CTL Engineering, Inc.
2860 Fisher Road, P.O. Box 44548, Columbus, Ohio 43204-3538
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July 3, 2025

BG Engineering Group, LLC
5960 Wilcox Place, Suite C
Dublin, OH 43016

Attention: Mr. Greg Boyer, P.E. – Principal

Reference: **Culvert Exploration Report – Final**
LAW-140-00.09
PID No. 119781
Washington Township, Lawrence County, Ohio
CTL Project No. 24050044COL

Dear Mr. Boyer:

CTL Engineering, Inc. has completed the final culvert exploration report for the above referenced project. We are providing an electronic version (PDF file) of the report via email.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact me at our office.

Respectfully submitted,

CTL ENGINEERING, INC.

Sastry Malladi, P.E
Project Engineer

CULVERT EXPLORATION REPORT – FINAL

LAW-140-00.09
LAWRENCE COUNTY, OHIO

PID NO. 119781

CTL PROJECT NO. 24050044COL

PREPARED FOR:

BG ENGINEERING GROUP, LLC
5960 WILCOX PLACE, SUITE C
DUBLIN, OH 43016

PREPARED BY:

CTL ENGINEERING, INC.
2860 FISHER ROAD
COLUMBUS, OHIO 43204

July 3, 2025

OHIO DEPARTMENT OF TRANSPORTATION

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The overall project identified as LAW-140-00.09 involves addressing the flooding between SLM 0.09 and SLM 0.16 along S.R 140 in Lawrence County, Ohio. The improvements will include the replacement of a single roadway culvert, vertical profile revisions, and driveway reconstruction due to vertical profile revisions.

According to the provided plans, it is understood that the existing 24-inch diameter corrugated plastic pipe culvert, located at Station 865+39.28, will be replaced with a new box culvert with an 8-feet span and 4-feet rise. The new box culvert will be 44 feet in length.

CTL performed two (2) structure test borings near the proposed box culvert location. No additional test borings or pavement cores were requested within other areas of the project. The test borings were extended to depths ranging from 30.0 to 34.0 feet below existing grade.

Beneath the pavement, the borings encountered both coarse grained soil and fine-grained cohesive soils prior to reaching the boring termination depths. The soils were described as coarse and fine sand (A-3a), fine sand (A-3), sandy silt (A-4a), and silty clay (A-6b).

Groundwater was encountered during drilling at depths ranging from 3.5 to 11.3 feet below existing grade and after completion of drilling at depths ranging from 15.5 to 16.1 feet below grade. None of the test borings encountered bedrock prior to reaching the termination depth.

The soils at the planned bottom of foundation elevations for the headwalls/wingwalls, are relatively weak and are not suitable to support the proposed foundations. These soils should be over-excavated to a depth of 5 feet below the planned bottom of foundations. The over-excavations should be backfilled with properly compacted granular material. The proposed headwall/wingwall foundations should then be constructed onto the compacted granular material. The box culvert should be supported onto a layer of granular bedding material per ODOT requirements. Groundwater should be expected during over-excavations for the headwall/wingwall foundations. The groundwater level will need to be temporarily lowered to facilitate fill placement and compaction. Refer to *Section VI.A Culvert Foundation Support* of this report for additional information.

II. INTRODUCTION

The overall project identified as LAW-140-00.09 involves addressing the flooding between SLM 0.09 and SLM 0.16 along S.R 140 in Lawrence County, Ohio. The improvements will include the replacement of a single roadway culvert, vertical profile revisions, and driveway reconstruction due to vertical profile revisions.

According to the Stage 1 plans for this project it is understood that the existing 30-inch diameter corrugated metal pipe culvert, located at Station 865+39.28, will be replaced with a new box culvert with an 8-feet span and 4-feet rise. The new box culvert will be

44 feet in length. According to the plan/profile sheets, the project begins at Station 864+00.00 and ends at Station 868+00.00.

This is a Final Report.

III. GEOLOGY AND OBSERVATIONS

A. Geology

According to the Ohio Department of Natural Resources (ODNR), *Physiographic Regions of Ohio*, the site lies in the glaciated portion of Ohio, within the Ironton Plateau. This physiographic region is described as Pennsylvanian-age (Pottsville, Allegheny and Conemaugh Groups) cycles of sandstones, siltstones, shales and economically important coals; Pleistocene (Teays)-age Minford Clay; silt-loam and channery colluvium.

According to web-based *Soil Survey Report for Lawrence County, Ohio*, from United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), the soils in the project area primarily consist of Stendal silt loam, occasionally flooded (St). These soils are considered to be somewhat poorly drained with moderately high to high capacity (0.60 to 2.00 in/hr) to transmit water. This soil types have moderate risk of corrosion to concrete and high risk of corrosion to steel.

According to the mapping of bedrock geology in the area, (Ohio Geology Interactive Map, *ODNR GIS & Mapping Services, https://ohiodnr.gov/*), the surficial soil deposits on the site are underlain by the bedrock that consists of Breathitt Formation from the Pennsylvanian-age. It should be noted that no bedrock was encountered in any of the test borings within the drilled depths.

According to the mapping of karst features (Known and Probable Karst in Ohio, *ODNR Geological Survey Map EG-1, 1999; Revised 2002, 2006*), no karst features were recorded within the project area. Additionally, karst features were not observed at the ground surface during our field exploration.

According to the mapping of historic and active mines (ODNR Mines of Ohio, ODNR, accessed 2024), there are no documented mines in the general vicinity of the project area.

B. Observations

A field reconnaissance was completed by CTL personnel on July 22, 2024. S.R. 140 is a two-lane, bi-directional road that runs generally southwest to northeast. The topography along the roadway within or immediately adjacent to the project site consists mostly of rolling hills. The existing culvert convey a tributary of Hales Creek from the north side of S.R. 140 to the south side of the road. Surrounding land usage consists of rural residential, and wooded. Linear

pavement cracking was observed along the roadway alignment, and some pavement crack sealing was also observed.

IV. EXPLORATION

Two (2) test borings, designated as B-001-0-24 and B-002-0-24, were drilled to depths 34.0 feet and 30.0 feet below the existing ground surface, respectively.

The test borings were drilled by CTL on July 29, 2024, utilizing 3-¼ inch I.D. hollow-stem augers powered by a track-mounted drill rig. Split-barrel (spoon) samples and Standard Penetration Tests (SPTs) were performed in the test borings using a 140-pound automatic hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches. The automatic hammer was calibrated at an energy ratio of 79.3 percent on November 4, 2022.

The recovered split spoon samples obtained during the drilling operations were preserved in glass jars, visually classified in the field, and laboratory and tested for moisture content. Representative samples were subjected to laboratory testing including Atterberg Limits, grain size distribution, and hand penetrometer tests.

Drilling, sampling, field and laboratory testing were performed according to standard geotechnical engineering practices and current ASTM procedures. Results from field and laboratory tests are shown on the enclosed test boring records in Appendix B of this report. The results of the laboratory tests are presented in *Appendix C.*

The locations of the test borings were determined in the field by CTL personnel. The coordinates and ground surface elevations were determined by the BG Engineering, LLC, which were provided to CTL.

Historic geotechnical records were searched for on the ODOT's Transportation Information Mapping System (TIMS) website. No historic records were found for the project.

V. FINDINGS

A. Subsurface Conditions

A general description of the soils encountered during our subsurface exploration is presented below. Further details of the subsurface conditions encountered during CTL's geotechnical exploration are presented in the Test Boring Records in *Appendix B.*

1. Surficial Materials

At the ground surface, each test boring was drilled within the existing S.R. 140 roadway pavement and encountered approximately eight (8) inches of asphalt at the surface.

2. General Stratigraphy

Beneath the surficial materials, each test boring encountered both coarse grained soils and fine-grained cohesive soils prior to reaching the boring termination depth.

The soils were described as coarse and fine sand (A-3a), fine sand (A-3), sandy silt (A-4a), and silty clay (A-6b). These soils exhibited corrected standard penetration N_{60} values ranging from 0 blows per foot (weight of hammer) to 50 blows for 2 inches of penetration with moisture content values ranging from 9 to 66 percent.

3. Groundwater

Table 1 shows the depths and elevations at which groundwater was encountered, if any, and the borehole cave-in depth.

Table 1. Groundwater and Cave-in Depths

Boring No.	Groundwater Depth (feet)		Groundwater Elevation (feet)		Hole Cave-in Depth (feet)
	During Drilling	At Completion	During Drilling	At Completion	
B-001-0-24	3.5	15.5	661.9	649.9	None
B-002-0-24	11.3	16.1	653.9	649.1	None

It should be noted that the groundwater levels encountered during this subsurface exploration are generally not a reliable indication of long-term groundwater levels. Fluctuations in the level of the groundwater table (or saturated soils/perched water levels) will occur due to seasonal variances in rainfall, drainage, types of soils present and other factors. We caution that groundwater can be perched at various elevations above the general static groundwater level after periods of rainfall, especially in the lower elevations and natural drainage paths of the site.

B. Results of Laboratory Tests

Selected soil samples were tested in the laboratory for Atterberg Limits, grain size distribution, and hand penetrometer. The results of the soil laboratory tests are displayed on the test borings records in *Appendix B,* presented in *Appendix C*, and are summarized below in *Table 2*.

Table 2. Soil Laboratory Test Results

Boring No.	Sample ID	Depth (feet)	ODOT	LL	PI	Silt (%)	Clay (%)
B-001-0-24	SS-2	3.5 – 5.0	A-6b	38	17	25	26
B-001-0-24	SS-4	8.5 – 10.0	A-4a	24	9	41	24
B-001-0-24	SS-6	13.5 – 15.0	A-4a	24	8	33	17
B-001-0-24	SS-8	18.5 – 20.0	A-3	NP	NP	4	5
B-001-0-24	SS-13	31.0 – 32.5	A-3	NP	NP	6	3
B-002-0-24	SS-1	1.0 – 2.5	A-4a	NP	NP	35	20
B-002-0-24	SS-3	6.0 – 7.5	A-4a	NP	NP	40	23
B-002-0-24	SS-5	9.0 – 10.5	A-4a	NP	NP	25	17
B-002-0-24	SS-7	13.5 – 15.0	A-3a	NP	NP	9	6
B-002-0-24	SS-12	26.0 – 27.5	A-3	NP	NP	3	5

SS-# = Split Spoon Sample Number
LL = Liquid Limit
PI = Plasticity Index
Silt Fraction (particle size < 0.075 mm
Clay Fraction (particle size < 0.005 mm)
NP = Non-Plastic

VI. ANALYSES AND RECOMMENDATIONS

Based upon the preceding considerations as well as the subsurface information obtained from the field and laboratory testing and CTL's experience with these soil types, the following recommendations are provided for the proposed embankments.

A. Culvert Foundation Support

According to the provided plans, it is understood that the existing 30-inch diameter corrugated metal pipe culvert, located at Station 865+39.28, will be replaced with a new box culvert with an 8-feet span and 4-feet rise. The new box culvert will be 44 feet in length.

The proposed box culvert invert ranges from 660.2 to 660.4. According to the plans, the headwall foundations will be constructed approximately 2.0 feet below the proposed invert levels. The soils at and below the bottom of the headwall/wingwall foundations consist of the relatively weak sandy silt (A-4a). These soils exhibit undrained shear strength values (S_u) less than 1,500 psf. Therefore, CTL recommends that the soils below the headwall/wingwall foundations are excavated and replaced with properly compacted Granular Material, Type B. The over excavation should be performed to a minimum depth of 5.0 feet below the bottom of the proposed footings. The over-excavation should be extended beyond the edge of the spread foundations in all directions a horizontal distance of 5.0 feet.

Groundwater should be expected during the over-excavation and subsequent fill placement. The groundwater level will need to be temporarily lowered to a depth of about 2 feet below the bottom of the excavation to facilitate fill placement. Cofferdams should be considered for the over-excavations on this project.

The proposed headwalls/wingwalls may be supported onto spread foundations constructed into the Granular Material, Type B. Foundation bearing resistance calculations are appended to this memo, and are summarized below. The foundation bearing resistance calculations were performed in the area of B-001-0-24, where the weakest soils were encountered.

Strength Limit State - Nominal Bearing Resistance (q_n) = 7.7 ksf

A resistance factor of 0.55 should be used for determining factored bearing resistance in the strength limit state. The resistance factor was obtained from AASHTO LRFD Table 11.5.7.1.

Service Limit State - Presumptive Bearing Resistance (q_r) = 1.0 ksf

A resistance factor of 1.0 should be used for determining factored bearing resistance in the service limit state. The resistance factor was obtained from AASHTO LRFD section 11.5.7.

The box culvert should be supported onto a layer of granular bedding material per ODOT requirements.

B. Settlement Analysis

According to the profile along the culvert, new fill placed above the culvert will range from about 1.5 to 1.6 feet. The culvert will be constructed in an area where about 7 feet of soil will be removed to allow for the culvert installation.

Based on this information, the net additional loading on soils at the bottom of the culvert will be relatively low, and settlement below the culvert will not be an issue.

C. General Construction and Earthwork

1. Site preparation and earthwork should be performed in accordance with the ODOT Construction and Material Specifications, and applicable sections of the ODOT GDM.

2. Embankment side slopes should be seeded and vegetation growth permitted to limit erosion, 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 should be notified so that our recommendations can be modified, if required.

VIII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL 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 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 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.

Shahedur Rahman, P. E
Project Engineer

Sastry Malladi, P.E.
Project Engineer

APPENDIX A
GEOTECHNICAL PROFILE- CULVERT

PROJECT DESCRIPTION

THE PROJECT INVOLVES ADDRESSING THE FLOODING BETWEEN SLM 0.09 AND SLM 0.16 ALONG S.R 140 IN LAWRENCE COUNTY, OHIO. THE IMPROVEMENTS WILL INCLUDE THE REPLACEMENT OF A SINGLE ROADWAY CULVERT, VERTICAL PROFILE REVISIONS, AND DRIVEWAY RECONSTRUCTION DUE TO VERTICAL PROFILE REVISIONS.

IT IS UNDERSTOOD THAT THE EXISTING 24- INCH DIAMETER CORRUGATED PLASTIC PIPE CULVERT, LOCATED AT STATION 865+39.28, WILL BE REPLACED WITH A NEW BOX CULVERT WITH AN 8-FEET SPAN AND 4-FEET RISE. THE NEW BOX CULVERT WILL BE 44 FEET IN LENGTH.

HISTORIC RECORDS

HISTORIC GEOTECHNICAL RECORDS WERE SEARCHED FOR ON THE ODOT TIMS WEBSITE. NO HISTORIC RECORDS WERE FOUND FOR THIS PROJECT.

GEOLOGY

THE PROJECT SITE IS LOCATED WITHIN THE IRONTON PHYSIOGRAPHIC REGION THAT IS DESCRIBED AS PLEISTOCENE- AGE MINFORD CLAY; SILT-LOAM AND CHANNERY COLLUVIUM UNDERLAIN BY PENNSYLVANIAN- AGE CYCLES OF SANDSTONE, SILTSTONES, SHALES AND COALS.

ACCORDING TO THE MAPPING OF KARST FEATURES (KARST INTERACTIVE MAP, ODNR DIVISION OF GEOLOGICAL SURVEY, ACCESSED 2024), THERE ARE NO MAPPED KARST FEATURES IN THE GENERAL VICINITY OF THE PROJECT AREA. ADDITIONALLY, KARST FEATURES WERE NOT OBSERVED AT THE GROUND SURFACE DURING OUR FIELD EXPLORATION.

ACCORDING TO THE MAPPING OF HISTORIC AND ACTIVE MINES (ODNR MINES OF OHIO, ODNR, ACCESSED 2024), THERE ARE NO DOCUMENTED MINES IN THE GENERAL VICINITY OF THE PROJECT AREA.

RECONNAISSANCE

A FIELD RECONNAISSANCE WAS COMPLETED BY CTL PERSONNEL ON JULY 22, 2024. S.R. 140 IS A TWO-LANE, BI-DIRECTIONAL ROAD THAT RUNS GENERALLY SOUTHWEST TO NORTHEAST. THE TOPOGRAPHY ALONG THE ROADWAY WITHIN OR IMMEDIATELY ADJACENT TO THE PROJECT SITE CONSISTS MOSTLY OF ROLLING HILLS. THE EXISTING CULVERT CONVEY A TRIBUTARY OF HALES CREEK FROM THE NORTH SIDE OF S.R. 140 TO THE SOUTH SIDE OF THE ROAD. SURROUNDING LAND USAGE CONSISTS OF RURAL RESIDENTIAL, AND WOODED. LINEAR PAVEMENT CRACKING WAS OBSERVED ALONG THE ROADWAY ALIGNMENT, AND SOME PAVEMENT CRACK SEALING WAS ALSO OBSERVED.

SUBSURFACE EXPLORATION

TWO (2) TEST BORINGS, IDENTIFIED AS B-001-0-24 AND B-002-0-24, WERE PERFORMED FOR THIS SUBSURFACE EXPLORATION. ALL TEST BORINGS WERE DRILLED WITHIN THE EXISITING ROADWAY PAVEMENT. THE TEST BORINGS WERE DRILLED TO DEPTHS RANGING FROM 30 FEET TO 34.0 FEET BELOW THE EXISTING GROUND SURFACE.

THE TEST BORINGS WERE DRILLED ON JULY 29, 2024, UTILIZING 3-1/4 INCH I.D. HOLLOW-STEM AUGERS POWERED BY A TRACK-MOUNTED ROTARY DRILL RIG. SPLIT-BARREL (SPOON) DISTURBED SOIL SAMPLES AND STANDARD PENETRATION TESTS WERE PERFORMED IN ACCORDANCE WITH AASHTO T206 AT 1.5- TO 2.5-FOOT INTERVALS. THE AUTOMATIC HAMMER WAS CALIBRATED ON NOVEMBER 4, 2022, AND HAD AN ENERGY RATIO OF 79.3 PERCENT.

EXPLORATION FINDINGS

THE TEST BORINGS ENCOUNTERED EIGHT (8) INCHES OF ASPHALT. BELOW THE SURFICIAL MATERIALS, EACH TEST BORING ENCOUNTERED BOTH FINE-GRAINED COHESIVE SOILS AND COARSE-GRAINED SOILS PRIOR TO REACHING THE BORING TERMINATION DEPTH. THE SOILS WERE DESCRIBED AS MEDIUM STIFF SILTY CLAY (A- 6b) AND NON- PLASTIC OR LOW PLASTICITY SANDY SILT (A- 4a), OVER VERY LOOSE TO MEDIUM DENSE COARSE AND FINE SAND (A-3a) OR FINE SAND (A-3).

GROUNDWATER WAS ENCOUNTERED DURING DRILLING AT DEPTHS RANGING FROM 3.5 TO 11.3 FEET BELOW EXISTING GRADE AND AFTER COMPLETION OF DRILLING AT DEPTHS RANGING FROM 15.5 TO 16.1 FEET BELOW GRADE.

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 19, 2024.

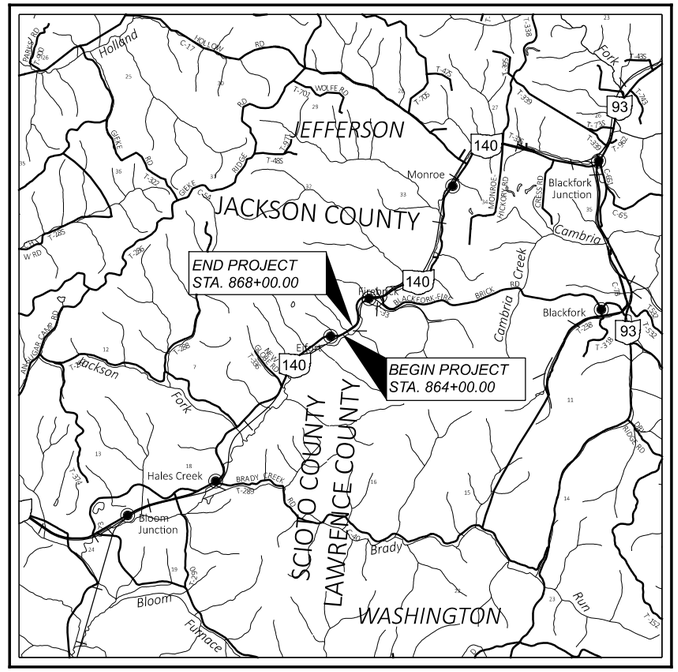
AVAILABLE INFORMATION

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

LEGEND

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
FINE SAND	A-3 (0)	3	10
COARSE AND FINE SAND	A-3a (0)	1	2
SANDY SILT	A-4a (4)	5	4
SILTY CLAY	A-6b (6)	1	1
	TOTAL	10	17

XXXXX	PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL
	BORING LOCATION - PLAN VIEW	
	DRIVE SAMPLE AND/OR TEST 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.	
W	INDICATES FREE WATER ELEVATION.	
	INDICATES WATER AT COMPLETION.	
X/Y/D"	NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT): X = NUMBER OF BLOWS FOR 6 INCHES (UNCORRECTED) Y/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D" OF PENETRATION AT REFUSAL.	
	INDICATES A PLASTIC MATERIAL WITH A 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.	



LOCATION MAP

SCALE IN MILES

0 1 2 3 4

N

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. - DW 07/22/2024
DRILLING - CTL ENGINEERING, INC. 07/29/2024
DRAWN - N.K.S 01/03/2025
REVIEWED - SM 01/03/2025

GEOTECHNICAL PROFILE - CULVERT

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 01-03-25

PROJECT ID 119781

SUBSET 1 TOTAL 4

SHEET P. TOTAL -

LAW-140-00.09

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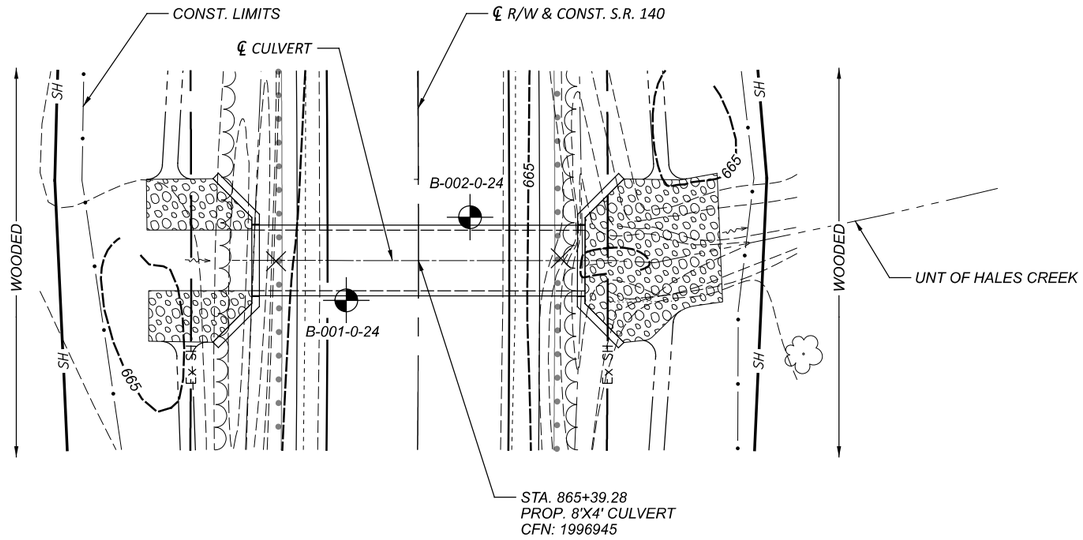

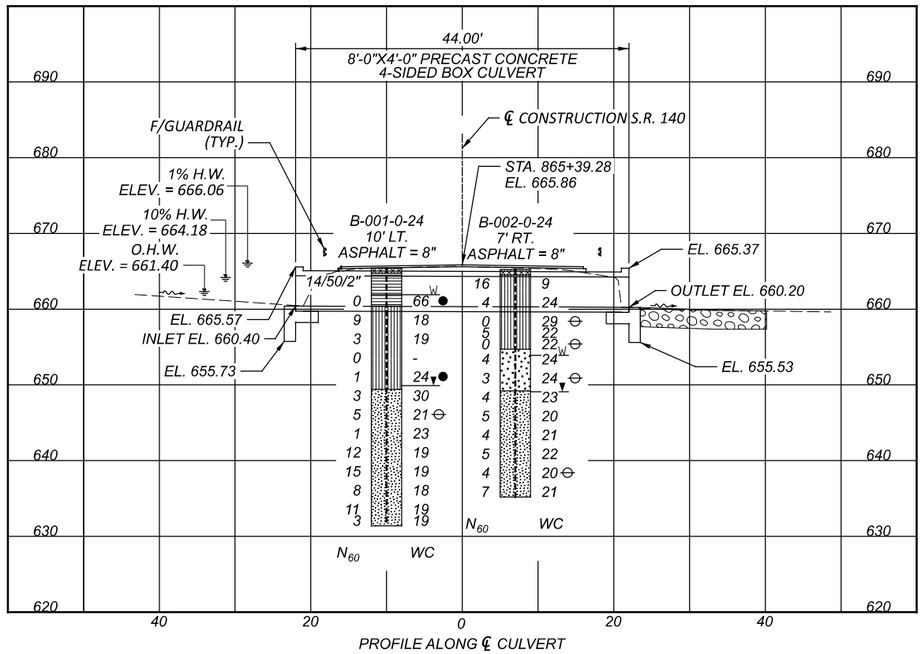

HORIZONTAL SCALE IN FEET
0 5 10 20

GEOTECHNICAL PROFILE - CULVERT
BRIDGE NO. LAW-140-00.09 OVER HALES CREEK (SR 140)

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

DESIGNER	N.K.S
REVIEWER	SM 01-04-25
PROJECT ID	119781
SUBSET	2
TOTAL	4
SHEET	P.
TOTAL	-

LAW-140-00.09

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PROJECT: LAW-140-00.09	DRILLING FIRM / OPERATOR: CTL / A.WILDER	DRILL RIG: CME 55 #393	STATION / OFFSET: 865+34, 10' LT.	EXPLORATION ID B-001-0-24
TYPE: CULVERT	SAMPLING FIRM / LOGGER: CTL / A.WILDER	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 140	
PID: 119781 SFN: 1996945	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 665.4 (MSL) EOB: 34.0 ft.	PAGE 1 OF 1
START: 7-29-24 END: 7-29-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.834072, -82.649967	

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
	665.4																	
ASPHALT (8")	664.7																	
VERY STIFF, BROWN AND BLACK, **SILTY CLAY**, LITTLE GRAVEL, CONTAINS ASPHALT, (FILL), DAMP	661.9	1	14 50/2"	-	100	SS-1	2.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
MEDIUM STIFF, BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, WET	660.4	W 661.9	0 0 0	0	22	SS-2	0.75	14	16	19	25	26	38	21	17	66	A-6b (6)	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WET			5 5 2	9	67	SS-3	1.00	-	-	-	-	-	-	-	-	18	A-4a (V)	
@8.5'; STIFF			2 1 1	3	100	SS-4	1.75	1	0	34	41	24	24	15	9	19	A-4a (6)	
@11.0'; VERY SOFT			0 0 0	0	0	SS-5	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
@13.5'; STIFF			1 0 1	1	100	SS-6	1.75	7	6	37	33	17	24	16	8	24	A-4a (3)	
	649.4																	
VERY LOOSE, GRAY, **FINE SAND**, TRACE CLAY, TRACE SILT, WET			1 1 1	3	100	SS-7	-	-	-	-	-	-	-	-	-	30	A-3 (V)	
@18.5'; LOOSE			0 3 1	5	100	SS-8	-	0	16	75	4	5	NP	NP	NP	21	A-3 (0)	
@21.0'; VERY LOOSE			1 1 0	1	100	SS-9	-	-	-	-	-	-	-	-	-	23	A-3 (V)	
@23.5'; MEDIUM DENSE			8 5 4	12	100	SS-10	-	-	-	-	-	-	-	-	-	19	A-3 (V)	
F.S.			5 5 6	15	100	SS-11	-	-	-	-	-	-	-	-	-	19	A-3 (V)	
@28.5'; LOOSE			4 4 2	8	100	SS-12	-	-	-	-	-	-	-	-	-	18	A-3 (V)	
@31.0'; MEDIUM DENSE			4 4 4	11	100	SS-13	-	0	19	72	6	3	NP	NP	NP	19	A-3 (0)	
@32.5'; VERY LOOSE	631.4	EOB	1 1 1	3	100	SS-14	-	-	-	-	-	-	-	-	-	19	A-3 (V)	

NOTES: NONE

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

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P. -	3 TOTAL 4	119781	SM 01-03-25	N.K.S	GTL ENGINEERING, INC. 6797 NORTH HIGH STREET, SUITE 305 COLUMBUS, OHIO 43094 PHONE (614) 430-6000 FAX (614) 430-6377

GEOTECHNICAL PROFILE - CULVERT
BORING LOG B-001-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 03-01-2025 TIME: 18:01:19 USER: hp
D:\Drop Box\CTL 2025\January\Dept 05\COL\Shahed\24050044COL_ODOT\Mod_03.01.25\119781ZL002.dgn

PROJECT: LAW-140-00.09	DRILLING FIRM / OPERATOR: CTL / A.WILDER	DRILL RIG: CME 55 #393	STATION / OFFSET: 865+45, 7' RT.	EXPLORATION ID B-002-0-24
TYPE: CULVERT	SAMPLING FIRM / LOGGER: CTL / A.WILDER	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 140	
PID: 119781 SFN: 1996945	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11-4-22	ELEVATION: 665.2 (MSL) EOB: 30.0 ft.	PAGE 1 OF 1
START: 7-29-24 END: 7-29-24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.834051, -82.649904	

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
ASPHALT (8")	665.2 664.5																	
MEDIUM DENSE, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP			18 8 4	16	100	SS-1	-	7	9	29	35	20	NP	NP	NP	9	A-4a (4)	
@3.5'; VERY LOOSE, WET			3 2 1	4	100	SS-2	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
			0 0 0	0	100	SS-3	-	0	1	36	40	23	NP	NP	NP	29	A-4a (6)	
@7.5'; LOOSE			0 2 2	5	100	SS-4	-	-	-	-	-	-	-	-	-	22	A-4a (V)	
@9.0'; VERY LOOSE	654.7		0 0 0	0	100	SS-5	-	0	2	56	25	17	NP	NP	NP	22	A-4a (1)	
VERY LOOSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, MOIST		W 653.9	0 1 2	4	100	SS-6	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
			2 1 1	3	100	SS-7	-	0	14	71	9	6	NP	NP	NP	24	A-3a (0)	
VERY LOOSE, GRAY, **FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	649.2		2 2 1	4	100	SS-8	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
@18.5'; LOOSE			2 1 3	5	100	SS-9	-	-	-	-	-	-	-	-	-	20	A-3 (V)	
@21.0'; VERY LOOSE			2 1 2	4	100	SS-10	-	-	-	-	-	-	-	-	-	21	A-3 (V)	
@23.5'; LOOSE	F.S.		1 2 2	5	100	SS-11	-	-	-	-	-	-	-	-	-	22	A-3 (V)	
@26.0'; VERY LOOSE			2 2 1	4	100	SS-12	-	1	7	84	3	5	NP	NP	NP	20	A-3 (0)	
@28.5'; LOOSE	635.2	EOB	3 3 2	7	100	SS-13	-	-	-	-	-	-	-	-	-	21	A-3 (V)	

NOTES: NONE

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

STANDARD ODOT SOIL BORING LOG (1) X (7) - OH DOT.GDT - 3-12-25 17:55 - G:\2025\JANUARY\03\24050044COL\24050044COL.GPJ

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P. -	4 TOTAL 4	119781	SM 01-03-25	N.K.S	GTL ENGINEERING

GTL ENGINEERING
CUYAHOGA FALLS, OHIO 44224
PHONE (614) 276-8577

GEOTECHNICAL PROFILE - CULVERT
BORING LOG B-002-0-24

APPENDIX B
TEST BORING RECORDS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 1/2/25 11:51 - O:\PROJECT\2024\COL-05\24050044COL_BG ENGINEERING GROUP LLC_LAW-140-00-00 CULVERT REPLACEMENT\R

PROJECT: LAW-140-00.09	DRILLING FIRM / OPERATOR: CTL / A.WILDER	DRILL RIG: CME 55 #393	STATION / OFFSET: 865+34, 10' LT.	EXPLORATION ID B-001-0-24
TYPE: CULVERT	SAMPLING FIRM / LOGGER: CTL / A.WILDER	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 140	
PID: 119781 SFN: 1996945	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 665.4 (MSL) EOB: 34.0 ft.	PAGE 1 OF 2
START: 7/29/24 END: 7/29/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.834072, -82.649967	

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
ASPHALT (8")	665.4 / 664.7																	
VERY STIFF, BROWN AND BLACK, **SILTY CLAY**, LITTLE GRAVEL, CONTAINS ASPHALT, (FILL), DAMP			14 50/2"	-	100	SS-1	2.50	-	-	-	-	-	-	-	-	12	A-6b (V)	
	661.9	W 661.9																
MEDIUM STIFF, BROWN, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, WET	660.4		0 0 0	0	22	SS-2	0.75	14	16	19	25	26	38	21	17	66	A-6b (6)	
MEDIUM STIFF, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, WET			5 5 2	9	67	SS-3	1.00	-	-	-	-	-	-	-	-	18	A-4a (V)	
@8.5'; STIFF			2 1 1	3	100	SS-4	1.75	1	0	34	41	24	24	15	9	19	A-4a (6)	
@11.0'; VERY SOFT			0 0 0	0	0	SS-5	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
@13.5'; STIFF			1 0 1	1	100	SS-6	1.75	7	6	37	33	17	24	16	8	24	A-4a (3)	
	649.4	▼																
VERY LOOSE, GRAY, **FINE SAND**, TRACE CLAY, TRACE SILT, WET			1 1 1	3	100	SS-7	-	-	-	-	-	-	-	-	-	30	A-3 (V)	
@18.5'; LOOSE			0 3 1	5	100	SS-8	-	0	16	75	4	5	NP	NP	NP	21	A-3 (0)	
@21.0'; VERY LOOSE			1 1 0	1	100	SS-9	-	-	-	-	-	-	-	-	-	23	A-3 (V)	
@23.5'; MEDIUM DENSE			8 5 4	12	100	SS-10	-	-	-	-	-	-	-	-	-	19	A-3 (V)	
			5 5 6	15	100	SS-11	-	-	-	-	-	-	-	-	-	19	A-3 (V)	
@28.5'; LOOSE			4 4 2	8	100	SS-12	-	-	-	-	-	-	-	-	-	18	A-3 (V)	

PID: 119781	SFN: 1996945	PROJECT: LAW-140-00.09	STATION / OFFSET: 865+34, 10' LT.	START: 7/29/24	END: 7/29/24	PG 2 OF 2	B-001-0-24

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
VERY LOOSE, GRAY, **FINE SAND**, TRACE CLAY, TRACE SILT, WET *(continued)*	635.4																	
@31.0'; MEDIUM DENSE		31	4 4 4	11	100	SS-13	-	0	19	72	6	3	NP	NP	NP	19	A-3 (0)	
@32.5'; VERY LOOSE		32																
		33	1 1 1	3	100	SS-14	-	-	-	-	-	-	-	-	-	19	A-3 (V)	
	631.4	EOB 34																

NOTES: NONE

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

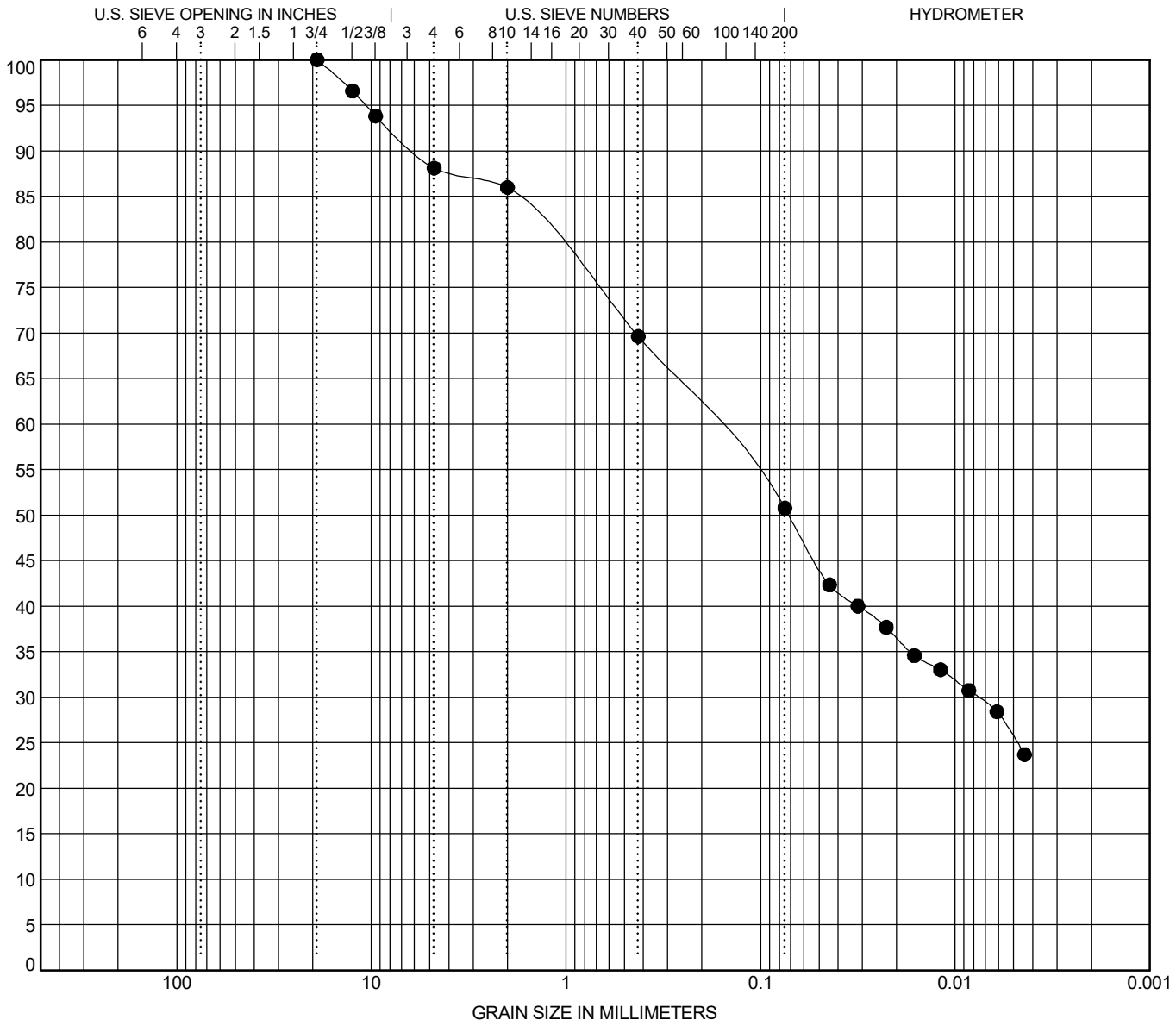
PROJECT: LAW-140-00.09	DRILLING FIRM / OPERATOR: CTL / A.WILDER	DRILL RIG: CME 55 #393	STATION / OFFSET: 865+45, 7' RT.	EXPLORATION ID B-002-0-24
TYPE: CULVERT	SAMPLING FIRM / LOGGER: CTL / A.WILDER	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 140	
PID: 119781 SFN: 1996945	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 11/4/22	ELEVATION: 665.2 (MSL) EOB: 30.0 ft.	PAGE 1 OF 1
START: 7/29/24 END: 7/29/24	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.3	LAT / LONG: 38.834051, -82.649904	

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
ASPHALT (8")	665.2 / 664.5																	
MEDIUM DENSE, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP		1–2	18 8 4	16	100	SS-1	-	7	9	29	35	20	NP	NP	NP	9	A-4a (4)	
@3.5'; VERY LOOSE, WET		3–4	3 2 1	4	100	SS-2	-	-	-	-	-	-	-	-	-	24	A-4a (V)	
		6–7	0 0 0	0	100	SS-3	-	0	1	36	40	23	NP	NP	NP	29	A-4a (6)	
@7.5'; LOOSE		8	0 2 2	5	100	SS-4	-	-	-	-	-	-	-	-	-	22	A-4a (V)	
@9.0'; VERY LOOSE	654.7	9–10	0 0 0	0	100	SS-5	-	0	2	56	25	17	NP	NP	NP	22	A-4a (1)	
VERY LOOSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE CLAY, MOIST	W 653.9	11–12	0 1 2	4	100	SS-6	-	-	-	-	-	-	-	-	-	24	A-3a (V)	
		14–15	2 1 1	3	100	SS-7	-	0	14	71	9	6	NP	NP	NP	24	A-3a (0)	
VERY LOOSE, GRAY, **FINE SAND**, TRACE SILT, TRACE CLAY, TRACE GRAVEL, WET	649.2	16–17	2 2 1	4	100	SS-8	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
@18.5'; LOOSE		19–20	2 1 3	5	100	SS-9	-	-	-	-	-	-	-	-	-	20	A-3 (V)	
@21.0'; VERY LOOSE		21–22	2 1 2	4	100	SS-10	-	-	-	-	-	-	-	-	-	21	A-3 (V)	
@23.5'; LOOSE		24–25	1 2 2	5	100	SS-11	-	-	-	-	-	-	-	-	-	22	A-3 (V)	
@26.0'; VERY LOOSE		26–27	2 2 1	4	100	SS-12	-	1	7	84	3	5	NP	NP	NP	20	A-3 (0)	
@28.5'; LOOSE	635.2	29 EOB	3 3 2	7	100	SS-13	-	-	-	-	-	-	-	-	-	21	A-3 (V)	

NOTES: NONE

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	

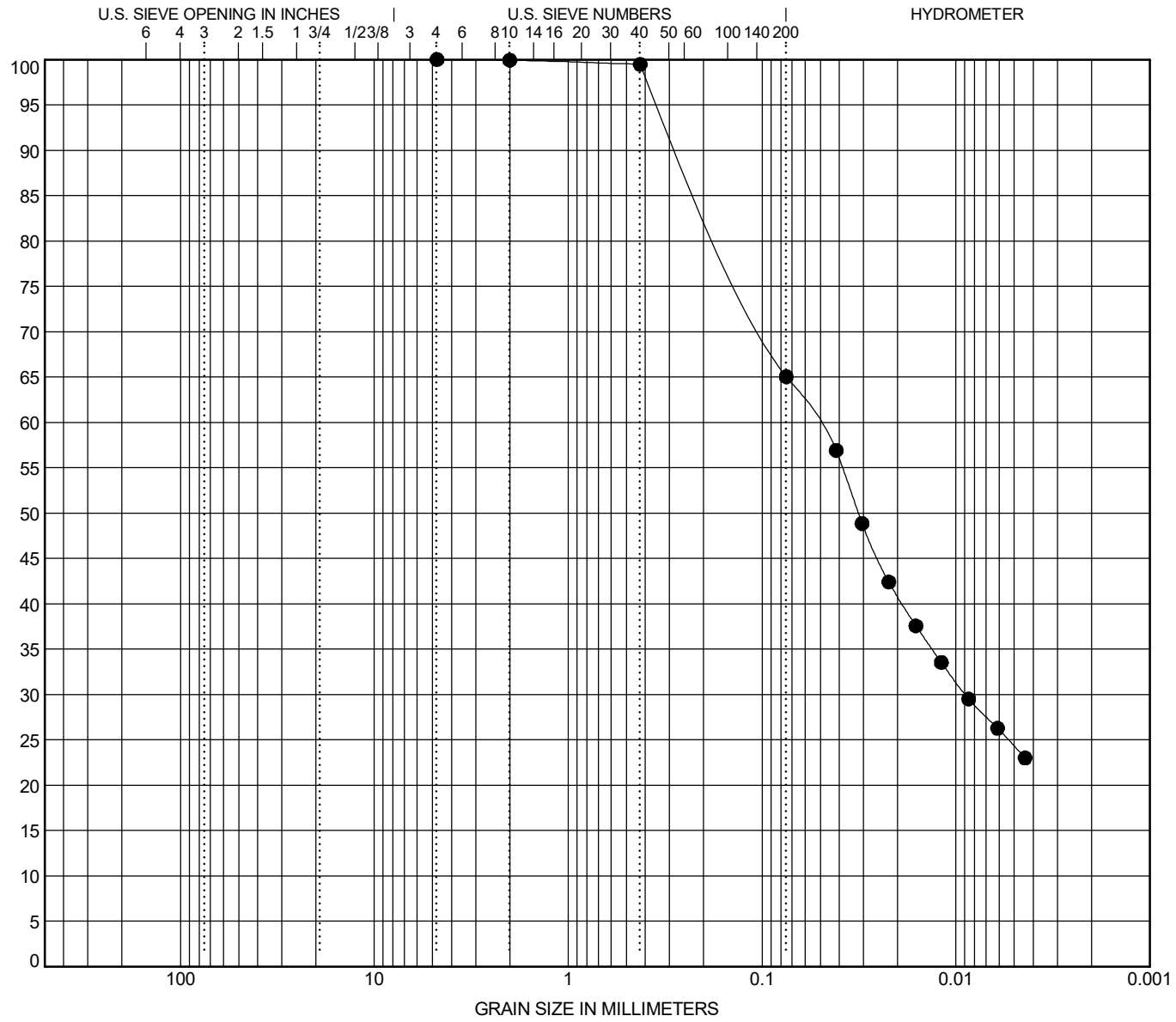
Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**3.5**	**A-6b(6)**	**66**	**38**	**21**	**17**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**3.5**	**19**	**0.176**	**0.072**	**0.008**		**14**	**16**	**19**	**25**	**26**

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

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-001-0-24	**8.5**	**A-4a(6)**	**19**	**24**	**15**	**9**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**8.5**	**4.75**	**0.052**	**0.032**	**0.009**		**1**	**0**	**34**	**41**	**24**

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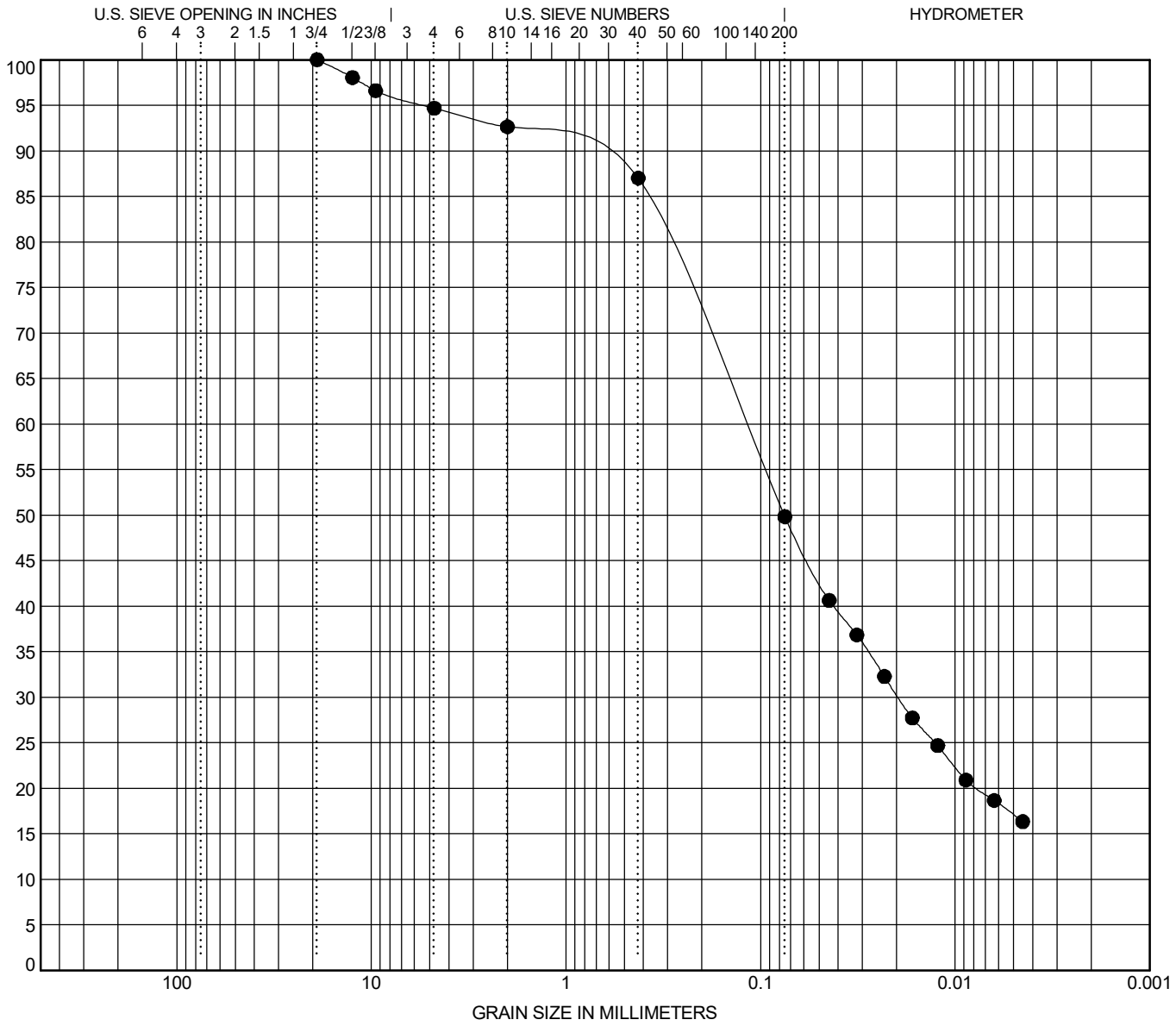
GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-001-0-24	**13.5**	**A-4a(3)**	**24**	**24**	**16**	**8**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**13.5**	**19**	**0.121**	**0.076**	**0.02**		**7**	**6**	**37**	**33**	**17**

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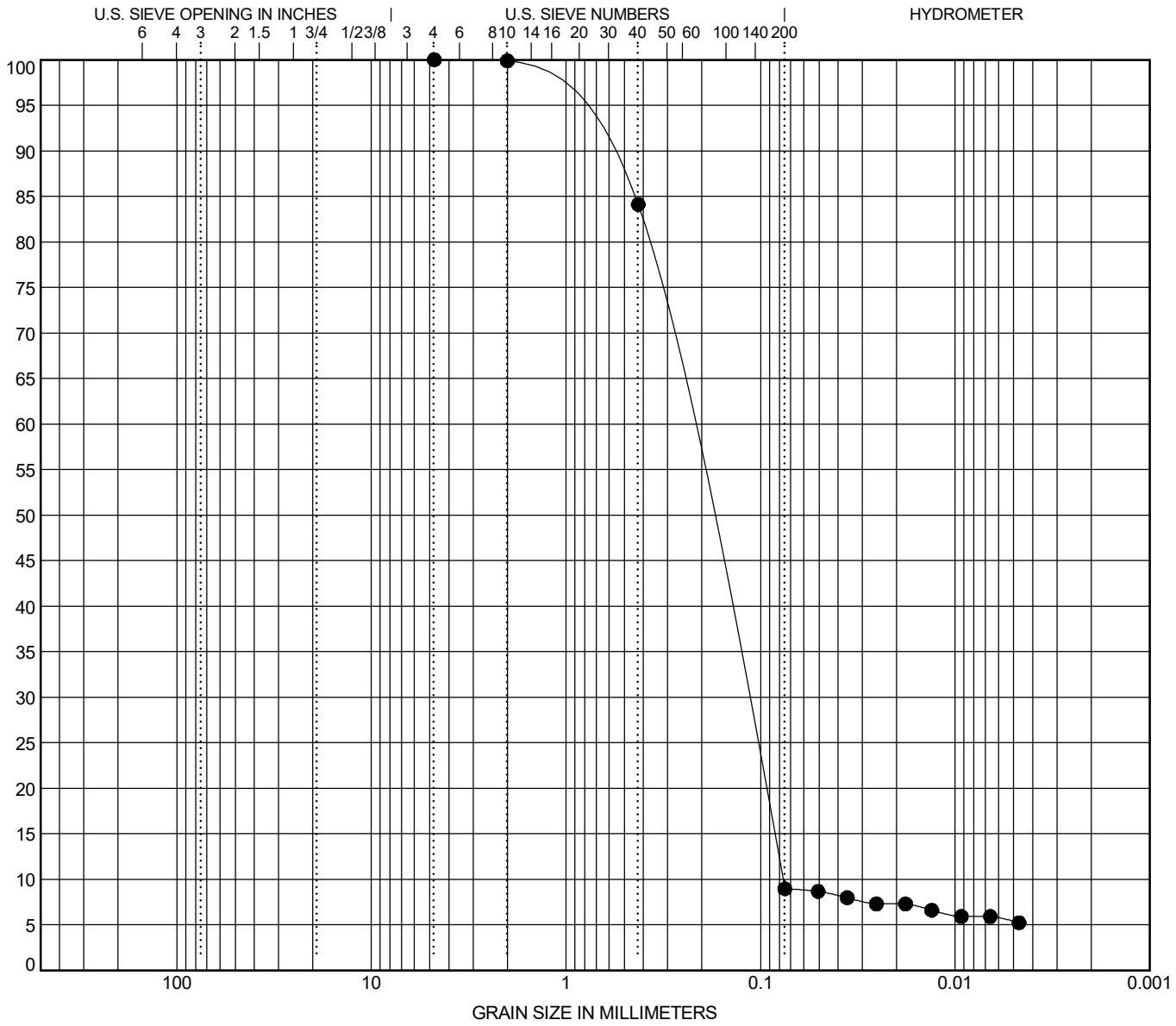
GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-001-0-24	**18.5**	**A-3(0)**	**21**	**NP**	**NP**	**NP**	**0.79**	**3.17**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**18.5**	**4.75**	**0.244**	**0.193**	**0.122**	**0.077**	**0**	**16**	**75**	**4**	**5**

CTL ENGINEERING

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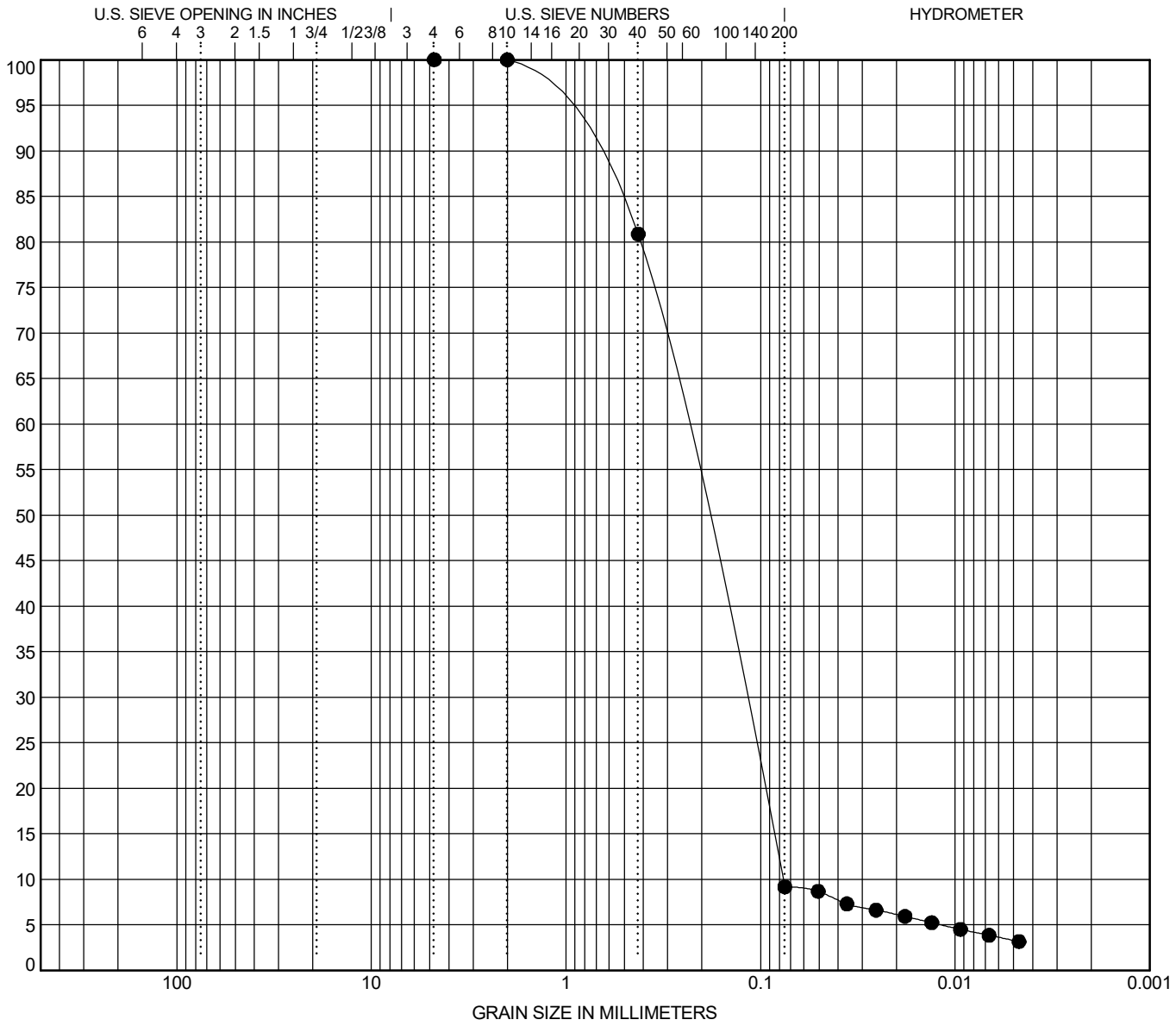
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-001-0-24	**31.0**	**A-3(0)**	**19**	**NP**	**NP**	**NP**	**0.79**	**3.35**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**31.0**	**4.75**	**0.257**	**0.201**	**0.124**	**0.077**	**0**	**19**	**72**	**6**	**3**

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Columbus, Ohio 43204
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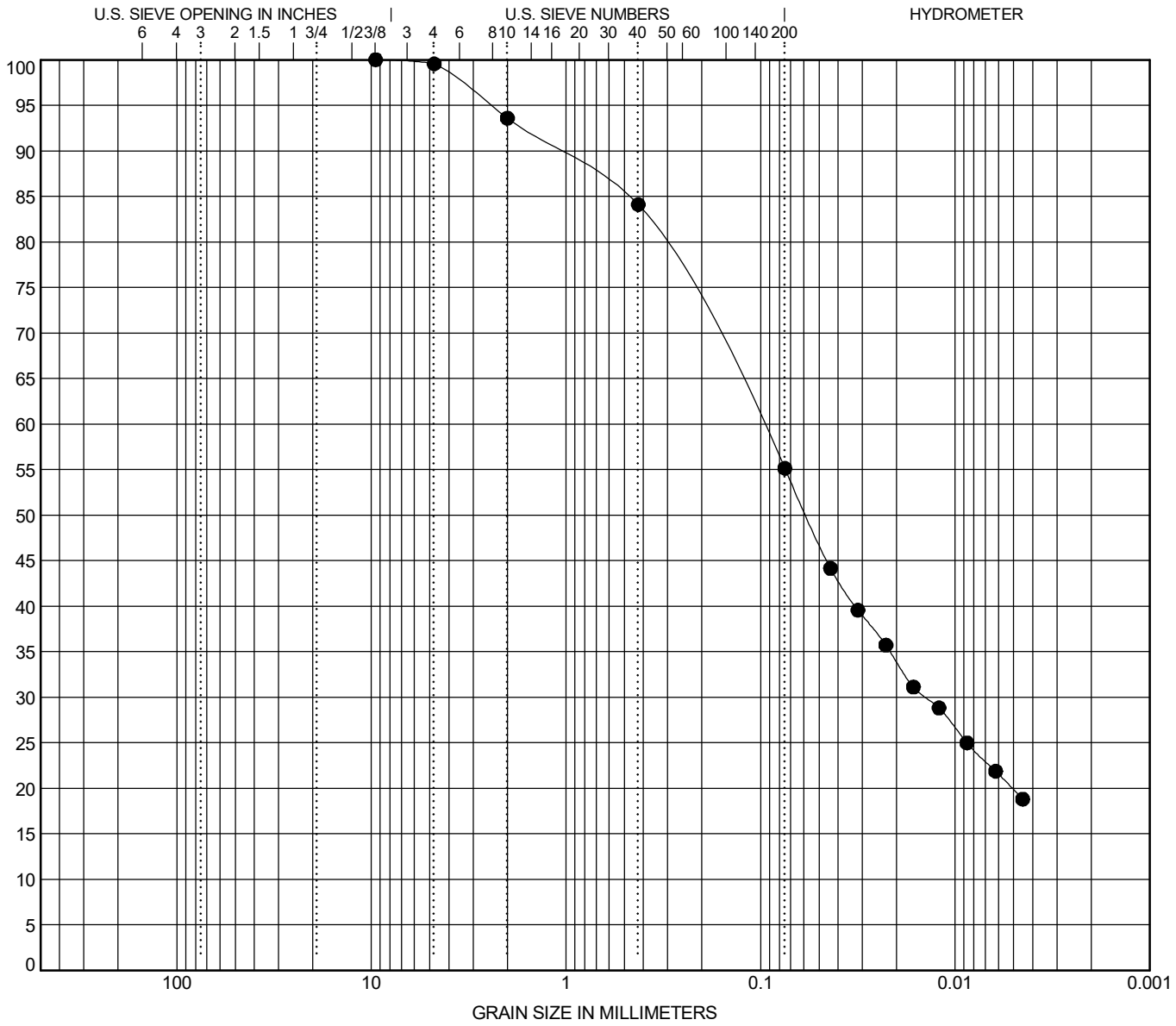
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-002-0-24	**1.0**	**A-4a(0)**	**9**	**NP**	**NP**	**NP**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**1.0**	**9.5**	**0.1**	**0.058**	**0.014**		**7**	**9**	**29**	**35**	**20**

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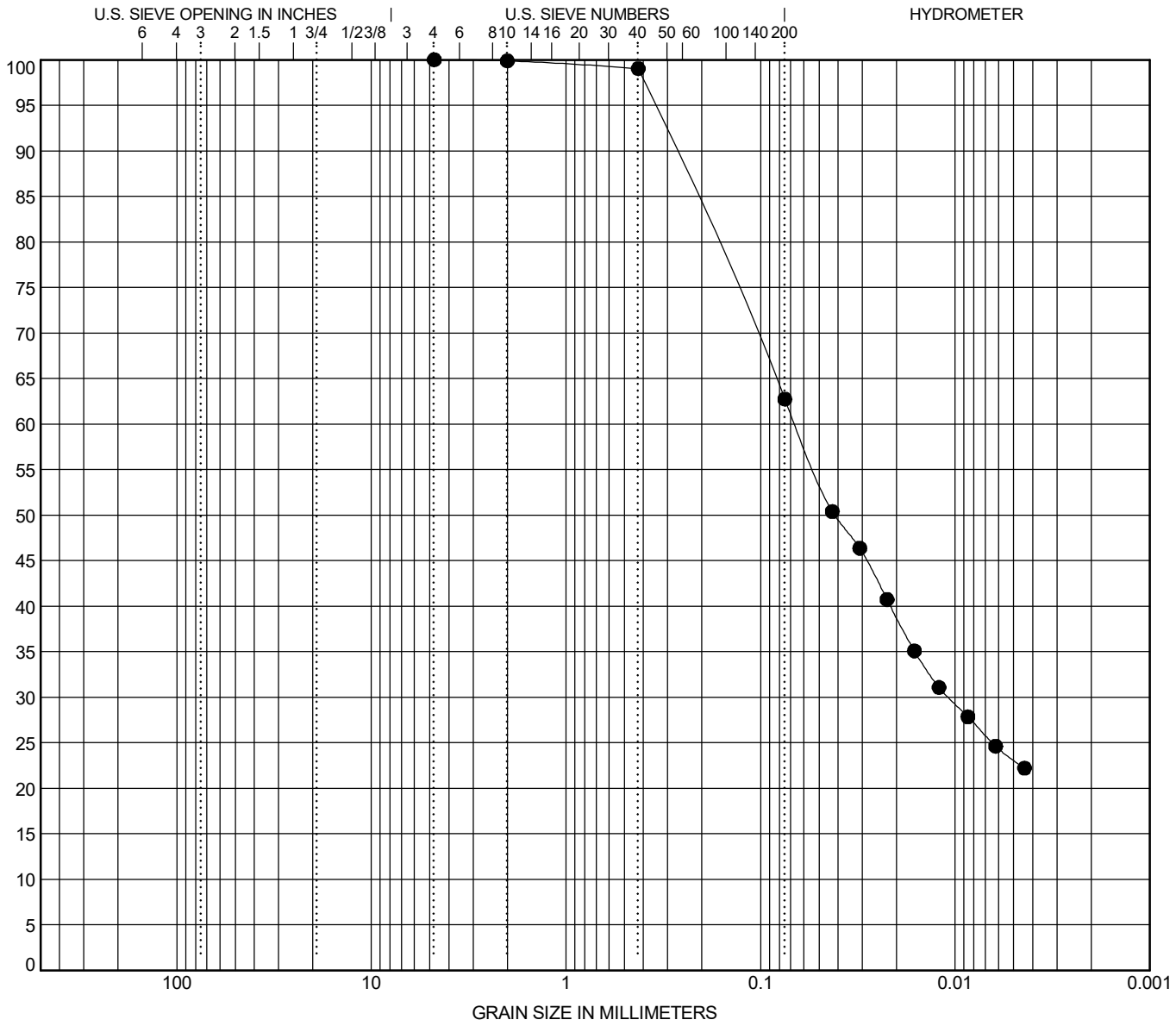
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-002-0-24	**6.0**	**A-4a(0)**	**29**	**NP**	**NP**	**NP**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**6.0**	**4.75**	**0.066**	**0.042**	**0.011**		**0**	**1**	**36**	**40**	**23**

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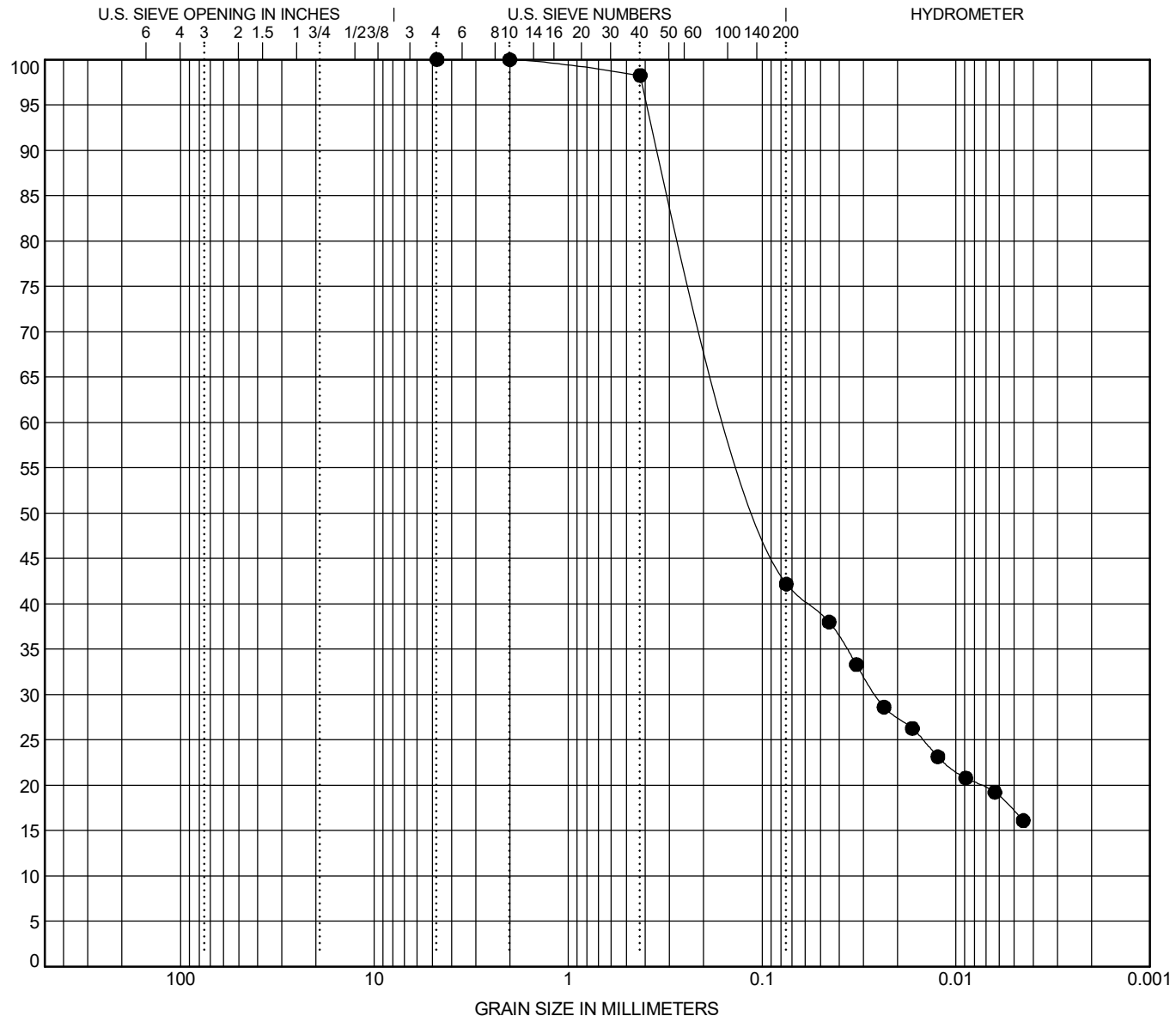
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-002-0-24	**9.0**	**A-4a(0)**	**22**	**NP**	**NP**	**NP**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**9.0**	**4.75**	**0.13**	**0.096**	**0.026**		**0**	**2**	**56**	**25**	**17**

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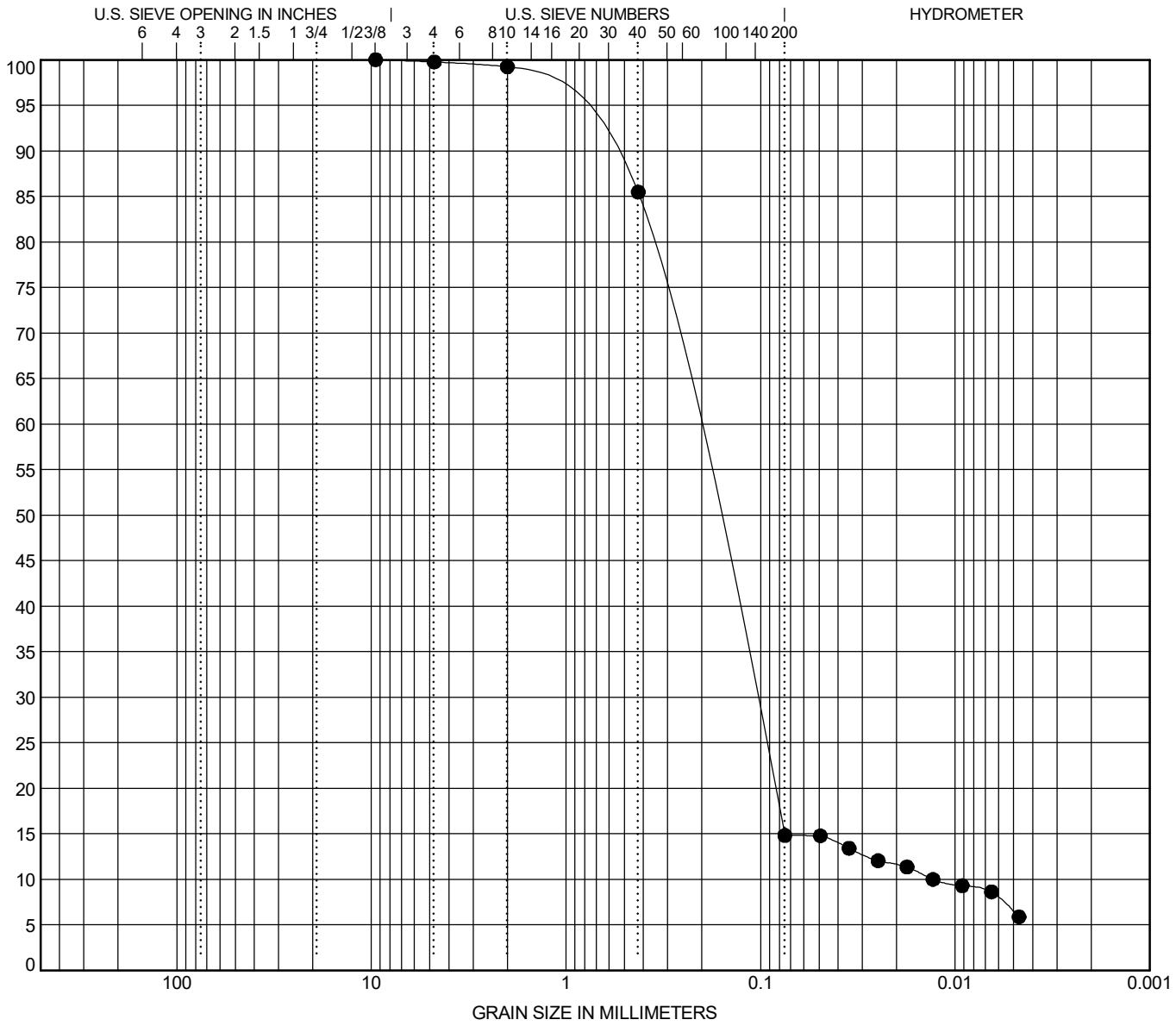
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW COUNTY
CTL Project Number:



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

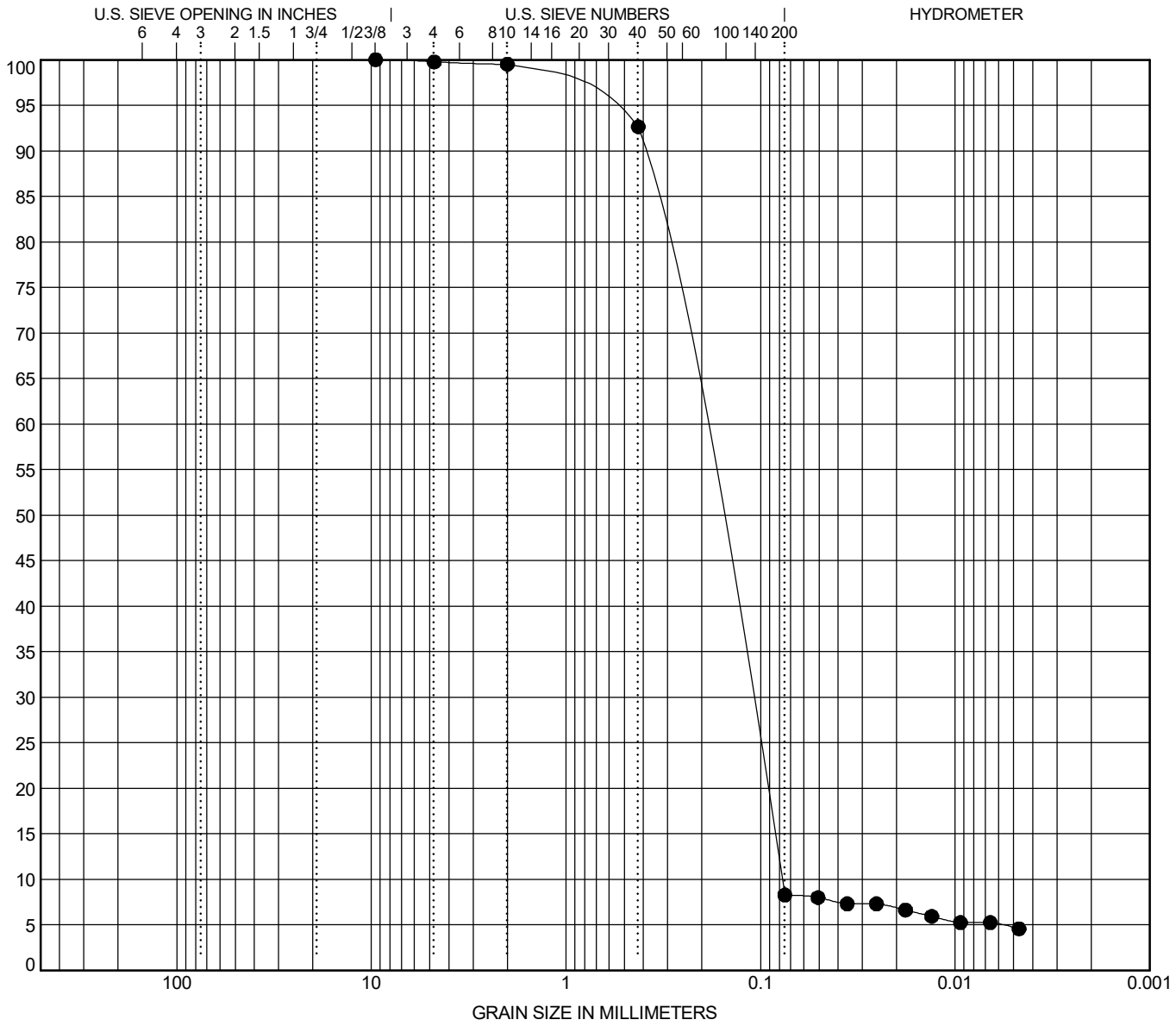
Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**13.5**	**A-3a(0)**	**24**	**NP**	**NP**	**NP**	**3.99**	**17.39**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**13.5**	**9.5**	**0.227**	**0.178**	**0.109**	**0.013**	**0**	**14**	**71**	**9**	**6**

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

GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW 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-002-0-24	**26.0**	**A-3(0)**	**20**	**NP**	**NP**	**NP**	**0.81**	**2.79**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**26.0**	**9.5**	**0.217**	**0.177**	**0.117**	**0.078**	**1**	**7**	**84**	**3**	**5**

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GRAIN SIZE DISTRIBUTION

Project: LAW-140-00.09
Location:LAW COUNTY
CTL Project Number:

APPENDIX D
CULVERT FOUNDATION SUPPORT CALCULATIONS

Project **LAW-140-00-00**
Project No. **24050044COL**
Boring Number **B-001-0-24 (inlet)**

Boring Number	N_{60} (average)	Soil Type	Su (psf)*	Profile Grade	Bottom of Ftg	Df (ft)	Dw (ft)	B (ft)	L (ft)
B-001-0-24 (outlet)	3	A-4a	375	660.4	658.3	2.1	0	4.5	6

Su < 1500 psf Therefore, over-excavate and replace with Granular Material, Type B

Use weaker soils from boring B-001-0-24 to compute the nominal bearing resistance.

Determine if Bearing Resistance should be analyzed as a 2-layer system per ODOT GDM 1402.5 & AASHTO LRFD 10.6.3.1.2d

H_{crit} = 4.6 ft AASHTO LRFD 10.6.3.1.2d-1

Provided that the depth of over-excavation is greater than or equal to Hcrit, then use Bearing Resistance value of Granular Material

Recommended Depth of Over-Excavation = 5.0 ft

Bearing Resistance- Strength Limit State

Nominal Bearing Resisance, $q_n = q_1$ = 7.7 ksf
Resistance Factor, ϕ_b = 0.55
Fact. Bearing Resistance, q_r = 4.2 ksf

Bearing Resistance- Service Limit State

Presumptive Bearing Resisance, q_r = 1.0 ksf
Resistance Factor, ϕ_r = 1.00

Project	**LAW-140-00-00**
Project No.	**24050044COL**
Boring Number	**B-001-0-24 (inlet)**
	Headwall Foundation on Granular Material, Type B

Bearing Resistance- Strength Limit State

Cohesion, c	0.0	ksf	
Friction Angle, ϕ_b	32	Degrees	ODOT BDM Table 307-1
Footing Width, B	4.50	feet	From Plans
Unit Wt. of Soil, γ	0.120	kcf	ODOT BDM Table 307-1
Footing Length, L_f	6	ft	From Plans
Footing Embedment Depth, D_f	2.1	ft	From Plans
GW Depth Below Footing, D_W	0	ft	
Nom. Bearing Resistance, q_1	7.7	ksf	$=c_fN_cs_c+\gamma D_fN_qs_qd_qC_{Wq}+0.5\gamma BN_\gamma s_\gamma C_{W\gamma}$
Where			
N_c	35.5		
N_q	23.2		Table 10.6.3.1.2a-1
N_γ	30.2		
s_c	1.49		$=1+(B/L_f)*(N_q/N_c)$; or 1+(B/5Lf) for $\phi = 0$
s_q	1.47		$=1+(B/L_f)*\tan\phi_f$; or 1.0 for $\phi = 0$ Table 10.6.3.1.2a-3
s_γ	0.70		$=1-0.4*(B/L_f)$; or 1.0 for $\phi = 0$
C_{Wq}	0.50		Table 10.6.3.1.2a-2
$C_{W\gamma}$	0.50		
$1.5B+D_f$	8.85	ft	For Cw Check
D_f/B	0.47		For dq by Hansen 1970
d_q	1.13		Hansen 1970 or Table 10.6.3.1.2a-4
Fact. Bearing Resistance, q_r	4.2	ksf	$=\phi_b*q_n$
Resistance Factor, ϕ_b	0.55		Table 11.5.7-1

Project	**LAW-140-00-00**
Project No.	**24050044COL**
Boring Number	**B-001-0-24 (inlet)**
	Headwall Foundation on Cohesive Soils

Bearing Resistance- Strength Limit State

Cohesion, c	0.38	ksf	(Based on the average blow count)
Friction Angle, ϕ_b	0	Degrees	(Assumed)
Footing Width, B	4.50	feet	From Plans
Unit Wt. of Soil, γ	0.115	kcf	(ODOT GDM Table 400-4)
Footing Length, L_f	6	ft	From Plans
Footing Embedment Depth, D_f	2.1	ft	From Plans
GW Depth Below Footing, D_W	0	ft	
Nom. Bearing Resistance, q_2	2.3	ksf	$=c_fN_cs_c+\gamma D_fN_qs_qd_qC_{Wq}+0.5\gamma BN_\gamma s_\gamma C_{W\gamma}$
Where			
N_c	5.14		
N_q	1		Table 10.6.3.1.2a-1
N_γ	0		
s_c	1.15		$=1+(B/L_f)*(N_q/N_c)$; or 1+(B/5Lf) for $\phi = 0$
s_q	1.00		$=1+(B/L_f)*\tan\phi_f$; or 1.0 for $\phi = 0$ Table 10.6.3.1.2a-3
s_γ	1.00		$=1-0.4*(B/L_f)$; or 1.0 for $\phi = 0$
C_{Wq}	0.50		Table 10.6.3.1.2a-2
$C_{W\gamma}$	0.50		
$1.5B+D_f$	8.85	ft	For Cw Check
D_f/B	0.47		For dq by Hansen 1970
d_q	1.00		Hansen 1970 or Table 10.6.3.1.2a-4
Fact. Bearing Resistance, q_r	1.3	ksf	$=\phi_b*q_n$
Resistance Factor, ϕ_b	0.55		Table 11.5.7-1

Bearing Resistance- Service Limit State

Pres. Bearing Resistance, qr	1.0	ksf	Table C10.6.2.5.1-1
Resistance Factor, ϕ_r	1.0		11.5.7

APPENDIX E
RESPONSE TO COMMENTS

OHIO DEPARTMENT OF TRANSPORTATION
Mike DeWine, *Governor*
Jack Marchbanks, Ph.D., *Director*

District 9
650 Eastern Avenue, Chillicothe, OH 45601
740-773-2691
transportation.ohio.gov

March 14th, 2025

Greg Boyer, P.E.
BG Engineering Group, LLC
269 Dovetail Drive
Lewis Center, Ohio 43035

Subject: LAW-140-0.09
PID 119781
Stage 3 Submission

Dear Mr. Boyer:

We have completed our review of the subject. The following are our comments:

1. Sheets 2 & 3 (Typical Sections):
    a. Add Item 203 – Embankment to the legend and label on the typical sections.
    b. Add note that reminds the contractor that the 301 lift thickness is limited to 6" per the CMS so layer above box is placed correctly.
    c. Legend item No. 8 should be 606 in lieu of 605.
2. Sheet 4 (General Notes):
    a. Charter Communications has finally responded that they have no facilities near the project. Please remove their contact information.
    b. Add standard note G121 and label the cross sections accordingly.
    c. Remove parentheses in the first paragraph of the "farm drains" note and eliminate whichever doesn't apply.
3. Sheet 5 (Maintenance of Traffic Notes):
    a. Remove all references to A+B bidding. Allow 30 days for the closure and a disincentive of $4,000 a day.
    b. Remove the text requiring the closure to start on a specific date and state that the road closure can't begin until 4/1/26 unless otherwise approved by the DCE.
4. Sheets 7 & 8 (General Summary):
    a. Add Plan split code 01/STR/66.
5. Sheet 9 (Sub-Summary):
    a. Add "MASH 2016" to type E anchor assembly.
6. Sheets 11 – 15 (Cross Sections):
    a. These sheets do not seem to be plotted according to ODOT CADD standards as the text is not searchable and the sheets are not easily viewed. Please confirm.
7. Sheet 17 (Site Plan):
    a. The inlet and outlet elevations do not match the hydraulic report. Please resolve.
    b. The RCP should be dimensioned. Currently, there are no limits defined in the plans.

8. Sheet 18 (Structure General Notes):
    a. Revise the last paragraph in the “design data” note as follows"... or a lighter total weight is used; ~~of~~ or if a foundation soil with…”
    b. The “Foreslope Wall Anchor Dowel” note seems to imply that resin bonding is shown in the plans, but we couldn’t find this detail?
9. Sheet 25 (geotechnical profile):
    a. Designation on material description at 13.5' as "stiff" appears incorrect with N60 of 1.

CTL Response: The unconfined compressive strength as determined by hand penetrometer for this cohesive layer is 1.5 tsf. Per SGE Section 602.1.2, unconfined compressive strength is preferred over standard penetration for description of relative consistency. Therefore, it is CTL’s opinion that “stiff” is the correct descriptor for this layer.

10. Sheet 26 (Geotechnical Profile):
    a. Descriptions for predominately Silt stratum on boring log B-002-0-24 from elev. 664.5 - 654.7 should be in terms of consistency on boring logs (e.g., very soft, soft, etc.).

CTL Response: Based on the classification test results, the silt layer encountered between elevation 664.5 - 654.7 in B-002-0-24, was identified as non-cohesive (granular) material. Therefore, it is CTL’s opinion that the description for the silt stratum should be in terms of the compactness (e.g. very loose, loose, medium dense, etc..), and not in terms of the consistency.

11. Geotechnical Report:
    a. The existing culvert in the geotechnical report on sheet Pp. 8 is reported be a 24-inch diameter corrugated plastic pipe, while the existing culvert on the plans is a 30" diameter CMP. Please resolve.

CTL Response: The existing culvert description was updated as 30-inch diameter corrugated metal pipe in the Final Report.

Nothing in these comments is to be construed as authorizing extra work for which additional compensation may be claimed. If you believe that these comments require work outside the limits of the Scope of Services for this project, please contact this office before proceeding.

Sincerely,

Matt McClellan, P.E.