APPENDIX B

Report of Geotechnical Exploration

Proposed Squirrel Creek Drainage Improvements

Between Squirrel Creek and Midway Drive

South Haven, Indiana

ATC Project No. H819081804

Prepared for:

Mr. Luke J. Sherry, PE
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May 18, 2018

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May 18, 2018

Mr. Luke J. Sherry, PE
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Re: **Report of Geotechnical Engineering Exploration**
Proposed Squirrel Creek Drainage Improvements
Between Squirrel Creek and Midway Drive, South Haven, Indiana
ATC Project No. H819081804

Dear Mr. Sherry:

ATC Group Services LLC (ATC) is pleased to submit herewith our report of a geotechnical engineering exploration for the proposed Squirrel Creek drainage improvements in South Haven, Indiana. The services were performed in accordance with ATC Proposal No. 2018-112G that was revised on April 6, 2018 and was authorized by Mr. Thomas T. Burke, Jr., Vice President, on April 6, 2018.

This report contains the results of our field and laboratory testing program, an engineering interpretation of the data with respect to the available project characteristics and our geotechnical recommendations regarding earth-related phases of this project.

ATC appreciates the opportunity to be of service to you on this project. If we can be of any further assistance, or if you have any questions regarding this report, please do not hesitate to contact us at 219-922-7235.

Respectfully submitted,
ATC Group Services LLC

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Table of Contents

Appendix

1 Introduction

The report presents the results of a geotechnical engineering exploration for the proposed Squirrel Creek drainage improvements in South Haven, Indiana. The study was performed in accordance with ATC Proposal No. 2018-112G that was revised on April 6, 2018.

1.1 Purpose and Scope

The purpose of the study was to:

- Obtain information regarding the subsurface soil and groundwater conditions present at the site based on test borings,
- Evaluate the suitability of the encountered materials to support the proposed construction,
- Provide geotechnical engineering recommendations for the design of the proposed improvements based on the field and laboratory findings, and
- Provide recommendations regarding earthwork activities for the project.

The scope of this study included;

- A site reconnaissance and limited review of available geologic information,
- Field and laboratory testing, and
- An engineering evaluation of the encountered subsurface conditions.

Assessment of site environmental conditions, including the detection of pollutants in the soil or groundwater, delineation of jurisdictional wetlands, etc., was beyond the scope of this study.

1.2 Project and Site Characteristics

We understand that CBBEL is preparing plans for the proposed storm water drainage improvements in the Squirrel Creek area of South Haven, Indiana. While no detailed drawings or other information is currently available, we understand that the project will include construction of new storm sewer and inlets, reconstruction of roadway in various parts, and a storm water retention area.

The new detention pond will be excavated east of the existing South Haven Elementary School and north of Midway Drive. The proposed storm sewers will reportedly extend westward from the pond along Midway Drive and head south along CR 400 W. We understand that the new sewers will include pipes no larger than about 4 ft in diameter with inverts no deeper than about 7 to 8 ft below the current grade.

Based on the topographic drawing provided to us, the proposed improvement area is relatively flat with a mild downward slope from the west towards the east with corresponding surface elevations varying between about 654 ft and 649 ft, MSL, in the roadway soil borings. The ground surface elevations at the bottom of the pond varies between about 644 ft and 646 ft, MSL.

2 Field and Laboratory Exploration

2.1 Field Exploration

The field exploration included a total of six (6) soil test borings at the locations shown approximately on the Boring Location Plan (Figure No.1). Borings B-1 and B-2 were completed at the proposed detention pond and Borings B-3 through B-6 were drilled along Midway Drive and CR 400 W. All soil borings were extended to a depth of 20 ft below the existing ground surface.

The soil boring locations were established at the site by an ATC representative based on drawing provided by the client and by estimating distances from various existing features. Since these measurements are not precise, all boring locations shown on the attached Boring Location Plan should be considered approximate. Surface elevations reported on the logs were provided by client.

IN811-the state utility locator service was notified to mark existing underground features at the site prior to field drilling and sampling. The test borings were completed with an ATV-mounted drill-rig. Conventional hollow-stem augers were used to advance the boreholes through the soil. Representative samples of the in-situ soils were obtained at selected intervals employing split-barrel sampling procedures in accordance with ASTM D-1586-11, Standard Test Method for Penetration Test and Split Barrel Sampling of Soils. Split-spoon samples were obtained at intervals of 2.5 ft and 5 ft. Standard Penetration Tests (SPT) values were recorded for each split spoon sample. The SPT (N) value corresponding to each split-spoon sample provides general information about the strength and consistency of the naturally occurring materials. The Soil Classification Sheet provided in the Appendix explains the SPT test procedure in brief.

Groundwater observations were made during and immediately after completion of the drilling operations. SPT values and groundwater observations are noted on the respective Test Boring Logs. All holes were backfilled with auger cuttings after drilling and patched.

2.2 Laboratory Exploration

Samples from the field were placed in sealed containers and brought to the ATC laboratory for further analysis. A supplemental laboratory exploration was conducted to determine pertinent engineering characteristics of the subsurface materials necessary to analyse the behavior of the foundations for the proposed project. The laboratory program included a visual classification on all samples. Moisture and organic contents, % finer than Sieve 200 and unconfined compressive strength tests were performed on selected samples. All laboratory tests were conducted in general accordance with applicable ASTM specifications and procedures and the test results are provided on the respective boring logs or in the appendix.

The Test Boring Logs in the Appendix describe visual classifications of all soil strata encountered using the Unified Soil Classification System (USCS). A Field Soil Classification Sheet explaining terms and symbols used on the logs, is provided in the Appendix. Please note that we will store the samples for thirty (30) days after which they will be discarded unless you request otherwise.

3 General Subsurface Conditions

The subsurface materials encountered and groundwater observations at each boring are described in detail in the respective Test Borings Logs provided in the Appendix. It should be noted that stratification lines shown on the boring logs represent approximate transitions between material types. In-situ strata changes could occur gradually or at slightly different levels. Also, it should be noted that the boring logs depict conditions at the soil boring locations only and the subsurface conditions at other locations may vary. In addition, some conditions, such as groundwater level, could change with time.

3.1 Subsurface Soil Profile

Borings B-1 and B-2, which were drilled at the proposed detention pond, revealed about 5 inches to 8 inches of dark brown to black clay (fill) at the present ground surface. Remaining Borings B-3 through B-6, which were completed on the roadway encountered asphalt pavement over concrete and/or aggregate base with combined thicknesses varying between about 8.5 inches and 10 inches at the existing surface.

All test borings then revealed brown to gray lean clay (CL) generally underlain or interbedded with gray silt (ML) with clay and/or sand to the termination depth of 20 ft below the current grade. Moisture contents of the samples varied between about 11% and 26%. Based on the field Standard Penetration Test (SPT) values, the granular soils was medium dense and the cohesive soils are medium stiff to very stiff.

3.2 Groundwater Conditions

Groundwater observations were made during the drilling operations by noting free water on the drilling and sampling tools and in the open boreholes immediately following withdrawal of the drilling augers. Groundwater was encountered in Borings B-1 through B-4 at depths varying between approximately 9.5 ft and 14 ft below the existing surface during or immediately after the drilling. Please note that short-term groundwater observations do not provide an accurate groundwater level information and may fluctuate due to precipitation, and other factors. Perched water within clayey soils may be encountered at different depths.

4 Geotechnical Recommendations

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered at the test boring locations. Please note that ATC should review the final construction drawings to verify that all recommendations presented herein are implemented in the construction documents. If there is any change in the project information, a review should be made by this office to ensure the continued validity of our recommendations.

4.1 Storm Sewer Recommendations

Test borings suggest that the native lean clay and the silt are adequate to support the proposed storm sewers. However, depending on the invert elevations, some of the proposed sewers may bear in or near the saturated silty soils. In such case, significant dewatering may be required to ensure that the excavation bottom is dry during the sewer installation. In addition, the contractor must realize that saturated silty soil may result in a “quick condition” where the soil loses its shear strength especially when excavated and the confinements are removed.

It is important to note that improper dewatering and/or inappropriate construction practice may deteriorate an otherwise suitable subgrade, which can impact performance the storm sewers. The dewatering contractor must realize that fine silty soils may migrate along with water when dewatering is performed and may result in loss of support and greatly impact the long-term performance of the proposed improvements. It is recommended that the dewatering operation be closely monitored to make sure that the fine particles are not being transported and resulting in loss of support.

We recommend that the joints of the pipes be wrapped with a geotextile filter fabric to prevent soils from “piping” into the pipes through the joints. A filter fabric such as Mirafi 180 N or equivalent may be placed over each joint, extending at least 12 inches beyond each side of the joint. The fabric should completely encircle each pipe joint and overlapped as per manufacturer’s recommendations.

The sewer trench should be backfilled in thin horizontal lifts and compacted with manually operated tampers or vibratory plate compactors to at least 12 to 18 inches above the top of the pipe. Above this zone the backfill should be compacted as specified in Section 4.5 of this report.

Utility trenches that are left open, backfilled without proper compaction or backfilled with open-graded stone, may become water collection points and allow infiltration into the surrounding soil. This condition may destabilize the subgrade around the trenches such that undercutting and repair will be needed prior to paving. We recommend using controlled soil fill or dense-graded base stone (such as INDOT Coarse Aggregate No. 53 or similar) to backfill utility excavations to minimize the potential for water collection points. It is advantageous to use dense graded coarse aggregate as it can be more easily compacted. Clayey soil may be used for backfill after the pipes have been adequately covered with bedding materials. In addition, weep-holes should be provided in drop inlets and catch basins to prevent water from ponding prior to base stone and pavement placement and to drain any water that becomes trapped in the granular base after paving.

Storm sewers may experience heavy thrust forces, especially where there is a significant change in horizontal or vertical alignment. This force may cause separation at the pipe joints and undermine the underlying soil. In order to resist the thrust at horizontal and vertical elbows, pipe sections should be supported on concrete thrust blocks (as needed), which should be designed to withstand the horizontal and vertical forces, generated as a result of change of alignment.

4.2 Pavement Subgrade Recommendations

In areas where pavement will be reconstructed, all existing pavement, highly organic and otherwise unsuitable materials should be removed and/or adequately stabilized from the proposed subgrade area prior to the placement of new fill or reconstruction of pavement. We recommend that all exposed suitable granular subgrade be surface compacted prior to the placement of any new fill. The subgrade soil in some areas may consists of very loose materials, which may deteriorate and rut and/or pump under the heavy construction traffic.

Recommendations for the removal and replacement of any unsuitable materials that may be encountered during construction are provided in Sections 5.1 and 5.2 of this report. Please note that a contingency plan must be in-place to handle any unstable soil subgrade during construction. Additional coarse aggregate, geogrid and/or other stabilization may be needed to stabilize the subgrade in such case. It is recommended that Type IIA subgrade treatment in accordance with INDOT Standard Specifications Section 207.04 may be used for the project, where necessary. If any undercut is necessary, it should be limited to no deeper than about 2 ft to 3 ft below the proposed subgrade as deep excavations may extend into the underlying highly organic and peat.

For budgetary purpose, it is recommended that an undistributed quantity for pavement foundation improvement equal to at least about 20% of the subgrade area be included in the contract and to be used only where needed. It is very important to provide positive drainage during construction before the subgrade treatment is performed in order to prevent wet soil conditions. Ditches must be kept open at all times, and the subgrade should be graded at the end of each day, to facilitate good drainage. It is recommended that the pavement construction be performed in segments to minimize deterioration of the subgrade.

The subgrade surface for the pavement should be uniformly sloped to facilitate drainage through the granular base and to minimize ponding of water beneath the pavement. The pavement surface should also be properly sloped to facilitate positive drainage and prevent surface water ponding on the pavement. Edges of the pavement should provide a means of water outlet by extending the aggregate base course through to side ditches or drain pipes. The subgrade surface should be uniformly sloped to facilitate drainage through the granular base (if any) and to avoid any ponding of water beneath the pavement. Subsurface drains without filter fabric are recommended if needed. Please note that inadequate surface and subsurface drainage often result in pavement failure.

In the absence of laboratory CBR test, a CBR value of 3 may be used for the design provided the subgrade is prepared as discussed in the report. The aggregate base materials should be well-graded granular materials conforming to INDOT Coarse Aggregate No. 53 in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications. The asphaltic concrete pavement should be constructed in accordance with the INDOT Standard Specifications Section 401-Hot Mix Asphalt, HMA, Pavement.

4.3 Corrosion Protection

The soil samples tested for pH during the laboratory tests (as reported on the logs) do not indicate that the soil at the site has a potential for causing significant corrosion. Corrosion protection does not appear to be needed for pipes or drainage structures based solely on the pH results of the samples tested. However, this study did not include a comprehensive evaluation of the corrosion characteristics of the soils below the site.

4.4 Drainage

Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation soils. All structural areas should be sloped away from the structures to prevent ponding of water around pavement areas. The site drainage should also be such that the run-off onto adjacent properties is controlled. Positive drainage should also be maintained during construction to minimize deterioration of the subgrade soils.

5 Recommended Earthwork Procedures

Since this exploration identified actual subsurface conditions only at the test boring locations, it was necessary for our geotechnical engineers to extrapolate these conditions in order to characterize the entire project site. Even under the best of circumstances, the conditions encountered during construction can be expected to vary somewhat from the test boring results and may, in the extreme case, differ to the extent that modifications to the foundation recommendations become necessary. Therefore, we recommend that ATC be retained as geotechnical consultant through the earth-related phases of this project to correlate actual soil conditions with test boring data, identify variations, conduct additional tests that may be needed and recommend solutions to earth-related problems that may develop.

5.1 Subgrade Preparation

Proper subgrade preparation is essential for long-term performance of storm sewers and pavement. While no cut and fill plan is available, we assume that the finished grade for the pavement will be at or near than the existing grades. Please note that improper earthwork may deteriorate an otherwise suitable subgrade especially in clayey soils. The time period between late spring and early fall are typically favorable for earthwork in the project area. Earthwork activities undertaken during late fall and winter often encounter substantial difficulties associated with snow, rain and cold temperatures.

In areas where pavement will be reconstructed, all existing pavement, exposed highly organic (over 5%), frozen, wet, soft, loose or otherwise unsuitable material should be removed to a maximum depth of 3 ft below the finished grade.

After rough grade has been established in cut areas and prior to placement of fill, the exposed subgrade should be carefully observed by an ATC representative by probing or other methods of testing. The suitable exposed subgrade should be surface compacted using a heavy smooth drum roller. The exposed subgrade should furthermore be observed by proofrolling with a tandem-axle dump truck loaded with at least 20 tons or similar in perpendicular directions. The purpose of the proofrolling is to locate soft, weak, or excessively wet soils present at the surface or beneath a thin crust of relatively stronger soil during the construction. The proofroll should also cover the entire improvement area in two perpendicular directions. If an area is too small to be proofrolled then it must be observed by an ATC representative, to establish its suitability. Suitable subgrade should be surface compacted prior to the placing new fill.

The test borings suggest that the pavement subgrade soil consist of predominantly clay soils. Depending on the weather conditions, these soils may become soft and unstable under construction traffic particularly if the construction is performed immediately after precipitation or during cooler temperatures. The extent to which this may be a problem is difficult to determine beforehand since it is dependent upon several factors including cut and fill depths, weather conditions, drainage provisions, variations in soil conditions across the site, sequencing and scheduling of the earthwork and construction traffic, etc. Construction traffic must be controlled to minimize disturbance and deterioration of the subgrade. The extent to which this may be a problem is difficult to determine beforehand since it is dependent upon several factors including cut and fill depths, weather conditions, drainage provisions, variations in soil conditions across the site, sequencing and scheduling of the earthwork and construction traffic, etc. Proper crowning of subgrade soil helps to minimize water ponding and reduces the possibility of deteriorating underlying soils.

In general, yielding subgrade problems are more prominent in cut areas (where saturated or nearly saturated soils are exposed by the excavation) or where little or no fill is placed. Depending on these factors, it may be possible to stabilize some yielding subgrade soils by disking, aerating and then re-compacting the soils. However, this is often unsuccessful, particularly when the weather conditions do not permit drying of wet soil. In such case, it may be necessary to undercut and replace with coarse aggregate with geogrid or to use chemical modification (such as lime, cement, etc.).

There should be a contingency plan in case unstable and saturated subgrade soil is encountered during construction. An ATC representative should be present throughout the earthwork to verify that they are performed as recommended and identify areas where special stabilization may be necessary.

5.2 Excavation and Slope Stability

There should not be any significant difficulty in excavating the soils at this site with conventional equipment. Unless specified otherwise, all permanent cut slopes should be no steeper than 3 horizontal to 1 vertical. All temporary excavations for the construction of foundations, utilities, etc., should be properly laid back or braced in accordance with Occupational Safety and Health Administration (OSHA) requirements and in no case should be steeper than 1.5 horizontal to 1 vertical. Flatter cut slopes may be required in cases where there is ground water seepage or poor soil conditions. Where new fill is placed against existing slopes that are steeper than 6 (horizontal) to 1 (vertical), it will be necessary to bench the new fill into the existing slope in order to provide a good bond between the existing soil and the new fill and to prevent the development of a zone of weak soil at the interface. If spatial constraints will not permit an open cut, bracing will be required for any excavation deeper that 5 ft.

Care must be exercised when excavating near existing facilities such as streets, underground utilities, etc., to protect the integrity of the existing facilities. Bracing or underpinning may be required if it becomes necessary to excavate below and in close proximity to such facilities. All temporary bracing and/or underpinning should be designed and installed by an experienced specialty contractor.

5.3 Engineered Fill

Once the subgrade has been properly prepared, engineered fill may be placed in order to attain desired final grades. In general, any non-organic, naturally occurring, non-expansive soils can be used for structural fill. However, it is recommended that only crushed limestone (INDOT Coarse Aggregate No. 53) be used as aggregate base. The proposed soil fill materials should consist of soil with the following characteristics:

- Organic content less than 5% by dry weight of soil,
- Liquid Limit less than 50 and Plasticity Index less than 30,
- Free of large rock fragments (no particles larger than 3 inches in diameter), debris, roots, rubble, wood or any other deleterious materials,
- The amount retained on a ¾ inch sieve should be less than 30%,
- The maximum dry density (ASTM D-698) should be at least 100 pcf.
- The soil fill should meet the requirements of the Unified Soil Classification System (USCS) (ASTM D-2487) as either CL, CL-ML, SM, SC, SP, SW, SP-SM, SC-SM, SP-SC, SW-SM, SW-SC, GW, GW-GM or GW-GC,
- The use of an essentially one-size material should not be permitted.

All new engineered fill should be compacted to a dry density of at least 95% of the standard Proctor maximum dry density (ASTM D-698). The aggregate base for pavement should be compacted to at least 100% of the same Proctor as per INDOT requirements. The compaction should be accomplished by placing the fill in about 8 inches thick (or less) loose horizontal lifts and mechanically compacting each lift to at least the specified minimum dry density. Field density tests should be performed on each lift as necessary to document moisture conditions and verify that specified compaction that is being achieved. Compaction of any fill by flooding is not considered acceptable. The soils should be placed and compacted at moisture contents within 3% of the optimum moisture content as determined by the specified Proctor test.

Modification to this range may be necessary depending on the characteristics of the fill and should be based on an evaluation by an ATC representative during construction. Suitable equipment for either aerating or adding water should be available as the soil moisture and weather conditions dictate. In general, smooth-wheel vibratory rollers or skid-plates are suitable for compacting sand and gravel type soils, and sheeps-foot non-vibratory rollers or jumping jacks are suitable for compacting cohesive soils.

It is recommended that ATC be retained to perform continuous review of construction of the soils related phases of this project. Otherwise, ATC can assume no responsibility for construction compliance with the design concepts, specifications, or our recommendations. As part of this review, field density tests should be performed frequently to assist in the evaluation of the fill with respect to the above recommendations.

5.4 Groundwater Control

Since free groundwater was noted as shallow as about 9.5 ft and may rise, dewatering should be expected during the storm sewer installations. If water accumulates or ponds in the construction area, it should be promptly and properly removed. Minor accumulations of water may be removed by pumps from an excavation terminating in clayey soil.

The contractor must realize that saturated silty soil may result in a "quick condition" where the soil loses its shear strength especially when excavated and the confinements are removed. Additionally, the dewatering contractor must realize that fine silty soils may migrate along with water when dewatering is performed and may result in loss of support and greatly impact the long-term performance of the proposed improvements.

It is recommended that the dewatering operation be closely monitored to make sure that the fine particles are not being transported and resulting in loss of support. Any dewatering should be designed and performed by an experienced contractor. The most appropriate dewatering system should be determined at the time of construction based upon those field conditions encountered. It is important to note that improper dewatering and/or inappropriate construction practice may deteriorate an otherwise suitable subgrade, which can impact performance the storm sewers and may damage nearby structures.

6 Limitations of Study

ATC notes the following limitations associated with this geotechnical exploration.

Differing Conditions: Our recommendations for this project were developed utilizing soils information obtained from the test borings that were made at the proposed site. At this time, we would like to point out that soil test borings only depict the soil conditions at the specific locations and time at which they were made. The soil conditions at other locations on the site may differ from those occurring at the boring locations. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of the soils engineer. This study did not include an assessment of the possibility of the presence of abandoned or active underground utilities on the site.

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 soils engineer to determine whether any changes in the foundation or earthwork recommendations are necessary.

Recommendations vs. Final Design: This report and the recommendations included within are not to be considered a final design, but rather as a basis for the final design to be completed by others (architect, Water Resources or structural engineer, etc.). It is the client's responsibility to insure 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.

We recommend that this firm be retained to review the final construction documents to confirm that the proposed project design sufficiently considers our geotechnical recommendations. We also suggest that our firm be represented at pre-bid and/or pre-construction meetings regarding this project to offer any needed clarifications of the geotechnical information to all involved.

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.

Report Interpretation: ATC is not responsible for the conclusions, opinions, or recommendations by others based upon 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.

Environmental & Other Considerations: The scope of our services does not include any environmental assessment investigation for the presence or absence of hazardous, toxic or corrosive materials in the soil, groundwater, or surface water within or beyond the site studies. Additionally, an evaluation of slope stability was beyond the scope of our work.

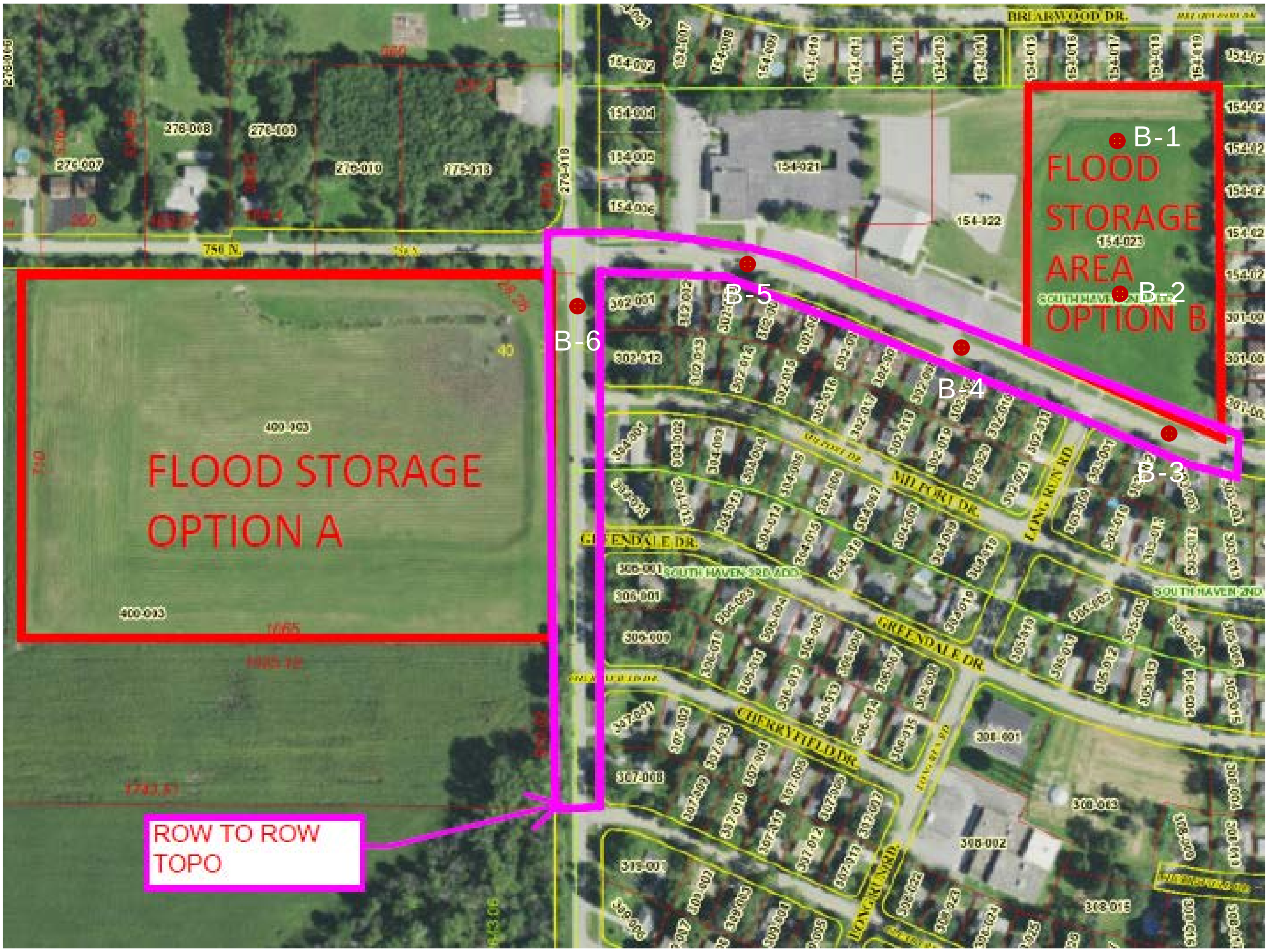
Any statements in this report or on the test boring logs regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended prior to the development of this site.

Standard of Care: Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This statement is made in lieu of all other warranties either expressed or implied.

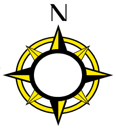
Proposed Squirrel Creek Drainage Improvements

Appendix

Boring Location Plan
Test Boring Logs
Laboratory Test Results
Field Classification System and
Important Information about Geotechnical Engineering Report



Scope of Work:
B-1 Thru B- 6 @ 20ft



ORIGINAL DRAWING WAS PROVIDED BY CLIENT
ALL BORING LOCATIONS ARE APPROXIMATE

BORING LOCATION PLAN

PROPOSED STORMWATER DRAINAGE IMPROVEMENT
SQUIRREL CREEK AND MIDWAY DRIVE
OLD SOUTH HAVEN, INDIANA
CLIENT: CHRISTOPHER B. BURKE ENGINEERING LTD.

Project Number: H819081804		Drawn By: NH
DATE: 04-10-18	Scale: NONE	Checked By: NH
⊕ Approximate Boring Locations		Approved By: AZ
ATC		Figure: 1

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TEST BORING LOG

CLIENT: **Christopher B. Burke Engineering, Ltd.**
PROJECT NAME: **Squirrel Creek Drainage Improvement Project**
PROJECT LOCATION: **Midway Drive and CR 400 W**
South Haven, Indiana

BORING #: **B-1**
JOB #: **H819081804**
DRAWN BY: **JS**
APPROVED BY: **AZ**

DRILLING and SAMPLING INFORMATION

Date Started	**5/1/18**	Hammer Wt.	**140** lbs.
Date Completed	**5/1/18**	Hammer Drop	**30** in.
Drill Foreman	**RG**	Spoon Sampler OD	**2** in.
Inspector	**JS**	Rock Core Dia.	**NA** in.
Boring Method	**HSA**	Shelby Tube OD	**NA** in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION 645.95*

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Dark Brown to Black Clay (Fill), Trace Gravel	0.4											
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			1	SS		3-6-9		4.5	19.2			
			2	SS		3-5-7		4.5	19.1			pH = 6.9
		5										*Surface Elev by Client.
			3	SS		3-3-6		3.0	21.2			
	9.0		4	SS		3-3-4		3.0	20.8			
Gray Silt with Clay (ML/CL), Trace Gravel, Moist, Stiff to Very Stiff					∇ (9.5)							
Noted Thin Wet Sand Layer at about 10.5 ft.		10			● (10.5)							
SS#5: Finer than Sieve 200= 93.8%			5	SS		7-9-10			18.2			
			6	SS		5-6-7			21.8			
		15			Cave (15.0)							
	18.5											
Gray Silt with Sand (ML/SM), Trace Gravel, Moist, Very Stiff			7	SS		7-9-10						
	20.0	20										
Boring Terminated at 20 ft.												

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

Depth to Groundwater
- ● Noted on Drilling Tools **10.5** ft.
- At Completion (open hole) **9.5** ft.
- After ____ hours ____ ft.
- After ____ days ____ ft.
- Cave Depth **15.0** ft.

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

TEST BORING LOG

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CLIENT: **Christopher B. Burke Engineering, Ltd.**
PROJECT NAME: **Squirrel Creek Drainage Improvement Project**
PROJECT LOCATION: **Midway Drive and CR 400 W**
South Haven, Indiana

BORING #: **B-2**
JOB #: **H819081804**
DRAWN BY: **JS**
APPROVED BY: **AZ**

DRILLING and SAMPLING INFORMATION

Date Started	5/1/18	Hammer Wt.	140 lbs.
Date Completed	5/1/18	Hammer Drop	30 in.
Drill Foreman	RG	Spoon Sampler OD	2 in.
Inspector	JS	Rock Core Dia.	NA in.
Boring Method	HSA	Shelby Tube OD	NA in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 645.27*	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Dark Brown to Black Clay (Fill), Trace Gravel	0.7												*Surface Elev by Client.
Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			1	SS			3-4-7		4.5	19.6			
			2	SS			2-4-4		3.5	21.1			
		5											
			3	SS			1-2-4		2.0	22.5			
			4	SS			1-2-4		3.0	21.2			
	10.5	10				∇ (10.0)							
Gray Silt (ML), Trace Clay and Gravel, Moist, Stiff to Very Stiff						● (11.0)							
			5	SS			4-8-8			19.0			
Noted Thin Wet Silt Layer at about 11 ft. SS#6: Finer than Sieve 200= 99.8%			6	SS			5-7-4			19.9			
		15				Cave (15.5)							
			7	SS			4-7-10			24.6			
Boring Terminated at 20 ft.	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

Depth to Groundwater
- ● Noted on Drilling Tools **11.0** ft.
- At Completion (open hole) **10.0** ft.
- After ______ hours ______ ft.
- After ______ days ______ ft.
- Cave Depth **15.5** ft.

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

TEST BORING LOG

ATC
2224 Industrial Drive, Suite A
Highland, IN 46322
219-922-7235
Fax 219-922-7243

CLIENT	**Christopher B. Burke Engineering, Ltd.**	BORING #	**B-3**
PROJECT NAME	**Squirrel Creek Drainage Improvement Project**	JOB #	**H819081804**
PROJECT LOCATION	**Midway Drive and CR 400 W**	DRAWN BY	**JS**
	South Haven, Indiana	APPROVED BY	**AZ**

DRILLING and SAMPLING INFORMATION

Date Started	**5/1/18**	Hammer Wt.	**140** lbs.
Date Completed	**5/1/18**	Hammer Drop	**30** in.
Drill Foreman	**RG**	Spoon Sampler OD	**2** in.
Inspector	**JS**	Rock Core Dia.	**NA** in.
Boring Method	**HSA**	Shelby Tube OD	**NA** in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 649.19*	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Asphalt-4.5 inch, Concrete-4 inch	0.8												*Surface Elev by Client.
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff			1	SS			2-4-6		3.0	22.4			
	3.5												
Brown Silt with Clay (ML/CL), Trace Gravel, Moist, Stiff			2	SS			4-7-8		4.5	23.9			
	5.0	5											
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Stiff			3	SS			4-6-7		4.0	22.9			pH = 7.1
			4	SS			3-5-6		3.5	24.3			
	10.5	10											
Gray Silt with Clay (ML/CL), Trace Gravel, Moist, Stiff to Very Stiff SS#5: Finer than Sieve 200= 98%			5	SS			3-6-12			18.1			
Noted Thin Wet Silt Layer at about 14.0 ft.			6	SS		●	4-6-9			18.1			
		15											
						Cave							
			7	SS			4-6-6			19.4			
	20.0	20											
Boring Terminated at 20 ft.													

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

Depth to Groundwater
- Noted on Drilling Tools **14.0** ft.
- At Completion (open hole) **14.0** ft.
- After ____ hours ____ ft.
- After ____ days ____ ft.
- Cave Depth **16.5** ft.

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

ATC
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TEST BORING LOG

CLIENT **Christopher B. Burke Engineering, Ltd.** BORING # **B-4**
PROJECT NAME **Squirrel Creek Drainage Improvement Project** JOB # **H819081804**
PROJECT LOCATION **Midway Drive and CR 400 W** DRAWN BY **JS**
South Haven, Indiana APPROVED BY **AZ**

DRILLING and SAMPLING INFORMATION

Date Started	**5/1/18**	Hammer Wt.	**140** lbs.
Date Completed	**5/1/18**	Hammer Drop	**30** in.
Drill Foreman	**RG**	Spoon Sampler OD	**2** in.
Inspector	**JS**	Rock Core Dia.	**NA** in.
Boring Method	**HSA**	Shelby Tube OD	**NA** in.

TEST DATA

SOIL CLASSIFICATION / SURFACE ELEVATION 651.13*	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Asphalt-5 inch, Concrete & Stone-4 inch	0.8												*Surface Elev by Client.
Gray Lean Clay with Silt (CL/ML), Trace Gravel, Moist, Medium Stiff	2.5		1	SS			2-3-3		3.5	11.1			
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			2	SS			2-4-5		4.5	20.7			
		5	3	SS			4-7-8		4.5	17.5			
			4	SS			4-5-7			18.6			
Noted Thin Wet Silt Layer at about 16 ft.		10	5	SS			3-5-7		4.5	18.0			
			6	SS		▽	2-4-6		3.0	19.5			
	16.0	15				●							
Gray Silt with Clay (ML/CL), Trace Silt and Gravel, Moist, Stiff						Cave							
	20.0	20	7	SS			4-6-8		3.5	20.6			
Boring Terminated at 20 ft.													

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

Depth to Groundwater
● Noted on Drilling Tools **16.0** ft.
▽ At Completion (open hole) **14.0** ft.
▼ After ____ hours ____ ft.
▼ After ____ days ____ ft.
Cave Depth **18.5** ft.

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

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TEST BORING LOG

CLIENT	**Christopher B. Burke Engineering, Ltd.**	BORING #	**B-5**
PROJECT NAME	**Squirrel Creek Drainage Improvement Project**	JOB #	**H819081804**
PROJECT LOCATION	**Midway Drive and CR 400 W**	DRAWN BY	**JS**
	South Haven, Indiana	APPROVED BY	**AZ**

DRILLING and SAMPLING INFORMATION

Date Started	**5/1/18**	Hammer Wt.	**140** lbs.
Date Completed	**5/1/18**	Hammer Drop	**30** in.
Drill Foreman	**RG**	Spoon Sampler OD	**2** in.
Inspector	**JS**	Rock Core Dia.	**NA** in.
Boring Method	**HSA**	Shelby Tube OD	**NA** in.

SOIL CLASSIFICATION

SURFACE ELEVATION 652.53*

TEST DATA

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Asphalt-6 inch, Concrete-4 inch	0.8												*Surface Elev by Client.
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			1	SS			2-2-4		3.0	21.2			
			2	SS			2-2-4		4.5	22.8			
		5											
			3	SS			2-5-6		4.0	20.5			
			4	SS			3-5-6		3.5	22.9			pH = 7.1
		10											
			5	SS			3-4-5		3.0	20.1			
			6	SS			2-4-5		3.0	21.4			
		15											
Gray Silt with Clay (ML/CL), Trace Gravel, Moist, Very Stiff SS#7: Finer than Sieve 200= 94.2%	16.0												
			7	SS			3-5-12			18.1			
Boring Terminated at 20 ft.	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

Depth to Groundwater

- Noted on Drilling Tools **None** ft.
- At Completion (open hole) **None** ft.
- After ______ hours ______ ft.
- After ______ days ______ ft.
- Cave Depth **None** ft.

Boring Method

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

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TEST BORING LOG

CLIENT **Christopher B. Burke Engineering, Ltd.**
PROJECT NAME **Squirrel Creek Drainage Improvement Project**
PROJECT LOCATION **Midway Drive and CR 400 W**
South Haven, Indiana

BORING # **B-6**
JOB # **H819081804**
DRAWN BY **JS**
APPROVED BY **AZ**

DRILLING and SAMPLING INFORMATION

Date Started	5/1/18	Hammer Wt.	140 lbs.
Date Completed	5/1/18	Hammer Drop	30 in.
Drill Foreman	RG	Spoon Sampler OD	2 in.
Inspector	JS	Rock Core Dia.	NA in.
Boring Method	HSA	Shelby Tube OD	NA in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION 654.13*

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Groundwater	Standard Penetration Test, blows/6 inches	Qu-tsf Unconfined Compressive Strength	HP-tsf Hand Penetrometer	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
Asphalt-5 inch, Slag- 4 inch	0.8											*Surface Elev by Client.
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			1	SS		3-6-7		4.0	21.6			
			2	SS		3-3-3		3.0	26.4			
	6.0	5										
Brown to Gray Silt with Clay(ML/CL), Trace Gravel, Moist, Soft			3	SS		2-2-2			24.3			
	7.5											
Brown to Gray Lean Clay (CL), Trace Gravel, Moist, Medium Stiff to Stiff			4	SS		2-6-7		4.5	21.0			
		10										
			5	SS		3-4-7		2.5	18.8			
			6	SS		2-4-4		2.5	21.2			
		15										
			7	SS		3-4-6		3.0	18.5			
	20.0	20										
Boring Terminated at 20 ft.												

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

Depth to Groundwater
Noted on Drilling Tools **None** ft.
At Completion (open hole) **None** ft.
After ____ hours ____ ft.
After ____ days ____ ft.
Cave Depth **None** ft.

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

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	- ½ to 1 inch
		Fine	- ¼ to ½ inch
Sand	-	Coarse	2.00mm to ¼ inch (dia. of pencil lead)
		Medium	0.42 to 2.00mm (dia. of broom straw)
		Fine	0.074 to 0.42mm (dia. of human hair)
Silt			0.074 to 0.002mm (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 the logs are made by visual inspection of samples.

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 inches. It is customary for ATC to drive the spoon 6 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 inches of penetration on the drill log (Example — 6-8-9). The standard penetration test result can be obtained by adding the last two figures (i.e., 8 + 9 = 17 blows/ft). (ASTM D-1586-11).

Strata Changes — In the column "Soil Descriptions" on the drill log the horizontal lines represent strata changes. A solid line (______) represents an actually observed change. 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.

SOIL CLASSIFICATION CHART

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
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	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
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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.

GBC GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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