Parker McDonald's Site ID#50162

Geotechnical Engineering Report

10950 South Parker Road

June 7, 2023 | Terracon Project No. 25235069

Prepared for:

McDonald's USA LLC
110 North Carpenter Street
Chicago, Illinois 60607

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June 7, 2023

McDonald's USA LLC
110 North Carpenter Street
Chicago, Illinois 60607

Attn: Trevor Prophet
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Re: Geotechnical Engineering Report
Parker McDonald's Site ID#50162
10950 South Parker Road
Parker, Colorado
Terracon Project No. 25235069

Mr. Prophet:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Purchase Order No. 2624727 dated March 29, 2023. 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

COLORADO LICENSED PROFESSIONAL ENGINEER DAVID WARD MCDANIEL 0059253 6/7/2023

David W. McDaniel, P.E.
Senior Staff Engineer

Scott B. Myers, P.E.
Regional Senior 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 Terracon 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.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	We understand the proposed project consists of a renovation to the existing building including the construction of a new addition to the northern portion of the existing building along with a new trash enclosure and reworking the drive-thru and parking areas. No below-grade areas are planned.
Geotechnical Characterization	Subsurface conditions encountered in the exploratory borings generally consisted of about 5 inches of asphalt or concrete over about 3 to 12 feet of existing fill materials consisting of sand with varying amounts of clay and gravel underlain by native sands with varying amounts of silt to the maximum depths explored of about 10 to 30 feet. Groundwater was not encountered in Boring Nos. P1 and P2 to the maximum depths explored of about 10 to 20 feet at the time of our field exploration. Groundwater was encountered in the remaining borings at about 20 to 22 feet below ground surface (bgs) at the time of our field exploration.
Existing Fill Materials	About 12 feet of fill materials were encountered around the existing building in Boring Nos. 1 to 3 and about 3 feet of fill materials were encountered in other areas of the site in Boring Nos. P1 and P2. The shallow fill is likely a result of previous site grading while the deeper fill around the existing building seems to indicate that a previous overexcavation was performed in the area of the existing building. Based upon the results of our field exploration and laboratory testing, it is our opinion that better performance of foundations, interior slabs, exterior slabs-on-grade and pavements would be achieved by complete removal and modification of the existing fill. However, if the existing building foundations, interior slabs, exterior slabs-on-grade and pavements are performing satisfactorily, consideration could be given to constructing foundations, slabs-on-grade, and pavements on a zone of modified existing fill materials.
Foundation Recommendations	The proposed building addition and trash enclosure may be constructed on a shallow spread footing foundation bottomed on new engineered fill, a zone of modified existing fill materials or

Topic [1]	Overview Statement [2]
	native soils provided the owner is willing to accept the associated risk of movement. As an alternative to shallow foundations constructed on new engineered fill, the proposed building addition could be constructed on helical piles.
Interior Floors	Based on the properties of the subsurface materials, the floor system for the proposed addition may consist of a slab-on-grade constructed on new engineered fill or a zone of modified existing fill materials provided the owner is willing to accept the risk of movement. If very little movement can be tolerated, structural floors, supported independent of the subgrade materials, are recommended.
Exterior Flatwork	Exterior flatwork may be constructed on partially modified existing fill materials.
Pavements	Pavements may be constructed on partially modified existing fill materials.
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.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Parker McDonald's Site ID#50162 to be located at 10950 South Parker Road in Parker, Colorado. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface conditions
- Groundwater conditions
- Earthwork
- Grading and drainage
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification
- Lateral earth pressure
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of five test borings (designated as Boring Nos. 1 to 3 and P1 to P2) to depths ranging from approximately 10 to 30 feet below existing site grades.

Plans 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 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. Our final understanding of the project conditions is as follows:

Item	Description
Information Provided	McDonald's provided the following PDF documents: ▪ 50162 PARKER MAINSTREET_Boring Locations.pdf96th at Tower_Concept Plan 3 BORINGS

Item	Description
Project Description	We understand the proposed project consists of a renovation to the existing building including the construction of a new addition to the northern portion of the existing building along with a new trash enclosure and reworking the drive-thru and parking areas. No below-grade areas are planned.
Building Construction	We anticipate the proposed building addition will be constructed of light gauge metal or wood framing and concrete masonry units with shallow foundations and a slab-on-grade floor.
Maximum Loads	▪ Columns: 20 to 50 kips ▪ Walls: 3 to 5 kips per linear foot (klf) ▪ Slabs: 100 to 200 pounds per square foot (psf)
Grading/Slopes	Cut and fill, 2 feet (+/-) max
Free-Standing Retaining Walls	None indicated
Pavements	New pavements will likely consist of flexible asphalt and rigid concrete pavement. Traffic loads were not available at the time of this report. We assumed traffic loads consistent with that of similar use.

Terracon should be notified if any of the above information is inconsistent with the planned construction as revised and/or additional geotechnical recommendations may be required.

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 to be located at 10950 South Parker Road in Parker, Colorado. Approximate coordinates: 39.5177° N, 104.7643° W. See **Site Location**.

Item	Description
Existing Improvements	The subject site has been previously developed with a single-story McDonald's restaurant building and associated parking and drive-thru areas occupy the site. As the renovation plans involve reusing the existing foundations, we assume that the existing foundations have been performing well. Pavements on the site also appear to be performing well.
Current Ground Cover	Ground cover on the subject site consists of asphalt and concrete pavements and landscaped areas.
Existing Topography	The area of the planned building addition is generally flat with an elevation difference of less than about 2 feet.

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 calculations and evaluation of the site. 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 noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Subsurface Profile

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	**Asphalt/Concrete**	Asphalt; about 5 inches Concrete; about 5 inches
2	**Fill**	Fill material consisting of sand with varying amounts of clay and gravel; various densities
3	**Native Sand**	Native sand with varying amounts of silt; loose to dense

Stratification boundaries on the boring logs represent the approximate location of changes in soil and material types; in situ, the transition between materials may be gradual. Further details of the borings can be found on the boring logs in the **Exploration Results**.

Based on the results of the laboratory testing and our experience in the area, the sand fill materials and native sand soils have nil to low expansive potential. A summary of laboratory test results is included in the **Exploration Results**.

Groundwater Conditions

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

Boring No.	Shallowest depth to groundwater encountered while or upon completion of drilling [1]
1	About 20 feet
2	About 20 feet
3	About 22 feet
P1	None encountered to the maximum depth explored of about 10 feet
P2	None encountered to the maximum depth explored of about 20 feet

1. Due to safety concerns, borings were backfilled immediately after completion. Therefore, subsequent groundwater measurements were not obtained.

These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times or at other locations.

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. Groundwater levels during construction or at other times in the life of the structures 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.

Corrosivity

The table below lists the results of laboratory soluble sulfate, sulfides, soluble chloride, electrical resistivity, Red-Ox, 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)	Soluble Sulfate (ppm)	Sulfides (mg/kg)	Soluble Chloride (mg/kg)	pH	Red-Ox (mV)	Electrical Resistivity (Ω-cm)
2	0.4 to 5	134	Nil	278	10.5	+121	1120

Results of water-soluble sulfate testing indicate that the sample of the on-site soils has an exposure class of S0 when classified in accordance with the American Concrete Institute (ACI) Design Manual. The results of the testing indicate ASTM Type I portland cement is suitable for project concrete in contact with on-site soils. However, if there is no (or minimal) cost differential, use of ASTM Type II portland cement is recommended for additional sulfate resistance of construction concrete. Concrete should be designed in accordance with the provisions of the ACI Design Manual.

Imported fill materials may have significantly different properties than the site materials noted above and should be evaluated if expected to be in contact with materials used for construction.

Geotechnical Overview

Based on subsurface conditions encountered in the borings, the site appears suitable for the proposed construction from a geotechnical point of view provided certain precautions and design and construction recommendations outlined in this report are followed. We have identified geotechnical conditions that could impact design and construction of the proposed structures.

Existing Fill Materials

About 12 feet of fill materials were encountered around the existing building in Boring Nos. 1 to 3 and about 3 feet of fill materials were encountered in other areas of the site in Boring Nos. P1 and P2. The shallow fill is likely a result of previous site grading while the deeper fill around the existing building seems to indicate that a previous overexcavation was performed in the area of the existing building. It should be noted that fill depths presented in the boring logs are approximate and the depth, lateral extents, and composition of fill should be expected to vary. We do not possess any information regarding whether the fill was placed under the observation of a geotechnical engineer. Without documentation to indicate the existing fill materials were placed in a controlled manner, there is an inherent risk of movement when construction on these materials. Based on our experience, if the existing foundations, slabs-on-grade, and pavements have performed satisfactorily, it is reasonable to assume that new elements constructed on partially modified existing fill would perform similarly.

Based upon the results of our field exploration and laboratory testing, it is our opinion that better performance of foundations, interior slabs, exterior slabs-on-grade and pavements would be achieved by complete removal and modification of the existing fill.

However, if the existing building foundations, interior slabs, exterior slabs-on-grade and pavements are performing satisfactorily, consideration could be given to constructing foundations, slabs-on-grade, and pavements on a zone of modified existing fill materials.

The existing fill can be reused as engineered fill below foundations, slabs-on-grade, and pavements, provided any deleterious materials are removed. Some removal and replacement may be required if unsuitable or soft materials are exposed.

Existing Structures

As part of the proposed project, a new building addition will be constructed on north side of the existing building. The foundation system of the existing building is unknown but is assumed to consist of spread footings. Care must be used while excavating adjacent to the existing foundations of the building to avoid undermining or otherwise disturbing these foundation elements. Test pits, incremental excavation, or shoring will be needed to avoid undermining the existing foundations. We recommend additional time and effort be budgeted for incremental excavations and/or a shoring contractor be consulted to recommend an appropriate shoring system for excavations that will extend below the existing footings.

Differential movement between the existing building and the proposed addition will occur. To reduce distress caused by differential movement, we recommend the addition be designed to be structurally independent of the existing building.

Earthwork

The following sections present recommendations for site preparation, excavation, subgrade preparation, and placement of engineered fills on the project. All earthwork on the project should be observed and evaluated by Terracon.

Site Preparation

Strip and remove existing pavements, vegetation, organics, and other deleterious materials from proposed building and pavement areas. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

Stripped materials consisting of vegetation, unsuitable fills, and organic materials should be wasted from the site or used to revegetate landscaped areas or exposed slopes after completion of grading operations.

Where possible, the site should be initially graded to create a relatively level surface to receive fill and to provide for a relatively uniform thickness of fill beneath the proposed building and improvement areas. All exposed areas that will receive fill, once properly cleared, should be scarified to a minimum depth of 12 inches, conditioned to near optimum moisture content, and compacted. It is imperative the moisture content of prepared materials be protected from moisture loss.

Although evidence of underground facilities such as grease pits and utility vaults was not observed during our exploration, such features could be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

Depending upon seasonal conditions, surface water may infiltrate into the excavations on the site. Water seeping into excavations at this site could most likely be controlled by shallow trenches leading to a sump pit where the water could be removed by pumping.

The stability of subgrade soils may be affected by precipitation, repetitive construction traffic, or other factors. If unstable conditions are encountered or develop during construction, workability may be improved by overexcavation of wet zones and mixing these soils with crushed gravel. Use of geotextiles could also be considered as a stabilization technique. Lightweight excavation equipment may be required to reduce subgrade pumping.

Material Types

Fill for this project should consist of engineered fill. Engineered fill is fill that meets the criteria presented in this report and has been properly documented.

Engineered fill should meet the following material property requirements:

Fill Type[1,2]	USCS Classification	Acceptable location for placement
On-site sand soils	SC, SM	On-site sand soils are considered suitable for reuse as engineered fill below foundation, slab, and pavement areas and as general fill for this project.

Fill Type[1,2]	USCS Classification	Acceptable location for placement
Processed Demolition Debris (concrete, brick, and asphalt)[3]	N/A	Properly processed demolition debris consisting of concrete, brick, and asphalt is considered suitable for reuse as engineered fill below foundations, slabs-on-grade, and pavement areas, and as general fill for this project.
Imported soils	Varies	Imported soils meeting the gradation outlined herein can be considered acceptable for use as engineered fill beneath foundations, slabs and pavements.

1. Engineered 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.
2. Care should be taken during the fill placement process to avoid zones of dis-similar fill. Improvements constructed over varying fill types are at a higher risk of differential movement compared to improvements over a uniform fill zone.
3. Demolition debris (concrete, brick, and asphalt) should be processed to a maximum size of 3 inches and blended with on-site soils at a ratio of 50 percent demolition debris (concrete, brick, and asphalt) to 50 percent soil prior to reuse. We are aware of instances in which demolition debris had environmental concerns. Assessment of environmental conditions is outside the scope of this exploration.

Imported soils for engineered fill (if required) should meet the following material property requirements:

Gradation	Percent finer by weight (ASTM C136)
3"	100
1"	90-100
¾"	50-100
No. 4 Sieve	50-100
No. 200 Sieve	35 or less

- Liquid Limit..30 (max)
- Plasticity Index..................................15 (max)
- Maximum Expansive Potential (%).........0.5*

  *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.

Compaction Requirements

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.

Item	Description
Fill 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, plate compactor) is used
Compaction requirements [1,2]	Minimum of 98% of the material's standard Proctor maximum dry density (ASTM D698)
Moisture content	-2 to +2% of the optimum moisture content

1. We recommend that engineered 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. Water levels should be maintained low enough to allow for satisfactory compaction to be achieved without the compacted fill material pumping when proofrolled.

Excavation

Excavations into the subsurface soils will encounter a variety of conditions. The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards.

Soils penetrated by the proposed excavations may vary significantly across the site. The soil classifications are based solely on the materials encountered in the exploratory borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, the actual conditions should be evaluated to determine any excavation modifications necessary to maintain safe conditions.

Grading and Drainage

All grades must be adjusted to provide positive drainage away from the building addition during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during construction. Landscaped irrigation adjacent to the foundation systems should be minimized or eliminated. Water permitted to pond near or adjacent to the perimeter of the structure (either during or post-construction) can result in significantly higher soil movements than those discussed in this report. As a result, any estimations of potential movement described in this report cannot be relied upon if positive drainage is not obtained and maintained, and water is allowed to infiltrate the fill and/or subgrade.

Permanent grades should be sloped at a minimum of 5 percent grade for at least 10 feet beyond the perimeter of the building addition. Asphalt pavement or concrete flatwork should be sloped at a minimum of 2 percent beyond the building perimeters for the life of the building addition. Where Americans with Disabilities Act (ADA) or other requirements or existing site features limit the gradient, slopes on the order of ½ to 1 percent minimum may be necessary to comply with the ADA but do increase the risk of unanticipated movement. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be compacted in accordance with recommendations in this report and free of all construction debris to reduce the possibility of water infiltration. After building construction and prior to project completion, we recommend that verification of final grading be performed to document that positive drainage, as described above, has been achieved.

Where paving or flatwork abuts the structure, care should be taken that joints are properly sealed and maintained to prevent the infiltration of surface water.

Landscape or xeriscape areas within 10 feet of the foundation systems shall not be hindered by landscape edging, grade variations, or vegetation. In addition, consideration should be given to snow removal practices that will minimize the stockpiling of snow in planter and landscaped areas adjacent to structural improvements.

Sprinkler mains and spray heads should be located a minimum of 10 feet away from the building lines. Where drip line irrigation is located near the building addition, we recommend that drip line irrigation systems be located at least 5 feet from the outside edge of the foundations. Roof drains should discharge on pavements or be extended away from the structure a minimum of 10 feet through the use of splash blocks or downspout extensions.

Earthwork Construction Considerations

Upon completion of grading operations, care should be taken to maintain the moisture content of the subgrade prior to construction of slabs-on-grade, pavements, etc. Construction traffic over prepared subgrade should be minimized and avoided to the extent practical.

The site should also be graded to prevent ponding of surface water on prepared subgrade or in excavations. In areas where water is allowed to pond over a period of time, the affected area should be removed and allowed to dry out; however, allowing the soils to dry out below the optimum moisture content is not recommended. If constraints do not allow for moisture conditioning of affected soils as recommended in this report, the affected area should be overexcavated and replaced with engineered fill. As an alternative, geotextiles could also be considered as a stabilization technique.

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

Foundation Recommendations

Based upon the results of the field exploration and laboratory testing program for this exploration, the following foundation systems were evaluated for use in supporting the proposed structures:

- Spread footing foundations on new engineered fill or native soils
- Spread footing foundations on partially modified existing fill materials
- Helical piles.

To improve performance, the proposed building addition and trash enclosure may be constructed on a shallow spread footing foundation system over new engineered fill or native soils provided the owner is willing to accept the associated risk of movement.

However, if the existing foundations are performing satisfactorily and the owner is willing to accept a higher risk of movement, the proposed building addition and trash enclosure may be constructed on a shallow spread footing foundation system over a zone of partially modified existing fill materials.

As an alternative to shallow foundations, the proposed building addition could be constructed on helical piles.

Spread Footing Foundation Recommendations

Design recommendations for spread footing foundation systems are presented in the following table and paragraphs.

Description	Value	
Thickness of Zone Of New Engineered Fill	All existing fill must be removed and modified or replaced. Native soils at the base of all overexcavations shall be scarified to a minimum depth of 12 inches, moisture conditioned, and compacted prior to placement of new engineered fill	Minimum of 3 feet below lowest foundation element. Soils at the base of all overexcavations shall be scarified to a minimum depth of 12 inches, moisture conditioned, and compacted prior to placement of modified existing fill materials
Supporting Stratum	New engineered fill or native soils	Modified existing fill materials
Maximum Allowable Bearing Pressure[1,2]	2,500 psf	
Coefficient of Friction (Sliding)	0.3	
Minimum Footing Dimensions	Isolated footings: 24 inches Continuous footings: 18 inches	
Minimum Embedment Below Finished Grade for Frost Protection[3]	3 feet	
Approximate Total Movement[4,5]	About 1 inch	About 1 to 1½ inches
Estimated Differential Movement[4,5,6]	About ½ to 1 inch	About ¾ to 1½ inches

1. The recommended maximum allowable bearing pressure assumes that any existing fill or lower strength soils, if encountered, will be excavated and replaced with engineered fill.
2. The maximum allowable soil bearing pressure can be increased by 1/3 for transient loading conditions.
3. For perimeter footings, footings beneath unheated areas, and footings that will be exposed to freezing conditions during construction. Interior footings may bottom at a minimum depth of 12 inches below finished grade in heated areas.

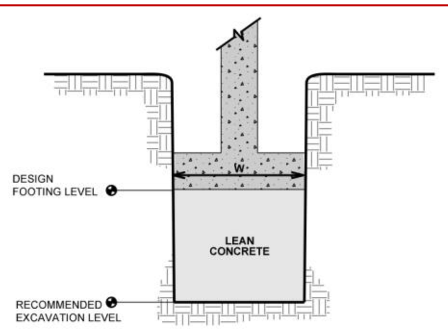
Description	Value

4. 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 engineered fill, and the quality of the earthwork operations and footing construction.
5. The differential movement between the existing building foundation elements and the new building addition's foundation elements will be on the order of the total movement presented in the table above.
6. Footings should be proportioned on the basis of equal total dead load pressure to reduce differential movement between adjacent footings.

Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction and throughout the life of the structure. Failure to maintain the proper drainage as recommended in the **Grading and Drainage** section of **Earthwork** will nullify the movement estimates provided above.

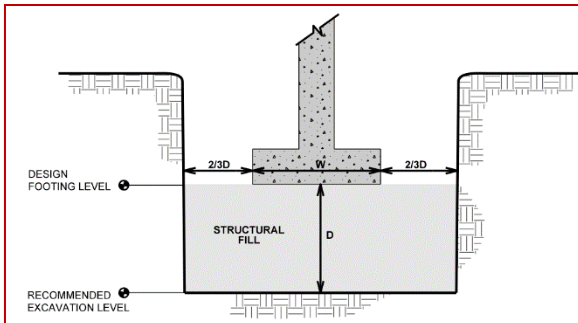
Unstable subgrade conditions should be observed by the Geotechnical Engineer to assess the subgrade and provide suitable alternatives for stabilization. Stabilized areas should be proofrolled prior to continuing construction to assess the stability of the subgrade.

Overexcavation of existing fill materials below new footings should extend laterally beyond all edges of the new footings that are not adjacent to an existing footing at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with approved fill placed in lifts of 8 inches or less in loose thickness (6 inches or less if using hand-guided compaction equipment) and compacted to at least 98 percent of the material's standard effort maximum dry density (ASTM D698). As an alternative to the lateral overexcavation requirement for placement of engineered fill soils, the overexcavation may be considered directly beneath the footings when lean concrete is used as the backfill material. The overexcavation and backfill extents are presented in the following figure.



LEAN CONCRETE BACKFILL

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



OVER-EXCAVATION / BACKFILL ZONE

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

The base of all foundation excavations should be free of water and loose soil prior to concrete placement. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soil should be removed prior to placing concrete.

Footings, foundations, and masonry walls should be detailed and reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Helical Pile Recommendations

Helical piles may be used to support the proposed addition. Design recommendations for helical piles are presented in the following paragraphs.

Description	Value
Minimum Pile Length Below Existing Ground Surface to Shallowest Pile Helix[1]	14 feet
Allowable Capacity	By others[2,3]
Maximum Allowable Movement	By others[2,3]

1. The minimum pile length to shallowest pile helix is from the current ground surface. This minimum length is intended to extend the shallowest helix of the pile below the estimated depth of fill below ground surface. The actual length of the helical piles will depend on the depth of the bottom of the foundation and any additional depth required to achieve the required design capacity.
2. We recommend the design capacity of the helical piles be determined by a design-build contractor that specializes in the design and installation of helical piles.
3. A pile load test should be performed on a production pile to verify the allowable capacity of the piles with respect to total movement.

The pile capacity should be determined through a combination of typical bearing capacity analysis, and results of the load tests correlated to helical pile installation torque. The actual design of the piles including the pile capacity, spacing, helix diameter(s), shaft length, bracket attachment and configuration, and shaft diameter should be performed by an experienced helical pile contractor or structural engineer. An experienced helical pile contractor should review the data to assess the equipment required to achieve the minimum length and capacity. We recommend a minimum of one load test be conducted at the site to confirm anticipated capacities and to finalize design information. The load test should be performed at the minimum length recommended above.

We should be consulted to review load test data, and a representative of the geotechnical engineer should be present to observe the test and production helical pile installation to verify that piles have been installed to the recommended torque and/or minimum depth.

Seismic Considerations

The following table presents the seismic site classification based on the 2021 International Building Code (IBC) and the subsurface conditions encountered within the borings:

Code Used	Site Classification
2021 International Building Code (IBC) [1,2]	D

1. In general accordance with the 2021 International Building Code.
2. The 2021 International Building Code (IBC) requires a site subsurface profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100-foot subsurface profile determination. The deepest borings of this exploration extended to a maximum depth of about 30 feet and this seismic site class definition considers that similar subsurface conditions exist below the maximum depth of the subsurface exploration.

Floor Slabs

Interior Floors

Slab-on-grade floors may be utilized for the interior floor systems when constructed on new engineered fill or a zone of modified existing fill materials, provided the owner is willing to accept the risk of movement. Slabs-on-grade constructed on new engineered fill is anticipated to have up to approximately 1 inch of movement.

However, if the existing interior slabs are performing satisfactorily and the owner is willing to accept a higher risk of movement, slab-on-grade floors may be utilized for the interior floor systems, provided slabs-on-grade are constructed on a zone of 3 feet of modified existing fill materials. The risk of movement for floor slabs constructed on these materials is anticipated to be on the order of 1 to 1½ inches.

If very little movement can be tolerated, structural floors, supported independent of the subgrade materials, are recommended.

The following design and construction recommendations apply to conventional slab-on-grade construction. New fill materials beneath slabs-on-grade should be placed and compacted as outlined in the **Earthwork** section of this report.

For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 110 pounds per cubic inch (pci) may be used for point or limited area loads for floors supported on an engineered fill.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns, or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications described previously.
- The use of a vapor retarder should be considered beneath concrete slabs on grade that will be 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 and slab contractor should refer to ACI 302 for procedures and cautions regarding the use and placement of a vapor retarder.
- Floor slabs should not be constructed on frozen subgrade.
- Other design and construction considerations, as outlined in the American Concrete Institute (ACI) Design Manual, are recommended.

Movements of slab-on-grades using the above outlined technique will likely be reduced and tend to be more uniform. The estimates outlined previously assume that the other recommendations in this report are followed. Additional movement could occur should the subsurface soils become wetted to significant depths, which could result in potential excessive movement causing uneven floor slabs and severe cracking. This could be due to over watering of landscaping, poor drainage, improperly functioning drain systems, and/or broken utility lines. Therefore, it is imperative that the recommendations outlined in this section and in the **Grading and Drainage** subsection of **Earthwork** be followed.

Exterior Flatwork

Exterior slabs-on-grade and flatwork constructed on the existing fill materials will have a low risk of movement. Prior to construction of slabs-on-grade, we recommend exterior slab-on-grade subgrade soils be scarified to a minimum depth of 12 inches, moisture conditioned, and compacted as outlined in the **Earthwork** section of this report.

For structural design of exterior concrete slabs-on-grade, a modulus of subgrade reaction of 110 pci may be used for point or limited area loads for exterior slabs-on-grade at this site.

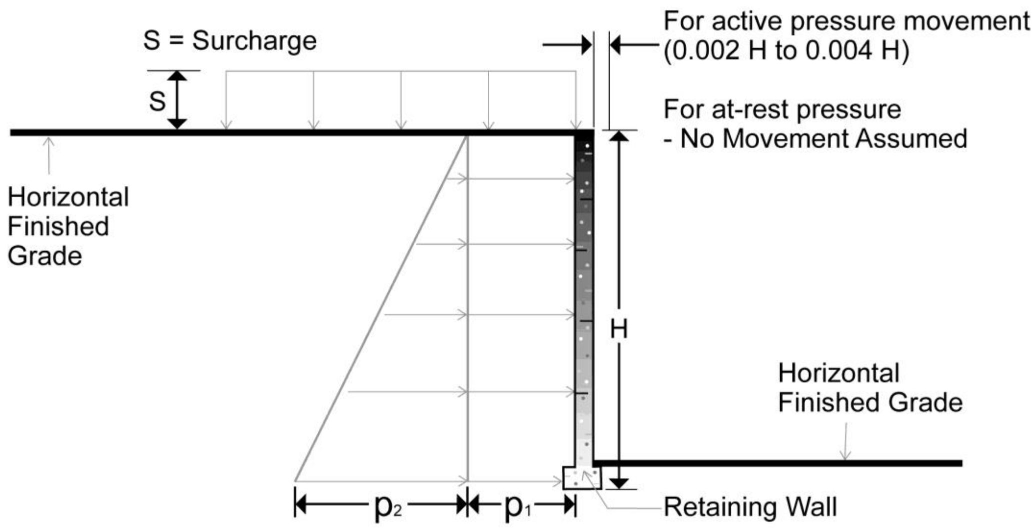
Additional slab design and construction recommendations are as follows:

- Minimizing moisture increases in the backfill.
- Controlling moisture-density during placement of backfill.
- Positive separations and/or isolation joints should be provided between exterior slabs and the building addition to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Exterior slabs should not be constructed on frozen subgrade
- Other design and construction considerations, as outlined in the American Concrete Institute (ACI) Design Manual, are recommended.

Movements of exterior slabs-on-grade using the above technique will likely be reduced and tend to be more uniform. Additional movement could occur should the subsurface soils and bedrock become wetted to significant depths, which could result in potential excessive movement causing uneven exterior slabs and severe cracking. This could be due to over watering of landscaping, poor drainage, and/or broken utility lines. Therefore, it is imperative that the recommendations outlined in the **Grading and Drainage** subsection of **Earthwork** be followed.

Lateral Earth Pressures

Below-grade walls or free-standing retaining walls are not anticipated for this project; however, we have included lateral earth pressures recommendations in case plans should change. Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Conditions	Lateral Earth Pressure Coefficient	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	0.41	49	(0.41)S	(49)H
At-Rest (Ko)	0.58	69	(0.58)S	(69)H
Passive (Kp)	2.46	296	---	---

<u>Applicable conditions to the above include:</u>

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

The preceding data are applicable only to cast-in-place concrete or modular block walls up to 5 feet in height. **If taller single walls, tiered walls, or Mechanically Stabilized Earth (MSE) walls will be included in the proposed development, additional site-specific studies and laboratory testing will be required.** In addition, the wall designer should perform standard wall design practices including analysis for overturning, sliding, bearing capacity, and global stability, and results of these analyses should be provided for our review. Additional sampling, laboratory testing and document review associated with retaining walls is beyond the original scope of work but can be performed as a separate scope, for a separate fee.

Pavements

Design of privately maintained pavements for the project has been based on the procedures outlined by the Asphalt Institute (AI) and the American Concrete Institute (ACI).

Design Traffic

We assumed the following design parameters for Asphalt Institute flexible pavement thickness design:

- Automobile Parking Areas
  - Parking stalls and parking lots for cars and pick-up trucks, up to 50 stalls
- Main Traffic Corridors
  - Parking lots with a maximum of 5 trucks per day
- Subgrade Soil Characteristics
  - USCS Classification – SC to SM (medium subgrade)

We assumed the following design parameters for ACI rigid pavement thickness design based upon the average daily truck traffic (ADTT):

- Automobile Parking Areas
  - ACI Category A-1: Automobile parking with an ADTT of 1 over 20 years
- Main Traffic Corridors
  - ACI Category B: Commercial entrance and service lanes with an ADTT of 25 over 20 years
- Subgrade Soil Characteristics
  - USCS Classification – SC to SM (medium support)
- Concrete modulus of rupture value of 500 psi

We should be contacted to confirm and/or modify the recommendations contained herein if actual traffic volumes differ from the assumed values shown above.

Subgrade Soils

Based on subgrade soil Unified Soil Classifications of SC to SM, AI classifies the subgrade soil as medium, while ACI classifies the subgrade soil as medium support. Existing fill materials will be encountered below the proposed pavement areas. Prior to construction of pavements, we recommend pavement subgrade soils be scarified to a minimum depth of 12 inches, moisture conditioned, and compacted as outlined in the **Earthwork** section of this report.

Recommended Minimum Pavement Sections and Materials

Recommended alternatives for flexible and rigid pavements are summarized for each traffic area as follows:

Traffic Area	Alternative	Preliminary Pavement Thickness (Inches)			
		Asphalt Concrete Surface	Aggregate Base Course	Portland Cement Concrete	Total
Automobile Parking (AI Class I and ACI Category A)	A	5	--	--	5
	B	4	6	--	10
	C [1]	--	--	5	5
Main Traffic Corridors (AI Class III and ACI Category B)	A	6	--	--	6
	B	4½	8	--	12½
	C [1]	--	--	6	6

1. The minimum pavement section thickness per ACI

Each alternative should be investigated with respect to current material availability and economic conditions. A minimum 7-inch thickness of rigid reinforced concrete pavement is recommended at the location of dumpsters where trash trucks park and load, and in areas of tight turning radius.

Concrete pavement joint spacing and reinforcement should be in accordance with specifications in the American Concrete Institute (ACI) Design Manual.

For analysis of pavement costs, the following specifications should be considered for each pavement component:

Pavement Component	Colorado Department of Transportation Criteria
Asphalt Concrete Surface	Grading S or SX
Aggregate Base Course	Class 5 or 6
Portland Cement Concrete	Class P

Pavement Maintenance

Future performance of pavements constructed at this site will be dependent upon several factors, including:

- Maintaining stable moisture content of the subgrade soils both before and after pavement construction.
- Providing for a planned program of preventative maintenance.

The performance of all pavements can be enhanced by minimizing excess moisture, which can reach the subgrade soils. The following recommendations should be implemented:

- Site grading at a minimum 2 percent grade onto or away from the pavements.
- Water should not be allowed to pond behind curbs.
- Compaction of any utility trenches for landscaped areas to the same criteria as the pavement subgrade.
- Sealing all landscaped areas in or adjacent to pavements or providing drains to reduce the risk of moisture migration to subgrade soils.
- Placing compacted backfill against the exterior side of curb and gutter.
- Placing curb, gutter, and/or sidewalk directly on subgrade soils without the use of base course materials.

Preventative maintenance should be planned and provided for an ongoing pavement management program in order to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration.

Preventative maintenance consists of both localized maintenance (e.g. crack sealing and patching) and global maintenance (e.g. surface sealing). Preventative maintenance is usually the first priority when implementing a planned pavement maintenance program.

Pavement Construction Considerations

Site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, or rainfall. As a result, the pavement subgrade may not be suitable for pavement construction and corrective action will be required. The subgrade should be carefully evaluated at the time of pavement construction for signs of disturbance or excessive rutting. If disturbance has occurred, pavement subgrade areas should be reworked, moisture conditioned, and properly compacted to the recommendations in this report immediately prior to paving.

We recommend the pavement areas be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and paving. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving.

The placement of a partial pavement thickness for use during construction is not recommended without a detailed pavement analysis incorporating construction traffic. In addition, if the actual traffic varies from the assumptions outlined above, we should be contacted to confirm and/or modify the pavement thickness recommendations outlined above.

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.

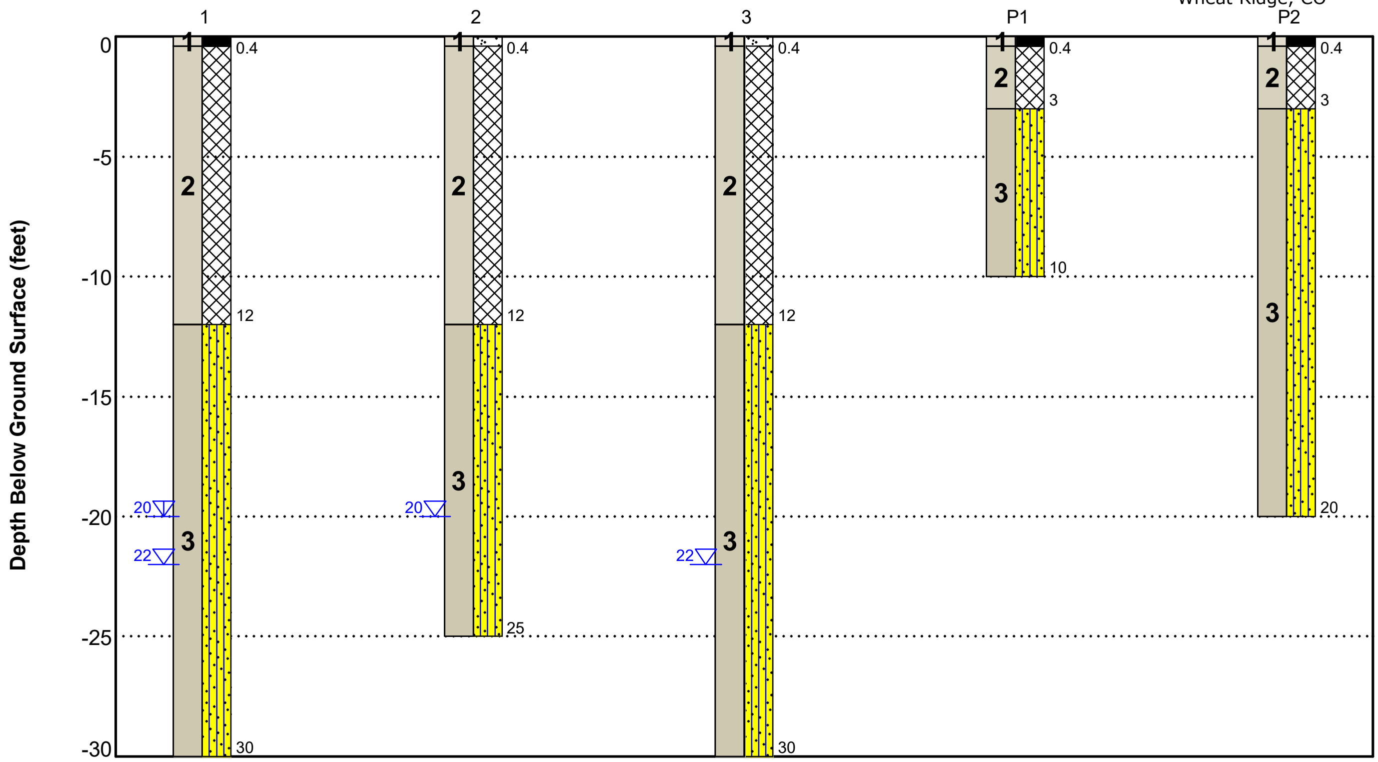
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation 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. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. 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.

Figures

Contents:

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

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
1	**Asphalt/Concrete**	Asphalt; about 5 inches Concrete; about 5 inches
2	**Fill**	Fill material consisting of sand with varying amounts of clay and gravel; various densities
3	**Native Sand**	Native sand with varying amounts of silt; loose to dense

LEGEND

Asphalt

Concrete

Fill

Silty Sand

First Water Observation

Second Water Observation

The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

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.

Attachments

Exploration and Testing Procedures

Field Exploration

Boring Layout and Elevations: The locations of the borings are presented in the **Site Location and Exploration Plans.** The borings were located in the field by overlaying the site plan on Google Earth, recording the latitude and longitude coordinates, and staking the borings using a handheld, recreational-grade GPS unit. The accuracy of the latitude and longitude values is typically about +/- 25 feet when obtaining the values using this method. The accuracy of the boring locations should only be assumed to the level implied by the methods used.

Subsurface Exploration Procedures: The borings were drilled with a CME-55 truck-mounted drill rig with a solid-stem auger. During the drilling operations, lithologic logs of the borings were recorded by the field engineer. Relatively undisturbed samples were obtained at selected intervals utilizing a 2½-inch outside diameter modified California barrel sampler. Bulk samples were obtained from auger cuttings. Penetration resistance values were recorded in a manner similar to the standard penetration test (SPT). This test consists of driving the sampler into the ground with a 140-pound hammer free falling through a distance of 30 inches. The number of blows required to advance the barrel sampler 12 inches (18 inches for standard split-spoon samplers, final 12 inches are recorded) or the interval indicated is recorded and can be correlated to the standard penetration resistance value (N-value). The blow count values are indicated on the boring logs at the respective sample depths, barrel sampler blow counts are not considered N-values.

An automatic hammer was used to advance the samplers in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The standard penetration test provides a reasonable indication of the in-place density of sandy type materials, but only provides an indication of the relative stiffness of cohesive materials since the blow count in these soils may be affected by the soil moisture content. In addition, considerable care should be exercised in interpreting the N-values in gravelly soils, particularly where the size of the gravel particle exceeds the inside diameter of the sampler.

Groundwater measurements were obtained in the borings at the time of drilling. Due to safety concerns, the borings were backfilled with auger cuttings and patched with cold patch asphalt and concrete after drilling. Some settlement of the backfill and patches may occur and should be repaired as soon as possible.

Laboratory Testing

Samples retrieved during the field exploration were returned to the laboratory for observation by the Geotechnical Engineer and were classified in general accordance with the Unified Soil Classification System presented in the **Supporting Information**.

At this time, an applicable laboratory-testing program was formulated to determine engineering properties of the subsurface materials. Following the completion of the laboratory testing, the field descriptions were confirmed or modified as necessary, and the boring logs were prepared. The boring logs are included in the **Exploration Results**.

Laboratory test results are included in the **Exploration Results**. These results were used for the geotechnical engineering analyses and the development of foundation, earthwork, and pavement recommendations. All laboratory tests were performed in general accordance with the applicable local or other accepted standards.

Selected soil samples were tested for the following engineering properties:

- Water content
- Dry density
- Grain size distribution
- Atterberg limits
- Swell/consolidation
- Water-soluble sulfate content
- Chlorides
- Sulfides
- Red-Ox
- pH
- Electrical resistivity

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

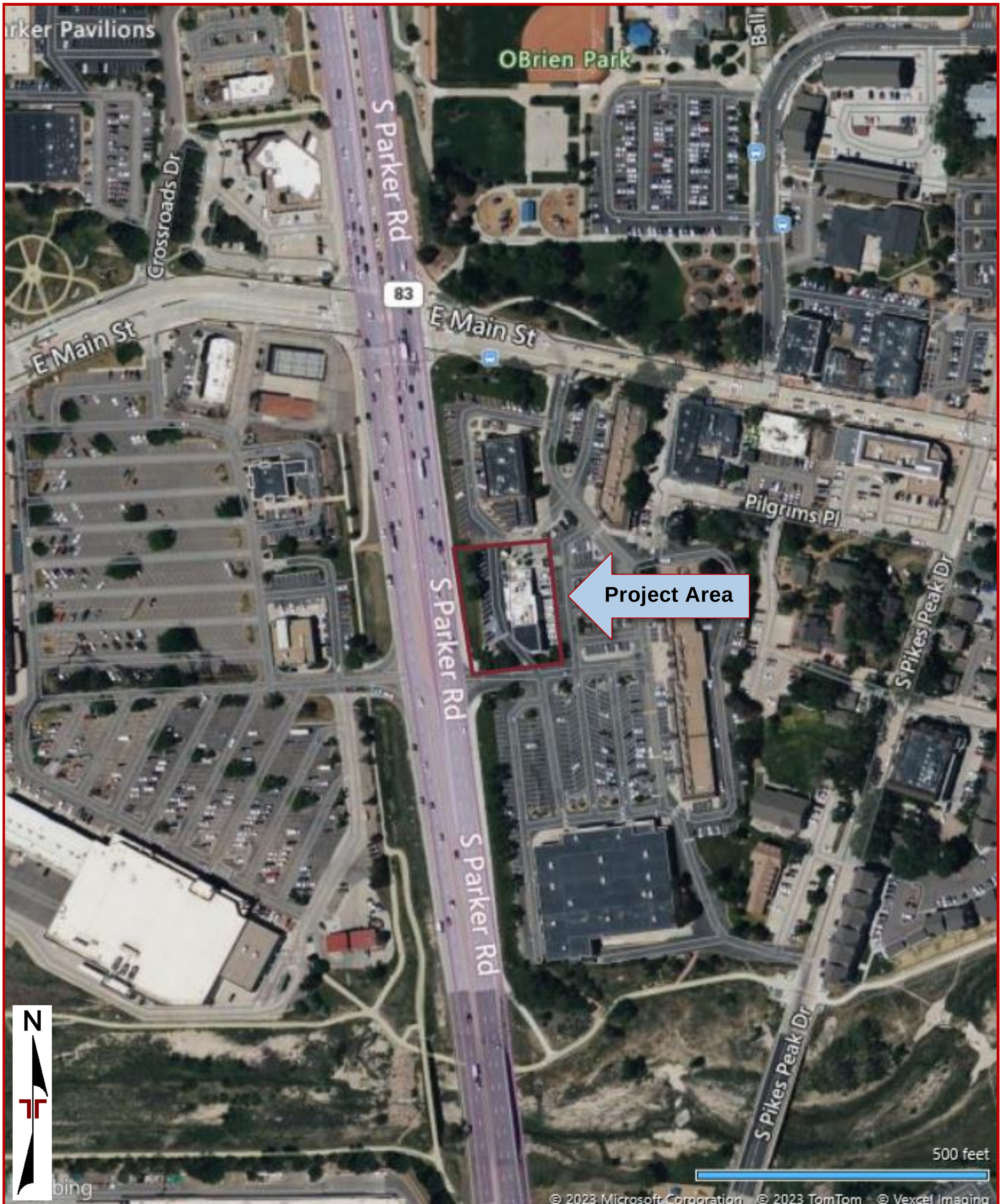


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

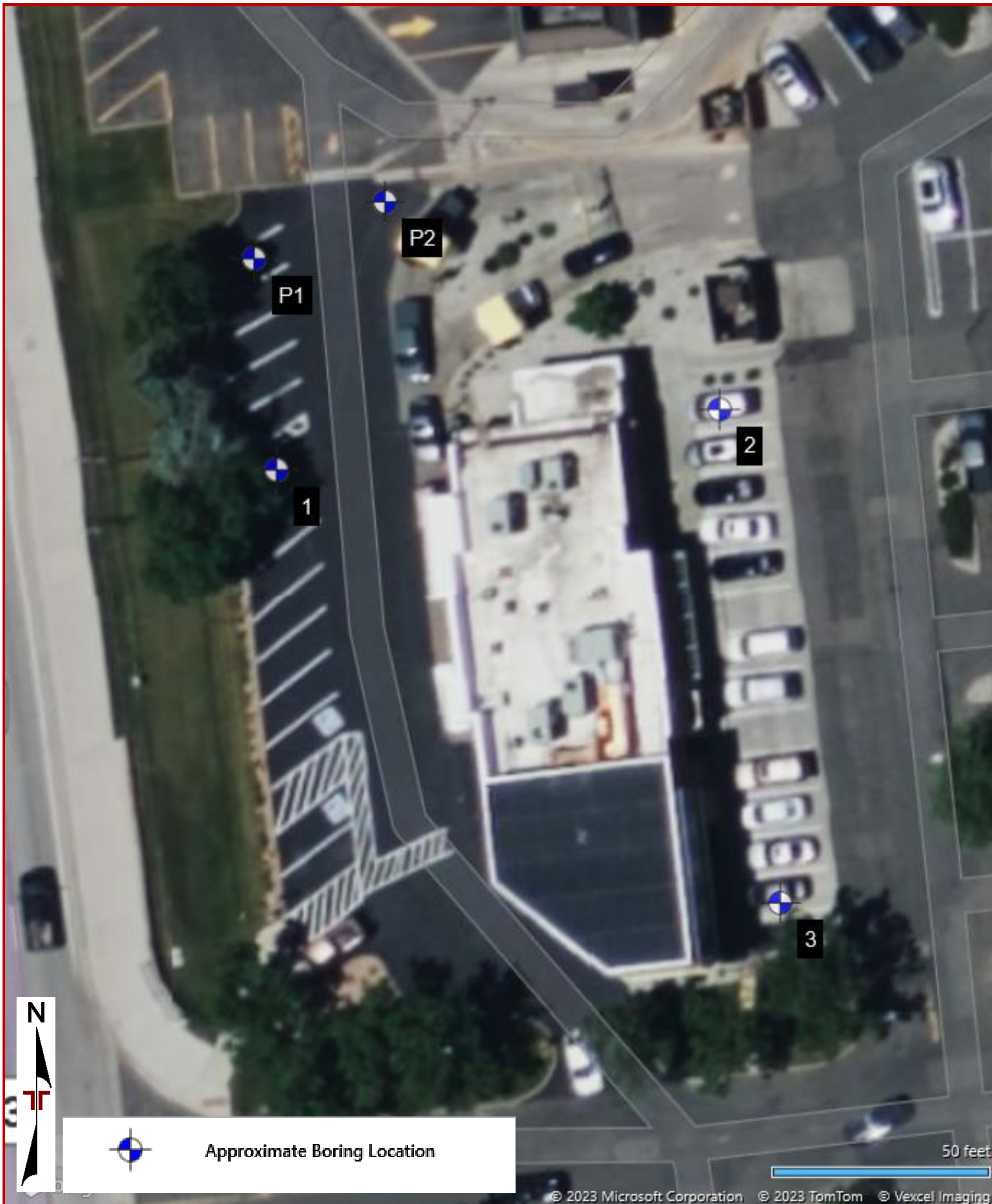


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan with Project Overlay

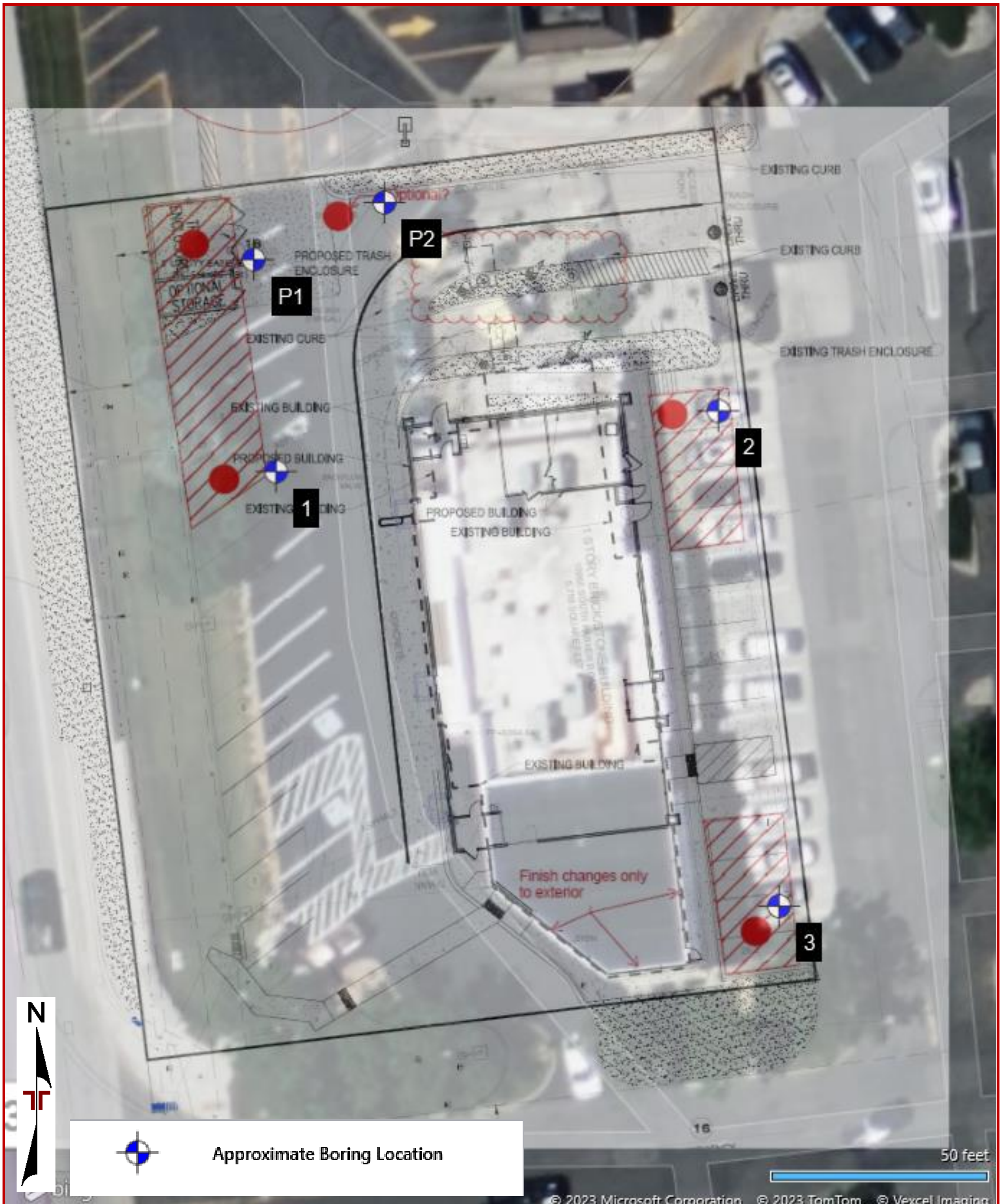


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (Boring Nos. 1 to 3 and P1 to P2)
Swell Consolidation Test (4 pages)
Grain Size Distribution (2 pages)
Corrosivity
Summary of Laboratory Test Results

Note: All attachments are one page unless noted above.

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Boring Log No. 1

Location: See Exploration Plan

Latitude: 39.5176° Longitude: -104.7645°

Model Layer	Depth (Ft.)	Material Description
1	0.4	**ASPHALT**, about 5 inches
2	12.0	**FILL - CLAYEY SAND (SC)**, fine to coarse grained, brown to grayish brown, loose to medium dense
3	30.0	**SILTY SAND (SM)**, fine to coarse grained, tan, medium dense to dense
		Boring Terminated at 30 Feet

Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
8-11	+0.1 @ 500 psf	20.6	104	39-17-22	38
7-7		19.1	101		
6-14	-0.1 @ 500 psf	10.5	117		
8-8		4.4			
10-10				NP	13
6-8-10					
7-12-16		11.4			

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
- 22 feet while drilling
- 20 feet upon completion of drilling

Notes

Advancement Method
4-inch diameter solid stem continuous flight power auger

Abandonment Method
Boring backfilled with auger cuttings and surface capped with asphalt upon completion.

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

Logged by
ST

Boring Started
04-18-2023

Boring Completed
04-18-2023

Parker McDonald's Site ID#50162
10950 South Parker Road | Parker, Colorado
Terracon Project No. 25235069

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Boring Log No. 2

Location: See Exploration Plan

Latitude: 39.5177° Longitude: -104.7641°

Model Layer	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.4	**CONCRETE**, about 5 inches									
2		**FILL - CLAYEY SAND (SC)**, fine to coarse grained, brown to grayish brown, loose to medium dense				4-4		14.8	114	40-16-24	29
			5			6-10		19.0	109		
	12.0		10			6-4	0.0 @ 500 psf	21.1	101		
3		**SILTY SAND (SM)**, fine to coarse grained, brown to tan, loose to medium dense	15			7-8					
			20	▽		7-5		9.6			
	25.0		25			6-7-11					
		Boring Terminated at 25 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
▽ 20 feet while drilling

Advancement Method
4-inch diameter solid stem continuous flight power auger

Abandonment Method
Boring backfilled with auger cuttings and surface capped with concrete upon completion.

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

Logged by
ST

Boring Started
04-19-2023

Boring Completed
04-19-2023

Parker McDonald's Site ID#50162
10950 South Parker Road | Parker, Colorado
Terracon Project No. 25235069

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Boring Log No. 3

Location: See Exploration Plan

Latitude: 39.5174° Longitude: -104.7641°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1		0.4	**CONCRETE**, about 5 inches									
2		12.0	**FILL - CLAYEY SAND (SC)**, fine to coarse grained, light brown to grayish brown, loose				3-3		17.0	109	37-17-20	27
				5			6-5	0.0 @ 500 psf	14.4	113		
				10			5-6		15.7	111		
3		30.0	**SILTY SAND (SM)**, fine to coarse grained, brown to tan, loose to dense	15			10-9					
				20			5-5					
					▽ (22 ft)							
				25			8-12-15		20.1			
				30			12-14-15					
			Boring Terminated at 30 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
▽ 22 feet while drilling

Advancement Method
4-inch diameter solid stem continuous flight power auger

Abandonment Method
Boring backfilled with auger cuttings and surface capped with concrete upon completion.

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

Logged by
ST

Boring Started
04-19-2023

Boring Completed
04-19-2023

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Boring Log No. P1

Location: See Exploration Plan

Latitude: 39.5178° Longitude: -104.7645°

Model Layer	Graphic Log	Depth (Ft.) / Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1		0.4 **ASPHALT**, about 5 inches									
2		**FILL - CLAYEY SAND (SC)**, with gravel, fine to coarse grained, brown to grayish brown, medium dense				12-15		15.7		34-16-18	28
3		3.0 **SILTY SAND (SM)**, fine to coarse grained, brown to tan, loose to medium dense	5			7-10					
		10.0	10			7-7		12.0			
		Boring Terminated at 10 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None encountered while drilling

Advancement Method
4-inch diameter solid stem continuous flight power auger

Abandonment Method
Boring backfilled with auger cuttings and surface capped with asphalt upon completion.

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

Logged by
ST

Boring Started
04-18-2023

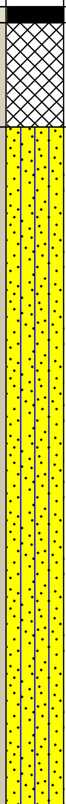
Boring Completed
04-18-2023

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Boring Log No. P2

Location: See Exploration Plan

Latitude: 39.5178° Longitude: -104.7644°



Model Layer	Depth (Ft.)	Material Description	Sample Depth (Ft.)	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.4	**ASPHALT**, about 5 inches							
2	3.0	**FILL - CLAYEY SAND (SC)**, fine to coarse grained, grayish brown, medium dense		10-8		11.4	103	34-15-19	31
3	20.0	**SILTY SAND (SM)**, fine to coarse grained, brown to tan, medium dense	5	7-6		12.6	112		
			10	14-17		3.0			
			15	10-11					
			20	10-11					

Boring Terminated at 20 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

Water Level Observations
None encountered while drilling

Advancement Method
4-inch diameter solid stem continuous flight power auger

Abandonment Method
Boring backfilled with auger cuttings and surface capped with asphalt upon completion.

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

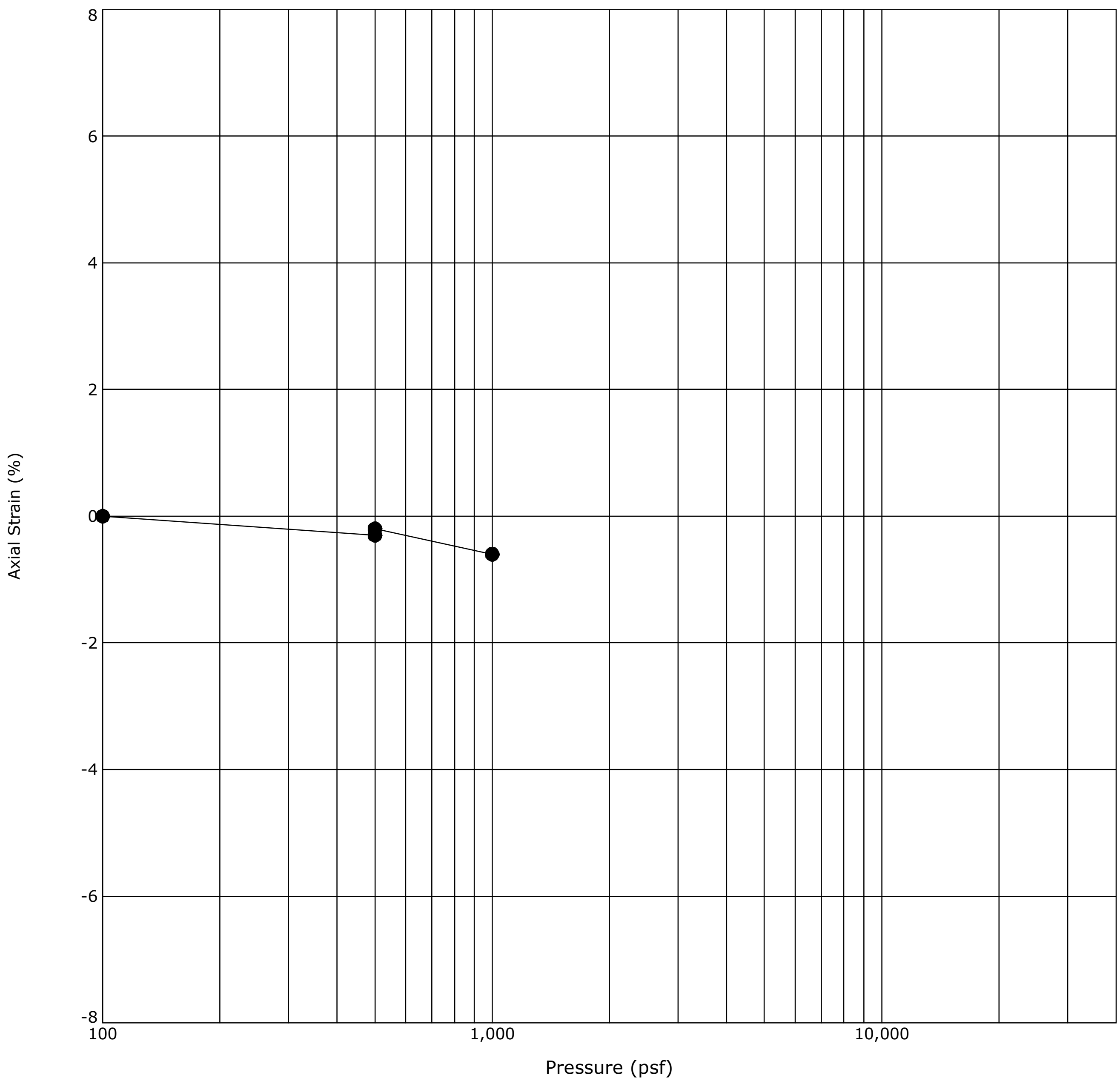
Logged by
ST

Boring Started
04-18-2023

Boring Completed
04-18-2023

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Swell Consolidation Test

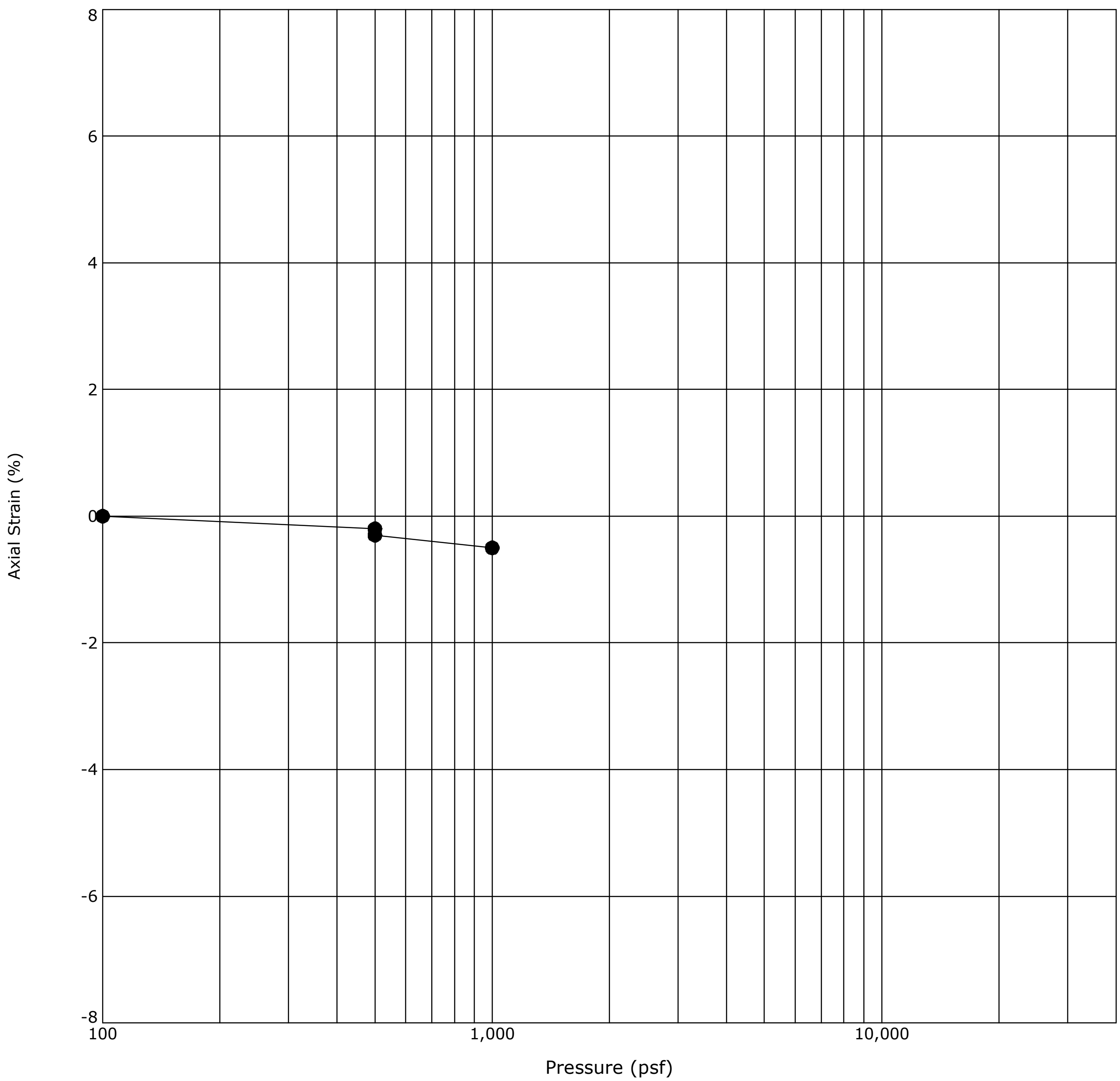


Boring ID		Depth (Ft)	Description	USCS	γ_d (pcf)	WC (%)
●	1	2 - 3	FILL - CLAYEY SAND	SC	104	20.6

Notes: Water was added at 500 psf.

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Swell Consolidation Test

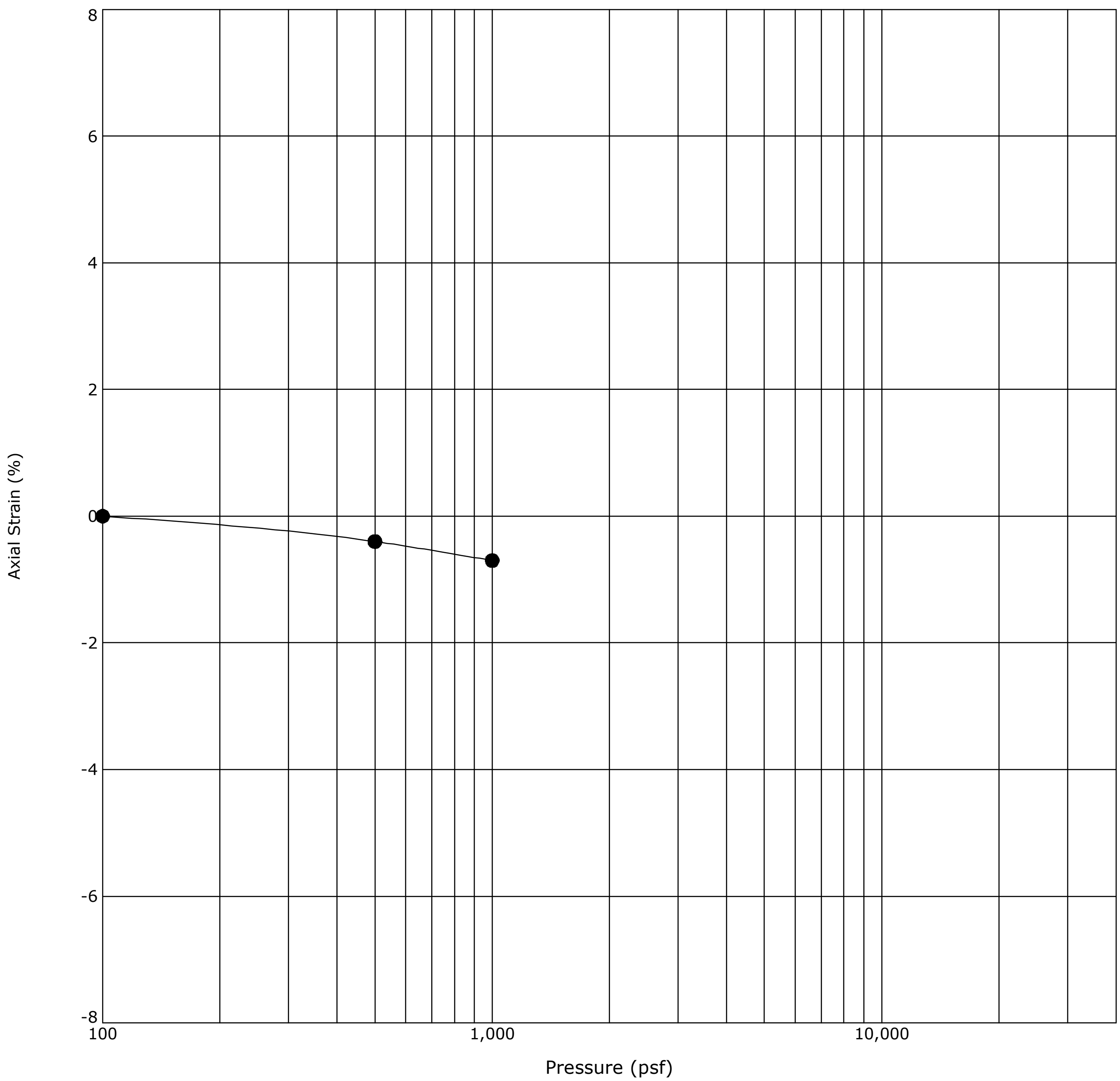


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	1	9 - 10	FILL - CLAYEY SAND	SC	117	10.5

Notes: Water was added at 500 psf.

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Swell Consolidation Test

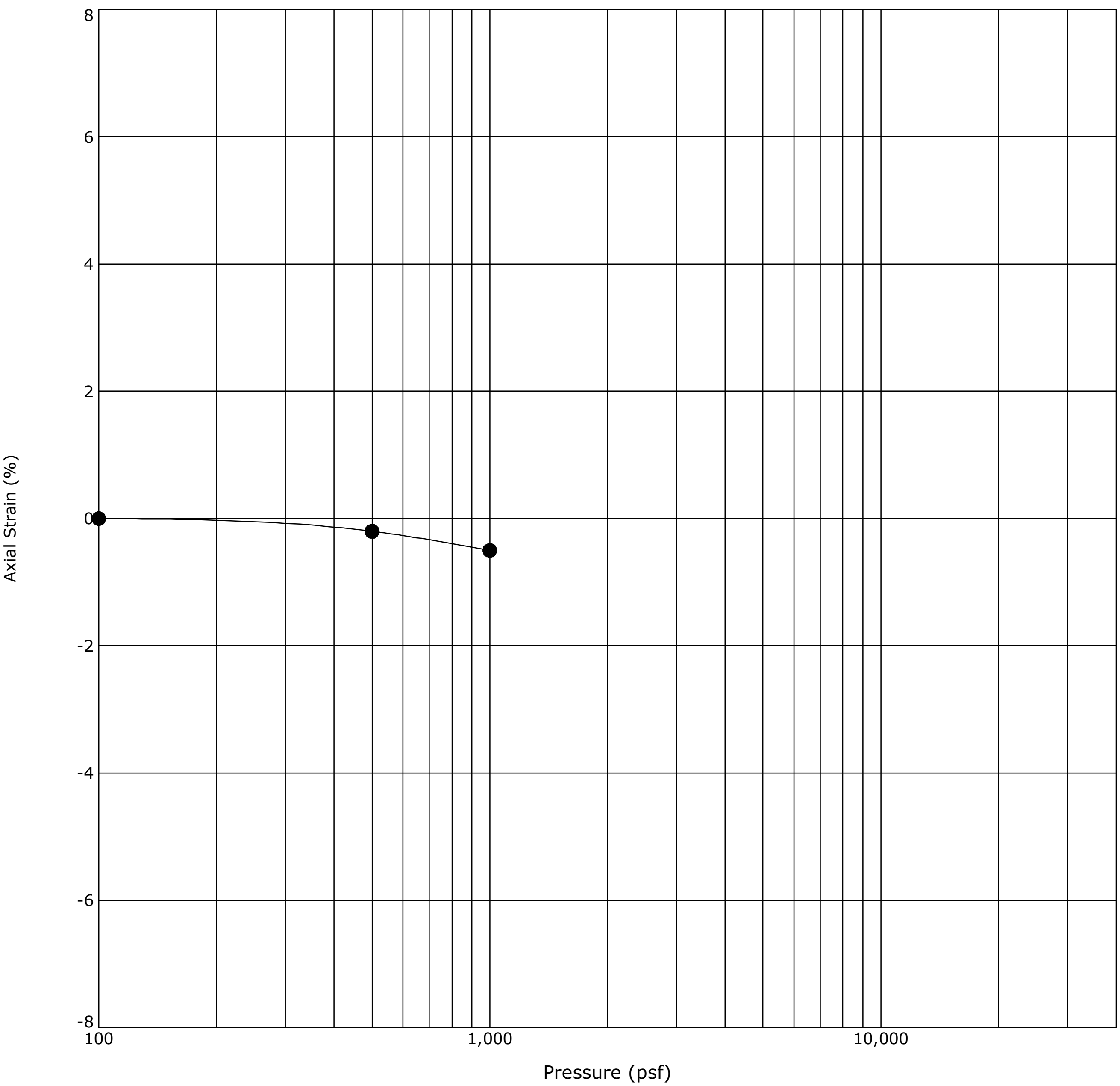


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	2	9 - 10	FILL - CLAYEY SAND	SC	101	21.1

Notes: Water was added at 500 psf.

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Swell Consolidation Test



Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	3	4 - 5	FILL - CLAYEY SAND	SC	113	14.4

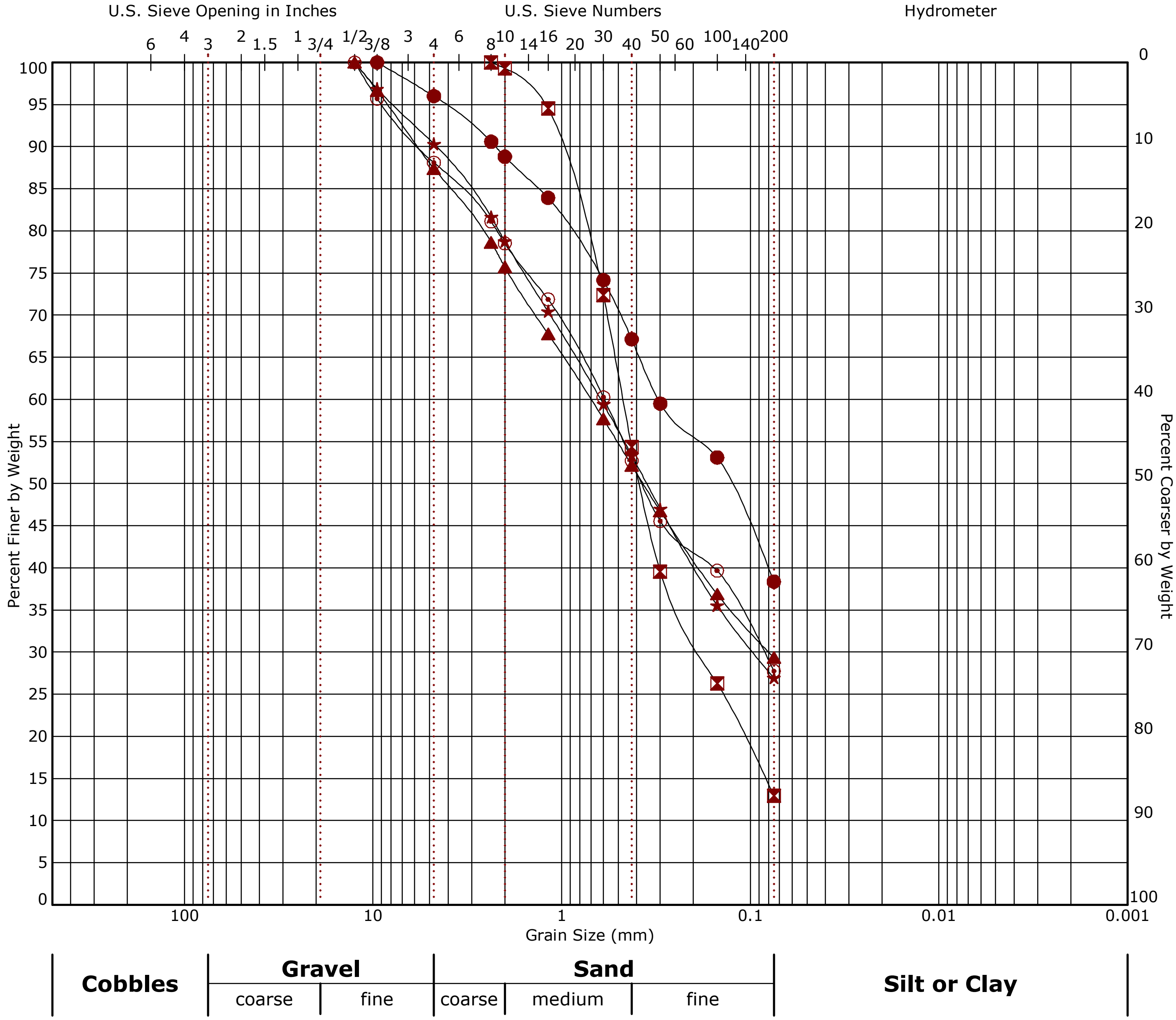
Notes: Water was added at 500 psf.

Parker McDonald's Site ID#50162
10950 South Parker Road | Parker, Colorado
Terracon Project No. 25235069

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Grain Size Distribution

ASTM D422 / ASTM C136



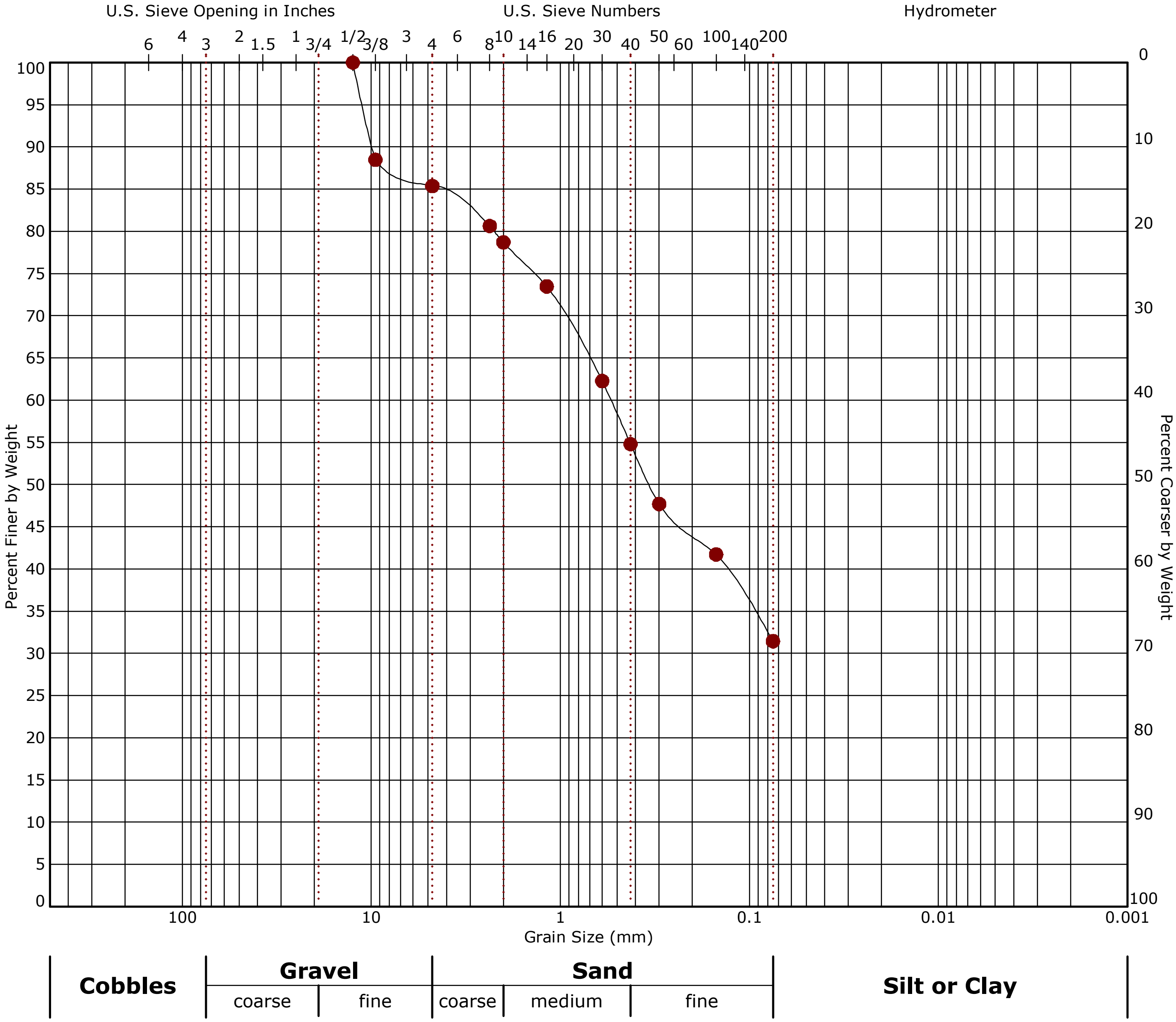
Boring ID		Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
●	1	0.4 - 5	CLAYEY SAND	SC	A-6 (3)	39	17	22		
⊠	1	19 - 20	SILTY SAND	SM	A-2-4 (0)	NP	NP	NP		
▲	2	0.4 - 5	CLAYEY SAND	SC	A-2-6 (2)	40	16	24		
★	3	0.4 - 5	CLAYEY SAND	SC	A-2-6 (1)	37	17	20		
⊙	P1	0.4 - 5	CLAYEY SAND	SC	A-2-6 (1)	34	16	18		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	1	0.4 - 5	9.5	0.307			0.0	4.0	57.6	38.4		
⊠	1	19 - 20	2.36	0.473	0.182		0.0	0.0	87.0	13.0		
▲	2	0.4 - 5	12.5	0.701	0.08		0.0	12.6	58.0	29.3		
★	3	0.4 - 5	12.5	0.621	0.096		0.0	9.7	63.4	26.9		
⊙	P1	0.4 - 5	12.5	0.593	0.085		0.0	11.9	60.3	27.8		

10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

Grain Size Distribution

ASTM D422 / ASTM C136



Boring ID	Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
● P2	0.4 - 5	CLAYEY SAND	SC	A-2-6 (1)	34	15	19		

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● P2	0.4 - 5	12.5	0.54			0.0	14.6	53.9	31.4		

Client
McDonald's Corporation

Project
Parker McDonald's Site ID#50162
25235069

Date Received: 4/26/2023

Results from Corrosion Testing

Sample Location	2
Sample Depth (ft.)	0 - 5
pH Analysis, ASTM D4972	10.5
Water Soluble Sulfate (SO4), AASHTO T290, (ppm)	134
Sulfides, ASTM A674, (mg/kg)	Negative
Chlorides, AASHTO T291, (mg/kg)	278
Red-Ox, ASTM G200, (mV)	+121
Resistivity (Saturated), ASTM G57, (ohm-cm)	1120

Analyzed By: Daryl Lee
Laboratory Supervisor

SUMMARY OF LABORATORY TEST RESULTS

Parker McDonald's Site ID#50162 - Parker, Colorado

Terracon Project No. 25235069

Boring No.	Depth (ft)	USCS Class.	Initial Water Content (%)	Initial Dry Density (pcf)	Swell/Consolidation		Particle Size Distribution, Percent Passing by Weight					Atterberg Limits		Water Soluble Sulfates (ppm)	Sulfides (mg/kg)	Chlorides (mg/kg)	pH	Red-Ox (mV)	Resistivity (ohm-cm)	Remarks
					Surcharge (ksf)	Swell (%)	3/4"	#4	#10	#40	#200	LL	PI							
1	0.4 - 5	SC					100	96	89	67	38	39	22							
1	2	SC	20.6	104	0.5	+0.1														3,4
1	4	SC	19.1	101																4
1	9	SC	10.5	117	0.5	-0.1														3,4
1	14	SM	4.4																	4
1	19	SM					100	100	99	54	13	NV	NP							
1	29	SM	11.4																	
2	0.4 - 5	SC					100	87	76	52	29	40	24	134	Negative	278	10.5	+121	1120	
2	2	SC	14.8	114																4
2	4	SC	19.0	109																4
2	9	SC	21.1	101	0.5	0.0														3,4
2	19	SM	9.6																	4
3	0.4 - 5	SC					100	90	79	53	27	37	20							
3	2	SC	17.0	109																4
3	4	SC	14.4	113	0.5	0.0														3,4
3	9	SC	15.7	111																4
3	24	SM	20.1																	
P1	0.4 - 5	SC					100	88	79	53	28	34	18							
P1	2	SC	15.7																	4
P1	9	SM	12.0																	4
P2	0.4 - 5	SC					100	85	79	55	31	34	19							
P2	2	SC	11.4	103																4
P2	4	SM	12.6	112																4
P2	9	SM	3.0																	4

Notes:
Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
* = Partially disturbed sample
- = Compression/settlement
NV = no value
NP = non-plastic

Remarks:
1 Remolded Compacted density (about 95% of ASTM D698 maximum density near optimum moisture content)
2 Remolded Compacted density (about 95% of ASTM D1557 maximum density near optimum moisture content)
3 Water added to sample
4 Dry density and/or moisture content determined from one ring of a multi-ring sample
5 Minus #200 Only
6 Moisture-Density Relationship Test Method ASTM D698/AASHTO T99
7 Moisture-Density Relationship Test Method ASTM D1557/AASHTO T180

Terracon

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
10625 W I70 Frontage Rd N
Ste 3
Wheat Ridge, CO

General Notes

Sampling	Water Level	Field Tests
Auger Cuttings Modified California Ring Sampler Standard Penetration Test	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.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (psf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**
Very Loose	0 - 3	0 - 5	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	6 - 14	Soft	500 to 1,000	2 - 4	3 - 5
Medium Dense	10 - 29	15 - 46	Medium Stiff	1,000 to 2,000	4 - 8	6 - 10
Dense	30 - 50	47 - 79	Stiff	2,000 to 4,000	8 - 15	11 - 18
Very Dense	> 50	> 80	Very Stiff	4,000 to 8,000	15 - 30	19 - 36
			Hard	> 8,000	> 30	> 36

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