Sugar House Park Pavilions — Salt Lake City, UT

Geotechnical Engineering Report

December 27, 2024 | Terracon Project No. 61245209

Prepared for:

Salt Lake County Parks & Recreation
2001 South State Street
Salt Lake City, UT 84190

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December 27, 2024

Salt Lake County Parks & Recreation
2001 South State Street
Salt Lake City, UT 84190

Attn: Dan Sonntag
P: (385) 468-1819
E: dsonntag@slco.org

Re: Geotechnical Engineering Report
Sugar House Park Pavilions — Salt Lake City, UT
Sugarhouse Park Road
Salt Lake City, Utah
Terracon Project No. 61245209

Dear Mr. Sonntag:

We have completed the scope of Geotechnical Engineering services for the above-referenced project in general accordance with Terracon Proposal No. P61245209 dated October 28, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction foundations and floor slabs 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

PROFESSIONAL ENGINEER
11136480-2202
ERIK FJELDSTED
12-27-2024
STATE OF UTAH

Erik B. Fjeldsted, P.E.
Project Engineer

Charles Molthen, P.E.
Department Manager III

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Figures

Attachments

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 that 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	New pavilions at Big Field (aprox. 84 ft x 49 ft) and Parleys Creek (aprox. 65 ft x 40 ft) are planned.
Geotechnical Characterization	Topsoil underlain by clayey sand to sandy lean clay in the upper 4 to 7 feet, underneath is predominantly dense gravel. No groundwater was observed in the explorations completed.
Earthwork	Exposed subgrade to be scarified, moisture conditioned, and compacted to a minimum of 95% of the maximum dry density (ASTM D1557) within 2% of the optimum moisture content.
Shallow Foundations	The structures are anticipated to be supported by a spot footings between 10 ft x 10 ft to 15 ft x 15 ft. Alternatively, spread footings can be used. Allowable bearing pressure = 1,400 psf bearing on native subgrade. Expected settlements: < 1 inch total, < ¾ inch differential
Below-Grade Structures	None anticipated
Pavements	None anticipated

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 pavilion structures to be located at the Sugar House Park in Salt Lake City, Utah. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- Seismic Site Class per IBC
- site preparation and earthwork
- foundation design and construction
- frost considerations
- preliminary corrosion recommendations

The geotechnical engineering Scope of Services for this project included the advancement of borings and Dynamic Cone Penetrations (DCPs), laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and exploration locations are shown in the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory index testing performed on soil samples obtained from the site during our field exploration are included in the boring logs. Detailed laboratory results are presented in the **Laboratory Testing** section.

Project Description

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

Item	Description
Information provided	Email communication from Salt Lake County Parks & Recreation on October 21, 2024, with forms outlining the proposed improvements and request for proposal.
Project description	New pavilions at Big Field (aprox. 84 ft x 49 ft) and Parleys Creek (aprox. 65 ft x 40 ft) are planned.
Proposed structure	Big Field Pavilion: approximately 84 feet x 49 feet Parleys Creek Pavilion: approximately 65 feet x 40 feet

Item	Description
Building construction	Based on plans provided on 11/26/2024, it appears the Big Field Pavillion will be supported on 14 ft x 14 ft spot footings and the Parleys Pavillion will be supported on 12 ft x 12 ft spot footings.
Finished floor elevation	Assumed to be within 1 foot of existing grade
Maximum loads	Anticipated structural loads are: ▪ Columns: 20 kips ▪ Slabs: 150 pounds per square foot (psf)
Grading/slopes	Finished grade for the pavilions is assumed to be near existing grade at the following elevations: Big Field Pavilion: 4,425 feet Parleys Pavillion: 4,430 feet Cuts and fills are assumed to be 1 foot or less.
Below-grade structures	None anticipated
Free-standing retaining walls	None anticipated
Pavements	None anticipated
Building code	2021 IBC

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

Site Conditions

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

Item	Description
Parcel information	The project is located at Sugar House Park at 2100 South Sugarhouse Park Road in Salt Lake City, Utah Big Field: Lat.: 40.723262° Long.: -111.849260° Parley's: Lat.: 40.721914° Long.: -111.848684° See **Site Location**

Item	Description
Existing improvements	The project area currently has a covered awning picnic table area with concrete sidewalks, parking lots, and a basketball court. Existing irrigation is understood to be in place.
Current ground cover	Sod, concrete sidewalks, and trees
Existing topography	Minor elevation variances. Grades and elevation changes are considered gradual.

Geotechnical Characterization

GeoModel

We have developed a general characterization of the subsurface conditions based on 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 in the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

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

Model layer	Layer name	General description
1	**Topsoil/sod**	Topsoil/sod generally comprised of clay and sand with frequent grass roots (aprox. 4 to 6 inches thick)
2	**Sandy lean clay/clayey sand**	Soft to medium stiff/loose, close to 1/2 sand and 1/2 fine
3	**Gravel**	Gravel with sand that is generally dense to very dense

Groundwater

Groundwater was not encountered in any of the explorations completed for this investigation. Groundwater conditions may be different at the time of construction. Groundwater conditions may vary based on seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Groundwater is not anticipated to be present in excavations completed for this project.

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 that will be used for project construction.

Corrosivity Test Results Summary

Boring	Sample depth (feet)	Soil description (USCS)	Soluble sulfate (ppm)	Soluble chloride (ppm)	Electrical resistivity (Ω-cm)	pH
B-1	2.5	CL	42	42	1,570	8.2
B-2	2.5	SC	31	32	1,970	8.2

Results of soluble sulfate testing were completed in accordance with EPA 300.00. Based on the results of 42 and 31 ppm, the soil tested would be anticipated to exhibit a *low sulfate attack* on concrete and classify as *S0,* based on the limits *in ACI 318*.

Numerous sources are available to characterize the corrosion potential to buried metals using the parameters above. ANSI/AWWA is commonly used for ductile iron, while threshold values for evaluating the effect on steel can be specific to the buried feature (e.g., piling, culverts, or welded wire reinforcement) or agency for which the work is performed. Based primarily on the electrical resistivity, the native soil in contact with metal is anticipated to be *severely corrosive.*

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 concrete or metal used for construction. Consultation with a NACE-certified corrosion professional is recommended for buried metals on the site.

Preliminary recommendations for mitigating the risks associated with corrosive soils are presented in **Preliminary Soil Corrosion Recommendations**.

DCP Test Results

The Dynamic Cone Penetration Test (DCP) (ASTM D6951) is an in-situ testing method used in geotechnical engineering to evaluate the relative density, strength, and compaction of soil layers. The test involves driving a standardized cone attached to a steel rod into the ground using a consistent hammer drop weight, with penetration depth measured after several blows. The resulting data provides an indication of soil resistance. DCP is particularly effective for assessing granular soils and can be correlated to soil parameters such as California Bearing Ratio (CBR) for pavement design or bearing capacity for shallow foundations. This test provides valuable, cost-effective field data to supplement borings or laboratory tests, supporting the characterization of subsurface conditions for engineering design and construction.

Four DCPs were completed in areas where the proposed pavilions will be located. The DCP test is used to provide a correlation to bearing capacity.

Depth (in.)	Bearing capacity (psf)			
	Big Field		Parley	
	DCP-1	DCP-2	DCP-3	DCP-4
4	1,700	4,200	6,000	3,000
8	1,800	2,200	2,100	1,500
12	2,100	2,200	1,700	1,500
16	4,000	2,400	1,500	1,500
20	4,200	2,800	1,400	1,400
24	3,400	1,500	1,200	1,400
28	2,200	1,300	1,400	1,500
32	1,900	1,300	1,400	1,600
36	2,400	1,400	1,200	1,600

The DCP data collected is used to provide the design maximum allowable bearing capacity recommendation in the shallow foundation section of this report.

Seismic Site Class

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

International Building Code (IBC). Based on the geologic setting, soil observed while drilling, and other local experience, our professional opinion is that the site would likely classify as a Seismic Site Class of D. Therefore, an *assumed* **Site Class D** should be considered for the project. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

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

The native soils are suitable for supporting the proposed pavilion structures on conventional spot footings.

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

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

Earthwork

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

Site Preparation

Prior to placing Structural Fill, any existing vegetation, topsoil, root mats, and undocumented fill soils should be removed. While undocumented fill was not encountered in our borings, it is possible that it may be encountered below the existing basketball court. Based on our explorations, the topsoil/sod zone is estimated to be 4 to 6 inches deep. Complete stripping of the topsoil/sod should be performed in the proposed structure area.

Subgrade Preparation

Following stripping of topsoil and rough grading, the exposed native subgrade in the proposed structure areas should be scarified, moisture conditioned and recompacted to a minimum of 95% of maximum dry density, based on the modified proctor (ASTM D1557). The compaction should be performed under the observation of the Geotechnical Engineer or representative. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Excavation

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

Soil Stabilization

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

Soft soil stabilization may be needed based on the fine-grained soils being present on the surface. If these soils become wet/saturated (either from rain/snow or earthwork processes) they may present equipment mobility problems. If encountered, we recommend the following alternatives:

- **Scarification and Recompaction** — It may be feasible to scarify, dry, and recompact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot or if construction is performed during a period of wet or cold weather when drying is difficult.

- **Crushed Stone** — The use of crushed cobbles or gravels is a common procedure to improve subgrade stability. We recommend that material be 3 to 6 inches in nominal diameter and angular. If material used is not angular the effectiveness of this approach will be diminished. Prior to placement any wet/saturated native soil should be removed first. Then the crushed stone should be worked into the soft subgrade until a relatively firm surface is developed. Once a firm unyielding surface is developed, Structural Fill may be placed to reach the desired finished grade.
- **Geotextile** — The use of high modulus geotextiles such as Tencate Mirafi HP 270 could also be considered after underground work, such as utility construction, is completed. Geotextile should have a minimum overlap of 18 inches or as recommended by the manufacturer (whichever is greater). The geotextile should be covered by a minimum of 18 inches of crushed stone no greater than 4 inches in diameter. Prior to placing the geogrid, we recommend that all below-grade construction, such as utility line installation, be completed to avoid damaging the fabric or geogrid. Equipment should not be operated above the geotextile until one full lift of crushed stone fill is placed above it. Prior to placement any wet/saturated native soil should be removed first.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Fill Material Types

While not anticipated to be needed, fill required to achieve design grade should be classified as Structural Fill and General Fill. Structural Fill is material used below or within a 1H:1V envelope of structures. General Fill material may be used to achieve grades outside of these areas.

Reuse of On-Site Soil:

We recommend reuse of the on-site soils as Structural Fill materials; however, due to the fine-grained consistency, these soils may be difficult to work with. Topsoil/sod should be segregated from other soils and not be reused as General or Structural Fill but may be reused as topsoil/for landscaping purposes. Furthermore, moisture control and compaction will be difficult to achieve during the wet and cold seasons.

Excavated on-site soil may be selectively reused as fill below landscaping areas. Portions of the on-site soil, especially in the upper 4 to 7 feet, have an elevated fines content and will be sensitive to moisture conditions (particularly during seasonally wet periods) and may not be suitable for reuse when above optimum moisture content.

Material property requirements for **on-site soil** for use as General Fill and Structural Fill are noted in the table below:

Property	General Fill	Structural Fill
Composition	2% to 5% organics permitted	2% or less organics
Maximum particle size	6 inches (or ⅔ of the lift thickness)	3 inches
Plasticity	Maximum Liquid Limit of 30 Maximum Plasticity Index of 15	Maximum Liquid Limit of 30 Maximum Plasticity Index of 15

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted 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.

Soil type[1]	USCS classification	Acceptable parameters (for imported Structural Fill)
Low Plasticity Sands	SM, SC, SW, SP	Liquid Limit less than 30 Plasticity index less than 10 Less than 35% retained on No. 200 sieve
Granular	GW, GP, GM, GC,	Maximum particle size 3 inches Less than 50% passing No. 200 sieve

1. Structural and General Fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to the use of uniformly graded gravel on the site.

Fill Placement and Compaction Requirements

Structural and General Fill should meet the following compaction requirements.

Item	Structural Fill	General 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 (e.g., jumping jack or plate compactor) is used	Same as Structural Fill
Minimum compaction requirements[1,2]	95% of max above and below foundations	92% of max
Water content range[1]	Low plasticity sand: -2% to +2% of optimum Granular: -3% to +3% of optimum	As required to achieve minimum compaction requirements

1. Maximum density and optimum water content as determined by the Modified Proctor test (ASTM D 1557).
2. If the granular material is a coarse sand or gravel, 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). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Grading and Drainage

Failure to provide proper drainage may result in unacceptable movements and distress to man-made elements. All grades must provide effective drainage away from the structure during and after construction and should be maintained throughout the life of the structure. Water retained next to the structure can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge a distance of at least 5 feet from the structure.

Exposed ground should be sloped and maintained at a minimum of 5% away from the structure for at least 5 feet beyond the perimeter of the structure. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork but doing so increases the risk of poor performance. After structure construction and landscaping have been completed, final grades should be verified to document that 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 for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to the construction of grade-supported improvements. 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, including any wet/saturated underlying soils. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed or scarified, moisture conditioned, and recompacted prior to floor slab construction.

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

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent to or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

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

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to the 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 structure areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill, and a minimum of one test should be performed for every 12 vertical inches of compacted backfill.

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

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer's presence 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 consisting of mat slab or conventional spread footings.

Design Parameters — Compressive Loads

Item	Description
Maximum net allowable bearing pressure[1, 2]	1,400 psf
Required bearing stratum[3]	Moisture conditioned and compacted native soil (6 in. minimum) or Structural Fill extending to prepared native soil
Ultimate passive resistance[4] **(equivalent fluid pressures)**	315 pcf (cohesive backfill) 450 pcf (granular backfill)
Sliding resistance[5]	150 psf allowable cohesion (native/Structural Fill clay) 0.45 allowable coefficient of friction — granular material
Minimum embedment below finished grade[6]	30 inches
Estimated total settlement from structural loads[2]	Less than about 1 inch
Estimated differential settlement[2, 7]	About 3/4 of total settlement

Item	Description

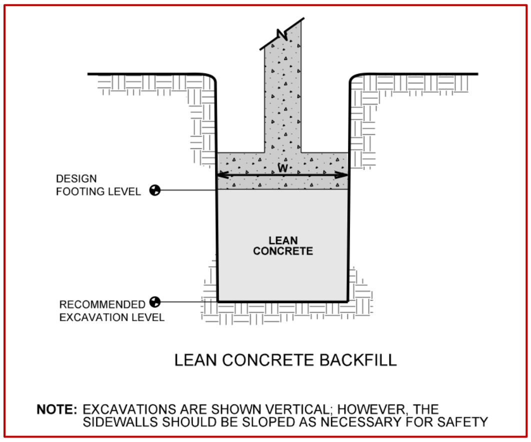
1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 10% within 10 feet of the structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures requires the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted Structural Fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure, which may vary due to load combinations. For fine-grained materials, lateral resistance using cohesion should not exceed ½ the dead load.
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 noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Foundation Construction Considerations

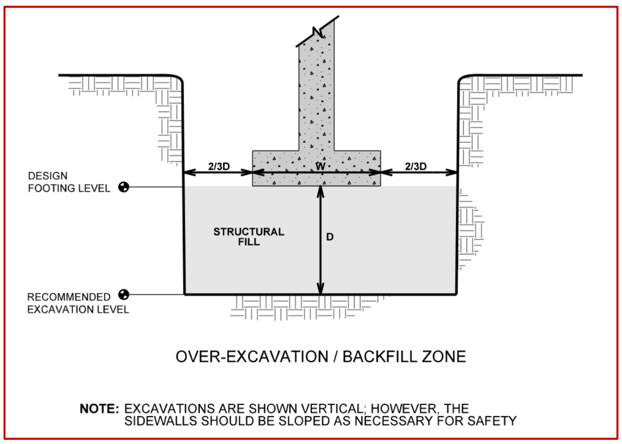
As noted in **Earthwork**, the footing/slab excavation should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation/slab excavations should be free of water and loose soil prior to placing the prefabricated structure. Concrete should be placed soon after excavating 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 the foundation concrete is placed.

If soils become soft and surficial compaction is not adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

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



Overexcavation for Structural Fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation, with Structural Fill placed, as recommended in the **Earthwork** section.



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

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, nonextruding 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 the use of sufficient control joints, appropriate reinforcing, or other means.

General Comments

Our analysis and opinions are based on 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, or bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or hazardous 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.

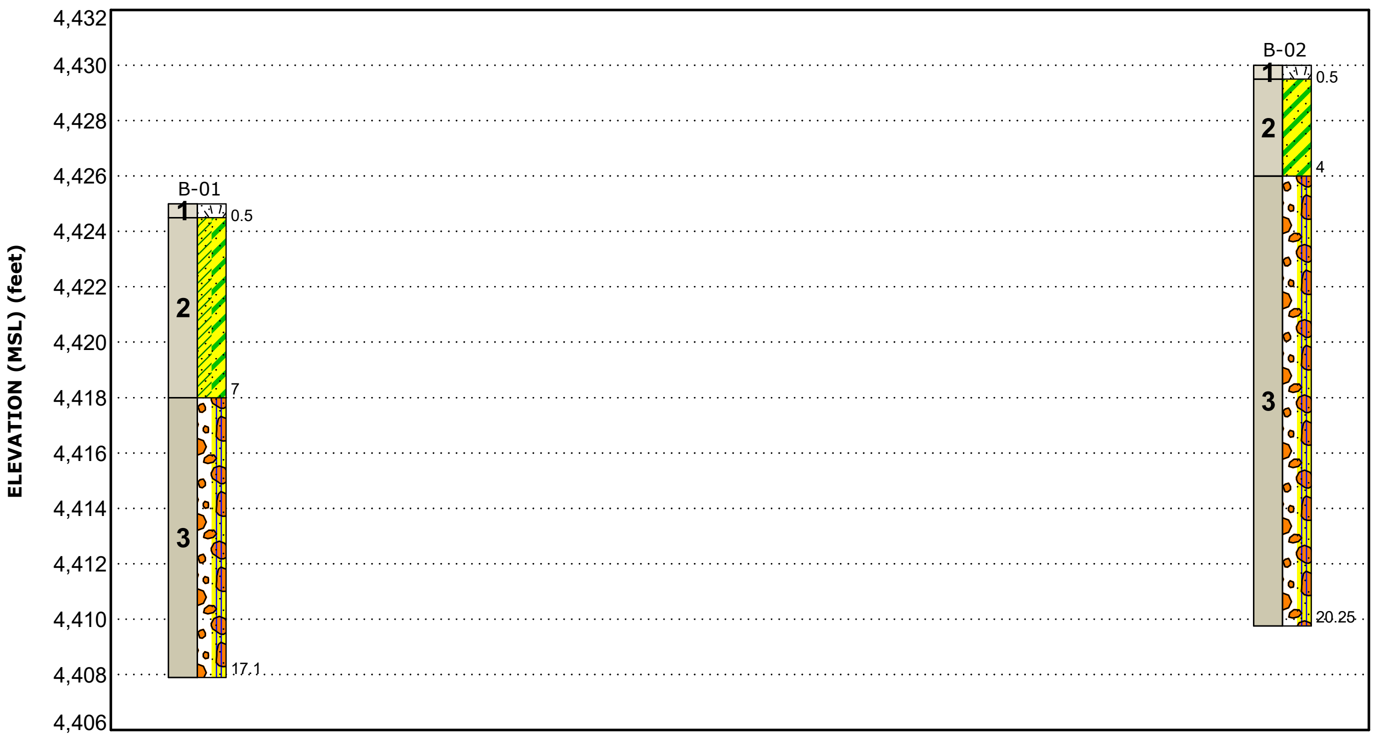
Construction and site development have the potential to affect adjacent properties. Such impacts can include damage due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, and noise or air quality concerns. Evaluation of these items on nearby properties is commonly associated with contractor means and methods and is not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of the 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
6952 S High Tech Dr, Ste B
Midvale, UT

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	Topsoil/sod	Topsoil/sod generally comprised of clay and sand with frequent grass roots (aprox. 4 to 6 inches thick)
2	Sandy lean clay/clayey sand	Soft to medium stiff/loose, close to 1/2 sand and 1/2 fine
3	Gravel	Medium dense to very dense, gravel with silt and sand

Legend

- Topsoil
- Poorly-graded Gravel with Silt and Sand
- Sandy Lean Clay/Clayey Sand
- Clayey Sand

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
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Exploration and Testing Procedures

Field Exploration

Number of explorations	Exploration type	Approximate exploration depth (feet)	Location
2	Hollow-stem auger boring	17.1 to 20.25	Proposed pavilions
4	DCP	3.5	Proposed pavilions

Exploration Layout and Elevations: Terracon personnel provided the exploration layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were estimated using Google Earth. If elevations and a more precise exploration layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight hollow-stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as *N*-values, are indicated in the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

We also checked the borings while drilling and at the completion of drilling for the presence of groundwater, which was not observed.

We advanced DCPs using a hand operated Dynamic Cone Penetration device to a depth of approximately 3.5 feet below existing grade to obtain correlations to bearing capacity.

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

Laboratory Testing

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

- Moisture Content (ASTM D2216)
- Atterberg Limits (ASTM D4318)
- Sieve Analysis (ASTM D6913)
- Percent Fines (ASTM D1140)
- Corrosion Suite (EPA 300.0, EPA 9045D, SSSA10-3.3)

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

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

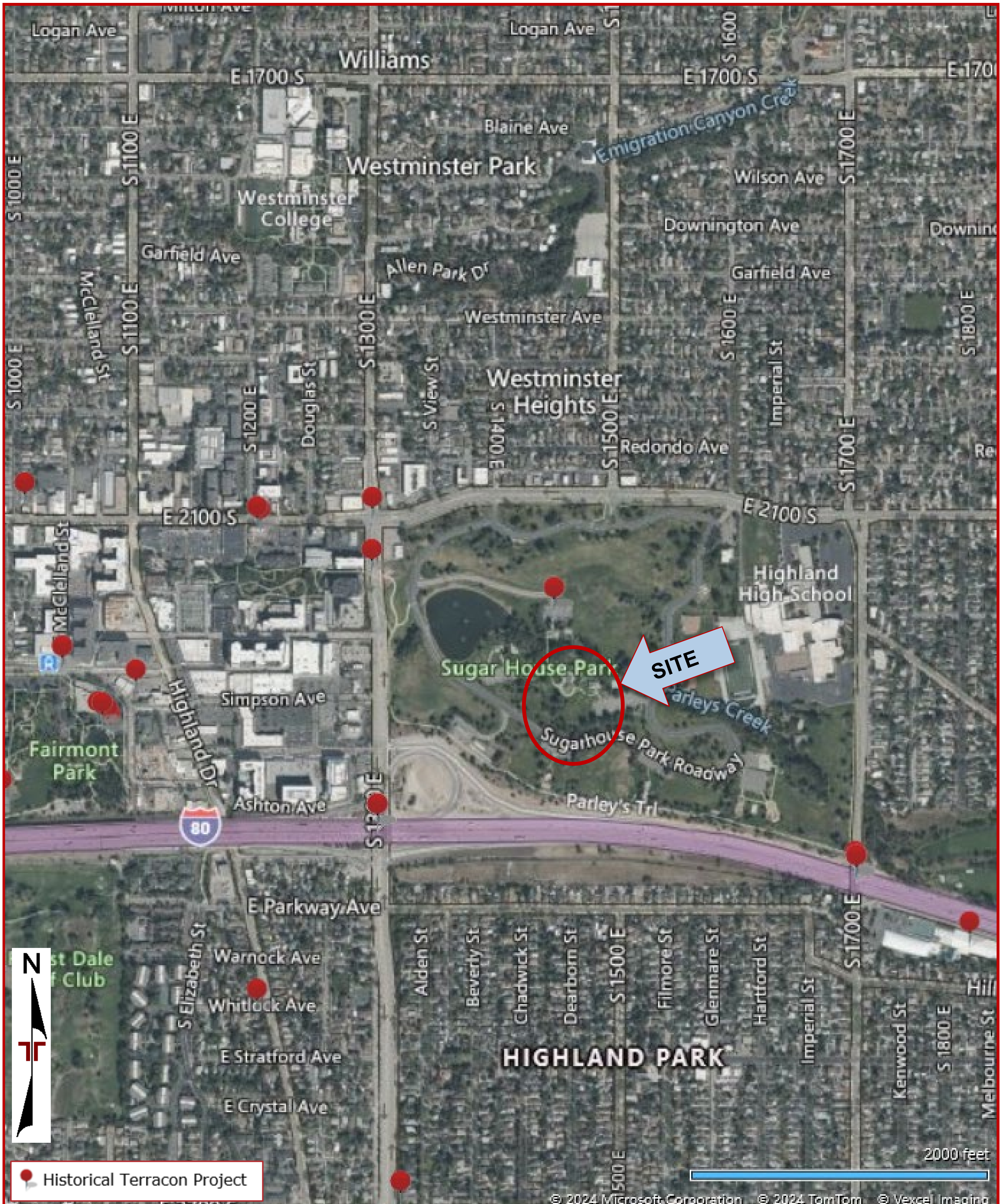
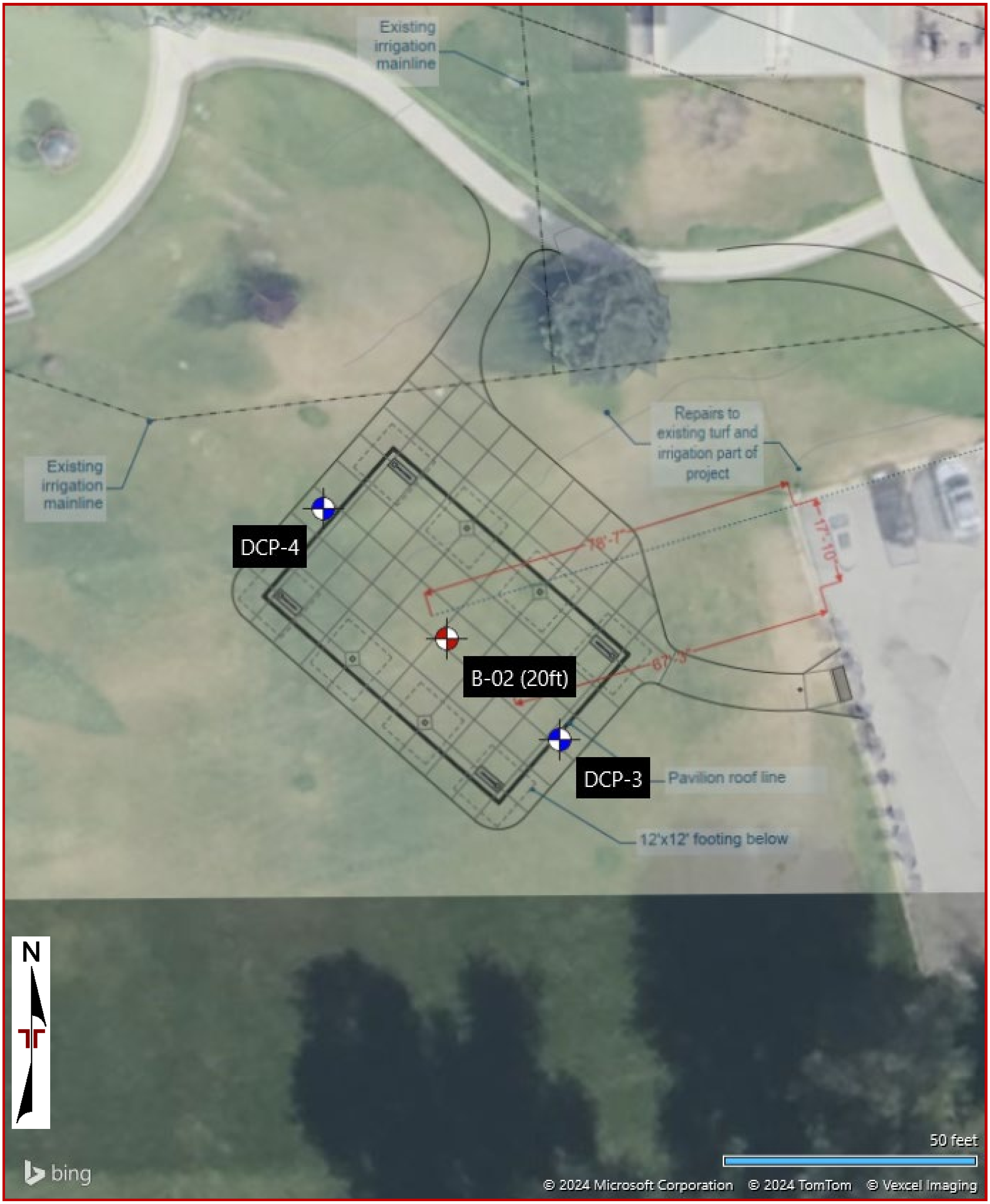


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan (Big Field)

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

Exploration Plan (Parley)



Exploration and Laboratory Results

Contents:

Note: All attachments are one page unless noted above.

Terracon
6952 S High Tech Dr, Ste B
Midvale, UT

Boring Log No. B-01

Location: See Exploration Plan

Latitude: 40.7233° Longitude: -111.8492°

Depth (Ft.) Elevation: 4425 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)
1	0.5	**TOPSOIL**, approximately 6" inches	4424.5
2	7.0	**SANDY LEAN CLAY (CL)**, dark brown, moist, soft, with rootlets, organic smell, mineral crystallization	4418
3	17.1	**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, fine to coarse grained, subangular, reddish brown, dry, dense to very dense decrease in moisture as depth increases	4407.9

Auger Refusal at 17.1 Feet

Sample Depth (Ft., approx.)	Recovery ()	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2.5–4	8	2-2-2 N=4	18.7	30-19-11	55
5–6.5	10	1-1-2 N=3			
7.5–9	12	5-20-29 N=49	3.8		11
10–11.5	12	16-29-33 N=62			
15–16.5	14	17-24-30 N=54			
17	0	50/1"			

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.
Elevation Reference: Elevation based on Google Earth

Water Level Observations
Groundwater not encountered

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
CH

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
AL

Boring Started
12-12-2024

Boring Completed
12-12-2024

6952 S High Tech Dr, Ste B
Midvale, UT

Boring Log No. B-02

Location: See Exploration Plan

Latitude: 40.7220° Longitude: -111.8487°

Elevation: 4430 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation	Sample Depth (Ft.)	Recovery ()	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.5	**TOPSOIL**, approximately 6" inches	4429.5						
2	4.0	**CLAYEY SAND (SC)**, dark brown, moist, very loose, with rootlets, organic smell, mineral crystallization	4426	2.5	12	1-1-2 N=3	22.7		46
3	20.3	**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, fine to coarse grained, subangular, reddish brown, dry, medium dense to very dense	4409.75	5	8	11-15-7 N=22			
		decrease in moisture as depth increases		7.5	12	11-21-21 N=42	2.8		10
				10	14	17-32-21 N=53			
				15	12	21-32-25 N=57			
				20	2	50/3"			

Auger Refusal at 20.25 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.
Elevation Reference: Elevation based on Google Earth

Water Level Observations
Groundwater not encountered

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
CH

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
AL

Boring Started
12-12-2024

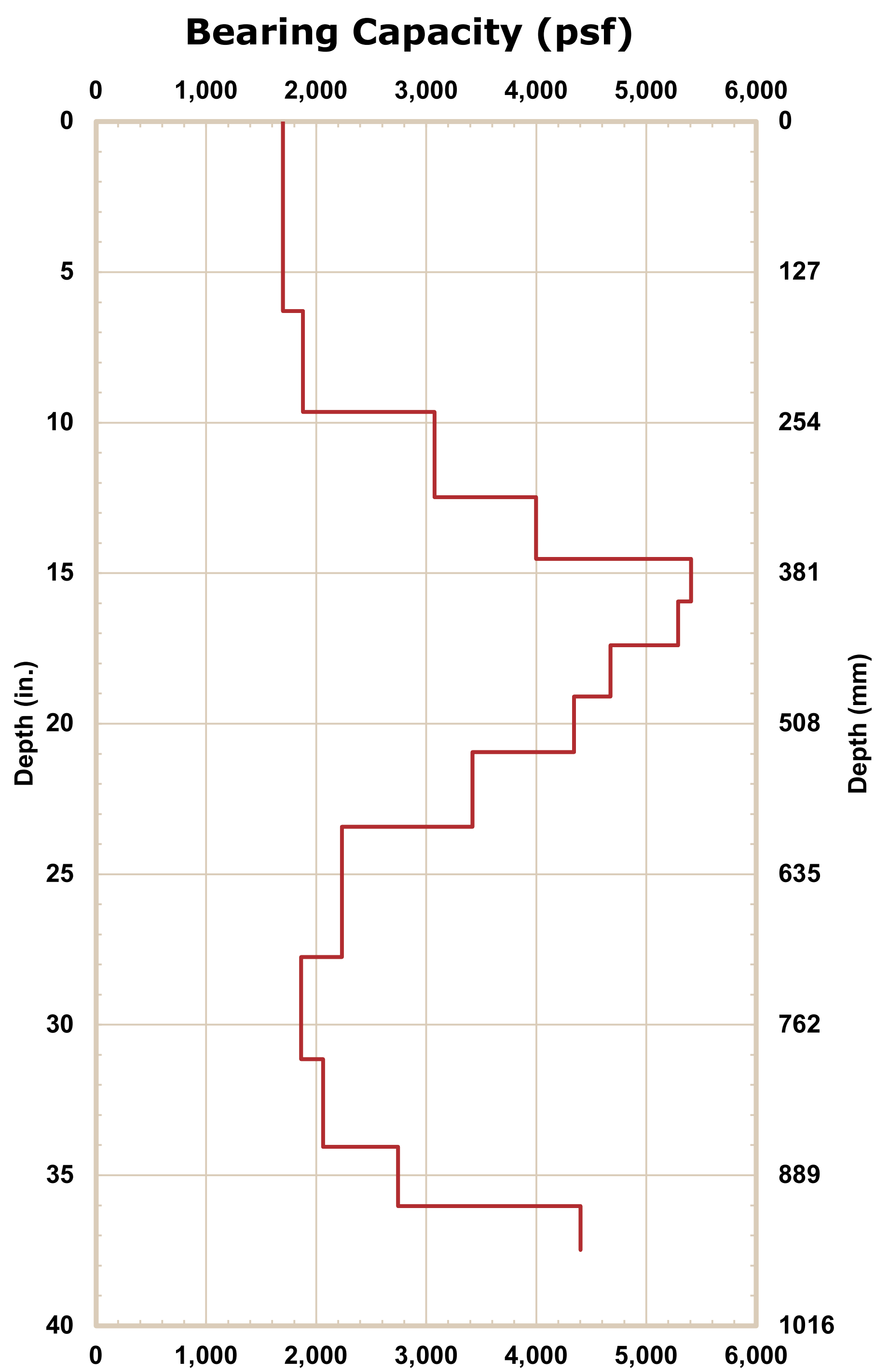
Boring Completed
12-13-2024

Dynamic Cone Penetrometer Results

Project: 61245209 - Sugarhouse Park
Location: DCP-1
Date: 12/12/2024

Hammer Type: Dual Mass (17.6 lbs)
Subgrade Soil Type: Other (Not CL or CH)

No. of Blows	Reading (mm)	Cum. Pen. (mm)
0	0	60
3	100	160
3	85	245
5	72	317
5	52	369
5	36	405
5	37	442
5	43	485
5	47	532
5	63	595
5	110	705
3	86	791
3	74	865
3	50	915
4	37	952



Dynamic Cone Penetrometer Results

Project: 61245209 - Sugarhouse Park
Location: DCP-2
Date: 12/12/2024

Hammer Type: Dual Mass (17.6 lbs)
Subgrade Soil Type: Other (Not CL or CH)

No. of Blows	Reading (mm)	Cum. Pen. (mm)
0	0	33
5	32	65
5	23	88
5	54	142
3	53	195
3	71	266
5	91	357
5	84	441
3	46	487
3	82	569
2	101	670
1	49	719
1	66	785
1	62	847
1	43	890
2	62	952

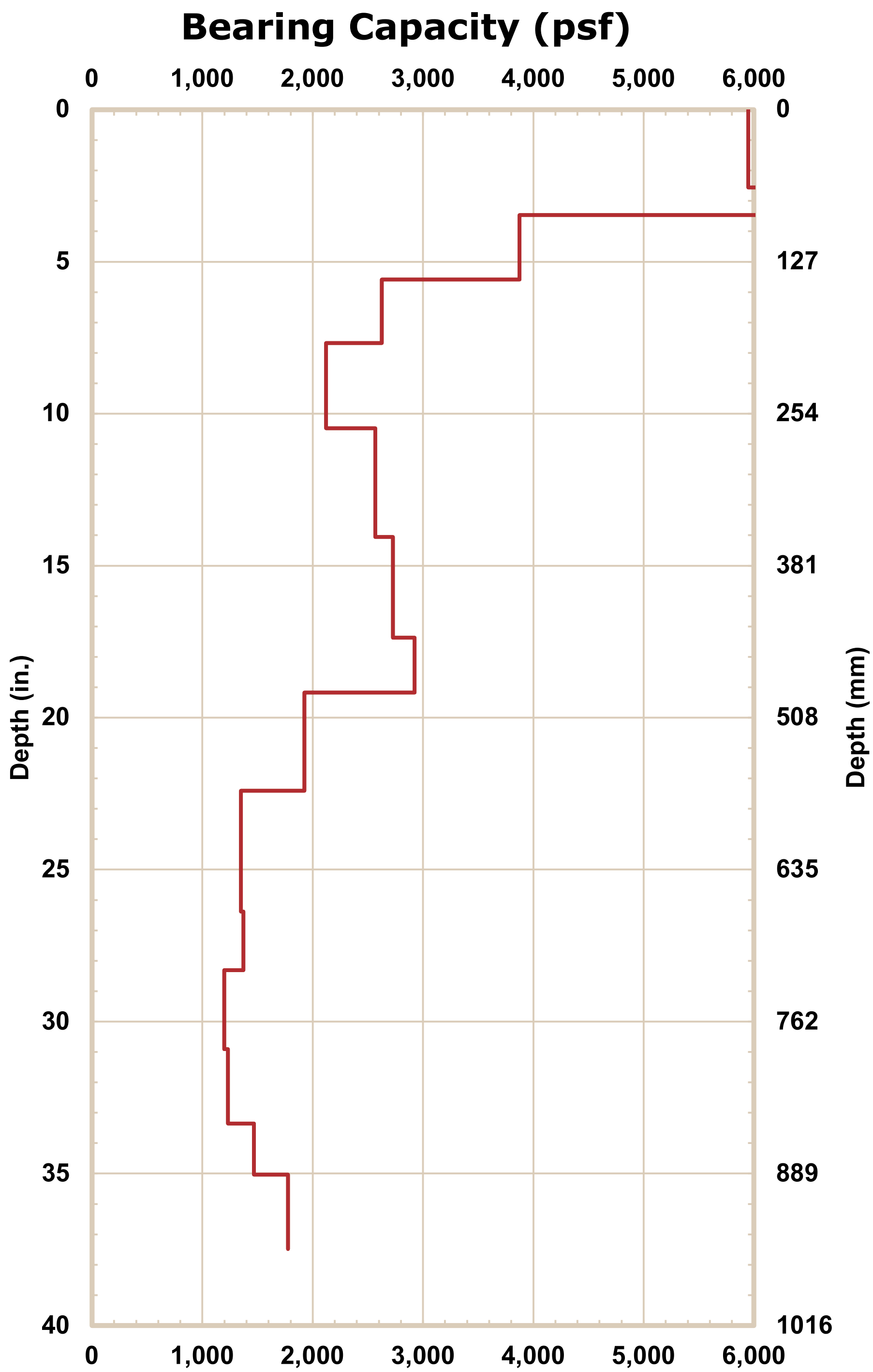


Exhibit B-25

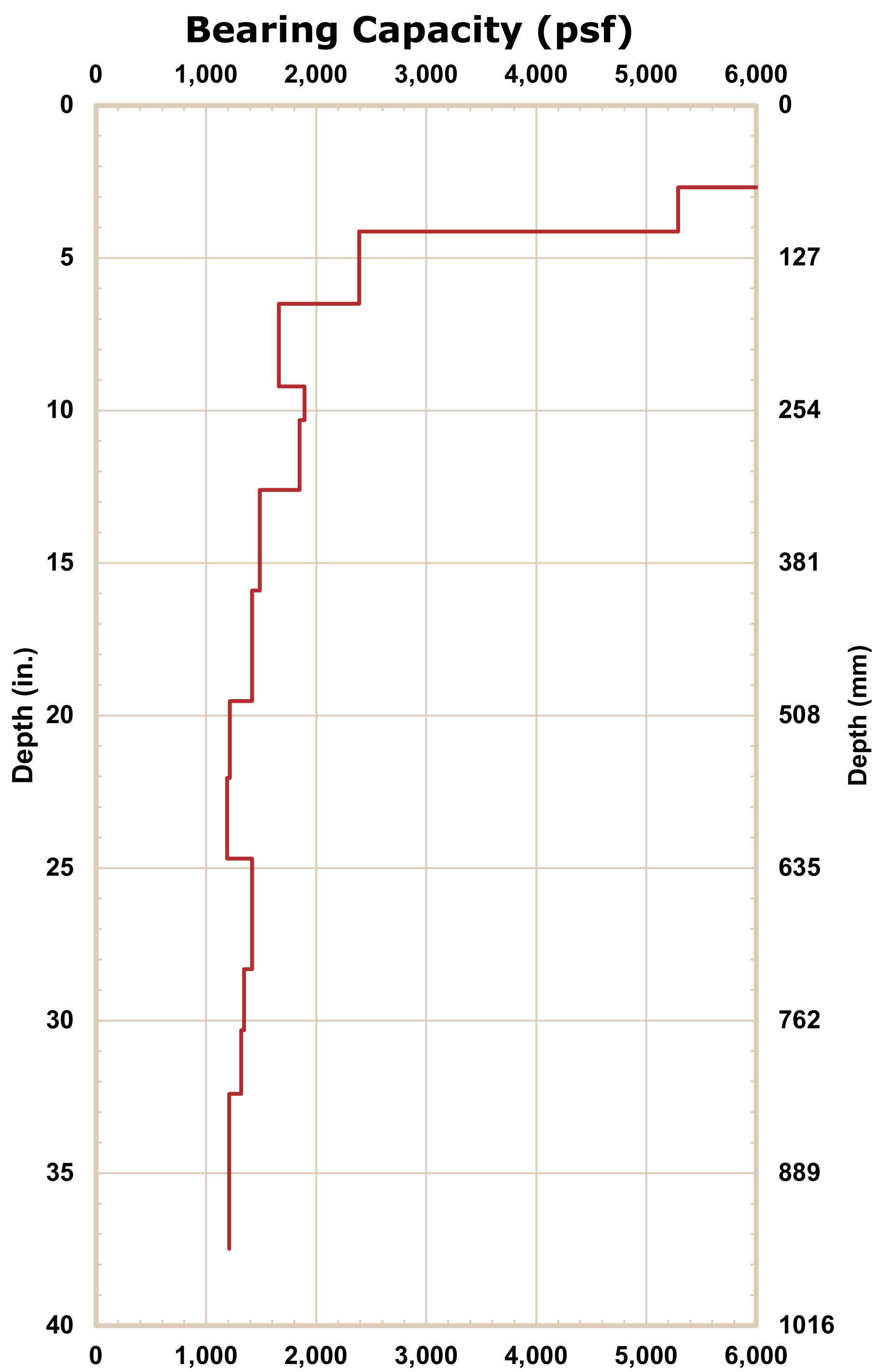
Dynamic Cone Penetrometer Results

Terracon
Explore with us

Project: 61245209 - Sugarhouse Park
Location: DCP-3
Date: 12/12/2024

Hammer Type: Dual Mass (17.6 lbs)
Subgrade Soil Type: Other (Not CL or CH)

No. of Blows	Reading (mm)	Cum. Pen. (mm)
0	0	41
5	27	68
5	37	105
3	60	165
2	69	234
1	28	262
2	58	320
2	84	404
2	92	496
1	64	560
1	67	627
2	92	719
1	51	770
1	53	823
2	129	952



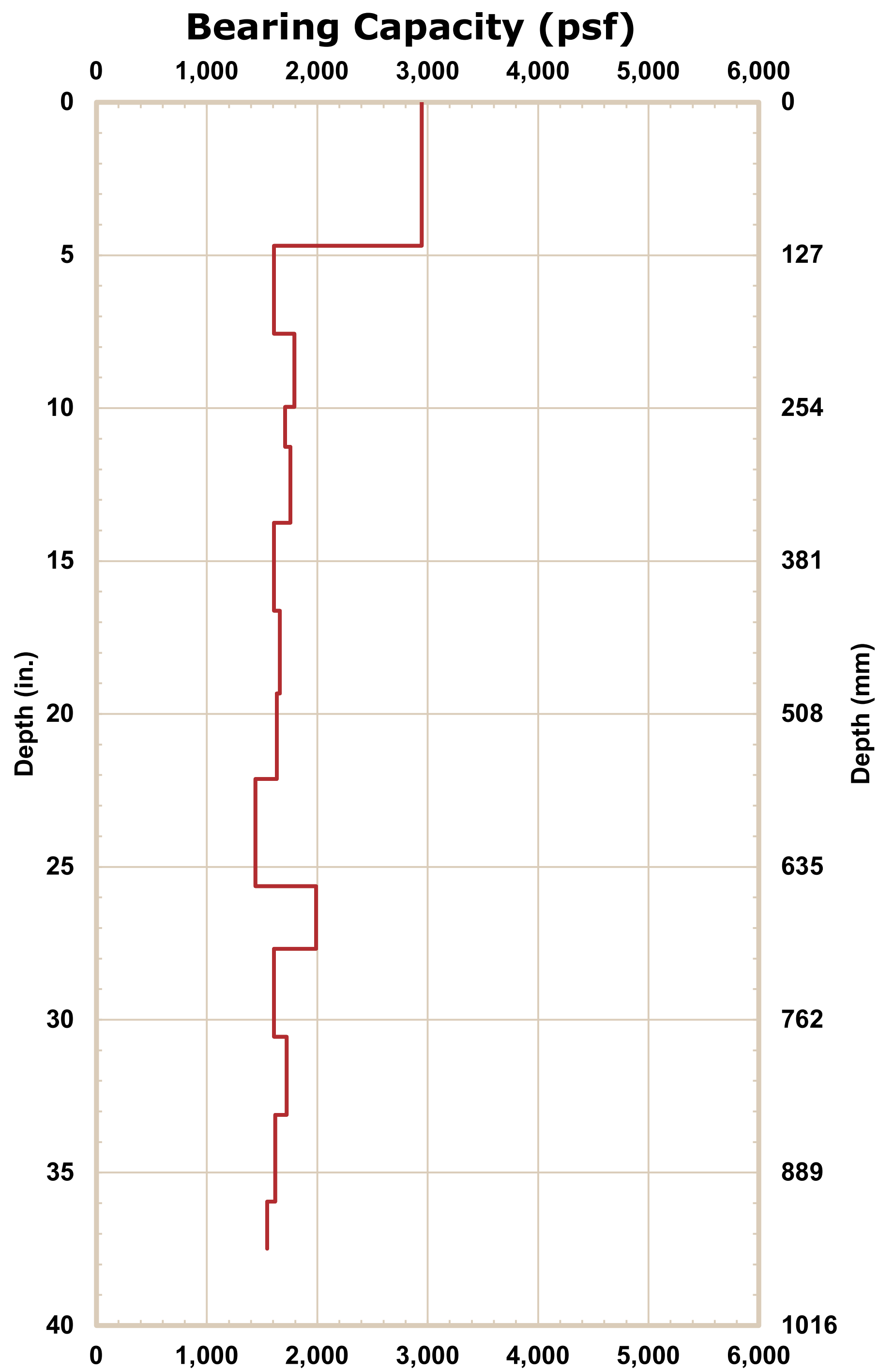
Dynamic Cone Penetrometer Results

Terracon
Explore with us

Project: 61245209 - Sugarhouse Park
Location: DCP-4
Date: 12/12/2024

Hammer Type: Dual Mass (17.6 lbs)
Subgrade Soil Type: Other (Not CL or CH)

No. of Blows	Reading (mm)	Cum. Pen. (mm)
0	0	43
5	76	119
2	73	192
2	61	253
1	33	286
2	63	349
2	73	422
2	69	491
2	71	562
2	89	651
2	52	703
2	73	776
2	65	841
2	72	913
1	39	952



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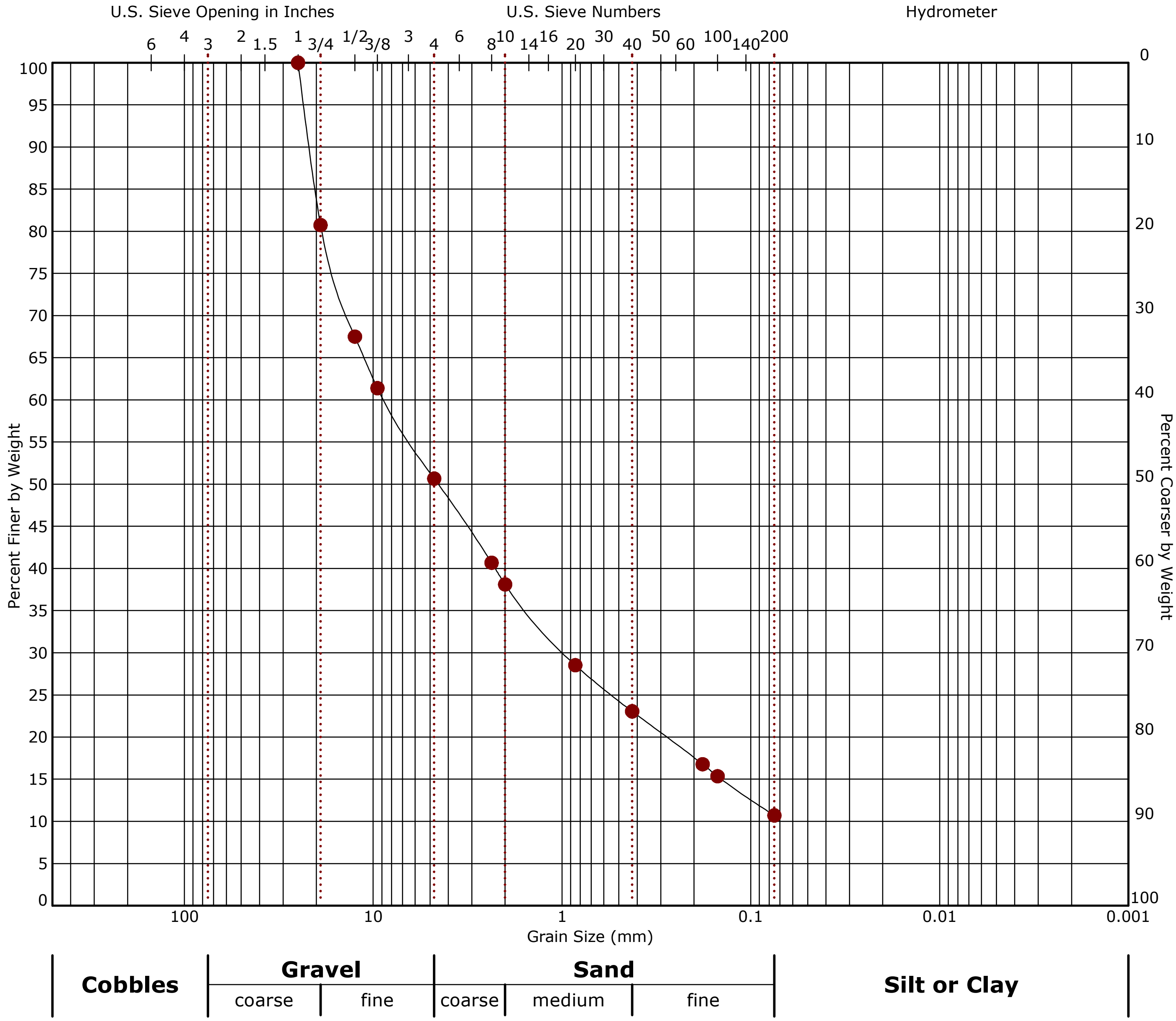
Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



	Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
●	B-01	7.5 - 9	POORLY GRADED GRAVEL WITH SILT AND SAND	GP-GM				1.60	128.49

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-01	7.5 - 9	25	8.682	0.97		0.0	49.3	40.0	10.7		

9632 South 500 West
Sandy, UT 84070
O:(801) 262-7299 F: (866) 792-0093
www.ChemtechFord.com

Certificate of Analysis

Terracon IHI
Amy Austin
6949 South High Tech Drive
Midvale, UT 84047

PO#: **61245209**
Receipt: **12/18/24 12:08 @ 18.2** °C
Date Reported: 12/26/2024
Project Name: **Sugar House Park**

Sample ID: **B - 01 @ 2.5-4.0**

Matrix: **Solid**
Lab ID: **24L1498-01**
Date Sampled: **12/17/24 0:00**
Sampled By: **client**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Chloride, Soluble (IC)	42	mg/kg dry	12	EPA 300.0	12/20/24	12/20/24	
pH	8.2	pH Units	0.1	EPA 9045D	12/18/24 12:53	12/18/24 13:47	
Resistivity	15.7	ohm m	1.0	SSSA 10-3.3	12/18/24	12/18/24	
Sulfate, Soluble (IC)	42	mg/kg dry	12	EPA 300.0	12/20/24	12/20/24	
Total Solids	81.6	%	0.1	CTF8000	12/18/24	12/18/24	

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Certificate of Analysis

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Amy Austin
6949 South High Tech Drive
Midvale, UT 84047

PO#: **61245209**
Receipt: **12/18/24 12:08 @ 18.2** °C
Date Reported: 12/26/2024
Project Name: **Sugar House Park**

Sample ID: **B - 02 @ 2.5-4.0**

Matrix: **Solid**

Lab ID: **24L1498-02**

Date Sampled: **12/17/24 0:00**

Sampled By: **client**

	Result	Units	Minimum Reporting Limit	Method	Preparation Date/Time	Analysis Date/Time	Flag(s)
Inorganic							
Chloride, Soluble (IC)	31	mg/kg dry	12	EPA 300.0	12/20/24	12/20/24	
pH	8.2	pH Units	0.1	EPA 9045D	12/18/24 12:53	12/18/24 13:49	
Resistivity	19.7	ohm m	1.0	SSSA 10-3.3	12/18/24	12/18/24	
Sulfate, Soluble (IC)	32	mg/kg dry	12	EPA 300.0	12/20/24	12/20/24	
Total Solids	82.9	%	0.1	CTF8000	12/18/24	12/18/24	

Terracon

LABORATORY TEST ASSIGNMENT & CHAIN OF CUSTODY
LAB: External - Chemtec

Telephone: 801-545-8500
Fax: 801-545-8600

Company Name and Address: Salt Lake County UT Salt Lake City, UT

Report To: Phone: Fax:

Project Name: Sugar House Park   Project Number: 61245209

24L 1498

Boring No.	Depth (Ft.)	Sample No.	Type	Subspecimen	Method	Corrosive Suite 01	Comments
B-01	2.5 - 4.0		SPT			X	
B-02	2.5 - 4.0		SPT			X	
Quantity Totals						2	

W- Q 18.2

Sample Receipt Conditions:

( ) Custody Seals Present
(✓) Containers Intact
(✓) COC and Labels Match
( ) Received on Ice
(✓) Correct Containers
(✓) COC Included
(✓) COC Complete
(✓) Sufficient Sample Volume
( ) Headspace Present (VOC)
( ) Temperature Blank
(✓) Received within Hold
Checked by:

Need by Date:		Comments:	
Report Delivery Method:	Fax	Mail	E-mail to:
Relinquished By (signature):		Date: 12/18/24	Time: 12:08
Received By (signature):		Date: 12/18/24	Time: 1208
Lab Use Only Project No.:	Testing Completed:	Report Delivered:	Sample Disposal Date:

Instructions: Enter the sample identification information then enter a slash "/" or "X" into the box for the requested test. Please provide complete instructions as necessary.   12/13/2024 10:38:22 AM

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
6952 S High Tech Dr, Ste B
Midvale, UT

General Notes

Sampling	Water Level	Field Tests
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.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

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

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	**Group Name** [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If the field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to the 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 the 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 the group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to the 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 the group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to the 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.