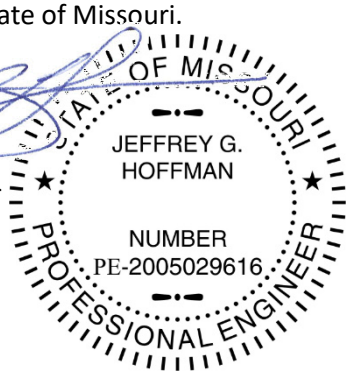
Geotechnical Evaluation Report

QuikTrip Store No. 183R
1001 SW Blue Parkway
Lee's Summit, Missouri

Prepared for

QuikTrip Corporation

Professional Certification:
I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Missouri.



Jeffrey G. Hoffman, PE
Technical Leader, Senior Engineer
License No. PE-2005029616
December 14, 2023

Project B2311165

Braun Intertec Corporation

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December 14, 2023 Project B2311165

Mr. Travis Wunsch
QuikTrip Corporation
4705 South 129th East Avenue
Tulsa, OK 74134-7008

Re: Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Parkway
Lee's Summit, Missouri

Dear Mr. Wunsch:

We are pleased to present this Geotechnical Evaluation Report for the new QuikTrip convenience store. The services provided were in general accordance with our Standard Services Agreement dated May 26, 2015. The purpose of the geotechnical study was to explore and evaluate the subsurface conditions at various locations on the site and develop geotechnical design and construction recommendations for the project. The attached Braun Intertec report contains a description of the findings of our field exploration and laboratory testing program, our engineering interpretation of the results with respect to the project characteristics, our geotechnical site development and foundation design recommendations as well as construction guidelines for the planned project.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please call Jeff Hoffman at 913.647.5017.

Sincerely,

BRAUN INTERTEC CORPORATION

Jeffrey G. Hoffman, PE
Technical Leader, Senior Engineer

Thomas Posey
Technical Leader

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Executive Summary

Site:

- The project site is currently occupied by a carwash and surrounding pavement in the northern one-third on the site, with the southern two-thirds occupied by a QuikTrip building, canopy, and associated pavement. Grass-covered landscaped areas with trees are located around the perimeter of the site.

- The site generally slopes gently down from south to north, with the area west of the existing QuikTrip building sloping down to the west. Based on information available on Google Earth™, there appears to be about 10 feet of elevation change across the site.

- Subsurface conditions generally consisted of clay soils underlain by shale bedrock at approximate depths of 11 to 13 feet.

- Several borings encountered existing fill below surficial material. The fill generally consisted of clay soils with vary gravel content, extending to approximate depths of 2 1/2 to 4 1/2 feet below existing grades.

- Existing fill remaining after initial site grading should be evaluated by a geotechnical representative by proofrolling to identify any soft, unsuitable materials. The contractor should remove unsuitable material identified by the geotechnical representative and replace it with engineered fill.

- Final site and grading plans were not available at the time of this report. Based on existing site grades, we anticipate less than 5 feet of cut or fill will be required to achieve design grades. We should be provided an opportunity to review the final grading plans and evaluate the anticipated settlement.

- Based on the current site use and subsurface conditions at our boring locations, we anticipate topsoil/rootzone depths will vary across the site, ranging from no topsoil to about 12 inches. For budgeting depths, an approximate depth of 12 inches should be allotted. Existing topsoil is not suitable for use as engineered fill and should be disposed of offsite or re-used in landscaped areas below proposed topsoil or outside of proposed topsoil limits, or as general fill outside of proposed structures and pavements.

QuikTrip and Carwash Buildings:

- Onsite soils consisted of fat clay that does not meet the criteria for low volume change (LVC) material below floor slabs. Depending on final grading plans, the contractor may need to undercut existing soils to allow placement of a minimum of 42 inches of LVC material below floor slabs.

- Based on the subsurface conditions at our borings, we anticipate generally medium to stiff clay soils will be encountered near the foundation bearing elevation.

- With the recommended site preparation, the QuikTrip building and carwash could be supported on spread footings bearing on new engineered fill, suitable existing fill, or native clay soils and designed using an allowable bearing capacity of 2,000 pounds per square foot (psf).

Fuel Canopy:

- With the recommended site preparation procedures, including the evaluation of existing fill material, subsurface conditions appear suitable for support of the fuel island canopy on shallow, dug, or auger footings bearing at a minimum depth of 3 feet below finished grade.

Tank Pit & Utility Excavations:

- Underground fuel tanks will be located west of the canopy structure and extend 16 to 18 feet below final grades.
- Based on the subsurface conditions encountered at Boring T-1, we anticipate the tank excavation will extend through overburden soils and into underlying bedrock comprised of shale with limestone seams. The contractor will likely pneumatic breakers or other rock excavating techniques to complete the tank excavation.
- We anticipate groundwater seepage into excavations will occur at a relatively slow rate and excavations could likely be dewatered using sumps and pumps.

Pavement:

- Based on our assumed grading plan, the pavement subgrade material is anticipated to consist of existing fill, native clay, or newly placed engineered fill comprised of material similar to the onsite soils.
- These soils are considered poor subgrade materials, and as such, pavements should consist of either 6 1/2 inches of concrete supported on 6 inches of aggregate base, or 6 inches of asphalt supported on 7 inches of aggregate base.
- Per QuikTrip standards, proofrolling of the exposed grade is required. Soft and unstable areas shall be excavated and replaced with engineered fill.

The information stated above is a summary of the recommendations presented within this report. The report should be reviewed in its entirety for proper implementation of the recommendations.

A. Introduction

A.1. Project Description

We understand the proposed project will include the demolition of existing structures and construction of a new QuikTrip convenience store, carwash, and canopy at 1001 SW Blue Parkway in Lee's Summit, Missouri. We understand that a grading plan has not been developed. QuikTrip will provide Braun Intertec an opportunity to review the grading plan when available, allow us to modify the recommendations herein where necessary. We summarized our current project understanding, including key design, construction, or performance components in Table 1.

Table 1. Proposed Components for QuikTrip Store No. 183R

Aspect	Description
Nature of Construction	<u>QuikTrip Building</u> ▪ One-story with plan area of 5,312 square feet ▪ Masonry with grade-supported floor slab ▪ Supported on shallow spread footings <u>Canopy-Covered Fuel Islands</u> ▪ Automobile fuel islands will be located south of the planned building ▪ Steel-frame structure ▪ Supported on standard QuikTrip shallow, excavated, or augured footings <u>Carwash Building</u> ▪ To be located west of canopy structure and southwest of building <u>Underground Storage Tanks</u> ▪ Fuel tanks will be located either east of canopy or west of building ▪ Excavation to extend up to 18 feet below final grade
Structural Loads (Provided)	▪ Buildings and Canopies: 2,000 psf
Maximum Tolerable Settlement	▪ 1-inch total settlement ▪ 1/2-inch differential settlement
Site Grading *(Assumed)*	▪ Based on existing grades, assume less than 5 feet of cut or fill will be required to achieve design grade
Pavement	▪ Traffic comprised of passenger vehicles and re-fueling trucks ▪ Pavements constructed per QuikTrip design standards

A.2. Background Information and Reference Documents

To facilitate our evaluation, we were provided with or reviewed the following information or documents:

- Site Plan, prepared by Midwest Design Group, provided by QuikTrip on November 16, 2023
- Google Earth™ and NetOnline Historical Aerial Photographs, accessed on December 10, 2023
- *Web Soil Survey*, http://websoilsruvey.nrcs.usda.gov, United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS), December 10, 2023

A.3. Site Conditions

The project site is located at the southwest corner of NW Blue Parkway and West 2nd Street in Lee's Summit. A carwash building and surrounding pavement currently occupies approximately the northern one-third of the site. A QuikTrip store, canopied-covered fuel islands and pavement occupies the southern two-thirds of the site. Grass-covered landscaped areas, along with several trees are located around the perimeter of the site. Overhead utilities are located along the northern and western property lines, as well as the northern half of the eastern property line. A gas pipeline extends in an east-west alignment along the southern property line. Topography generally slopes gently down from south to north, with about 10 feet of elevation differential indicated on Google Earth™. Grades west of the existing QuikTrip slope down to the west, away from the building.

A.4. Site History

Our evaluation included a review of publicly available satellite imagery on Google Earth™ and the NetOnline website. The first available image was dated 1955 and depicts a building located in the southern portion of the site, with apparent drives and parking on the east side the building. The northern half of the site was undeveloped in 1955. The building was removed/demolished between 1985 and 1990. The existing QuikTrip building and carwash to the north were constructed sometime between 1996 and 2002. No significant site changes were apparent in available photographs after 2002.

A.5. Regional Geology

We also reviewed the Web Soil Survey developed by the United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS) to evaluate the anticipated near-surface (upper 6 to 7 feet) soils. Arisburg-Urban land complex is plotted across the entire site and consists of a combination of wind-blown loess and materials placed by human activities. According to the Soil Survey, near-surface should consist of lean and fat clay that typically have approximate liquid limits and plasticity indices ranging from 30 to 65 and 10 to 35, respectively.

B. Results

Our subsurface exploration program consisted of drilling 11 borings at the approximate locations depicted in Figure A-2 in the Appendix. Log of Boring sheets for our test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated and present the results of penetration resistances, laboratory tests performed on representative samples and groundwater measurements. Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1. Geologic Profile

Table 2 provides a summary of the soil boring results completed for this evaluation; in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. Figure A-4 in the Appendix depicts a generalized geologic profile of the site in a south to north direction. We developed the fence diagram based on information obtained from the borings. The Descriptive Terminology sheets in the Appendix includes definitions of abbreviations used in Table 2.

Table 2. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Test Results	Commentary and Details
Topsoil	N/A		▪ Encountered at Borings B-2, D-3 through D-6 ▪ Approximately 6 to 12 inches thick
Pavement	N/A		▪ Encountered at Borings B-1, C-1, C-2, D-1, D-2, and T-1 ▪ Borings B-1 and D-2, located in the northern portion of the site, encountered about 4 inches of asphalt underlain by 6 to 7 inches of concrete ▪ Boring D-1, along with Borings C-1, C-2, and T-1 on the QuikTrip site encountered 7 to 11 1/2 inches of concrete
Existing Fill	CH, GM	N-value = 5 to 18 bpf MC = 20 to 29%	▪ Encountered at Borings B-2, D-1, D-5, D-6, and T-1 ▪ Except for gravel directly below the concrete pavement at Boring T-1, existing fill consisted of fat clay with varying amounts of gravel ▪ Extended to depths of 2 1/2 to 4 1/2 feet below existing grades ▪ Exhibited medium to stiff consistencies

Table 2. Subsurface Profile Summary* (cont.)

Strata	Soil Type - ASTM Classification	Test Results	Commentary and Details
Native Clay	CH	N-value = 7 to 13 bpf MC = 19 to 31% UCS = 0.9 to 3.3 tsf DD = 92 to 104 pcf	▪ Encountered below existing fill or surficial material in all borings ▪ Continued to termination depths at Borings B-2, D-4, D-5, and D-6 ▪ Generally exhibited medium to stiff consistencies ▪ Moisture condition moist
Shale	N/A	N-value = 19 bpf to 50 for 3 inches MC = 12 to 23%	▪ Encountered below native soils at depths of 11 to 13 feet at Borings B-1, C-1, C-2, D-1 through D-3, D-6, and T-1 ▪ Top of rock elevation appears to slope down from south to north, ranging from approximate elevation 997 1/2 feet to 983 feet ▪ Highly weathered and soft near interface with overburden soils, generally becoming less weathered and harder with depth ▪ Approximate 9-inch thick limestone seam encountered in Boring T-1 at approximate depth of 17 feet ▪ Shale continued to boring termination depths

*Abbreviations defined in the attached Descriptive Terminology sheets.

B.2. Groundwater

We observed groundwater at approximate depths of 12 to 13 1/2 feet while drilling Borings C-1 and C-2, with the remaining borings remaining dry during drilling. We rechecked groundwater levels 24 hours after drilling in Borings D-1, D-5, D-6, and T-1, with water observed at approximate depths ranging from 1 to 11 feet below existing grades. Cohesive soils encountered across the site have relatively low permeabilities and would require observations over an extended period to better define current groundwater conditions.

Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

C. Design and Construction Considerations

C.1. General

Based on the results of our evaluation, it is our professional opinion that the proposed project site may be developed for the proposed construction. The primary geotechnical concerns for the proposed project are the presence of existing fill across the site and moderately to highly expansive soils. Recommendations addressing geotechnical aspects of the project design and construction are presented below.

C.1.a. Expansive Soils

The clay soils encountered across the project site have a moderate to high volume change potential, characterized by their ability to undergo volume change (shrink/swell) with changes in moisture content. Changes in soil moisture may cause unacceptable settlement or heave of on-grade slabs supported on these materials. Per QuikTrip's standard construction procedures, we recommend placing a minimum of 42 inches (6 inches below foundation bearing elevation) of low volume change (LVC) soil below the proposed footing of the QuikTrip building and carwash. The contractor should place the LVC fill in accordance with Section C.5, extending the LVC fill a minimum of 3 feet outside the building wall lines.

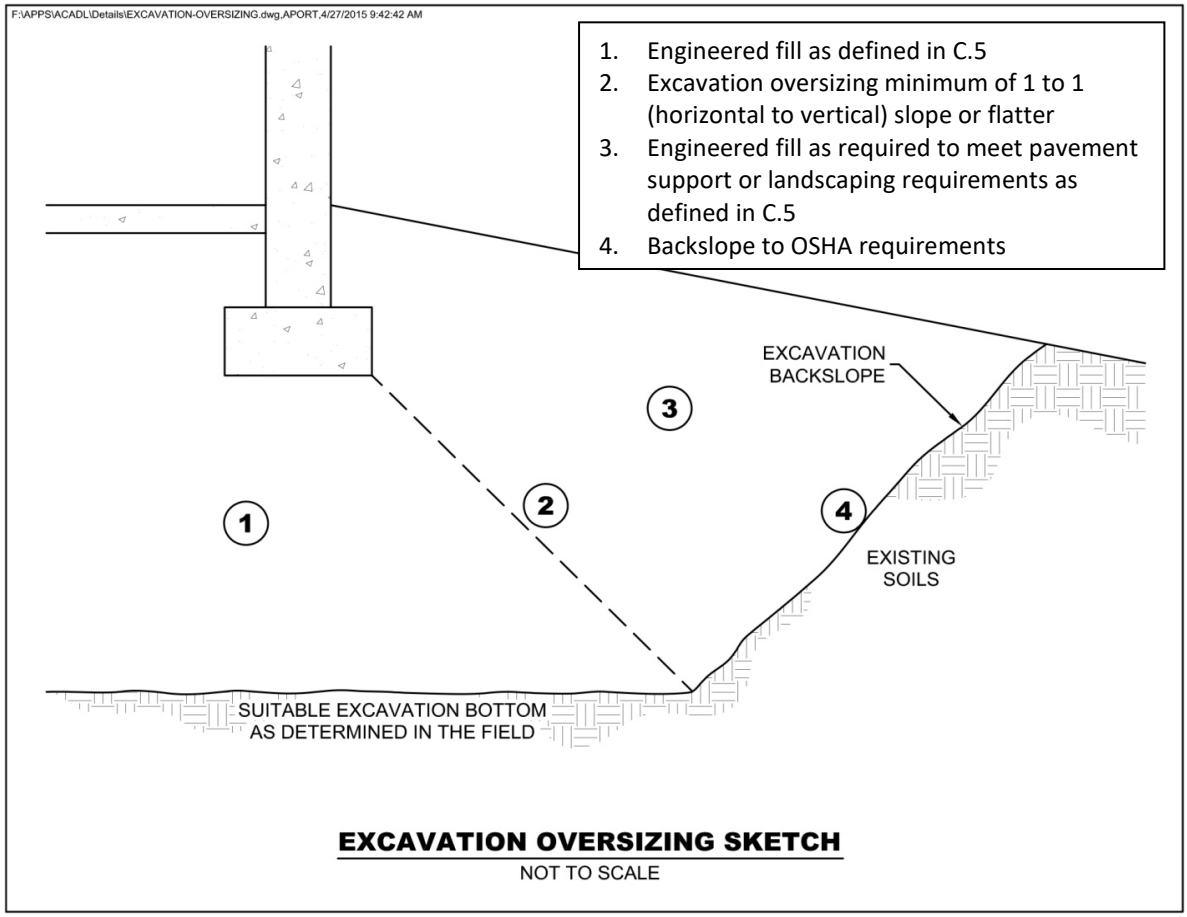
A site grading plan was not available at the time of this report. Depending on final design grades, the contractor may need to undercut existing clay soils to allow for the placement of a minimum of 42 inches of LVC material below the QuikTrip floor slab.

C.1.b. Existing Fill

We encountered existing fill at Borings B-2, D-1, D-5, D-6, and T-1 that extended to depths of 2 1/2 to 4 1/2 feet below existing grade. In addition, our review of historical images indicates that a structure was previously located in the southern half of the site. The existing fill material encountered at our boring locations generally consisted of clay soils with varying amounts of gravel and exhibited medium to stiff consistencies.

If fill material remains after initial site grading and undercutting to allow for the placement of LVC material below the floor slab, we recommend a geotechnical engineer or senior engineering technician (engineering representative) evaluate the remaining existing fill prior to new fill placement. The geotechnical representative should evaluate the fill material by appropriate methods, such as hand auger probes, observation of test pits, and observation of proofrolls where feasible. The contractor should remove soft or unsuitable material identified by the geotechnical representative and replace it with new engineered fill. Where unsuitable material is encountered below structure foundations, the undercutting shall be oversized as illustrated below in Figure 1.

Figure 1. Generalized Illustration of Oversizing



C.2. Site Development

C.2.a. Demolition

Site preparation should commence with the demolition of existing structures within proposed areas. Demolition of existing buildings should include removal of at grade floor slabs, sidewalks and shallow spread footings. The contractor should remove broken concrete, asphalt and other debris from the site. A geotechnical representative should evaluate areas disturbed during demolition of the pavements prior to placement of engineered fill. The contractor should undercut disturbed soils prior to placement of engineered fill.

C.2.b. Site Stripping and Grubbing

The contractor should continue site preparation by stripping vegetation and topsoil from the construction areas. A geotechnical representative should observe stripping operations to review that the

contractor removes unsuitable materials. The contractor could use soils removed during site stripping operations for final site grading outside the proposed pavement areas. The contractor should separate these materials in order to avoid incorporation of the organic matter in engineered fill sections. Any materials re-used from the stripping and grubbing process in proposed landscaping areas should not be used as topsoil within these areas.

The contractor should accomplish any required tree removal at this time, removing all root systems within the proposed building and pavement areas, as well as soils disturbed during removal of stumps. A zone of desiccated soils having a high swell potential may exist in the vicinity of the trees. The contractor should also undercut the desiccated soils and replace them with engineered fill. Should there be any debris from the previous structure, the contractor should remove any debris that was not removed.

C.2.c. Existing Utilities

We recommend relocating existing utility lines within the zone of influence of proposed construction areas to areas outside of the proposed construction. The contractor should cut excavations created during the removal of the existing lines wide enough to allow the use of self-propelled construction equipment to re-compact the fill. In addition, the base of the excavations should be evaluated by a geotechnical representative prior to placement of fill. Fill shall be placed in accordance with the recommendations presented in the Section C.5 of this report.

C.2.d. Undercutting Below Building and Evaluation of Existing Fill

Following site stripping and initial site grading, the contractor shall undercut the existing soils within the footprint of the QuikTrip building and carwash to allow for the placement of LVC fill as outlined in Section C.1.a. Prior to placement of engineered fill, a geotechnical representative should evaluate the exposed subgrade for the presence of existing fill material as discussed in Section C.1.b. The contractor shall undercut unsuitable materials and replace them with engineered fill.

C.2.e. Scarification, Moisture Conditioning, and Compaction

Prior to the fill placement, the geotechnical representative should evaluate the moisture content of the grade exposed in cut and fill areas. Where moisture contents are below levels recommended for engineered fill, we recommend scarifying and moisture conditioning the exposed grade to a minimum depth of 8 inches. If moisture contents are above the levels recommended for engineered fill, the contractor may need to scarify and aerate the subgrade to lower the soil moisture content to levels that will allow proper compaction of the exposed grade. After moisture conditioning the soils, the contractor should then compact the soil to the degree recommended for engineered fill.

C.2.f. Proofrolling

Following moisture conditioning, we recommend that a geotechnical representative observe the contractor perform a proofroll of the exposed subgrade. Proofrolling aids in identifying soft or disturbed areas, and the contractor can accomplish proofrolling by using a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading. The contractor should undercut unsuitable areas identified by the geotechnical representative and replace the removed material with engineered fill.

C.3. Climatic Conditions

Weather conditions will influence the site preparation required. In spring and late fall, following periods of rainfall, the moisture content of the near-surface soils may be significantly above the optimum moisture content. Excessive moisture could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include aerating the wet subgrade, removal of the wet materials and replacing them with dry materials, reinforcing the subgrade with geotextiles/geogrid or treating the material with lime, cement or fly ash.

If site grading commences during summer months, moisture contents may be low and clay soils could have a high swell potential. Typically, discing and moisture conditioning of the exposed subgrade materials to the moisture content criteria outlined in Section C.5 will reduce this swell potential of the dry materials. As an alternative, the dry materials could be undercut and replaced with moisture conditioned engineered fill.

If construction of the project is to be performed during winter months, appropriate steps shall be taken to prevent the soils from freezing. In no case shall the foundations, fill, or other exterior flat work be placed on or against frozen or partially frozen materials. Frozen materials shall be removed and replaced with a suitable material. Frozen materials shall not be included in any compacted fills.

C.4. Excavations

C.4.a. Excavation Safety

All excavations must comply with applicable local, state, and federal safety regulations. The responsibility for excavation safety and stability of temporary construction slopes lies solely with the contractor. We are providing this information below solely as a service to our client. Under no circumstances should this information provided be interpreted to mean that Braun Intertec is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

C.4.b. Excavation Equipment

We anticipate excavations will be required for construction of foundation elements, tanks, and utilities at this site. Excavations will generally extend into existing fill, native clay soils, and newly placed engineer fill that the contractor could likely excavate with conventional equipment.

C.4.c. Excavation Dewatering

We anticipate groundwater seepage in excavations extending through clay soils will occur at a relatively slow rate, and the contractor could likely use conventional sumps and pumps to dewater excavations.

C.4.d. Excavation Support

Excavations shall be cut to a stable slope or be temporarily braced, depending upon the excavation depths and the subsurface conditions encountered. The contractor should be aware that slope height, slope inclination, surcharges or excavation depths should in no case exceed those specified by local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations.

We recommend placing stockpiles away from the edge of excavations a distance equal to the height of the excavation. We also recommend limiting stockpile heights, so they do not surcharge the sides of the excavation. The contractor should control surface drainage to prevent the flow of water into the excavations. We recommend observing construction slopes for signs of mass movement: tension cracks near the crest, bulging at the toe, etc. If the project team observes potential stability problems, they should immediately stop construction in the area and contact a geotechnical engineer.

C.5. Engineered Fill

C.5.a. Materials

Engineered fill and backfill shall consist of approved materials, free of organic matter (organic content less than 5 percent) and debris. Approved materials are defined as those soils classified by ASTM D 2487 as CL, CH, GW, GP, GC, GM, SM, SW, SC and SP. Unsuitable materials are defined as those soils classified by ASTM D 2487 as ML, MH, OL, OH and PT.

LVC Fill: Engineered fill placed below floor slabs shall consist of low volume change (LVC) soil having a liquid limit less than 50 percent when determined in accordance with the wet preparation procedures outlined in ASTM D4318. Based on the results of our exploration, there does not appear to be onsite material suitable for use as LVC fill. Therefore, we recommend basing construction budgets on importing low plasticity clay or crushed limestone aggregate such as KDOT AB-3 or MoDOT Type 1 aggregate and

limestone screenings, or chemically treating onsite clay soils with cement, lime, lime kiln dust, or Class "C" fly ash. For budgeting purposes, a typical application rate for lime, cement, and cement kiln dust is 6 percent on a dry-weight basis. For Class "C" fly ash, we recommend an application rate of 15 percent (dry weight basis). We recommend laboratory tests be performed to evaluate the actual amount required.

C.5.b. Placement and Compaction of Backfill and Fill

We recommend spreading backfill and fill in loose lifts of approximately 8 inches. We recommend compacting backfill and fill in accordance with the criteria presented below in Table 3. The relative compaction of utility backfill should be evaluated based on the structure below which it is installed and vertical proximity to that structure.

Table 3. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D 698 – standard Proctor)	Moisture Content Variance from Optimum, percentage points
Below Structures and Pavements	95	• Cohesive Soil with LL>40: 0 to +4 • Cohesive Soil with LL≤40: -2 to +2 • Granular with >15% fines: -3 to +3
Below landscaped surfaces	90	-5 to +5

We recommend changing the compaction of cohesionless fill materials, where the percentage passing the United States Standard Number 200 sieve is less than 15 percent by dry weight and the moisture-density curve indicates relatively slight sensitivity to changing moisture content, to be greater than 70 percent relative density (ASTM D4253 and ASTM D4254) rather than 95 percent of the standard Proctor maximum dry density. Please note that relative density and standard Proctor compaction tests measure different parameters and are not interchangeable.

The contractor should anticipate adjusting the moisture content of the onsite soils to achieve the specified compaction. The contractor should maintain moisture contents within the recommended range until completion of the fill section. We recommend performing density tests in fill to evaluate if the contractor has compacted the soil to the level required by project requirements.

C.6. Permanent Slopes

Permanent cut or fill slopes shall be no steeper than 3H:1V to maintain long-term stability and to provide ease of maintenance. Steeper slopes are susceptible to erosion, will be difficult to maintain and could experience problems with instability. The crest, toe of cut or fill slopes shall be no closer than 10 feet from any foundation and no closer than 5 feet from the edge of any pavement. It is recommended that permanent slopes be vegetated as soon as is practical, in order to minimize the potential for erosion.

C.7. Foundation Recommendations

With the recommended site preparation procedure described above, including evaluation of existing fill material, the site should be suitable for support of the proposed structures on native clay, suitable existing fill or newly placed engineered fill.

C.7.a. Building and Carwash Foundations

Footings founded on native clay, suitable existing fill, and new engineered fill may be proportioned for a maximum, allowable bearing pressure of 2,000 psf. Continuous wall footings shall have a minimum width of 16 inches. Exterior footings and footings founded in unheated portions of the structure shall be supported a minimum of 36 inches below final exterior grade to reduce the influence of possible frost penetration. Footings shall be earth-formed, poured in neat excavations.

We estimate that the total and differential settlements among the footings will amount to less than 1 inch and 1/2 inch, respectively, under the assumed loads.

C.7.b. Canopy Foundations

Subsurface conditions appear suitable for support of the proposed canopy of standard shallow, excavated, or auger footings. Foundations for the canopy should be designed to resist uplift and lateral loading. Uplift wind loads can be resisted by the effective dead weight of the foundation plus the weight of any soil above the foundation. For design purposes, we recommend a unit weight of 110 pcf be used for the compacted soil above the foundation. To develop the required uplift resistance, footings may need to extend below the minimum depth of 36 inches required for frost protection.

Care must be exercised during excavation of the footings to minimize disturbance to the materials surrounding the excavation, as disturbance to adjacent soils could significantly influence the resistance to lateral and uplift loads.

Lateral loads acting on the foundation may be resisted by passive resistance of the soils around the perimeter of the footing and sliding friction acting on the base of the foundation. The lateral load capacity of the foundation can be determined using an allowable equivalent fluid unit weight of 200 pcf for calculating the passive lateral earth pressure acting on the edge of footings. The recommended passive pressure parameter is applicable to earth-formed foundations and should be determined from final grade to the bottom of the foundation; however, the passive resistance provided in the upper 3 feet of the profile should be ignored, as this is the zone subject to moisture changes and frost penetration. For sliding friction, an allowable friction coefficient of 0.20 could be assigned to the base of the foundation bearing on cohesive soil. The recommended passive pressure and sliding friction values include a factor of safety of approximately 1.5.

C.7.c. Construction Considerations

We recommend that all foundation excavations be evaluated and tested by the geotechnical engineer immediately prior to placement of foundation concrete. Unsuitable areas identified at this time shall be corrected. Corrective procedures would be dependent upon conditions encountered and may include deepening of foundation elements or undercutting of unsuitable materials and replacement with controlled engineered fill.

The base of all footing excavations shall be free of all water and loose material prior to placing concrete. Concrete shall be placed as soon as possible after excavating so that excessive drying or disturbance of bearing materials does not occur. Should the materials at bearing level become excessively dry or saturated, we recommend that the affected material be removed prior to placing concrete.

C.8. Seismic Determination

Based on the subsurface information, the project site would be characterized as a Site Class "C" per the 2018 International Building Code (IBC). In addition, there is no significant risk of liquefaction or mass movement of the on-site soils due to a seismic event.

C.9. Interior Slabs

C.9.a. Subgrade Preparation

Recommendations outlined in Sections C.1, C.2, and C.5 of this report are intended to develop subgrades that are suitable for support of building floor slabs. Immediately prior to construction of floor slabs, we recommend that a geotechnical representative evaluate the exposed subgrade to assess whether moisture contents are within the recommended range and to identify areas disturbed by construction operations. The contractor shall rework unsuitable or disturbed areas prior to placement of the granular leveling course and construction of the floor slab.

C.9.b. Aggregate Leveling Course

A granular leveling course and vapor barrier meeting QuikTrip's design specifications shall be used below building floor slabs supported on soil subgrades.

C.10. Below-Grade Walls

We anticipate the carwash structure may include below-grade walls. Based on our experience with soils similar to those encountered at the site, below grade walls subjected to lateral earth pressure could be

designed for an equivalent fluid pressure of 65 pounds per cubic foot. This lateral earth pressure assumes an at-rest stress distribution condition; i.e., no wall rotation is allowed. The load distribution does not include a factor of safety or the influence of hydrostatic loading on the wall. Also, the stress distribution does not include the influence of foundations or other surcharges located in or adjacent to wall backfill.

To prevent hydrostatic loading on the walls, we recommend a perforated drain line be installed at the base of below grade walls and sloped to provide positive gravity drainage outside the building area or should extend to a sump where water can be collected and removed. The drain should be backfilled with free draining granular material extending vertically above the drain line to within 2 feet of final grade and wrapped with filter fabric to prevent intrusion of fines. The remaining portion of the excavation should be backfilled with cohesive soils to minimize the infiltration of surface water. The project team could use consider using a prefabricated drainage blanket installed in accordance with the manufacturer's recommendations.

C.11. Underground Storage Tanks

Underground fuel tanks will be installed on the west side of the proposed canopy structure, near Boring T-1. Based on subsurface conditions encountered at Boring T-1, we anticipate subsurface conditions at the tank location will generally consist of clay soils underlain by shale bedrock at an approximate depth of 12 feet below existing grades. We anticipate tank excavations will likely extend into the shale bedrock that may also contain thin limestone seams. The contractor should be prepared to use pneumatic breakers or other rock excavating techniques to complete the tank excavation. We recommend the tanks be designed to withstand buoyant forces.

C.12. Pavements

C.12.a. General

We understand that either Portland cement concrete or asphaltic cement concrete pavements will be constructed in accordance with QuikTrip standards. As such, our analyses did not include evaluating minimum pavement sections.

C.12.b. Pavement Subgrade Preparation

Construction scheduling, involving paving and grading by separate contractors, typically results in a time lapse between the end of grading operations and the commencement of paving. Disturbance, desiccation and/or wetting of the subgrade between grading and paving can result in deterioration of the previously completed subgrade. A non-uniform subgrade can result in poor pavement performance and local failures relatively soon after pavements are constructed.

We recommend that a geotechnical representative observe the contractor perform a proofroll of the exposed pavement subgrades, and that the geotechnical representative check the moisture content and density of the top 8 inches of subgrade within two days prior to the commencement of paving operations. If a significant event, such as precipitation, occurs after proofrolling, the geotechnical representative should review the pavement subgrade prior to the contractor placing the pavement. The subgrade should be in its finished form at the time of the final review.

C.12.c. Minimum Pavement Section

We anticipate the pavement subgrade will consist of existing fill, native clay soils, and newly placed engineered fill comprised of material similar to the onsite soils. These soils are considered poor subgrade material per QuikTrip standard pavement design. With the recommended site preparation procedures, the subgrade material would be suitable for the standard QuikTrip pavement sections summarized in Table 4.

Table 4. Standard QuikTrip Pavement Sections for Poor Subgrade Material

Material	Pavement (in.)	Aggregate Base* (in.)
Concrete	6 ½	6
Asphalt	6**	7

*Gradation similar to KDOT Type AB-3 or MoDOT Type 1 aggregate
**Minimum 3 inch wearing course

C.13. Landscaping and Site Grading Considerations

Provisions should be made to reduce the potential for large moisture changes within building and pavement subgrades located adjacent to landscape areas, to reduce the potential for subgrade movement. Positive drainage away from the building and pavement areas should be incorporated into the design plans. Ponding of water adjacent to the building and/or pavements could contribute to significant moisture increases in the subgrade soils and subsequent heaving.

Consideration should also be given to limiting landscaping and irrigation adjacent to the building and pavement areas. Trees and large bushes can develop intricate root systems that can draw moisture from the subgrade soils, causing them to shrink during dry periods of the year. Desiccation of soils below foundations can result in settlement of shallow foundations.

C.14. Construction Quality Control

C.14.a. Excavation Observations

We recommend having a geotechnical representative observe all excavations related to subgrade preparation and spread footing, slab-on-grade and pavement construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations and the adequacy of required excavation oversizing.

C.14.b. Materials Testing

We recommend density tests be taken in excavation backfill and additional required fill placed below spread footings, slab-on-grade construction and below pavements. We also recommend slump, air content and strength tests of Portland cement concrete.

C.14.c. Pavement Subgrade Proof Roll

We recommend that proof rolling of the pavement subgrades be observed by a geotechnical engineer to determine if the results of the procedure meet project specifications or delineate the extent of additional pavement subgrade preparation work.

D. Procedures

D.1. Penetration Test Borings

Braun Intertec conducted the subsurface exploration between November 30th and December 2nd, 2023. We established boring locations in the field using a handheld global positioning system (GPS) and coordinates estimated from a publicly available geographical information system (GIS). We determined ground surface elevations using Trimble Catalyst GPS equipment having vertical accuracy of less than 1/2 foot. Locations and elevations of the borings should be considered accurate only to the degree implied by the methods used to obtain them.

Our subcontractor drilled the borings with an ATV mounted drill. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance with ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths.

D.2. Material Classification and Testing

D.2.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered in accordance with ASTM D2488. The Appendix includes a chart explaining the classification system.

D.2.b. Laboratory Testing

The exploration logs in the appendix note the results of the laboratory tests performed on geologic material samples. We performed the tests in general accordance with ASTM procedures.

D.3. Groundwater Measurements

We checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. The boreholes were then backfilled or allowed to remain open for an extended period of observation, as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

E.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

E.2. Continuity of Professional Responsibility

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

E.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed within a reasonable time from its issuance, but in no event later than three years from the date of the report. Land use, site conditions (both on- and off-site) or other factors may change over time and additional work may be required. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

BRAUN INTERTEC

Aerial photograph obtained from Google Earth, December 10, 2023.

BRAUN INTERTEC

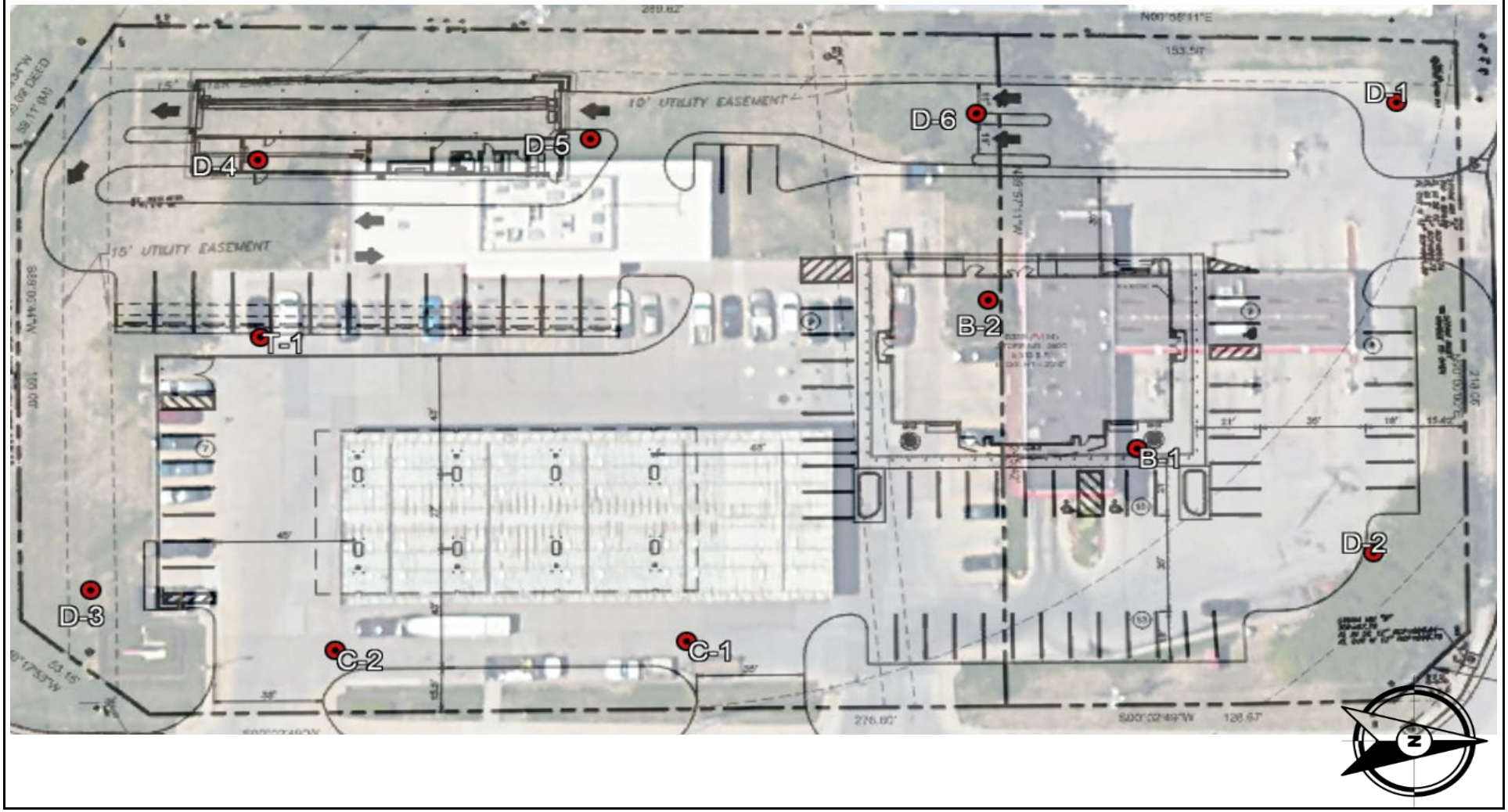
PROJECT NO.	B2311165
DRAWN:	12/10/2023
DRAWN BY:	JGH
CHECKED BY:	TP
FILE NAME:	

Site Vicinity Map

QuikTrip Store No. 183R
1001 SW Blue Parkway
Lee's Summit, MO

FIGURE

A-1



BRAUN INTERTEC

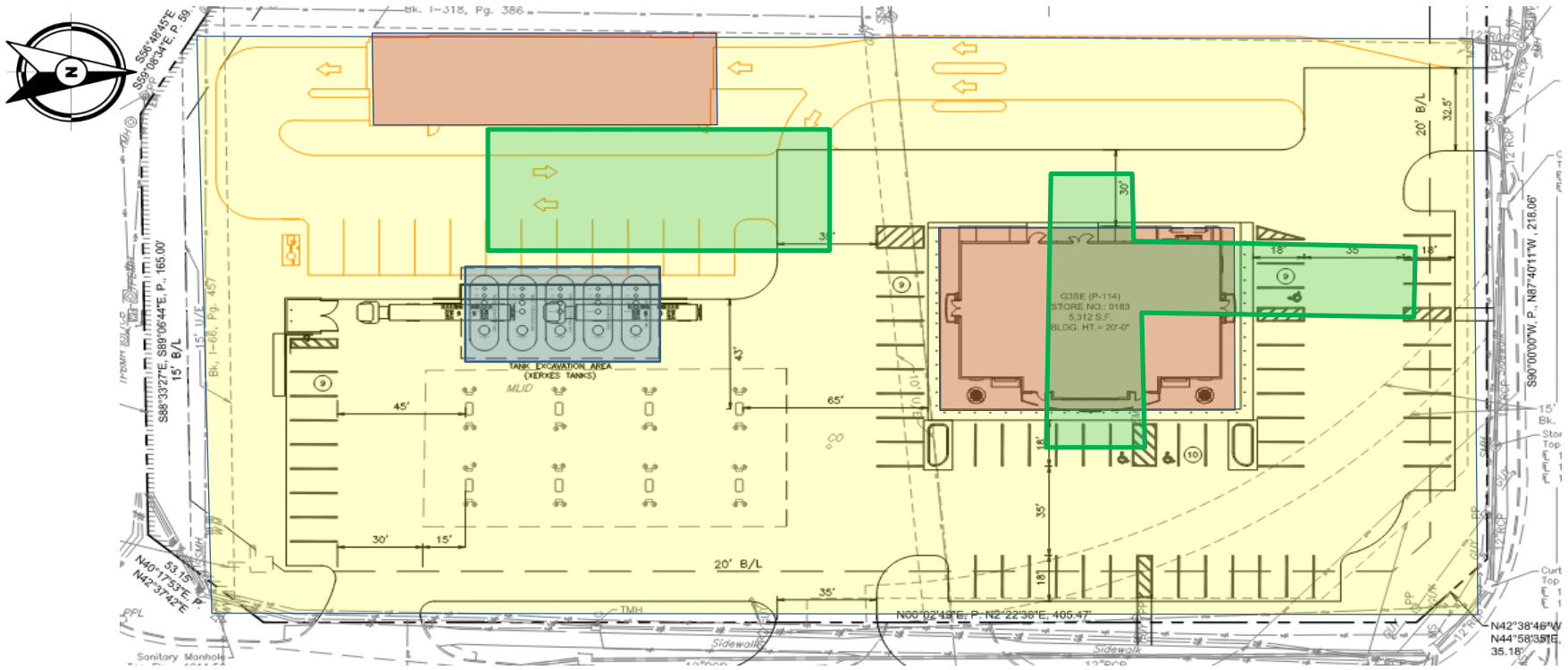
PROJECT NO.	B2311165
DRAWN:	12/10/2023
DRAWN BY:	JGH
CHECKED BY:	TP
FILE NAME:	

Site Plan with Boring Locations

QuikTrip Store No. 183R
1001 SW Blue Parkway
Lee's Summit, MO

FIGURE

A-2



	The contractor shall undercut within the planned building footprint, allowing for the placement of a minimum of 42 inches of LVC material. The LVC fill should extend a minimum of 3 feet outside the wall lines.
	After initial grading, a geotechnical representative shall evaluate any remaining existing fill. The contractor shall remove unsuitable fill and replaced with new engineered fill.
	Tank pit excavation will likely extend through overburden clay soils and into underlying bedrock comprised of shale with limestone seams. The contractor will likely require pneumatic breakers to complete the tank excavation.
	Approximate location of existing structures. Following demolition, a geotechnical representative should evaluate the exposed subgrade for the presence of debris and disturbed soils.

BRAUN INTERTEC

PROJECT NO.	B2311165
DRAWN:	12/10/2023
DRAWN BY:	JGH
CHECKED BY:	TP
FILE NAME:	

Development Concerns

QuikTrip Store No. 183R
1001 SW Blue Parkway
Lee's Summit, MO

FIGURE

A-3

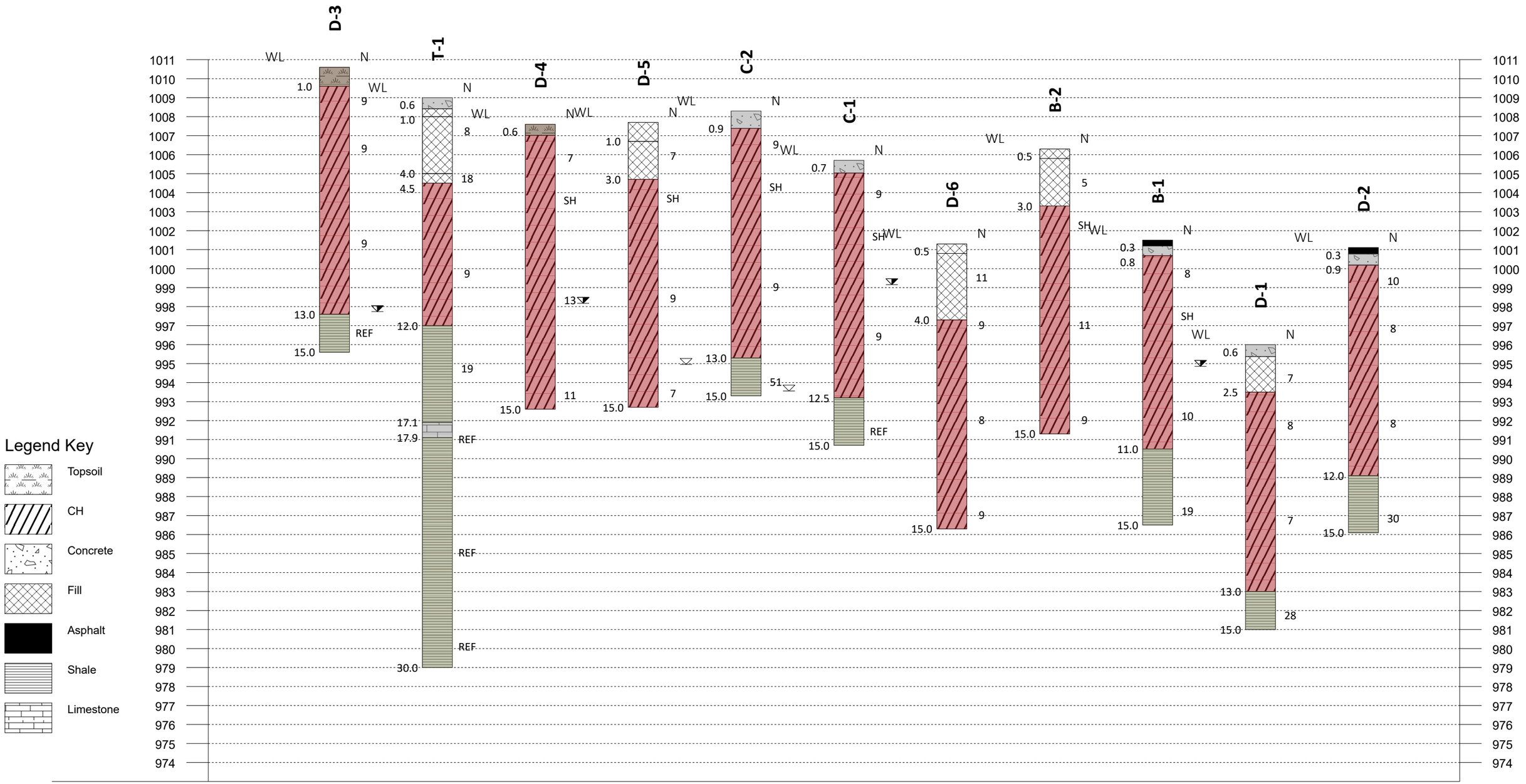


Figure A-4: Subsurface Profile

Fence Diagram
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

Project ID: B2311165
Vert. Scale: 1"= 5'
Hor. Scale: NTS
Date: 12/11/2023

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **B-1**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912490 LONGITUDE: -94.392570
START DATE: 11/30/23 END DATE: 11/30/23
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez
SURFACE ELEVATION: 1001.5 ft RIG: Subcontractor METHOD: 8 1/4" HSA
SURFACING: Asphalt WEATHER: Drizzle, 40°

Elev./ Depth ft	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~1001.2~~	ASPHALT, (3.75")					
0.3	CONCRETE, (6")					
1000.7	FAT CLAY (CH), very dark gray, moist, medium		3-3-5 (8) 12"		30	LL=80, PL=27, PI=53
0.8	*Becoming gray with brown, stiff*		SH 11"		24	DD=98 pcf q_u=1.96 tsf
990.5			2-4-6 (10) 18"		27	
11.0	SHALE, yellowish brown with gray, highly weathered, soft		4-7-12 (19) 18"		23	
986.5						
15.0	END OF BORING					Water not observed while drilling.
	Boring immediately backfilled					Water not observed immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **B-2**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912339 LONGITUDE: -94.392700
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 11/30/23 END DATE: 11/30/23
SURFACE ELEVATION: 1006.3 ft RIG: Subcontractor METHOD: 8 1/4" HSA SURFACING: Topsoil Material WEATHER: Rain, 50s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1005.8		FILL: TOPSOIL MATERIAL, (6")					
0.5		FILL: FAT CLAY (CH), with Gravel, brown with dark gray, moist		2-1-4 (5) 13"		20	LL=57, PL=22, PI=35
1003.3							
3.0		FAT CLAY (CH), brown, moist, very stiff		SH 18"		23	DD=104 pcf q_u=3.37 tsf
		Becoming gray, stiff		2-5-6 (11) 13"		25	
		Becoming gray with brown		2-3-6 (9)		27	
991.3							
15.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled					Water not observed immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **C-1**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912047 LONGITUDE: -94.392350
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 12/01/23 END DATE: 12/01/23
SURFACE ELEVATION: 1005.7 ft RIG: Subcontractor METHOD: SSA SURFACING: Concrete WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1005.0		CONCRETE, (8")					
0.7		FAT CLAY (CH), gray, moist, stiff		3-4-5 (9) 18"		28	
		Becoming gray with brown		SH 9"		26	DD=97 pcf q_u=2.15 tsf
5							
				2-4-5 (9) 18"		27	
10							
993.2	▽						
12.5		SHALE, yellowish brown with olivish gray, highly weathered, soft		2-15-50/6" (REF) 18"		15	
990.7							
15							
15.0		END OF BORING					Water observed at 12.0 feet while drilling.
		Boring immediately backfilled					Water not observed immediately after withdrawal of auger.
20							
25							
30							

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **C-2**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.911755 LONGITUDE: -94.392360
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 12/01/23 END DATE: 12/01/23
SURFACE ELEVATION: 1008.3 ft RIG: Subcontractor METHOD: SSA SURFACING: Concrete WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1007.4		CONCRETE, (11.5")					
0.9		FAT CLAY (CH), gray, moist, stiff		3-4-5 (9) 16"		31	
		Becoming gray with brown, mediu		SH 17"		30	DD=92 pcf q_u=0.89 tsf
995.3		*Becoming brow with gray, stiff*		2-4-5 (9) 18"		27	
13.0	▽	SHALE, yellowish brown with olivish gray, highly weathered, soft		10-21-30 (51) 18"		17	
993.3							
15.0		END OF BORING					Water observed at 13.2 feet while drilling.
		Boring immediately backfilled					Water not observed immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-1**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912782 LONGITUDE: -94.392960
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 11/30/23 END DATE: 11/30/23
SURFACE ELEVATION: 996.0 ft RIG: Subcontractor METHOD: SSA SURFACING: Concrete WEATHER: Overcast, 50s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
995.4		CONCRETE, (7.5")					
0.6	▽	FILL: FAT CLAY (CH), gray with brown, moist		3-3-4 (7) 10"		27	
993.5							
2.5		FAT CLAY (CH), gray with brown, moist, medium		2-3-5 (8) 17"		27	
			5				
		Becoming brown with gray		2-3-4 (7) 16"		28	
			10				
983.0							
13.0		SHALE, yellowish brown with olivish gray, highly weathered, soft		9-11-17 (28) 17"		21	
981.0			15				
15.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled					Water observed at 1.0 feet when rechecked 24 hours after drilling.
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-2**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912713 LONGITUDE: -94.392240
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 11/30/23 END DATE: 11/30/23
SURFACE ELEVATION: 1001.1 ft RIG: Subcontractor METHOD: SSA SURFACING: Asphalt WEATHER: Overcast, 50s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~1000.8~~		ASPHALT, (4")					
0.3		CONCRETE, (7")					
1000.2		FAT CLAY (CH), dark gray, moist, stiff		4-4-6 (10) 12"		22	
0.9		*Becoming gray with brown*	5	2-3-5 (8) 13"		26	
		Becoming yellow brown with gray	10	2-3-5 (8) 15"		27	
989.1							
12.0		SHALE, yellowish brown with olivish gray, highly weathered, soft		6-12-18 (30) 18"		21	
986.1			15				
15.0		END OF BORING Boring immediately backfilled					Water not observed while drilling. Water not observed immediately after withdrawal of auger.
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-3**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912337 LONGITUDE: -94.392980
START DATE: 12/01/23 END DATE: 12/02/23
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez
SURFACE ELEVATION: 1010.6 ft RIG: Subcontractor METHOD: SSA
SURFACING: Topsoil Material WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1009.6		TOPSOIL, (12")					
1.0		FAT CLAY (CH), dark gray, moist, stiff		2-3-6 (9) 13"		19	
		Becoming gray and brown		3-4-5 (9) 14"		24	
				3-4-5 (9) 18"		23	
997.6							
13.0		SHALE, yellow brown, highly weathered, soft		34-50/5" (REF) 10"		12	
995.6							
15.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled					Water not observed immediately after withdrawal of auger.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-4**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.912002 LONGITUDE: -94.392940
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 12/01/23 END DATE: 12/01/23
SURFACE ELEVATION: 1007.6 ft RIG: Subcontractor METHOD: SSA SURFACING: Topsoil Material WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1007.0		TOPSOIL, (7")					
0.6		FAT CLAY (CH), brown, moist, medium		2-3-4 (7) 11"		22	LL=52, PL=22, PI=30
		Becoming stiff		SH 21"		20	DD=97 pcf q_u=1.29 tsf
5							
				5-7-6 (13) 0"		28	
10							
		Becoming gray with brown		3-6-5 (11) 2"		28	
992.6							
15.0		END OF BORING	15				Water not observed while drilling.
		Boring immediately backfilled					Water not observed immediately after withdrawal of auger.
20							
25							
30							

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-5**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.911710 LONGITUDE: -94.392950
START DATE: 12/01/23 END DATE: 12/01/23
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez
SURFACE ELEVATION: 1007.7 ft RIG: Subcontractor METHOD: SSA
SURFACING: Topsoil Material WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1006.7		FILL: TOPSOIL MATERIAL, (12")					
1.0		FILL: FAT CLAY (CH), trace Gravel, brown, moist		2-2-5 (7) 15"		25	LL=54, PL=21, PI=33
1004.7							
3.0		FAT CLAY (CH), brown, moist, very stiff		SH 15"		25	DD=102 pcf q_u=3.06 tsf
	▽	*Becoming gray trace brown, stiff*		2-4-5 (9)		25	
		Becoming gray with brown, medium		2-3-4 (7)		24	
992.7							
15.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled					Water observed at 9.4 feet when rechecked 24 hours after drilling.

BRAUN INTERTEC
The Science You Build On.

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **D-6**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.911695 LONGITUDE: -94.392710
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 11/30/23 END DATE: 12/02/23
SURFACE ELEVATION: 1001.3 ft RIG: Subcontractor METHOD: SSA SURFACING: Topsoil Material WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1000.8		FILL: TOPSOIL MATERIAL, (6")					
0.5	▼	FILL: FAT CLAY (CH), trace Gravel, root hairs, dark brown, moist		3-4-7 (11) 10"		21	
997.3				2-3-6 (9) 13"		24	
4.0		FAT CLAY (CH), trace roots, dark brown with brown, moist, stiff to medium	5				
		Becoming gray with brown		2-3-5 (8) 18"		24	
			10				
986.3				2-3-6 (9)		25	
15.0		END OF BORING	15				Water not observed while drilling.
		Boring immediately backfilled					Water observed at 2.0 feet when rechecked 24 hours after drilling.
			20				
			25				
			30				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2311165
Geotechnical Evaluation
QuikTrip Store No. 183R
1001 SW Blue Pkwy
Lees Summit, Missouri

BORING: **T-1**
LOCATION: Captured with RTK GPS.
DATUM: WGS 84
LATITUDE: 38.911916 LONGITUDE: -94.392680
DRILLER: RC Drilling LOGGED BY: I. Vazquez-Nevarez START DATE: 12/01/23 END DATE: 12/02/23
SURFACE ELEVATION: 1009.0 ft RIG: Subcontractor METHOD: SSA SURFACING: Concrete WEATHER: Overcast, 40s

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
1008.4		CONCRETE, (7")					
0.6		FILL: SILTY GRAVEL (GM), gray, dry		2-3-5 (8) 14"		26	
1008.0 1.0		FILL: FAT CLAY (CH), gray with brown, moist					
1005.0				7-14-4 (18) 15"		29	
4.0		FILL: SILTY GRAVEL (GM), gray, moist					
1004.5 4.5		FAT CLAY (CH), dark gray, moist, stiff	5			6	
	▼	*Becoming gray with brown*	10	2-4-5 (9) 18"		21	
997.0 12.0		SHALE, yellowish brown with olivish gray, highly weathered, soft	15	4-6-13 (19) 18"		18	
991.9 17.1		LIMESTONE, yellowish brown with gray, hard		42-50/5" (REF) 17"		16	
991.1 17.9		SHALE, dark gray, slightly weathered to moderately weathered, moderately hard	20			14	
			25	35-50/4" (REF)		15	
				45-50/3" (REF)		15	
979.0 30.0		END OF BORING	30				Water not observed while drilling.
		Boring immediately backfilled					Water observed at 11.1 feet when rechecked 24 hours after drilling.

BRAUN INTERTEC
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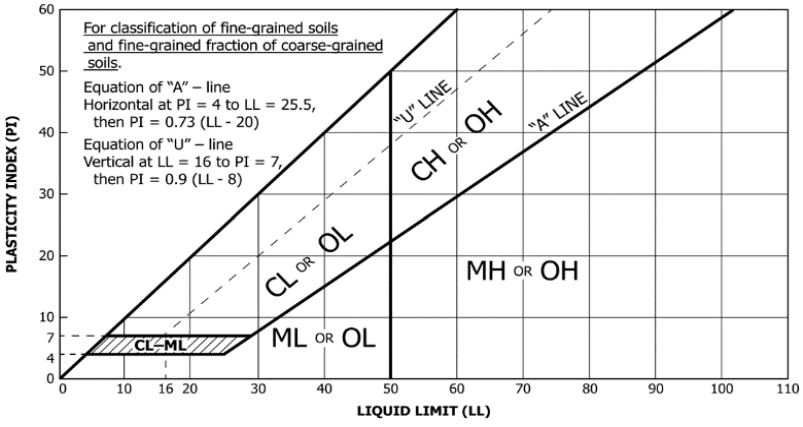
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(Unified Soil Classification System)

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

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	**q_p**	Pocket penetrometer strength, tsf
WD	Wet density, pcf	**q_U**	Unconfined compression test, tsf
P200	% Passing #200 sieve	**LL**	Liquid limit
MC	Moisture content, %	**PL**	Plastic limit
OC	Organic content, %	**PI**	Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L, M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose ..... 0 to 4 BPF
Loose ..... 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

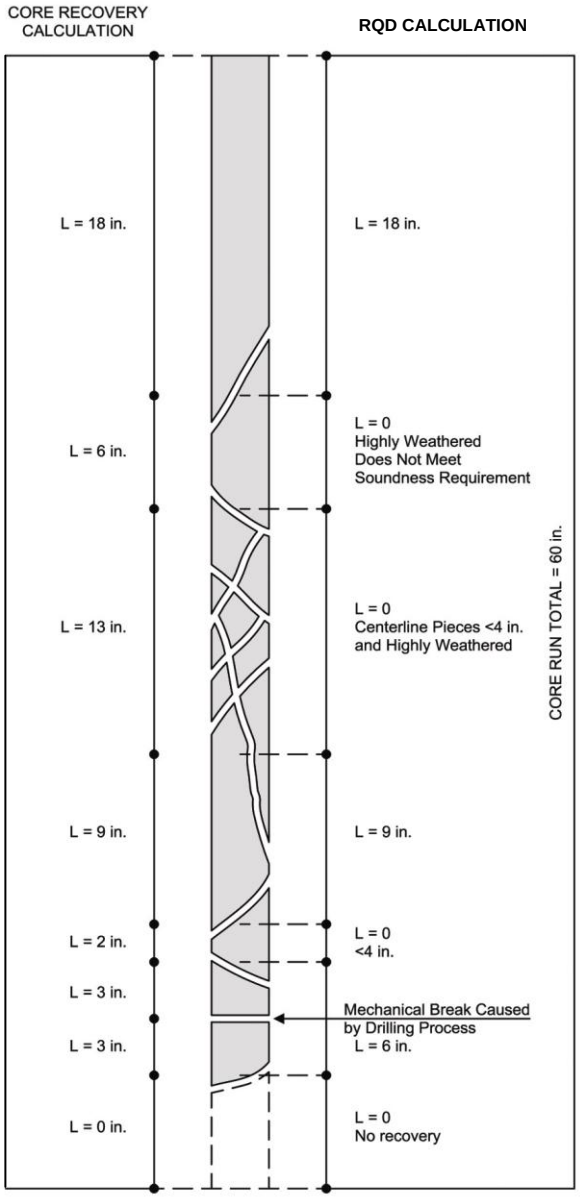
Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Sample Symbols

Standard Penetration Test
Modified California (MC)
Auger
Grab Sample
Rock Core
Thinwall (TW)/Shelby Tube (SH)
Texas Cone Penetrometer
Dynamic Cone Penetrometer

Descriptive Terminology of Rock

Based on U.S. Army Corps of Engineers EM 1110-1-2908



Example Calculations

Core Recovery, CR = $\frac{\text{Total length of rock recovered}}{\text{Total core run length}}$

Example:CR = $\frac{(18 + 6 + 13 + 9 + 2 + 3 + 3)}{(60)}$

CR = 90%

RQD = $\frac{\text{Sum of sound pieces 4 inches or larger}}{\text{Total core run length}}$

RQD Percent	Rock Quality
< 25	very poor
25 < 50	poor
50 < 75	fair
75 < 90	good
90 < 100	excellent

Example: RQD = $\frac{(18 + 9 + 6)}{(60)}$

RQD = 55%

Weathering

Unweathered: No evidence of chemical or mechanical alteration.

Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

Moderately Weathered: Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

Highly Weathered: Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

Decomposed: Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

Hardness

Very soft:	Can be deformed by hand
Soft:	Can be scratched with a fingernail
Moderately hard:	Can be scratched easily with a knife
Hard:	Can be scratched with difficulty with a knife
Very hard:	Cannot be scratched with a knife

Texture

Sedimentary Rocks:	*Grain Size*
Coarse grained	2 – 5 mm
Medium grained	0.4 – 2 mm
Fine grained	0.1 – 0.4 mm
Very fine grained	< 0.1 mm

Igneous and Metamorphic Rocks:	
Coarse grained	5 mm
Medium grained	1 – 5 mm
Fine grained	0.1 – 1 mm
Aphanitic	< 0.1 mm

Thickness of Bedding

Massive:	3 ft. thick or greater
Thick bedded:	1 to 3 ft. thick
Medium bedded:	4 in. to 1 ft. thick
Thin bedded:	4 in. thick or less

Degree of Fracturing (Jointing)

Unfractured:	Fracture spacing 6 ft. of more
Slightly fractured:	Fracture spacing 2 to 6 ft.
Moderately fractured:	Fracture spacing 8 in. to 2 ft.
Highly fractured:	Fracture spacing 2 in. to 8 in.
Intensely fractured:	Fracture spacing 2 in. or less