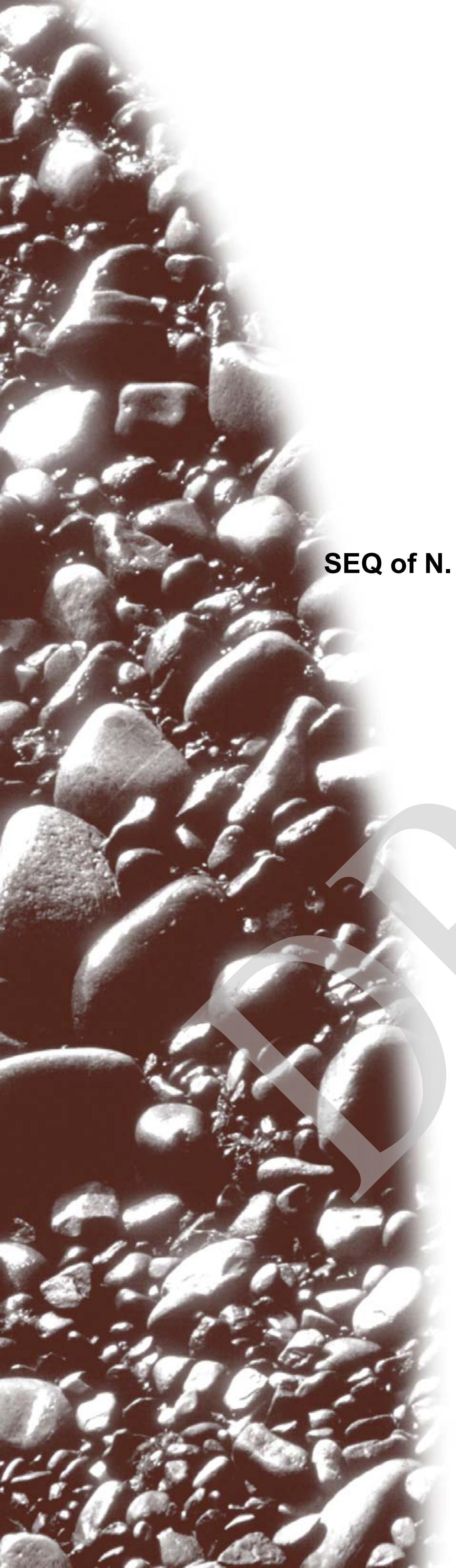

GREEN

Geotechnical Engineering Exploration and Analysis DRAFT

Proposed Chick-fil-A Restaurant #5934
Powers & Palmer Park FSU
SEQ of N. Powers Boulevard and Palmer Park Boulevard
Colorado Springs, Colorado

Prepared for:

Chick-fil-A, Inc.
Atlanta, Georgia

Prepared by:

Giles Engineering Associates, Inc.

December 31, 2024
Project No. 4G-2411003

GILES
ENGINEERING ASSOCIATES, INC.

GILES
ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

• Dallas, TX
• Los Angeles, CA
• Manassas, VA
• Milwaukee, WI

December 31, 2024

Chick-fil-A, Inc.
15635 Alton Parkway, Suite 350
Irvine, California 92618

Attention: Ms. Leslie Clay
New Restaurants

Subject: Geotechnical Engineering Exploration and Analysis - DRAFT
Proposed Chick-fil-A Restaurant #5934
Powers & Palmer Park FSU
SEQ of N. Powers Boulevard and Palmer Park Boulevard
Colorado Springs, Colorado
Project No. 4G-2411003

Dear Ms. Clay:

Giles Engineering Associates, Inc. (Giles) conducted a Geotechnical Engineering Exploration and Analysis for the proposed project. The accompanying report describes the services that were performed and provides geotechnical engineering conclusions and recommendations.

We sincerely appreciate the opportunity to provide geotechnical engineering services for the proposed project. Please contact the undersigned if there are questions concerning the report or if we may be of further service.

Very truly yours,
GILES ENGINEERING ASSOCIATES, INC.

Junayed Hemel
Project Manager

Michael F. Pisarik, P.E.
Regional Director

Distribution: Chick-fil-A, Inc.
Attn: Ms. Leslie Clay (e-mail: leslie.clay@cfacorp.com)
Mr. Steve Schwartz (e-mail: steve.schwartz@cfacorp.com)
Ms. Jessica Garcia (e-mail: jessica.garcia44@cfacorp.com)
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COLORADO SPRINGS, COLORADO
PROJECT NO. 4G-2411003

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GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS - DRAFT

PROPOSED CHICK-FIL-A RESTAURANT #5934
POWERS & PALMER PARK FSU
SEQ OF N. POWERS BOULEVARD AND PALMER PARK BOULEVARD
COLORADO SPRINGS, COLORADO
PROJECT NO. 4G-2411003

GREEN: This site has been given a GREEN designation. No significant geotechnical engineering related construction concerns or problems are expected which are unusual or not typical to this general area. Fill was observed at the site. Fill material, where encountered, are recommended to be evaluated by a geotechnical engineer, at the time of construction, to determine if removal and replacement with engineered fill is necessary.

ITEMS OF IMPORTANCE

1. **The site is developed and occupied by a paved parking lot, landscape, utilities and the surface is covered with asphalt concrete pavement, concrete sidewalks, curbs, and soils. Site preparation will require complete removal and proper disposal of the existing pavements and underground utilities that are not reused. Unsuitable materials might have been buried beneath the site surface from previous grading of the site during the construction of the parking lot.**
2. **The site is underlain by generally fill, possible fill and native silty sand with varying amounts of silt and gravel to 4 to 5.5, followed by poorly graved sand with varying amount of silt and clay to depths of 5 to 21 feet, followed by silty sand with trace gravel to depths of 25 feet The silty sand was followed poorly graded sand with trace gravel and silt that extended to the maximum boring termination depth of approximately 30 feet bgs.**
3. **Recommended Building Foundations - Moderately rigid reinforced shallow foundation (i.e., spread and/or continuous strip footings) and reinforced slab-on-grade floor placed on properly prepared subgrade. The building pad subgrade should be scarified to a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content, and the soil compacted extending at least 5 feet beyond the building perimeter. The building pad should pass a proof roll. The building foundations subgrade should be scarified to a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content. The foundation is recommended to be designed using a 2,000 pounds per square foot (psf) maximum, net allowable soil bearing capacity and a maximum subgrade modulus of 65 pci.**
4. **Recommended Canopy Foundations – Isolated shallow square footing foundations placed on a suitable bearing native soil at a depth of 7 feet below top of drive through lane can be used for canopy foundation support. It is recommended that the canopy foundation systems be designed using a 2,000 pounds per square foot (psf) maximum, net allowable soil bearing capacity.**
5. **Asphalt pavement and aggregate base and PCC pavement is recommended to be underlain by 8 inches of a scarified, moisture conditioned, and recompacted subgrade.**
6. **Hot Mix Asphalt (HMA) Pavement:**
    a. **Four (4) inches of HMA concrete pavement, underlain by six (6) inches of compacted aggregate base is recommended for standard duty pavements. Five (5) inches of HMA concrete pavement, underlain by nine (9) inches of compacted aggregate base is recommended for heavy duty pavements. If asphalt pavement is used, Portland cement concrete pavement is recommended for high stress areas.**

7. **Portland Cement Concrete (PCC):**
    a. **Five (5) inches of reinforced PCC pavement is recommended for standard duty sections. Six (6) inches of reinforced PCC pavement is recommended for heavy duty sections, such as at exit/entrance aprons. Seven (7) inches of reinforced PCC pavement is recommended for high stress areas, such as at the dumpster pad and approach.**
8. **Free water was encountered at depths of 12.5 to 14 feet during drilling and at 12.5 to 14 feet after completion of drilling Test Borings B2 through B4.**
9. **Granular soils were encountered in all of the borings; therefore, soil cave-in may be an issue during site excavations. Care should be taken during excavation operations to install the appropriate excavation protection.**

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS - DRAFT

PROPOSED CHICK-FIL-A RESTAURANT #5934
POWERS & PALMER PARK FSU
SEQ OF N. POWERS BOULEVARD AND PALMER PARK BOULEVARD
COLORADO SPRINGS, COLORADO
PROJECT NO. 4G-2411003

EXECUTIVE SUMMARY

The executive summary is provided solely for the purpose of overview. Any party who relies on this report must read the full report. The executive summary omits a number of details, any one of which could be crucial to the proper application of this report.

Site and Subsurface Conditions

- Site subsurface conditions were evaluated by performing a total of eleven (11) soil test borings extending to depths from 5± feet to 30± feet below existing grade.
- The site is located on the southeast quadrant (SEQ) of N. Powers Boulevard and Palmer Park Boulevard in Colorado Springs, El Paso County, Colorado.
- Fill and possible fill soils extending to depths of approximately 1.5 to 5.5 feet were observed below the existing pavement surface in all Test Boring except B4 and B6. The fill and possible fill generally consisted of loose to dense, brown, dark brown, tan, fine to coarse grained silty sand and occasional clayey sand and clayey, silty sand, all with trace to little gravel.
- Below the fill and possible fill in all Test Borings except B4 and B6 and from the surface in B4 and B6, native soils encountered generally consisted of loose to firm, brown, light brown, tan silty sand with varying amounts of gravel and clay to depths of 4 to 8.5 feet, followed by very loose to firm brown, tan, light brown, gray poorly graded sand with various amounts of silt and gravel to the maximum boring depth of 5 to 21 feet in all borings except B3. In Test Boring B3, the poorly graded sands were followed by firm to dense light brown, tan silty sand with trace gravel to of 25 feet, underlain by dense light brown, tan poorly graded sand with trace silty and gravel that extended to the maximum boring termination depth of approximately 30 feet.
- Free water was encountered at depths of 12.5 to 14 feet during drilling and at 12.5 to 14 feet after completion of drilling Test Borings B2 through B4.

Site Design Considerations

- The site is developed and occupied by a paved parking lot, landscape, utilities. Site preparation will require complete removal and proper disposal of the existing pavements and underground utilities that are not reused. Unsuitable materials might have been buried beneath the site surface from previous grading of the site during the construction of the parking lot.
- Disposal of debris should be in accordance with local, state, and federal regulations for the material type. Soil disturbed during demolition operations should be removed to a firm subgrade.
- Any surface vegetation, topsoil with adverse organic and unsuitable bearing materials are recommended to be removed.
- Site preparation will require complete removal and proper disposal of the existing pavements and underground utilities that are not reused. Unsuitable materials might have been buried beneath the site surface from previous grading of the site during the construction of the parking lot.

- After the site is rough graded, as needed, the site is recommended to be proof-rolled and, where feasible, proof-rolling should extend at least several feet beyond development areas. The decision to over excavate, moisture condition, and recompact these soils should be made following the proof roll at the time of construction.

Building Foundations and Floor Slab

- The foundations are recommended to consist of moderately rigid reinforced shallow footings and a grade supported reinforced floor slab. A monolithically poured turned-down slab could also be used for the building. The building pad subgrade should be scarified to a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content, and the soil compacted extending at least 5 feet beyond the building perimeter. The building pad should pass a proof roll. The building foundations subgrade should be scarified to a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content.
- The foundation is recommended to be designed using a 2,000 pounds per square foot (psf) maximum, net allowable soil bearing capacity and a maximum subgrade modulus of 65 pci.
- The floor slab is recommended to be designed as a grade-supported slab, minimum 5 inches in thickness with a minimum 4-inch-thick aggregate base course
- A soil Site Class D is recommended for seismic design.

Canopy Foundations

- Isolated shallow square footing foundations designed using a 2,000 pounds per square foot (psf) maximum, net allowable soil bearing capacity.
- The embedment depth of the square footings are recommended to be a minimum of about 7 feet below the top of the drive through lane.

Pavement

- Standard Duty Asphalt Pavement: Four (4) inches of asphaltic concrete pavement, underlain by six (6) inches of compacted aggregate base is recommended.
- Heavy Duty Asphalt Pavement: Five (5) inches of asphaltic concrete pavement, underlain by nine (9) inches of compacted aggregate base is recommended.
- Portland cement concrete pavement is recommended for high stress areas.
- Six (6) inches of reinforced PCC pavement is recommended for standard duty sections. Seven (7) inches of reinforced PCC pavement is recommended for heavy duty sections.
- Asphalt pavement and aggregate base and PCC pavement is recommended to be underlain by 8 inches of a scarified, moisture conditioned, and recompacted subgrade.

Construction/Design Considerations

- Corrosivity testing was in progress at the time of preparation of this draft report, therefore results and recommendations were not available. Corrosion results and recommendations will be provided in the Final report.
- Paving/sidewalks are recommended adjacent to the structure perimeter to reduce seasonal drying of the soils near the perimeter of the structure. Preventing large moisture fluctuations in the soils beneath the foundation/floor slab system is critical to foundation/slab performance.
- Construction traffic should be controlled and limited to the extent possible.

- Fill and Possible fill soils ranging from approximately 1.5 to 5.5 feet were encountered at the site, therefore, fill soils should be carefully evaluated during excavation and, may require over excavation and replacement or moisture conditioning and recompaction.
- Granular soils were encountered in all of the borings; therefore, soil cave-in may be an issue during site excavations. Care should be taken during excavation operations to install the appropriate excavation protection

GREEN: This site has been given a GREEN designation. No significant geotechnical engineering related construction concerns or problems are expected which are unusual or not typical to this general area, however. Fill material, where encountered, are recommended to be evaluated by a geotechnical engineer, at the time of construction, to determine if removal and replacement with engineered fill is necessary.

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS - DRAFT

PROPOSED CHICK-FIL-A RESTAURANT #5934
POWERS & PALMER PARK FSU
SEQ OF N. POWERS BOULEVARD AND PALMER PARK BOULEVARD
COLORADO SPRINGS, COLORADO
PROJECT NO. 4G-24110036

1.0 SCOPE OF SERVICES

This report provides the results of the *Geotechnical Engineering Exploration and Analysis* that Giles Engineering Associates, Inc. (Giles) conducted regarding the proposed development. The Geotechnical Engineering Exploration and Analysis included several separate, but related, service areas referenced hereafter as the Geotechnical Subsurface Exploration Program, Geotechnical Laboratory Services, and Geotechnical Engineering Services. The scope of each service area was narrow and limited, as directed by our client and in consideration of the proposed project. The scope of each service area is discussed subsequently in this report.

Geotechnical engineering recommendations for design and construction of the foundation and ground-bearing floor slab, canopy and paved areas are provided in this report. Site preparation recommendations are also given; however, those recommendations are only preliminary since the means and methods of site preparation will depend on factors that were unknown when this report was prepared. Those factors include the weather before and during construction, subsurface conditions that are exposed during construction, and finalized details of the proposed development.

Giles conducted a Phase I Environmental Site Assessment (ESA) regarding the subject site and the outcome of those services are given in a separate report, Giles Project No. 4E-2411004.

2.0 SITE DESCRIPTION

The site is located on the southeast quadrant (SEQ) of N. Powers Boulevard and Palmer Park Boulevard in Colorado Springs, El Paso County, Colorado. At the time the Geotechnical Field Study was performed, the site was developed and occupied by a paved parking lot, landscape islands, utilities and the surface was covered with asphalt concrete pavement, concrete sidewalks, curbs, and soil. Electrical poles and other utilities were observed scattered around the site. The topography of the site was generally flat with no discernible slope.

A 7 Eleven and Conoco gas station followed by N. Palmer Park Boulevard border the site to the north; an existing building borders the site to the east; Pizza Hut and its associated paved parking borders the site to the south; N Powers Blvd, followed by a paved parking lot border the site to the west.

According to a review of historical aerial photographs, the site was vacant, undeveloped land until 1983. In the 1983 aerial, the site was developed with a paved parking lot and appeared to remain unchanged until the time of the Geotechnical Field Study in December 2024.

3.0 PROJECT DESCRIPTION

The proposed Chick-fil-A restaurant will be a single-story type P14-LE-XP, 5,653± square foot, wood framed structure that will have a wood truss roof system. Other site improvements will include the construction of a drive-thru lane, outdoor patio area, parking area and curbing. The restaurant will not have a basement or other below-ground spaces. Exterior walls and interior columns will support the structure. The maximum combined live and dead loads for walls and columns will likely be about 2,000 pounds per lineal foot (plf) and 20,000 pounds, respectively. It is understood that the floor is to be a ground-bearing concrete slab designed to support a maximum of 100 pounds per square foot (psf) live load. A new parking lot, and automobile drive lanes, will be located to the east of the proposed building and double drive through lanes will be constructed along the northern, southern, and western sides of the site.

The proposed building and parking lot finished elevations were not available at the time of this report. Considering the site topography when the test borings were performed, it is assumed that no more than 2 feet of cut/fill will be needed for final site development. The following recommendations are based on the existing grades at the test borings at the time of the subsurface exploration and no more than 2 feet of cut or fill required to grade the site. It is recommended that the proposed grading plan, finished floor elevation and foundation construction drawings be forwarded to this office, when available for review, to determine if the provided geotechnical recommendations should be modified.

4.0 SUBSURFACE EXPLORATION PROGRAM

Subsurface conditions at the site were evaluated by drilling a total of eleven (11) test borings. The borings were advanced to depths ranging from 5 feet to 35 feet below existing ground surface utilizing a truck-mounted drill rig equipped with solid-flight augers. The approximate test boring locations are shown on the *Test Boring Location Plan*.

Samples were collected from the test borings, at certain depths, using a split-barrel sampler during Standard Penetration Testing (SPT) which are described in Appendix B, along with descriptions of other field procedures. Immediately after sampling, select portions of the samples recovered were retained and labeled at the site for identification. The retained samples were transported to *Giles*' geotechnical laboratory as part of the Geotechnical Subsurface Exploration Program.

5.0 LABORATORY TESTING PROGRAM

The retained samples were classified by Giles geotechnical personnel using the descriptive terms and particle-size criteria shown on the General Notes in Appendix D, and by using the Unified Soil Classification System (ASTM D 2488-75) as a general guide. The classifications are shown on the Test Boring Logs, along with horizontal lines that show estimated depths of material change. Field-related information pertaining to the test borings is also shown on the Test Boring Logs. For simplicity and abbreviation, the terms and symbols used on the Test Boring Logs are defined on the General Notes.

Laboratory tests were performed on selected samples recovered from the borings as summarized in the table below and included on the *Test Boring Logs* and Figures 2 through 4 in Appendix A.

SUMMARY OF LABORATORY TESTING				
Test Boring ID	**Sample Depth**	**ASTM D-4318**		**Percent Passing No. 200 Sieve (P200)**
	(feet)	**Liquid Limit (LL)**	**Plasticity Index (PI)**	**(%)**
B1	2-3.5	--	--	24.5
B2	9.5-11	--	--	9.7
B3	0-1.5	26	7	27.3
B3	4.5-6	--	--	17.9
B4	7-8.5	--	--	10.0
B6	4-6.5	--	--	20.6
B7	0-1.5	25	6	32.3
B9	0-1.5	27	10	27.3
Notes: tsf = tons per square foot				

As part of the Geotechnical Laboratory Services, the retained samples were screened with a Photoionization Detector (PID) to check for Volatile Organic Compound (VOC) vapors, such as vapors associated with gasoline. The results of the PID screening are on the Test Boring Logs.

6.0 MATERIAL CONDITIONS

Since material sampling at the test borings was discontinuous, it was necessary for Giles to assume conditions between sample intervals. The conditions encountered at the test borings and assumed between sample intervals are briefly discussed in this section and are described in more detail on the Test Boring Logs. Also, the conclusions and recommendations in this report are based on the conditions encountered and inferred between the test borings.

6.1. Surface Materials

The surface of the site is covered with 6± inches of asphalt concrete pavements, concrete curbs, and landscape islands with soil and sparse vegetation.

6.2. Subsurface Material

Fill and Possible fill: Fill and possible fill soils extending to depths of approximately 1.5 to 5.5 feet below existing ground surface (bgs) were observed below the existing pavement surface in all Test Boring except B4 and B6. The fill and possible fill generally consisted of loose to dense, brown, dark brown, tan, fine to coarse grained silty sand and occasional clayey sand and clayey, silty sand, all with trace to little gravel.

Native Soils: Below the fill and possible fill in all Test Borings except B4 and B6 and from the surface in B4 and B6, native soils encountered generally consisted of loose to firm, brown, light brown, tan silty sand with varying amounts of gravel and clay to depths of 4 to 8.5 feet, followed by very loose to firm brown, tan, light brown, gray poorly graded sand with various amounts of silt and gravel to the maximum boring depth of 5 to 21 feet in all borings except B3. In Test Boring B3, the poorly graded sands were followed by firm to dense light brown, tan silty sand with trace gravel to of 25 feet, underlain by dense light brown, tan poorly graded sand with trace silty and gravel that extended to the maximum boring termination depth of approximately 30 feet bgs.

7.0 CORROSIVITY

Corrosivity testing was in progress at the time of preparation of this draft report, therefore results and recommendations were not available. Corrosion results and recommendations will be provided in the Final Report.

8.0 GROUNDWATER CONDITIONS

Free water was encountered at depths of 12.5 to 14 feet during drilling and at 12.5 to 14 feet after completion of drilling Test Borings B2 through B4. The remaining borings appeared to be dry during drilling and upon completion of drilling.

Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Groundwater may require special attention if encountered during construction.

Estimation of the water table by observation of open boreholes in a soil profile is difficult even after several days of observation. The actual water table depth may be higher or lower than estimated. If a more precise depth estimate is needed, groundwater observation wells are recommended to be installed at the site and observed. Giles can install and observe the wells if it is decided that observation wells are necessary.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1. Seismic Design Considerations

A soil Site Class D is recommended for seismic design based on Table 20.3-1 of Chapter 20 of ASCE 7 which is accordance with Section 1613.2.2 of Chapter 16 of the 2021 International Building Code By definition, Site Class is based on the average properties of subsurface materials to a depth of 100 feet below the ground surface. Since 100-foot-deep test borings were not requested or authorized for the project, it was necessary to estimate the subsurface conditions below the exploration depths based on the test borings and presumed area geology.

9.2. Design Considerations

The site is underlain by generally fill, possible fill and native silty sand with varying amounts of silt and gravel to 4 to 5.5, followed by poorly graved sand with varying amount of silt and clay to depths of 5 to 21 feet, followed by silty sand with trace gravel to depths of 25 feet. In the Test Boring B3, the silty sands were followed poorly graded sand with trace gravel and silt that extended to the maximum boring termination depth of approximately 30 feet bgs.

Possible fill and fill materials, where encountered, are recommended to be evaluated by a geotechnical engineer. These soils may require over excavation and replacement or moisture conditioning and recompaction if they occur in the building pad area. The decision to over excavate, moisture condition, and recompact these soils should be made following the proof roll at the time of construction. Disposal of any unsuitable material should be in accordance with local, state, and federal regulations for the material type. This report might need to be revised if conditions are encountered that differ from those described herein and reported on the Test Boring Logs.

The Potential Vertical Rise (PVR) was estimated based on the existing soil conditions utilizing the laboratory testing performed. Briefly, the PVR is defined as the potential of the soil material, based upon given conditions, to swell and thereby increase the upper surface elevation along with any structure resting on it. The PVR for the proposed structure supported on the existing soils encountered at the test borings has been estimated to be 1± inch or less, which is considered to be below tolerable limits.

Giles should review the finished grading plan when it becomes available to assess the validity of our recommendations and provide revised recommendations if necessary.

Based on the subsurface soils encountered at the borings and site-specific considerations, geotechnical design parameters are provided for a moderately rigid reinforced shallow foundation system on properly prepared subgrade.

9.3. Moderately Rigid Shallow Foundation and Floor Slab

Foundations

The foundations are recommended to consist of moderately rigid reinforced shallow footings (*i.e.,* continuous strip and/or spread footings) and a grade supported reinforced floor slab for the building. A monolithically poured turned-down slab could also be used for the building.

The building pad subgrade should be scarified a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content, and the soil compacted and pass a successful proof roll.

The building foundations subgrade should be scarified to a minimum of 10 inches, the soil moisture content adjusted to between -1 to +3% above the optimum moisture content, and the soil compacted.

The foundations bearing on properly prepared subgrade are recommended to be designed for a 2,000 psf maximum, net, allowable soil bearing capacity. The recommended allowable soil bearing pressure may be increased by ⅓ for short term wind and/or seismic loads. Strip footing pads are recommended to be at least 14 inches wide and isolated column pads are recommended to be at least 24 inches wide for geotechnical engineering considerations, regardless of the calculated foundation bearing stress. The foundation is recommended to be designed based on a maximum Modulus of subgrade reaction of 65 pci. A combination of footing pad and stemwall reinforcement could be used to provide the intended rigidity. Foundation walls could be built of cast-in-place concrete or concrete masonry units. It is recommended that a structural engineer provide the specific foundation details including footing dimensions, reinforcing, and other details.

Frost embedment depth is understood to be 36 inches in this area. The footings for perimeter walls and other exterior elements of the proposed structure are therefore recommended to bear at least 36 inches below the finished exterior grade. Interior footings could be directly below the floor slab in portions of the building that will be heated, and the support soil will not freeze. The foundation analysis was conducted assuming that the perimeter and interior foundations will bear at about 3¼ and 2 feet below the floor surface, respectively.

Foundation excavations are recommended to be dug with a smooth-edge backhoe bucket to develop a relatively undisturbed bearing grade. A toothed bucket will likely disturb foundation-bearing soil more than a smooth-edge bucket, thereby making soil at the excavation base more susceptible to saturation and require recompaction and instability, especially during adverse weather. It is critical that contractors protect foundation support soil and foundation construction materials.

Foundation Support Soil Requirements

It is recommended that the strength characteristics of soil within the entire foundation influence zone meet or exceed the recommended values unless *Giles* approves lesser values. It is further recommended that Giles evaluate foundation support soil immediately before foundation construction. The purpose of the recommended evaluation is to confirm that the foundation will be properly supported. In the event that another firm performs the recommended evaluation of foundation support soil, they should use appropriate means and methods and Giles must be notified if the composition or strength characteristics of the foundation support soil differ from the recommended value. Soil that is within the foundation influence zone but does not meet the recommended strength criteria (described above), or is otherwise unsuitable, is recommended to be removed and replaced. A relatively level and uniform bearing grade is required for the foundation. All footings must be directly supported by suitable on-site native soil. Based on the recommended 2,000 psf maximum, net, allowable soil bearing capacity, and a maximum subgrade modulus (Ks) of 65 pci, the granular native soils, within foundation influence zones is recommended to have a corrected N-value (determined from SPT's and correlated from other in-situ tests) of at least 14, based on the recommended bearing capacity.

The post-construction total and differential movement of the shallow depth foundation system designed and constructed based on the recommendations of this report are estimated to be less than 1.25 inch and 0.75 inch, respectively. The post-construction angular distortion is estimated to be less than 0.003 across a distance of 20 feet or more.

Floor Slab

Assuming a maximum 100 psf floor load, the floor slab is recommended to be at least 5 inches thick for geotechnical purposes. The actual design thickness and strength of the concrete floor slab should be based on structural loading and local building code considerations and based on a maximum subgrade modulus of 65 pci. It is recommended that a structural engineer specify the floor slab thickness, reinforcing, joint details and other parameters.

A minimum 4-inch-thick free-draining granular base is recommended to be directly below the floor slab to serve as a capillary break and help develop more uniform support. It is recommended that the base consist of free-draining aggregate. Also, it is recommended that Giles test and approve base course aggregate or sand before it is placed. Depending on gradation, a geotextile might need to be below the base course.

A minimum 15-mil moisture vapor retarder is recommended to be directly below the floor slab or base course throughout the entire floor area. It is recommended that a structural engineer or architect specify the vapor retarder location with careful consideration of concrete curing and the effects of moisture on future flooring materials. The moisture vapor barrier is recommended to be in accordance with ASTM E 1745-97, which is entitled: *Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs*. If the base course has sharp, angular aggregate, protecting the barrier with a geotextile (or by other means) is recommended.

The post-construction total and differential movements of an isolated floor slab constructed in accordance with the recommendations of this report are estimated to be less than 0.6 inch and 0.4 inch, respectively, over a distance of about 20 feet.

9.4. Canopy Recommendations

Based on the Canopy Footings Design Note# 2021-007, provided by Chick-fil-A, dated 03/10/21, either square or round footings will be used to support the proposed canopy structures. Recommendations for isolated shallow square footing foundations are provided for the proposed canopies due to the presence of granular soils that are not feasible for the construction of drilled circular footings.

Footing Foundations

Shallow foundations bearing on native soil that has not been activated by exposure to moisture may be designed using a 2,000 psf maximum, net, allowable soil bearing capacity. The square footing or drilled circular foundations are recommended to extend at least 7 feet below the top of the drive through lanes.

Minimum foundation widths for square footings should be 24 inches footings, regardless of actual soil pressure. The maximum bearing value applies to combined dead and sustained live loads. The recommended allowable soil bearing pressure may be increased by ⅓ for short term wind and/or seismic loads.

Reinforcing

The design of the foundations as well as determination of the actual quantity of steel reinforcing and the footing dimensions should be performed by the structural engineer.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. Passive pressure and friction may be used in combination, without reduction, in determining the total resistance to lateral loads. A one-third increase in the passive pressure value may be used for short duration wind or seismic loads.

A coefficient of friction of 0.35 may be used with dead load forces for footings placed on newly placed compacted fill soil. An allowable passive earth pressure of 250 psf per foot of footing depth (pcf) below the lowest adjacent grade may be used for the sides of footings placed against competent materials or newly placed structural fill.

Bearing Material Criteria

All footings must be directly supported by suitable bearing (non-organic) on site soil, and/or by new engineered fill placed directly on suitable soil. Based on the recommended 1,500 psf maximum, net, allowable soil bearing capacity, the granular native soils, within foundation influence zones is recommended to have a corrected N-value (determined from SPT's and correlated from other in-situ tests) of at least 7, based on the recommended bearing capacity. It is further recommended that the strength characteristics of soil within all foundation influence zones (determined by geotechnical engineer during construction) meet or exceed the recommended values unless Giles approves other values.

Evaluation of the foundation bearing soils is recommended to be performed by the geotechnical engineer at the time of foundation construction prior to placement of reinforcing steel. The depth of evaluation should be determined by the geotechnical engineer. If unsuitable bearing soils are encountered, they should be recompacted in-place if feasible, or excavated to a suitable bearing soil subgrade and to a lateral extent as defined by Item No. 3 of the enclosed Guide Specifications, with the excavation backfilled with structural compacted fill to develop a uniform bearing grade. Alternatively, footings may be extended in depth so that they are underlain by suitable bearing materials.

Foundation Embedment

The embedment depth of the footings is designed to be about 7 feet below the top of the drive through lane. All footings must be protected against weather and water damage during and after construction and must be supported within suitable bearing materials.

Estimated Foundation Movement

Post-construction total and differential static settlement of a shallow foundation system designed and constructed in accordance with the recommendations provided in this report are estimated to be less than 1 and 0.5 inch, respectively, for static conditions.

9.5. Pavement Recommendations

It is understood, the typical traffic at Chick-fil-A sites consists of 3 large tractor-trailer trucks per week and 4 general delivery trucks per day. Therefore, the pavement section is based on an estimated maximum daily traffic volume consisting of 50,000-pound equivalent single axle loads (ESALs).

It is recommended that the project owner, developer, civil engineer and other design professionals involved with the project confirm that the design traffic volumes are appropriate. If requested, Giles can provide supplemental pavement recommendations based upon other traffic conditions if the design traffic volumes are not appropriate. If the pavement section is subject to traffic greater than assumed, increased maintenance and premature failure could occur.

A California Bearing Ratio (CBR) test is commonly used to determine soil support parameters for pavement design. Since a CBR test or other appropriate test was not authorized for this project, it was necessary for Giles to assume the CBR value used to give pavement recommendations. The following pavement sections are based on an assumed CBR value of 8, considering the presence of clayey soils. Engineered fill that is placed in proposed pavement areas is recommended to have a CBR value equal to or greater than 8 and the fill is recommended to be placed and compacted per the recommendations of this report.

The required pavement thickness and the performance of the pavement will depend in large part upon the strength and uniformity of the subgrade. The subgrade must be made reasonably uniform, with no abrupt changes in degree of support and with subgrade soils that are uniform in material and density. Attention to this aspect of pavement construction is often neglected, especially for light traffic pavements. It is important to note that soft spots that show up during construction should be excavated and recompacted with the same or similar soil as in the adjacent subgrade.

Recommendations for both new rigid Portland cement concrete and flexible hot mix asphalt pavement sections have been provided for the proposed site. The pavement recommendations assume that the pavement sub-grade will be prepared per this report, the base course (where used) will be properly drained, and *Giles* will observe and test pavement construction. The pavement was designed based on AASHTO design parameters for a twenty-year design period. Pavement maintenance along with a major rehabilitation after about 8 to 10 years should be expected. Local codes may require specific testing to determine soil support characteristics and/or minimum pavement section thicknesses might be required.

Hot Mix Asphalt Pavement Alternate

Standard and heavy duty asphaltic concrete pavement sections as shown in the following table can be considered.

<table>
<tr><th colspan="5">HOT MIX ASPHALT (HMA) PAVEMENT SECTIONS</th></tr>
<tr><th colspan="2" rowspan="2">Material</th><th colspan="2">Section Thickness (Inches)</th><th rowspan="2">Colorado DOT Standard Specifications</th></tr>
<tr><th>Standard Duty</th><th>Heavy Duty</th></tr>
<tr><td colspan="2">Hot Mix Asphalt Surface Course</td><td>1½</td><td>1½</td><td>Section 403</td></tr>
<tr><td colspan="2">Hot Mix Asphalt Binder Course</td><td>2½</td><td>3½</td><td>Section 403</td></tr>
<tr><td colspan="2">Aggregate Base Course</td><td>6</td><td>9</td><td>Section 304, Class 6</td></tr>
<tr><td>Subgrade</td><td>Scarify, Moisture Condition & Recompact Subgrade</td><td>8</td><td>8</td><td>--</td></tr>
</table>

Depending on the site and weather conditions at the time of construction it may be necessary to further stabilize the subgrade. Additional recommendations, if necessary, can be supplied at the time of construction.

Portland Cement Concrete pavement is recommended in high-stress areas such as at the drive-through pavement, lot entrance and exit aprons, and at dumpster enclosures. Recommendations for Portland Cement Concrete pavement are presented below.

Portland Cement Concrete Pavement Alternate

As an alternate, pavement could consist of Portland cement concrete (PCC) pavement. The PCC pavement is recommended to be underlain with a minimum 8-inch thick scarified, moisture conditioned, and recompacted subgrade. The concrete should have a minimum 28-day compressive strength of 4,000 psi with 4 to 7 percent air entrainment; The pavement should be reinforced with No. 4 steel reinforcement bars at 18 inches on-center each-way, which should be at about mid-height within the slab.

Based upon the assumed traffic intensity, the concrete pavement should be at least 5 inches thick. In heavy duty areas, such as at the entrance/exit aprons, drive-through pavement and in areas where trucks will turn or will be parked, however, the pavement is recommended to be at least 6 inches thick. Seven (7) inches of reinforced PCC pavement is recommended for high stress areas, such as at the dumpster pad and approach. If pavement sections greater than six inches are utilized, then No. 3 steel reinforcing bars, spaced at 14 inches on center each way, should be utilized. Tie bars should be at all construction joints parallel to traffic and consist of grade 40, No. 4 reinforcing bars 24 inches in length and 48 inches on-center. Three-quarter (¾) inch diameter lubricated smooth dowel bars should be at all control joints perpendicular to traffic.

The dowel bars should be 18 inches long and 12 inches on-center. Control joint spacing should be determined in accordance with the current ACI code. ACI 330R-08 (*Guide for Design and Construction of Concrete Parking Lots*) recommends a maximum contraction joint spacing of 15 feet for a pavement thickness 6 inches or greater and a maximum spacing of 12.5 feet for a pavement thickness of 5 inches. Contraction joint panels should divide pavements into approximate square panels. The length of a panel should not be more than 25% greater than the width. Expansion joints should be provided where pavement abuts fixed objects, such as the buildings and light poles. Materials and construction procedures for the PCC pavement should be in accordance with Colorado DOT Standard Specifications Section 412 for concrete.

9.6. Generalized Site Preparation Recommendations

The means and methods of site preparation will greatly depend on the weather conditions before and during construction, the subsurface conditions that are exposed during earthwork operations, and the finalized details of the proposed development. Therefore, only generalized site preparation recommendations are given.

In addition to being generalized, the following site preparation recommendations are abbreviated; the *Guide Specifications* in Appendix D gives additional recommendations. The *Guide Specifications* should be read along with this section. Also, the *Guide Specifications* are recommended to be used as an aid to develop the project specifications.

Demolition, Clearing, Grubbing and Stripping

The site is developed and occupied by a paved parking lot, landscape, utilities and the surface is covered with asphalt concrete pavement, concrete sidewalks, curbs, and soils. Site preparation will require complete removal and proper disposal of the existing pavements and underground utilities that are not reused. Unsuitable materials might have been buried beneath the site surface from previous grading of the site during the construction of the parking lot.

Disposal of debris should be in accordance with local, state, and federal regulations for the material type. Soil disturbed during demolition operations should be removed to a firm subgrade. All excavations must be backfilled with engineered fill performed under engineering-controlled conditions, and fill should be properly benched into surrounding soils.

Any surface vegetation, topsoil with adverse organic content including tree roots and root balls, and otherwise unsuitable bearing materials are recommended to be removed from the proposed building footprint, pavement areas, other structural areas, and areas to receive any fill to raise site grades. Clearing, grubbing, and stripping should extend at least several feet beyond proposed development areas, where feasible. All excavations must be backfilled with engineered fill performed under engineering-controlled conditions, and fill should be properly benched into surrounding soils. Refer to the Guide Specifications enclosed within Appendix D for additional recommendations regarding fill selection, placement, and compaction, including deep fill.

Existing Fill Considerations

Fill and possible fill soils extending to depths of approximately 1.5 to 5.5 feet bgs were encountered in some of the Test Borings. If fill materials are encountered at greater depths than observed during the field exploration, the fill materials are recommended to be evaluated by a geotechnical engineer and the decision to over excavate, moisture condition, and recompact these soils should be made following the proof roll at the time of construction. These soils may require over excavation and replacement or moisture conditioning and recompaction for the building pad area. For pavement areas, the decision to over excavate, moisture condition, and recompact these soils should be made following the proof roll at the time of construction. Disposal of any unsuitable material should be in accordance with local, state, and federal regulations for the material type. This report might need to be revised if conditions are encountered that differ from those described herein and reported on the Test Boring Logs.

<u>Proof-Rolling and Fill Placement</u>

After the recommended clearing, grubbing, and stripping operations the sub-grade is recommended to be proof-rolled with a fully loaded, tandem-axle dump truck or other suitable construction equipment to help locate unstable soil based on sub-grade deflection caused by the wheel loads of the proof-roll equipment. After the site is rough graded, as needed, the portions of the site to be redeveloped are recommended to be proof-rolled and, where feasible, proof-rolling should extend at least several feet beyond development areas. The decision to over excavate, moisture condition, and recompact these soils should be made following the proof roll at the time of construction. It is recommended that *Giles* observe proof-roll operations and evaluate the sub-grade stability based on those observations.

Soil that yields excessively or ruts during proof-rolling, or shows other signs of instability, is recommended to be replaced with engineered fill. As an option to replacement, unsuitable soil could be scarified to a sufficient depth (likely 6 to 12 inches, or more), moisture-conditioned (uniformly moistened or dried), and compacted to the required in-place density. Unsuitable soil could also be modified with hydrated lime or Portland cement, or mechanically stabilized with coarse aggregate and/or geosynthetics (geogrids, geotextiles, etc.). Soil improvement recommendations can be provided by *Giles* based on the conditions during construction.

The site is recommended to be raised, where necessary, to the planned finished grade with engineered fill immediately after the sub-grade is confirmed to be stable and suitable to support the proposed site improvements. Engineered fill is recommended to be placed in uniform, relatively thin layers (lifts). Each layer of engineered fill is recommended to be compacted to at least 95 percent of the fill material's maximum dry density determined from the geotechnical test titled: *Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort* (ASTM D698). That test is hereafter referenced as: *The Standard Proctor Compaction test*. As an exception, the in-place dry density of engineered fill for the top one foot of the pavement sub-grade is recommended to be compacted to at least 100 percent of the fill's maximum dry density. Item Nos. 4 and 5 of the *Guide Specifications* give more specific information pertaining to selection and compaction of engineered fill.

The water content of fill material is recommended to be uniform and within a narrow range of the optimum moisture content, as described in Item No. 5 of the *Guide Specifications*. The optimum moisture content is to be determined by the Standard Proctor Compaction test.

Engineered fill that does not meet the density and water content requirements is recommended to be replaced or scarified to a sufficient depth (likely 6 to 12 inches, or more), moisture-conditioned, and compacted to the required density. A subsequent lift of fill should only be placed after *Giles* confirms that the previous lift was properly placed and compacted. Sub-grade soil may need to be recompacted immediately before construction since equipment traffic and adverse weather may reduce soil stability.

Use of Site Soil as Engineered Fill

Site soil that does not contain adverse organic content or other deleterious materials, as noted in the *Guide Specifications*, could be used as engineered fill. Site soil may need to be moisture-conditioned prior to use as engineered fill. The soils must be placed and maintained at a moisture content that is within a narrow range of the optimum moisture content as determined by Standard Proctor (ASTM D-698) procedures for proper compaction as noted in the enclosed *Guide Specifications*. The moisture requirements should be given as much importance as the density requirements to reduce the potential for future volume change of the sandy soil. The suitability of engineered fill materials is recommended to be evaluated by *Giles* prior to placement. Additional recommendations regarding fill selection, placement and compaction are given in the *Guide Specifications*.

9.7. Generalized Construction Considerations

Import Soil Considerations

Suitable material for use as engineered fill is recommended to consist of low-expansive material, with a Liquid Limit of 30 or less and a Plasticity Index between 4 and 15. Low expansive material may be compacted at a moisture content that is within –1 to +3 percent of the optimum moisture content determined by ASTM D698. The suitability of import fill materials should be evaluated by *Giles* prior to placement.

Adverse Weather

Site soil can be sensitive to adverse weather, increased moisture, excess construction traffic and excess vibrations of construction vehicular activity. Construction traffic should be controlled and limited to the extent possible. Excessive construction traffic should be restricted to certain aggregate-covered areas to reduce the risk of the site soils pumping and rutting.

In an effort to protect soil from adverse weather, the site surface is recommended to be smoothly graded and contoured to divert surface water away from construction areas. Also, contoured subgrades are recommended to be rolled with a smooth-drum compactor, before precipitation, to “seal” the surface. Furthermore, construction traffic should be restricted to certain aggregate-covered areas in an effort to reduce construction traffic-related soil disturbance. Foundation, floor slab and pavement construction should begin immediately after suitable support is confirmed.

Area Flatwork

It should be noted that ground-supported flatwork such as walkways, etc. will be subject to the same magnitude of potential soil-related movements as discussed previously. Thus, where ground-supported flatwork such as walkways, etc. abut rigid building foundations or isolated/suspended structures, differential movements should be anticipated. As a minimum, we recommend that flexible joints be provided where such elements abut the main structure to allow for differential movement at these locations. Where the potential for differential movement is objectionable, it may be beneficial to consider methods of reducing anticipated movements.

Existing Utilities

All existing utilities should be identified and located, and any planned to be maintained should be relocated outside the proposed development area. Utilities that are not reused should be capped off and removed in accordance with local codes and ordinances. Excavations for the removal of utilities are recommended to be backfilled with engineered fill placed under engineering-controlled conditions. Grading operations must be done carefully so that existing utilities are not damaged or disturbed. Utility invert elevations, depths and sizes should be checked relative to the planned foundation elevations to identify specific concerns.

New Utilities/Landscaping

Final grading, plumbing design, and positioning of landscaped areas is important so that surface and sprinkler water, and building roof drainage, does not collect around the structure. Any plumbing leaks that develop must be corrected immediately. We recommend paving/sidewalks be placed adjacent to the structure perimeter to reduce seasonal drying of the soils near the perimeter of the structure. Irrigation of lawn and landscaped areas should be moderate, with no excessive wetting or drying of soils around the perimeter of the structure allowed. Positive drainage away from the structure should also be provided. Trees and bushes/shrubs planted near the perimeter of the structure can withdraw large amounts of water from the soils and should be planted at least their anticipated mature height away from the building. Flexible couplings are recommended to be used for utilities where they connect with the proposed structure to accommodate the possible movements of the structure.

Utility cuts should not be left open for extended periods of time and should be properly backfilled. Backfilling should be accomplished with properly compacted on-site cohesive soils, rather than granular materials. If granular materials are used, a utility trench cut-off at the building line is recommended to help prevent water from migrating through the utility trench backfill to beneath the proposed structure. Flexible couplings and expansion sleeves are recommended to be used for utilities where they connect with the proposed structure to accommodate the possible movements of the structure.

Dewatering

Free water was encountered at depths of 12.5 to 14 feet during drilling and at 14 feet after completion of drilling Test Borings B2 through B4. Therefore, some dewatering might be needed during construction due to precipitation or if a shallow perched water level is encountered. Water that accumulates in construction areas is recommended to be removed from excavations and other construction areas, along with unstable soil as soon as possible. Filtered sump pumps, drawing water from sump pits excavated in the bottom of construction trenches, will likely be adequate to remove water that collects in shallow excavations. Excavated sump pits should be fully-lined with a geotextile and filled with open-graded, free-draining aggregate.

Excavation Stability

Granular soils were encountered in all of the borings; therefore, soil cave-in may be an issue during site excavations. Care should be taken during excavation operations to install the appropriate excavation protection. Excavations are recommended to be made in accordance with current OSHA excavation and trench safety standards, and other applicable requirements. Sides of excavations might need to be sloped or braced to maintain or develop a safe work environment. Temporary shoring must be designed according to applicable regulatory requirements. Contractors are responsible for excavation safety.

9.8. Recommended Construction Materials Testing Services

This report was prepared assuming that Giles will perform Construction Materials Testing ("CMT") services during construction of the proposed development. In general, CMT services are recommended (and expected) to at least include observation and testing of foundation, floor slab and pavement support soil; concrete; asphalt, and other construction materials. It might be necessary for Giles to provide supplemental geotechnical engineering recommendations based on the results of CMT services and specific details of the project not known at this time.

10.0 BASIS OF REPORT

This report is strictly based on the project description given earlier in this report. Giles must be notified if any parts of the project description or our assumptions are not accurate so that this report can be amended, if needed. This report is based on the assumption that the facility will be designed and constructed according to the codes that govern construction at the site.

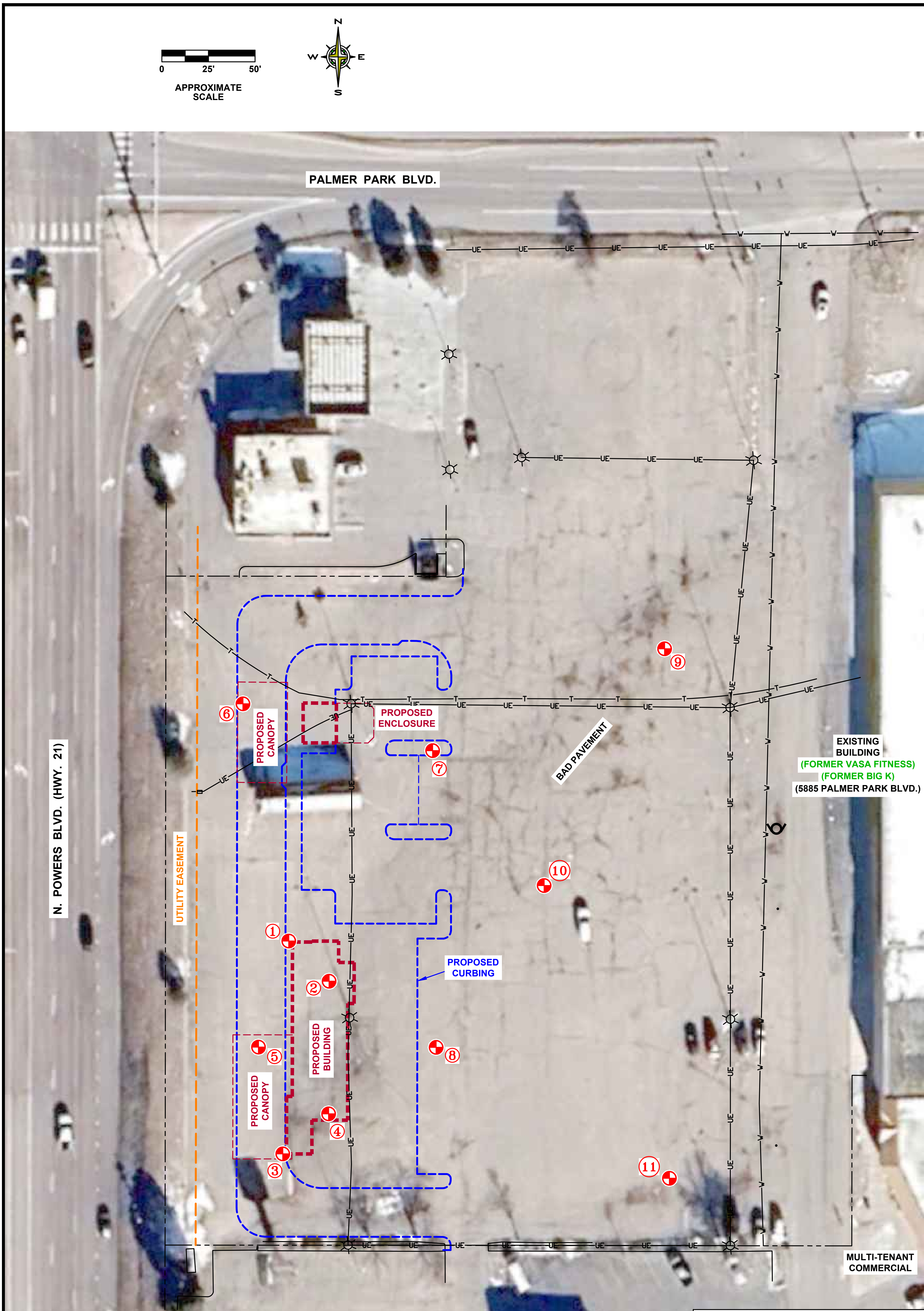
The conclusions and recommendations in this report are based on the encountered and inferred subsurface conditions as shown on the Test Boring Logs. Giles must be notified if the subsurface conditions that are encountered during construction of the proposed development differ from those shown on the Test Boring Logs because this report will likely need to be revised. General comments and limitations of this report are given in the appendix.

APPENDIX A

FIGURES AND TEST BORING LOGS

The Test Boring Location Plan contained herein was prepared based upon information supplied by *Giles'* client, or others, along with *Giles'* field measurements and observations. The diagram is presented for conceptual purposes only and is intended to assist the reader in report interpretation.

The Test Boring Logs and related information enclosed herein depict the subsurface (soil and water) conditions encountered at the specific boring locations on the date that the exploration was performed. Subsurface conditions may differ between boring locations and within areas of the site that were not explored with test borings. The subsurface conditions may also change at the boring locations over the passage of time.



GILES ENGINEERING ASSOCIATES, INC.
N8 W22350 JOHNSON DRIVE, SUITE A1
WAUKESHA, WI 53186 (262)544-0118
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FIGURE 1
TEST BORING LOCATION PLAN
PROPOSED CHICK-FIL-A RESTAURANT NO. 05934
POWERS & PALMER PARK FSU
SEQ OF N. POWERS BLVD. AND PALMER PARK BLVD.
COLORADO SPRINGS, COLORADO

DESIGNED	DRAWN	SCALE	DATE	REVISED
CNM/CR	[signature]	approx. 1"=50'	11-18-24	--
PROJECT NO.: 4G-24110003			CAD No. 4g2411003-blp	

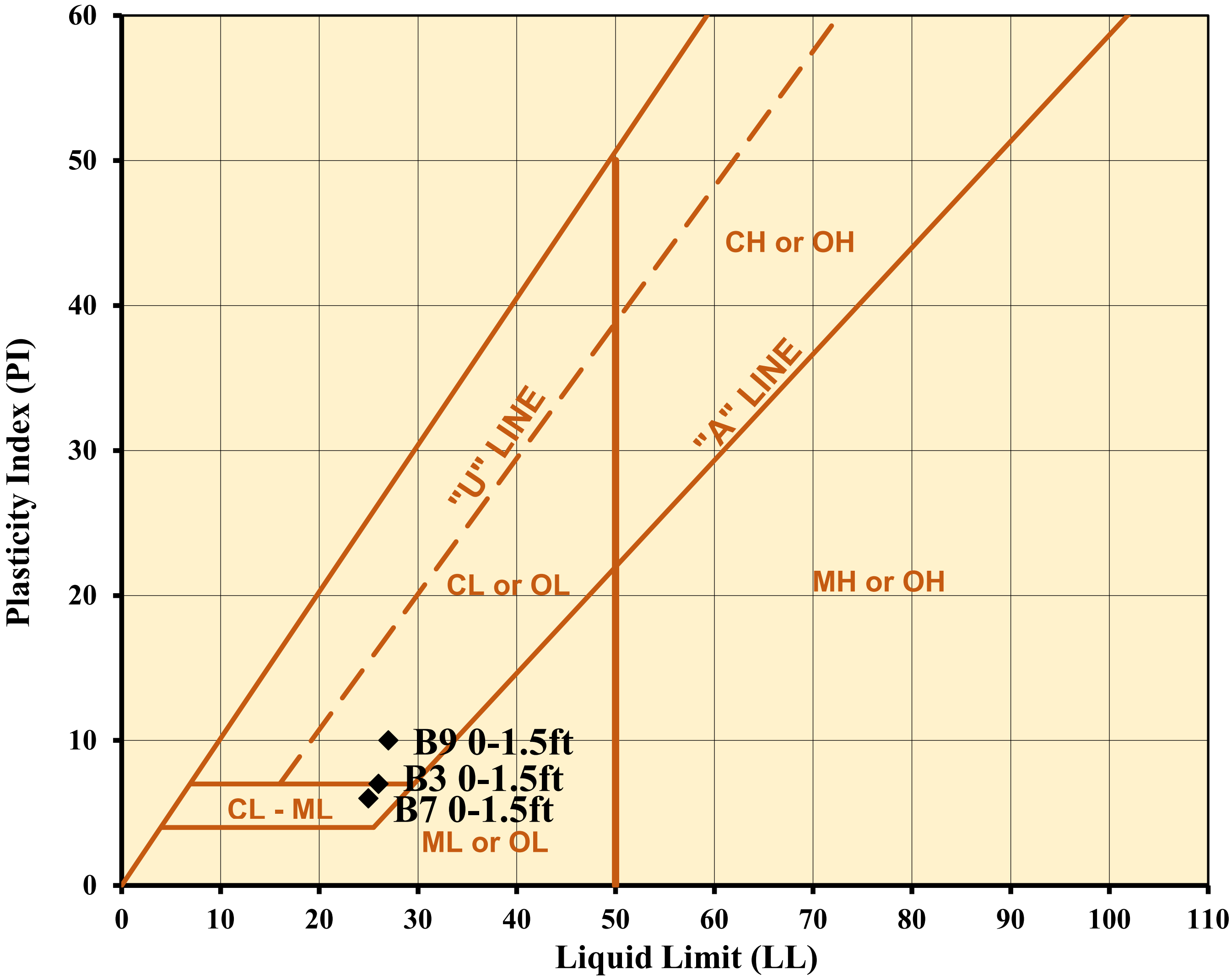
NOTES:
1.) TEST BORING LOCATIONS ARE APPROXIMATE.
2.) PROPOSED FEATURES ARE APPROXIMATE BASED ON THE "ENGINEERED SITE PLAN", DATED 9-25-2024, PREPARED BY MERRICK.

LEGEND:
- GEOTECHNICAL TEST BORING
- PROPERTY LINE
- TELECOMMUNICATIONS LINE
- UNDERGROUND ELECTRIC LINE
- LIGHT POLE
- WATER LINE
- FIRE HYDRANT

GILES ENGINEERING ASSOCIATES, INC.

R18
D4318

SOIL CLASSIFICATION - PLASTICITY INDEX (PI) CHART



Boring	Depth	Liquid Limit	Plastic Limit	Plasticity Index
B3	0-1.5	26	19	7
B7	0-1.5	25	19	6
B9	0-1.5	27	17	10

Sample Preparation Type:
Wet Method

Liquid Limit Procedure Type:
Method B - Single Point

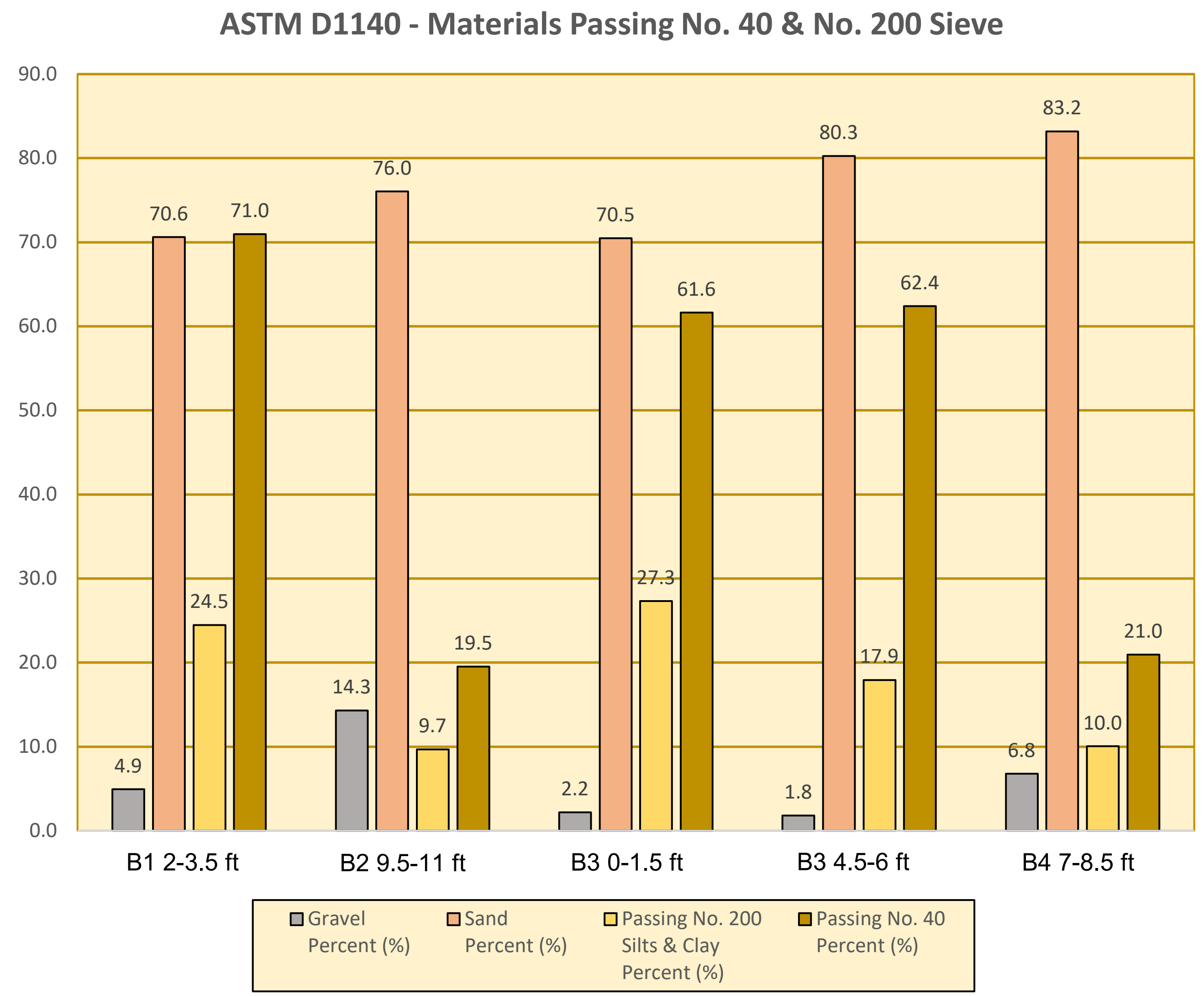
Plastic Limit Procedure Type:
Hand Rolled

Client:	**Chick-fil-A, Inc.** **Atlanta, Georgia**
Project:	**Proposed Chick-fil-A Restaurant #5934** **Powers & Palmer Park FSU** **Colorado Springs, Colorado**
Project No.:	**4G-2411003**

Figure No.: 2

Giles Engineering Associates, Inc.

R18
D1140



Boring No.	**Depth**	**Sample Weight (g)**	**Gravel** Percent (%)	**Sand** Percent (%)	**Passing No. 200 Silts & Clay** Percent (%)	**Passing No. 40** Percent (%)
B1	2-3.5 ft	103.0	4.9	70.6	24.5	71.0
B2	9.5-11 ft	104.0	14.3	76.0	9.7	19.5
B3	0-1.5 ft	150.0	2.2	70.5	27.3	61.6
B3	4.5-6 ft	101.0	1.8	80.3	17.9	62.4
B4	7-8.5 ft	103.0	6.8	83.2	10.0	21.0

Sample Date: December 9, 2024
Date Tested: December 17, 2024

Test Method Used: Method B - Cohesive
Soaking Time (HRS): 26.0

Client: **Chick-fil-A, Inc.**
Atlanta, Georgia

Project: **Proposed Chick-fil-A Restaurant #5934**
Powers & Palmer Park FSU - Colorado Springs, Colorado

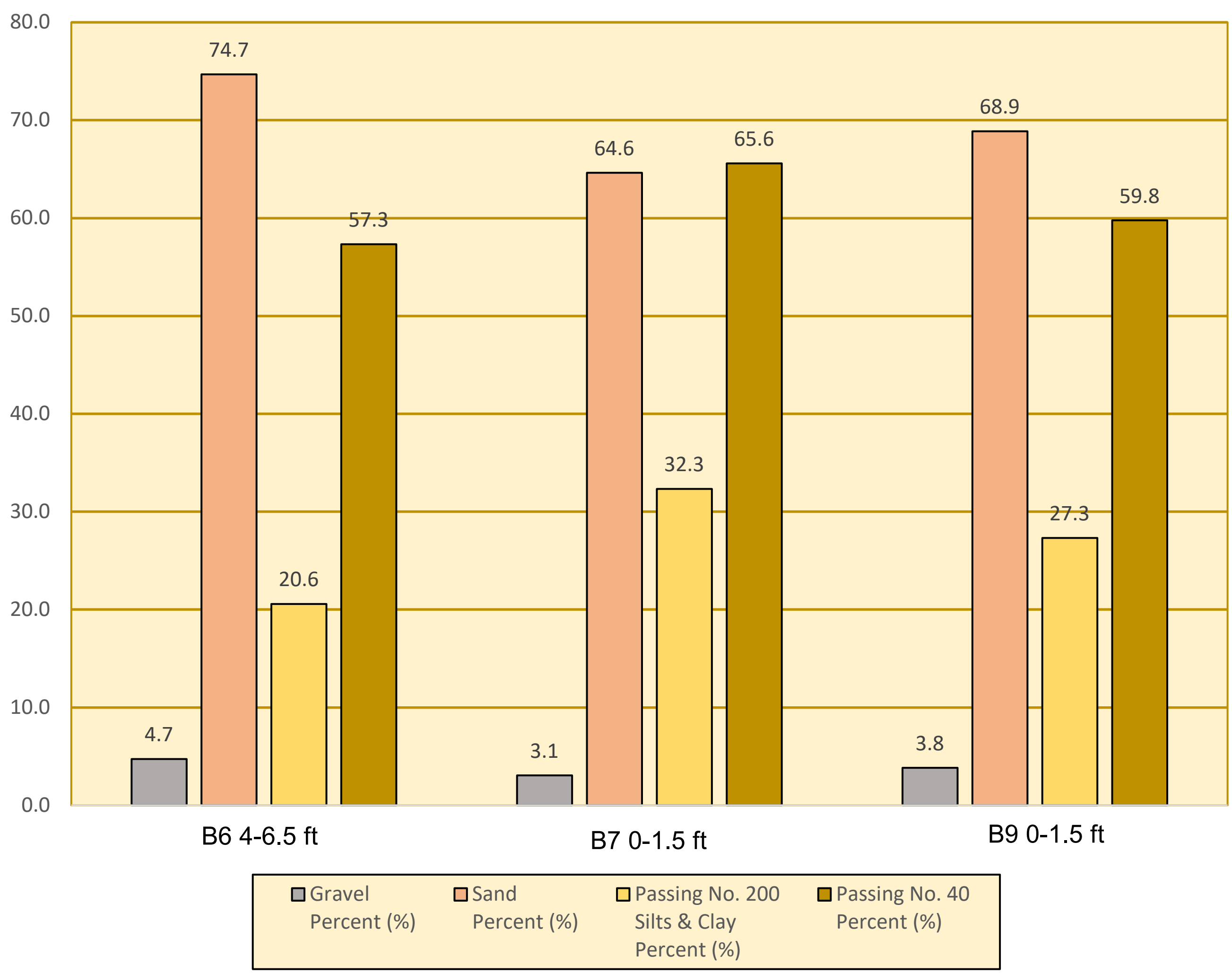
Project No.: **4G-2411003**

Figure No.: **3**

Giles Engineering Associates, Inc.

R18
D1140

ASTM D1140 - Materials Passing No. 40 & No. 200 Sieve



Boring No.	Depth	Sample Weight (g)	Gravel Percent (%)	Sand Percent (%)	Passing No. 200 Silts & Clay Percent (%)	Passing No. 40 Percent (%)
B6	4-6.5 ft	102.0	4.7	74.7	20.6	57.3
B7	0-1.5 ft	103.0	3.1	64.6	32.3	65.6
B9	0-1.5 ft	105.0	3.8	68.9	27.3	59.8

Sample Date: December 9, 2024
Date Tested: December 17, 2024

Test Method Used: Method B - Cohesive
Soaking Time (HRS): 26.0

Client: Chick-fil-A, Inc.
Atlanta, Georgia
Project: Proposed Chick-fil-A Restaurant #5934
Powers & Palmer Park FSU - Colorado Springs, Colorado
Project No.: 4G-2411003 **Figure No.:** 4

BORING NO. & LOCATION: B1	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Brown **Silty Sand**, with trace Clay and Gravel, Loose-Moist (Possible Fill)			1-SS	8				5	BDL	
			2-SS	5				17	BDL	P200=24.5%
Light Brown, Tan **Poorly Graded Sand**, with trace Silt and fine Gravel, fine to Coarse Grained, Loose to Firm Slightly-Moist	5		3-SS	17				4	BDL	
			4-SS	11				5	BDL	
Light Brown **Poorly Graded Sand**, with trace Gravel, fine to Coarse Grained, Firm-Moist	10		5-SS	14				9	BDL	
	15		6-SS	13				16	BDL	

Boring Terminated at about 16 feet

Water Observation Data	Remarks:
Water Encountered During Drilling: None	BDL=Below Detectable Levels
Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B2	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Brown, Tan **Silty Sand**, with little Clay and trace Gravel, Fine to Coarse Grained, Firm-Moist (Possible Fill)			1-SS	13				5	BDL	
			2-SS	7				12	BDL	
Brown **Silty Sand**, with trace Gravel, Fine to Coarse Grained, Loose to Firm-Moist -with some thin layers of Clay, firm below 4 feet	5		3-SS	14				11	BDL	
			4-SS	21				6	BDL	
Tan, Brown, Light Brown **Poorly Graded Sand**, with trace Silt, little Gravel, Fine to Coarse Grained, Firm Slightly-Moist	10		5-SS	16				6	BDL	P200=9.7%
Tan, Brown **Poorly Graded Sand**, with trace Silt, with some Gravel, Fine to Coarse Grained, Firm-Moist	15		6-SS	20				13	BDL	
	20		7-SS	28				14	BDL	

Boring Terminated at about 21 feet

Water Observation Data	Remarks:
Water Encountered During Drilling: 14 ft.	BDL=Below Detectable Levels
Water Level At End of Drilling: 14 ft.	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B3	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Dark Brown **Clayey, Silty Sand**, with trace Gravel, Fine to Coarse Grained, Firm-Moist (Fill)			1-SS	20				11	BDL	LL=26, PI=7 P200=27.3%
			2-SS	12				8	BDL	
	5		3-SS	4				9	BDL	P200=17.9%
Tan, Brown **Silty Sand**, with some Clay and some Gravel, fine to Medium Grained, Very Loose to Firm-Moist			4-SS	11				10	BDL	
Brown, Tan, Light Brown **Poorly Graded Sand**, with trace Silt and Gravel, fine to Coarse Grained, Firm-Moist	10		5-SS	21				7	BDL	
	▼ (12.5)									
	15		6-SS	24				16	BDL	
Light Brown, Tan **Silty Sand**, with trace Gravel, fine to Coarse Grained, Firm to Dense-Moist	20		7-SS	29				16	BDL	
Light Brown, Tan **Poorly Graded Sand**, with trace Silt and fine Gravel, Fine to Coarse Grained, Dense-Moist	25		8-SS	44				11	BDL	
	30		9-SS	30				12	BDL	
Boring Terminated at about 30 feet										

	Water Observation Data	Remarks:
▽	Water Encountered During Drilling: 12.5 ft.	BDL=Below Detectable Levels
▼	Water Level At End of Drilling: 12.5 ft.	ST=Shelby Tube / SS=Split Spoon
	Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
▼	Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
	Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B4	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO PROJECT NO: 4G-2411003	
COMPLETION DATE: 12/09/24		
FIELD REP: C. ROMERO		

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**			1-SS	15				5	BDL	
Brown **Silty Sand**, with trace Fine Gravel, Fine to Coarse Grained, Firm Slightly-Moist			2-SS	15				4	BDL	
Brown, Light Brown **Silty Sand**, with some Clay and trace Gravel, Fine to Coarse Grained, Loose-Moist	5		3-SS	6				10	BDL	
Brown, Tan, Gray **Poorly Graded Sand**, with trace Silt and Gravel, Fine to Coarse Grained, Very Loose to Firm-Moist			4-SS	4				5	BDL	P200=10.0%
	10		5-SS	25				11	BDL	
	15		6-SS	18				17	BDL	

Boring Terminated at about 16 feet

Water Observation Data	Remarks:
Water Encountered During Drilling: 14 ft.	BDL=Below Detectable Levels
Water Level At End of Drilling: 14 ft.	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B5	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO PROJECT NO: 4G-2411003	
COMPLETION DATE: 12/09/24		
FIELD REP: C. ROMERO		

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Dark Brown **Silty Sand**, with trace Clay and Fine Gravel, Fine to Coarse Grained, Loose to Very Loose-Moist (Possible Fill)			1-SS	6				10	BDL	
			2-SS	6				7	BDL	
Brown, Light Brown **Poorly Graded Sand**, with trace Silt and Fine Gravel, Fine to Coarse Grained, Firm-Moist	5		3-SS	4				12	BDL	
			4-SS	9				14	BDL	
	10		5-SS	12				14	BDL	

Boring Terminated at about 11 feet

Water Observation Data	Remarks:
Water Encountered During Drilling: None	BDL=Below Detectable Levels
Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION:	TEST BORING LOG	
B6		
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	GILES ENGINEERING ASSOCIATES, INC.
COMPLETION DATE: 12/09/24		
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Brown, Tan **Silty Sand**, Fine to Medium Grained, Loose-Moist			1-SS	7				10	BDL	
			2-SS	9				8	BDL	
Light Brown, Tan **Silty Sand**, with trace Silt and Gravel, Fine to Medium Grained, Firm Slightly-Moist	5		3-SS	15				8	BDL	P200=20.6%
			4-SS	17				5	BDL	
Light Brown, Tan **Poorly Graded Sand**, with trace Silt and Fine Gravel, Fine to Coarse Grained, Firm Slightly-Moist	10		5-SS	22				9	BDL	

Boring Terminated at about 11 feet

	Water Observation Data	Remarks:
▽	Water Encountered During Drilling: None	BDL=Below Detectable Levels
▼	Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
	Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION:	TEST BORING LOG	
B7		
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	GILES ENGINEERING ASSOCIATES, INC.
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**										
Dark Brown, Brown **Clayey, Silty Sand**, with trace Fine Gravel, Fine to Coarse Grained, Firm-Moist (Possible Fill)			1-SS	18				11	BDL	LL=25, PI=6 P200=32.3%
			2-SS	11				10	BDL	
Light Brown, Tan **Poorly Graded Sand**, with trace Silt and Fine Gravel, Fine to Corase Grained, Firm Slightly-Moist	5		3-SS	11				6	BDL	
Boring Terminated at about 5 feet										

Water Observation Data	Remarks:
Water Encountered During Drilling: None	BDL=Below Detectable Levels
Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B8	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
COMPLETION DATE: 12/09/24		
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**			1-SS	12				10	BDL	
Dark Brown **Silty Sand**, with trace Fine Gravel, Fine to Coarse Grained, Firm-Moist (Fill)			2-SS	7				8	BDL	
Brown, Tan **Silty Sand**, with little Gravel, Fine to Medium Grained, Loose to Very Loose-Moist	5		3-SS	4				10	BDL	
Boring Terminated at about 5 feet										

Water Observation Data	Remarks:
Water Encountered During Drilling: None	BDL=Below Detectable Levels
Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B9	# TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**			1-SS	40				11	BDL	LL=27, PI=10 P200=27.3%
Brown **Clayey Sand**, with trace Gravel, Fine to Medium Grained, Dense-Moist (Fill)			2-SS	7				6	BDL	
Brown **Silty Sand**, with trace Fine Gravel, Fine to Medium Grained, Loose to Very Loose Slightly-Moist	5		3-SS	3				8	BDL	
Boring Terminated at about 5 feet										

Water Observation Data	Remarks:
Water Encountered During Drilling: None	BDL=Below Detectable Levels
Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index
Water Level After Drilling:	P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

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BORING NO. & LOCATION: B10	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU	
COMPLETION DATE: 12/09/24	SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO	
FIELD REP: C. ROMERO	PROJECT NO: 4G-2411003	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**			1-SS	14				5	BDL	
Dark Brown, Tan **Silty Sand**, with trace Fine Gravel, Fine to Medium Grained, Firm Slightly-Moist (Fill)			2-SS	5				8	BDL	
Brown **Silty Sand**, with trace Fine Gravel, Fine to Coarse Grained, Loose-Moist	5		3-SS	6				11	BDL	
Boring Terminated at about 5 feet										

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling: None	BDL=Below Detectable Levels ST=Shelby Tube / SS=Split Spoon LL=Liquid Limit / PI=Plasticity Index P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
▼	Water Level At End of Drilling: None	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B11	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION:	PROPOSED CHICK-FIL-A RESTAURANT #5934 POWERS & PALMER PARK FSU SEQ OF POWERS BLVD AND PALMER PARK BLVD COLORADO SPRINGS, COLORADO PROJECT NO: 4G-2411003	
COMPLETION DATE: 12/09/24		
FIELD REP: C. ROMERO		

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
6± inches of **Asphalt Concrete Pavement**			1-SS	20				7	BDL	
Light Brown, Tan **Silty Sand**, with trace fine Gravel, Fine to Coarse Grained, Firm Slightly-Moist (Fill)			2-SS	22				12	BDL	
Dark Brown **Clayey Sand**, fine to Medium Grained, Firm-Moist	5		3-SS	10				10	BDL	
Boring Terminated at about 5 feet										

	Water Observation Data	Remarks:
▽	Water Encountered During Drilling: None	BDL=Below Detectable Levels
▼	Water Level At End of Drilling: None	ST=Shelby Tube / SS=Split Spoon
	Cave Depth At End of Drilling:	LL=Liquid Limit / PI=Plasticity Index P200=Percent Passing No. 200 Sieve UCS=Unconfined Compressive Strength
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	Drilling Contractor: Dakota Drilling

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

APPENDIX B

FIELD PROCEDURES

The field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) designation D

420 entitled "Standard Guide for Sampling Rock and Rock" and/or other relevant specifications. Soil samples were preserved and transported to *Giles'* laboratory in general accordance with the procedures recommended by ASTM designation D 4220 entitled "Standard Practice for Preserving and Transporting Soil Samples." Brief descriptions of the sampling, testing and field procedures commonly performed by *Giles* are provided herein.

GENERAL FIELD PROCEDURES

Test Boring Elevations

The ground surface elevations reported on the Test Boring Logs are referenced to the assumed benchmark shown on the Boring Location Plan (Figure 1). Unless otherwise noted, the elevations were determined with a conventional hand-level and are accurate to within about 1 foot.

Test Boring Locations

The test borings were located on-site based on the existing site features and/or apparent property lines. Dimensions illustrating the approximate boring locations are reported on the Boring Location Plan (Figure 1).

Water Level Measurement

The water levels reported on the Test Boring Logs represent the depth of “free” water encountered during drilling and/or after the drilling tools were removed from the borehole. Water levels measured within a granular (sand and gravel) soil profile are typically indicative of the water table elevation. It is usually not possible to accurately identify the water table elevation with cohesive (clayey) soils, since the rate of seepage is slow. The water table elevation within cohesive soils must therefore be determined over a period of time with groundwater observation wells.

It must be recognized that the water table may fluctuate seasonally and during periods of heavy precipitation. Depending on the subsurface conditions, water may also become perched above the water table, especially during wet periods.

Borehole Backfilling Procedures

Each borehole was backfilled upon completion of the field operations. If potential contamination was encountered, and/or if required by state or local regulations, boreholes were backfilled with an “impervious” material (such as bentonite slurry). Borings that penetrated pavements, sidewalks, etc. were “capped” with Portland Cement concrete, asphaltic concrete, or a similar surface material. It must, however, be recognized that the backfill material may settle, and the surface cap may subside, over a period of time. Further backfilling and/or re-surfacing by *Giles’* client or the property owner may be required.

FIELD SAMPLING AND TESTING PROCEDURES

Auger Sampling (AU)

Soil samples are removed from the auger flights as an auger is withdrawn above the ground surface. Such samples are used to determine general soil types and identify approximate soil stratifications. Auger samples are highly disturbed and are therefore not typically used for geotechnical strength testing.

Split-Barrel Sampling (SS) – (ASTM D-1586)

A split-barrel sampler with a 2-inch outside diameter is driven into the subsoil with a 140-pound hammer free-falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the "Standard Penetration Resistance" or N-value is an index of the relative density of granular soils and the comparative consistency of cohesive soils. A soil sample is collected from each SPT interval.

Shelby Tube Sampling (ST) – (ASTM D-1587)

A relatively undisturbed soil sample is collected by hydraulically advancing a thin-walled Shelby Tube sampler into a soil mass. Shelby Tubes have a sharp cutting edge and are commonly 2 to 5 inches in diameter.

Bulk Sample (BS)

A relatively large volume of soils is collected with a shovel or other manually-operated tool. The sample is typically transported to *Giles'* materials laboratory in a sealed bag or bucket.

Dynamic Cone Penetration Test (DC) – (ASTM STP 399)

This test is conducted by driving a 1.5-inch-diameter cone into the subsoil using a 15-pound steel ring (hammer), free-falling a vertical distance of 20 inches. The number of hammer-blows required to drive the cone 1¾ inches is an indication of the soil strength and density, and is defined as "N". The Dynamic Cone Penetration test is commonly conducted in hand auger borings, test pits and within excavated trenches.

- Continued -

Ring-Lined Barrel Sampling – (ASTM D 3550)

In this procedure, a ring-lined barrel sampler is used to collect soil samples for classification and laboratory testing. This method provides samples that fit directly into laboratory test instruments without additional handling/disturbance.

Sampling and Testing Procedures

The field testing and sampling operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the field testing (i.e. N-values) are reported on the Test Boring Logs. Explanations of the terms and symbols shown on the logs are provided on the appendix enclosure entitled "General Notes".

APPENDIX C

LABORATORY TESTING AND CLASSIFICATION

The laboratory testing was conducted under the supervision of a geotechnical engineer in accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Brief descriptions of laboratory tests commonly performed by *Giles* are provided herein.

LABORATORY TESTING AND CLASSIFICATION

Photoionization Detector (PID)

In this procedure, soil samples are "scanned" in *Giles'* analytical laboratory using a Photoionization Detector (PID). The instrument is equipped with an 11.7 eV lamp calibrated to a Benzene Standard and is capable of detecting a minute concentration of **certain** Volatile Organic Compound (VOC) vapors, such as those commonly associated with petroleum products and some solvents. Results of the PID analysis are expressed in HNu (manufacturer's) units rather than actual concentration.

Moisture Content (w) (ASTM D 2216)

Moisture content is defined as the ratio of the weight of water contained within a soil sample to the weight of the dry solids within the sample. Moisture content is expressed as a percentage.

Unconfined Compressive Strength (qu) (ASTM D 2166)

An axial load is applied at a uniform rate to a cylindrical soil sample. The unconfined compressive strength is the maximum stress obtained or the stress when 15% axial strain is reached, whichever occurs first.

Calibrated Penetrometer Resistance (qp)

The small, cylindrical tip of a hand-held penetrometer is pressed into a soil sample to a prescribed depth to measure the soils capacity to resist penetration. This test is used to evaluate unconfined compressive strength.

Vane-Shear Strength (qs)

The blades of a vane are inserted into the flat surface of a soil sample and the vane is rotated until failure occurs. The maximum shear resistance measured immediately prior to failure is taken as the vane-shear strength.

Loss-on-Ignition (ASTM D 2974; Method C)

The Loss-on-Ignition (L.O.I.) test is used to determine the organic content of a soil sample. The procedure is conducted by heating a dry soil sample to 440°C in order to burn-off or "ash" organic matter present within the sample. The L.O.I. value is the ratio of the weight loss due to ignition compared to the initial weight of the dry sample. L.O.I. is expressed as a percentage.

Particle Size Distribution (ASTB D 421, D 422, and D 1140)

This test is performed to determine the distribution of specific particle sizes (diameters) within a soil sample. The distribution of coarse-grained soil particles (sand and gravel) is determined from a "sieve analysis," which is conducted by passing the sample through a series of nested sieves. The distribution of fine-grained soil particles (silt and clay) is determined from a "hydrometer analysis" which is based on the sedimentation of particles suspended in water.

Consolidation Test (ASTM D 2435)

In this procedure, a series of cumulative vertical loads are applied to a small, laterally confined soil sample. During each load increment, vertical compression (consolidation) of the sample is measured over a period of time. Results of this test are used to estimate settlement and time rate of settlement.

Classification of Samples

Each soil sample was visually-manually classified, based on texture and plasticity, in general accordance with the Unified Soil Classification System (ASTM D-2488-75). The classifications are reported on the Test Boring Logs.

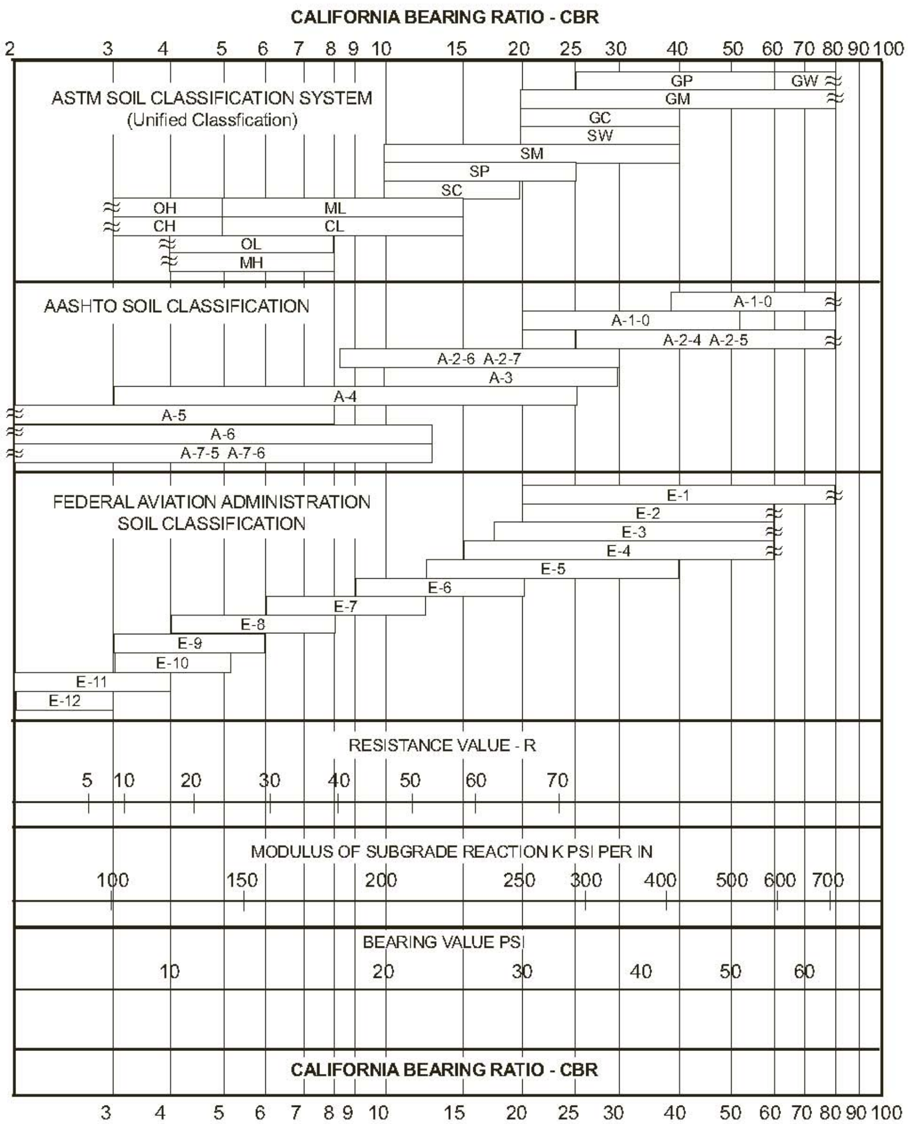
Laboratory Testing

The laboratory testing operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the laboratory tests are provided on the Test Boring Logs or other appendix enclosures. Explanation of the terms and symbols used on the logs is provided on the appendix enclosure entitled "General Notes."

California Bearing Ratio (CBR) Test ASTM D-1833

The CBR test is used for evaluation of a soil subgrade for pavement design. The test consists of measuring the force required for a 3-square-inch cylindrical piston to penetrate 0.1 or 0.2 inch into a compacted soil sample. The result is expressed as a percent of force required to penetrate a standard compacted crushed stone.

Unless a CBR test has been specifically requested by the client, the CBR is estimated from published charts, based on soil classification and strength characteristics. A typical correlation chart is below.



APPENDIX D

GENERAL INFORMATION

GUIDE SPECIFICATIONS FOR SUBGRADE AND GRADE PREPARATION FOR FILL, FOUNDATION, FLOOR SLAB AND PAVEMENT SUPPORT; AND SELECTION, PLACEMENT AND COMPACTION OF FILL SOILS USING STANDARD PROCTOR PROCEDURES

1. Construction monitoring and testing of subgrades and grades for fill, foundation, floor slab and pavement; and fill selection, placement and compaction shall be performed by an experienced soils engineer and/or his representatives.

2. All compaction fill, subgrades and grades shall be (a) underlain by suitable bearing material; (b) free of all organic, frozen, or other deleterious material, and (c) observed, tested and approved by qualified engineering personnel representing an experienced soils engineer. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of (a) proof-rolling to detect soil, wet yielding soils or other unstable materials that must be undercut, (b) scarifying top 6 to 8 inches, (c) moisture conditioning the soils as required, and (d) recompaction to same minimum in-situ density required for similar materials indicated under Item 5. Note: compaction requirements for pavement subgrade are higher than other areas. Weather and construction equipment may damage compacted fill surface and reworking and retesting may be necessary to assure proper performance.

3. In overexcavation and fill areas, the compacted fill must extend (a) a minimum 1 foot lateral distance beyond the exterior edge of the foundation at bearing grade or pavement subgrade and down to compacted fill subgrade on a maximum 0.5(H):1(V) slope, (b) 1 foot above footing grade outside the building, and (c) to floor subgrade inside the building. Fill shall be placed and compacted on a 5(H):1(V) slope or must be stepped or benched as required to flatten if not specifically approved by qualified personnel under the direction of an experienced soil engineer.

4. The compacted fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated”, and shall be low-expansive with a maximum Liquid Limit (ASTM D-423) and Plasticity Index (ASTM D-424) of 30 and 15, respectively, unless specifically tested and found to have low expansive properties and approved by an experienced soils engineer. The top 12 inches of compacted fill should have a maximum 3-inch-particle diameter and all underlying compacted fill a maximum 6-inch-diameter unless specifically approved by an experienced soils engineer. All fill materials must be tested and approved under the direction of an experienced soils engineer prior to placement. If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per the Unified Soil Classification System (ASTM D-2487).

5. For structural fill depths less than 20 feet, the density of the structural compacted fill and scarified subgrade and grades shall not be less than 95 percent of the maximum dry density as determined by Standard Proctor (ASTM-698) with the exception of the top 12 inches of pavement subgrade which shall have a minimum in-situ density of 100 percent of maximum dry density, or 5 percent higher than underlying fill materials. Where the structural fill depth is greater than 20 feet, the portions below 20 feet should have a minimum in-place density of 100 percent of its maximum dry density of 5 percent greater than the top 20 feet. The moisture content of cohesive soil shall not vary by more than -1 to +3 percent and granular soil ±3 percent of the optimum when placed and compacted or recompacted, unless specifically recommended/approved by the soils engineer monitoring the placement and compaction. Cohesive soils with moderate to high expansion potentials (PI>15) should, however, be placed, compacted and maintained prior to construction at a moisture content 3±1 percent above optimum moisture content to limit further heave. The fill shall be placed in layers with a maximum loose thickness of 8 inches for foundations and 10 inches for floor slabs and pavement, unless specifically approved by the soils engineer taking into consideration the type of materials and compaction equipment being used. The compaction equipment should consist of suitable mechanical equipment specifically designed for soil compaction. Bulldozers or similar tracked vehicles are typically not suitable for compaction.

6. Excavation, filling, subgrade and grade preparation shall be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs and seepage water encountered shall be pumped or drained to provide a suitable working platform. Springs or water seepage encountered during grading/foundation construction must be called to the soil engineer’s attention immediately for possible construction procedure revision or inclusion of an underdrain system.

7. Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below-grade walls (i.e. basement walls and retaining walls) must be properly tested and approved by an experienced soils engineer with consideration for the lateral pressure used in the wall design.

8. Whenever, in the opinion of the soils engineer or the Owner’s Representatives, an unstable condition is being created either by cutting or filling, the work shall not proceed into that area until an appropriate geotechnical exploration and analysis has been performed and the grading plan revised, if found necessary.

GENERAL COMMENTS

The soil samples obtained during the subsurface exploration will be retained for a period of thirty days. If no instructions are received, they will be disposed of at that time.

This report has been prepared exclusively for the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. Copies of this report may be provided to contractor(s), with contract documents, to disclose information relative to this project. The report, however, has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project architect, structural engineer, and/or civil engineer. Reproduction and distribution of this report must be authorized by the client and *Giles*.

This report has been based on assumed conditions/characteristics of the proposed development where specific information was not available. It is recommended that the architect, civil engineer and structural engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. The project plans and specifications may also be submitted to *Giles* for review to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted.

The analysis of this site was based on a subsoil profile interpolated from a limited subsurface exploration. If the actual conditions encountered during construction vary from those indicated by the borings, *Giles* must be contacted immediately to determine if the conditions alter the recommendations contained herein.

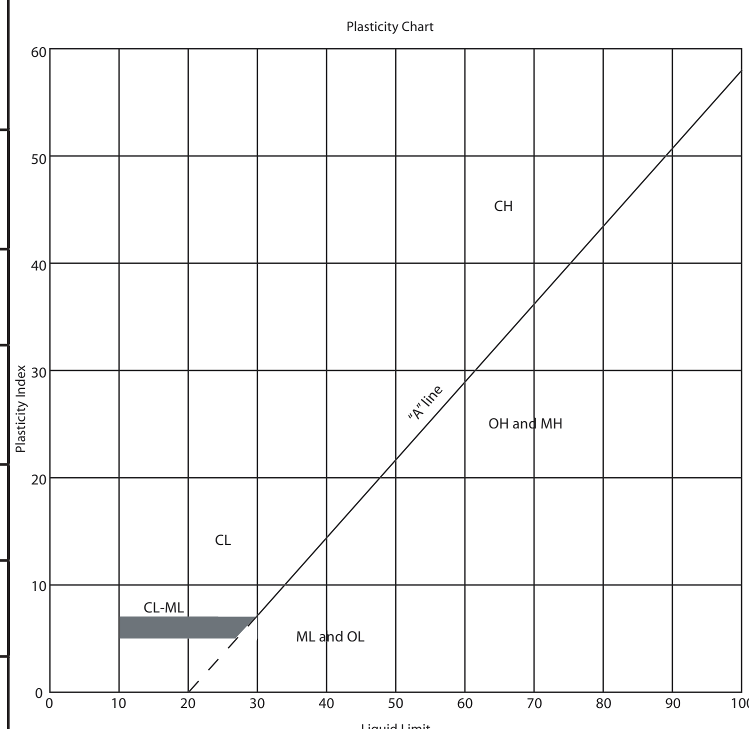
The conclusions and recommendations presented in this report have been promulgated in accordance with generally accepted professional engineering practices in the field of geotechnical engineering. No other warranty is either expressed or implied.

CHARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SOIL CONSTRUCTION *									
Class	**Compaction Characteristics**	**Max. Dry Density Standard Proctor (pcf)**	**Compressibility and Expansion**	**Drainage and Permeability**	**Value as an Embankment Material**	**Value as Subgrade When Not Subject to Frost**	**Value as Base Course**	**Value as Temporary Pavement**	
								With Dust Palliative	**With Bituminous Treatment**
GW	Good: tractor, rubber-tired, steel wheel or vibratory roller	125-135	Almost none	Good drainage, pervious	Very stable	Excellent	Good	Fair to poor	Excellent
GP	Good: tractor, rubber-tired, steel wheel or vibratory roller	115-125	Almost none	Good drainage, pervious	Reasonably stable	Excellent to good	Poor to fair	Poor	
GM	Good: rubber-tired or light sheepsfoot roller	120-135	Slight	Poor drainage, semipervious	Reasonably stable	Excellent to good	Fair to poor	Poor	Poor to fair
GC	Good to fair: rubber-tired or sheepsfoot roller	115-130	Slight	Poor drainage, impervious	Reasonably stable	Good	Good to fair **	Excellent	Excellent
SW	Good: tractor, rubber-tired or vibratory roller	110-130	Almost none	Good drainage, pervious	Very stable	Good	Fair to poor	Fair to poor	Good
SP	Good: tractor, rubber-tired or vibratory roller	100-120	Almost none	Good drainage, pervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SM	Good: rubber-tired or sheepsfoot roller	110-125	Slight	Poor drainage, impervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SC	Good to fair: rubber-tired or sheepsfoot roller	105-125	Slight to medium	Poor drainage, impervious	Reasonably stable	Good to fair	Fair to poor	Excellent	Excellent
ML	Good to poor: rubber-tired or sheepsfoot roller	95-120	Slight to medium	Poor drainage, impervious	Poor stability, high density required	Fair to poor	Not suitable	Poor	Poor
CL	Good to fair: sheepsfoot or rubber-tired roller	95-120	Medium	No drainage, impervious	Good stability	Fair to poor	Not suitable	Poor	Poor
OL	Fair to poor: sheepsfoot or rubber-tired roller	80-100	Medium to high	Poor drainage, impervious	Unstable, should not be used	Poor	Not suitable	Not suitable	Not suitable
MH	Fair to poor: sheepsfoot or rubber-tired roller	70-95	High	Poor drainage, impervious	Poor stability, should not be used	Poor	Not suitable	Very poor	Not suitable
CH	Fair to poor: sheepsfoot roller	80-105	Very high	No drainage, impervious	Fair stability, may soften on expansion	Poor to very poor	Not suitable	Very poor	Not suitable
OH	Fair to poor: sheepsfoot roller	65-100	High	No drainage, impervious	Unstable, should not be used	Very poor	Not suitable	Not suitable	Not suitable
Pt	Not suitable		Very high	Fair to poor drainage	Should not be used	Not suitable	Not suitable	Not suitable	Not suitable

* "The Unified Classification: Appendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments and Foundations," Technical Memorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

** Not suitable if subject to frost.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			*Group Symbols*		*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (more than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP; More than 12 percent: GM, GC, SM, SC; 5 to 12 percent: *Borderline* cases requiring dual symbols[b]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtrues, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt		Peat and other highly organic soils			

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits, suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group sympols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 inch and larger
Cobbles:	3 inch to 8 inch
Gravel:	coarse - ¾ to 3 inch
	fine – No. 4 (4.76 mm) to ¾ inch
Sand:	coarse – No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium – No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (non-plastic)
Clay:	No 200 (0.074 mm) and smaller (plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance (correlated to Unconfined Compressive Strength, tsf)
PID:	Results of vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-Units. (BDL=Below Detection Limit)
N:	Penetration Resistance per 12 inch interval, or fraction thereof, for a standard 2 inch O.D. (1⅜ inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N-Values where plus sign (+) is shown.
Nc:	Penetration Resistance per 1¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.
Nr:	Penetration Resistance per 12 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube – 3 inch O.D. (except where noted)
CS:	3 inch O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	BLOWS PER FOOT (N)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
Very Soft	0 - 2	0 - 0.25
Soft	3 - 4	0.25 - 0.50
Medium Stiff	5 – 8	0.50 - 1.00
Stiff	9 – 15	1.00 - 2.00
Very Stiff	16 – 30	2.00 - 4.00
Hard	31+	4.00+

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	BLOWS PER FOOT (N)
Very Loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	51+

DEGREE OF PLASTICITY	PI
None to Slight	0 - 4
Slight	5 - 10
Medium	11 - 30
High to Very High	31+

DEGREE OF EXPANSIVE POTENTIAL	PI
Low	0 - 15
Medium	15 - 25
High	25+

Important Information about This

Geotechnical-Engineering Report

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

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

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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