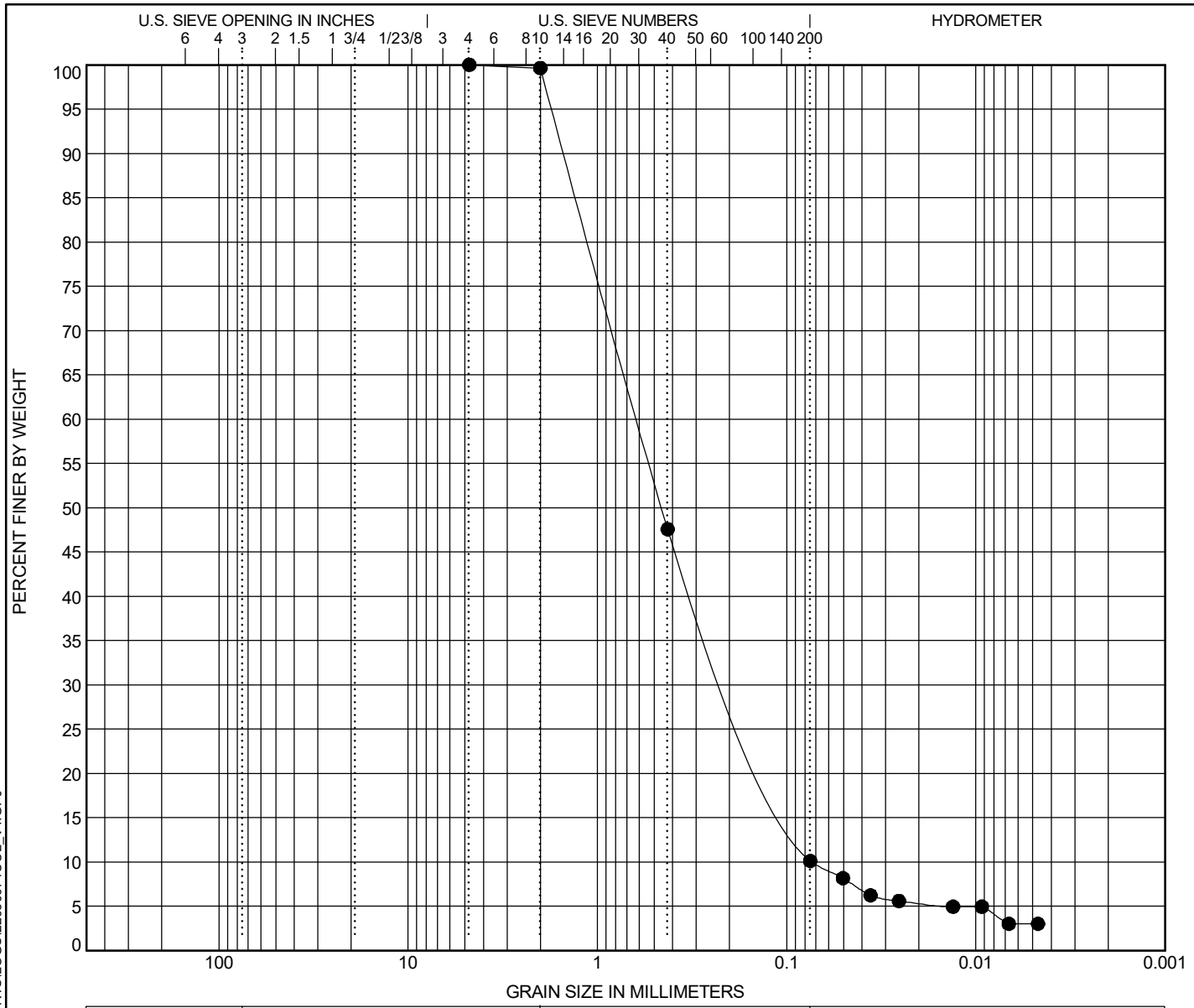

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-22	**43.5**	**A-1-b(0)**	**12**	**NP**	**NP**	**NP**	**0.79**	**8.37**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-22	**43.5**	**4.75**	**0.615**	**0.457**	**0.188**	**0.074**	**1**	**52**	**37**	**7**	**3**

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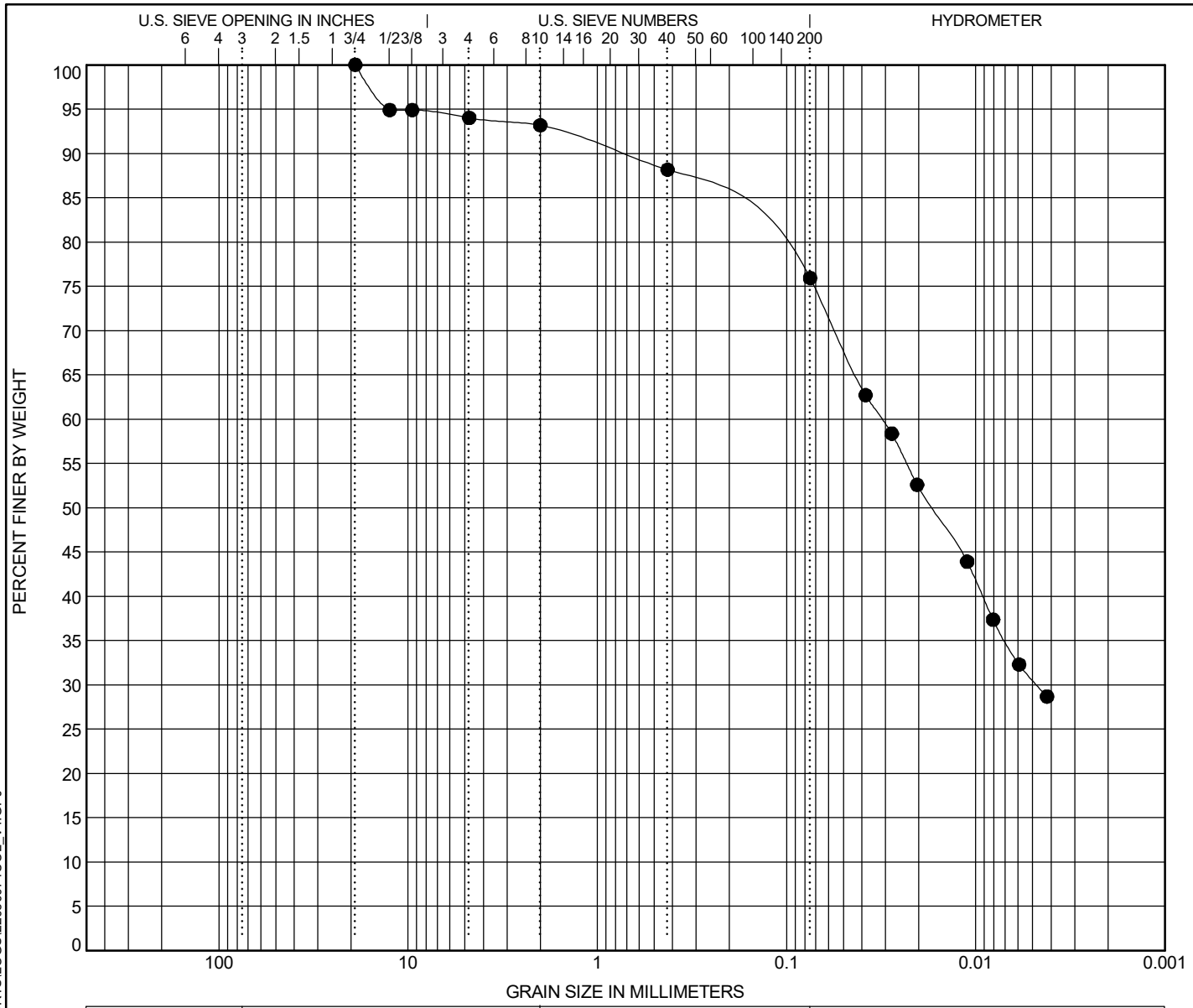

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**1.0**	**A-6a(9)**	**32**	**33**	**20**	**13**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**1.0**	**19**	**0.031**	**0.017**	**0.005**		**7**	**5**	**12**	**45**	**31**

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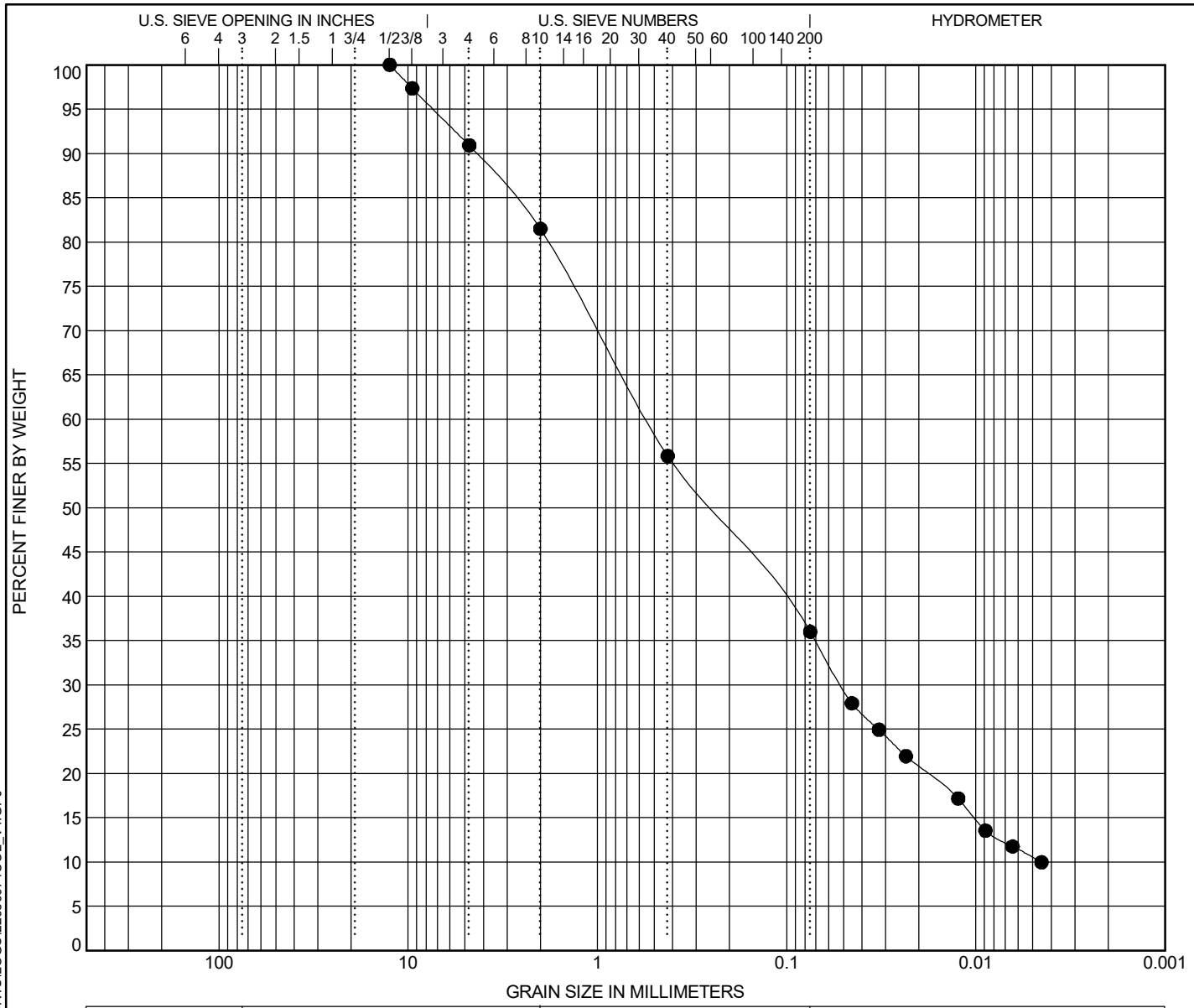

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**6.0**	**A-4a(0)**	**9**	**27**	**21**	**6**	**1.07**	**120.29**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**6.0**	**12.5**	**0.547**	**0.255**	**0.052**	**0.005**	**18**	**26**	**20**	**26**	**10**

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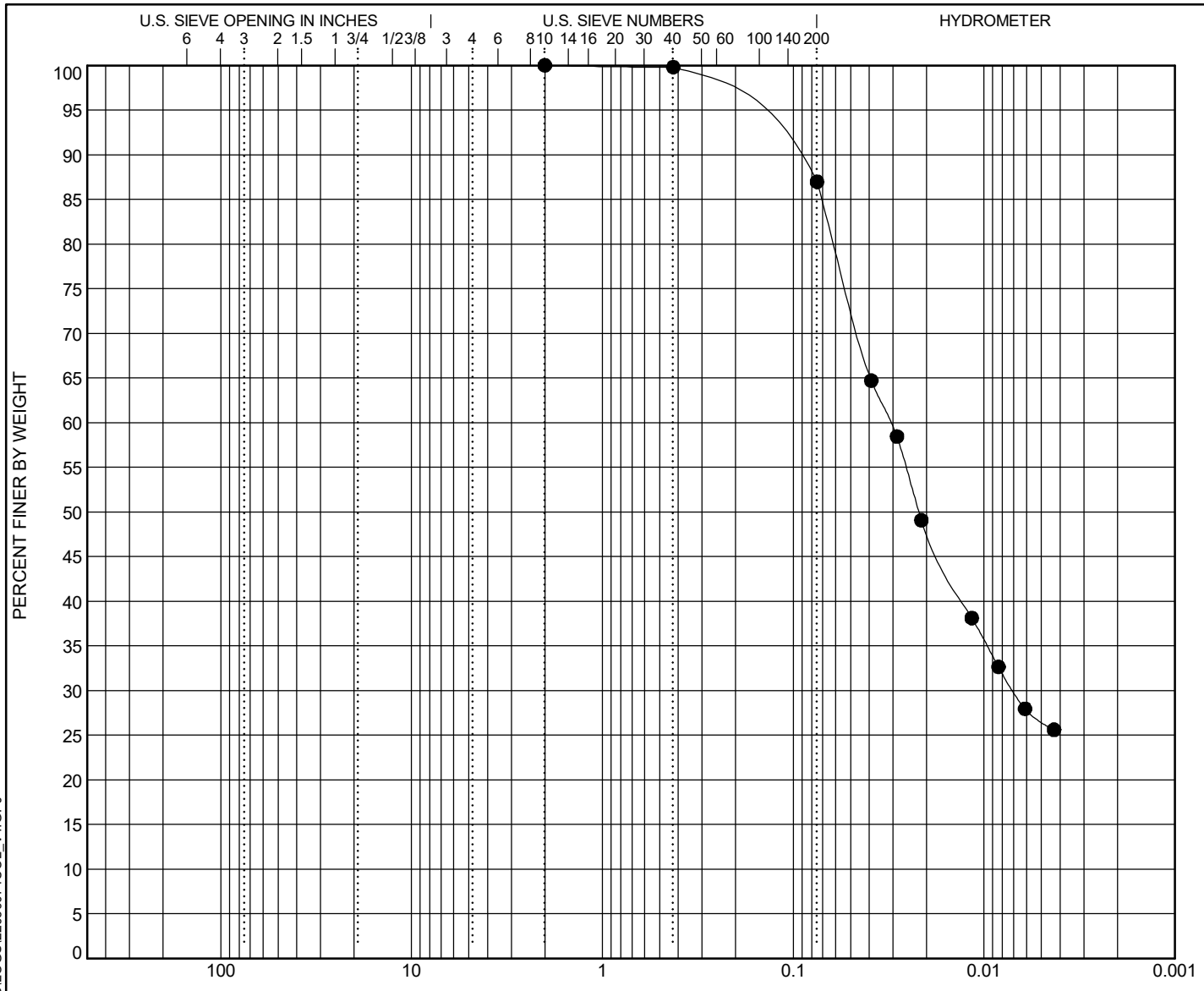

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**11.0**	**A-6a(8)**	**20**	**31**	**20**	**11**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**11.0**	**2**	**0.031**	**0.022**	**0.007**		**0**	**0**	**13**	**60**	**27**

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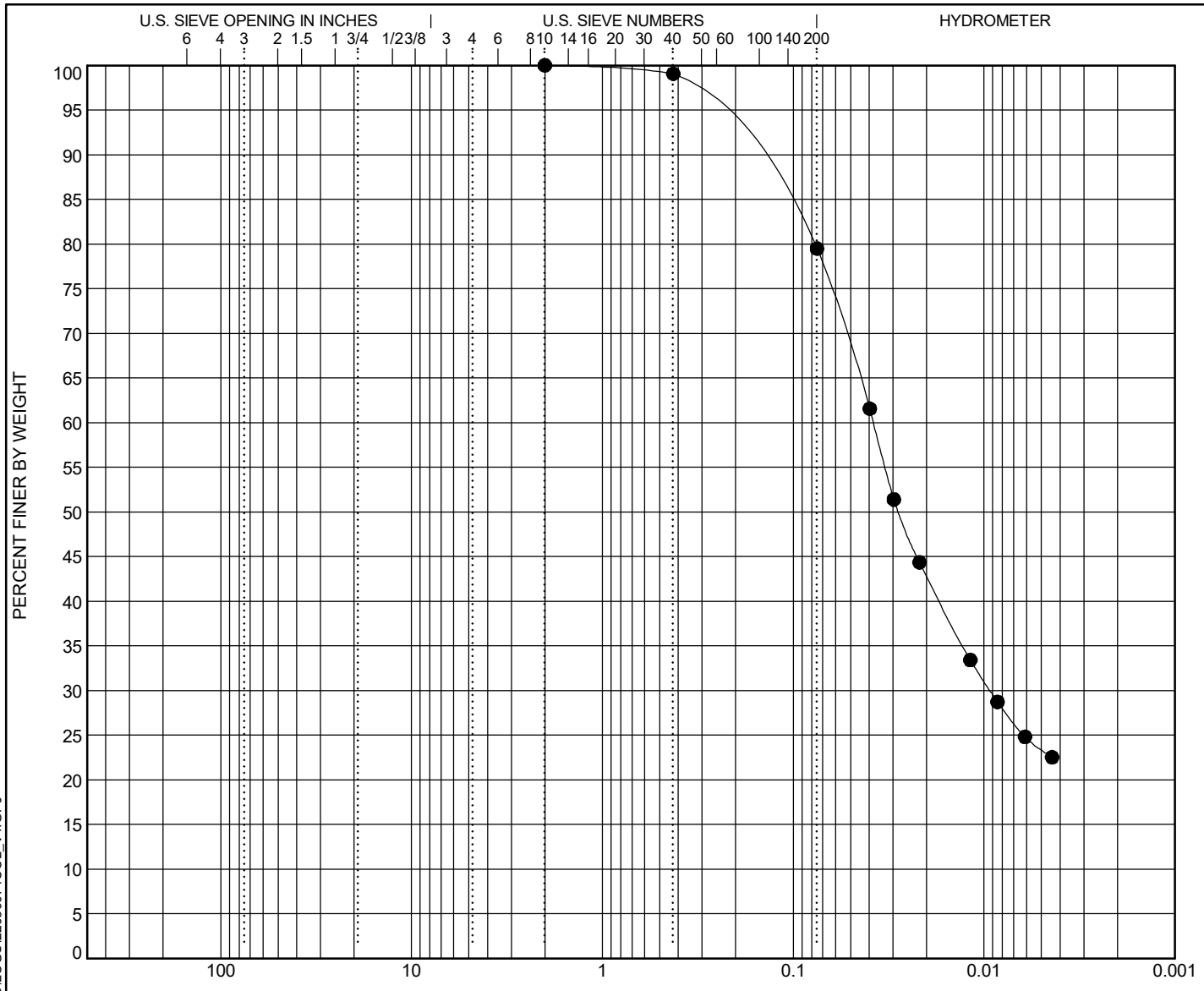

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**16.0**	**A-6a(8)**	**22**	**30**	**19**	**11**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**16.0**	**2**	**0.038**	**0.028**	**0.009**		**0**	**1**	**20**	**56**	**23**

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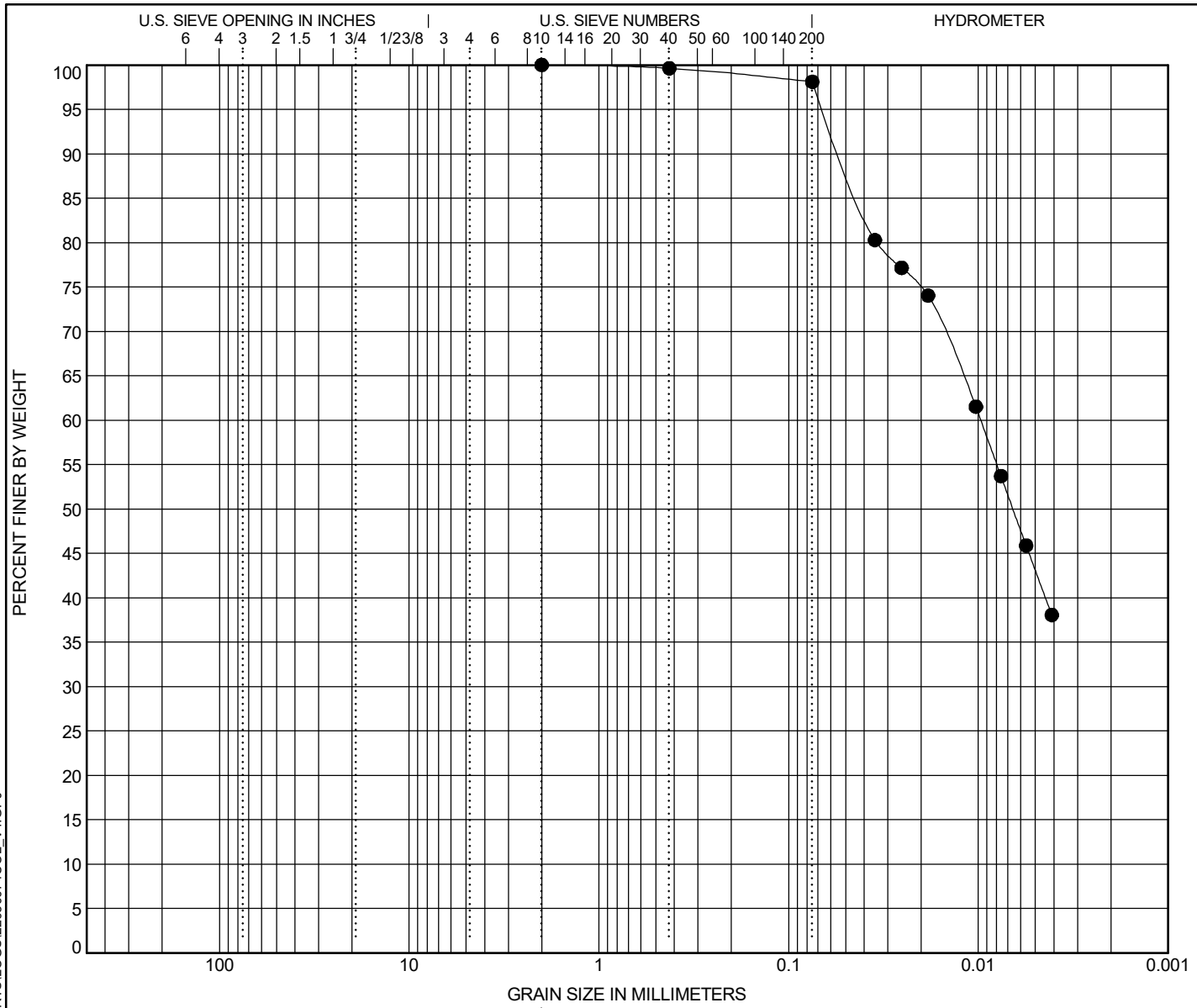

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**23.5**	**A-7-5(17)**	**35**	**57**	**33**	**24**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**23.5**	**2**	**0.01**	**0.007**			**0**	**0**	**2**	**55**	**43**

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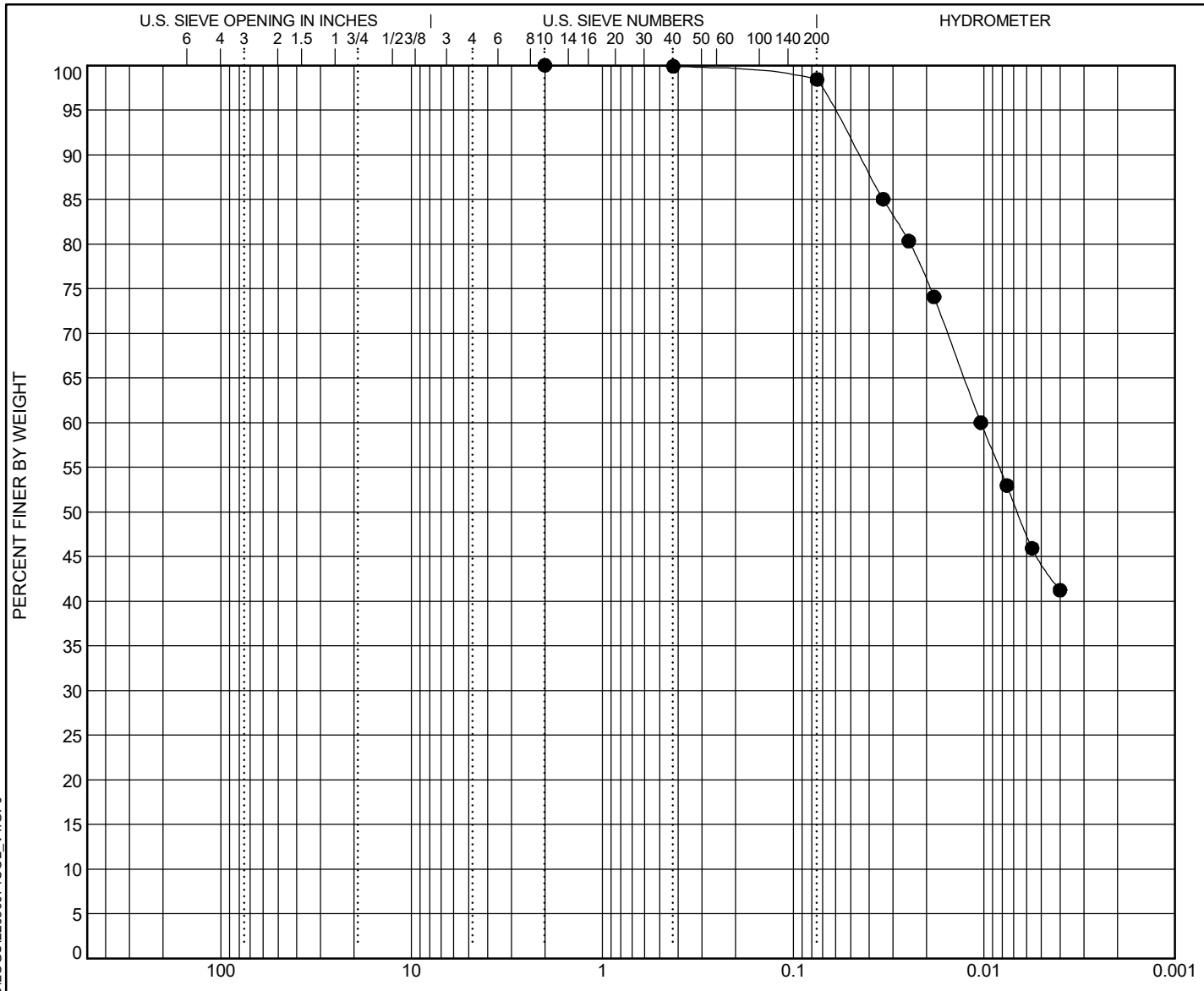

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**31.0**	**A-7-6(15)**	**25**	**49**	**25**	**24**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**31.0**	**2**	**0.01**	**0.007**			**0**	**1**	**1**	**54**	**44**

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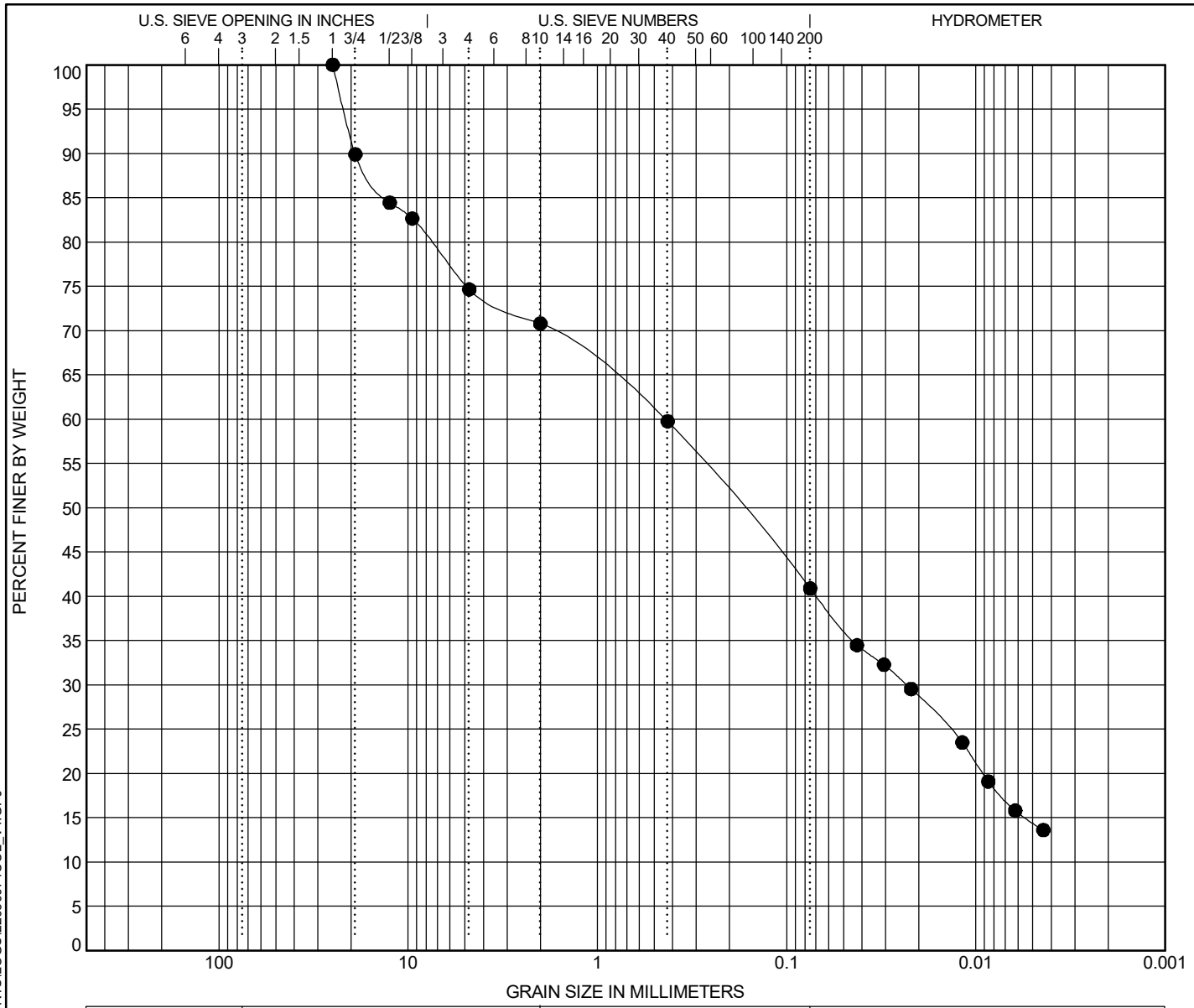

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**43.5**	**A-4a(1)**	**25**	**28**	**18**	**10**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**43.5**	**25**	**0.441**	**0.174**	**0.023**		**29**	**11**	**19**	**27**	**14**

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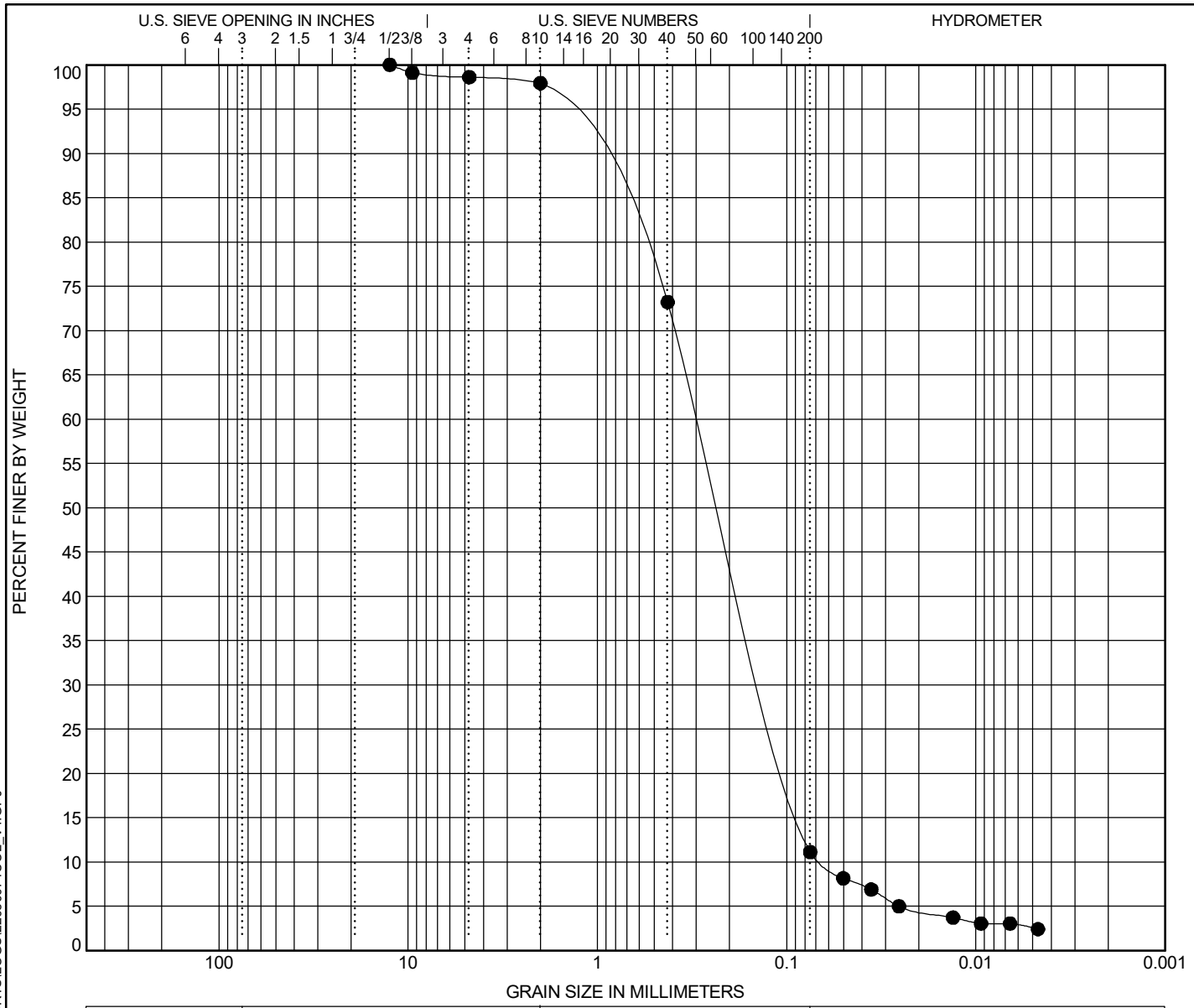


COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

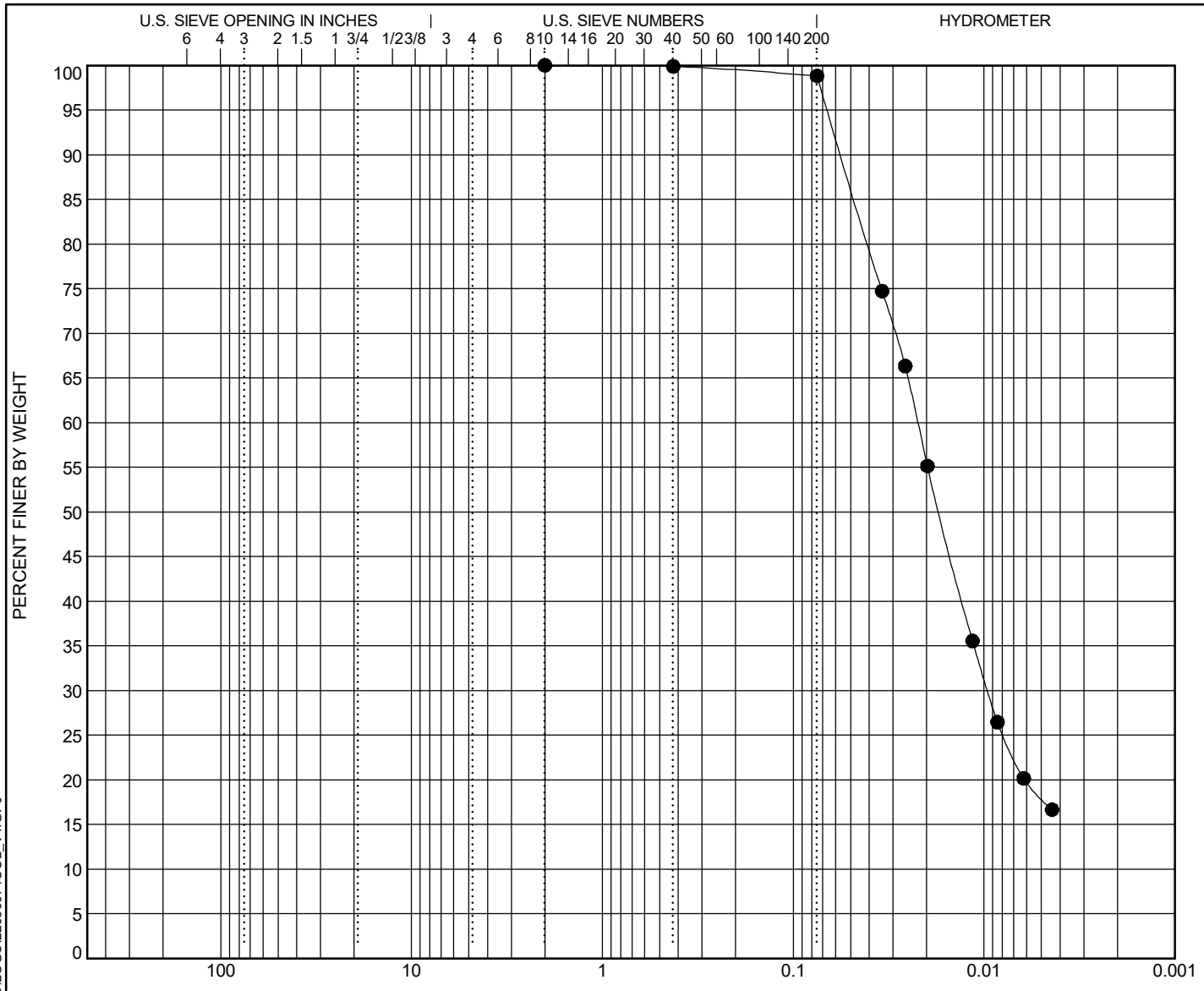
Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**53.5**	**A-3a(0)**	**32**	**NP**	**NP**	**NP**	**0.85**	**4.55**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**53.5**	**12.5**	**0.294**	**0.222**	**0.127**	**0.065**	**2**	**25**	**62**	**8**	**3**

CTL Engineering, Inc.
2860 Fisher Road
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-52-12.452
Location:BRO COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-22	**63.5**	**A-4b(8)**	**25**	**26**	**21**	**5**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-22	**63.5**	**2**	**0.022**	**0.017**	**0.01**		**0**	**0**	**1**	**81**	**18**

CTL Engineering, Inc.
2860 Fisher Road
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-52-12.452
Location:BRO COUNTY
CTL Project Number:

OHIO DEPARTMENT OF TRANSPORTATION

DETERMINING SULFATE CONTENT IN SOILS
SUPPLEMENT 1122

Project C-R-S: BRO-52-12.43

PID No: 100897

Report Date: 4/26/2023

Consultant: CTL Engineering, Inc.

Technician: RV

Sample or Boring ID	Station	Offset	Latitude & Longitude or State Plane Coordinates		Elevation	Soaking Time (hr)	Replicate Sample Readings						Sulfate Content (ppm)
							1		2		3		
							Dilution	Reading	Dilution	Reading	Dilution	Reading	
B-001-0-22	657+03.2	1.13 Rt	38.7437156	-83.8440407	506.39	22	20	< 5	20	< 5	20	< 5	< 100
B-004-0-22	660+34.18	3.43 Rt	38.7428904	-83.8435522	506.4	22	20	< 5	20	< 5	20	< 5	< 100

PROJECT NO:	22050074COL
DATE:	1/19/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

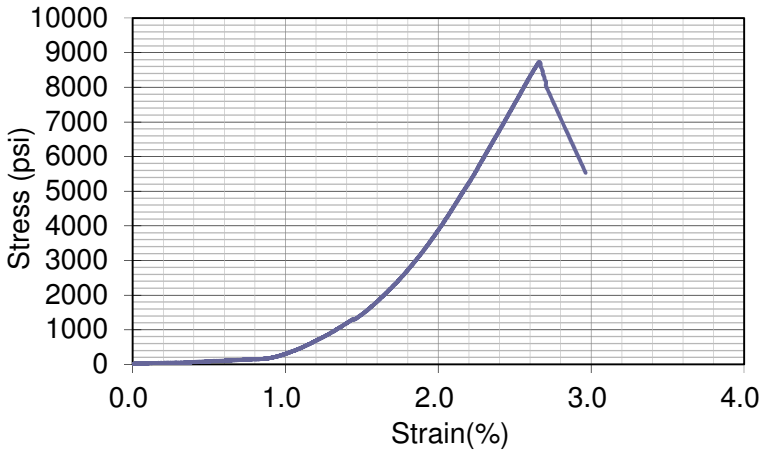
BORING NUMBER	B-001-1-22	TOP DEPTH(FT)	92.2	BOTTOM DEPTH(FT)	92.7
SAMPLE NUMBER	NQ-1	DISTRICT	9	PID NO.	100897
COUNTY	BRO	ROUTE	US-52	SECTION	12.43

FORMATION	Ordovician Age Point Pleasant Formation
DESCRIPTION	Limestone, Gray, Slightly Weathered, Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.009	1.980
2	4.009	1.976
3	4.008	1.978
AVERAGE	4.009	1.978

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	538.0
UNIT WEIGHT(LBS/FT^3)	166.4

RATE OF LOADING (in/min)
0.09
COMPRESSIVE STRENGTH (PSI)
8,730
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.17
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room



BEFORE TESTING

AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

PROJECT NO:	22050074COL
DATE:	1/19/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

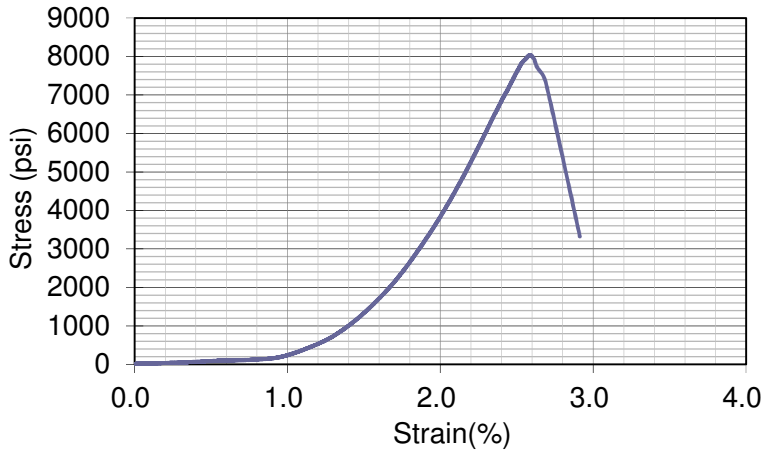
BORING NUMBER	B-004-1-22	TOP DEPTH(FT)	92.0	BOTTOM DEPTH(FT)	92.5
SAMPLE NUMBER	NQ-1	DISTRICT	9	PID NO.	100897
COUNTY	BRO	ROUTE	US-52	SECTION	12.43

FORMATION	Ordovician Age Point Pleasant Formation
DESCRIPTION	Limestone, Gray, Slightly Weathered, Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.016	1.971
2	4.018	1.972
3	4.017	1.977
AVERAGE	4.017	1.973

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	539.1
UNIT WEIGHT(LBS/FT^3)	167.2

RATE OF LOADING (in/min)
0.10
COMPRESSIVE STRENGTH (PSI)
8,040
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.08
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room



BEFORE TESTING

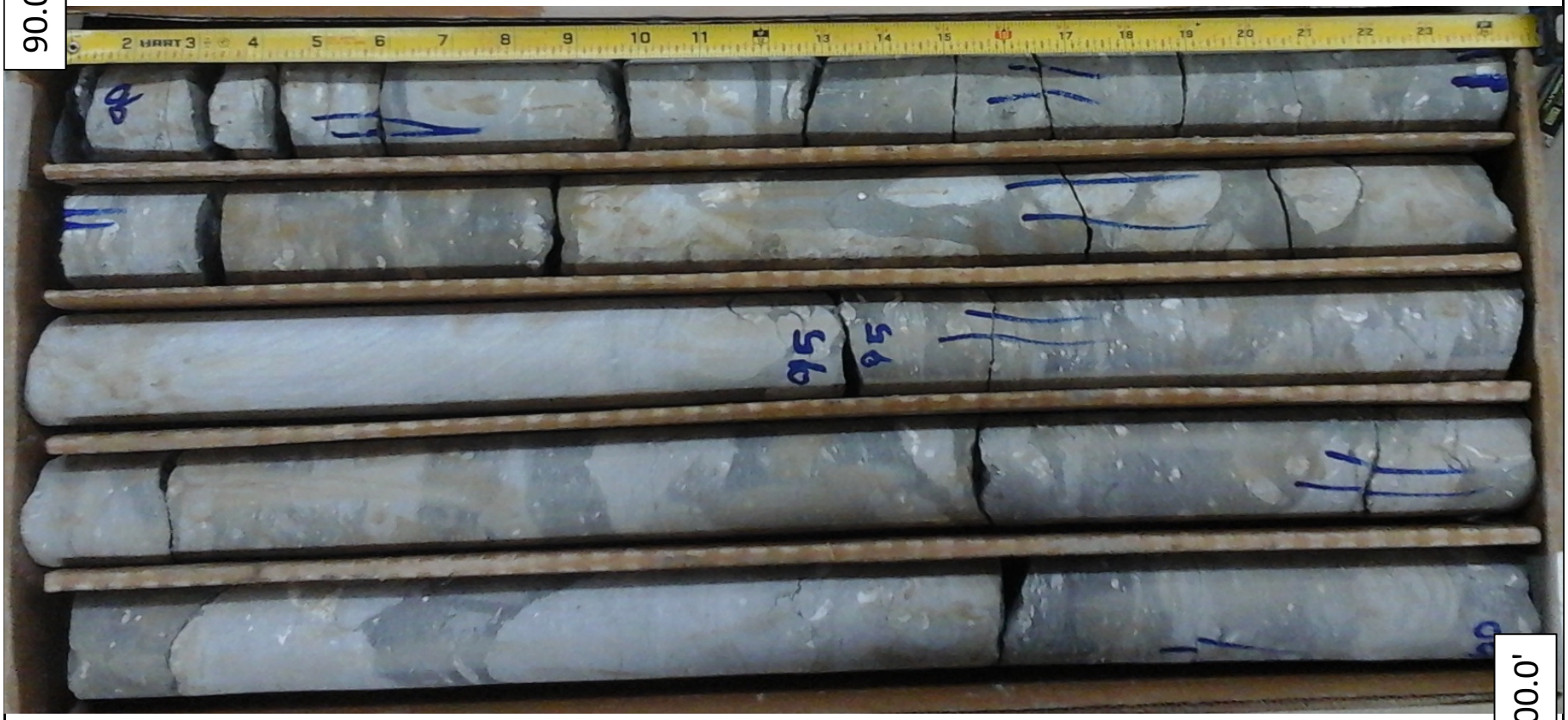
AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

APPENDIX D
ROCK CORE PHOTOS

B-001-1-22

90.0'

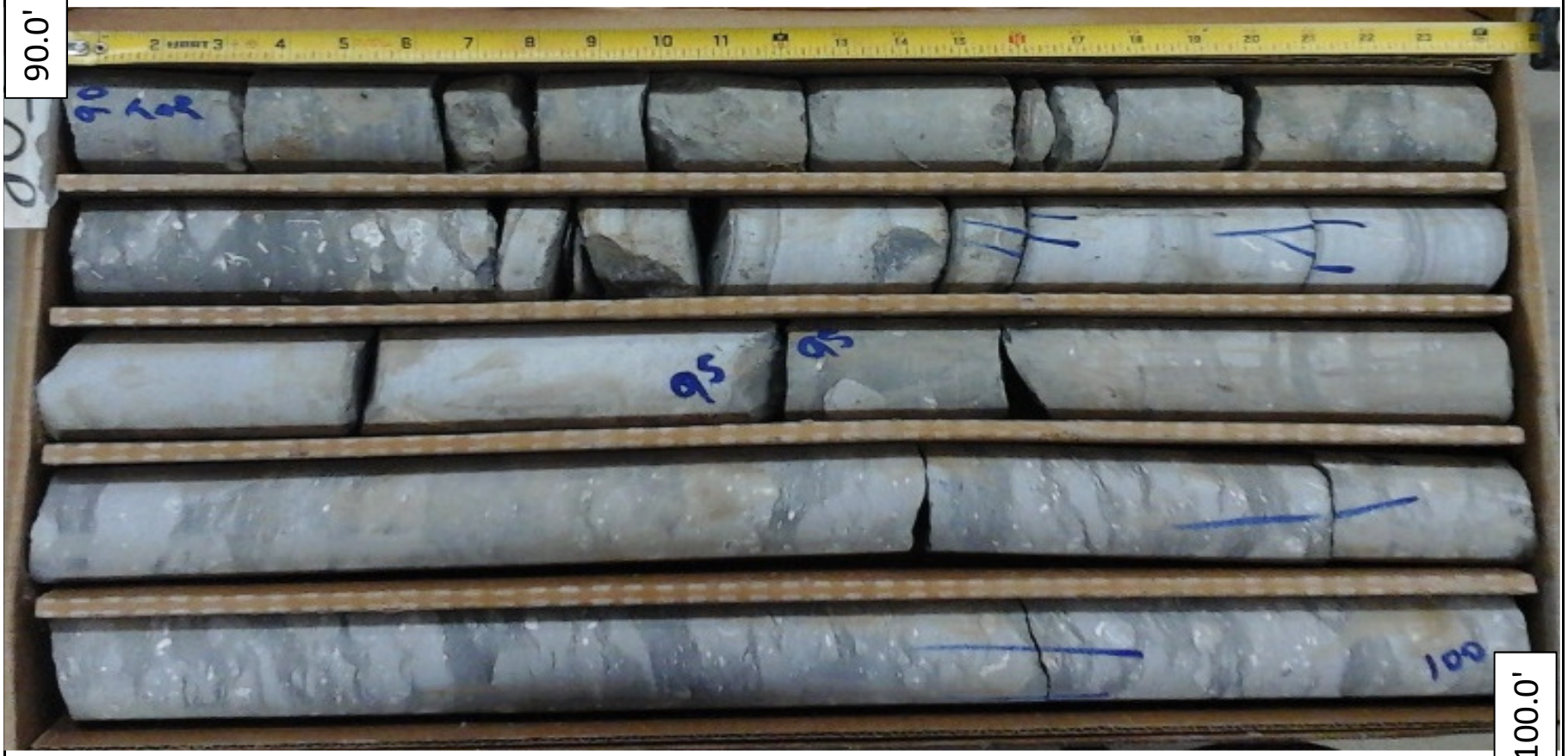


100.0'

Run #:	Depth		Recovery		RQD	
NQ-1	90.0'	95.0'	45/60	75%	60/60	100%
NQ-2	95.0'	100.0'	56/60	93%	60/60	100%
BRO-52-12.43, PID 100897						

GTL ENGINEERING INC

B-004-1-22



Run #:	Depth		Recovery		RQD	
NQ-1	90.0'	95.0'	31/60	52%	60/60	100%
NQ-2	95.0'	100.0'	55/60	92%	60/60	100%
BRO-52-12.43, PID 100897						

CTL ENGINEERING INC.

APPENDIX E
SUBGRADE ANALYSIS SPREADSHEET

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

BRO-52-12.43
100897

CTL ENGINEERING, INC

Prepared By: Shahedur Rahman
Date prepared: Thursday, April 20, 2023

Shahedur Rahman
2860 Fisher Road
Columbus
Ohio 43204
(614) 276-8123
srahman@ctleng.com

NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-22	US 52	657+03	1	Rt	CME 55 Track	79	506.4	505.4	1.0 C
2	B-004-0-22	US 52	660+34	3	Rt	CME 55 Track	79	506.4	505.4	1.0 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	2.0	3.5	1.0	2.5	12		1.25	45	24	21	50	46	96	23	21	A-7-6	13	99		HP		**12"**	
	001-0	SS-2	3.5	5.0	2.5	4.0	16		4.25							19	16	A-6b	16						
	22	SS-3	6.0	7.5	5.0	6.5	59		2	39	23	16	29	22	51	22	18	A-6b	5						
		SS-4	8.5	10.0	7.5	9.0	15	12	2.25							24	18	A-7-6							
2	B	SS-1	1.0	2.5	0.0	1.5	25		1.5	33	20	13	45	31	76	32	15	A-6a	9	99		HP & Mc		**12"**	
	004-0	SS-2	3.5	5.0	2.5	4.0	13		2							29	14	A-6a	10						
	22	SS-3	6.0	7.5	5.0	6.5	41			27	21	6	26	10	36	9	16	A-4a	0						
		SS-4	8.5	10.0	7.5	9.0	13	13	4							26	14	A-6a							

PID: 100897

County-Route-Section: BRO-52-12.43
No. of Borings: 2

Geotechnical Consultant: CTL ENGINEERING, INC
Prepared By: Shahedur Rahman
Date prepared: 4/20/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12''

Excavate and Replace Stabilization Options	
Global Geotextile Override(N60L):	18''
Override(HP):	24''
Global Geogrid Override(N60L):	12''
Override(HP):	18''

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	0%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	33%	1 < HP ≤ 2	67%
$N_{60} \geq 20$	50%	HP > 2	17%
M+	17%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

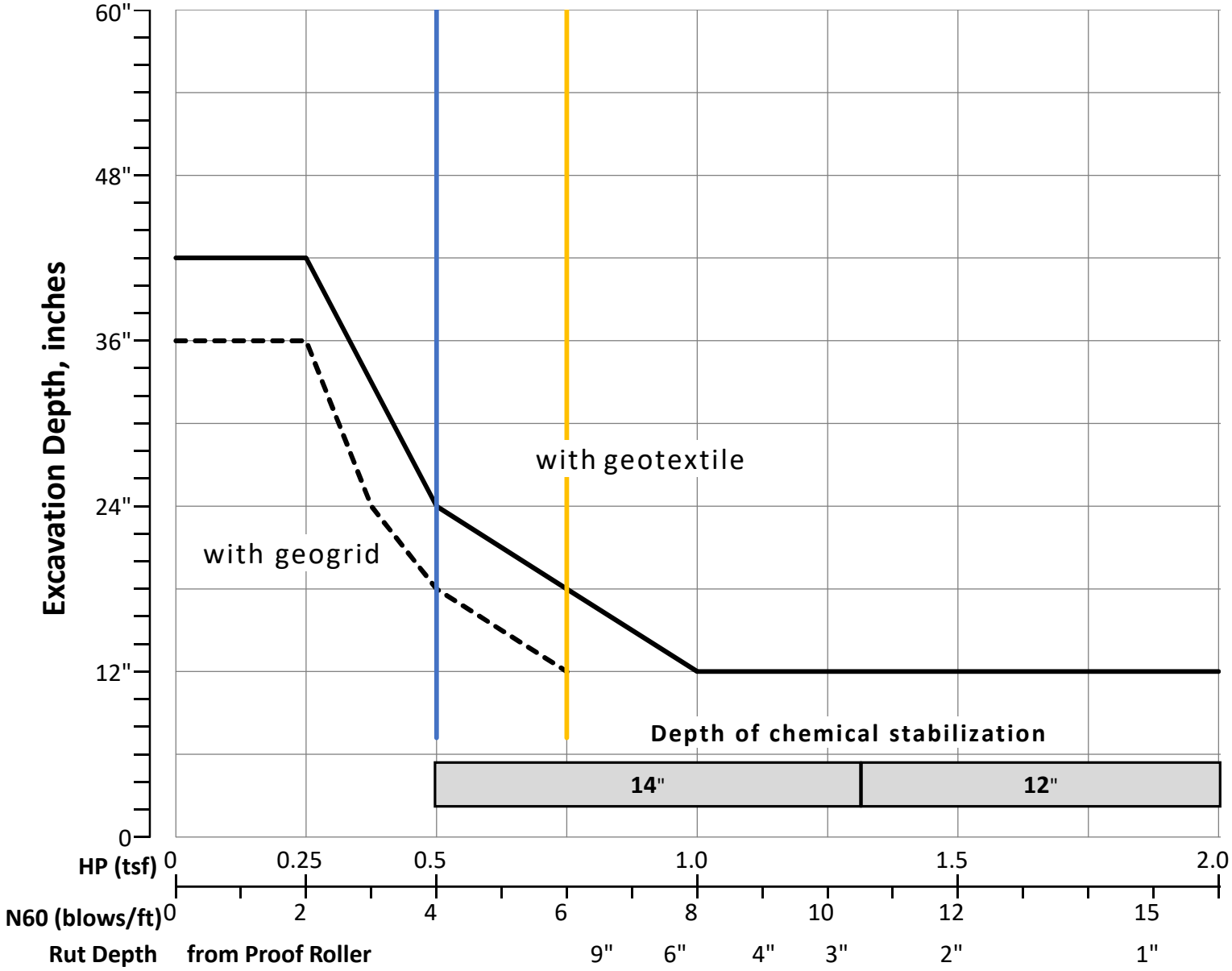
% Proposed Subgrade Surface	
Unstable & Unsuitable	50%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	24	13	2.46	36	22	14	38	27	65	23	17	9
Maximum	59	13	4.25	45	24	21	50	46	96	32	21	16
Minimum	12	12	1.25	27	20	6	26	10	36	9	14	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	1	0	0	3	2	0	2	0	0	8
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	38%	25%	0%	25%	0%	0%	100%
% Rock|Granular|Cohesive	0%	13%									88%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	25%	0%	25%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
2.46	0.50	☑ HP
12.50	6.00	☑ N60L

Average HP
Average N_{60L}

The subgrade analysis workbook consists of five worksheets. Each worksheet functions independently. In all of the worksheets the fields are color coded as follows:

- Every yellow highlighted field indicates a field to be entered by the user.
- Every salmon field is to indicate a problem/issue.
- Every gray or green field is a heading/informational field.

IMPORTANT: The sequence of filling out the data needs to be followed as outlined below:

1. Cover Sheet: this worksheet is designed for the purpose of entering the project information. Enter all the following fields:

County-Route-Section	This includes the county, route, section number assigned to the project.
PID	the Project Identification Number
Project Description	See Cover Sheet for list of example details
Geotechnical Consultant	The Geotechnical Consultant performing the analysis.
Prepared By	The preparer of the subgrade analysis
Date prepared	The date the analysis is performed.
Contact Information	Name, address, telephone #, and email address
No. of Borings	Enter the total number of borings within the alignment that is being analyzed.

2. Boring Logs Entry Worksheet: this worksheet has a programming code that will run in the background every time the sheet is activated and will make the sheet unresponsive for less than a minute. The code is designed to read the total number of borings from the cover sheet and generate the needed number of fields.
   a. All yellow highlighted fields are user's entry.
   b. ODOT has developed a text table export from gINT *(GB 1 Borings Log Entry Tab)* that will allow for copy and paste of all highlighted fields with the exception of proposed subgrade elevation. The designer must provide a proposed subgrade elevation in order for the spreadsheet to function properly.
   c. The Cut/Fill field is a calculated field that, based on the difference between the boring elevation and the proposed subgrade elevation, will highlight the cell either gray and adds the letter "C" to the end in a cut situation or highlights the cell in light purple and adds the letter "F" to the end in a fill situation.
   d. Every duplicate boring ID will be highlighted in salmon background and red text.
   e. **IMPORTANT**: After entering all the borings' information, the user must click "Add Subgrade Analysis Entry Fields" button. This will generate all the required fields in the "Subgrade Analysis" Worksheet.

3. Subgrade Analysis Worksheet:
   a. The boring number and boring ID is read from the "Boring Logs Entry Worksheet" excluding every boring that has six feet or more of fill.
   b. All yellow highlighted fields are to be entered by the user and salmon highlighted fields indicates a problem or issue.
   c. Every sample that has a Sulfate Content greater than or equal to 3000 will be highlighted in light salmon background. Every sample that has a Sulfate Content greater than or equal to 8000 will be highlighted in darker salmon background. Note the revised sulfate criteria in GB1 issued July 20, 2018.

d. Unsuitable/Unstable:

i. Unsuitable samples that are within 3 feet of the top of subgrade will be highlighted with salmon background and the class will be showing in this field.

ii. Unstable Samples that are within 3 feet of top of subgrade will be highlighted with salmon background and text to indicate the problem as follows:

Criterion	Stabilization Need Check	Text displayed in the field
A-1-a, A-1-b, A-3, or A-3a Soil Class	No Stabilization is needed	
HP ≥ 1.875	No Stabilization is needed	
N_{60} ≥ 15	No Stabilization is needed	
1.875 ≥ HP ≥ 1.5 and M_c≥ Opt. M_c+3	Unstable Subgrade	HP & Mc
15 ≥ N_{60} ≥ 12 and M_c≥ Opt. M_c+3	Unstable Subgrade	N_{60} & Mc
HP ≤ 1.5	Unstable Subgrade	HP
N_{60} ≤ 12	Unstable Subgrade	N_{60}

iii. The field is formulated to check for HP first and check for N_{60} second.

e. Excavate and Replace (Item 204) is going to be calculated based on the subgrade depth for each sample indicating an unsuitable or unstable problem.

f. Recommendation:

i. Geotextile Option is calculated and rounded to a multiple of 3 inches based on the subgrade depth for every sample indicating an unsuitable or unstable problem.

ii. GEOGRID Option is only offered in case of unstable subgrade problem and if the geotextile option indicates the need to excavate greater than 12 inches.

PLEASE NOTE: The Problem, Excavate & Replace, and Recommendation Fields are the responsibility of the Designer. These fields are being enhanced to attempt to capture the ODOT philosophy regarding the GB1 stabilization chart, but are considered still under development. If there are discrepancies between the spreadsheet output and the GB1 chart - the chart governs in conjunction with engineering judgement. Please contact Steve Taliaferro at stephen.taliaferro@dot.ohio.gov if you have any questions.

PLEASE NOTE: It is the Designer's responsibility to identify the most representative data when samples have been separated into multiple specimen (say 1.5 to 2.3 feet and 2.3 to 3.0 feet). The spreadsheet is not capable at this time of addressing this issue within a direct data export from gINT.

4. Results Summary:
All fields in this sheet are password protected and are either calculated or read from the other worksheets.

5. Graph Worksheet:
This worksheet is designed to read the average N_{60L} and the average HP from the Cover Sheet and plot a blue line for Average HP and orange line for Average N_{60L} on GB1 Figure B – Subgrade Stabilization. The Override Table can be used to enter HP and/or N_{60L} values that are different than the calculated averages. The Override values will change the global undercut recommendation in the Results Summary.

APPENDIX F
LPILE PARAMETERS

L-PILE Soil and Rock Parameters

BRO-52-12.43
Rear Abutment

Boring No	B-001-0-22 and B-001-1-22		
Bottom of Pile Cap Elevation	495.6	feet	
Top of Rock Elevation	416.4	feet	From Boring
Pile Tip Elevation	416.4	feet	

From Bottom of Pile Cap to 485.4 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	59.6	pcf	
Undrained Cohesion =	2125	psf	
Strain Factor E50 =	0.005		From L-pile
k =	1000	pci	From L-pile

From 485.4 to 472.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	67.6	pcf	
Undrained Cohesion =	4500	psf	
Strain Factor E50 =	0.004		From L-pile
k =	2000	pci	From L-pile

From 472.9 to 457.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	59.6	pcf	
Undrained Cohesion =	1700	psf	
Strain Factor E50 =	0.007		From L-pile
k =	500	pci	From L-pile

From 457.9 to 447.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	62.6	pcf	
Undrained Cohesion =	3000	psf	
Strain Factor E50 =	0.005		From L-pile
k =	1000	pci	From L-pile

From 447.9 to 416.4 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	63.6	pcf	
Friction Angle =	34	Degrees	
k =	60	pci	From L-pile

Below 416.4 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	104	pcf	Laboratory Test of B-001-1-22, NQ-1
Strain Factor K_{rm} =	0.00005		From L-pile
Compressive Strength q_u =	8730	psi	Laboratory Test of B-001-1-22, NQ-1
Initial Rock Modulus =	680000	psi	GDM Table 400-6, Strong Rock
RQD =	75%		B-001-1-22, NQ-1

L-PILE Soil and Rock Parameters

BRO-52-12.43
Pier 1

Boring No	B-002-0-22 and C-002-0-39		
Bottom of Pile Cap Elevation	474.0	feet	
Top of Rock Elevation	418.83	feet	From C-002-0-39
Pile Tip Elevation	418.83	feet	

From Bottom of Pile Cap to 458.5 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	62.6	pcf	
Undrained Cohesion =	1750	psf	
Strain Factor E50 =	0.007		From L-pile
k =	500	pci	From L-pile

From 458.5 to 453.5 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	65.6	pcf	
Friction Angle =	30.5	Degrees	
k =	60	pci	From L-pile

From 453.5 to 438.5 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	67.6	pcf	
Friction Angle =	33	Degrees	
k =	60	pci	From L-pile

From 438.5 to 418.83 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	67.6	pcf	
Friction Angle =	36	Degrees	
k =	60	pci	From L-pile

Below 418.83 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	104	pcf	Laboratory Test of B-001-1-22, NQ-1
Strain Factor K_{rm} =	0.00005		From L-pile
Compressive Strength q_u =	8730	psi	Laboratory Test of B-001-1-22, NQ-1
Initial Rock Modulus =	680000	psi	GDM Table 400-6, Strong Rock
RQD =	75%		B-001-1-22, NQ-1

L-PILE Soil and Rock Parameters

BRO-52-12.43
Pier 2

Boring No	B-003-0-22 and C-004-0-39		
Bottom of Pile Cap Elevation	477.6	feet	
Top of Rock Elevation	416.83	feet	From C-004-0-39
Pile Tip Elevation	416.83	feet	

From Bottom of Pile Cap to 464.4 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	62.6	pcf	
Undrained Cohesion =	1750	psf	
Strain Factor E50 =	0.007		From L-pile
k =	500	pci	From L-pile

From 464.4 to 459.4 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	65.6	pcf	
Friction Angle =	30.5	Degrees	
k =	60	pci	From L-pile

From 459.4 to 449.4 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	67.6	pcf	
Friction Angle =	34	Degrees	
k =	60	pci	From L-pile

From 449.4 to 416.83 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	67.6	pcf	
Friction Angle =	36	Degrees	
k =	60	pci	From L-pile

Below 416.83 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	104.8	pcf	Laboratory Test of B-004-1-22, NQ-1
Strain Factor K_{rm} =	0.00005		From L-pile
Compressive Strength q_u =	8040	psi	Laboratory Test of B-004-1-22, NQ-1
Initial Rock Modulus =	680000	psi	GDM Table 400-6, Strong Rock
RQD =	52%		B-004-1-22, NQ-1

L-PILE Soil and Rock Parameters

BRO-52-12.43
Forward Abutment

Boring No	B-004-0-22 and B-004-1-22		
Bottom of Pile Cap Elevation	496.3	feet	
Top of Rock Elevation	416.4	feet	From Boring
Pile Tip Elevation	416.4	feet	

From Bottom of Pile Cap to 480.4 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	57.6	pcf	
Undrained Cohesion =	1500	psf	
Strain Factor E50 =	0.007		From L-pile
k =	500	pci	From L-pile

From 480.4 to 462.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	59.6	pcf	
Undrained Cohesion =	2200	psf	
Strain Factor E50 =	0.005		From L-pile
k =	1000	pci	From L-pile

From 462.9 to 452.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	65.6	pcf	
Undrained Cohesion =	4125	psf	
Strain Factor E50 =	0.004		From L-pile
k =	2000	pci	From L-pile

From 452.9 to 447.9 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	65.6	pcf	
Friction Angle =	36	Degrees	
k =	125	pci	From L-pile

From 447.9 to 437.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	62.6	pcf	
Undrained Cohesion =	2625	psf	
Strain Factor E50 =	0.005		From L-pile
k =	1000	pci	From L-pile

From 437.9 to 416.4 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	65.6	pcf	
Friction Angle =	36	Degrees	
k =	60	pci	From L-pile

Below 416.4 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	104.8	pcf	Laboratory Test of B-004-1-22, NQ-1
Strain Factor K_{rm} =	0.00005		From L-pile
Compressive Strength q_u =	8040	psi	Laboratory Test of B-004-1-22, NQ-1
Initial Rock Modulus =	680000	psi	GDM Table 400-6, Strong Rock
RQD =	52%		B-004-1-22, NQ-1