Professional Service Industries, Inc.
5555 Canal Road, Cleveland, Ohio 44125
(216) 447-1335 (P), (216) 642-7008 (F)

March 20, 2018

Mr. Charles Hauber, PE, PS
Civil Engineer/ Construction Supervisor
Summit Metro Parks
975 Treaty Line Road
Akron, Ohio 44313
330-865-8040 ext. 206
chauber@summitmetroparks.org

Re: Report for Geotechnical Subsurface Exploration
Proposed 54" Pipe Culvert
Gardner Road
Akron, Summit County, Ohio
PSI Project Number: 0142-1710

Dear Mr. Hauber:

Per your request, Professional Service Industries, Inc. (PSI) is pleased to submit this Geotechnical Engineering Services Report for the above referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report.

After the plans and specifications are complete, PSI should review the final design and specifications in order to verify that the earthwork and recommendations are properly interpreted and implemented. **It is considered imperative that the geotechnical engineer and/or its representative be present during earthwork operations and culvert installation to observe the field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.**

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Joseph Corrigan
Project Manager

A. Veeramani, P.E.
Vice President

Subsurface Exploration Report

For the Proposed

54" Pipe Culvert
Gardner Road
Akron, Summit County, Ohio

Prepared for

Summit Metro Parks
975 Treaty Line Road
Akron, Ohio 44313

Prepared by

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125

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TABLE OF CONTENTS

PROJECT INFORMATION

Project Authorization

This report presents the results of a geotechnical subsurface exploration and evaluation conducted for Summit Metro Parks in connection with the proposed 54-inch-diameter pipe culvert to be located crossing Gardner Road, in the City of Akron, Summit County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 0142-237396, dated March 1, 2018. Authorization to perform this exploration and analysis was in the form of a signed Special Services Agreement between Summit Metroparks and PSI, dated March 2, 2018.

Project Description

Project information was provided by Mr. Charles Hauber, Civil Engineer of Summit Metroparks. Included, we have received a preliminary site plan showing the general layout of the proposed culvert.

Based on the provided information, it is understood that the proposed project includes installation of a 54" pipe culvert on Gardner Road. The project site is located within a golf course in the Summit Metroparks area. No other information was available at the time of this report.

Based on the provided site plan, the culvert installation site is relatively flat, with an elevation difference of less than 1 foot over the 135-foot length of the culvert. The proposed culvert will be installed with a 0.95% grade, sloping from north to south. Therefore, it is assumed that maximum cut/fill operations of less than 2 feet will be necessary for the proposed culvert installation.

The geotechnical recommendations presented in this report are based on the available project information, the proposed location and orientation of the culvert on the site and the subsurface materials described in this report. If any of the information we have been given or have assumed is incorrect, please contact us so that we may amend the recommendations presented accordingly. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site and to prepare recommendations, from a geotechnical engineering viewpoint, for pipe culvert installation, site preparation, and other construction considerations. Our scope for this service included a project site reconnaissance, drilling and sampling one (1) soil test

boring, completing a laboratory testing program, and submitting an engineering analysis and evaluation of the surface materials.

PSI's scope also did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or reoccurrence of mold amplification.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The site for the proposed culvert installation is located approximately 1,100 feet west of Cuyahoga Street, in Akron, Summit County, Ohio.

The proposed site is within an existing golf course and is predominantly an open grass area. Based on site observations, the overall site slopes downward from east to west, with an elevation difference of approximately 4 feet within the proposed development area. Based on the provided site plan, the culvert installation site is relatively flat, with an elevation difference of less than 1 foot over the 135-foot length of the culvert. We recommend that any existing utility lines be checked and marked prior to construction activities.

Subsurface Conditions

The subsurface conditions at the site were explored with one (1) test boring for the proposed culvert. The test boring was drilled to a depth of about 30 feet below the existing surface grade. The approximate boring location is shown on the Boring Location Plan presented in the *Appendix* of this report. The number of test borings was selected and field located by a representative of PSI.

The borings were advanced utilizing 3½ inch inside diameter, hollow-stem auger drilling methods. Soil samples were routinely obtained during the drilling process. Select soil samples were later tested in the laboratory to obtain soil material properties for the foundation, floor slabs and pavement recommendations. Drilling, sampling, and laboratory testing was accomplished in general accordance with ASTM procedures.

The types of subsurface materials encountered in the test borings have been visually classified. The results of the visual classifications, Standard Penetration tests, moisture contents and water level observations are presented on the boring logs in the *Appendix* of this report. Representative samples of the soils were placed in sample jars and are now stored in the laboratory for further analysis, if requested. Unless notified to the contrary, all samples will be disposed of after 60 days following the date of this report.

The surface of the site at the test boring location was covered with a layer of topsoil measuring approximately 2 inches in thickness. The thickness of the surface materials is expected to vary across the site.

Underlying the surface materials, natural soils were encountered, extending to the terminal depth of 30 feet below the existing surface grades. The natural soils consisted primarily of lean clay with some organic material, and silt with varying amounts of sand and rock fragments. The natural soils exhibited moisture contents of about 20 to 33 percent. The natural cohesive soil exhibited a medium stiff to very stiff consistency, based on the Standard Penetration tests.

Additionally, dark brown peat material was encountered at depths of 2 to 4 feet below the existing grade. The peat exhibited moisture contents ranging from 121 to 149 percent.

The subsurface description is of a generalized nature provided to highlight the major strata encountered. The boring logs included in the Appendix should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

Water Level Measurements

Groundwater was encountered at test boring location B-1 at a depth of about 3.5 feet below the existing grade during the field drilling operations. Note that groundwater levels fluctuate seasonally as a function of rainfall. During a time of year or weather different from the time of drilling, there may be a considerable change in the water table. Furthermore, the water levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures. The borings were backfilled on completion of drilling for safety concerns and no groundwater piezometers were installed at the site.

EVALUATION AND RECOMMENDATIONS

Foundation Recommendations

Considering the subsurface conditions and the proposed installation, the proposed culvert pipe can be supported on either a concrete or compacted stone foundation. If a stone foundation is selected, the stone mat should be a twelve-inch-thick layer of compacted ODOT 57.

Foundations supporting the proposed headwalls, bearing on natural soil or properly placed and compacted engineered fill can be designed utilizing a maximum allowable soil bearing pressure of 2,000 psf.

Bearing surfaces are to be critically inspected and tested to verify consistency and compatibility with subsurface exploration data, and to assure that the recommended bearing capacity is being achieved. It is recommended that a representative of PSI be present at the site throughout foundation excavation and construction.

Based on the assumed structural loads, it is anticipated that total and differential foundation settlements will be less than 1-inch and ½-inch, respectively. However, actual settlements will be dependent upon the depth of the foundations, structural loads, and other related factors.

Groundwater Control and Drainage

Groundwater was encountered at test boring location B-1 at a depth of about 3.5 feet below the existing grade during field drilling operations. Therefore, it is expected that groundwater will be encountered during foundation excavation and construction. Moreover, dewatering will be required to maintain groundwater levels below the proposed foundation depths for the culvert. Adequate dewatering procedures as deemed necessary by the field conditions should be implemented throughout construction such that the groundwater is controlled and maintained at an elevation of at least 2 feet below the excavation bottom at all times. Every effort should be made to keep the excavations dry if water is encountered.

Scour Analysis Parameters

The following soil parameters can be utilized for the scour analysis at the proposed culvert location:

Boring No.	Sample #	Depths (ft)	D_{50} mm	D_{95} mm
B-1	SS-1	1.0 – 2.5	0.064	0.600
	SS-3	6.0 – 7.5	0.013	0.064
	SS-4	8.5 – 10.0	0.014	0.061

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better insure the safety of workers entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or foundation excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced. If they are not followed closely, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person" as defined in "CFR Part 1926," should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case, should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred. If the excavations are left open and exposed to the elements for a significant length of time, desiccation of the clays may create minute shrinkage cracks which could allow large pieces of clay to collapse or slide into the excavation.

Weather Considerations

The soils encountered at this site are known to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Care should be exercised during the grading operations

at the site. Due to the fine-grained nature of the surficial soils, the traffic of heavy equipment, including heavy compaction equipment, may very well create pumping and a general deterioration of those soils in the presence of water. Therefore, the grading should, if at all possible, be performed during a dry season. A layer of crushed stone may be required to allow the movement of construction traffic over the site during the rainy season. The contractor should maintain positive site drainage and if wet/pumping conditions occur, the contractor will be responsible to over excavate the wet soils and replace them with a properly compacted engineered fill. During wet seasons, limestone stabilization may be required to place engineer fill.

GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken. A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by Mr. Charles Hauber, PE, PS, Civil Engineer of Summit Metro Parks. If there are any revisions to the plans for the proposed fishing piers, building structures, or pavement areas, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Summit Metro Parks, for the specific application to the proposed culvert off of Cuyahoga Street, in Akron, Summit County, Ohio.

APPENDIX

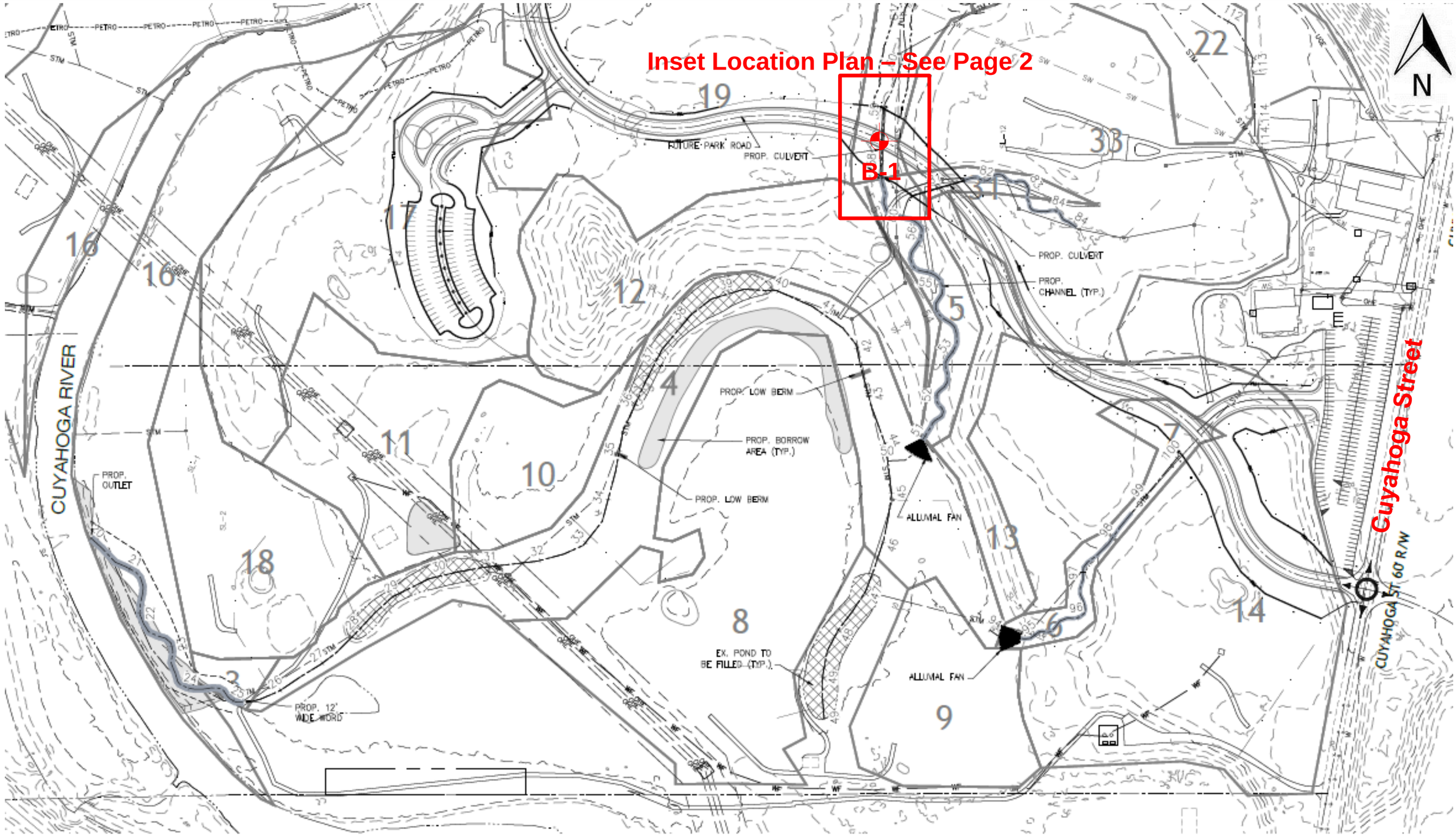
Boring Location Plan

Boring Logs

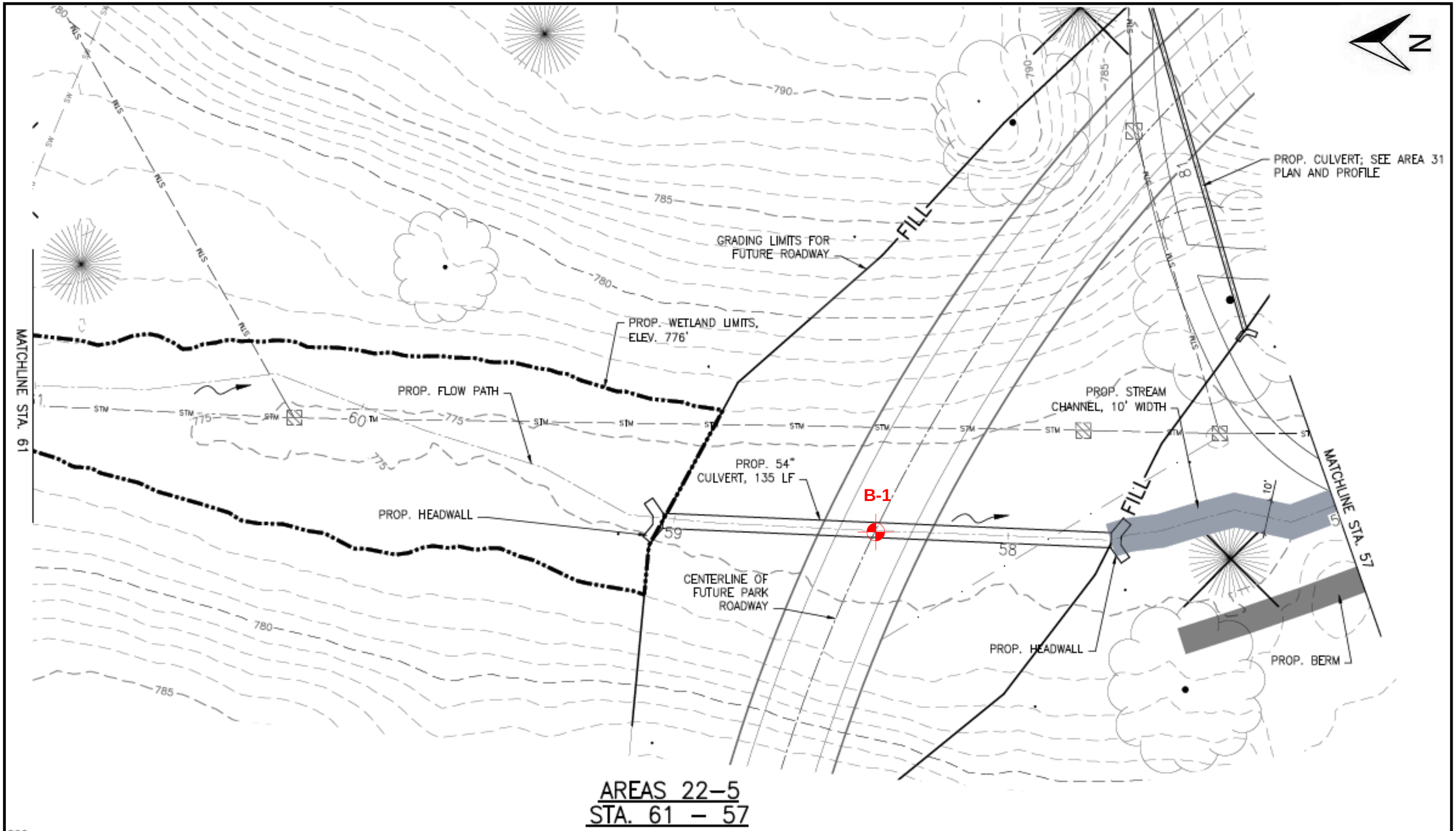
Grain Size Graph

General Notes

USCS Soil Classification Chart



intertek psi	**Lakes 54" Pipe Culvert** **Summit Metro Parks** **Gardner Road, Akron, Summit County, Ohio**	**Date:3/8/18** **Drawn By: ST** **Scale: NA**	**Bore Location Plan (1 of 2)** **PSI Project No: 0142-1710**



AREAS 22–5
STA. 61 – 57

intertek psi	**Lakes 54" Pipe Culvert** **Summit Metro Parks** **Gardner Road, Akron, Summit County, Ohio**	**Date:3/8/18** **Drawn By: ST** **Scale: NA**	**Bore Location Plan (2 of 2)** **PSI Project No: 0142-1710**

BORING B-1

DATE STARTED:	3/12/18	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	3/12/18	**DRILLER:** T.S.	**LOGGED BY:** J.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55 ATV
BENCHMARK:	N/A	**DRILLING METHOD:**	2.25" Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	A.V.

REMARKS: Borings backfilled with soil/auger cuttings

Water

While Drilling	3.5	feet
Upon Completion	3.5	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0					2" TOPSOIL	Topsoil		
				1	18	Very Soft, Moist, Brown and Gray, Silty CLAY, Some Organics	CL	2-1-W	33
						Very Soft, Wet, Dark Brown, PEAT	PT	N=1	121
				2	4	Medium Stiff, Moist to Wet, Gray, SILT, Trace Sand		W-5-15	149
	5					** Very Stiff with Sandstone Fragments @ 4.0' - 5.0'		N=20	
				3	17			3-4-4 N=8	24
				4	18			4-4-5 N=9	24
	10			5	18			3-4-5 N=9	23
				6	18			4-5-5 N=10	23
	15			7	18		ML	3-3-4 N=7	20
				8	18			3-4-5 N=9	24
	20								
				9	18			4-4-5 N=9	23
	25								
				10	17			4-6-8 N=14	25
	30								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Additional Remarks

- >>× Non-Plastic Fines=54.0%
- >>×
- LL = 22 PL = 21 Fines=98.3%
- LL = 23 PL = 22 Fines=99.5%

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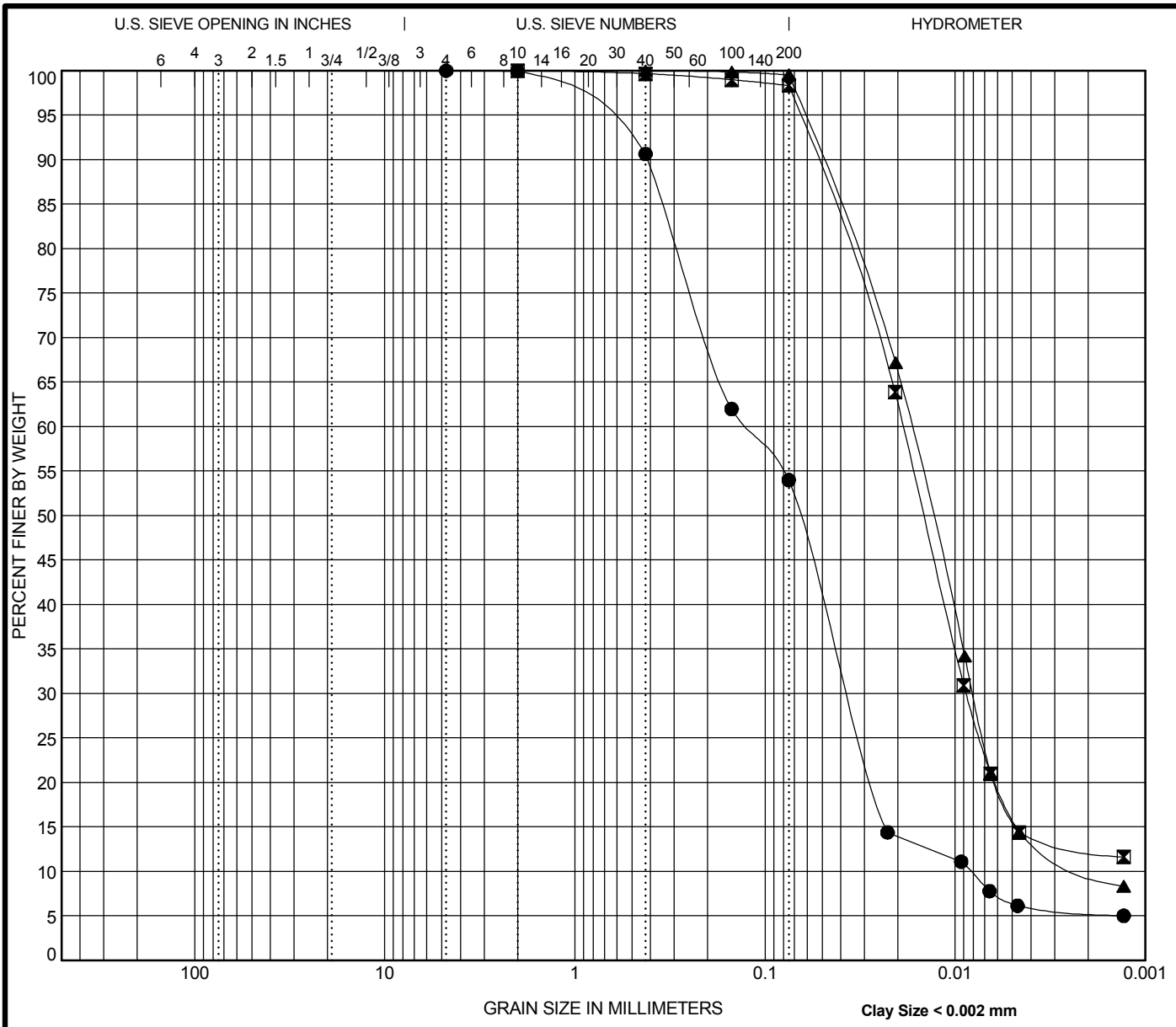
Telephone: (216) 447-1335

PROJECT NO.: 0142-1710
PROJECT: 54" Culvert - Summit Metropark
LOCATION: Gardner Road
Akron, Summit County, Ohio

The stratification lines represent approximate boundaries. The transition may be gradual.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-1	2.3	Dark Brown PEAT (PT)	NP	NP	NP	1.26	15.21
⊠	B-1	6.8	Gray SILT, Trace Sand (ML)	22	21	1		
▲	B-1	9.3	Gray SILT, Trace Sand (ML)	23	22	1	2.05	9.30

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	2.3	4.75	0.126	0.036	0.008	0.0	46.0	48.6	5.4
⊠	B-1	6.8	2	0.019	0.009		0.0	1.7	85.8	12.6
▲	B-1	9.3	0.425	0.017	0.008	0.002	0.0	0.5	89.1	10.4

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Fax: (216) 642-7008

GRAIN SIZE DISTRIBUTION

Project: 54" Culvert - Summit Metropark
PSI Job No.: 0142-1710
Location: Gardner Road
Akron, Summit County, Ohio

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.002 mm to 0.075 mm
Clay:	<0.002mm to <0.005 mm depending on agency

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

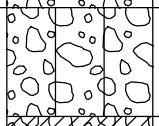
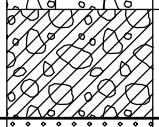
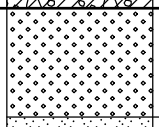
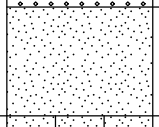
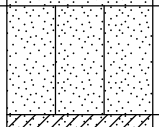
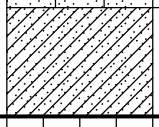
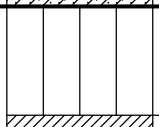
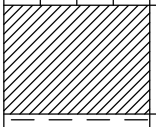
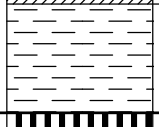
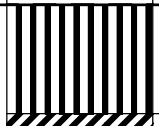
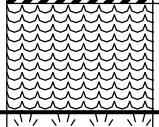
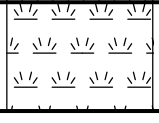
Slightly Weathered: Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.

Weathered: Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.

Highly Weathered: Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS