

300 CHASE PARK SOUTH • SUITE 200 • HOOVER, ALABAMA 35244
205-988-9112

ADDENDUM NO. 1
ADDITION TO FIELDHOUSE FOR CHELSEA HIGH SCHOOL FOOTBALL
Architect Job No. 23-63
October 3, 2023
DCM #Pending

BIDS DUE:

Tuesday, November 7, 2023
until 2:00 p.m., local time
At Shelby County Board of Education,
Facilities and Maintenance Building
125 Industrial Parkway
Columbiana, AL 35051

The Plans and Specifications are hereby amended. The following supersedes all contrary and/or conflicting information and is made part of the contract documents.

GENERAL

1. See the attached GEOTECHNICAL INVESTIGATION ENTITLED:

"FIELD HOUSE ADDITIONS CHELSEA HIGH SCHOOL
GEOTECHNICAL ENGINEERING REPORT "
PROJECT NO. E1235115

was prepared by: Terracon Consultants, Inc. - 2147 Riverchase Office Road, Birmingham, AL 35244.

The General Contractor and Subcontractors are responsible for familiarizing themselves with geotechnical information, for visiting the site, ascertaining the conditions thereof, and conditions under which work is to be done. The General Contractor shall include in their bid the cost of meeting the requirements and conditions of the geotechnical investigation.

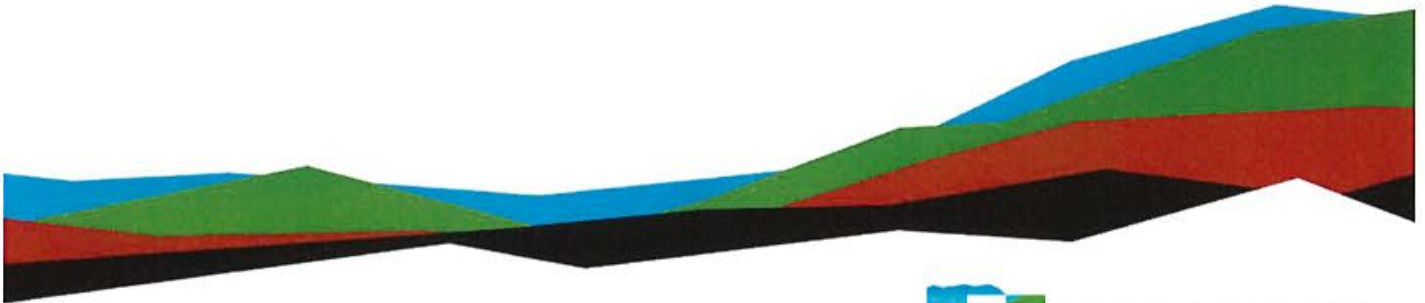
Field House Additions Chelsea High School

Geotechnical Engineering Report

August 15, 2023 | Terracon Project No. E1235115

Prepared for:

Shelby County Board of Education
410 East College Street
Columbiana, Alabama 35051



Nationwide
[Terracon.com](https://www.terracon.com)

- Facilities
- Environmental
- Geotechnical
- Materials



2147 Riverchase Office Road
Birmingham, Alabama 35244
P (205) 942-1289
Terracon.com

August 15, 2023

Shelby County Board of Education
410 East College Street
PO Box 1910
Columbiana, Alabama 35051

Attn: Mr. David Calhoun
Assistant Superintendent of Operations/Chief of Staff


Re: Geotechnical Engineering Report
Field House Additions
Chelsea, Shelby County, Alabama
Terracon Project No. E1235115

Dear Mr. Calhoun:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PE1235115 dated January 14, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,


Bryan C. Ritenour, P.E.

Senior Engineer



Matthew S. McCullough, P.E.

Manager, Geotechnical Services

Table of Contents

Introduction.....	1
Project Description.....	1
Site Conditions	2
Geotechnical Characterization	3
Seismic Site Class.....	3
Geotechnical Overview	4
Earthwork	4
Subgrade Preparation	5
Excavation.....	5
Soil Stabilization.....	6
Fill Material Types.....	6
Fill Placement and Compaction Requirements	7
Utility Trench Backfill	7
Grading and Drainage.....	8
Earthwork Construction Considerations	8
Construction Observation and Testing	9
Shallow Foundations	10
Design Parameters – Compressive Loads	10
Design Parameters – Overturning and Uplift Loads	11
Foundation Construction Considerations	11
Floor Slabs	12
Floor Slab Design Parameters	13
Floor Slab Construction Considerations.....	13
Lateral Earth Pressures	14
Design Parameters.....	14
Subsurface Drainage for Below-Grade Walls	16
General Comments	17

Figures

GeoModel

Attachments


Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Geotechnical Engineering Report

Field House Additions | Chelsea, AL

August 15, 2023 | Terracon Project No. E1235115



Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed field house additions at the Chelsea High School stadium. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 4 test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the [Site Location](#) and [Exploration Plan](#), respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in the [Exploration Results](#) section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Site layout plans with were provided by Mr. Howard Rasco via email.
Project Description	The project will consist of an addition to the existing field house.
Proposed Structures	Field house addition
Building Construction	Masonry with slab on grade

Item	Description
Finished Floor Elevation	Upper Level: El 688.25 Lower Level: El 679.25
Maximum Loads	<ul style="list-style-type: none"> ■ Walls: 3 to 4 kips per linear foot (klf) ■ Columns: 50 kips
Grading/Slopes	The portion of the addition having a single level will require maximum cuts and fills of about 1 foot. The portion of the addition having a lower/basement level will require a maximum cut of about 9 feet.
Below-Grade Structures	Lower-level portion
Free-Standing Retaining Walls	None
Pavements	None
Building Code	2021 IBC

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	<p>The project is located at the existing Stadium at Chelsea High School in Chelsea, AL.</p> <p>Latitude/Longitude (approximate): 33.3318° N, 86.6819° W (See Exhibit D)</p>
Existing Improvements	Field house
Current Ground Cover	Bare ground, gravel, sparse vegetation

Item	Description
Existing Topography	Ground elevations within the addition footprint range from about El. 683 to El. 688

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the [Exploration Results](#) and the GeoModel can be found in the [Figures](#) attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Surface Layer	Gravel (2")
2	Native Soils	Sandy Lean Clay (CL), typically yellowish brown with light gray, stiff to hard

The borings were advanced in the dry using a hollow stem auger drilling technique that allows short term groundwater observations to be made while drilling. Groundwater was not encountered within the maximum drilling depth at the time of our field exploration. Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of

ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of C** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 15.4 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

Beneath the surface material composed of crushed stone gravel, the borings encountered native soils consisting of Sandy Lean Clay (CL). The native soils were of stiff to hard consistency.

Based on the conditions encountered and estimated load-settlement relationships, the proposed structures can be supported on conventional continuous or spread footing foundations bearing on the stiff to hard native soils

The near surface soils could become unstable with typical earthwork and construction traffic, especially after precipitation events. The effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as

necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Subgrade Preparation

Initially, site preparation should include removal of all vegetation and loose surface soils. Also, utilities such as the existing sanitary sewer lift station should be removed. After removal of any vegetation and existing utilities, the exposed subgrade of the main-level slab on grade portion of the addition should be densified using a heavy vibratory roller having a maximum static weight of 12,000 lbs. and capable of exerting a minimum impact energy of 20,000 lbs. After excavating to the lower level, all disturbed soils should be removed and the subgrade should be densified using a portable vibrating plate. After densification/compaction as described above, the subgrade should be proofrolled, where possible, with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The lower-level area will likely have to be evaluated by probing. The proofrolling and/or probing should be performed under the observation of the Geotechnical Engineer or representative. Unstable areas should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed, further densified in place, or stabilized by other methods discussed in the following sections, depending on site and weather conditions. Excessively wet or dry material should either be removed or moisture conditioned and recompacted. Compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or pavement construction.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable; however, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Some moisture conditioning (i.e., drying) of the existing soils should be anticipated for onsite soils to be reused. Furthermore, soils failing the proofroll test may require additional reworking and drying to be stabilized in place, especially if earthwork is performed during the winter months.

Excavation

We anticipate that most excavations for the proposed construction can be accomplished with conventional earthmoving equipment. However, excavating to the proposed lower-level elevation could require an excavator with rock teeth. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Soil Stabilization

While the subgrade is generally anticipated to be stable after the initial exposure (except for the poorly compacted fill) and compaction, unstable subgrades may develop in areas subjected to repetitive construction traffic or if earthwork is performed during the wetter and cooler periods of the year. Methods of subgrade improvement could include scarification, moisture conditioning and recompaction or removal of unstable materials. The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, the size of area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help reduce the amount of subgrade stabilization required.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes.

Reuse of On-Site Soil: Excavated on-site soil may be selectively reused as fill. Material property requirements for on-site soil for use as structural fill are noted in the table below:

Property	Structural Fill
Composition	Free of deleterious material
Maximum particle size	4 inches
Fines content	Not limited
Plasticity	Liquid Limit less than 50 Plasticity index less than 25
GeoModel Layer Expected to be Suitable ¹	2

1. Based on subsurface exploration.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Soil Type ¹	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Cohesive	CL, CL-ML ML, SM, SC	Liquid Limit less than 50 Plasticity index less than 25
Granular	GW, GP, GM, GC, SW, SP, SM, SC	Less than 50% passing No. 200 sieve

1. Structural fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to use of uniformly graded gravel on the site.

Fill Placement and Compaction Requirements

Structural fill should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements ¹	98% of max.
Water Content Range ¹	Low plasticity cohesive: -2% to +2% of optimum Granular: -3% to +3% of optimum

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from

existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill of utility and pipe trenches, provided the material is free of organic matter and deleterious substances. However, material used as trench backfill should comply with the pipe manufacturer or governing municipality's requirements.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs, footings, or pavements, the backfill should satisfy the gradation requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. In areas where hardscapes and/or paving do not abut against the structure, the roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent

ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations. A temporary excavation will be required to construct the lower level portion of the field house. The excavation should be performed in manner that will not undermine the existing field house or nearby running track. Shoring may be required to meet OSHA regulations. Information included in this report is not intended to be used for design of temporary slopes or shoring systems.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project

provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure ^{1, 2}	3,000 psf - foundations bearing on stiff to hard native soils
Required Bearing Stratum ³	GeoModel Layer 2
Minimum Foundation Dimensions	Per IBC 1809.7
Ultimate Passive Resistance ⁴ (equivalent fluid pressures)	330 pcf (cohesive backfill) 420 pcf (crushed stone)
Sliding Resistance ⁵	0.30 ultimate coefficient of friction – onsite soil or structural fill 0.35 ultimate coefficient of friction – granular material
Minimum Embedment below Finished Grade ⁶	18 inches
Estimated Total Settlement from Structural Loads ²	Less than about 1 inch
Estimated Differential Settlement ^{2, 7}	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in [Project Description](#). Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in [Earthwork](#).
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure. Apply a factor of safety of at least 1.5 when designing for lateral force resistance.

5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., $e < b/6$, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

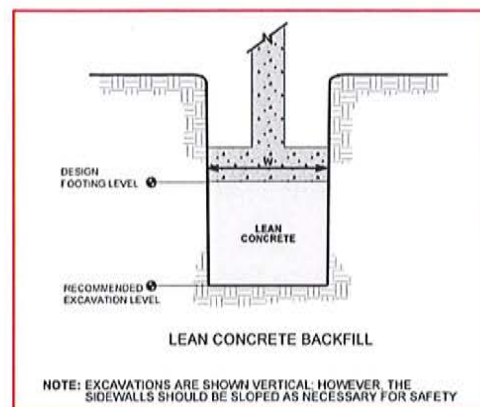
Item	Description
Soil Moist Unit Weight	120 pcf
Soil Effective Unit Weight¹	60 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface
<ol style="list-style-type: none"> 1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable. 	

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Sensitive soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill, steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The lean concrete replacement zone is illustrated on the sketch below.



A temporary excavation will be required to construct the lower level portion of the field house. The excavation should be performed in manner that will not undermine the existing field house or nearby running track. Shoring may be required to meet OSHA regulations. Information included in this report is not intended to be used for design of temporary slopes or shoring systems.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Depending upon the site and weather conditions at the time of construction, unsuitable, weak, and/or loose soils may be observed at the floor slab subgrade level. These soils should be densified in place or undercut and replaced with structural fill.

Floor Slab Design Parameters

Item	Description
Floor Slab Support¹	Minimum 4 inches base course meeting material specifications of ACI 302 Subgrade compacted to recommendations in Earthwork
Estimated Modulus of Subgrade Reaction²	100 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in [Earthwork](#), and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or

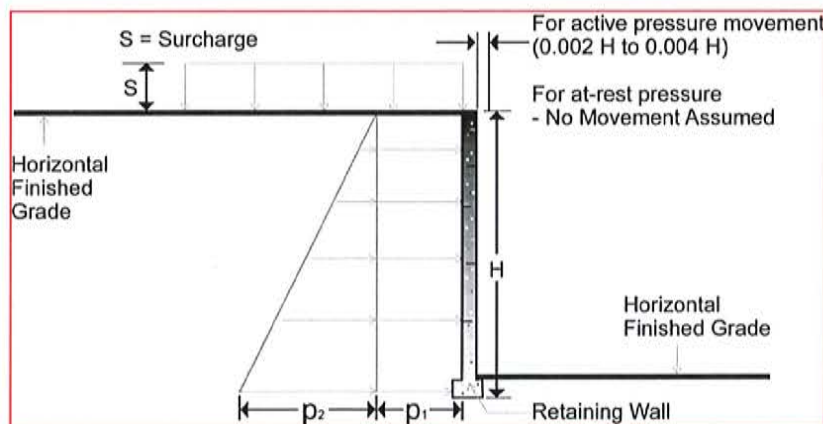
desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition ¹	Coefficient for Backfill Type ²	Surcharge Pressure ³ p ₁ (psf)	Equivalent Fluid Pressures (psf) ^{2,4}	
			Unsaturated ⁵	Submerged ⁵
Active (K _a)	Crushed Stone - 0.24	(0.24)S	(25)H	(75)H
	Fine Grained - 0.42	(0.42)S	(50)H	(85)H
At-Rest (K _o)	Crushed Stone - 0.38	(0.38)S	(40)H	(80)H
	Fine Grained - 0.59	(0.59)S	(70)H	(95)H
Passive	Crushed Stone - 3.85	---	(420)H	---
	Fine Grained - 2.77	---	(330)H	---

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, with a maximum unit weight of 120 pcf for cohesive soils and 110 pcf for open graded crushed stone.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Submerged" conditions are recommended when water cannot be evacuated from behind the walls using positive drainage or a permanent sump pump.

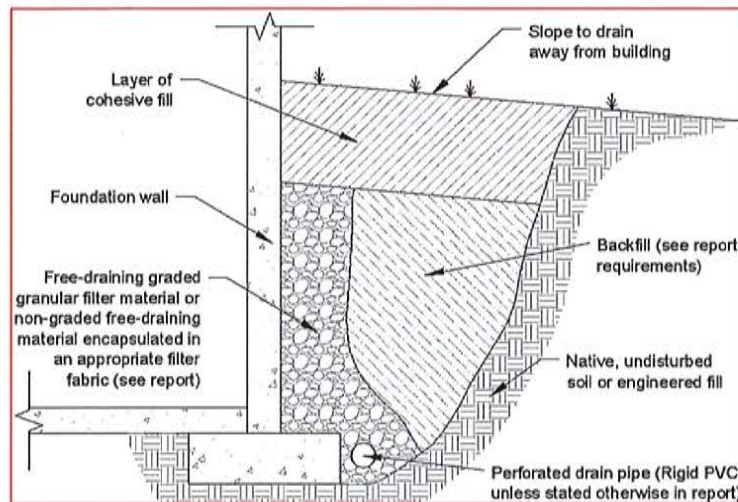
Backfill placed against structures should consist of open-graded crushed stone or low plasticity cohesive soils. For the crushed stone values to be valid, the stone backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

Footings, floor slabs or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls) or temporary shoring systems. Recommendations covering these types of wall systems are beyond the scope of services for this assignment.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as ALDOT No. 57 stone. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

The use of a permanent dewatering system is recommended to control long term hydrostatic uplift and lateral pressures beneath and around the below-grade walls. Typically, this system would consist of a retaining wall drainage layer and piping network which drains discharges by positive drainage or one or more permanent sump pumps. The permanent sump pump(s) should include an emergency backup generator, and redundant pumps should also be considered.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and



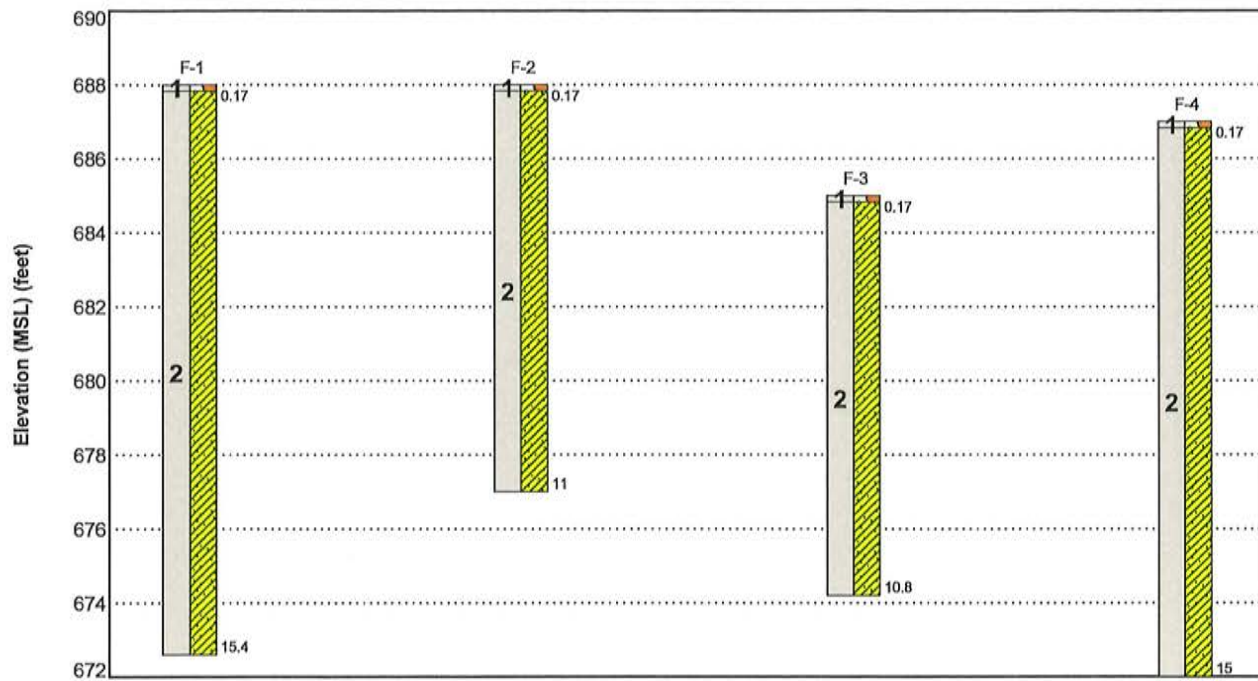
recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

Contents:

GeoModel



GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface Layer	Gravel (2")
2	Native Soils	Sandy Lean Clay (CL), typically yellowish brown with light gray, stiff to hard

LEGEND

-  Poorly-graded Gravel
-  Sandy Lean Clay

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
4	11 to 15	Addition Area

Boring Layout and Elevations: Terracon personnel provided the boring layout using existing site features. If a more precise boring layout is desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted, rotary drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with auger cuttings after their completion and the upper portion of the borehole was plugged with a cement mixture.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. The groundwater levels are shown on the attached boring logs.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Percent Passing No. 200 Sieve

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

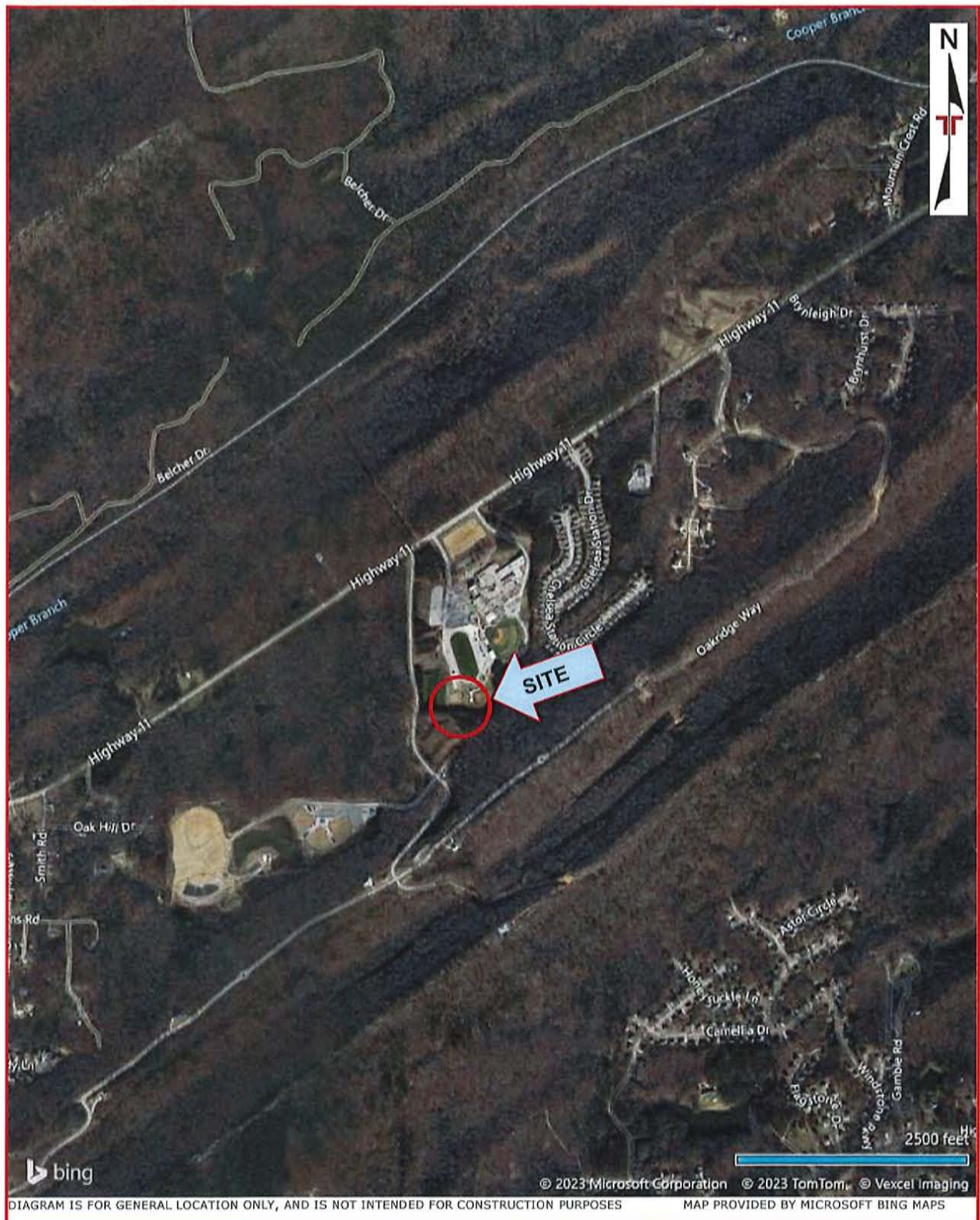
Site Location and Exploration Plans

Contents:

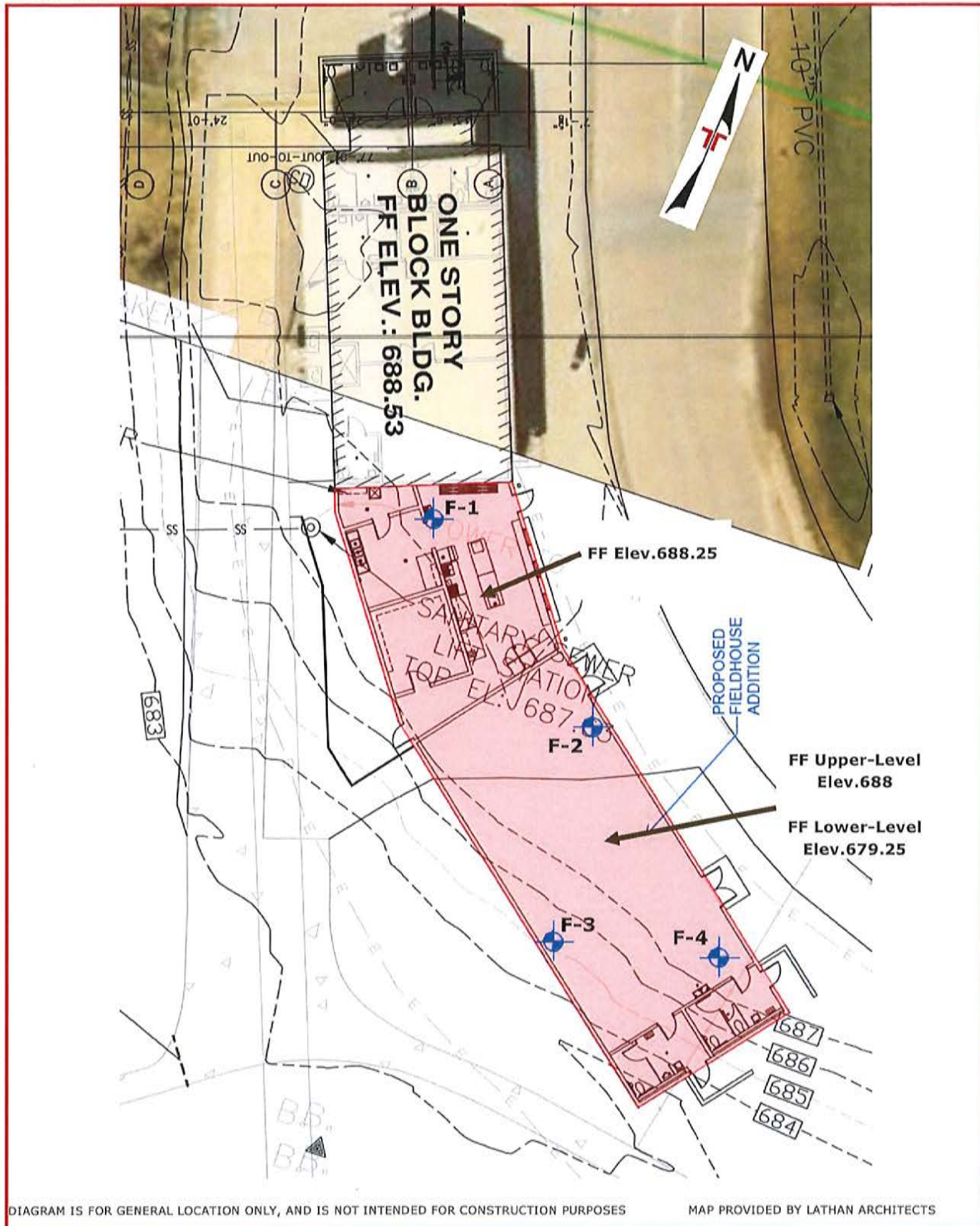
Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location



Exploration Plan



Exploration and Laboratory Results

Contents:

Boring Logs (F-1 through F-4)

Note: All attachments are one page unless noted above.

Boring Log No. F-1

Model Layer	Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
1		Depth (Ft.) Elevation.: 688 (Ft.)							
		0.2' GRAVEL (2") SANDY LEAN CLAY (CL) , brownish yellow, stiff	687.83						
						2-4-4 N=8	22.1		
			5			6-5-6 N=11	15.5		
		becomes very stiff				5-8-8 N=16	15.2		
2		becomes hard	10			8-16-20 N=36			
			15			25-50/4" N=50+			
		15.4 Boring Terminated at 15.4 Feet	672.6						

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).
 See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations
 No water observed during drilling

Drill Rig
 CME 45

Notes

Advancement Method
 Continuous flight auger

Driller
 Smith Drilling
Logged by
 BCR

Abandonment Method
 Boring backfilled with auger cuttings upon completion.

Boring Started
 07-18-2023
Boring Completed
 07-18-2023

Boring Log No. F-2

Model Layer	Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
1		Depth (Ft.) Elevation.: 688 (Ft.) 0.2 GRAVEL (2") 687.83							
		SANDY LEAN CLAY (CL), some sand, yellowish brown, very stiff							
						6-8-10 N=18	16.3		69
2			5			5-7-10 N=17	18.1		
						9-12-14 N=26	17.0		
		becomes hard and contains some relict bedding							
			10			17-30-35 N=65			
		11.0 Boring Terminated at 11 Feet 677							

See **Exploration and Testing Procedures** for a description of field and laboratory procedures used and additional data (If any).
 See **Supporting Information** for explanation of symbols and abbreviations.

Notes

Water Level Observations
 No water observed during drilling

Drill Rig
 CME 45

Advancement Method
 Continuous flight auger

Driller
 Smith Drilling
Logged by
 BCR

Abandonment Method
 Boring backfilled with auger cuttings upon completion.

Boring Started
 07-18-2023
Boring Completed
 07-18-2023

Boring Log No. F-3

Model Layer	Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
1		Depth (Ft.) Elevation.: 685 (Ft.)							
		0.2' GRAVEL (2")	684.83						
		SANDY LEAN CLAY (CL) , yellowish brown, hard, contains relict bedding							
2									
						8-12-20 N=32	18.0		
			5			25-35-50/3" N=50+	16.7		
						16-30-40 N=70			
			10			14-30-50/5" N=50+			
		10.8	674.2						
		Boring Terminated at 10.8 Feet							

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).
 See [Supporting Information](#) for explanation of symbols and abbreviations.

Water Level Observations
 No water observed during drilling

Drill Rig
 CME 45

Notes

Advancement Method
 Continuous flight auger

Driller
 Smith Drilling
Logged by
 BCR

Abandonment Method
 Boring backfilled with auger cuttings upon completion.

Boring Started
 07-18-2023
Boring Completed
 07-18-2023

Boring Log No. F-4

Model Layer	Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
1		Depth (Ft.) Elevation.: 687 (Ft.) 0.2 GRAVEL (2") 686.83							
		SANDY LEAN CLAY (CL), light gray, very stiff to hard, relict bedding							
						7-12-16 N=28	18.3		
			5			9-12-20 N=32	18.4		
		becomes brownish yellow							
						6-10-20 N=30			
2									
		contains light gray and becomes stiff	10			4-5-9 N=14			
		becomes hard							
						10-17-25 N=42			
		15.0 672	15						
		Boring Terminated at 15 Feet							

See **Exploration and Testing Procedures** for a description of field and laboratory procedures used and additional data (If any).
 See **Supporting Information** for explanation of symbols and abbreviations.

Water Level Observations
 No water observed during drilling

Drill Rig
 CME 45

Notes

Advancement Method
 Continuous flight auger

Driller
 Smith Drilling
Logged by
 BCR

Abandonment Method
 Boring backfilled with auger cuttings upon completion.

Boring Started
 07-18-2023
Boring Completed
 07-18-2023

Supporting Information






Contents:

General Notes

Unified Soil Classification System

Note: All attachments are one page unless noted above.

General Notes

Sampling	Water Level	Field Tests
 Standard Penetration Test	 Water Initially Encountered	N Standard Penetration Test Resistance (Blows/Ft.)
	 Water Level After a Specified Period of Time	(HP) Hand Penetrometer
	 Water Level After a Specified Period of Time	(T) Torvane
	 Cave In Encountered	(DCP) Dynamic Cone Penetrometer
	<p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>	UC Unconfined Compressive Strength
		(PID) Photo-Ionization Detector
		(OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F
			$Cu < 4$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	GP	Poorly graded gravel ^F
	Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
		Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I
			$Cu < 6$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	SP	Poorly graded sand ^I
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
		Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots above "A" line ^J	CL	Lean clay ^{K, L, M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K, L, M}
	Silts and Clays: Liquid limit 50 or more	Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OL	Organic clay ^{K, L, M, N}
					Organic silt ^{K, L, M, O}
Highly organic soils:	Inorganic:	PI plots on or above "A" line	CH	Fat clay ^{K, L, M}	
		PI plots below "A" line	MH	Elastic silt ^{K, L, M}	
	Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OH	Organic clay ^{K, L, M, P}	
				Organic silt ^{K, L, M, Q}	
Primarily organic matter, dark in color, and organic odor				PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

^E $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

