Please revise report based on Soils and Geology Report Checklist that will be uploaded seperately

Terracon GeoReport

Geotechnical Engineering Report

Meridian Circle K Retail Store

Falcon, Colorado

November 30, 2018

Terracon Project No. 23185069

Prepared for:

Land Development Consultants

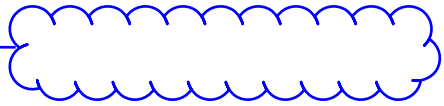
Phoenix, Arizona

Prepared by:

Terracon Consultants, Inc.

Colorado Springs, Colorado

PCD File VR-22-03



November 30, 2018

Terracon GeoReport

Land Development Consultants
11811 North Tatum Boulevard, Suite 1051
Phoenix, Arizona 85028

GEOTECH did not include a geologic hazards study (as required per Section C.2 - Geologic Hazards Report of the El Paso County Engineering Criteria Manual), and the geotechnical report does not discuss the site geology or the potential geologic hazards associated with the site.

Attn: Mr. Jared Fischer
P: (602) 617-7602
E: jared@ldcaz.com

Re: Geotechnical Engineering Report
Meridian Circle K Retail Store
U.S. Highway 24 and New Meridian Road
Falcon, Colorado
Terracon Project No. 23185069

Dear Mr. Fischer:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P23185069 dated June 20, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

For

Nathan D. Hukkanen, E.I.
Staff Engineer

COLORADO LICENSED
ROBERT MICHAEL HERNANDEZ
PE-44312
PROFESSIONAL ENGINEER

Robert M. Hernandez, P.E.
Geotechnical Services Manager

See notes below concerning borings

REPORT TOPICS

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

ATTACHMENTS

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	4,968 square foot building, car wash structure, underground storage tank, canopy's, and parking areas Max. Column loads: 12 kips, Max. Wall loads: 1.8 kips per lineal foot Assumed up to 2 feet of fill to achieve final grade Little excavation other than foundation construction Expected traffic for pavement areas: ■ 200 autos/light trucks per day ■ Up to 20 medium-duty delivery/trash trucks per week
Geotechnical Characterization	Existing fill encountered in Boring P-1 to a depth of about 1 foot Sand with various amounts of silt and clay Sandstone bedrock below about 12 to 13½ feet Groundwater observed about 5½ to 8 feet below existing site grade
Earthwork	Remove existing fill where encountered Existing lean clays cannot be used for structural fill Existing sand soils can be used for engineered fill
Shallow Foundations	Shallow foundations supported on a minimum of 1-foot of structural fill will be sufficient Allowable bearing pressure = 2,000 pounds per square foot (psf) Expected settlements: about 1-inch total, ½ to ¾ inch differential Detect and remove zones of fill as noted in **Earthwork**
Deep Foundations	Deep foundations are not necessary for this site
Below Grade Structures	Below grade fuel storage tank will be constructed at this site. Basements or crawl spaces for the proposed building have not been reported.
Pavements	With subgrade prepared as noted in **Earthwork** Concrete: ■ 5" PCC in Light Duty areas ■ 6" PCC in Heavy Duty areas ■ 7" in Dumpster Pad areas Asphalt: ■ 4.0" ACC over 6" granular base in Light Duty areas ■ 4.5" ACC over 6" granular base in Medium Duty areas
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

Meridian Circle K Retail Store
U.S. Highway 24 and New Meridian Road
Falcon, Colorado

Terracon Project No. 23185069
November 30, 2018

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Circle K Retail Store to be located at U.S. Highway 24 and New Meridian Road in Falcon, Colorado. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

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

The geotechnical engineering scope of services for this project included the advancement of nine test borings to depths ranging from approximately 10 to 29½ feet below existing site grades.

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

SITE CONDITIONS

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

Item	Description
Parcel Information	The project is located at U.S. Highway 24 and New Meridian Road in Falcon, Colorado. The site is bordered by U.S. Highway 24 to the north, the existing Meridian Road to the east, the future new alignment of Meridian Road to the west, and single-family, residential homes to the south. The future new alignment to Meridian Road is not constructed at this time and currently consists of relatively undeveloped land. The parcel includes a total area of 4.65 acres. Latitude/Longitude: 38.9315°, -104.6101° (approximate) See **Site Location**
Existing Improvements	An existing single-family, residential home is located within the south/southwest portion of the site, roughly south/southwest of the proposed building. A basement is not reported as part of existing home development. An unpaved access road for the home is present and extends north/northeast from the home to Meridian Road. An existing gas station not part of this development is located northeast of the proposed Circle K site. Remaining areas of the site appear to be relatively undeveloped.
Current Ground Cover	Unpaved with moderate amounts of grasses, weeds, and trees.
Existing Topography	Relatively flat ground

We also collected photographs at the time of our field exploration program. Representative photos are provided in our **Photography Log**.

PHOTOGRAPHY LOG

Near Boring FC-1 Facing Southeast

Near Boring FC-1 Facing Northeast

Near Boring FC-1 Facing South

PROJECT DESCRIPTION

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

Item	Description
Information Provided	An email request for proposal on June 18, 2018 with a provided conceptual site plan by Bowman Consultants, dated October 23, 2017.
Project Description	The proposed project consists of the construction of a new single-story, slab-on-grade building occupying a footprint on the order of 4,968 square-feet. Additional development will include parking areas surrounding the proposed building, two new canopy fueling stations (one north and one south of the proposed building), construction of underground tanks east of the building, and a car wash east of the proposed underground fuel tanks.
Building Construction	Metal or wood-framed, slab-on-grade construction. Steel-structured canopies for the fueling stations supported on a drilled shaft foundation system.
Finished Floor Elevation	Unknown. Not available at the time of report preparation. We assume to be within 2 feet of the current ground elevation.

Item	Description
Maximum Loads	■ Columns: 12 kips ■ Walls: 1.8 kips per lineal foot ■ Slabs: 100 psf max
Grading/Slopes	Finished floor elevation was not available at the time of report preparation. We assume it will be near existing site grades. Up to 2 feet of cut and 2 feet of fill is assumed to develop final grades. Final slope angles no steeper than 3H:1V (Horizontal: Vertical) up to 5 feet in height are assumed.
Below Grade Structures	Below grade fuel storage tank will be constructed at this site. Basements or crawl spaces for the proposed building have not been reported.
Free-Standing Retaining Walls	Not reported as part of site development.
Pavements	Paved driveway and parking will also be constructed on the parcel. We assume rigid (concrete) or flexible (asphalt concrete) sections should be considered. Please confirm this assumption. Assumed traffic is as follows: ■ Standard Duty: 27,000 ESALs over a 20-year design period ■ Heavy Duty: 110,000 ESALs over a 20-year design period

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides our geotechnical characterization.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density/ Hardness
1	1	Fill consisting of well graded sand[1]	N/A
2	3½ to 13	Sand with various amounts of silt	Loose to medium dense
3	5	Sandy lean clay[2]	Very Stiff

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density/ Hardness
4	10 to 13½	Clayey sand	Loose to medium dense
5	Undetermined: Borings terminated within this stratum at the planned depth of approximately 30 feet	Sandstone bedrock	Weathered to very hard

1. Observed only in Boring No. P-1.
2. Observed only in Boring No. B-1.

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil and bedrock types; in situ, the transition between materials may be gradual.

Groundwater Conditions

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

Boring Number	Approximate Depth to Groundwater while Drilling (feet) [1]	Approximate Depth to Groundwater after Drilling (feet) [1]
B-1	7	7
B-2	7	6
CW-1	7	7
FC-1	8	7
FC-2	8	8
P-1	6	5½
P-2	Not encountered	Not encountered
P-3	8	8
UST-1	8	8

1. Below ground surface

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.

GEOTECHNICAL OVERVIEW

Based on the results of our field investigation, laboratory testing program and geotechnical analyses, development of the site is considered feasible from a geotechnical viewpoint provided that the conclusions and considerations provided herein are incorporated into the design and construction of the project.

Potentially loose native sand soils were encountered at this site. This report provides recommendations to help mitigate the effects of settlement that may occur when bearing on these native sand soils. We recommend the proposed building be supported on reinforced shallow spread footings bearing on a minimum of 12 inches of newly placed structural fill. We also recommend floor slabs bear on a minimum of 12 inches of structural fill. On-site native sand soils are considered suitable for reuse as structural fill beneath foundations and slabs. Should foundation or structural loading conditions or anticipated maximum foundation dimensions differ from the assumptions presented in this report, we request the opportunity to re-evaluate the conditions and provide supplemental recommendations, if needed.

Fill material was observed in Boring No. P-1 to a depth of approximately 1-foot below existing site grade as part of an aggregate surfaced drive area at the time of field exploration. We do not possess any information on if the fill was placed and compacted under the direction of a geotechnical engineer. We recommend the fill material be removed to expose native, firm soils, prior to construction.

Fill material was not observed in our remaining borings. However, based on the existing development at the site, it is our opinion that there is a higher probability of encountering additional manmade fill at the time of construction. If encountered at the time of building or pavement construction, we recommend existing fill soils be removed to expose firm, native soils, and backfilled with approved on-site or imported soils. If observed, the fill soils will need to be evaluated for reuse and replacement prior to pavement, foundation, or slab construction.

We recommend foundations and slabs associated with the existing development be completely removed and backfilled with compacted fill. Existing utilities to be abandoned should be removed within 10 feet of the newly proposed building perimeter. Abandoned utilities to remain in place beyond the perimeter should be grouted and capped.

Shallow groundwater will likely cause difficulties during construction of foundations, slabs, and proposed utilities depending on the depths. Dewatering of foundation excavations and utility trenches may be required during construction should these elements be constructed near the groundwater

depth. The use of sumps or well points are common dewatering methods used for this type of construction, however, the requirements for properly dewatering the utility trenches and foundation excavations are beyond the scope of services provided for this project. Caution is advised during the dewatering process as the sand soils are susceptible to flowing and piping that can lead to unstable trench excavations as well as undermining behind conventional trench box and sump pump dewatering systems. Filter material or closely spaced well points may be necessary to reduce the risk of piping sands. Lightweight excavation and compaction equipment as well as stabilization of the exposed subgrade may be required. The individual contractor(s) should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom.

The proposed underground storage tank at this site is expected to be constructed beneath the groundwater table. The underground storage tank should be designed for buoyant uplift forces to account for saturated conditions. Caving of the on-site sand soils should be expected during construction of the underground storage tank. A temporary dewatering system consisting of sumps with pumps will likely be necessary to achieve the recommended depth of excavation for the proposed tanks.

We recommend foundations be excavated using a backhoe or trackhoe equipment placed outside the excavations. Construction equipment within the excavation should be avoided to reduce the potential for unstable soils at bearing level.

Groundwater was observed at depths ranging from about 5½ to 8 feet below existing site grades. We recommend consideration be given to raising site grades to avoid excavating near the groundwater table. We also recommend maintaining a separation of at least 2 feet between the bottom of proposed foundations and top of groundwater to reduce potential construction related difficulties previously described. It is also possible that groundwater levels at this site may fluctuate due to seasonal variations and other factors. Final site grading should be planned and designed to avoid cuts where shallow groundwater is known to exist, and in areas where such grading would create shallow groundwater conditions. If deeper cuts are unavoidable, installation of a subsurface drainage system may be needed.

It is our opinion that soils removed below the water table will likely require significant drying in order for these materials to be reused as compacted fill. If time constraints or allowable drying areas do not permit the use of the removed materials, consideration should be given to the use imported backfill.

Additional site preparation recommendations including subgrade improvement and fill placement are provided in the **Earthwork** section.

The **Shallow Foundations** section addresses support of the building bearing on structural fill. The **Floor Slabs** section addresses slab-on-grade support of the building. The **Pavements** section

addresses the design of pavement systems. The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

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

Site Preparation

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

The subgrade should be proof-rolled with an adequately loaded vehicle such as a fully loaded tandem axle dump truck. The proof-rolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by stabilizing with geotextile. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Existing Fill

As noted in the **Geotechnical Overview**, existing fill was encountered as part of an aggregate surfaced drive area in the vicinity of Boring No. P-1, and there is a possibility of encountering additional fill soils at this site. We have no records to indicate where fill was placed, if fill was placed in a controlled manner, or what materials the possible fill may contain. There is an inherent risk for the owner that compressible fill or unsuitable material will be buried within possible fill soils. This risk of unforeseen conditions cannot be eliminated without completely removing the encountered possible fill soils. Therefore, we recommend that fill soils encountered be completely removed and replaced with compacted structural fill.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures and pavements. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
On-Site Sand Soils	SP, SM, SP-SM, SC, SC-SM	The on-site sand soils are considered suitable for reuse as structural fill beneath foundations, slabs, and pavements, as well as general fill.
On-Site Clay Soils	CL	The on-site clay soils are not considered suitable for reuse as structural fill beneath foundations, slabs, or within 12 inches of pavement subgrade. Clay soils may be reused at depths greater than 12 inches from pavement subgrade, within general fill, or landscaped areas.
Imported Soils	Varies	Imported soils meeting the gradation outlined herein can be considered acceptable for use as structural fill beneath foundations, slabs, and pavements, as well as general fill.

Imported soils should conform to the following:

Gradation	Percent finer by weight (ASTM C136)
3”	100
No. 4 Sieve	50-100
No. 200 Sieve	20 (max)

- Liquid Limit……....35 (max)
- Plastic Index……..6 (max)
- Maximum Expansive Potential (%)……..1.5*

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at optimum water content. The sample is confined under a 200 psf surcharge and submerged.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements [1, 2, 3]	98% of max. below foundations and within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade

Item	Structural Fill
Water Content Range [2,4]	Low plasticity cohesive: -2% to +3% of optimum Granular: -3% to +3% of optimum

1. We recommend that structural fill be tested for water content and compaction during placement. Should the results of the in-place density tests indicate the specified water or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified water and compaction requirements are achieved.
2. Maximum dry density and optimum water content as determined by the Standard Proctor test (D698).
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).
4. Water levels should be maintained low enough to allow for satisfactory compaction to be achieved without the compacted fill material becoming unstable under the weight of construction equipment or during proof-rolling. Indications of unstable soil can include pumping or rutting.

Utility Trench Backfill

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.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to structures can result in soil movements greater than those discussed in this report. These 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 percent 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 (if planned), final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations are anticipated to be accomplished with conventional construction equipment. Although the exposed subgrade is anticipated to be relatively stable upon initial

exposure, unstable subgrade conditions could develop during general construction operations, particularly near the groundwater table and if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of foundations, 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 re-compacted, prior to construction.

The groundwater table could affect over-excavation efforts, particularly for the planned underground storage tank. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of excavation for the proposed tanks.

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.

Construction Observation and Testing

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

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, 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 to be used for support of the proposed building and carwash.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	2,000 pounds per square foot (psf)
Required Bearing Stratum [3]	On a minimum of 12 inches of newly placed, structural fill
Minimum foundation dimensions	Columns: 24 inches Continuous: 16 inches
Maximum foundation dimensions	Columns: 5 feet Continuous: 3 feet
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	Above Groundwater: 300 pounds per cubic foot (pcf) Below Groundwater: 210 pounds per cubic foot (pcf)
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: 18 inches
Estimated Total Settlement from Structural Loads [2]	About 1 inch [8]
Estimated Differential Settlement [2, 7]	About ½ to ¾ of total settlement

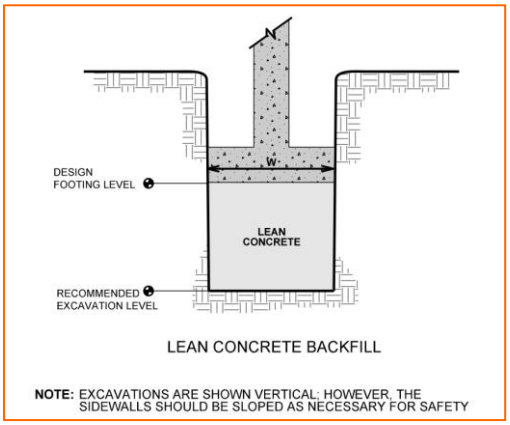
Item	Description
1.	The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2.	Values provided are for maximum loads noted in **Project Description**. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, the quality of the earthwork operations, and maintaining uniform soil water content throughout the life of the structure. The estimated movements are based on maintaining uniform soil water content during the life of the structure. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage and irrigation practices should be incorporated into the design and operation of the facility. Failure to maintain soil water content and positive drainage will nullify the movement estimates provided above.
3.	Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4.	Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5.	Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6.	Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7.	Differential settlements are as measured over a span of 50 feet.
8.	Failure to maintain soil water content and positive drainage will nullify the movement estimates.

Foundation Construction Considerations

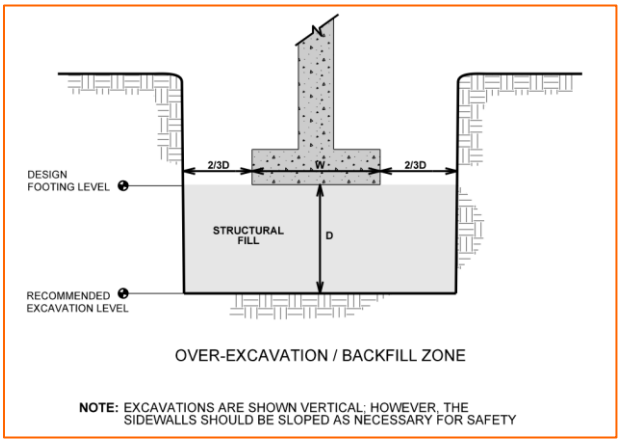
As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance.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

As previously stated, shallow groundwater was encountered at this site. We recommend maintaining a separation of at least 2 feet between the bottom of proposed foundations and observed groundwater levels. It is also possible that groundwater levels at this site may fluctuate due to seasonal variations and other factors.

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

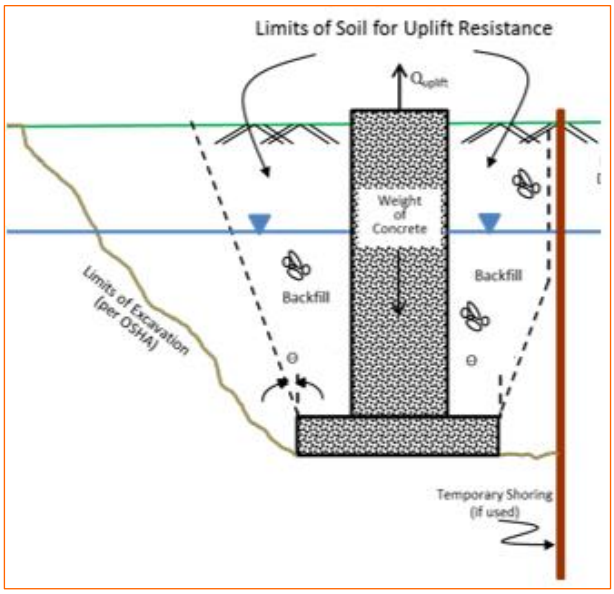


Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with structural fill placed as recommended in the **Earthwork** section.



Design Parameters - Uplift Loads

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum unit weight of 100 pcf should be used for the backfill above groundwater, and a unit weight of 35 pcf should be used for backfill below groundwater.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7-10.

Description	Value
2015 International Building Code Site Classification	C [1]
Site Latitude	38.9315°
Site Longitude	-104.6101°

1. Seismic site classification in general accordance with the *2015 International Building Code*, which refers to ASCE 7-10.
2. The 2015 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 30 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

FLOOR SLABS

Soils should be moisture conditioned and compacted as stated in our **Earthwork** section.

Should structural loading conditions differ from the assumptions presented in this report, we request the opportunity to re-evaluate the conditions and provide supplemental recommendations, if needed.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	We recommend floor slabs be supported on 1-foot of newly placed, structural fill.
Estimated Modulus of Subgrade Reaction [2]	125 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, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

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

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

Floor Slab Construction Considerations

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

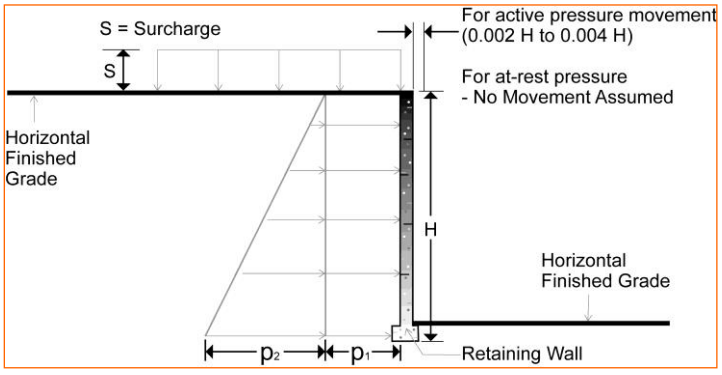
resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

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

LATERAL EARTH PRESSURES

Design Parameters

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. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3, 4, 5] p_1 (psf)	Effective Fluid Pressures (psf) [2, 4, 5]	
			Unsaturated [6]	Submerged [6]
Active (Ka)	Granular - 0.39	(0.39)S	(50)H	(85)H
At-Rest (Ko)	Granular - 0.56	(0.56)S	(70)H	(95)H
Passive (Kp)	Granular - 2.56	---	(300)H	(210)H

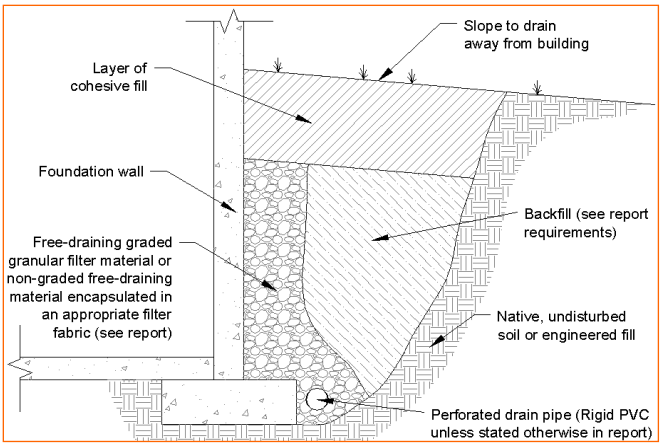
Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3, 4, 5] p_1 (psf)	Effective Fluid Pressures (psf) [2, 4, 5]	
			Unsaturated [6]	Submerged [6]

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.
2. Uniform, horizontal backfill, compacted to at least 95 percent of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. In order 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. 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 and 60 degrees from vertical for the active and passive cases, respectively.

Subsurface Drainage for Below Grade Walls

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



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

PAVEMENTS

General Pavement Comments

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

Pavement Design Parameters

Design of Asphaltic Concrete (AC) pavements are based on the procedures outlined in the National Asphalt Pavement Association (NAPA) Information Series 109 (IS-109). Design of Portland Cement Concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-01; Guide for Design and Construction of Concrete Parking Lots. Site specific traffic loading and Equivalent Single-Axel Loads (ESAL) were not available at the time of our report preparation. Pavement thickness design has been based assumed ESALs of 27,000 and 110,000 for the proposed Light Duty and Heavy Duty pavement areas, respectively, over a 20-year design life.

We have based our pavement thickness design based on the NAPA design traffic classes presented below:

- **Traffic Class II** – Traffic consisting of autos, home delivery trucks, trash pickup, occasional moving vans, and ESAL's up to 27,000.

- **Traffic Class III** – Up to 10 single-unit or 3-axle semi-trailer trucks per day or equivalents: average gross vehicle weight should be less than the legal limit. Considered for ESAL's up to 110,000.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Asphaltic Concrete Design		
Layer	Thickness (inches)	
	Light Duty [1]	Heavy Duty [1]
AC [2]	4.0	4.5
Aggregate Base [2]	6.0	6.0
Compacted Structural Fill (in.)	12.0 [3]	

1. See **Project Description** for more specifics regarding expected traffic.
2. All materials should meet the current Colorado Department of Transportation (CDOT) Standard Specifications for Highway and Bridge Construction.
3. The on-site sand soils are considered suitable for use as structural fill.

Portland Cement Concrete Design			
Layer	Thickness (inches)		
	Light Duty [1]	Heavy Duty [1]	Dumpster Pad
PCC [2]	5.0	6.0	7.0
Compacted Structural Fill (in.)	12.0 [3]		

1. See **Project Description** for more specifics regarding expected traffic.
2. All materials should meet the current Colorado Department of Transportation (CDOT) Standard Specifications for Highway and Bridge Construction.
3. The on-site sand soils are considered suitable for use as structural fill.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary						
Boring	Sample Depth (feet)	Soil Description	Soluble Sulfate (percent)	Soluble Chloride (percent)	Electrical Resistivity (Ω-cm)	pH
UST-1	0.5 to 10	Silty to clayey sand	0.0064	0.0098	3201	8.02

Corrosivity Test Results Summary						
Boring	**Sample Depth (feet)**	**Soil Description**	**Soluble Sulfate (percent)**	**Soluble Chloride (percent)**	**Electrical Resistivity (Ω-cm)**	**pH**
UST-1	10 to 20	Sandstone	0.0075	0.0108	1940	8.01

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

GENERAL COMMENTS

As the project progresses, we address assumptions by incorporating information provided by the design team, if any. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

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

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

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties.

Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet) [1]	Location
2	25 to 29½	Planned building area
3	10	Planned parking/driveway, and trash enclosure area
2	25	Planned fuel station canopies
1	25	Planned underground storage tank area
1	25	Planned car wash

1. Below ground surface, or auger refusal, whichever occurs first.

Boring Layout and Elevations: We used handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet. Field measurements from existing site features were also utilized.

Subsurface Exploration Procedures: We advance soil borings with a truck-mounted drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Four samples are obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling is typically performed using split-barrel sampling procedures. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon is 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. The samples are placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. In addition, we observe and record groundwater levels during drilling and sampling.

Our exploration team prepares field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Laboratory Testing

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

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D2435/D2435M Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
- ASTM D4327 or EPA 300/300 Standard Test Methods for Water Soluble Chloride and Sulfate Content
- AASHTO T289-91 or ASTM G 51 Standard Test Methods for Determination of pH
- ASTM D5268 Standard Specification for Topsoil Used for Landscaping Purposes

The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System.

Rock classification is conducted using locally accepted practices for engineering purposes.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION and NEARBY GEOTECHNICAL DATA

Meridian Circle K Retail Store ■ Falcon, Colorado
November 30, 2018 ■ Terracon Project No. 23185069

Terracon GeoReport

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

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Meridian Circle K Retail Store ■ Falcon, Colorado
November 30, 2018 ■ Terracon Project No. 23185069

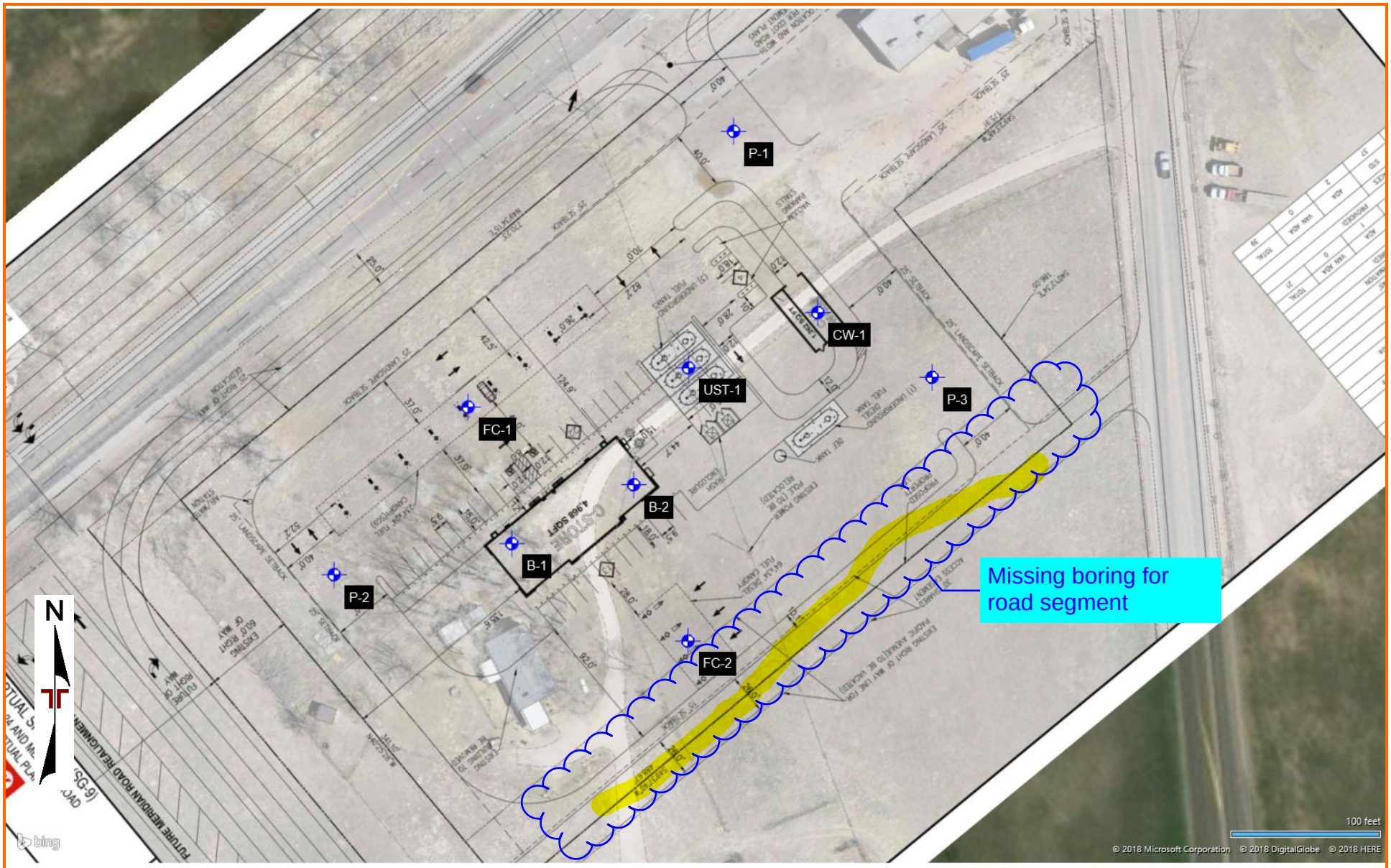


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS WITH THE PROVIDED SITE PLAN OVERLAY

ECM Appdx D
D.2. - SUBGRADE INVESTIGATION
D.2.1. Field Investigation

The field investigation shall consist of borings or other suitable methods of sampling subgrade soils for visual classification to a depth of at least 5 feet below proposed subgrade elevation, at spacings of not more than 500 feet. A minimum of one boring shall be obtained for any roadway segment. Every fifth hole shall be 10 feet deep. The ECM Administrator may require more frequent testing or additional borings that extend deeper should bedrock or high groundwater be a design concern. All borings shall be field logged and visually classified. Samples shall be obtained from each soil type in the upper 24 inches of subgrade for testing and evaluation. The soil investigation associated with this report occurs after the roadways are graded and the deepest utility is installed. Multiple samples shall be taken alternating among lanes and shall be evenly spaced.

EXPLOI

C.3.3. Boring Standards

The following represent the minimum boring standards and guidelines for conducting borings for Geotechnical Reports.

A.Timing of Soil Borings. 1.Initial Borings. The information from the initial soil borings shall be summarized in the Geotechnical Report. The entire site shall be sampled for initial testing. This is required to evaluate soil and groundwater conditions and for evaluating roadway locations that may not yet be determined or may change.2.Structures. Soil borings for design of transportation structures shall be taken prior to the design of the structure.3.Fill for Right-of-Way Grading. Testing shall be provided for all proposed fill material. All proposed fill material shall be approved by The ECM Administrator prior to placement. The material shall meet minimum requirements and be equal to or better than existing conditions. No fill material with a liquid limit greater than 40 and plasticity index greater than 20 shall be used in the upper 2-feet of the pavement subbase without implementing proper mitigation techniques.

The replat and subdivision requires boring in the roadway section and within Lot #2
Update the maps to represent the entire site to include both Lot #1 and Lot #2

BORING LOG NO. B-1

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9315° Longitude: -104.6101°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), fine to medium grained, brown, medium dense, with rootlets									
						9-11		6	114		
3.5		**SANDY LEAN CLAY (CL)**, dark brown to light brown, very stiff, with rootlets									
						14-18	-0.1/500	18	102	26-14-12	50
5.0		**SILTY SAND (SM)**, fine to medium grained, light brown, beginning of layer observed in tip of sampler at approximatley 5 feet.	5								
6.5		**CLAYEY SAND (SC)**, fine to coarse grained, gray, loose		▽		6-6		15	110		
		sample disturbed at 9 feet, dry unit weight not obtained									
						4-6		23			
13.5		**SANDSTONE**, fine to medium grained, gray, hard to very hard	10								
						40-50		15	118		
			15								
						18-19-50 N=69		18			
			20								
						12-32-45 N=77		30			
			25								
29.5											
		Boring Terminated at 29.5 Feet				50/6" N=50/6"		15			

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At about 7 feet while drilling*

▽ *At about 7 feet at the completion of drilling*

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. B-2

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9316° Longitude: -104.6098°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND, fine to medium grained, light brown, loose to medium dense				7-10		8	101		
					8-14	-0.3/500	16	99	NP	20
	6.0	5								
	CLAYEY SAND, fine to coarse grained, gray, medium dense				7-12		15	115		
					15-18		19	102		
	13.0	10								
	SANDSTONE, fine to medium grained, gray, hard to very hard				33-50/2"		18	106		
		15								
					23-50/5" N=50/5""		15			
		20								
	24.5				N=50/6"		14			
	Boring Terminated at 24.5 Feet									

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

At about 7 feet while drilling

At about 6 feet at the completion of drilling

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. CW-1

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9319° Longitude: -104.6093°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine to medium grained, light brown, medium dense									
					10-10		1	110		
					12-17		14	114		
	5.0	5								
	CLAYEY SAND (SC), fine to coarse grained, gray with orange, loose to medium dense		▽		12-13		10	123		
					6-8		10	127		
	13.0	10								
	SANDSTONE, fine to coarse grained, gray, hard to very hard				50/6"		18	107		
		15								
					19-50/6" N=69		15			
		20								
	25.0				20-50/5" N=50/5"		19			
	Boring Terminated at 25 Feet	25								

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At about 7 feet while drilling*

▽ *At about 7 feet at the completion of drilling*

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. FC-1

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9318° Longitude: -104.6102°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, brown, medium dense									
	4.0				11-13		7	109		
	WELL GRADED SAND (SW), medium to coarse grained, brown, medium dense -approximately 6-inch clayey sand layer observed in 4-foot sample	5			9-15		11	115		
	6.0									
	CLAYEY SAND (SC), fine to medium grained, gray, loose to medium dense				8-8		12	108		
		10			6-14		18	111		
	12.0									
	SANDSTONE, fine to medium grained, gray, hard to very hard	15			50/6"		15	114		
		20			17-50/6" N=50/6"		17			
	25.0	25			45-50/3" N=50/3"		13			
	Boring Terminated at 25 Feet									

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

At about 8 feet while drilling

At about 7 feet at the completion of drilling

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. FC-2

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9313° Longitude: -104.6096°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), fine to medium grained, dark brown, loose to medium dense								
					5-6		11	99		
5					11-12		18	111		
			▽		10-13		17	105		
					3-5		19			
10										
6.0		**WELL GRADED SAND (SW)**, medium to coarse grained, light brown, loose to medium dense								
13.0		**SANDSTONE**, fine to coarse grained, gray, very hard			22-40-50/5" N=90/11"		17			
15										
					25-32-50/3" N=82/9"		16			
20										
25.0					20-50/6" N=50/6"		19			
25		***Boring Terminated at 25 Feet***								

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At about 8 feet while drilling*

▽ *At about 8 feet at the completion of drilling*

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. P-1

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9323° Longitude: -104.6095°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0		**FILL - PARKING AREA SURFACING MATERIAL - WELL GRADED SAND (SW)**, coarse to medium grained, brown									
		POORLY GRADED SAND WITH SILT (SP-SM), coarse to medium grained, gray to brownish gray, medium dense				13-18	0/500	8	115	NP	9
						11-17		13	113		
			5	▽							
						15-21		12	113		
						11-14		11	113		
10.0		***Boring Terminated at 10 Feet***	10								

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At about 6 feet while drilling*

▽ *At about 5 1/2 feet at the completion of drilling*

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. P-2

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9315° Longitude: -104.6105°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine to medium grained, light brown, medium dense									
					7-13		2	105		
		5			10-11		10	111		
	5.5 **WELL GRADED SAND (SW)**, trace silt, medium to coarse grained, orangish brown and gray, medium dense									
					11-16		11	125		
	8.5 **CLAYEY SAND (SC)**, fine grained, gray, loose									
					6-9		22	105		
	10.0 ***Boring Terminated at 10 Feet***	10								

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. P-3

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9318° Longitude: -104.6091°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), fine to medium grained, light brown, loose									
						6-7		5	96		
3.5		**WELL GRADED SAND (SW)**, trace gravel, fine to coarse grained, light brown, loose to medium dense	5			10-13		11	118		
				▽		10-14		12	119		
						8-8		15	114		
10.0		***Boring Terminated at 10 Feet***	10								

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At about 8 feet while drilling*

▽ *At about 8 feet at the completion of drilling*

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

BORING LOG NO. UST-1

PROJECT: Meridian Circle K

CLIENT: Land Development Consultants
Phoenix, AZ

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

LOCATION See Exploration Plan

Latitude: 38.9318° Longitude: -104.6096°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%/psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine to medium grained, brown, loose to medium dense						13			
					8-10		4	109		
		5			10-11		19	82		
	6.0						19			
	CLAYEY SAND (SC), fine to coarse grained, gray with orangish brown, medium dense				13-8		18	104	31-15-16	24
	10.0									
	WEATHERED SANDSTONE, medium to coarse grained, gray	10			4-6-10 N=16		17			
	13.0									
	SANDSTONE, medium to coarse grained, gray, very hard	15			12-20-50/5" N=70/11"		15			
		20			28-50/5" N=50/5"		15			
	25.0									
	Boring Terminated at 25 Feet	25			30-50/4" N=50/4"		16			

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

Hammer Type: Automatic

Advancement Method:
4-inch solid stem auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

Notes:

WATER LEVEL OBSERVATIONS

At about 8 feet while drilling

At about 8 feet at the completion of drilling

Terracon
4172 Center Park Dr
Colorado Springs, CO

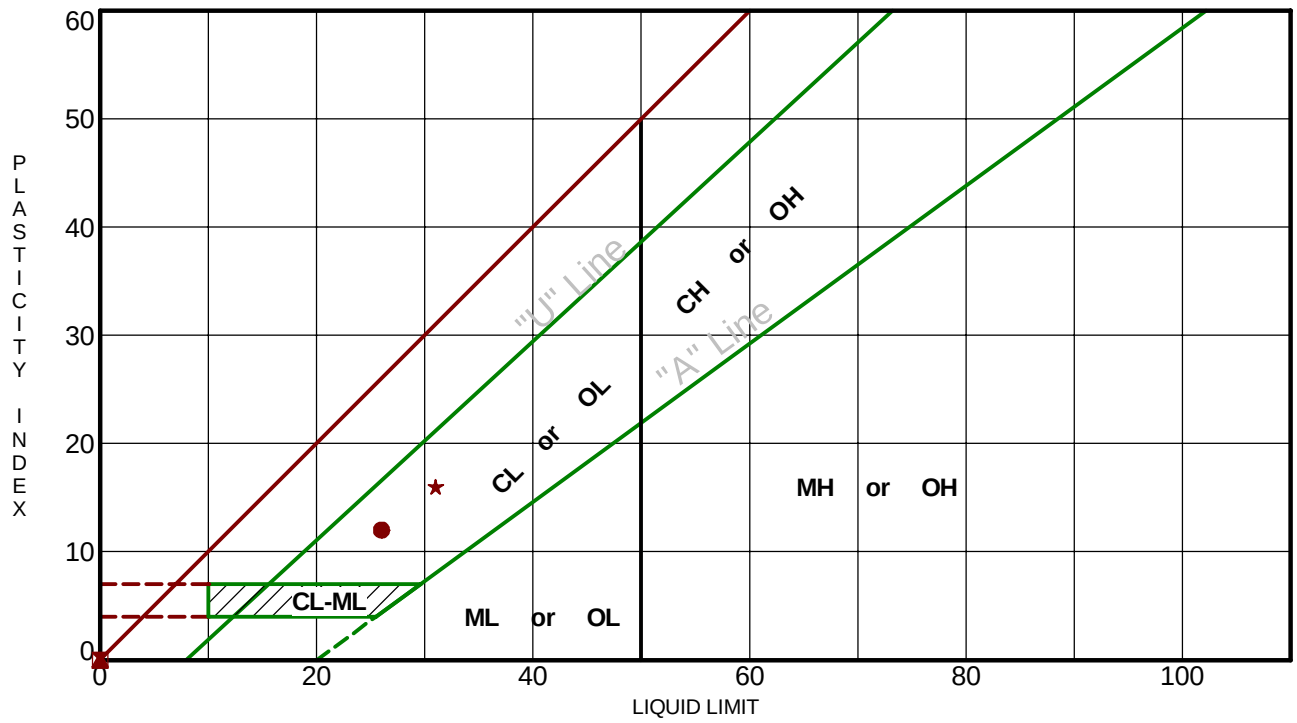
Boring Started: 11-07-2018 | Boring Completed: 11-07-2018

Drill Rig: CME 45 | Driller: Unlimited Access, Inc.

Project No.: 23185069

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	B-1	4 - 5	26	14	12	50	CL	SANDY LEAN CLAY
⊠	B-2	4 - 5	NP	NP	NP	20	SM	SILTY SAND
▲	P-1	2 - 3	NP	NP	NP	9	SP-SM	POORLY GRADED SAND with SILT
★	UST-1	7 - 8	31	15	16	24	SC	CLAYEY SAND

PROJECT: Meridian Circle K

PROJECT NUMBER: 23185069

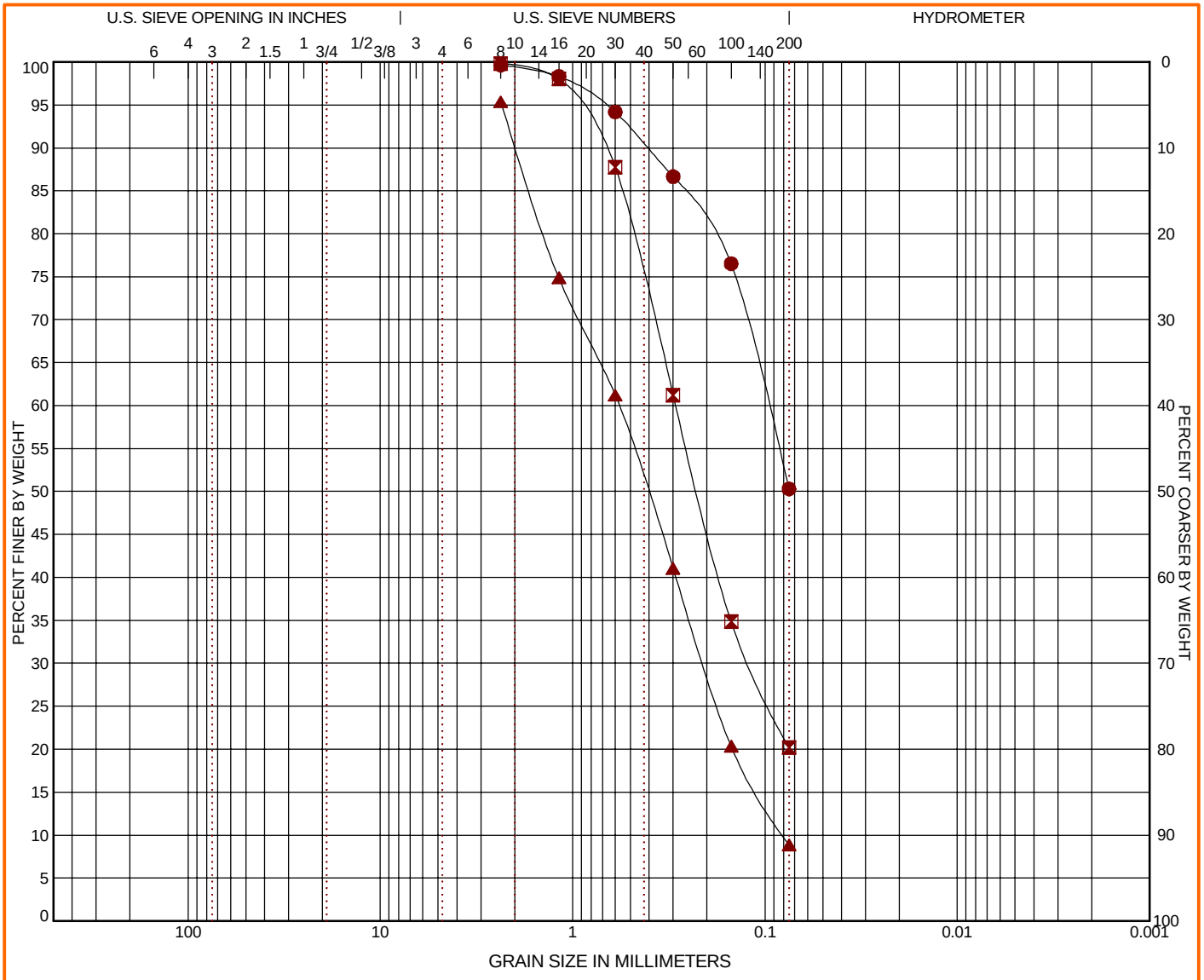
SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

CLIENT: Land Development Consultants
Phoenix, AZ

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-1	4 - 5			49.3		50.3		CL
⊠	B-2	4 - 5			79.6		20.2		SM
▲	P-1	2 - 3			86.5		8.9		SP-SM

GRAIN SIZE	●	⊠	▲
D_{60}	0.097	0.291	0.576
D_{30}		0.119	0.207
D_{10}			0.08

COEFFICIENTS	●	⊠	▲
C_C			0.93
C_U			7.16

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#8	99.63	#8	99.81	#8	95.37
#16	98.32	#16	98.03	#16	74.88
#30	94.18	#30	87.75	#30	61.21
#50	86.65	#50	61.18	#50	41.03
#100	76.52	#100	34.87	#100	20.33
#200	50.29	#200	20.21	#200	8.86

SOIL DESCRIPTION	
●	SANDY LEAN CLAY (CL)
⊠	SILTY SAND (SM)
▲	POORLY GRADED SAND with SILT

(SP-SM)	REMARKS
●	
⊠	
▲	

PROJECT: Meridian Circle K

PROJECT NUMBER: 23185069

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

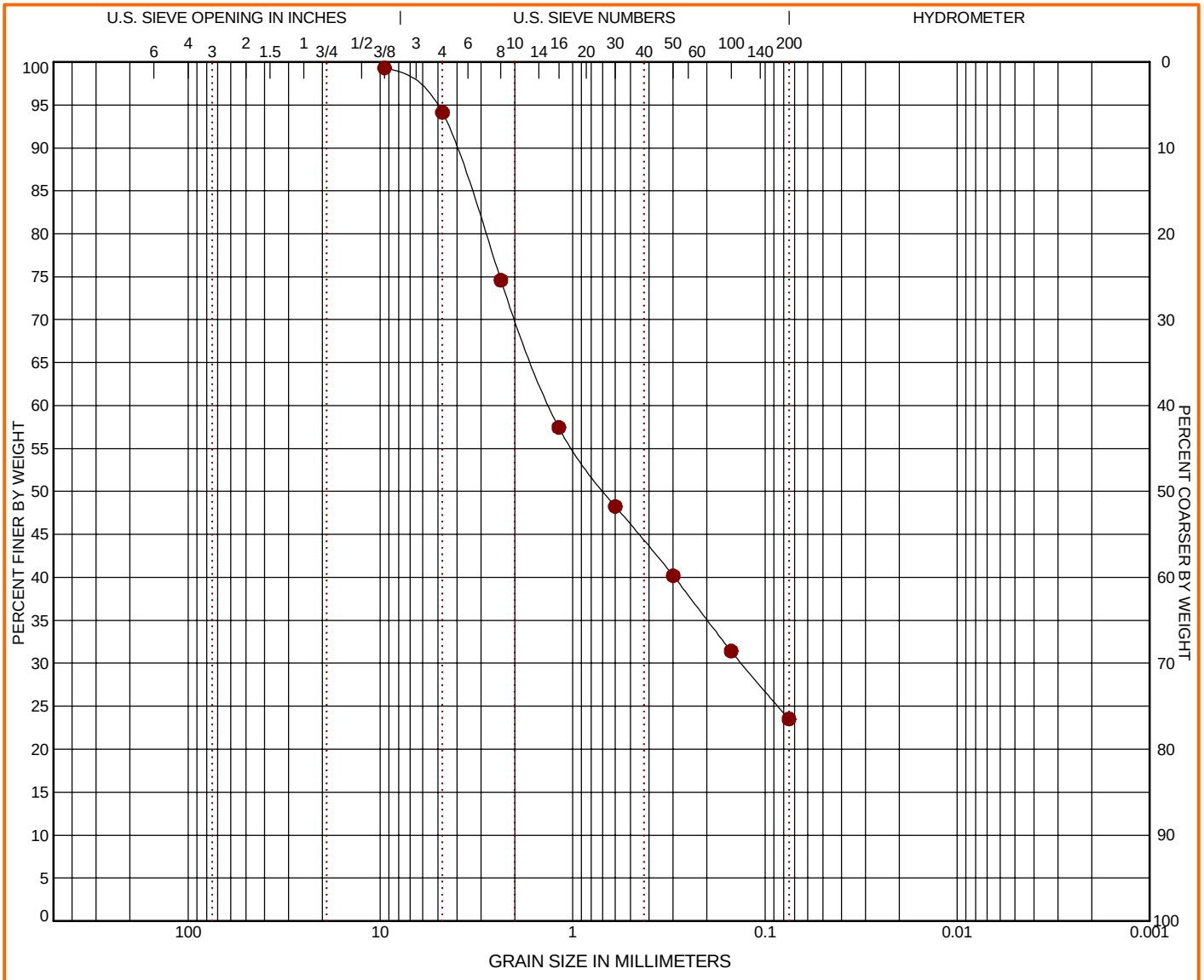
Terracon
4172 Center Park Dr
Colorado Springs, CO

CLIENT: Land Development Consultants
Phoenix, AZ

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 23185069 MERIDIAN CIRCLE K.GPJ TERRACON_DATATEMPLATE.GDT 11/26/18

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	UST-1	7 - 8		5.2	70.6		23.5		SC

GRAIN SIZE			
	●		
D_{60}	1.308		
D_{30}	0.132		
D_{10}			

COEFFICIENTS			
	●		
C_C			
C_U			

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	99.3				
#4	94.12				
#8	74.59				
#16	57.46				
#30	48.26				
#50	40.19				
#100	31.42				
#200	23.51				

SOIL DESCRIPTION	
●	CLAYEY SAND (SC)

REMARKS	
●	

PROJECT: Meridian Circle K

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

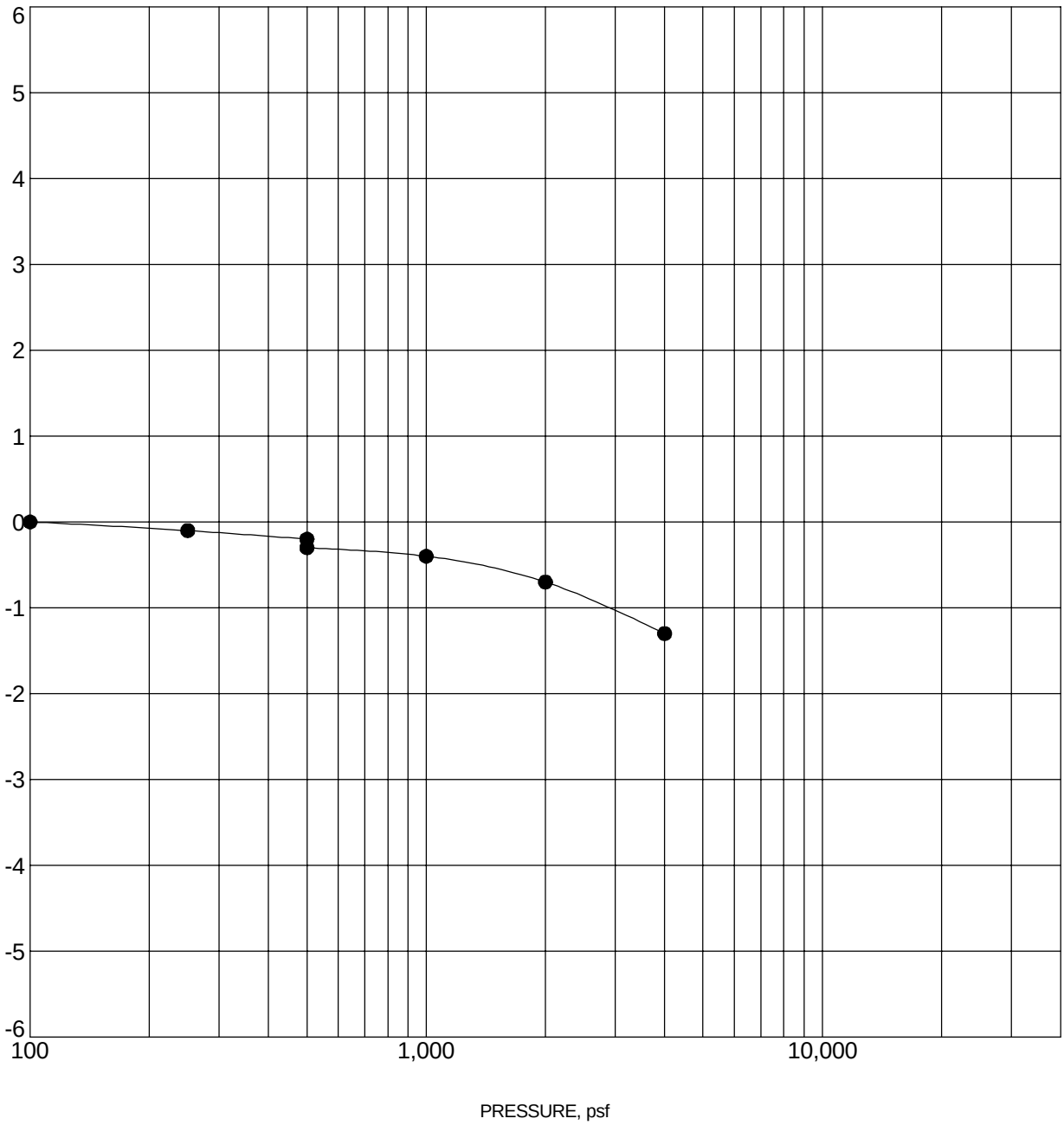
PROJECT NUMBER: 23185069

CLIENT: Land Development Consultants
Phoenix, AZ

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 23185069 MERIDIAN CIRCLE K.GPJ TERRACON_DATATEMPLATE.GDT 11/26/18

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-1	4 - 5 ft	SANDY LEAN CLAY(CL)	102	6

NOTES: Sample exhibited approximately 0.1 percent compression when inundated with water at 500psf.

PROJECT: Meridian Circle K

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

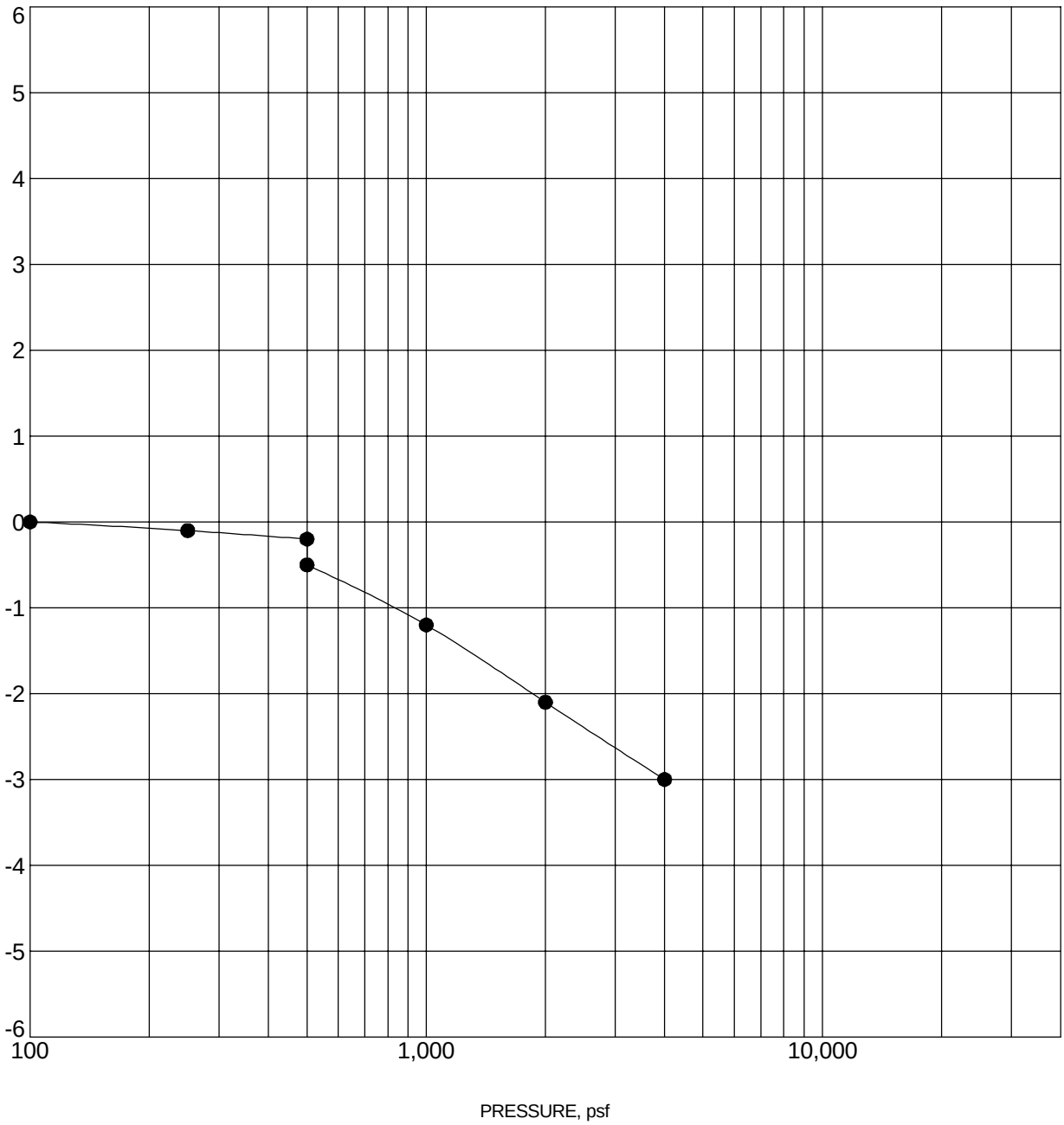
Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23185069

CLIENT: Land Development Consultants
Phoenix, AZ

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-2	4 - 5 ft	SILTY SAND(SM)	99	16

NOTES: Sample exhibited approximately 0.3 percent compression when inundated with water at 500psf.

PROJECT: Meridian Circle K

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

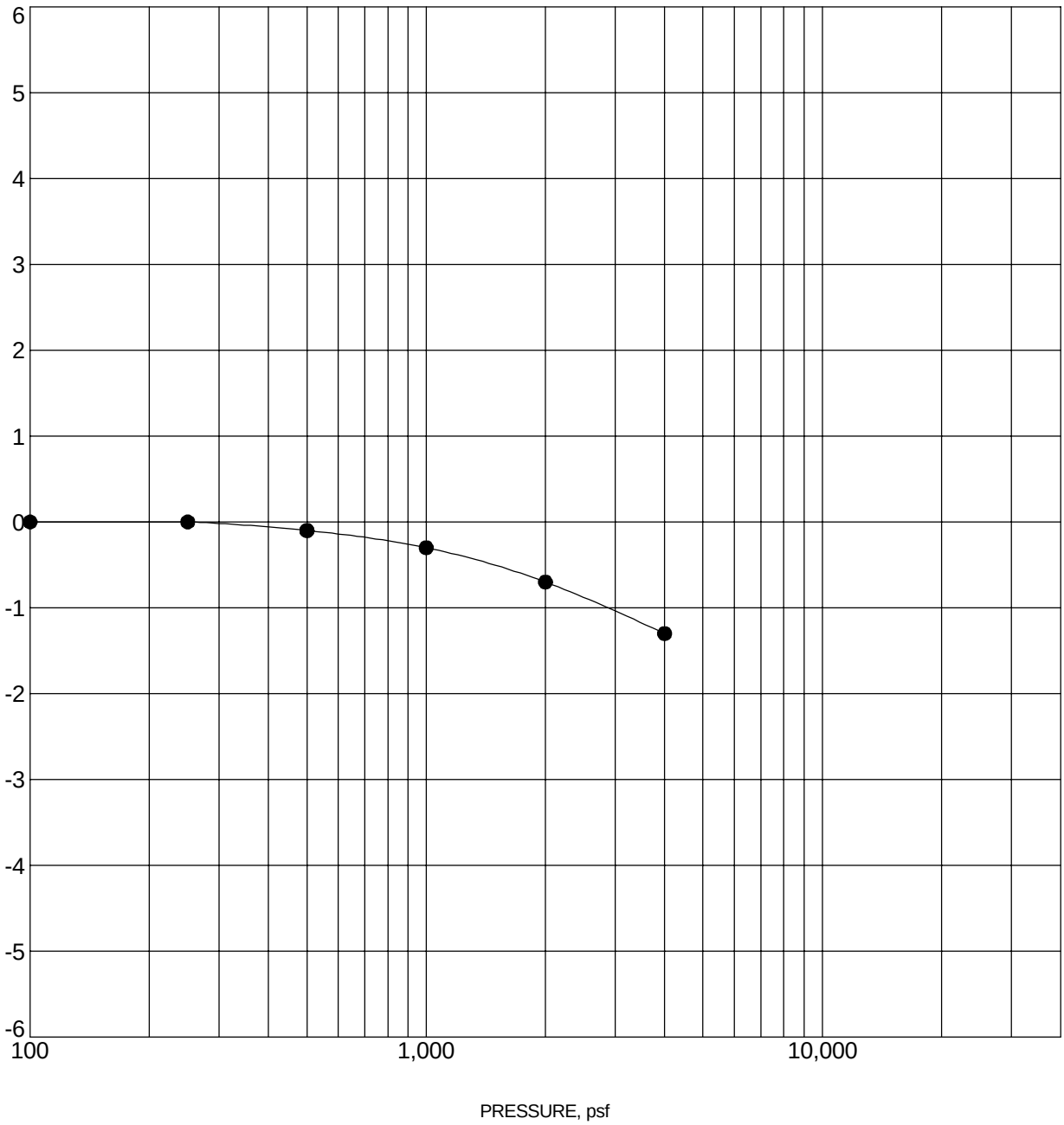
Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23185069

CLIENT: Land Development Consultants
Phoenix, AZ

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	P-1	2 - 3 ft	POORLY GRADED SAND with SILT(SP-SM)	115	8

NOTES: Sample exhibited no apparent movement when inundated with water at 500psf.

PROJECT: Meridian Circle K

SITE: U.S. Highway 24 and Meridian Road
Falcon, CO

Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23185069

CLIENT: Land Development Consultants
Phoenix, AZ

CHEMICAL LABORATORY TEST REPORT

Project Number: 23185069
Service Date: 11/20/18
Report Date: 11/29/18
Task:

Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Land Development Consultants
Phoenix, AZ

Project

Meridian Circle K

Sample Submitted By: Terracon (23) **Date Received:** 11/15/2018 **Lab No.: 18-1380**

Results of Corrosion Analysis

Sample Number		
Sample Location	UST-1	UST-1
Sample Depth (ft.)	0.5-10	10.0-20.0
pH Analysis, AWWA 4500 H	8.02	8.01
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	64	75
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil
Chlorides, ASTM D 512, (mg/kg)	98	108
Red-Ox, AWWA 2580, (mV)	+684	+679
Total Salts, AWWA 2520 B, (mg/kg)	703	972
Resistivity, ASTM G 57, (ohm-cm)	3201	1940
Moisture Content, ASTM D2216 (percent %)	13.6	19.3

Analyzed By: Trisha Campo

Trisha Campo
Chemist

Soil Nutrient Laboratory Report

Lab No.: *181119005-01* **Date Rec:** *11/19/18* **Reported:** *11/29/18*	**Report To:** Nathan Hukkanen	**Company:** Terracon, Inc. - Colo Springs 4172 Center Park Drive Colo. Springs CO 80916

Sample ID: *UST-1 @ 0ft-5ft* **Project:**

Laboratory Results:

	Sample Result	Low----------Ave----------High
Field Texture (EST)	Silt Loam	
pH (units)	8.0	**********
Salts (MMHOS/CM)	1.3	**********
CEC Est. (MEQ/100G)	19.0	**********
Lime (Qual.)	Medium	**********
Organic Matter (%)	5.1	**********
Organic N (lbs/acre)	151.9	**********
Sodium (meq/100g Soil)	0.62	**********
Available Nutrients (ppm)		
Nitrate Nitrogen	1.0	
Phosphorus	4.8	**********
Potassium	538.5	**********
Calcium	4444.0	**********
Magnesium	299.3	**********
Sulfur	31.5	**********
Boron	3.6	**********
Zinc	5.3	**********
Iron	10.1	**********
Manganese	2.6	**********
Copper	2.1	**********

Note: Average Values are for Colorado Soils

Fertilizer Recommendations

General Landscape

Nitrogen:	*130 lbs/Acre*
Phosphorus - P2O5:	*80 lbs/Acre*
Potassium - K2O:	*0 lbs/Acre*
Sulfur SO4-S:	*5 lbs/Acre*
Lime:	*0 lbs/Acre*

**To convert recommendations to lbs/1000 sq. ft. divide by 40.*

Comments ***Split Nitrogen Recommendations 2 to 3 Times Throughout the Growing Season.***

Yield Reduction Likely Due to High Boron.

SUPPORTING INFORMATION

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Meridian Circle K Retail Store ■ Falcon, CO

November 30, 2018 ■ Terracon Project No. 23185069

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Auger Cuttings Modified Dames & Moore Ring Sampler Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** 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 is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. 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				BEDROCK		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4	30 - 49	20 - 29	Firm
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9	50 - 89	30 - 49	Medium Hard
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18	90 - 119	50 - 79	Hard
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42	> 119	>79	Very Hard
			Hard	> 4.00	> 30	> 42			

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Meridian Circle K Retail Store ■ Falcon, Colorado

November 30, 2018 ■ Terracon Project No. 23185069

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 ³ 4 and 1 £ Cc £ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [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 ³ 6 and 1 £ Cc £ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above “A”		CL	Lean clay [K, L, M]
			PI < 4 or plots below “A” line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K, L, M]
			PI plots below “A” line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

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

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

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ³ 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 ³ 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 ³ 30% plus No. 200 predominantly sand, add “sandy” to group name.

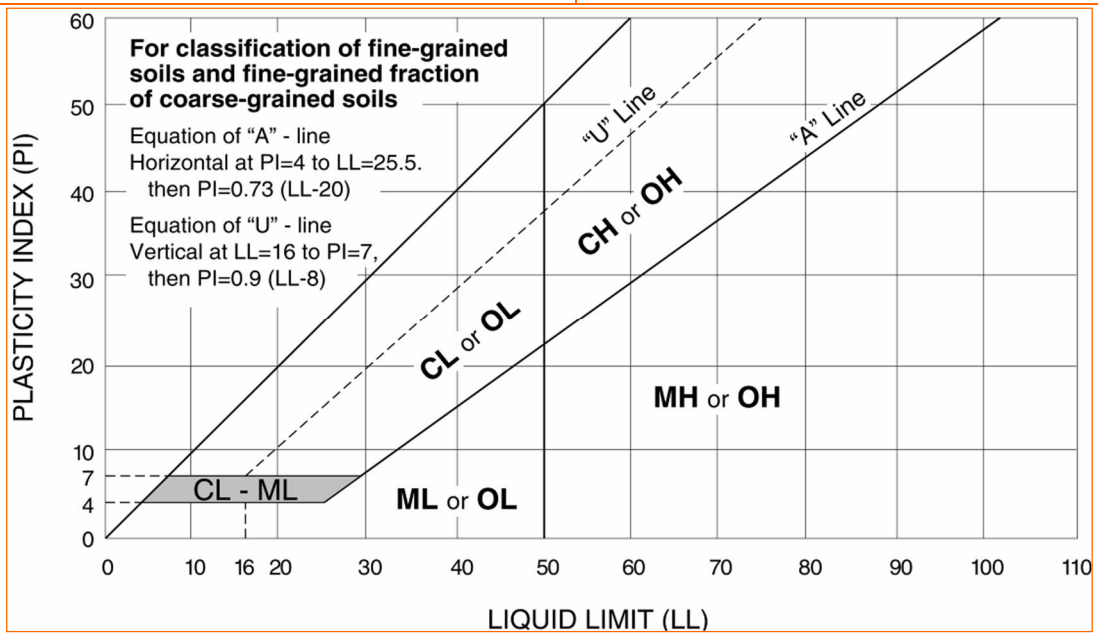
[M] If soil contains ³ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ³ 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.



DESCRIPTION OF ROCK PROPERTIES

Meridian Circle K Retail Store ■ Falcon, Colorado

November 30, 2018 ■ Terracon Project No. 23185069

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements