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1.0 INTRODUCTION

This geotechnical subsurface investigation report has been prepared for the Proposed Addition to Building 403 Corrosion Control Facility to be constructed at the National Guard Air Base located in Mansfield, Ohio. The general area of the project is shown on the attached Site Location Map (Plate 1.0).

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures, presents the findings, and discusses our evaluations and conclusions.

This report has been prepared for CH2M Jacobs and their respective affiliates and subsidiaries. This study was performed in accordance with TTL Proposal No. 1812901, dated March 26, 2019 and subsequent authorization.

The purpose of this investigation was to evaluate the subsurface conditions and provide laboratory data relative to the design and construction at the referenced site. This investigation included one test borings, field and laboratory soil testing.

This report includes a description of the subsurface soil and groundwater conditions encountered in the borings and laboratory test results.

2.0 INVESTIGATIVE PROCEDURES

This subsurface investigation included one test borings drilled by TTL on June 24, 2019. Boring designated as B-1 was drilled in the general area of the proposed building addition. The test boring was located in the field by a representative of the national guard based on site plan provided by CH2M Jacobs. The approximate location of the boring is shown on the Test Boring Location Plan (Plate 2.0).

The test boring was performed in general accordance with geotechnical investigative procedures outlined in ASTM Standards D 1452 and D 5434. The test borings performed during this investigation were drilled with a truck-mounted drilling rig utilizing hollow-stem augers. Boring B-1 was terminated upon split spoon and auger refusal and extended to the depth of 81.5 feet below existing grades.

During auger advancement, soil samples were generally collected at 2½-foot intervals to a depth of 15 feet and at 5-foot intervals thereafter. Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The samples were sealed in jars and shipped to our laboratory for further classification and testing.

Two Shelby tube samples, designated ST-1 and ST-2 on the Logs of Test Borings, were obtained from the Boring B-1. The Shelby tube samples were obtained by hydraulically advancing a 3-inch diameter, thin-walled sampler approximately 24 inches beyond the hollow-stem auger into relatively undisturbed soil in accordance with ASTM D 1587. The Shelby tubes were then extracted from the subsoils, and the ends were capped and sealed. These samples were transported to our laboratory where they were extruded, classified, and tested.

All of the recovered samples of the subsoils were visually or manually classified in accordance

with the Unified Soil Classification System (USCS) (ASTM D 2487 and D 2488). Unconfined compressive strength estimates were obtained for the intact cohesive samples using a calibrated hand penetrometer. Laboratory tests that were performed for this investigation are on the following table.

Table 1. Laboratory Testing Summary

Laboratory Testing	Number of Tests
Moisture Content (ASTM D 2216)	15
Atterberg Limits (ASTM D 4318)	4
Percent Fines (P200) (ASTM D 1140)	10
Corrosivity (pH, sulfates, resistivity and chlorides) (ASTM D4972, ASTM G 187, and 9056)	2

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as field logs of the encountered soils.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings made at specific locations, especially at previously developed sites such as this site. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

3.0 PROPOSED CONSTRUCTION

The type of construction and size of the proposed construction were not available at the time of writing this report. Final design foundation loads for the building were unavailable at the time of preparing this report.

Proposed grading plans were not available at the time of preparing this report. In general, we have assumed that final grades will approximate existing grades present at the time of our investigation.

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site and Soils Conditions

The project site appeared to be located within a landscaped area bounded by an existing structure to the east, an existing pavement to the south, Electrical/Mechanical area to the west, a landscaped area to the north.

The surface materials encountered in the boring consisted of about 4 inches of topsoil, over approximately 13.5 feet of possible cohesive fill materials over native Lean Clay (CL). This Possible fill material predominantly consisted of lean clay with sand with trace gravel and organics. SPT N-values ranged from 2 to 4 blows per foot (bpf), indicating very soft to soft consistency. Unconfined compressive strengths ranged from 500 to 1,000 psf. Moisture contents typically varied from 19 to 35 percent. Liquid limit varied between 33 and 36 percent, and plasticity index varied between 11 and 14 percent for samples obtained from this layer in Boring B-1. Low and variable SPT values in conjunction with higher moisture contents are indicative of possible fill material consisting of lean clay with sand (FILL-CL) designation as classified in accordance with the Unified Soil Classification System (USCS).

Based on the results of the field and laboratory tests, the native subsoils encountered underlying the surface materials and possible fill can be generally characterized by two layers of cohesive soils exhibiting varying strength and moisture characteristics.

The upper native subsoil layer consisted of predominantly medium stiff to stiff cohesive soils to depth of approximately 48½ feet below existing grade. These cohesive soils consisted of lean clay (CL) with varying amounts of sand and trace gravel. SPT resulted in N-values ranging from 7 to 22 bpf. Unconfined compressive strengths ranged from 1,000 psf to 8,000 psf. An SPT N-value of 46 blows per foot (bpf), indicating hard consistency, was determined for a zone of clay encountered from approximately 18½ to 20 feet below existing grades. A trace amount of organics was observed in sample SS-6 (13½ to 15 feet). Moisture contents typically varied from 14 to 23 percent. These values, along with gradation results, are indicative of lean clay with sand (CL) designation as classified in accordance with the Unified Soil Classification System

(USCS).

The lower native subsoil layer consisted of very stiff to hard cohesive soils to depth of approximately 62 feet below existing grade. These cohesive soils consisted of lean clay (CL) with varying amounts of sand and trace gravel. SPT resulted in N-values ranging from 19 to 47 bpf. Unconfined compressive strengths ranged from 4,000 psf to 5,000 psf. Moisture contents typically varied from 15 to 16 percent. Liquid limit of 29 percent and plasticity index of 11 percent were determined for a sample obtained from this layer in Boring B-9 (SS-13). These values, along with gradation results, are indicative of lean clay with sand (CL) designation as classified in accordance with the Unified Soil Classification System (USCS).

Underlying the very stiff to hard cohesive soils, weathered shale was encountered at 62 feet and extended to the boring termination depth of 81½ feet below existing grade. Split-spoon refusal (50 or more blows for 6 inches or less penetration) was recorded for the sample intervals in Boring B-6 from 62 to 81½ feet below existing grade.

4.3 Groundwater Conditions

Groundwater was initially encountered in Boring B-1 at a depth of approximately 8 feet below existing grade and was observed upon completion of drilling at a depth of approximately 43 ½ feet below existing grade. It should be noted that the boring was drilled and backfilled within the same day, and stabilized water levels may not have occurred over this limited period. Instrumentation was not installed to observe long-term groundwater levels. It should also be noted that the encountered water in the boring could be perched in the possible fill layer fill and overlying relatively impermeable native cohesive soils.

Based on the limited data available, such as the soil characteristics and the moisture conditions encountered in the borings, it is our opinion that the "normal" groundwater level may be generally encountered at depths greater than 30 feet below existing grade. However, this investigation did not include research of possible hydrological influences at the project site. It should be noted that groundwater elevations can fluctuate with seasonal and climatic influences. In particular, "perched" water may be encountered in granular soils that are underlain by relatively impermeable native cohesive soils. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this investigation.

4.4 Laboratory Testing

All samples of the subsoils were visually or manually classified in general accordance with the Unified Soil Classification System (ASTM D 2487 or D 2488). Selected samples of the subsoils were tested in our laboratory for moisture content (ASTM D 2216). Unconfined compressive strength estimates were obtained for select intact cohesive samples using a calibrated hand penetrometer. Atterberg limits tests (ASTM D 4318) and washed sieve analyses (ASTM D 422) were performed on selected samples. Test results are presented on the Logs of Test Borings and Tabulation of Test Data sheet attached to this report.

Additionally, a series of tests were performed on samples from Boring B-1 (ST-1) and B-1 (composite from SS-1 through SS-3) to evaluate potential soil corrosivity, including:

- pH determination (ASTM D 4972),
- soil box resistivity (ASTM G 57), and
- sulfate and chloride content (EPA 9056).

These results are summarized in the table below.

Table 2.0- Corrosivity Test Results

Boring or Test Pit / Sample Number	Sample Depth (feet)	Soil Description	Soil Box (Laboratory) Resistivity (ohm-cm)	pH	Chloride Content (mg/kg)[1]	Sulfate Content (mg/kg)
B-1 (Composite)	1 to 7.5	Lean Clay	8,383	6.9	U	75
B-1 (ST-1)	8 to 10	Lean Clay	8,942	6.8	U	71

1. Samples with undetectable amounts of chloride are indicated with a "U".

The results of the chloride and sulfate content test are attached to this report.

5.0 QUALIFICATION OF FINDINGS

Our review of the subsurface conditions has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data obtained at the boring location. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions in other areas of the site will differ from those at the boring location, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. This is especially true for previously developed sites. The nature and extent of variations between the borings may not become evident until the course of construction.

Our professional services have been performed and our findings have been derived in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. TTL is not responsible for the conclusions, opinions, or recommendations of others based on this data.

Soil samples collected during this investigation will be stored in our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you.

Should you have any questions regarding this report or require additional information, please contact our office.

Plates

Plate 1.0 Site Location Map
Plate 2.0 Test Boring Location Plan

LEGEND

APPROXIMATE SITE LOCATION

N

APPROXIMATE SCALE – FEET

0 2,000 4,000

PLATE 1.0
SITE LOCATION MAP

PROPOSED ADDITION TO BUILDING 403 CORROSION CONTROL FACILTY
NATIONAL GUARD AIR BASE
MANSFIELD, OHIO

PREPARED FOR
CH2M JACOBS
2411 DULLES CORNER PARK, SUITE 500
HAMPTON, VIRGINIA 20171

DRAWN TRR/8–6–19	CHECKED
REVISED	APPROVED
JOB NO. 1812901	
DRAWING NUMBER **1812901–01G**	

TTL associates inc
Environmental, Geotechnical Engineering & Testing

N

LEGEND

B-1 APPROXIMATE TEST BORING LOCATION

APPROXIMATE SCALE – FEET

0 50 100

PLATE 2.0
TEST BORING LOCATION PLAN
PROPOSED ADDITION TO BUILDING 403 CORROSION CONTROL FACILITY
NATIONAL GUARD AIR BASE
MANSFIELD, OHIO

PREPARED FOR
CH2M JACOBS
2411 DULLES CORNER PARK, SUITE 500
HERNDON, VIRGINIA 20171

DRAWN TRR/8-6-19	CHECKED
REVISED	APPROVED
JOB NO. 1812901	
DRAWING NUMBER **1812901-02G**	

associates inc
Environmental, Geotechnical Engineering & Testing

ATTACHMENT

Log of Test Boring B-1

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-1

CLIENT CH2M Jacobs
PROJECT NAME Mansfield Municipal Airport
PROJECT NUMBER 1812901
PROJECT LOCATION Mansfield, OH
DRILLING CONTRACTOR TTL Associates TB JP/IC
RIG NO. 844
GROUND ELEVATION
DRILLING METHOD 3-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 6/24/19 **COMPLETED** 6/24/19
AT TIME OF DRILLING 8.0 ft
LOGGED BY KKC **CHECKED BY**
AT END OF DRILLING 43.5 ft
NOTES Auger refusal encountered at a depth of 81.5 feet.
0hrs AFTER DRILLING Backfilled w/Cuttings and Bentonite Chips

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL (20 40 60 80) ▲ SPT N VALUE ▲ (20 40 60 80)
	0		TOPSOIL - 4 Inches 0.3'						
			Moist Medium Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL) (Possible Fill) @0.6': Gray (Possible Fill) 3.5'	SS 1	44	2-2-3 (5)	NI		19
	5		Moist Soft Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Organics (CL) (Possible Fill)	SS 2	44	2-2-2 (4)	0.50		32
				SS 3	56	1-1-2 (3)	0.50		35
	10		@9.5': w/Sand and Trace Gravel (Possible Fill)	ST 1	42		0.50		28
				SS 4	33	1-2-2 (4)	0.50		
			@11.5': Very Soft (Possible Fill) 13.0'	SS 5	33	1-1-1 (2)	<0.25		31
	15		Moist Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL) 18.5'	SS 6	33	1-2-10 (12)	1.50		23
	20		Moist Hard Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL) 21.0'	SS 7	11	18-24-22 (46)	4.00		13
	25		Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 8	100	3-3-4 (7)	1.00		15

(Continued Next Page)

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BORING NUMBER B-1

CLIENT CH2M Jacobs **PROJECT NAME** Mansfield Municipal Airport

PROJECT NUMBER 1812901 **PROJECT LOCATION** Mansfield, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
			Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) *(continued)*						
			28.5'						
	30		Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 9	100	4-5-7 (12)	2.50		▲
	35		@33.5': Very Stiff	SS 10	100	5-9-13 (22)	3.50		13 ● ▲
	40		@38.5': Stiff	SS 11	100	3-4-6 (10)	2.00		13 ▲●
			43.5'						
	45		Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 12	100	2-3-4 (7)	0.50		14 ▲●
				ST 2	0		NR		
			48.5'						
	50		Moist Very Stiff Brown/Gray SANDY LEAN CLAY w/Trace Gravel (CL)	SS 13	100	9-11-13 (24)	2.00		14 ●▲
			52.0'						
	55		Moist Hard Brown/Gray SANDY LEAN CLAY w/Trace Gravel and Organics (CL)	SS 14	67	15-27-20 (47)	2.50		▲

(Continued Next Page)

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BORING NUMBER B-1

CLIENT CH2M Jacobs
PROJECT NAME Mansfield Municipal Airport
PROJECT NUMBER 1812901
PROJECT LOCATION Mansfield, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
			56.0' Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)						
	60			SS 15	100	6-8-11 (19)	2.50		16
			62.0' Moist Very Dense Gray WEATHERED SHALE						
	65			SS 16	100	50/4"	NP		>>
	70			SS 17	67	50/3"	NP		>>
	75			SS 18	20	50/5"	NP		>>
	80			SS 19	100	50/1"	NP		>>
			81.5' Bottom of hole at 81.5 feet.						

ATTACHMENT

Legend Key

LEGEND KEY

Unified Soil Classification System Soil Symbols

- GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.
- GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.
- GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.
- GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.
- SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.
- SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.
- SM - SILTY SAND Includes Sand-Silt mixtures.
- SC - CLAYEY SAND Includes Sand-Clay mixtures.
- ML - SILT Includes Silt with Sand and Sandy Silt.
- CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.
- MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.
- CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.
- CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.
- OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.
- OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.
- Pt - PEAT Includes humus, swamp and other soils with high organic content.
- FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.
- TOPSOIL
- ASPHALT - Bituminous Asphalt
- CONCRETE - Includes broken concrete rubble.

Sample Symbols

- SS - Split Spoon
- ST - Shelby Tube
- RC - Rock Core
- GS - Geoprobe Sleeve
- AU - Auger Cuttings
- GB - Grab

Notes:

1. Exploratory boring was drilled on June 24, 2019, using 3¼ -inch diameter holow-stem augers.
2. This log is subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.
3. The test boring was located in the field by TTL Associates in accordance with a proposed boring location plan provided by CH2M Jacobs.
4. Unconfined Compressive Strength (tsf):
   NP = Non-Plastic
   NI = Not Intact

ATTACHMENT

Tabulation of Test Data

PROJECT: Mansfield Municipal Airport, Mansfield, Ohio	**TTL Associates, Inc.**	PROJECT NO: 1812901

TABULATION OF TEST DATA

Boring Number	Sample Number	Sample Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)		Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	SS-1	1.0-2.5		5	18.9				- 24 -				- 76 -		34	20	14	CL
	SS-2	3.5-5.0		4	32.1		*1,000		- 41 -				- 59 -		33	22	11	CL
	SS-3	6.0-7.5		3	35.0		*1,000											
	ST-1	8.0-10.0			28.2		*1,000		- 39 -				- 61 -		36	22	14	CL
	SS-4	10.0-11.5		4			*1,000											
	SS-5	11.5-13.0		2	30.8		*<500		- 33 -				- 67 -					
	SS-6	13.5-15.0		12	22.9		*3,000											
	SS-7	18.5-20.0		46	13.0		*8,000											
	SS-8	23.5-25.0		7	14.8		*2,000		- 35 -				- 65 -					
	SS-9	28.5-30.0		12			*5,000											
	SS-10	33.5-35.0		22	13.3		*7,000		- 44 -				- 56 -					
	SS-11	38.5-40.0		10	13.0		*4,000		- 42 -				- 58 -					
	SS-12	43.5-45.0		7	14.0		*1,000											
	ST-2	46.0-48.0																
	SS-13	48.5-50.0		24	14.5		*4,000		- 47 -				- 53 -		29	18	11	CL
	SS-14	53.5-55.0		47			*5,000											
	SS-15	58.5-60.0		19	16.3		*5,000											

SSR = Split-Spoon Refusal

*Unconfined compressive strength derived from a calibrated hand penetrometer

PROJECT: Mansfield Municipal Airport, Mansfield, Ohio	**TTL Associates, Inc.**	PROJECT NO: 1812901

TABULATION OF TEST DATA

Boring Number	Sample Number	Sample Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)		Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	SS-16	63.5-63.8		SSR														
	SS-17	68.5-68.8		SSR														
	SS-18	73.5-73.9		SSR														
	SS-19	78.5-78.6		SSR														

SSR = Split-Spoon Refusal

*Unconfined compressive strength derived from a calibrated hand penetrometer

ATTACHMENT

Grain Size Distribution

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1915 N 12th Street
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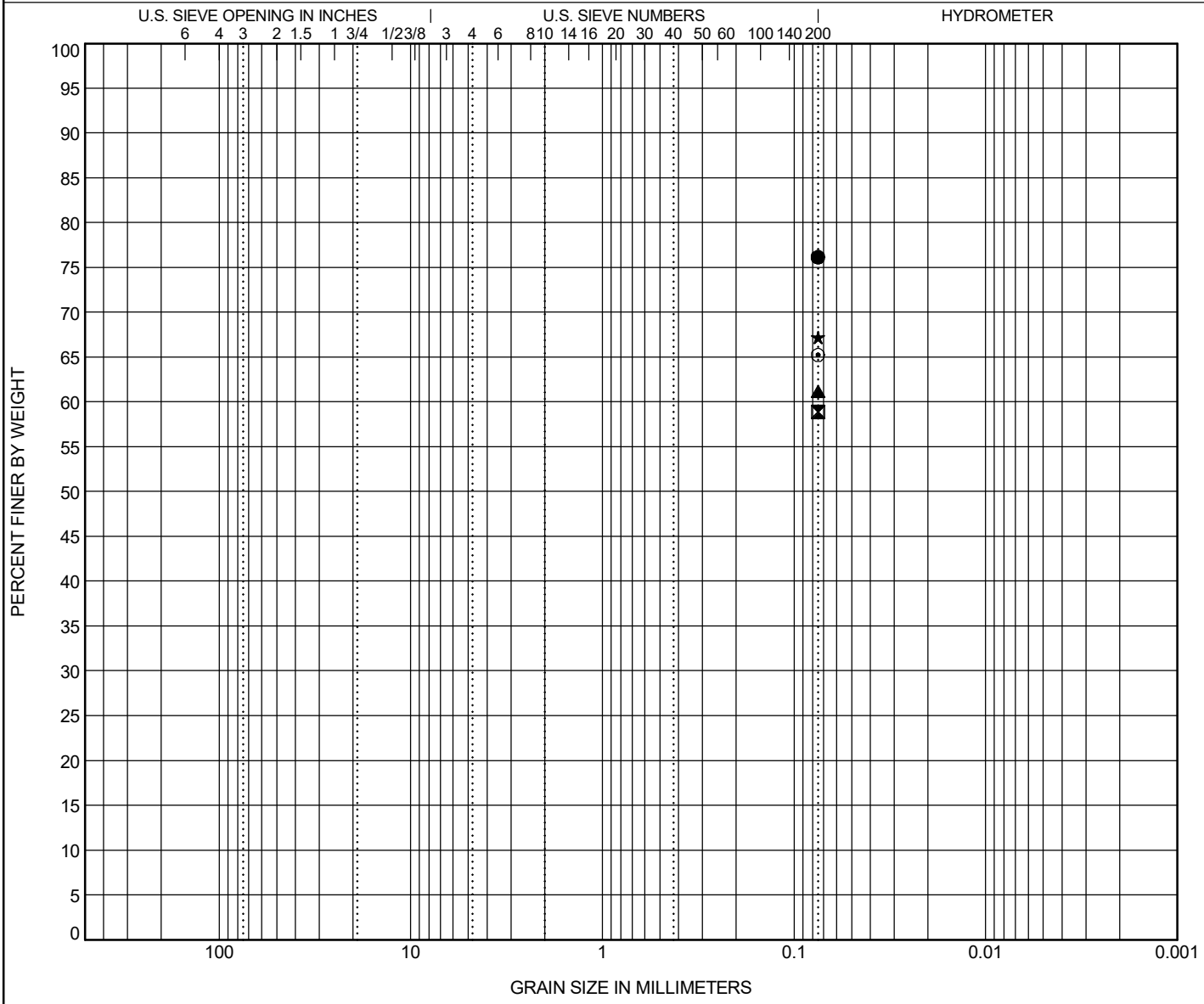
Fax: 419-241-1808

GRAIN SIZE DISTRIBUTION

CLIENT CH2M Jacobs **PROJECT NAME** Mansfield Municipal Airport

PROJECT NUMBER 1812901 **PROJECT LOCATION** Mansfield, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-1	1.0	**LEAN CLAY with SAND (CL)**	**34**	**20**	**14**		
⊠	B-1	3.5	**SANDY LEAN CLAY (CL)**	**33**	**22**	**11**		
▲	B-1	8.0	**SANDY LEAN CLAY (CL)**	**36**	**22**	**14**		
★	B-1	11.5						
⊙	B-1	23.5						

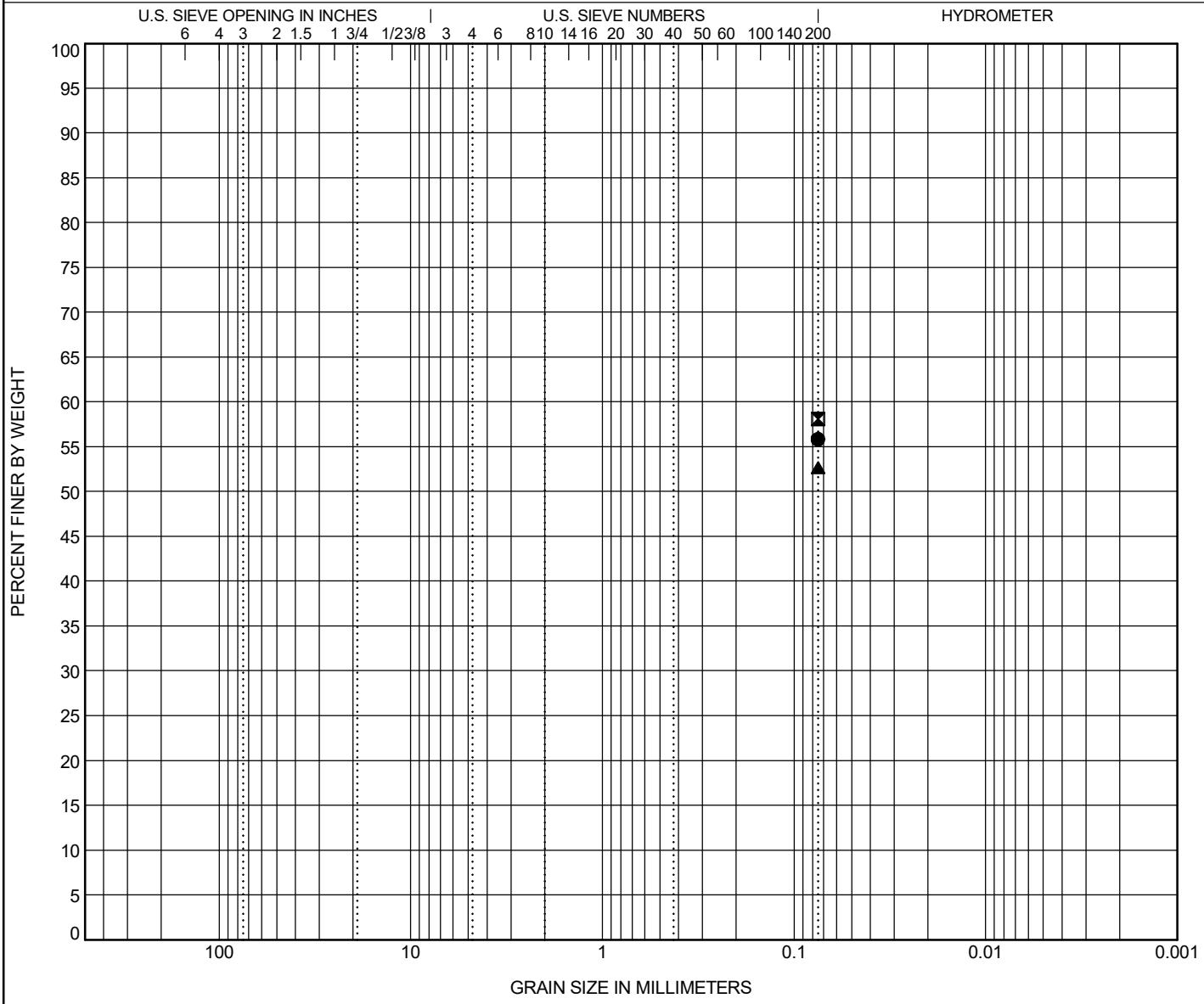
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	1.0	**0.075**						**76.1**	
⊠	B-1	3.5	**0.075**						**58.9**	
▲	B-1	8.0	**0.075**						**61.2**	
★	B-1	11.5	**0.075**						**67.2**	
⊙	B-1	23.5	**0.075**						**65.2**	

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

GRAIN SIZE DISTRIBUTION

CLIENT CH2M Jacobs **PROJECT NAME** Mansfield Municipal Airport

PROJECT NUMBER 1812901 **PROJECT LOCATION** Mansfield, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	**B-1**	**33.5**						
⊠	**B-1**	**38.5**						
▲	**B-1**	**48.5**	**SANDY LEAN CLAY (CL)**	**29**	**18**	**11**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-1**	**33.5**	**0.075**						**55.8**	
⊠	**B-1**	**38.5**	**0.075**						**58.1**	
▲	**B-1**	**48.5**	**0.075**						**52.7**	

ATTACHMENT

Resistivity Test Results

Laboratory Measurement of Soil Resistivity Using the Wenner Four Electrode Method (AASHTO T 288)

Project No.: 1812901 Sample No.: B-1 SS-(1-3) Composite
Soil Description: Brown/Gray LEAN CLAY w/Sand and Trace Gravel
Soil Temperature= 21 C Moisture Content = 44.8 %
Outer Electrode Spacing = 4.8 cm Inner Electrode Spacing = 12.7 cm
Cross-sectional Area = 12.48 cm^2

Trial Number	Voltage (mV)	Current (mA)	Resistance (Ohm)	Resistivity (Ohm-cm)	Temperatue Corrected Resistivity (Ohm-cm)
1	1200	0.16	7500.00	7370.08	8383.46
2	1200	0.16	7500.00	7370.08	8383.46
3	1200	0.16	7500.00	7370.08	8383.46

Average Corrected Resistivity (Ohm-cm): 8,383

Project No.: 1812901 Sample No.: B-1 ST-1
Soil Description: Brown/Gray LEAN CLAY w/Sand and Trace Gravel
Soil Temperature= 21 C Moisture Content = 42.7 %
Outer Electrode Spacing = 4.8 cm Inner Electrode Spacing = 12.7 cm
Cross-sectional Area = 12.48 cm^2

Trial Number	Voltage (mV)	Current (mA)	Resistance (Ohm)	Resistivity (Ohm-cm)	Temperatue Corrected Resistivity (Ohm-cm)
1	1200	0.15	8000.00	7861.42	8942.36
2	1200	0.15	8000.00	7861.42	8942.36
3	1200	0.15	8000.00	7861.42	8942.36

Average Corrected Resistivity (Ohm-cm): 8,942

ATTACHMENT

Sulfate and Chloride Test Results

Fibertec
environmental
services

Wednesday, July 17, 2019

Fibertec Project Number:	91435
Project Identification:	Mansfield ANG (1812901) /1812901
Submittal Date:	07/09/2019

Mr. Chris Iott
TTL Associates, Inc.
1915 North 12th Street
Toledo, OH 43624

Dear Mr. Iott,

Thank you for selecting Fibertec Environmental Services as your analytical laboratory. The samples you submitted have been analyzed in accordance with NELAC standards and the results compiled in the attached report. Any exceptions to NELAC compliance are noted in the report. These results apply only to those samples submitted. Please note TO-15 samples will be disposed of 7 calendar days after the reporting date. All other samples will be disposed of 30 days after the reporting date.

If you have any questions regarding these results or if we may be of further assistance to you, please contact me at (517) 699-0345.

Sincerely,

By Stephannie Wallace at 10:07 AM, Jul 17, 2019

For Daryl P. Strandbergh
Laboratory Director

Enclosures

Client Identification:	**TTL Associates, Inc.**	Sample Description:	**B-1 (SS-1, SS-2, SS-3) Composite**	Chain of Custody:	**155123**
Client Project Name:	**Mansfield ANG (1812901)**	Sample No:	**1**	Collect Date:	**06/24/19**
Client Project No:	**1812901**	Sample Matrix:	**Soil/Solid**	Collect Time:	**NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable ‡: Parameter not included in NELAC Scope of Analysis.

Water (Moisture) Content Dried at 105 ± 5°C **Aliquot ID: 91435-001** **Matrix: Soil/Solid**
Method: ASTM D2216-10 **Description: B-1 (SS-1, SS-2, SS-3) Composite**

Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Preparation P. Date	Preparation P. Batch	Analysis A. Date	Analysis A. Batch	Init.
‡ 1. Percent Moisture (Water Content)	U		%	1	1.0	07/11/19	MC190711	07/12/19	MC190711	JBA

Inorganic Anions by IC **Aliquot ID: 91435-001** **Matrix: Soil/Solid**
Method: EPA 0300.0 (Solids Prep)/EPA 9056A **Description: B-1 (SS-1, SS-2, SS-3) Composite**

Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Preparation P. Date	Preparation P. Batch	Analysis A. Date	Analysis A. Batch	Init.
1. Chloride	U		µg/kg	100000	1.0	07/10/19 17:45	PW19G10D	07/11/19	WT19G10A	VO
2. Sulfate	**75000**		µg/kg	10000	1.0	07/10/19 17:45	PW19G10D	07/11/19	WT19G10A	VO

Client Identification:	**TTL Associates, Inc.**	Sample Description:	**B-1 (ST-1)**	Chain of Custody:	**155123**
Client Project Name:	**Mansfield ANG (1812901)**	Sample No:	**2**	Collect Date:	**06/24/19**
Client Project No:	**1812901**	Sample Matrix:	**Soil/Solid**	Collect Time:	**NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable ‡: Parameter not included in NELAC Scope of Analysis.

Water (Moisture) Content Dried at 105 ± 5°C **Aliquot ID: 91435-002** **Matrix: Soil/Solid**
Method: ASTM D2216-10 **Description: B-1 (ST-1)**

Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Preparation P. Date	Preparation P. Batch	Analysis A. Date	Analysis A. Batch	Init.
‡ 1. Percent Moisture (Water Content)	U		%	1	1.0	07/11/19	MC190711	07/12/19	MC190711	JBA

Inorganic Anions by IC **Aliquot ID: 91435-002** **Matrix: Soil/Solid**
Method: EPA 0300.0 (Solids Prep)/EPA 9056A **Description: B-1 (ST-1)**

Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Preparation P. Date	Preparation P. Batch	Analysis A. Date	Analysis A. Batch	Init.
1. Chloride	U		µg/kg	100000	1.0	07/10/19 17:45	PW19G10D	07/11/19	WT19G10A	VO
2. Sulfate	**71000**		µg/kg	10000	1.0	07/10/19 17:45	PW19G10D	07/11/19	WT19G10A	VO

Definitions/ Qualifiers:

A: Spike recovery or precision unusable due to dilution.
B: The analyte was detected in the associated method blank.
E: The analyte was detected at a concentration greater than the calibration range, therefore the result is estimated.
J: The concentration is an estimated value.
M: Modified Method
U: The analyte was not detected at or above the reporting limit.
X: Matrix Interference has resulted in a raised reporting limit or distorted result.
W: Results reported on a wet-weight basis.
***:** Value reported is outside QC limits

Exception Summary:

Analysis Locations:

All analyses performed in Holt.

Accreditation Number(s):

T104704518-19-8 (TX)