ENVIRONMENTAL • GEOTECHNICAL
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GEOTECHNICAL EXPLORATION REPORT
CRACKEL SUBDIVISION SANITARY SEWER
PAGE SCHOOL ROAD
WEST UNION, ADAMS COUNTY, OHIO
ATC FILE NUMBER: 241GC00332

Prepared for: Village West Union
c/o CT Consultants, Inc.
148 North High Street
Gahanna, Ohio 45230
Attn: Mr. Ivan Caballero

Prepared By: ATC Group Services LLC
11121 Canal Road
Cincinnati, Ohio 45241-1861

February 20, 2020

ENVIRONMENTAL • GEOTECHNICAL
BUILDING SCIENCES • MATERIALS TESTING

ATC Group Services LLC

11121 Canal Rd
Cincinnati, OH 45241

Phone +1 513 771 2112
Fax +1 513 782 6908

www.atcgroupservices.com

February 20, 2020

Mr. Ivan Caballero, E.I.
Project Engineer
Village of West Union
c/o CT Consultants, Inc.
148 North High Street
Gahanna, Ohio 45230

Re: Geotechnical Exploration Report
Crackel Subdivision Sanitary Sewer
Page School Road
West Union, Adams County, Ohio
ATC File Number: 241GC00332

Gentlemen:

In compliance with your recent request, ATC Group Services LLC (ATC) has completed a subsurface exploration and evaluation for the above referenced project. It is our pleasure to transmit herewith this report of the result of this exploration.

This work was performed in general accordance with ATC's Proposal No. 241-2019-0571, dated December 6, 2019, and was authorized by the ATC Client Services Agreement that was signed by Mr. Kent Bryan on December 18, 2019. If you have any questions regarding the report, please contact this office.

Sincerely,

ATC Group Services LLC

STATE OF OHIO
ALEXANDER S. HAM
E-73527
REGISTERED
PROFESSIONAL ENGINEER
2/20/20

Alexander S. Ham, P.E.
Geotechnical Engineer

Robert E. Sheets, P.E.
Senior Geotechnical Engineer

TABLE OF CONTENTS

SECTION PAGE

GEOTECHNICAL EXPLORATION REPORT

CRACKEL SUBDIVISION SANITARY SEWER
PAGE SCHOOL ROAD
WEST UNION, ADAMS COUNTY, OHIO
ATC FILE NUMBER: 241GC00332

1.0 INTRODUCTION

This report presents the results of a geotechnical exploration and subsurface condition evaluation for the proposed Crackel Subdivision sanitary sewer to be located along and off of Page School Road in West Union, Adams County, Ohio. This work was performed in general accordance with ATC's Proposal No. 241-2019-0571, dated December 6, 2019, and was authorized by the ATC Client Services Agreement that was signed by Mr. Kent Bryan on December 18, 2019.

The purpose of the exploration was to identify the subsurface profile at the site, to evaluate the suitability of the materials for support of structure foundations, and to develop recommendations relative to the design and construction of the foundations, building slab, sewer pipe installation, and other project components as outlined in the report. Comments and recommendations regarding earthwork, site preparation, and foundation construction have also been developed.

The scope of the exploration included a review of available geologic and subsurface data for the project area, completion of six (6) test borings, field and laboratory testing of recovered samples, and an engineering analysis and evaluation of the subsurface conditions encountered at the site.

2.0 PROJECT AND SITE CHARACTERISTICS

Proposed for construction is a new sanity sewer for the Crackel Subdivision located along the south side of Page School Road in West Union, Ohio. Based on the drawing provided to us by the client, it appears that approximately 4,700 linear feet of new 12 and 8 inch sanitary sewer is planned for installation, with a lift station to be located at the southeastern end of the new sewer. We understand that the proposed depth of the sewer will range from approximately 10 to 35 feet below the existing ground surface. The project area is mainly open agricultural fields.

The Test Boring Location Plan, included in the Appendix, shows the locations of some of the existing and proposed site features and the approximate locations of the borings completed for this study. If any of the information provided or ATC's assumptions are misrepresented and/or incorrect, please contact us so that we may review our recommendations.

3.0 GENERAL SUBSURFACE CONDITIONS

Six (6) test borings were completed for the proposed construction on January 20 and 21, 2020. Subsurface material samples were recovered and returned to ATC's Cincinnati, Ohio laboratory for analysis, testing and evaluation. Samples were classified by ATC's engineering staff by visual/manual methods, and boring logs were prepared.

It should be noted that stratification lines shown on the soil boring logs represent approximate transitions between material types. In-situ strata changes could occur at slightly different levels, and/or may transition more gradually. It should also be noted that the boring logs depict conditions at the particular locations and times indicated on the logs. Some conditions, particularly groundwater levels can change with time. Variations may be present between boring positions. The generalized subsurface and groundwater conditions for each boring are described in detail on the test boring logs located in the Appendix of this report. Ground surface elevations shown on the boring logs were estimated from the provided drawings.

3.1 Geology

The *Soil Survey of Adams County, Ohio*, prepared by the Ohio Department of Natural Resources (ODNR) indicates the site soils as belonging to the Aaron Silt Loam. The Aaron series consists of deep, moderately well-drained, slowly permeable soils in uplands, and are formed in residuum (in-place weathering of the parent bedrock) derived from interbedded limestone, siltstone, and calcareous shale.

ODNR Bedrock Topography of the West Union 7.5-Minute Quadrangle, dated 1995, indicated bedrock at the site to be at a depth of less than approximately 20 feet, and is associated with the Dayton Limestone, Noland and Brassfield Formations Undivided of the Silurian geologic age.

3.2 Subsurface Profile

At the ground surface, the borings encountered approximately 1 to 6 inches of topsoil. As noted above, the majority of the project site is agricultural in nature, and it is not unusual for organic matter to have been dispersed throughout the "plow zone" (up to approximately 18 or more inches) and greater thicknesses of organic soil may be present.

Beneath the surficial material, the borings encountered brown, gray, and gray-brown lean to fat clay (CL to CH) with varying amounts of silt, sand, limestone fragments, and organics to depths ranging from approximately 3 to 6 feet below the existing ground surface. Standard Penetration Test (SPT) N-values in this material ranged from 5 to 15 blows per foot (bpf), indicating soft to stiff consistencies for cohesive soils. Boring B-5 then encountered a layer of hard, red-brown laminated silty clay (CL) with little sand and brown shale fragments to a depth of approximately 7.5 feet below the existing ground surface.

Beneath the upper cohesive layer, Borings B-1, B-2, and B-6 encountered gray, gray-brown, and brown-gray laminated lean to fat clay (CL to CH) to a depth of approximately 13 feet below the existing ground surface. It is believed that his material represents completely weathered and decomposed bedrock (residuum). SPT N-values in this material ranged from 18 to 47 bpf, indicating very stiff to hard consistencies for cohesive soils. These borings then encountered gray weathered to extremely weathered shale to depths ranging from approximately 14 to 23.5 feet below the existing ground surface. SPT N-values in this material ranged from 54 bpf to split-spoon sampler refusal (greater than 50 blows over 6 inches).

Beneath the weathered shale in Borings B-1, B-2, and B-6, and the upper cohesive layer in Borings B-3, B-4, and B-5, the borings then encountered auger refusal on competent bedrock at depths ranging from approximately 4 to 23.5 feet below the existing ground surface. Bedrock was cored and sampled at each boring location, and was generally classified as hard, gray limestone with varying amounts of interbedded soft gray shale. The following table summarizes the rock cores performed for this investigation:

Boring	Depth (ft)	Recovery (%)	RQD* (%)	Rock Mass Quality
B-1	23.5 – 30	96	49	Poor
B-2	14 – 19	87	45	Poor
	19 – 25	82	54	Fair
B-3	4 – 9	92	50	Poor
	9 – 14	63	23	Very Poor
	14 – 19	52	7	Very Poor
	19 – 20	100	67	Fair
B-4	4.5 – 9	96	74	Good
	9 – 14	65	20	Very Poor
	14 – 20	92	56	Fair
B-5	7.5 – 8.5	50	0	Very Poor
	8.5 – 13.5	86	62	Fair
	13.5 – 18.5	95	63	Fair
	18.5 – 23.5	83	45	Poor
	23.5 – 25	100	28	Poor
B-6	16.5 – 19.2	100	34	Poor
	19.2 – 24.2	97	83	Good
	24.2 – 29.2	100	43	Poor
	29.2 – 34.2	95	48	Poor
	34.2 – 40	97	54	Fair

*Rock Quality Designation

The generalized subsurface and groundwater conditions for each boring completed for this investigation are described in detail on the test boring logs presented in the Appendix of this report.

3.3 Groundwater Conditions

Groundwater level observations were made both during and at the completion of drilling operations. Groundwater was not encountered during or upon completion of the drilling in any of the borings completed for this investigation. Note that observed groundwater levels may fluctuate in response to short-term and seasonal variations in precipitation, surface runoff, and local pockets of groundwater may be present at shallower depths in the profile during wetter periods.

4.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Based upon the analysis of the subsurface conditions and the layout and design information supplied for this project by the client as previously outlined, the following conclusions and recommendations have been developed. If the project design or layout changes from that noted herein, ATC should be notified so that the recommendations can be reviewed and revised as necessary to reflect the changes. The recommendations given below should be considered minimum requirements.

4.1 Sewer Conduit Support

Hard limestone with interbedded soft shale will be present at or near the proposed sanitary sewer invert levels at each of the boring locations. These material should offer sufficient support for the proposed sanitary sewer. Proper bedding should be used beneath the pipe.

4.2 Sewer Excavation

Conventional hydraulic excavators should be able to excavate the overburden soils and weathered shale material encountered in the area. Rock removal equipment and methods, such as using a trackhoe bucket equipped with a ripping tooth, will be required to penetrate the encountered hard limestone. The use of pneumatic or hydraulic-actuated impact equipment may be necessary to excavate the hard limestone material, particularly if relatively neat excavation sidewalls are desired.

No measurable groundwater was noted in the short term observations of the test borings and boreholes. However, depending upon the seasonal and the recent precipitation amounts, some groundwater may be encountered when excavating for the project. It is our opinion that if seepage is encountered, it should be able to be controlled with sump pumps placed in the excavation.

All temporary excavations for utilities or other structures should be shored and/or sloped in accordance with Occupational Safety and Health Administration (OSHA) requirements, and stabilized as necessary. It is our opinion that the cohesive materials encountered in the upper approximate 3 to 6 feet in our borings should be considered OSHA Type "B" material, requiring excavation sideslopes to be 1 horizontal to 1 vertical (1H:1V) or flatter, and/or braced as necessary. We believe that the very stiff to hard residual soils and weathered shale material can be considered an OSHA Type "A" soil, allowing open trench side slopes laid back at 0.75H:1V or flatter, and/or suitably braced. The encountered hard limestone can be considered OSHA "Stable Rock."

A 'competent person' as defined by OSHA should evaluate the actual excavation conditions during construction and modify trench stabilization measures as appropriate.

4.3 Sewer Backfill

Only suitably graded granular material should be used below and beside the pipe and for one-foot above the pipe. The backfill material above the granular backfill could consist of the excavated cohesive and residual soils. If the excavated weathered shale will be re-used as fill, it *must* be thoroughly broken up, wetted, and slaked into a soil-like consistency and placed as a soil fill. Under no circumstances should it be placed as a bulk rockfill, as might be done for a durable rock.

The backfill should be placed in lifts not exceeding twelve (12) inches in thickness. Each lift should be compacted to at least 95 percent of the maximum laboratory dry density as determined per ASTM standard method D-698. Vibratory compaction equipment will most likely be required for granular materials, if used, and sheep's foot type compactors will be needed for clayey soil. Soils classified as fat clays (CH) should be avoided as backfill within the upper 3 feet below the proposed subgrade elevation.

The fill should be free of rock fragments with dimensions greater than 3 inches. If fill construction takes place during the winter months, care should be taken so as to avoid placement of fill over frozen subgrade, and to preclude inclusion of frozen materials within any backfill. The fill should be placed in lifts of uniform thickness. The lift thickness should not exceed that which can be properly compacted throughout its entire depth with the equipment available, and should not be greater than twelve (12) inches in any case. Fill soils should be placed at or near the optimum moisture content as determined in accordance with ASTM D 698. Suitable equipment for either aerating or adding water should be available as the soil moisture and weather conditions dictate.

5.0 PLAN REVIEW AND CONSTRUCTION MONITORING

It is recommended that ATC be retained to review final project plans and specifications, and to perform continuous monitoring of the geotechnical and earthwork phases of the project. If ATC is not retained for these purposes, we can assume no responsibility for compliance of the work with the design concepts, specifications, or for modifications or recommendations made during construction. As part of this review, site clearing and stripping, undercutting, fill placement and foundation excavation operations should be monitored and in-place density tests should be performed on fill and backfill as frequently as necessary to allow evaluation of the fill with respect to project earthwork specifications.

6.0 FIELD AND LABORATORY INVESTIGATIONS

6.1 Field Exploration

The field exploration included the performance of six (6) soil test borings located approximately as shown on the enclosed Test Boring Location Plan. Test borings were performed with a truck-mounted drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Samples of the in-situ soils were obtained employing split-barrel sampling procedures in general accordance with ASTM Standard Method D-1586. Observations regarding groundwater levels, and other pertinent conditions were made at each boring location.

The encountered materials have been visually classified by the ATC's engineering staff, and are described in detail on the boring logs. The results of the field penetration tests, strength tests, Atterberg Limit tests, water level observations, and laboratory moisture content determinations are presented on the boring logs in numerical form. Samples of the soils encountered in the field were placed in sealed sample jars and are stored in the laboratory for further analysis, if desired. Unless notified to the contrary, all samples will be disposed of in thirty (30) days from the date of this report.

6.2 Laboratory Testing Program

In conjunction with the field exploration, a laboratory testing program was conducted to determine pertinent engineering characteristics of the subsurface materials as necessary for development of engineering recommendations. The laboratory-testing program included visual classification of all samples. Natural moisture content, Pocket Penetrometer, and Atterberg Limit tests were conducted on selected soil samples. Point load strength index tests were conducted on selected rock core samples. All phases of the laboratory-testing program were conducted in general accordance with applicable ASTM specifications and procedures.

7.0 LIMITATIONS OF STUDY

7.1 Differing Conditions

Recommendations for this project were developed utilizing soil information obtained from the test borings that were completed at the proposed site. These borings indicate subsurface soil and groundwater conditions at the specific locations and time at which the borings were conducted. Conditions at other locations on the site may differ from those occurring at the boring positions. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the immediate attention of the geotechnical engineer so that recommendations can be reviewed and revised as required.

7.2 Changes in Plans

The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project and/or as assumed herein. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in the foundation or earthwork recommendations are necessary.

7.3 Recommendations vs. Final Design

This report and the recommendations included within are not intended as a final design, but rather as a basis for the final design to be completed by others. It is the client's responsibility to ensure that the recommendations of the geotechnical engineer are properly integrated into the design, and that the geotechnical engineer is provided the opportunity for design input and comment after the submittal of this report, as needed. It is strongly recommended that ATC be retained to review the final construction documents to confirm that the proposed project design sufficiently incorporates the geotechnical recommendations. ATC should be represented at pre-bid and/or preconstruction meetings regarding this project to offer any needed clarifications of the geotechnical information to all involved.

7.4 Construction Issues

Although general constructability issues have been considered in this report, the means, methods, techniques, sequences and operations of construction, safety precautions, and all items incidental thereto and consequences of, are the responsibility of the parties to the project other than ATC. This office should be contacted if additional guidance is needed in these matters.

7.5 Report Interpretation

ATC is not responsible for conclusions, opinions, or recommendations developed by others on the basis of the data included herein. It is the client's responsibility to seek any guidance and clarifications from the geotechnical engineer needed for proper interpretation of this report.

7.6 Environmental Considerations

The scope of services does not include any environmental assessment investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studies. Any statements in this report or on the test boring logs regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended prior to the development of this site.

7.7 Standard of Care

The professional services and engineering recommendations presented in this report have been developed in accordance with generally accepted geotechnical engineering principles and practices in the geographical area of the project at the time of the report. No other warranties, either expressed or implied are offered.

APPENDIX

Test Boring Location Plan

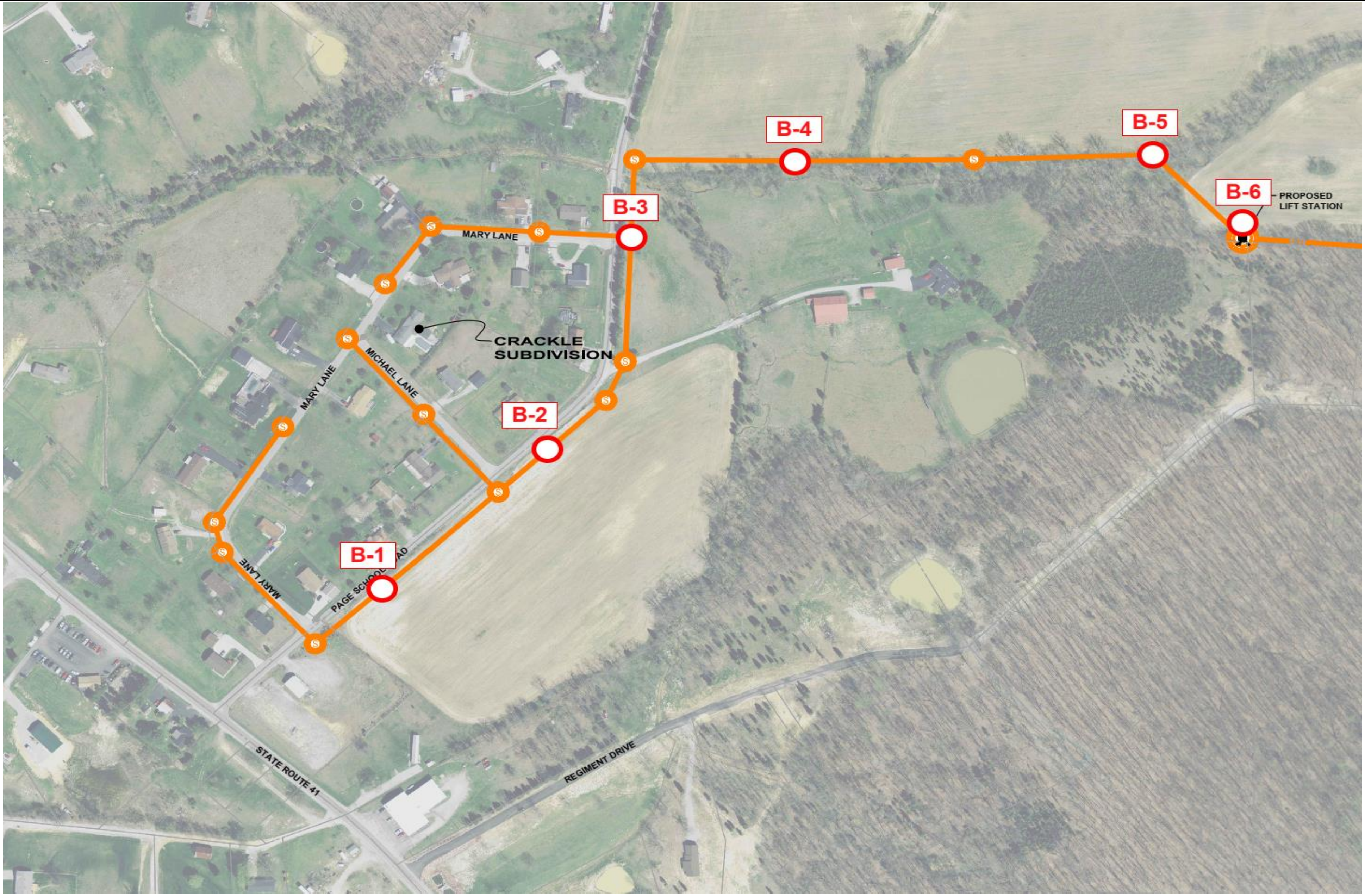
Logs of Borings (6)

Atterberg Limits Test Results

Field Classification System for Soil Exploration

Unified Soil Classification

Important Information About Your Report



ATC
11121 Canal Rd, Cincinnati, Ohio 45241
Ph. 513-771-2112

Drawing:	**TEST BORING LOCATION PLAN**
Project:	**CRACKEL SUBDIVISION SANITARY SEWER**
Location:	**WEST UNION, OHIO**
Client:	**CT CONSULTANTS**
ATC Proposal No.:	**241GC00332**

TEST BORING LOG

ATC — AN ATLAS COMPANY

CLIENT: **CT Consultants**
PROJECT NAME: **Crackel Subdivision Sanitary Sewer**
PROJECT LOCATION: **Page School Road**
West Union, Ohio

BORING #: **B-1**
JOB #: **241GC00332**
DRAWN BY: **ASH**
APPROVED BY: **RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/20/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/20/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION — SURFACE ELEVATION ~790

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
6 inches TOPSOIL.	0.5										
Brown and gray SILTY CLAY (CL). Moist. Medium stiff.	3.0		1	SS	7		2.5	27			
Brown-gray laminated FAT CLAY (CH). Damp. Very stiff to hard. [Residuum]		5	2	SS	18		4.5+	20			
			3	SS	29		4.5+	17			
	13.0	10	4	SS	45		4.5+	15			
Gray extremely weathered SHALE. Dry.		15	5	SS	54						
	23.5	20	6	SS	75						
Auger refusal encountered at 23.5 feet. Rock Core 1 sampled from 23.5 to 30 feet.		25	1	RC							

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools **Dry** ft.
At Completion (in augers) ____ ft.
At Completion (open hole) **n/a** ft.
After ____ days ____ ft.
After ____ days ____ ft.
Cave Depth **n/a** ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

ATC — AN ATLAS COMPANY

CLIENT	**CT Consultants**	BORING #	**B-1**
PROJECT NAME	**Crackel Subdivision Sanitary Sewer**	JOB #	**241GC00332**
PROJECT LOCATION	**Page School Road**	DRAWN BY	**ASH**
	West Union, Ohio	APPROVED BY	**RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/20/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/20/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION (continued)	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
Gray hard LIMESTONE, trace soft gray Shale. Recovery = 96% RQD = 49%	30.0	30											
- Boring complete at a depth of 30 feet.													

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater

- Noted on Drilling Tools **Dry** ft.
- At Completion (in augers) ____ ft.
- At Completion (open hole) **n/a** ft.
- After ____ days ____ ft.
- After ____ days ____ ft.
- Cave Depth **n/a** ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

—AN ATLAS COMPANY—

CLIENT **CT Consultants**
PROJECT NAME **Crackel Subdivision Sanitary Sewer**
PROJECT LOCATION **Page School Road**
West Union, Ohio

BORING # **B-2**
JOB # **241GC00332**
DRAWN BY **ASH**
APPROVED BY **RES**

DRILLING and SAMPLING INFORMATION

Date Started	01/20/2020	Hammer Wt.	140 lbs.
Date Completed	01/20/2020	Hammer Drop	30 in.
Drill Foreman	MJ	Spoon Sampler OD	2 in.
Inspector		Rock Core Dia.	in.
Boring Method	HSA	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION ~781

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
6 inches TOPSOIL.	0.5											
Brown and gray SILTY CLAY (CL), trace Sand. Moist. Medium dense.			1	SS		6		1.5	30			
	3.0											
Gray-brown laminated FAT CLAY (CH). Damp. Very stiff. [Residuum]			2	SS		18		2.75	22	57	32	
		5										
- little brown Shale at 6 feet			3	SS		27		4.5+	19			
			4	SS		27						
		10										
	13.0											
Gray weathered SHALE and hard Limestone. Dry.	14.0		5	SS		50/4"						
Auger refusal encountered at 14 feet. Rock Core 1 sampled from 14 to 19 feet.		15										
Gray hard LIMESTONE, trace soft gray Shale. Recovery = 87% RQD = 45%			1	RC								
	19.0											
Rock Core 2 sampled from 19 to 25 feet.		20										
Gray hard LIMESTONE, trace soft gray Shale. Recovery = 82% RQD = 54%			2	RC								
	25.0	25										
- Boring complete at a depth of 25 feet.												

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools **Dry** ft.
At Completion (in augers) ft.
At Completion (open hole) **n/a** ft.
After days ft.
After days ft.
Cave Depth **n/a** ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

ATC — AN ATLAS COMPANY

CLIENT: **CT Consultants**
PROJECT NAME: **Crackel Subdivision Sanitary Sewer**
PROJECT LOCATION: **Page School Road, West Union, Ohio**

BORING #: **B-3**
JOB #: **241GC00332**
DRAWN BY: **ASH**
APPROVED BY: **RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/20/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/20/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SURFACE ELEVATION ~767

SOIL CLASSIFICATION	Stratum Depth	Depth Scale	Sample No.	Sample Type	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
1 inch TOPSOIL.	0.1											
Brown SILTY CLAY (CL), little Sand and Limestone fragments. Moist. Medium stiff to hard.			1	SS		7		2.0	28			
	4.0		2	SS		50/2"						
Auger refusal encountered at 4 feet. Rock Core 1 sampled from 4 to 9 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 92% RQD = 50%		5	1	RC								
Rock Core 2 sampled from 9 to 14 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 63% RQD = 23%	9.0	10	2	RC								
Rock Core 3 sampled from 14 to 19 feet. Gray hard LIMESTONE, some soft gray Shale. Recovery = 52% RQD = 7%	14.0	15	3	RC								
Rock Core 4 sampled from 19 to 20 feet. Gray hard LIMESTONE, some soft gray Shale. Recovery = 100% / RQD = 67%	19.0		4	RC								
- Boring complete at a depth of 20 feet.	20.0	20										

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools **Dry** ft.
At Completion (in augers) ft.
At Completion (open hole) **n/a** ft.
After days ft.
After days ft.
Cave Depth **n/a** ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

ATC — AN ATLAS COMPANY

TEST BORING LOG

CLIENT	**CT Consultants**	BORING #	**B-4**
PROJECT NAME	**Crackel Subdivision Sanitary Sewer**	JOB #	**241GC00332**
PROJECT LOCATION	**Page School Road**	DRAWN BY	**ASH**
	West Union, Ohio	APPROVED BY	**RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/20/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/20/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION ~768	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
6 inches TOPSOIL.	0.5												
Gray-brown SILTY CLAY (CL), trace Sand and Organics. Moist. Medium stiff to hard.			1	SS			6		1.5	22	39	20	
	4.5		2	SS			50/4"*		1.25	21			*3-50/4"
Auger refusal encountered at 4.5 feet. Rock Core 1 sampled from 4.5 to 9 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 96% RQD = 74%	9.0	5	1	RC									
Rock Core 2 sampled from 9 to 14 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 65% RQD = 20%	14.0	10	2	RC									
Rock Core 3 sampled from 14 to 20 feet. Gray hard LIMESTONE, some soft gray Shale. Recovery = 92% RQD = 56%	20.0	15	3	RC									
- Boring complete at a depth of 20 feet.		20											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater

- Noted on Drilling Tools **Dry** ft.
- At Completion (in augers) ____ ft.
- At Completion (open hole) **n/a** ft.
- After ____ days ____ ft.
- After ____ days ____ ft.
- Cave Depth **n/a** ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

ATC — AN ATLAS COMPANY

CLIENT: **CT Consultants**
PROJECT NAME: **Crackel Subdivision Sanitary Sewer**
PROJECT LOCATION: **Page School Road**
West Union, Ohio

BORING #: **B-5**
JOB #: **241GC00332**
DRAWN BY: **ASH**
APPROVED BY: **RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/21/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/21/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION — SURFACE ELEVATION ~772

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
6 inches TOPSOIL.	0.5											
Gray-brown SILTY CLAY (CL), trace Sand and Organics. Moist. Soft to medium stiff.			1	SS		5		1.25	25			
		5	2	SS		8		1.25	26			
Red-brown laminated SILTY CLAY (CL), little Sand and brown Shale fragments. Moist. Hard.	6.0		3	SS		50/3"						
Auger refusal encountered at 7.5 feet.	7.5											
Rock Core 1 sampled from 7.5 to 8.5 feet. Gray hard LIMESTONE. Recovery = 50% / RQD = 0%	8.5		1	RC								
Rock Core 2 sampled from 8.5 to 13.5 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 88% RQD = 62%	13.5	10	2	RC								
Rock Core 3 sampled from 13.5 to 18.5 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 95% RQD = 63%	18.5	15	3	RC								
Rock Core 4 sampled from 18.5 to 23.5 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 83% RQD = 45%	23.5	20	4	RC								
Rock Core 5 sampled from 23.5 to 25 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 100% / RQD = 28%	25.0	25	5	RC								
- Boring complete at a depth of 25 feet.												

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools **Dry** ft.
At Completion (in augers) ft.
At Completion (open hole) **n/a** ft.
After ____ days ____ ft.
After ____ days ____ ft.
Cave Depth **n/a** ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

ATC — AN ATLAS COMPANY

CLIENT: **CT Consultants**
PROJECT NAME: **Crackel Subdivision Sanitary Sewer**
PROJECT LOCATION: **Page School Road**
West Union, Ohio

BORING #: **B-6**
JOB #: **241GC00332**
DRAWN BY: **ASH**
APPROVED BY: **RES**

DRILLING and SAMPLING INFORMATION

Date Started	**01/21/2020**	Hammer Wt.	**140** lbs.
Date Completed	**01/21/2020**	Hammer Drop	**30** in.
Drill Foreman	**MJ**	Spoon Sampler OD	**2** in.
Inspector		Rock Core Dia.	in.
Boring Method	**HSA**	Shelby Tube OD	in.

TEST DATA

SOIL CLASSIFICATION SURFACE ELEVATION ~780	Stratum Depth	Depth Scale	Sample No.	Sample Type	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
6 inches TOPSOIL.	0.5										Boring offset 20' east.
Brown SILTY CLAY (CL), trace Sand. Moist. Soft.	3.0		1	SS	5		1.75	37			
Brown and gray FAT CLAY (CH). Moist. Stiff.	6.0	5	2	SS	15		4.25	21	60	40	
Gray laminated SILTY CLAY (CL). Damp. Hard. [Residuum]	13.0		3	SS	47						
		10	4	SS	44		4.5+	14			
Gray extremely weathered SHALE. Dry.	16.5	15	5	SS	85						
Auger refusal encountered at 16.5 feet. Rock Core 1 sampled from 16.5 to 19.2 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 100% / RQD = 34%	19.2		1	RC							
Rock Core 2 sampled from 19.2 to 24.2 feet. Gray hard LIMESTONE, trace soft gray Shale. Recovery = 97% RQD = 83%	24.2	20	2	RC							
		25	3	RC							

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube
SPT - Standard Penetration Test

Depth to Groundwater
Noted on Drilling Tools **Dry** ft.
At Completion (in augers) ft.
At Completion (open hole) **n/a** ft.
After days ft.
After days ft.
Cave Depth **n/a** ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

TEST BORING LOG

—AN ATLAS COMPANY—

CLIENT	CT Consultants	BORING #	B-6
PROJECT NAME	Crackel Subdivision Sanitary Sewer	JOB #	241GC00332
PROJECT LOCATION	Page School Road	DRAWN BY	ASH
	West Union, Ohio	APPROVED BY	RES

DRILLING and SAMPLING INFORMATION

Date Started	01/21/2020	Hammer Wt.	140 lbs.
Date Completed	01/21/2020	Hammer Drop	30 in.
Drill Foreman	MJ	Spoon Sampler OD	2 in.
Inspector		Rock Core Dia.	in.
Boring Method	HSA	Shelby Tube OD	in.

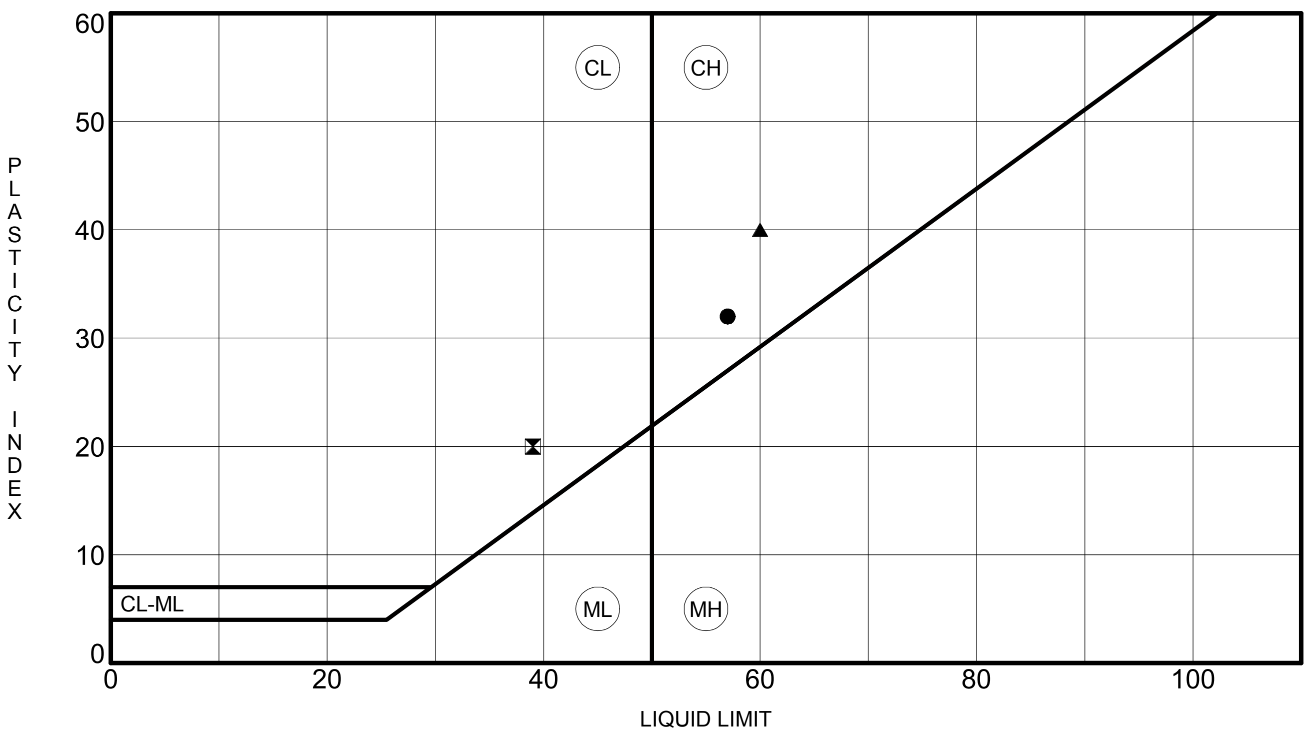
TEST DATA

SOIL CLASSIFICATION (continued)	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test, blows per foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Remarks
Rock Core 3 sampled from 24.2 to 29.2 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 100% RQD = 43% *(layer continued from previous page)*	29.2	30											
Rock Core 4 sampled from 29.2 to 34.2 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 95% RQD = 48%	34.2	35	4	RC									
Rock Core 4 sampled from 34.2 to 40 feet. Gray hard LIMESTONE, little soft gray Shale. Recovery = 97% RQD = 54%	40.0	40	5	RC									
- Boring completed at a depth of 40 feet.													

Sample Type
- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube
- SPT - Standard Penetration Test

Depth to Groundwater
- Noted on Drilling Tools Dry ft.
- At Completion (in augers) ft.
- At Completion (open hole) n/a ft.
- After ____ days ____ ft.
- After ____ days ____ ft.
- Cave Depth n/a ft.

Boring Method
- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2**	**3.5**	**57**	**25**	**32**		**Gray-brown laminated FAT CLAY (CH)**
⧗	**B-4**	**1.0**	**39**	**19**	**20**		**Gray-brown SILTY CLAY (CL), trace Sand and Organics**
▲	**B-6**	**3.5**	**60**	**20**	**40**		**Brown and gray FAT CLAY (CH)**

ATC — AN ATLAS COMPANY —
11121 Canal Road
Cincinnati, OH
Office (513) 771-2112
Fax (513) 782-6908

ATTERBERG LIMITS RESULTS

Project: Crackel Subdivision Sanitary Sewer

Location: Page School Road

Number: 241GC00332

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	– 5 blows/ft. or less
Loose	– 6 to 10 blows/ft.
Medium Dense	– 11 to 30 blows/ft.
Dense	– 31 to 50 blows/ft.
Very Dense	– 51 blows/ft. or more

Relative Proportions

DESCRIPTIVE TERM	PERCENT
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 – 50

Particle Size Identification

Boulders	– 8 inch diameter or more	
Cobbles	– 3 to 8 inch diameter	
Gravel	– Coarse	– 1 to 3 inch
	– Medium	– 1/2 to 1 inch
	– Fine	– 1/4 to 1/2 inch
Sand	– Coarse	– 2.00 mm to 1/4 inch (diameter of pencil lead)
	– Medium	– 0.42 to 2.00 mm diameter of broom straw)
	– Fine	– 0.074 to 0.42 mm (dia. of a human hair)
Silt		– 0.074 to 0.002 mm (cannot see particles)

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very Soft	– 3 blows/ft. or less
Soft	– 4 to 5 blows/ft.
Medium Stiff	– 6 to 10 blows/ft.
Stiff	– 11 to 15 blows/ft.
Very Stiff	– 16 to 30 blows/ft.
Hard	– 31 blows/ft. or more

Plasticity

DEGREE OF PLASTICITY	PLASTICITY INDEX
None to slight	0 – 4
Slight	5 – 7
Medium	8 – 22
High to very high	over 22

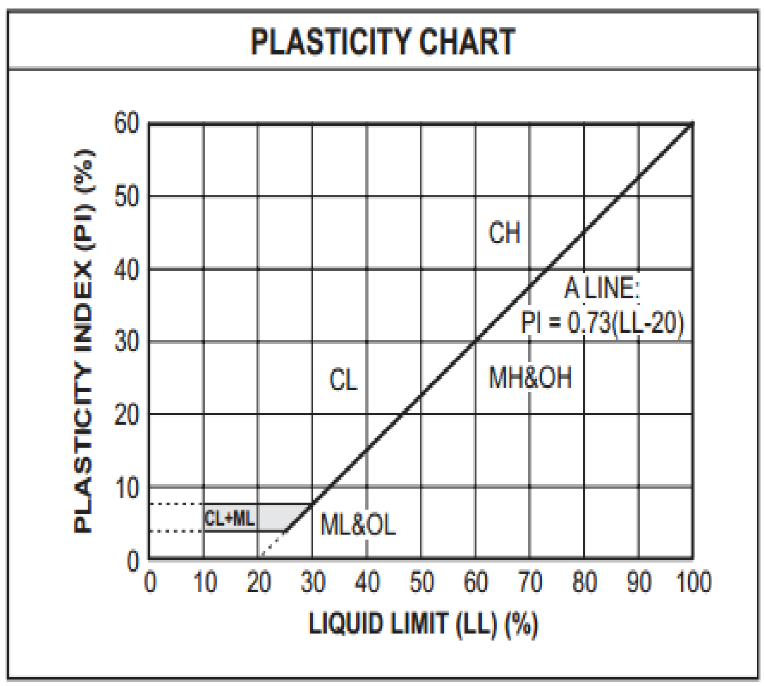
Classification on logs are generally made by visual inspection of samples, but may be supplemented with laboratory testing as noted.

Standard Penetration Test – Driving a 2.0' O.D., 1-3/8 I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for Cardno ATC to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6.0 inches of penetration (Example: 6\8\9). The standard penetration test result N–value is obtained by adding the last two figures (Example: 8+9=17 blows/ft.) (ASTM D-1586-67).

Strata Changes – In the column "Soil Descriptions" on the drilling log the horizontal lines represent strata changes. A solid line (______) represents an actually observed change, and a dashed line (_ _ _ _ _ _) represents an estimated change.

Ground Water – Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Major Divisions			Group Symbol	Typical Names	Laboratory Classification Criteria		
COARSE GRAINED SOILS (More than half of material is larger than #200 sieve)	**Gravels** (More than half of coarse fraction is larger than #4 sieve)	Clean Gravels	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than #200 sieve size), coarse grained soils are classified as follow: Less than 5%......GW, GP, SW, SP More than 12%....GM, GC, SM, SC 5 to 12%......Borderline cases requiring dual symbols	$C_U=D_{60}/D_{10} > 4$ & $1 > C_C=D_{30}^2/(D_{10}xD_{60}) > 3$	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.		Not meeting all gradiation recruitments for GW	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravels-sand-clay mixtures.		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than #4 sieve)	Clean Sands	SW	Well graded sands, gravely sands, little or no fines		$C_U=D_{60}/D_{10} > 4$ & $1 > C_C=D_{30}^2/(D_{10}xD_{60}) > 3$	
			SP	Poorly graded sands, gravely sands, little or no fines.		Not meeting all gradiation requirements for SW.	
		Sands with fines	SM	Silty sands, sand-silt mixtures.		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits above "A" line with P.I. greater than 7	
FINE GRAINED SOILS (More than half of material is smaller than #200 sieve)	**Silts and Clays** (LL less than 50)		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.			
			CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays.			
			OL	Organic silts and organic silty clay of low plasticity			
	Silts and Clays (LL greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts.			
			CH	Inorganic clays of high plasticity, fat clays.			
			OH	Organic clays of medium to high plasticity, organic silts.			
	Highly Organic Soil		PT	Peat, humus, swamp soils with high organic contents.			



ATC

Unified Soil Classification System

ASTM Designation D- 2487

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org