STATE OF ALABAMA
No. 3365
RICK N. LATHAN
REGISTERED ARCHITECT

LATHAN ARCHITECTS
LATHAN ▪ BRYANT ▪ CALMA

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

ADDENDUM NO. 4
NEW ADDITION AND RENOVATION FOR RUSSELLVILLE HIGH SCHOOL
PACKAGE B - RENOVATION
Architect Job No. 19-90B
DCM #2021216
July 15, 2022

<u>BIDS DUE:</u>
Tuesday, July 26, 2022, until
2:00 p.m. local time
Russellville City Board of Education
1945 Waterloo Road
Russellville, AL 35653

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

<u>ATTACHED IS TERRACON GEOTECHNICAL REPORT DATED MARCH 25, 2020.</u>

<u>DRAWINGS</u>

1. Sheet E5.1 - <u>Floor Plan - Auxiliaries</u>:
   Add fire alarm annunciator in Corridor 4 near the front entrance and connect to FACP as required.

Geotechnical Engineering Report

Russellville HS Building Additions
Russellville, Franklin County, AL
March 25, 2020
Terracon Project No. E1205012

Prepared for:
Russellville City Schools
Russellville, Alabama

Prepared by:
Terracon Consultants, Inc.
Madison, Alabama

March 25, 2020

Russellville City Schools
1945 Waterloo Road
Russellville, Alabama 35243

Attn: Mr. Heath Grimes, Superintendent
P: (256) 331-2000

Re: Proposal for Geotechnical Engineering Services
Russellville HS Building Additions
1865 Waterloo Road
Russellville, Franklin County, AL
Terracon Project No. E1205012

Dear Superintendent Grimes:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. E1205012 dated February 3, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements 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,
Terracon Consultants, Inc.

Charlie L. Bragg
Field Project Manager

Frank Whitman, P.E.
Senior Engineer
Alabama P.E. No. 23152

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange 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 ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed additions to the Russellville High School in Russellville, Franklin County, Alabama. The geotechnical engineering Scope of Services for this project included the advancement of ten test borings performed within the planned building additions and new parking and drive areas. The borings were extended to depths ranging from about 5 to 25 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section of this report.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Borings B-1 to B-5 penetrated about 3 to 5.5 feet of existing fill material consisting of Sandy Fat Clay, Sandy Lean Clay, Clayey Sand and Lean Clay with Sand. Support of foundations, floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

- Boring B-2, performed within the proposed building addition, penetrated near surface, very loose to loose (N-values of 0 to 7 blows per foot) fill and native soils extending to a depth of about 7.5 feet. These low relative density soils are not suitable for the support of conventional shallow foundation systems and floor slabs. Low relative density/consistency or otherwise unsuitable soils within limits of the proposed new construction will require improvement prior to construction. The need for improvement should be determined at the time of construction by proofrolling.

- Removal of some of the existing pavements, concrete slabs and utilities will be required prior to construction. Removal of these items will likely create a disturbed subgrade. We caution that foundations, septic systems, organic debris, construction debris or other deleterious materials could also exist across the site, between or away from our borings. Debris fill may not become evident until construction.

- Following proper site preparation measures, the site materials will provide adequate support for shallow spread footing foundations, floor slabs and pavements. The **Shallow Foundations** section addresses foundations bearing on medium stiff or better native soils, approved existing fill, or new engineered fill. The **Floor Slabs** section addresses slab-on-grade support on medium stiff or better native soils, approved existing fill, or new engineered fill. The **Pavements** section addresses pavement support on stiff or better native soils, approved existing fill, or new engineered fill.

- Support of foundations, floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

- The 2015 International Building Code (IBC), seismic site classification for this site is C. Please see the **Seismic Considerations** section for further details.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that the Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The **General Comments** section provides an understanding of the report limitations.

Geotechnical Engineering Report

Russellville HS Building Additions

Russellville, Franklin County, AL

Terracon Project No. E1205012

March 25, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed additions to the Russellville High School in Russellville, Franklin County, Alabama. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

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

The geotechnical engineering Scope of Services for this project included the advancement of eight test borings performed within the planned building additions and two test borings performed within the planned pavement relocation area. The borings were extended to depths ranging from about 7.5 to 25 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

Item	Description
Parcel Information	The project is located at 1865 Waterloo Road in Russellville, Franklin County, AL. (See **Site Location Map**). Approximate GPS: 34.52496, -87.73831
Existing Improvements	The site is currently developed, with existing school buildings, parking and drives and landscaped areas.
Existing Topography	Relatively level near the existing buildings and gently sloping east of the existing buildings
Geology	Tuscaloosa Group; Gordo Formation

PROJECT DESCRIPTION

Item	Description
Information Provided	Preliminary floor plans provided by Lathan
Project Description	■ Approximate 32,000-SF footprint building additions ■ Relocated pavements
Proposed Structure	New one- to three-story building additions; assumed to be masonry construction, with concrete slab-on-grade.
Building Construction (Assumed)	■ Concrete slab-on-grade ■ Masonry load-bearing walls ■ Shallow, soil-supported spread footings ■ One- to three-story
Finished Floor Elevation	Main level matching existing FFE
Maximum Loads (Assumed)	■ Columns: 150 kips ■ Walls: 12 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	■ We anticipate 0 to about 6 feet of new fill will be required to obtain the desired finish grades ■ New slopes will be less than 10 feet in total height
Free-Standing Retaining Walls	■ Basement walls up to 13 feet in height
Pavements	■ Relocated pavements will be constructed ■ We assume flexible (asphalt) pavement sections will be used ■ No anticipated traffic patterns or vehicle loads have been provided to us at this time. ■ The assumed pavement design period is 20 years.

GEOTECHNICAL CHARACTERIZATION

Geology

Published maps from the Geological Survey of Alabama indicates that the project site is underlain by the Tuscaloosa Group; Gordo Formation. Locally, the Tuscaloosa Group; Gordo Formation is composed of massive beds of cross-bedded sand, gravelly sand, and lenticular beds of locally carbonaceous partly mottled moderate-red and pale-red-purple clay; lower part is predominantly a gravelly sand consisting chiefly of chert and quartz pebbles.

Subsurface Profile

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 forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section of this report.

Borings B-1 through B-8 were performed with in the area of the proposed building additions. Borings B-1 to B-4 and B-7 initially penetrated about 3 to 5 inches of topsoil. Boring B-5 initially penetrated about 4 inches of asphalt paving underlain by about 3 inches of base material.

Beneath the topsoil and pavement section, borings B-1 to B-5 penetrated about 3 to 5.5 feet of fill material consisting of Sandy Fat Clay (CH), Sandy Lean Clay (CL), Clayey Sand (SC) and Lean Clay with Sand (CL). Recorded N-values with in the fill ranged from 4 to 16 blows per foot. Underlying the existing fill, these borings penetrated naturally deposited soils consisting of Sandy Lean Clay (CL), Clayey Sand (SC), Silty Sand (SM), Fat Clay with Sand (CH), Sandy Silty Clay (CL-ML), Clayey Gravel with Sand (GC), Sandy Fat Clay (CH) and Clayey Sand with Gravel (SC). The consistency/relative density of the naturally deposited soils ranged from very soft to hard for cohesive silts and clays and from very loose to very dense for gravels and sands. Recorded N-values within the naturally deposited soils ranged from weight of hammer (WOH), to more than 50 blows per foot.

Beneath the topsoil and pavement section, borings B-6 to B-8 penetrated naturally deposited soils consisting of Sandy lean Clay (CL), Fat Clay (CH), Fat Clay with Sand (CH), Gravelly Fat Clay (CH) and Sandy Fat Clay (CH). The consistency of the naturally deposited soils ranged from very stiff to hard, with recorded N-values ranging from 21 to more than 50 blows per foot. Borings B-1 through B-8 were terminated at a depth of about 25 feet below the existing surface grade.

Borings P-9 and P-10 were performed within the area of the proposed relocated pavements. These borings initially penetrated about 3 to 4 inches of asphalt paving topsoil. Boring B-5 initially penetrate about 4 inches of asphalt paving underlain by about 3 to 4 inches of base material. Beneath the pavement section, these borings penetrated naturally deposited soils consisting of Sandy lean Clay (CL). The consistency of these soils ranged from stiff to very stiff, with recorded N-values ranging from 10 to 20 blows per foot. Borings P-9 and P-10 were terminated at a depth of about 7.5 feet below the existing surface grade.

Natural moisture content of the soils ranged from about 11 to 44 percent for the samples tested. The soil samples tested had the following particle size distribution (percent passing the No. 200 sieve):

Sample Location, Depth	Liquid Limit	Plastic Limit	Plasticity Index	-200 sieve (%)
Boring B-1, 3.5 – 5.0 5 feet	--	--	--	67
Boring B-2, 3.5 – 5.0 feet	--	--	--	24
Boring B-3, 3.5 – 5.0 feet	--	--	--	55
Boring B-5, 3.5 – 5.0 feet	--	--	--	64
Boring B-5, 13.5 – 15.0 feet	--	--	--	42
Boring B-5, 23.5 – 25.0 feet	--	--	--	52
Boring B-7, 3.5 – 5.0 feet	--	--	--	55
Boring P-9, 1.0 – 2.5 feet	--	--	--	56
Boring P-10, 1.0 – 2.5 feet	--	--	--	58

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**, and are summarized below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet)1[1,2]
B-1	14
B-2	8
B-3	7
B-4	11

1. Depth is below existing ground surface at time of drilling.
2. Borings were backfilled immediately upon completion; therefore, the long-term groundwater levels were not determined

A relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs.

GEOTECHNICAL OVERVIEW

Based on the information obtained from our subsurface exploration, the following geotechnical considerations were identified:

Borings B-1 to B-5 penetrated about 3 to 5.5 feet of existing fill material consisting of Sandy Fat Clay, Sandy Lean Clay, Clayey Sand and Lean Clay with Sand. Support of foundations, floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

Boring B-2, performed within the proposed building addition, penetrated near surface, very loose to loose (N-values of 0 to 7 blows per foot) fill and native soils extending to a depth of about 7.5 feet. These low relative density soils are not suitable for the support of conventional shallow foundation systems and floor slabs. Low relative density/consistency or otherwise unsuitable soils within limits of the proposed new construction will require improvement prior to construction. The need for improvement should be determined at the time of construction by proofrolling.

Removal of some of the existing pavements, concrete slabs and utilities will be required prior to construction. Removal of these items will likely create a disturbed subgrade. We caution that foundations, septic systems, organic debris, construction debris or other deleterious materials could also exist across the site, between or away from our borings. Debris fill may not become evident until construction.

The contractor should be prepared to conduct undercutting activities such that existing structures are not undermined.

Following proper site preparation measures, the site materials will provide adequate support for shallow spread footing foundations, floor slabs and pavements. The **Shallow Foundations** section addresses foundations bearing on medium dense/stiff or better native soils, approved existing fill, or new engineered fill. The **Floor Slabs** section addresses slab-on-grade support on medium stiff or better native soils, approved existing fill, or new engineered fill. The **Pavements** section addresses pavement support on stiff or better native soils, approved existing fill, or new engineered fill.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. 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.

Site Preparation

Prior to placing fill, the existing topsoil, vegetation, root mat, and existing pavements should be removed.

After completion of stripping, clearing, grubbing, and removal of existing pavements, the exposed subgrades should be proof-rolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proof-rolling should be performed under the observation of the Geotechnical Engineer. Areas excessively deflecting or rutting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed or moisture conditioned and re-compacted. Lower consistency soils exposed at the time of the proof-roll will likely require undercutting.

Fill Material Types

Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Lean clay	CL (LL<50 and PI<25)	All locations and elevations
Fat Clay	CH (LL>50 and PI >25	Not acceptable for use as Structural Fill
Sand	SW, SC, SM, SP	All locations and elevations

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
On-Site Soils	Varies	The existing naturally deposited soils consisting of Sandy Lean Clay (CL), Clayey Sand (SC), Silty Sand (SM), Sandy Silty Clay (CL-ML), Clayey Gravel with Sand (GC), and Clayey Sand with Gravel (SC), which are free of organics appear suitable for reuse as fill. Provided they are free of topsoil, construction debris or other deleterious material, existing fill material classified as Sandy Lean Clay(CL), Clayey Sand (SC) and Lean Clay with Sand (CL) appear suitable for reuse as fill.

1. Structural and general 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.

Fill Compaction Requirements

Structural and general 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 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements	98% of the Standard Proctor Maximum Dry Density (SPMDD)
Water Content Range	Cohesive: -2% to +2% of optimum Granular: workable moisture levels

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. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Earthwork Construction Considerations

Even if the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Permanent fill slopes up to 10 feet in height should be graded no steeper than 2.5(H):1.0(V). Proper management of surface water runoff around the slopes will also contribute to the stability of permanent slopes. This will help prevent erosion and saturation of the slope. Positive drainage should be maintained with ditches or channels at the top and bottom of the slopes. It is also recommended that a minimum distance of 10 feet be provided between the top edge of any slope and the proposed buildings. A minimum shoulder of 5 feet should also be provided between curbs and top of slopes.

Temporary excavations will likely be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, existing fill, proof-rolling, and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved 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. One density and water content test should be performed per lift for every 50 linear feet of compacted utility trench backfill.

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

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade, and just prior to construction of building floor slabs. 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

The following design parameters are applicable for shallow foundations bearing in medium stiff or better native soils, approved existing fill, or new engineered fill following proper site preparations.

Design Parameters – Compressive Loads

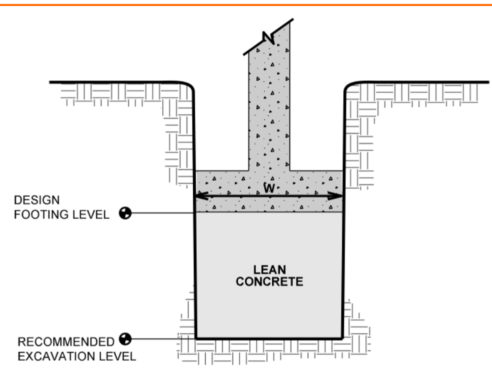
Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	2,500 psf
Required Bearing Stratum [3]	Medium dense/stiff or better native soils, approved existing fill, or new engineered fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	330 pcf (cohesive backfill) 460 pcf (granular backfill)
Ultimate Coefficient of Sliding Friction [5]	0.32
Minimum Embedment below Finished Grade [6]	18 inches
Estimated Total Settlement from Structural Loads [2]	1 inch or less
Estimated Differential Settlement [2, 7]	¾ inch or less

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. 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**.
3. Any unstable soils should be removed and replaced with engineered fill.
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.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
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 as measured over a span of 40 feet.

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.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings should bear on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

SEISMIC CONSIDERATIONS

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).

To evaluate the seismic site classification based on shear-wave velocities, Terracon conducted two (2) seismic survey lines designated as Seismic Array-1 and Seismic Array-2 on the subject site using a refraction micro-tremor (ReMi) method. A shear-wave velocity seismic survey is effective in characterizing the shear-wave velocities at various depths in the subsurface, which can be correlated to relative soil densities. Relatively higher shear-wave velocities indicate very stiff soil and/or bedrock, and relatively lower shear-wave velocities indicate soft and/or medium soils. Along each seismic survey, a subsurface cross-sectional profile was constructed which show seismic-velocities correlated with depth along the seismic survey (see attached Shear-Wave Velocity Profiles for Seismic Array-1 and Seismic Array-2).

Using the ReMi geophysical method to measure shear-wave velocities in the upper 100 feet of the subsurface profile, we have determined that the site characterization based on Shear wave velocity is **Seismic Site Class 'C'**.

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.

Floor Slab Design Parameters

Item	Description
Floor Slab Support	Minimum 4 inches of free-draining (less than 5% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 95% of ASTM D 698 [1, 2] Medium stiff or better native soils or new engineered fill soils beneath the free-draining crushed aggregate
Estimated Modulus of Subgrade Reaction [1]	100 pounds per square inch per inch (psi/in) for point loads

1. 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.

2. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

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, 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 control 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 water-proof, 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

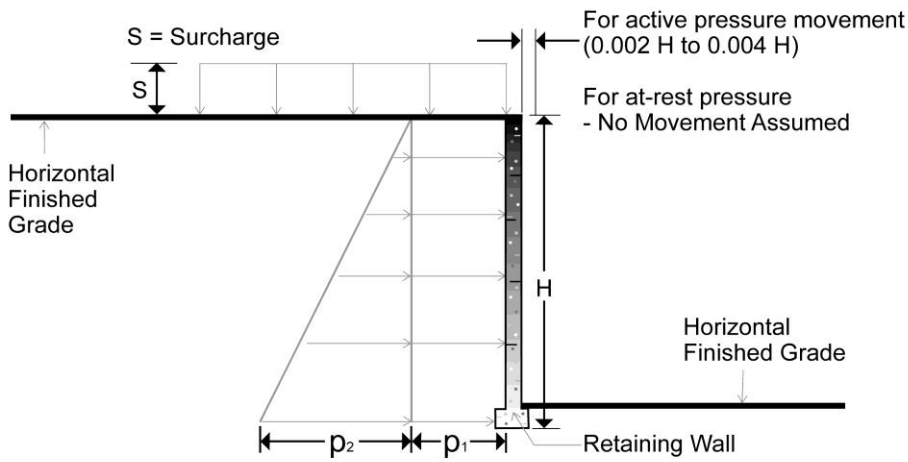
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor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

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those 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. 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. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Open Graded Granular - 0.24 Low Plasticity Clay - 0.36	26 43	(0.24)S (0.36)S	(26)H (43)H
At-Rest (Ko)	Open Graded Granular - 0.38 Low Plasticity Clay - 0.53	42 64	(0.38)S (0.53)S	(42)H (64)H
Passive (Kp)	Open Graded Granular – 4.2 Low Plasticity Clay - 2.8	460 330	--- ---	--- ---

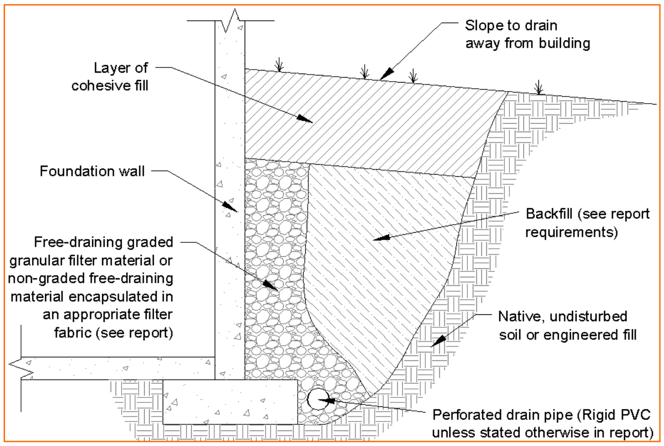
Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf; 110 pcf for open graded granular
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of open graded granular material (e.g. ALDOT No. 57 stone) or low plasticity clay soils. For the granular values to be valid, the open graded granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.32 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

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 percent passing the No. 200 sieve, such as ALDOT No. 57 aggregate. 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 pre-fabricated drainage structure may be used. A pre-fabricated 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.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

After proof-rolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the **Earthwork** section to provide a uniform subgrade for pavement construction. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Pavement Design Parameters

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by passenger vehicles, school busses, trash collection trucks, and the occasional emergency vehicle. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle, emergency vehicles and trash removal truck traffic if this information is provided.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter. Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound
- Granular base course materials.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Typical Pavement Section Thickness (inches)						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course**[4]	**Asphalt Concrete Binder**[5]	**Portland Cement Concrete** [1]	**Aggregate Base Course** [2]	**Total Thickness**
Light Duty (Car Parking)	Rigid	--	--	5.0	4.0	11.0
	Flexible	1.0	2.0	--	6.0	9.0
Heavy Duty (Drive Lanes)	Rigid	--	--	6.0	4.0	10.0
	Flexible	1.0	2.5	--	8.0	11.5
Trash Container Pad [3]	Rigid	--	--	6.0	4.0	10.0

1. 4,000 psi at 28 days
2. ALDOT 825B dense graded aggregate base compacted to at least 100 percent of the modified Proctor
3. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.
4. ALDOT 424A Superpave Bituminous Concrete Wearing Surface Layer
5. ALDOT 424B Superpave Bituminous Concrete Binder Layer

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with ACC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphaltic cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Based on the possibility of shallow and/or perched groundwater, we recommend installing a pavement subdrain system to control groundwater, improve stability, and improve long-term pavement performance.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

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. Natural 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 or collaboration through this system 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 impact 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. 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.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Planned Boring Depth (feet) [1]	Planned Location
8	25	Building Additions
2	7.5	Pavements

1. Below ground surface.

Boring Layout: Terracon personnel staked the boring locations in the field based on the proposed boring layout and floor plan provided by Lathan. The borings were located by taping from existing site features. Boring locations were offset from the proposed locations due to buried utilities, surface and overhead obstructions (e.g., canopies, power lines), soft ground, or other conflicts.

Subsurface Exploration Procedures: We advanced the borings with an ATV-mounted drill rig using continuous flight solid stem augers. 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 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. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion. The upper 1 foot of the borehole was plugged with a cement mixture. Pavements were patched with cold-mix asphalt.

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 encountered 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.

Shear-Wave Velocity Seismic Survey

To evaluate the seismic site classification based on shear-wave velocities, Terracon conducted two (2) seismic survey lines designated as seismic Array-1 and seismic Array-2 on the subject site using a refraction micro-tremor (ReMi) method. A shear-wave velocity seismic survey is effective in characterizing the shear-wave velocities at various depths in the subsurface, which can be correlated to relative soil densities. Relatively higher shear-wave velocities indicate very stiff soil and/or bedrock, and relatively lower shear-wave velocities indicate soft and/or medium soils. Along each seismic survey, a subsurface cross-sectional profile was constructed which show seismic-velocities correlated with depth along the seismic survey (see attached Shear-Wave Velocity Profiles for Seismic Array-1 and Seismic Array-2).

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D422 Standard Test Method for Particle Size Analysis of Soils

The laboratory testing program often included examination of soil samples by an engineer. Based on the material’s texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

Contents:

SITE LOCATION MAP

Russellville HS Building Additions ■ Russellville, Franklin County, AL

March 25, 2020 ■ Terracon Project No. E1205012

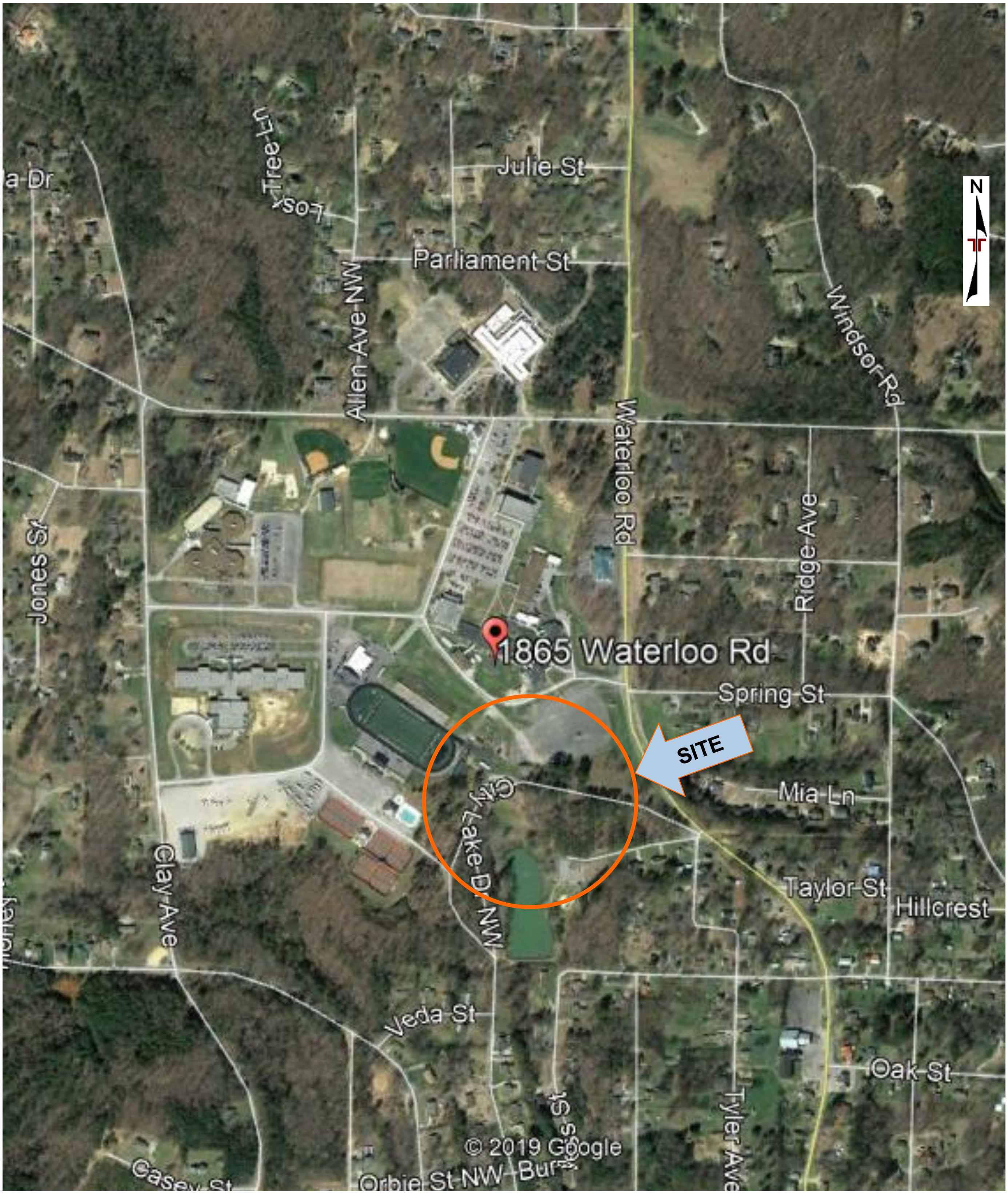


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY GOOGLE

EXPLORATION PLAN – BORING LOCATIONS

Russellville HS Building Additions ■ Russellville, Franklin County, AL
March 25, 2020 ■ Terracon Project No. E1205012

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through P-10)
Shear-Wave Velocity Profiles

BORING LOG NO. B-01

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5261° Longitude: -87.7389°

DEPTH	Description
0.3	**TOPSOIL (4")**
3.0	**FILL - SANDY FAT CLAY**, dark brown and gray
6.0	**SANDY LEAN CLAY (CL)**, light brown and gray, stiff
12.0	**CLAYEY SAND (SC)**, light brown and gray, very dense
25.0	**SILTY SAND (SM)**, light brown and gray, very dense
	Boring Terminated at 25 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1-2.5		X	6-7-9 N=16	17		
3.5-5		X	4-6-5 N=11	16		67
6-7.5		X	22-29-36 N=65	13		
8.5		X	50/5"	11		
13.5-15	▽	X	21-26-32 N=58	18		
18.5-20		X	17-25-26 N=51	19		
23.5-25		X	17-29-26 N=55	22		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

▽ *While drilling*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-02

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5257° Longitude: -87.7391°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL (3")**							
	FILL - CLAYEY SAND, trace organics, dark brown and gray			X	2-3-1 N=4	15		
3.0								
	CLAYEY SAND (SC), light brown and gray, very loose, wet				WOH	33		24
		5						
6.0								
	SILTY SAND (SM), light brown and light gray, loose			X	3-3-4 N=7	17		
			▽					
	medium dense			X	3-9-11 N=20	13		
		10						
12.0								
	FAT CLAY WITH SAND (CH), light gray, very stiff							
				X	8-11-14 N=25	26		
		15						
				X	6-8-12 N=20	24		
		20						
21.0								
	SILTY SAND (SM), light gray, medium dense							
				X	8-8-11 N=19	21		
25.0		25						
	Boring Terminated at 25 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

▽ *While drilling*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-03

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5251° Longitude: -87.7381°

DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	**TOPSOIL (5")**							
	FILL - SANDY LEAN CLAY, red and gray			X	6-7-8 N=15	18		
3.0	**SANDY SILTY CLAY (CL-ML)**, gray, very stiff			X	5-6-10 N=16	27		55
	wet, very soft	5	▽	X	WOH	21		
8.0	**CLAYEY GRAVEL WITH SAND (GC)**, gray, very dense			X	26-50/5"	13		
13.0	**SANDY FAT CLAY (CH)**, with trace gravel, light brown and gray, stiff	10		X	5-6-9 N=15	19		
18.0	**CLAYEY GRAVEL WITH SAND (GC)**, yellowish brown, medium dense	15		X	4-5-6 N=11	23		
		20		X	6-6-8 N=14	21		
25.0	***Boring Terminated at 25 Feet***	25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

▽ *While drilling*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-04

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.525° Longitude: -87.738°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	**TOPSOIL (5")**							
3.0	**FILL - SANDY LEAN CLAY**, red and gray			X	4-5-6 N=11	18		
5.5	**FILL - LEAN CLAY WITH SAND**, trace organics, gray and red	5		X	4-6-8 N=14	37		
7.0	**SANDY SILTY CLAY (CL-ML)**, gray, soft, wet			X	1-2-24 N=26	21		
9.5	**CLAYEY GRAVEL WITH SAND (GC)**, brown and gray, dense			X	22-24-8 N=32	15		
	SANDY FAT CLAY (CH), with trace gravel, brown and gray, hard	10	▽					
		15		X	12-18-21 N=39	21		
	very stiff	20		X	6-8-8 N=16	23		
25.0		25		X	5-6-9 N=15			

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

▽ *While drilling*

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-05

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.525° Longitude: -87.7383°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**ASPHALT (4")**							
0.6	**BASE (3")**							
3.0	**FILL - SANDY LEAN CLAY**, red and gray, slight organic odor			X	6-5-9 N=14	18		
6.0	**SANDY LEAN CLAY (CL)**, reddish-brown, very stiff	5		X	8-9-11 N=20	17		64
	SANDY LEAN CLAY (CL), red, yellow, and gray, very stiff			X	8-8-14 N=22	16		
12.0	hard	10		X	17-19-50/5"	18		
17.0	**CLAYEY SAND WITH GRAVEL (SC)**, red, yellow, and gray, dense	15		X	15-17-28 N=45	21		42
22.0	**SANDY LEAN CLAY (CL)**, with trace gravel, red and gray, hard	20		X	20-15-17 N=32	27		
25.0	**SANDY FAT CLAY (CH)**, with trace gravel, grayish brown, hard	25		X	6-14-16 N=30	26		52
	Boring Terminated at 25 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-06

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5247° Longitude: -87.7384°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**ASPHALT (3 1/2")**							
0.6	**BASE (4")**							
6.0	**GRAVELLY FAT CLAY (CH)**, reddish-brown, hard			X	18-50/5"	18		
		5		X	19-23-31 N=54	15		
17.0	**SANDY LEAN CLAY (CL)**, trace gravel, red and tan, hard			X	10-12-19 N=31	15		
		10		X	10-14-17 N=31	21		
		15		X	11-11-14 N=25	26		
21.0	**FAT CLAY WITH SAND (CH)**, red, yellow, and gray, hard	20		X	14-14-21 N=35	34		
25.0	**SANDY FAT CLAY (CH)**, reddish-brown, very stiff	25		X	12-15-14 N=29	21		

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started:	Boring Completed:
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-07

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5245° Longitude: -87.7383°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**TOPSOIL (4")**							
	SANDY LEAN CLAY (CL), reddish-brown, very stiff			X	12-12-9 N=21	20		
		5		X	10-10-11 N=21	23		55
6.0	**FAT CLAY WITH SAND (CH)**, red, yellow, and gray, very stiff			X	10-13-12 N=25	33		
	hard	10		X	13-16-29 N=45	36		
	very stiff	15		X	10-11-14 N=25	29		
17.0	**SANDY FAT CLAY (CH)**, reddish-brown, very stiff	20		X	13-14-15 N=29	28		
25.0		25		X	12-14-15 N=29	32		
	Boring Terminated at 25 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started:	Boring Completed:
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. B-08

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5244° Longitude: -87.7384°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**ASPHALT (4")**							
0.8	**BASE (5")**							
	SANDY LEAN CLAY (CL), reddish-brown, hard			X	14-18-21 N=39	16		
				X	19-21-50/5"	19		
		5		X	16-18-21 N=39	19		
		10		X	15-19-20 N=39	23		
15.0				X	14-15-16 N=31	24		
	FAT CLAY (CH), gray and brown, very stiff	15		X	12-11-13 N=24	33		
		20						
25.0	hard			X	12-17-18 N=35	44		
	Boring Terminated at 25 Feet	25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-17-2020	Boring Completed: 02-17-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. P-09

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5247° Longitude: -87.7381°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	**ASPHALT (3")**							
0.6	**BASE (4")**							
	SANDY LEAN CLAY (CL), reddish-brown, stiff			X	6-8-6 N=14	16		56
	very stiff	5		X	2-8-12 N=20	17		
7.5				X	2-8-9 N=17	21		
	Boring Terminated at 7.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	

BORING LOG NO. P-10

PROJECT: Russellville High School - New Additions

CLIENT: Russellville City Schools
1945 Waterloo Road, Russellville, AL 35653

SITE: 1865 Waterloo Road
Russellville, AL

LOCATION See Exploration Plan

Latitude: 34.5242° Longitude: -87.7382°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	**ASPHALT (4 1/2")**							
0.6	**BASE (3")**							
	SANDY LEAN CLAY (CL), reddish-brown, stiff			X	5-5-5 N=10	18		58
				X	6-2-8 N=10	16		
		5						
7.5				X	2-7-7 N=14	17		
	Boring Terminated at 7.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Hollow stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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.

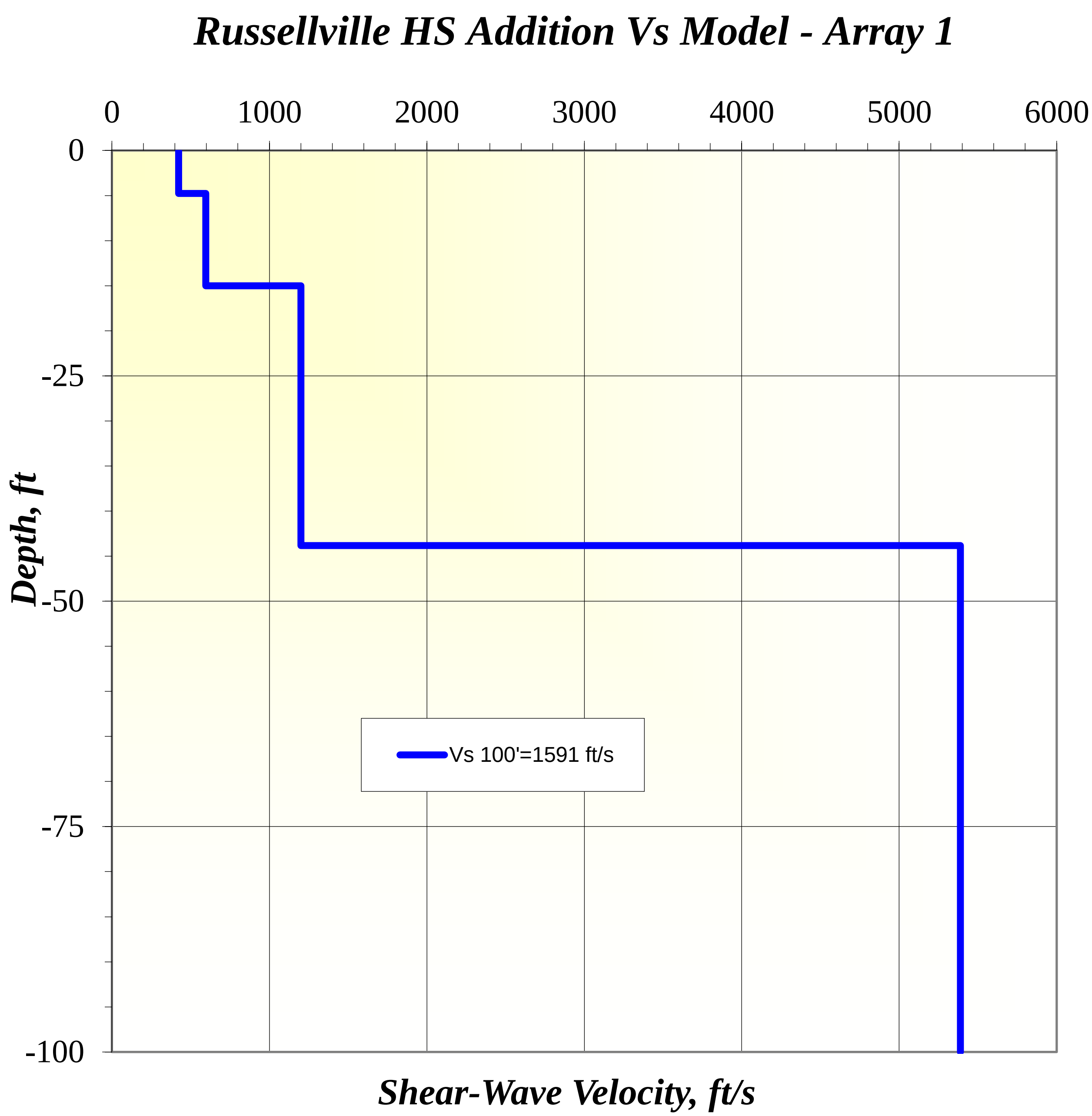
Notes:

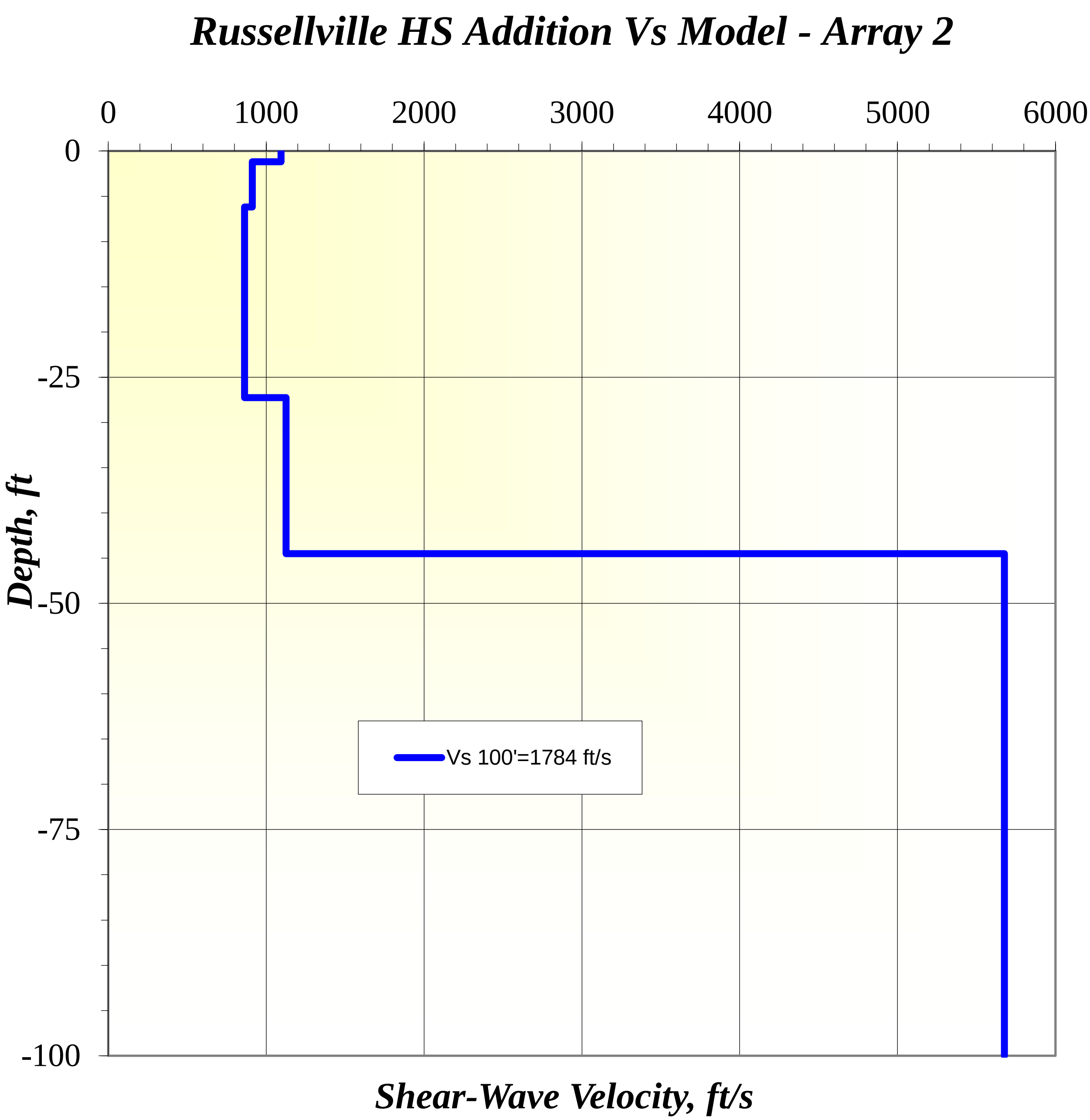
WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
2147 Riverchase Office Rd
Hoover, AL

Boring Started: 02-15-2020	Boring Completed: 02-15-2020
Drill Rig: Mobile B-47	Driller: Earth Core, LLC
Project No.: E1205012	


Russellville HS Addition Vs Model - Array 1
0
1000
2000
3000
4000
5000
6000
0
-25
-50
-75
-100
Depth, ft
Vs 100'=1591 ft/s
Shear-Wave Velocity, ft/s


Russellville HS Addition Vs Model - Array 2
0
1000
2000
3000
4000
5000
6000
0
-25
-50
-75
-100
Depth, ft
Vs 100'=1784 ft/s
Shear-Wave Velocity, ft/s

SUPPORTING INFORMATION

Contents:

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Russellville High School - New Additions ■ Russellville, AL

Terracon Project No. E1205012

Terracon GeoReport

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
	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.		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		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (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 SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification: Group Symbol	Soil Classification: 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 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 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		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]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above “A” line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below “A” line [J]	ML	Silt [K, L, M]
		Organic:	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**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:	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 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 ≥ 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 ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ≥ 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.