

Express Oil Change – Sand Springs, OK

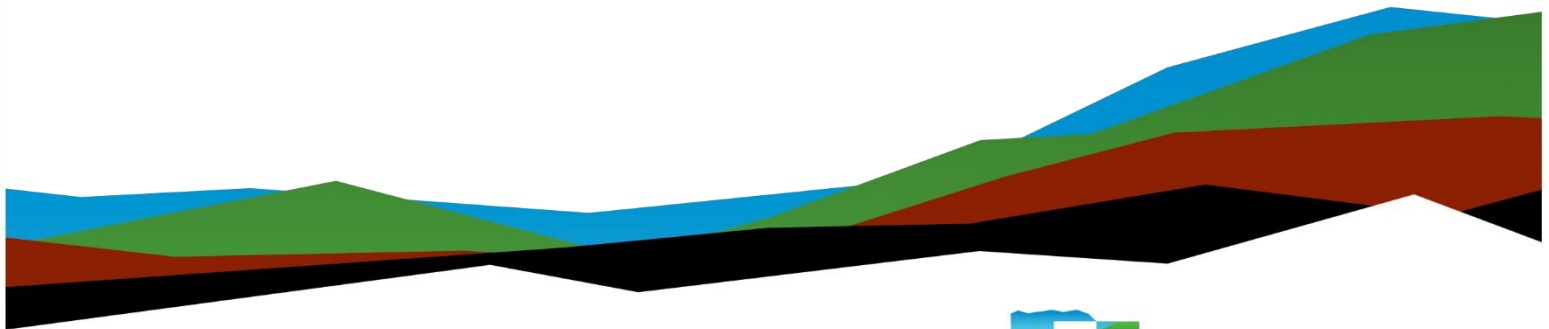
Geotechnical Engineering Report

Sand Springs, Oklahoma

January 19, 2026 | Terracon Project No. 03255274

Prepared for:

Express Oil Change, LLC
1880 Southpark Drive
Birmingham, AL 35244



Nationwide
Terracon.com

- Facilities
- Environmental
- Geotechnical
- Materials



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January 19, 2026

Express Oil Change, LLC
1880 Southpark Drive
Birmingham, AL 35244

Attn: Tyler Hendon
P: 205 206 9006
E: Tyler.Hendon@expressoil.com

Re: Geotechnical Engineering Report
Express Oil Change – Sand Springs, OK
3507 S 113th Ave West
Sand Springs, Oklahoma
Terracon Project No. 03255274

Dear Mr. Hendon:

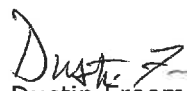
We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. P03255274 dated November 14, 2025. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

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

Sincerely,

Terracon

Cert. Of Auth. #CA-4531 exp. 6/30/27


Dustin Freeman, P.E.
Oklahoma No. 35726




Norman Tan, P.E.
Regional Technical Consultant

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

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Express Oil Change to be located at 3507 S 113th Ave West in Sand Springs, Oklahoma. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Lateral earth pressure
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of 8 test borings, laboratory testing, engineering analysis, and preparation of this report. Borings B-1, B-2, B-5, and B-6 were terminated at an auger refusal depths ranging from 6.5 to 13.5 feet.

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

Project Description

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

- A temporary piezometer used to measure the groundwater table at 48 hours post drilling was planned to be installed in boring B-2. However, due to the presence of limestone causing auger refusal at a shallower depth than B-1, the temporary piezometer was installed in B-1 at the request of Tyler Hendon with Express Oil Change.
- Boring B-8 was shifted south due to the presence of underground utilities.

Item	Description
Information Provided	An email request for proposal was provided by Tyler Hendon on November 7, 2025. The request included a Parcel Map and conceptual plan drawings of the layout of the planned development and proposed boring locations and depths.
Project Description	The project includes the construction of a new Express Oil Changed located at 3507 S 113th Ave West, in Sand Springs, Oklahoma. Pavement and a detention pond is planned for the site.
Proposed Structure	The structure associated with the project is an approximately 5,572 square foot single-story building with a below-grade oil change pit.
Finished Floor Elevation	Not provided; boring depths have assumed that finished floor is not more than 2 feet below existing grade.
Maximum Loads	Anticipated structural loads were not provided. In the absence of information provided by the design team, we have used the following loads in estimating settlement based on our experience with similar projects. ■ Columns: 60 kips ■ Walls: 2 to 3 kips per linear foot (klf) ■ Slabs: 125 pounds per square foot (psf)
Grading/Slopes	A site grading plan was not provided. We have considered no more than 2 feet of cut or fill will be required to develop final grades. An exception to this will occur in the oil change pit where excavation depth of about 7 to 9 feet will be required to reach the pit slab subgrade level.
Below-Grade Structures	Oil change "Pit" area under the southern end of the building.
Free-Standing Retaining Walls	We are unaware of any planned retaining walls.
Pavements	Paved driveway and parking will also be constructed. We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Anticipated traffic is as follows: Light Duty: Autos/light trucks: 500 vehicles per day Heavy Duty: (in addition to autos/light trucks) Light delivery and trash collection vehicles: 10 vehicles per week Tractor-trailer trucks: <1 vehicle per week
Building Code	2018 IBC

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

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration.

Item	Description
Parcel Information	The project is located at 3507 S 113th Ave West in Sand Springs, Oklahoma. Latitude/Longitude (approximate) 36.1113°, -96.1183° See Site Location
Existing Improvements	Based on Google Earth Pro, the site appears to be clear of any improvements.
Current Ground Cover	The site contains vegetation for ground cover with some trees near the edge of the site.
Existing Topography	Slopes downward towards the east with about 1 foot of maximum elevation difference between the borings in the proposed building area and 10 feet of maximum elevation difference between the borings throughout the site.

Geotechnical Characterization

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

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

Model Layer	Layer Name	General Description
1	Overburden Soils	Lean to Fat Clay
2	Bedrock	Weathered Shale/Limestone to Limestone

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

Groundwater was not observed in the borings while drilling, or for the short duration the borings could remain open. Boring B-1 was converted into a temporary piezometer, with groundwater levels being measured again at 48 hours after drilling. The boring was still dry at that time. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

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

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of C** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 13.5 feet. The subsurface characteristics below the maximum boring depth were estimated based on our experience and knowledge of geologic conditions of the general area. Upon request, we could perform deeper borings or geophysical testing to confirm the conditions below the current maximum boring depth.

Geotechnical Overview

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

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

The soils which form the bearing stratum for shallow foundations are plastic and exhibit potential for shrink-swell movements with changes in moisture. Maintaining a minimum dead load pressure on footings should reduce the anticipated swell movements to tolerable levels. The **Shallow Foundations** section addresses support of the building directly bearing on native medium stiff to very stiff clay, bedrock, or engineered fill. We do not expect significant dead load on the floors and recommend either overexcavation of near-surface high plasticity clays to reduce the heave potential or use of suspended slabs to accommodate potential ground heave. The **Floor Slabs** section addresses slab-on-grade support of the building using overexcavation techniques.

Our opinion of pavement section thickness design has been developed based on our understanding of the intended use, assumed traffic, and subgrade preparation recommended herein. The **Pavements** section includes minimum pavement component thickness.

Expansive soils are present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and (at least minor) cracking in the structure should be anticipated. The severity of cracking and other damage such as uneven floor slabs will probably increase if modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Excavation of limestone bedrock may be required to reach the planned bearing elevation for the oil change pit. In our experience, weathered limestone bedrock (bedrock penetrated with our flight augers) can generally be excavated with conventional

excavating equipment such as scrapers and loaders. Excavation of harder limestone strata will be difficult and will require the use of large pneumatic breakers or other rock excavating techniques. Excavation of rock formations in confined excavations such as utility trenches or footings is more difficult, regardless of the degree of weathering.

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

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

Subgrade Preparation

After removing the vegetation, topsoil and performing any required cuts, but before placing any fill or constructing the floor slab, we recommend undercutting the building area to allow construction of a minimum 5-feet thickness of low volume change fill below the design finish subgrade elevation. The zone of fill compacted to meet this criteria should extend beyond the building footprint at least 1 foot laterally for each foot of fill required to develop design grade.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck weighing at least 25 tons. The proofrolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. The unstable soils should be overexcavated and replaced with an approved low volume change soil, moisture conditioned and recompacted. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

All exposed building areas or pavement area which will receive fill, once properly cleared, should be scarified to a minimum depth of 8 inches, moisture conditioned as necessary, and compacted per the compaction requirements in this report. Compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or pavement construction.

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

Excavation

We anticipate that excavations of the existing soils for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

We anticipate that excavations for the oil change pit will extend into bedrock. Rock formations that have standard penetration test results of 4 or more inches per 50 blows can usually be excavated with heavy excavation equipment equipped with ripping teeth. Rock formations that have standard penetration test results of 3 inches or less per 50 blows usually require either pneumatic breaking equipment or blasting to remove. Variations in hardness of rock will likely can occur with depth and distance from the borings.

We anticipate pneumatic equipment or blasting will be required to remove the limestone encountered at this site.

Fill Material Types

All fill required to develop the design subgrade elevation should be an approved material that is free of organic matter and debris. Earthen materials used for fill should meet the following material property requirements:

Soil Type ¹	USCS Classification	Acceptable Location for Placement
Low Volume Change (LVC) material	CL (LL<40 and PI<15) At least 60% passing No. 200 sieve	All locations and elevations, except where free-draining material is required
On-site cohesive soils	CL, CH	Pavement areas and at depths greater than 5 feet below building finished grade
ODOT Type "A" Aggregate meeting the requirements of Section 703.01 ²	GW, GP	All locations and elevations, except where free-draining material is required

1. Fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Recycled aggregate is not recommended.

Fill Compaction Requirements

Engineered fill should meet the following compaction requirements.

Item	Description
Maximum Lift Thickness ²	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements ^{1, 3}	Cohesive soils: At least 95% Less than 5 feet of fill: At least 95% Greater than 5 feet of fill: At least 98% Modified pavement subgrade: At least 98% ODOT Type A Aggregate: At least 98%
Water Content Range ^{1, 4}	Cohesive Soils: Optimum and above ODOT Type A Aggregate: Workable moisture content

Item	Description
1.	Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2.	Thinner lifts are recommended in confined areas or when hand-operated compaction equipment is used.
3.	We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
4.	Workable moisture content is the moisture content sufficient to achieve the specified compaction without causing pumping when proofrolled.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with engineered fill or bedding material in accordance with public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

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

Utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Accumulation of water adjacent to the structure could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement or expansion/heave, which could result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

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

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

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

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review

of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

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

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

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

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

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

Shallow Foundation Design Parameters

Item	Description
Maximum Net Allowable Bearing Pressure ^{1, 2, 3}	2,000 psf
Required Bearing Stratum ³	Undisturbed native soils, weathered limestone, or engineered fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance ⁴ (equivalent fluid pressures)	285 pcf (cohesive backfill) 360 pcf (granular backfill)
Ultimate Coefficient of Sliding Friction ⁵	0.35
Minimum Embedment below Finished Grade ⁶	Exterior footings in unheated areas: 30 inches Interior footings in heated areas: 12 inches
Estimated Total Settlement from Structural Loads ²	About 1 inch
Estimated Differential Settlement ^{2, 7}	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in [Project Description](#). Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in [Earthwork](#).
4. An appropriate safety factor should be applied to the ultimate passive earth pressure. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure. The passive resistance should be disregarded to a depth of 1.5 feet below final grade.
5. An appropriate safety factor should be applied to the ultimate coefficient of sliding friction. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.

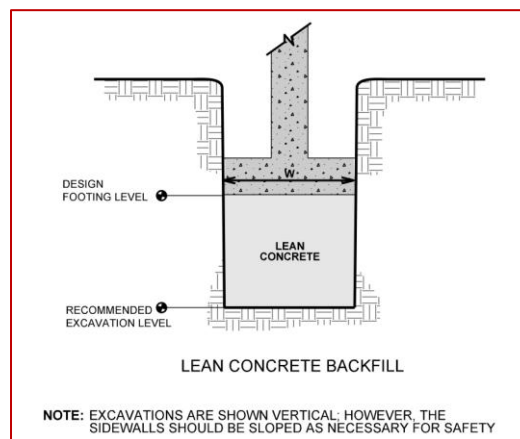
Item	Description
7.	Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Foundation Construction Considerations

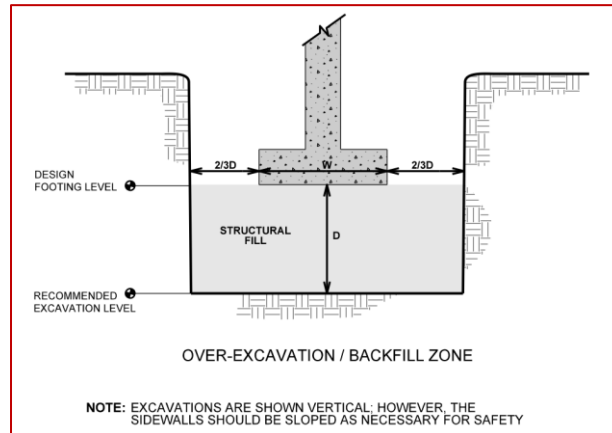
As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. If the soils at the bearing level become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed prior to placing concrete. If the excavations must remain open overnight or for an extended period of time, placement of a lean concrete mud-mat over the bearing soils should be considered.

The bearing materials at the base of each footing excavation should be evaluated by a representative of the Geotechnical Engineer.

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



Overexcavation for structural fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation, with low plasticity cohesive materials placed, as recommended in the **Earthwork** section.



Floor Slabs

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

The subgrade soils are comprised of high plasticity clays exhibiting the potential to swell with increased water content. Construction of the floor slab, combined with the removal of trees, and revising site drainage creates the potential for gradual increased water contents within the clays. Increases in water content will cause the clays to swell and damage the floor slab. To reduce the swell potential to less than about 1 inch, at least the upper 5 feet of subgrade soils below the floor slab should be an approved Low Volume Change (LVC) material consisting of lean clays.

Floor Slab Design Parameters

Item	Description
Floor Slab Support¹	At least 5 feet of low volume change (LVC) material prepared in accordance with Earthwork
Estimated Modulus of Subgrade Reaction²	100 pounds per square inch per inch (psi/in) for point loads

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

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

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

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

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

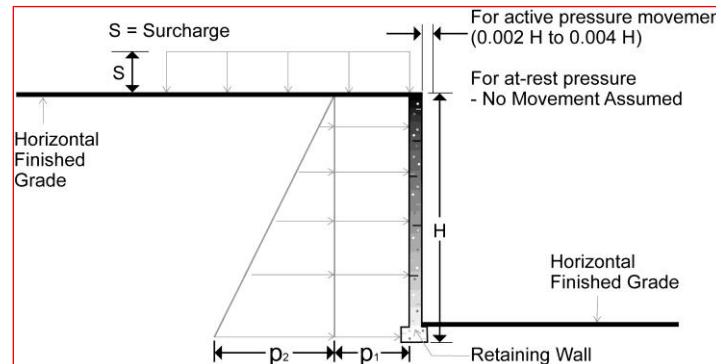
The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches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

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of

construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement is acceptable. The “at-rest” condition assumes no wall movement and is commonly used for design of basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition ¹	Coefficient for Backfill Type ²	Surcharge Pressure ³ p_1 (psf)	Equivalent Fluid Pressures P_2 (psf) ^{2,4}	
			Unsaturated ⁵	Submerged ⁵
Active (K_a)	Granular - 0.33	$(0.33)S$	$(45)H$	$(85)H$
	Fine Grained - 0.42	$(0.42)S$	$(50)H$	$(85)H$
At-Rest (K_o)	Granular - 0.50	$(0.50)S$	$(65)H$	$(95)H$
	Fine Grained - 0.59	$(0.59)S$	$(70)H$	$(95)H$

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, with a maximum unit weight of 120 pcf for cohesive soils and 130 pcf for granular soils.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. To achieve “Unsaturated” conditions, follow guidelines in Subsurface Drainage for Below-Grade Walls below. “Submerged” conditions are recommended when drainage behind walls is not incorporated into the design.

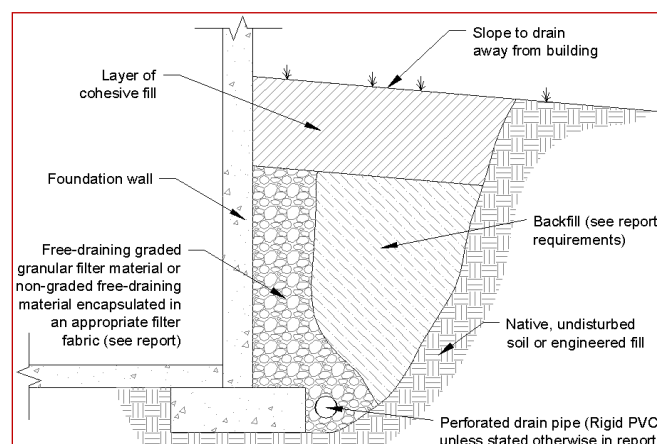
Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

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

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

Subsurface Drainage for Below-Grade Walls

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



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

Pavements

General Pavement Comments

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

Pavement Subgrade Preparation

Expansive soils are present at this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these recommendations are followed some pavement distress could still occur. It is, therefore, important to minimize moisture changes in the subgrade both during construction and during the life of the pavement to reduce shrink/swell movements.

To reduce potential trafficability problems and strength loss, we recommend the top 8 inches of the subgrade be modified with hydrated lime. Based on past experience with soils similar to those present at the site, we estimate 5 to 7 percent hydrated lime will be needed to adequately modify the on-site soils. The actual percentage of additive should be determined at the time of construction by the Geotechnical Engineer. The lime should be thoroughly blended into the subgrade and allowed to cure for 48 to 72 hours before being remixed and compacted. Before compaction, the modified soil zone should be adjusted to within 2 percent of the material's optimum moisture as determined by the standard Proctor test method ASTM D698. After conditioning the soil to the required moisture content, the modified subgrade should be compacted to at least 98 percent of the material's maximum dry density.

As an alternative to subgrade modification, we recommend placing at least 6 inches of ODOT Type "A" aggregate base meeting the requirements of Section 703.01. The aggregate should be spread and densified to at least 98 percent of the material's maximum dry density as determined by the standard Proctor test method ASTM D698.

Pavement Section Thicknesses

The following table provides our opinion of minimum thickness for Asphaltic Concrete and Portland Cement Concrete sections:

Minimum Pavement Recommendations¹

Pavement Type	Light Duty ²	Heavy Duty ²
Full Depth ACC	2.0" Type "B" Asphaltic Concrete 3.0" Type "A" Asphaltic Concrete 8.0" Modified Subgrade OR 2.0" Type "B" Asphaltic Concrete 3.0" Type "A" Asphaltic Concrete 6.0" Type "A" Aggregate Base ³	2.0" Type "B" Asphaltic Concrete 5.0" Type "A" Asphaltic Concrete 8.0" Modified Subgrade OR 2.0" Type "B" Asphaltic Concrete 5.0" Type "A" Asphaltic Concrete 6.0" Type "A" Aggregate Base ³
PCC	5.0" Concrete 8.0" Modified Subgrade OR 5.0" Concrete 6.0" Type "A" Aggregate Base ³	6.0" Concrete 8.0" Modified Subgrade OR 6.0" Concrete 6.0" Type "A" Aggregate Base ³

1. All materials should meet the current Oklahoma Department of Transportation (ODOT) Standard Specifications for Highway and Bridge Construction. For asphaltic concrete, refer to ODOT 1988 Specifications.
2. See [Project Description](#) for more specifics regarding traffic assumptions.
3. ODOT Type "A" aggregate base should meet the requirements of Section 703.01. The aggregate should be spread and densified to at least 98 percent of the material's maximum dry density as determined by the standard Proctor test method ASTM D698.

Note: We recommend that reinforced concrete pads be provided in front of and beneath trash receptacles. The dumpster trucks should be parked on the rigid concrete pavement when the trash receptacles are lifted. The concrete pads should be a minimum of 7 inches thick and properly reinforced

PCC pavements will perform better than ACC in areas where short radius turning and braking are expected (i.e., entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to heavy static loads.

Construction traffic on the pavements was not considered in developing our opinions of minimum pavement thickness. If the pavements will be subject to construction equipment/vehicles, the pavement sections should be revised to consider the additional loading.

Pavements and subgrades will be subject to freeze-thaw cycles and seasonal fluctuations in moisture content. Pavement thickness design methods are intended to provide adequate thickness of structural materials over a particular subgrade such that wheel loads are reduced to a level that the subgrade can support. The subgrade support parameters for pavement thickness design do not account for shrink/swell movements of a subgrade constructed of expansive clay soils. Therefore, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

The pavement sections provided above consider that the subgrade soils will not experience significant increases in moisture content. Paved areas should be sloped to provide rapid drainage of surface water and to drain water away from the pavement edges. Pavements should be designed so water does not accumulate on or adjacent to the pavement, since this could saturate and soften the subgrade soils and subsequently accelerate pavement deterioration.

Pavement Drainage

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

Pavement Maintenance

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

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

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.

- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.

General Comments

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

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

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

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that

could significantly impact excavation cost. Any parties charged with design of excavation support, dewatering, or working platforms should seek their own site characterization for specific purposes to obtain the specific level of detail necessary. Site safety and construction cost estimating are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Geotechnical Engineering Report

Express Oil Change – Sand Springs, OK | Sand Springs, Oklahoma
January 19, 2026 | Terracon Project No. 03255274

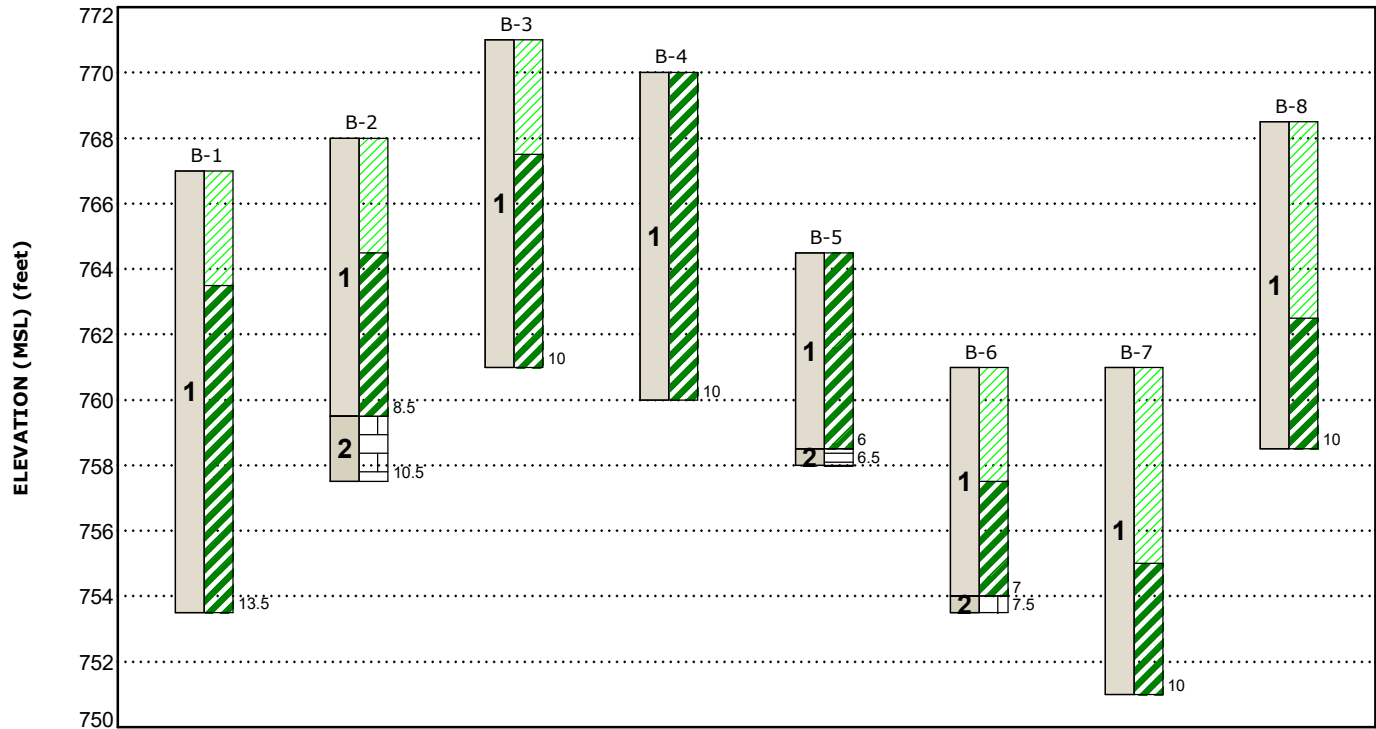


Figures

Contents:

GeoModel

GeoModel



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

Model Layer	Layer Name	General Description	Legend	
1	Overburden Soils	Lean to Fat Clay	Lean Clay	Fat Clay
2	Bedrock	Weathered Shale/Limestone to Limestone	Limestone	Shale

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

Geotechnical Engineering Report

Express Oil Change – Sand Springs, OK | Sand Springs, Oklahoma
January 19, 2026 | Terracon Project No. 03255274



Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
1 (B-1)	13.5 ³	Within the proposed building area ¹
1 (B-2)	10.5 ³	Within the proposed oil change pit in the building area ¹
2 (B-3 and B-4)	10	Within the proposed parking/driveway area
1 (B-5)	6.5 ³	
1 (B-6)	7.5 ³	Within the proposed detention basin area
2 (B-7 and B-8 ²)	10	Within the backup detention basin areas

1. A temporary piezometer used to measure the groundwater table at 48 hours post drilling was planned to be installed in boring B-2. However, due to the presence of limestone causing auger refusal at a shallower depth than B-1, the temporary piezometer was installed in B-1 at the request of Tyler Hendon with Express Oil Change.
2. Boring B-8 was shifted south due to the presence of underground utilities.
3. Auger refusal was encountered prior to reaching the planned boring termination depth.

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a Pointone NAV RTK system GPS device. The ground surface elevations at the boring locations ranged from 761 to 771 feet. We rounded the elevations on the boring log to the nearest one-half foot. Consider the location and elevation of the boring accurate only to the degree implied by the methods used to make these measurements.

Subsurface Exploration Procedures: We advanced the borings with an ATV-mounted rotary drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling

procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

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

Laboratory Testing

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

- Moisture Content
- Atterberg Limits
- Grain size analysis

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

Rock classification was conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification was determined using the Description of Rock Properties.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan with Aerial Image
Exploration Plan with Project Overlay

Note: All attachments are one page unless noted above.

Geotechnical Engineering Report

Express Oil Change – Sand Springs, OK | Sand Springs, Oklahoma
January 19, 2026 | Terracon Project No. 03255274



Site Location



Exploration Plan with Aerial Image



Exploration Plan with Project Overlay



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

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-8)
Grain Size Distribution

Note: All attachments are one page unless noted above.

Model Layer	Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
		Latitude: 36.1114° Longitude: -96.1183°							LL-PL-PI	
		Depth (Ft.) Approximate Elevation: 767.0 (Ft.)								
1		LEAN CLAY (CL) , dark brown, medium stiff								
		3.5 763.5								
		FAT CLAY (CH) , dark orangish brown, medium stiff								
		-stiff below 6'								
		-very stiff below 8.5'								
		13.5 753.5								
		Auger Refusal in apparent Limestone at 13.5 Feet				0	50/0"			

Boring Completed
12-08-2025

Boring Log No. B-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 36.1111° Longitude: -96.1188° Depth (Ft.) Approximate Elevation: 771.0 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
1		LEAN CLAY (CL) , orangish brown, medium stiff	5		12	2-3-4 N=7	21.7	45-20-25		
	3.5 767.5									
	FAT CLAY (CH) , olive, very stiff									
	10.0 761									
		Boring Terminated at 10 Feet								

Notes Vegetation at Surface	See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any). See Supporting Information for explanation of symbols and abbreviations.	Water Level Observations No free water observed	Drill Rig 578
			Hammer Type Automatic
			Driller PH
		Advancement Method Power Auger	Logged by MN
		Abandonment Method Boring backfilled with soil cuttings and bentonite chips upon completion.	Boring Started 12-08-2025
			Boring Completed 12-08-2025

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 36.1111° Longitude: -96.1185° Depth (Ft.) Approximate Elevation: 770.0 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1		FAT CLAY (CH) , dark orangish brown, medium stiff	5		X	8	1-3-5 N=8	23.7	52-16-36	
		-olive, stiff below 3.5'			X	7	4-4-5 N=9	21.3		
		-very stiff below 6'			X	12	6-10-18 N=28	15.9		
					X	12	9-15-10 N=25	14.9		
		10.0		760						
		Boring Terminated at 10 Feet	10							

Boring Completed
12-08-2025

Boring Log No. B-5

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 36.1113° Longitude: -96.1180° Depth (Ft.) Approximate Elevation: 764.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
									LL-PL-PI	
1		FAT CLAY (CH) , dark brown, medium stiff	5							
		-light brown below 3.5'			8	2-2-4 N=6	25.0			
					9	2-3-5 N=8	21.0	55-15-40		
2		6.0 758.5 6.5 WEATHERED SHALE , light brown, moderately hard 758			2	50/3"	23.8			
		Auger Refusal in apparent Limestone at 6.5 Feet								

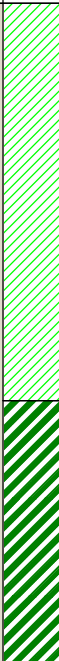
Notes Vegetation at Surface	See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any). See Supporting Information for explanation of symbols and abbreviations.	Water Level Observations No free water observed	Drill Rig 578
			Hammer Type Automatic
			Driller PH
		Advancement Method Power Auger	Logged by MN
		Abandonment Method Boring backfilled with soil cuttings upon completion.	Boring Started 12-08-2025
			Boring Completed 12-08-2025

Boring Log No. B-6

Model Layer	Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
		Latitude: 36.1114° Longitude: -96.1178°	Depth (Ft.)							LL-PL-PI	
1		Approximate Elevation: 761.0 (Ft.)									
		LEAN CLAY (CL) , dark brown, medium stiff									
		3.5	757.5			X	9	1-2-3 N=5	25.5		
		FAT CLAY (CH) , dark orangish brown, medium stiff				X	13	2-3-4 N=7	22.0	51-20-31	
2		7.0	754			X	8	3-50/5"	24.8		
		WEATHERED LIMESTONE , gray, soft		7.5	753.5						
		Auger Refusal in apparent Limestone at 7.5 Feet									

Notes Vegetation at Surface	Water Level Observations No free water observed		Drill Rig 578
			Hammer Type Automatic
			Driller PH
	Advancement Method Power Auger		Logged by MN
			Boring Started 12-08-2025
	Abandonment Method Boring backfilled with soil cuttings and bentonite chips upon completion.		Boring Completed 12-08-2025

Boring Log No. B-7

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 36.1112° Longitude: -96.1178° Depth (Ft.) Approximate Elevation: 761.0 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
									LL-PL-PI	
1		LEAN CLAY (CL) , dark orangish brown, medium stiff	5		12	2-2-4 N=6	20.3	32-17-15		
		-stiff below 3.5'								
		6.0 755								
		FAT CLAY (CH) , dark orangish brown, medium stiff								
		10.0 751								
		Boring Terminated at 10 Feet								

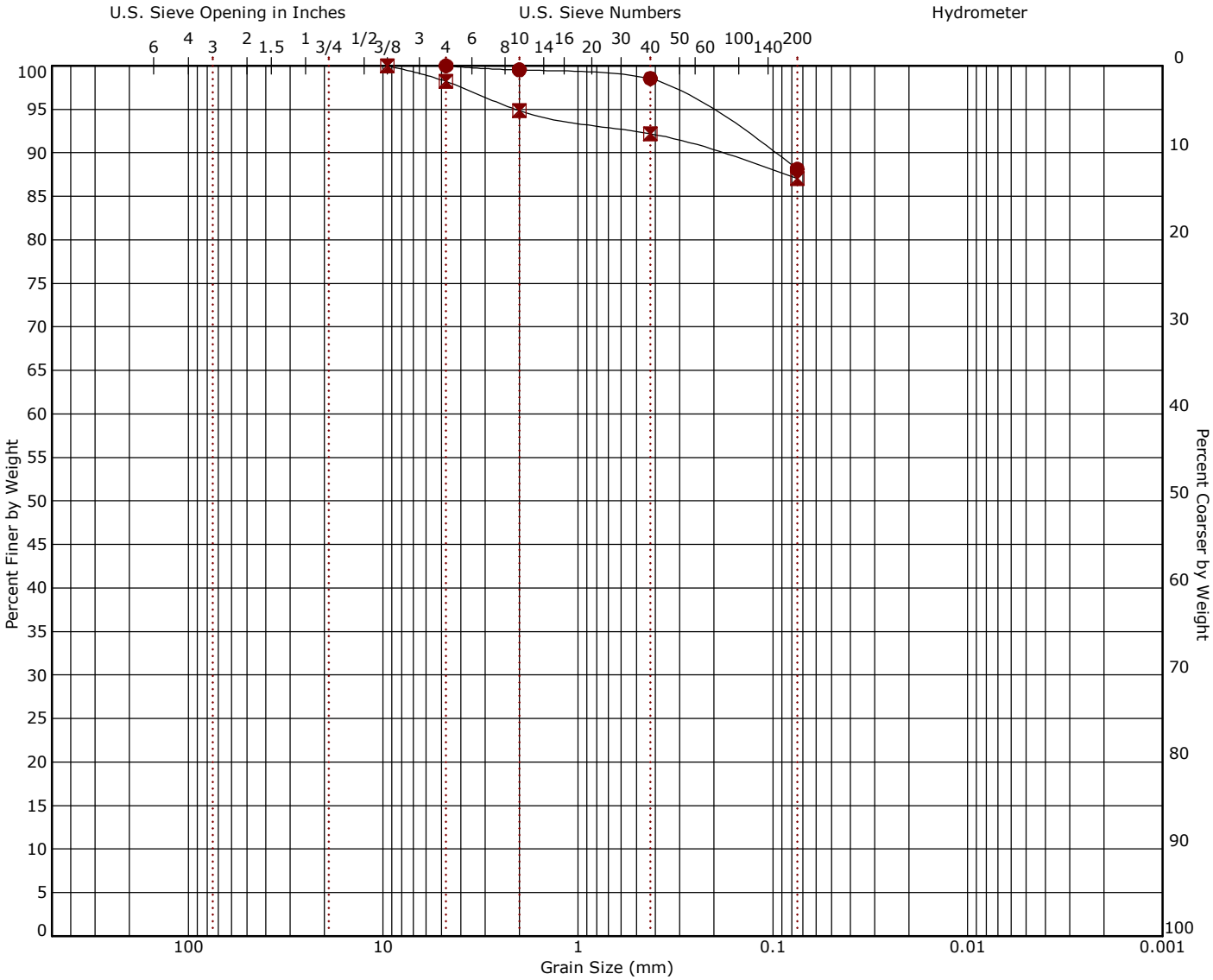
Notes Vegetation at Surface	Water Level Observations No free water observed	Drill Rig 578
		Hammer Type Automatic
		Driller PH
	Advancement Method Power Auger	Logged by MN
	Abandonment Method Boring backfilled with soil cuttings upon completion.	Boring Started 12-08-2025
		Boring Completed 12-08-2025

Boring Log No. B-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 36.1113° Longitude: -96.1187° Depth (Ft.) Approximate Elevation: 768.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	Percent Fines
									LL-PL-PI	
1		LEAN CLAY (CL) , dark brown, medium stiff	5		14	1-3-4 N=7	20.3	29-21-8		
		-dark orangish brown, stiff below 3.5'								
		6.0 762.5								
		FAT CLAY (CH) , dark orangish brown, stiff								
		10.0 758.5								
		Boring Terminated at 10 Feet	10							

Notes Vegetation at Surface	See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any). See Supporting Information for explanation of symbols and abbreviations.	Water Level Observations No free water observed	Drill Rig 578
			Hammer Type Automatic
			Driller PH
		Advancement Method Power Auger	Logged by MN
		Abandonment Method Boring backfilled with soil cuttings upon completion.	Boring Started 12-08-2025
			Boring Completed 12-08-2025

Grain Size Distribution
ASTM D422 / ASTM C136



Cobbles		Gravel		Sand			Silt or Clay				
		coarse	fine	coarse	medium	fine					
Boring ID	Depth (Ft)	USCS Classification			USCS	AASHTO	LL	PL	PI	Cc	Cu
●	B-1	1 - 2.5	LEAN CLAY			CL	A-6 (18)	40	20	20	
▣	B-2	3.5 - 5	FAT CLAY			CH	A-7-6 (30)	57	26	31	
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-1	1 - 2.5	4.75			0.0	0.0	11.9	88.1		
▣	B-2	3.5 - 5	9.5			0.0	1.8	11.2	87.0		

Supporting Information

Contents:

General Notes
Unified Soil Classification System
Description of Rock Properties

Note: All attachments are one page unless noted above.

General Notes

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

Descriptive Soil Classification

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

Location And Elevation Notes

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

Strength Terms

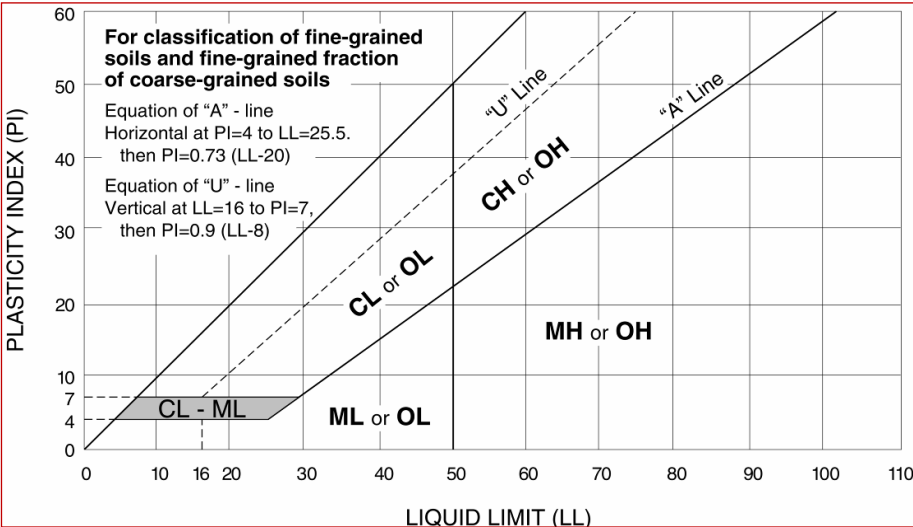
Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (psf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 500	0 - 1
Loose	4 - 9	Soft	500 to 1,000	2 - 4
Medium Dense	10 - 29	Medium Stiff	1,000 to 2,000	5 - 8
Dense	30 - 50	Stiff	2,000 to 4,000	9 - 15
Very Dense	> 50	Very Stiff	4,000 to 8,000	16 - 30
		Hard	> 8,000	> 30

Relevance of Exploration and Laboratory Test Results

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

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E	GW	Well-graded gravel ^F
			Cu < 4 and/or [Cc < 1 or Cc > 3.0] ^E	GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E	SW	Well-graded sand ^I
			Cu < 6 and/or [Cc < 1 or Cc > 3.0] ^E	SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above "A" line ^J	CL	Lean clay ^{K, L, M}
			PI < 4 or plots below "A" line ^J	ML	Silt ^{K, L, M}
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	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:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay ^{K, L, M, P} Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat
^A Based on the material passing the 3-inch (75-mm) sieve. ^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name. ^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay. ^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay. ^E $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ ^F If soil contains ≥ 15% sand, add "with sand" to group name. ^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM. ^H If fines are organic, add "with organic fines" to group name. ^I If soil contains ≥ 15% gravel, add "with gravel" to group name. ^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay. ^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant. ^L If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name. ^M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name. ^N PI ≥ 4 and plots on or above "A" line. ^O PI < 4 or plots below "A" line. ^P PI plots on or above "A" line. ^Q PI plots below "A" line.					



Rock Classification Notes

DESCRIPTIVE ROCK CLASSIFICATION					
Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, and rock of clay and silt size grains is called mudstone or claystone, siltstone, or shale. Modifiers such as shaley, sandy, dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.					
Limestone	Light to dark colored, crystalline to fine-grained texture, composed of CaCO ₃ , reacts readily with HCl.				
Dolomite	Light to dark colored, crystalline to fine-grained texture, composed of CaMg(CO ₃) ₂ , harder than limestone, reacts with HCl when powdered.				
Chert	Light to dark colored, very fine-grained texture, composed of micro-crystalline quartz (SiO ₂), brittle, breaks into angular fragments, will scratch glass.				
Shale	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.				
Sandstone	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.				
Conglomerate	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size (1/2 inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.				
PHYSICAL PROPERTIES					
Degree of Weathering		Bedding and Joint Characteristics ¹			
Slight	Slight decomposition of parent material on joints. May be color change.	Bed Thickness	Joint Spacing	Dimensions	
		Laminated	---	.1 in. – .4 in.	
Moderate	Some decomposition and color change throughout.	Very thin	Very close	.4 in. – 2 in.	
		Thin	Close	2 in. – 1 ft.	
High	Rock highly decomposed, may be extremely broken.	Medium	Moderately close	1 ft. – 3 ft.	
		Thick	Wide	3 ft. – 10 ft.	
		Very thick	Very wide	More than 10 ft.	
Hardness and Degree of Cementation		¹ . Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.			
Limestone and Dolomite					
Hard	Difficult to scratch with a knife.	Bedding Plane	A plane dividing sedimentary rocks of the same or different lithology.		
Moderately Hard	Can be scratched easily with a knife, cannot be scratched with a fingernail.				
Soft	Can be scratched with a fingernail.	Joint	Fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.		
Shale, Siltstone and Claystone					
Hard	Can be scratched easily with a knife, cannot be scratched with a fingernail.	Seam	Generally applies to bedding plane with an unspecified degree of weathering.		
Moderately Hard	Can be scratched with a fingernail.				
Soft	Can easily be dented but not molded with fingers.	Solution and Void Conditions			
Sandstone and Conglomerate	Capable of scratching a knife blade.	Solid	Contains no voids.		
		Vuggy (Pitted)	Rock having small solution pits or cavities up to ½ inch diameter, frequently with a mineral lining.		
Well Cemented	Capable of scratching a knife blade.	Porous	Containing numerous voids, pores, or other openings, which may or may not interconnect.		
Cemented	Difficult to scratch with a knife.	Cavernous	Containing cavities or caverns, sometimes quite large.		
Poorly Cemented	Can be broken apart easily with fingers.				