Raising Cane's 1360 – Puyallup, WA

Geotechnical Engineering Report

Puyallup, WA

April 18, 2025 | Terracon Project No. 81255047

Prepared for:

Raising Cane's Restaurants, LLC
6800 Bishop Road
Plano, TX 75024

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April 18, 2025

Raising Cane's Restaurants, LLC
6800 Bishop Road
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Attn: LuAron Foster – Senior Property Development Manager
P: (214) 455-7776
E: LFoster@raisingcanes.com

Re: Geotechnical Engineering Report
Raising Cane's 1360 – Puyallup, WA
43rd Ave SE & S Meridian
Puyallup, WA
Terracon Project No. 81255047

Dear Ms. Foster:

We have completed the scope of services for the above referenced project in general accordance with Terracon Task Order No. P81255050 dated March 3, 2025. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, canopies, 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

Jenna Batchelder

Zachary Koehn

ZACHARY L. KOEHN
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

04/18/2025

Jenna Batchelder, EIT
Staff Engineer

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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 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.

Introduction

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Raising Cane's to be located at 43rd Ave SE & S Meridian in Puyallup, WA (#1360). The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface and groundwater conditions
- Seismic considerations and liquefaction
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Canopy foundations
- Lateral earth pressure
- Preliminary stormwater management discussion
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of soil borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and 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	■ Email titled "C1360 Meridian & 43rd (Puyallup WA) – DD Kick-off Memo," with attached Site Aerial, Site Sketch, and Proposal Request Form
Project Description	The project will include the construction of a new approximately 2,804 square feet single-story Raising Cane's Restaurant building (Prototype 6-V-AV). The development will include double drive thru lanes, two canopies over segments of the drive-thru lanes, an enclosed dumpster area, and at-grade paved parking.
Building Construction	We anticipate that the building will be constructed using steel or timber framing and shallow foundations with slab-on-grade floors.
Maximum Loads	Anticipated structural loads were not provided. Based on our experience with similar projects we assumed the following maximum structural loads. ■ Columns: 100 kips ■ Walls: 4 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	The site has been previously graded and developed. The proposed finished grade elevation for the building pad is assumed to be at or near existing grade.
Below-Grade Structures	Below-grade structures are not expected to be constructed as part of site development.
Free-Standing Retaining Walls	Retaining walls are not expected to be constructed as part of site development to achieve final grades.

Item	Description
Pavements	Paved driveway and parking will be constructed as part of the development. A preferred pavement surfacing has not been identified to us at this stage of the project. For design purposes, we assume both rigid (concrete) and flexible (asphalt) pavement sections will be considered and will assume that the following traffic demand presented as equivalent 18-kip single-axle loads (ESALs): ▪ Parking areas: 30,000 ▪ Drive aisles and entrances: 60,000 The assumed pavement design period is 20 years.
Building Code	The following design codes are assumed: ▪ International Building code – Version 2021 (2021 IBC) ▪ ASCE 7-22 for seismic considerations

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

Site Conditions

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

Item	Description
Parcel Information	Lot Size: ~0.73 acres Latitude (approximate): 47.1524° N Longitude (approximate): 122.2934° W See **Site Location**
Existing Improvements	The site is currently developed with an unoccupied restaurant building. The site includes paved asphalt parking, drive aisles and landscaping planters surrounding the building.
Current Ground Cover	Paved asphalt parking and drive aisles.
Existing Topography	Based on **Google Earth Pro**, the site is relatively flat with elevations ranging from 449 to 454 feet.
Photography Log	Sample photos from the site are provided in our **Photography Log**.

Geotechnical Characterization

Subsurface Conditions

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 and the GeoModel can be found in the **Exploration Results** section of this report.

Soil Layer	Layer Name	USCS	General Description
1	**Recessional Outwash / Possible Fill**	SM, SP	Very loose to medium dense, brown, damp to moist SANDS with variable silt and gravel, possible zone of fill within the eastern region of the site
2	**Glacial Till**	SM, SC-SM, GM	Dense to very dense, brown, moist to wet SANDS with variable silt, clay and gravel; and GRAVELS with variable silt and sand

Mapped Surface Geology

The site is mapped as glacial outwash (Qgo) based on our review of the Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington. In general, the subsurface explorations were consistent with the mapped geology.

Groundwater Conditions

The explorations were observed during advancement for the presence and level of groundwater. The water levels observed at each exploration are summarized below.

Exploration ID	Shallowest Observed Groundwater (feet) [1, 2]	Observation Date
B-04 / MW-01	38	3/17/25

1. Below ground surface.
2. Inferred from change in sample moisture or from evidence of free water on drilling equipment.

A monitoring well was constructed following the advancement of soil boring B-04 /MW-01. The well construction consisted of a screen interval and sand pack from the bottom of the borehole to about 35 feet below the existing ground surface (bgs). On March 17, 2025 a piezometer data logger and barometric pressure logger were installed in monitoring well B-04 / MW-01 to observe potential groundwater fluctuations through the wet season (typically early December through late April).

Groundwater was not observed in the remaining borings while drilling. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels.

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

Seismic Site Class and Hazards

Ground Motion

In 2024, the State of Washington adopted the 2021 IBC allowing the Multi-Period Response Spectrum (MPRS) of ASCE 7-22 for determination of design ground motion values. The amendment requires use of the updated Site Class designations found in Chapter 20 of ASCE 7-22. The MPRS values were obtained from the ASCE 7-22 online tool (**https://asce7hazardtool.online/**) and are presented in the below table. If values for ASCE 7-16 are desired, please contact Terracon.

Description	Value [1]
ASCE 7-22 Site Classification	D
Site Latitude	47.1524° North
Site Longitude	122.2934° West
S_S – Short Period Spectral Acceleration	1.43 g
S_1 – 1-Second Period Spectral Acceleration	0.41 g
S_{MS} – Short Period Spectral Acceleration Adjusted for Site Class	1.55 g
S_{M1} – 1-Second Spectral Acceleration Adjusted for Site Class	0.89 g
S_{DS} – Design Short Period Spectral Acceleration	1.03 g
S_{D1} – Design 1-Second Spectral Acceleration	0.59 g

Description	Value [1]
PGA_M - ASCE 7, PGA Adjusted for Site Class	0.53 g

1. The IBC requires a site profile extending to a depth of 100 feet for seismic site classification. Borings were extended to a maximum depth of 50 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area.

Surface-Fault Rupture

The hazard of damage from onsite fault rupture appears to be low based on review of the USGS Earthquake Hazards Program Quaternary Faults and Folds Database available online (**https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf**) accessed on April 7, 2025. The closest mapped fault is the Tacoma fault zone, which lies approximately 7 miles to the northeast, and has a slip rate of between 0.2 and 1.0 mm/yr.

Liquefaction

Liquefaction is the phenomenon where saturated soils develop high porewater pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity, where groundwater is shallow and loose granular soils or relatively non-plastic fine-grained soils are present. Based on the site geology and subsurface groundwater conditions, the hazard of liquefaction of the site soils is low for this site during a design level earthquake.

Geotechnical Overview

The presence of the existing building limited the extent of the geotechnical study. Our explorations were advanced outside the building and subsurface conditions below the building are inferred between borings. The conditions below the existing building are unknown and presents a geotechnical data gap. If the owner is unwilling to accept the risk of assuming subsurface conditions below the building, please contact Terracon to provide a supplemental study once the building is removed.

The subsurface materials generally consisted of silty sands overlaying silty gravels extending to the maximum depth of the borings. Groundwater was encountered at approximately 38 feet below ground surface. Zones of very loose to loose sandy soils with variable silt and gravel were observed within the eastern region of the site. We suspect these soils could be undocumented, existing fill from previous grading efforts.

Based on the conditions encountered and estimated load-settlement relationships, the proposed structures can be supported on conventional spread footings. However, the very loose to loose zones of potential fill present concerns for erratic and unpredictable settlement. Partial overexcavation is recommended to address this settlement risk. The **Shallow Foundations** section addresses support of the building bearing on compacted structural fill or dense native soils. The **Floor Slabs** section addresses slab on-grade support of the building using overexcavation techniques.

Due to increased potential for moisture sensitivity in soils with high fines content, the on-site soils will require review by the geotechnical engineer prior to utilization as engineered fill material.

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

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

Earthwork

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

Demolition

The proposed building will be constructed within the footprint of the existing building which will need to be demolished, as well as exterior sidewalks, pavements, and utilities. We recommend existing foundations, slabs, and utilities be removed from within the development area.

Site Preparation

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

Mature trees are located within the proposed development and will require removal at the onset of construction. Tree root systems can remove substantial moisture from surrounding soils. Where trees are removed, the full root ball and all associated dry and desiccated soils should be removed. The soil materials which contain less than 5 percent organics can be reused as engineered fill provided the material is moisture conditioned and properly compacted. The void left by removal of the root ball should be backfilled in lifts with compacted structural fill as recommended herein.

Subgrade Preparation

We recommend that the soils within the footprint of the proposed structures be removed to a minimum depth of 2 feet below the bottom of footings. Deeper removal depths may be necessary if deleterious materials are observed following the 2 feet overexcavation. Subgrade soils beneath proposed exterior slabs and pavements should be removed to a depth of at least 1 foot beneath proposed slab or pavement section, or existing grade, whichever is greater. Following the 1-foot removal, the exposed subgrade should be scarified to a minimum depth of 1 foot then moisture-conditioned as needed and recompacted in place. Earthwork should be observed full-time by the geotechnical engineer during overexcavation, scarifying, and compaction of structural fill to restore grades.

Large-area subgrades should be proofrolled with an adequately loaded vehicle such as a fully loaded tandem-axle dump truck. The proofrolling should be performed under the observation of the geotechnical engineer. Areas excessively deflecting under the proofroll should be delineated and remedial recommendations provided by the geotechnical engineer.

All other exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 1 foot, moisture conditioned as necessary, and compacted per the compaction requirements in this report. Compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or pavement construction.

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

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and common fill. Structural fill is material used below, or within 2 feet of structures, pavements or constructed slopes. Common fill is material used to achieve grade outside of these areas.

Import and On-Site Soil: Excavated onsite soil may be selectively reused as structural fill pending review by the geotechnical engineer prior to use. In general, the granular onsite soils appear suitable for reuse; however, the contractor must effectively segregate the granular soils from cohesive soils and organic-rich soils by maintaining separate stockpiles. Mixing soil types within a singular stockpile will render the onsite soils unsuitable for reuse.

Portions of the on-site soil 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.

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.

Material property requirements for onsite soil for use as fill are noted in the table below:

Fill Type	Recommended Materials	Acceptable Location for Placement
Structural Fill	9-03.9(3) *Crushed Surfacing Base Course* [1] 9-03.12(1)A *Gravel Backfill for Foundations Class A* [1] 9-03.14(1) *Gravel Borrow* [1] On-site Soils (i.e. Soil Layer 1,2) [2, 3]	Beneath and adjacent to structural slabs, foundations, building appurtenances, and pavement subgrades
Common Fill	Section 9-03.14(3) *Common Borrow* [1] On-site Soils (i.e. Soil Layers 1,2) [2, 3]	Grade filling, utility trench backfill outside the building foundation and appurtenances

Fill Type	Recommended Materials	Acceptable Location for Placement
Free-Draining Granular Fill	Structural Fill [4] 9-03.9(2) *Permeable Ballast* [1] 9-03.12(2) *Gravel Backfill for Walls* [1] 9-03.12(4) *Gravel Backfill for Drains* [1]	Backfilling in wet weather, drainage layers for walls, sump drains, footing drains [5]

1. WSDOT Standard Specifications
2. A sample of each material type should be submitted to the geotechnical engineer for evaluation prior to use.
3. May contain local areas of higher fines content that could make this material moisture sensitive. Particles with a nominal diameter greater than about 3 in. should be removed.
4. Material provided must be specified to be less than 5-percent passing the #200 sieve for the portion of material passing the #4 sieve.
5. Minimum particle size must be greater than drainpipe perforations.

Other earthen materials may be suitable for use in addition to the options presented in the table above. All materials should be approved by the geotechnical engineer prior to use.

Fill Placement and Compaction Requirements

Structural and common fill should meet the following compaction requirements.

Item	Structural Fill	Common Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements[1,2,3]	95% of max. below foundations and within 1 foot of finished pavement subgrade 92% of max. 1 foot or more below finished pavement subgrade	92% of maximum dry density

Item	Structural Fill	Common Fill
Water Content Range[1]	Typically, +/-2% of the optimum moisture content	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the Modified Proctor test (ASTM D 1557).
2. High plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Utility Trench Backfill

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

Onsite materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

All trenches should be wide enough to allow for compaction around the haunches of the pipe. If water is encountered in the excavations, it should be removed prior to fill placement. The presence of cobbles and boulders may present challenges with respect to trench stability. Nested cobbles and boulders in trench side walls may become loosened during trench that could influence trench stability. The utility contractor should be prepared to contend with the likely presence of cobbles and boulders in utility trench alignments.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Effective drainage will be essential during construction to limit the extent of soil disturbance during the wet season.

Water retained next to the building 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. Gutters and downspouts should be routed into tightline pipes that discharge either directly into a municipal storm drain or to an alternative drainage facility. Splash-blocks should also be considered below hose bibs and water spigots.

Site grades should be established such that surface water is directed away from foundation and pavement subgrades to prevent an increase in the water content of the soils. Adequate positive drainage diverting water from structures, open cuts, and slopes should be established to prevent erosion, ground loss, and instability. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be verified to document effective drainage has been achieved. 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 construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

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

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

Construction Observation and Testing

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

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content. Where not specified by local ordinance, a minimum of 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 performed for every 12 vertical inches of compacted backfill. More frequent testing should be performed if materials are variable or if existing onsite soils are used. The testing frequency should be defined by the geotechnical engineer at the time observations are performed.

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

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

Wet Weather Earthwork

The near-surface soils have variable fines content based on our visual observations and lab testing and are considered moisture sensitive. The soils will exhibit moderate erosion potential and may be transported by running water. Silt fences and other best-management practices will be necessary to control erosion and sediment transport during construction.

The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content (the soil fraction passing the U.S. No. 200 Sieve) increases, soils become more sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than 2 percentage points above or below optimum. Optimum moisture content is the moisture content at which the maximum dry density for the material is achieved in the laboratory by the ASTM D1557 test procedure.

If inclement weather or in situ soil moisture content prevents the use of on-site material as structural fill, we recommend use of materials specified in **Fill Material Types** for free-draining granular fill.

Shallow Foundations

A minimum over excavation depth of 2 feet is recommended below foundations. Following observation from the geotechnical engineer, additional overexcavation may be necessary. Foundations should bear on compacted structural fill or dense native soils (i.e. Soil Layer 2). Assuming the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	3,000 psf
Minimum Foundation Dimensions	24 inches for Spread Footing 18 inches for Wall Footing
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	400 pcf (granular backfill)
Sliding Resistance [5]	0.4 allowable coefficient of friction - granular material
Minimum Embedment Below Finished Grade [6]	18 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 2/3 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. 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. Passive resistance in the upper 2 feet of the soil profile should be neglected. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the

Item	Description

footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.

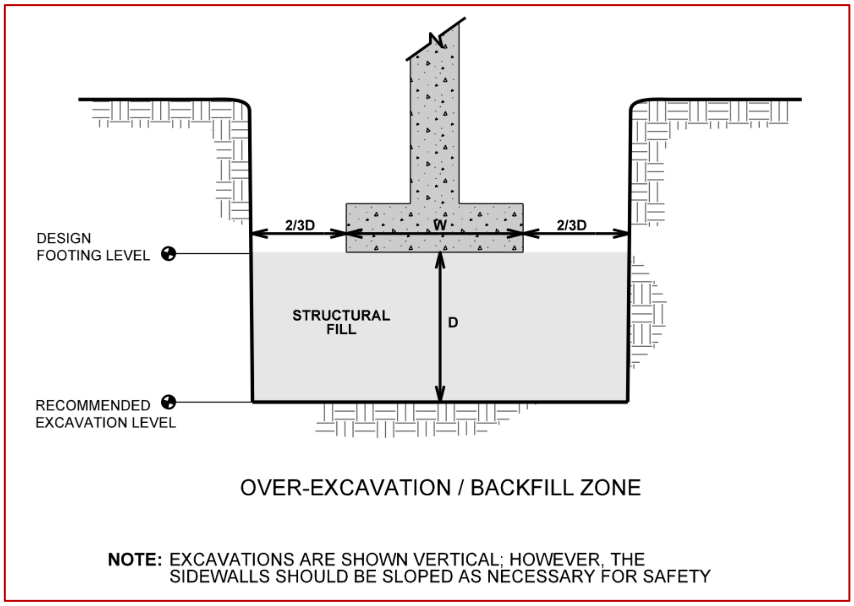
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. For frost protection and to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements assume a span of 50 feet. We should review the settlement estimates after the foundation plan has been prepared by the structural engineer

Foundation Construction Considerations

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

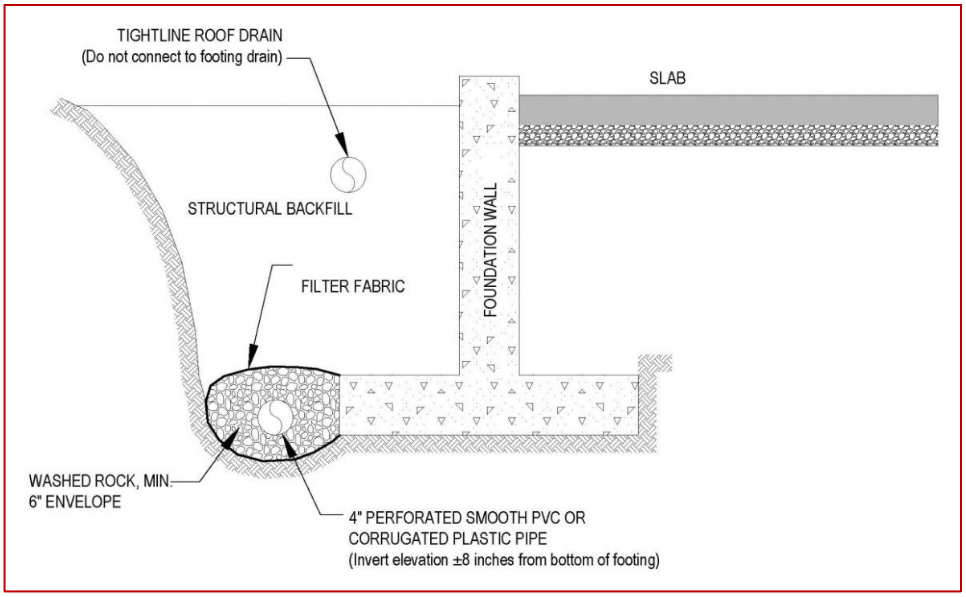
Sensitive soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill, steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

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.



Foundation Drains

We recommend the building be encircled with a perimeter foundation drain to collect exterior seepage water. This drain should consist of a 4-inch diameter perforated pipe within an envelope of washed rock, extending at least 6 inches on all sides of the pipe. The washed rock should conform to WSDOT Section 9-03.12(4), Gravel Backfill for Drains or 9-03.12(5), Gravel Backfill for Drywells. The washed rock envelope should be wrapped with filter fabric meeting the material requirements for Low Survivability Nonwoven with maximum AOS of No. 40 Geotextile for Underground Drainage found in WSDOT Section 9-33.2(1) (such as Mirafi 140N, or equal) to reduce the migration of fines from the surrounding soil. Ideally, the drain invert would be installed no more than 8 inches above or below the base of the perimeter footings. The perimeter foundation drain should not be connected to roof downspout drains and should be constructed to discharge into the site storm water system or other appropriate outlet. These recommendations are summarized in the figure below.



Floor Slabs

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

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of free-draining of either of the following: ▪ Washed drain rock ▪ 9-03.12(1)A *Gravel Backfill for Foundations Class A* (compacted to at least 95% of ASTM D 1557) [2, 3]
Estimated Modulus of Subgrade Reaction [4]	With 2 feet of compacted structural fill: 270 pounds per square inch per inch (psi/in) for point loads 150 psi/in for distributed loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. WSDOT Standard Specification.
3. The floor slab design should include a capillary break, comprised of compacted material with less than 12% passing the No. 40 sieve and less than 5% fines

Item	Description
	(material passing the No. 200 sieve). Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve).
	4. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. Values of modulus of subgrade reaction are estimated for subgrade conditions where non-yielding, native soils are present, either partial/full-depth replacement via structural fill has been performed, or ground improvement with aggregate piers under the floor slab.

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

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

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

Floor Slab Construction Considerations

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

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

Canopy Foundations

Augered and Cast-in-Place (ACIP) Pile Design Parameters

The following table can be used to estimate capacities for individual, continuous flight auger piles, commonly referred to as Augered and Cast-in-Place (ACIP) piles. The values are presented for allowable side friction and end bearing include a factor of safety of 2 and 3, respectively. We recommend augered piers are at least advanced three (3) pile diameters into the native glacial till unit.

Pile Design Summary [1]

Depth (ft; bgs) [4]	Soil Layer [2]		Allowable Side Friction (psf) [3]	Allowable End Bearing Pressure (psf) [4]
	No.	Material		
0 – 5	1	Recessional Outwash	1,500	---
>5	2	Glacial Till	4,000	12,000

1. Design capacities are dependent upon the method of installation and quality control parameters. The values provided are estimates and should be verified after finalization of installation protocol.
2. See Subsurface Profile in **Geotechnical Characterization** for more details on stratigraphy.
3. Applicable for compressive loading only. Reduce to 2/3 of values shown for uplift loading. The effective weight of the pile can be added to uplift load capacity to the extent permitted by IBC.
4. Piles should at least 3 times the pile diameter into the bearing stratum (Soil Layer 2) for end bearing to be considered. The depth to the bearing stratum is variable.

Piles should have a minimum (center-to-center) spacing of six (6) pile diameters. Closer spacing may require a reduction in axial load capacity. If 6B cannot be achieved due to site constraints, please contact Terracon to provide updated lateral design.

A minimum pile diameter of 12 inches should be used. Pile embedment should be no less than 5 feet below ground level.

ACIP Pile Lateral Loading

The following table lists input values for use in LPILE analyses of single auger cast piles. The LPILE software will estimate values for horizontal soil modulus (K); however, non-default values of K should be used where provided. Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters. We assume the structural engineer will add load resistance design factors (LRFD) as appropriate in lieu of a factor of safety.

Stratigraphy[1]		L-Pile Soil Model	ϕ [2]	γ' (pcf) [2]	K (pci)	
Depth (ft; bgs)	Material				Static	Cyclic
0 – 5	Recessional Outwash	Sand (Reese)	32°	120	90	---
>5	Glacial Till	Sand (Reese)	38°	135	180	---

1. See Subsurface Profile in **Geotechnical Characterization** for more details on Stratigraphy.
2. Definition of Terms:
   ϕ : Internal friction angle
   γ': Effective unit weight

ACIP Pile Construction Considerations

Installation of adjacent piles with a clear distance spacing of less than ten pile diameters should be delayed until grout in the initial pile has set to avoid possible grout intrusion between the piles which could jeopardize pile integrity.

Proper ACIP pile installation is highly operator-dependent and requires a greater than average dependence on quality workmanship and quality control monitoring. In addition, the successful ACIP pile completion largely depends on the equipment and installation procedures. The auger should be withdrawn in a controlled manner and a sufficient head of grout should always be maintained in the augers to prevent necking of fluid grout due to hydrostatic pressures.

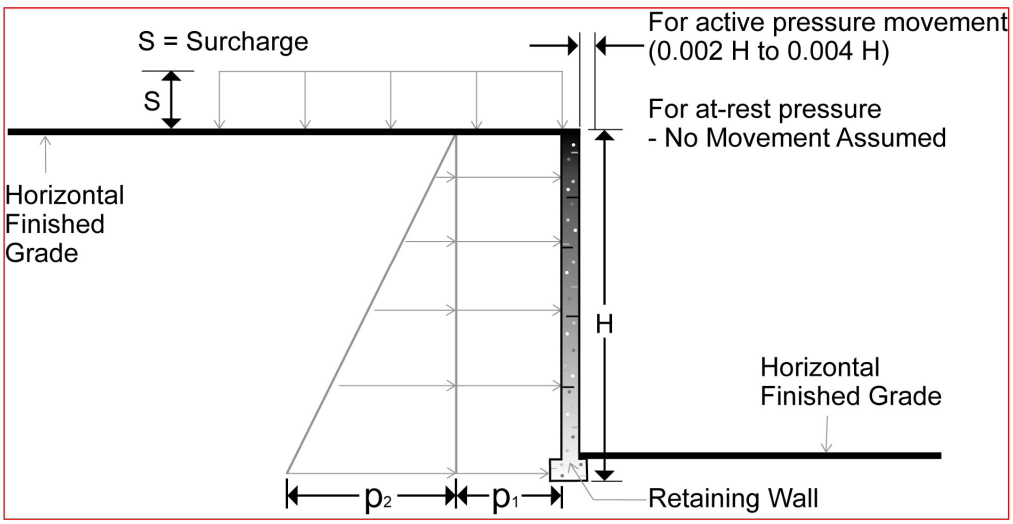
If practical drilling refusal is experienced above the planned termination depth, then a boulder or other obstruction may be present, and a replacement pile should be installed. The situation should be evaluated by the Geotechnical Engineer and the Structural Engineer during the pile driving operations. Continued "hard" drilling to attempt to extend through an obstruction should not be performed due to the possibility of excessive soil removal.

The ACIP pile installation process should be performed under observation of the Geotechnical Engineer. The Geotechnical Engineer should document the pile installation process including soil/rock and groundwater conditions observed, consistency with expected conditions, and details of the installed pile.

Lateral Earth Pressures

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3,4,5] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4,5]
Active (Ka)	0.31	(0.31)S	(40)H
At-Rest (Ko)	0.47	(0.47)S	(60)H
Passive (Kp)	3.20	---	(400)H
Seismic[6]	---	(7)H – Active (12)H – At-Rest	---

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, compacted to at least 92 percent of the ASTM D1557 maximum dry density. Compacted unit weight of 125 pcf is assumed.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values
6. Values are in addition to static earth pressures

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

Preliminary Stormwater Management Discussion

Due to the destructive nature of infiltration test pits, this testing type is deferred until a later design phase or until after the property has been acquired. In situ testing via pilot infiltration testing (PIT) may be required by local jurisdictions to confirm the values herein.

For planning purposes, we evaluated a potential infiltration rate based on grain size analyses and comparison with other glacial till sites in western Washington where pit infiltration testing has been performed. These values should be used for preliminary sizing of the infiltration facility only.

Grain-Size Correlation

Representative samples of the Soil Layer 2 were selected for grain size analysis and correlation to an infiltration rate.

Using the equation presented in the SWMMWW developed by Massmann (2003) for saturated hydraulic conductivity, a design infiltration rate of 3.7 to 5.9 inches per hour is estimated. Reduction factors of 1.0, 0.4, and 0.9 were applied for site variability, test method, and siltation/bio-buildup, respectively. The civil engineer should confirm these assumed correction factors are suitable. We estimate the following infiltration rates based on grainsize correlation:

Test Location	Depth	Initial Infiltration Rate (in/hr)	Factored Infiltration Rate (in/hr)
B-01	5 – 6.5	4	1
B-04 / MW-01	7.5 – 9	6	1½

Previous Experiences

The infiltrating unit is likely to be glacial till (i.e. Soil Layer 2), which is predominately an over-consolidated sand and gravel deposit with variable silt content. Due to the stress history of the soils, infiltration is typically slow in glacial till units. Grain-size correlations are unable to capture the influence of the over-consolidated nature of the soils.

Glacial till will typically render little to no infiltration, and often times infiltration is infeasible due to impermeable nature. Infiltration rates will often vary but could be on the order of 0.3 to 1 inch. In our opinion, evaluation of a design infiltration rate should be derived from in situ testing.

Preliminary Recommendations

If the civil engineer elects to use (or evaluate) an infiltration system, an infiltration rate of 0.3 in/hr can be assumed. However, confirmation testing should be performed prior to final design. We recommend Terracon is retained through permitting and to perform pilot infiltration testing (PITs), if an infiltration system is to be designed.

Pavements

General Pavement Comments

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

The standard equivalent single-axle load (ESAL) was estimated using 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO-1993).

Traffic loading was not provided to us. We assume the following traffic loading for flexible and rigid pavement areas based on the Equivalent Single Axle Loads (ESALs):

- Light Duty Areas: 30,000 ESALs
- Heavy Duty Areas: 60,000 ESALs

If traffic volumes will exceed the assumed values, Terracon should be notified to provide pavement sections designed for higher levels of traffic.

We have assumed a CBR value of 10 for the subgrade. Any soils imported to the site must have a CBR of 10 or higher. We have also assumed a pavement design life of 20 years.

Pavement Section Thicknesses

Design of Asphaltic Concrete (AC) pavements are based on the 1993 AASHTO guidelines. Minimum recommended pavement section thicknesses are presented below:

Asphaltic Concrete (AC) Design

Layer	Light Duty Layer Thickness (inches)	Heavy Duty Layer Thickness (inches)
Compacted Subgrade [1]	12	12
Crushed Aggregate Base [2]	6	6
Asphalt Thickness [3, 4]	3	4

1. May vary based on observations following proof-rolling.
2. Aggregate base meeting WSDOT:9-03.9(3) Base Course specifications, and the requirements specified in the Earthwork section.
3. Aggregates for asphalt surface meeting WSDOT: 9-03.8(2) ½-inch HMA requirements.
4. PG58H-22 asphalt binder.

Portland Cement Concrete (PCC) Design

Layer	Light Duty Layer Thickness (inches)	Heavy Duty Layer Thickness (inches)
Compacted Subgrade [1]	12	12
Crushed Aggregate Base [2]	5	5

Layer	Light Duty Layer Thickness (inches)	Heavy Duty Layer Thickness (inches)
Portland Cement Concrete Thickness	5	6

1. May vary based on observations following proof-rolling.
2. Aggregate base meeting WSDOT:9-03.9(3) Base Course specifications, and the requirements specified in the Earthwork section.

We recommend that Portland cement concrete (PCC, rigid) pavement be used where rigid pavements are appropriate. These areas include but are not limited to entrance and exit sections, dumpster pads, or any areas where extensive wheel maneuvering or repeated loading are expected. The rigid pavement pads should be large enough to support the wheels of the truck which will bearing the haul load. Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. Although not required for structural support, the base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, subgrade "pumping" through joints, and provide a workable surface. These thicknesses assume the subgrade is properly prepared and compacted as noted above. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

The minimum pavement sections outlined above were determined based on post-construction traffic loading conditions. These pavement sections do not account for heavy construction traffic during development. A partially constructed structural section that is subjected to heavy construction traffic can result in pavement deterioration and premature distress or failure. Our experience indicates that this pavement construction practice can result in pavements that will not perform as intended. Considering this information, several alternatives are available to mitigate the impact of heavy construction traffic prior to pavement construction. These include using thicker sections to account for the construction traffic after paving; using some method of soil stabilization to improve the support characteristics of the pavement subgrade; routing heavy construction traffic around paved areas; or delaying paving operations until as near the end of construction as is feasible.

Pavement Drainage

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

We recommend drainage be included at the bottom of Aggregate Base (when used) at the storm structures to aid in removing water that may enter this layer. Drainage could consist of small diameter weep holes excavated around the perimeter of the storm structures. The weep holes should be excavated at the elevation of the Aggregate Base and soil interface. The excavation should be covered with Aggregate Base encompassed in Mirafi 140NL, or an approved equivalent, which will aid in reducing the amount of fines that enter the storm system.

Pavement Maintenance

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

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

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.

General Comments

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

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

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

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

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Explorations	Type of Exploration	Approximate Exploration Depth (feet)	Location
1	Soil Boring / Monitoring Well	50	building
3	Soil Boring	25	building
3	Soil Boring	10	pavement

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

Soil Boring Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous flight hollow stem augers. Samples were obtained at intervals of 2.5 feet 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 rope and cathead hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings, except where monitoring wells were installed, were backfilled with bentonite chip after their completion in accordance with Washington Department of Ecology requirements related to completion of borings. Pavements were patched with cold-mix asphalt.

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

Monitoring Wells: Following advancement of soil boring MW-04, a monitoring well was constructed in the borehole. The well screen interval and construction details are shown on the well logs. A piezometer datalogger was placed in the well to observe water levels every 12 hours. A barometric pressure data logger was installed at the well location to collect barometric pressure values concurrent with the groundwater level.

Laboratory Testing

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

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D1140 Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing

The laboratory testing program often 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:

Site Location

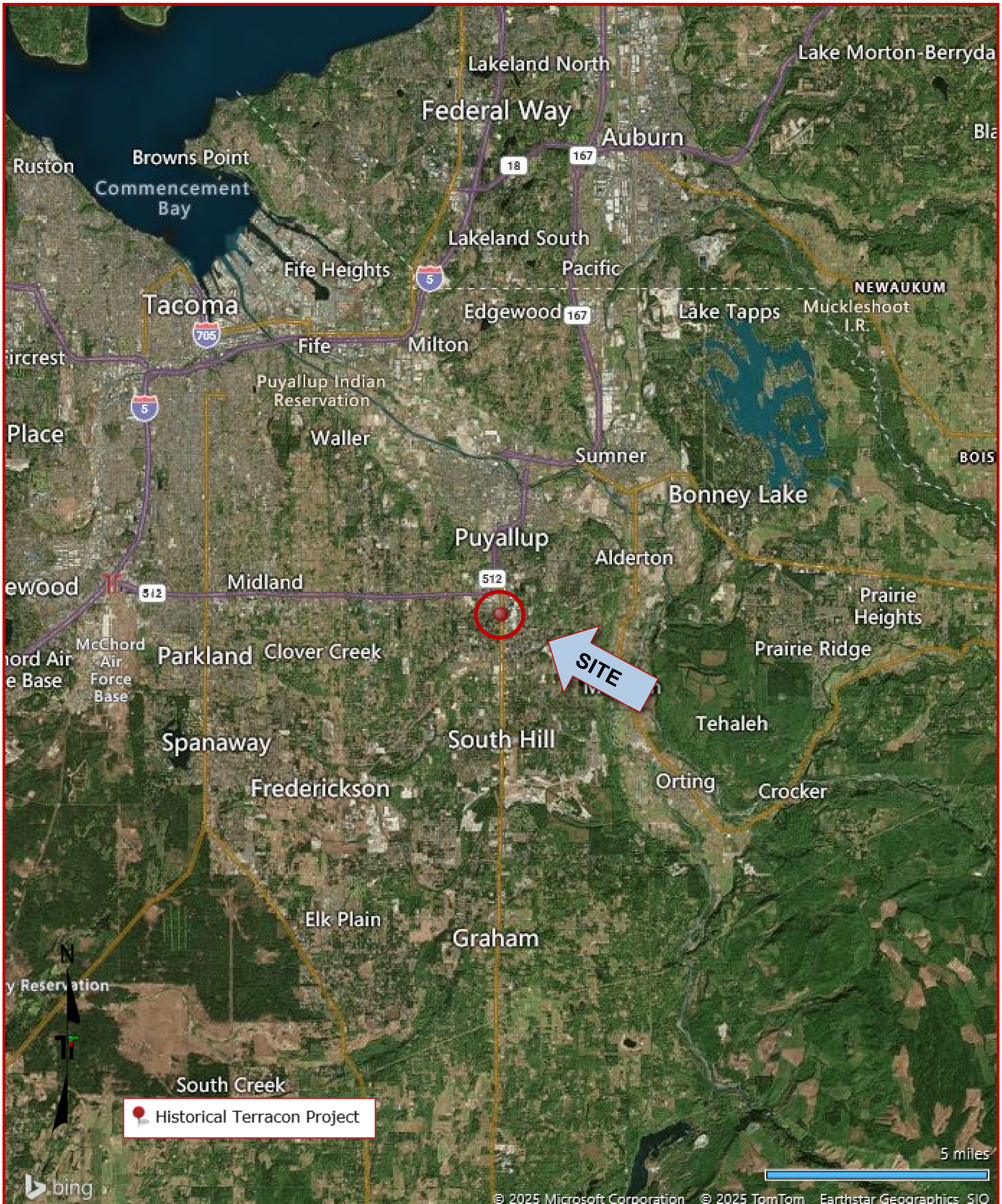


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

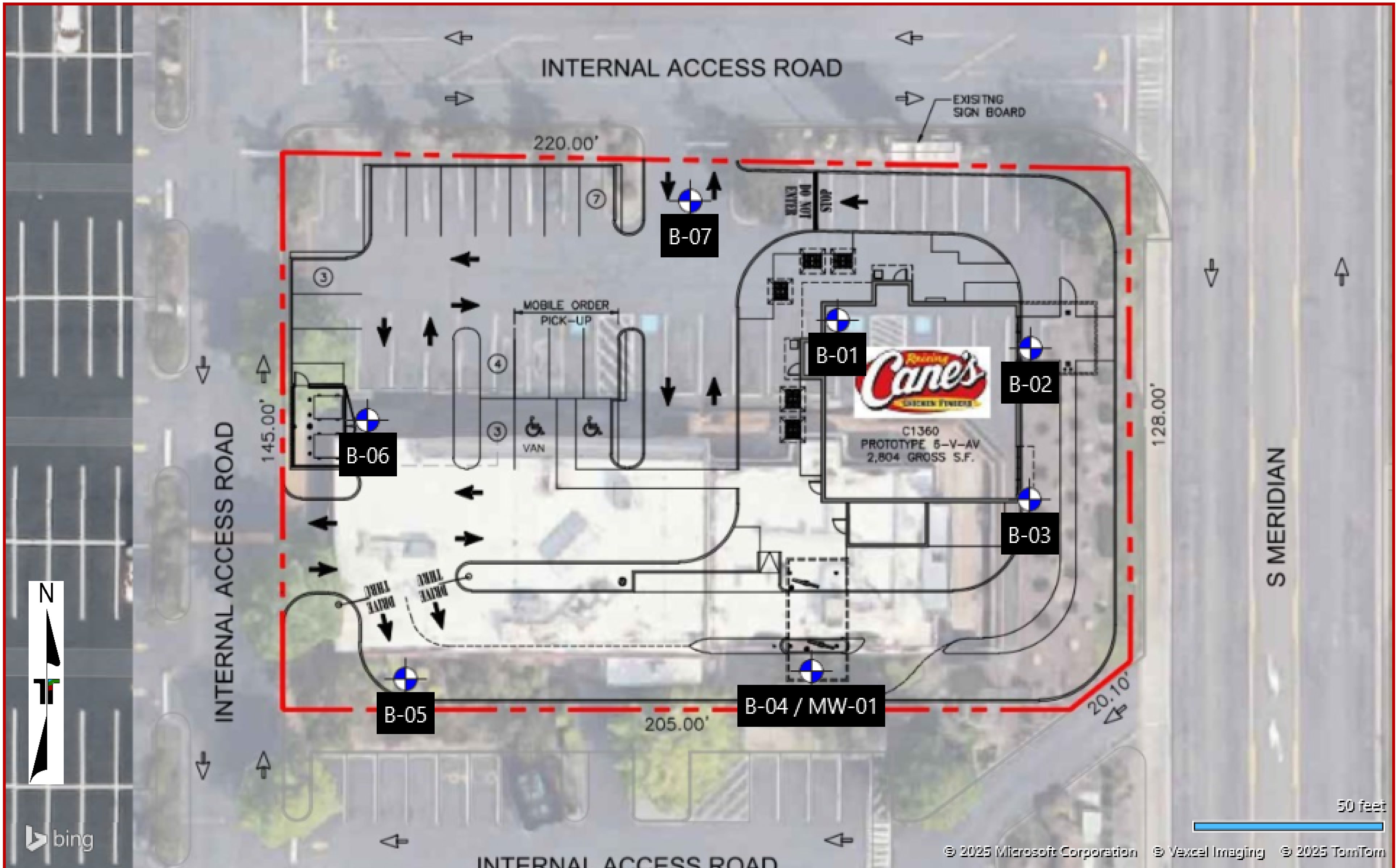


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

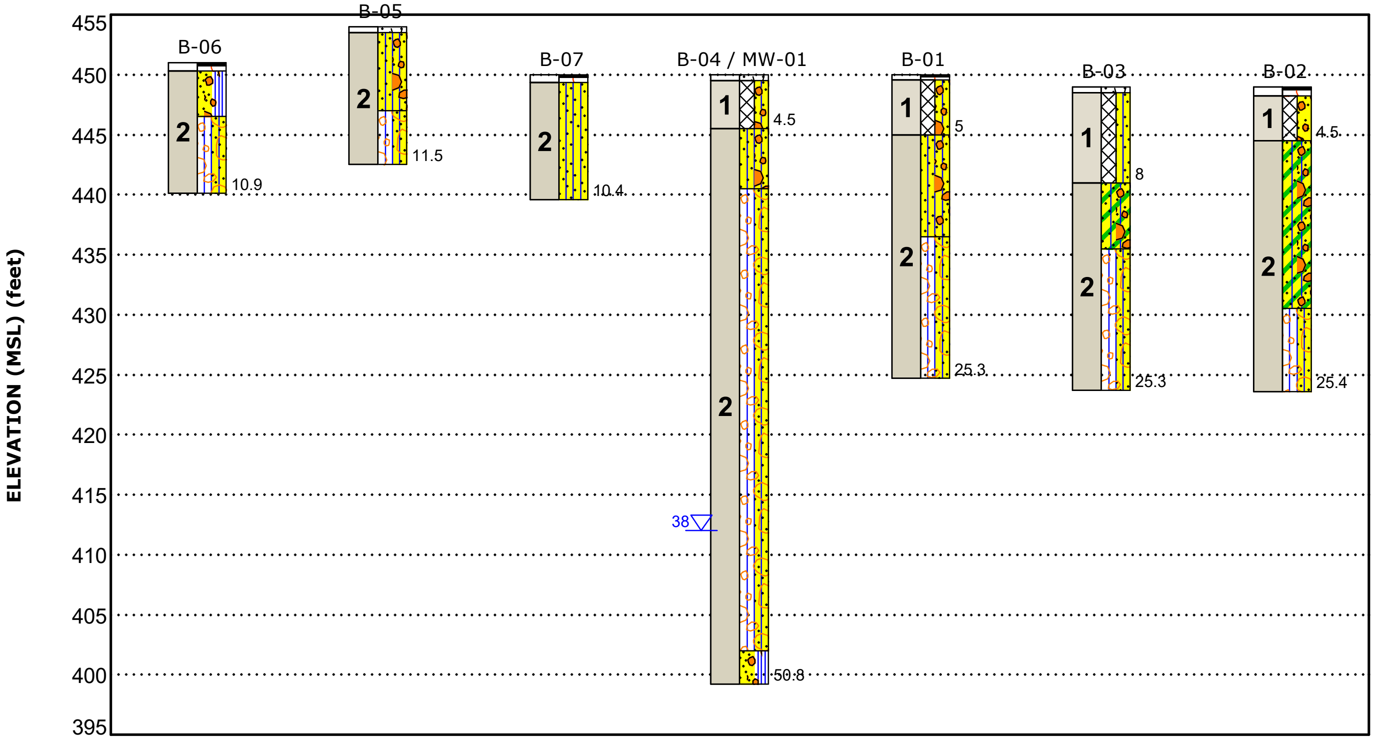
MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

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	Recessional Outwash / Possible Fill	Very loose to medium dense, brown, damp to moist SANDS with variable silt and gravel
2	Glacial Till	Dense to very dense, brown, moist to wet SANDS with variable silt, clay and gravel; and GRAVELS with variable silt and sand

Legend

- Asphalt
- Aggregate Base Course
- Silty Sand with Gravel
- Silty Gravel with Sand
- Poorly-graded Sand with Gravel
- Silty Clayey Sand with Gravel
- Topsoil
- Silty Sand
- Poorly-graded Sand with Silt and Gravel

First Water Observation

Groundwater levels are temporal. The 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.

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-01

Location: See Exploration Plan

Latitude: 47.1525° Longitude: -122.2934°

Depth (Ft.) | Elevation: 450 (Ft.) +/-

Model Layer	Depth (Ft.)	Description	Elevation
	0.2	**ASPHALT**, ~2 inches asphalt	449.83
	0.4	**AGGREGATE BASE COURSE**, ~3 inches base course	449.58
1	5.0	**(Possible Fill) SILTY SAND WITH GRAVEL (SM)**, with cobbles, fine to coarse grained, orangey brown, damp, loose	445
2	13.5	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained, grayish brown with orange mottling, moist, very dense at ~5.5 feet: ~1 inch thick wet perch layer	436.5
2	25.3	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist, very dense	424.7

Boring Terminated at 25.3 Feet

Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2.5		Split spoon	7	8-5-3 N=8	S-1			
5		Split spoon	11	10-17-50/6" N=67/12"	S-2	12.0		37
7.5		Split spoon	13	15-23-27 N=50	S-3			
10		Split spoon	10	18-50/4" N=50/4"	S-4			
15		Split spoon	7	28-50/3" N=50/3"	S-5			
20		Split spoon	2	50/2"	S-6			
25		Split spoon	4	50/4"	S-7			

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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: paved parking space
At S-1, S-2, S-3, S-5, S-7: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with cold mix asphalt.

Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-02

Location: See Exploration Plan

Latitude: 47.1525° Longitude: -122.2932°

Elevation: 449 (Ft.) +/-

Model Layer	Depth (Ft.)	Description	Elevation
	0.3	**ASPHALT**, ~3 inches asphalt	448.75
	0.8	**AGGREGATE BASE COURSE**, ~6 inches base course	448.25
1	4.5	**(Possible Fill) POORLY GRADED SAND WITH GRAVEL (SP)**, trace sand, with cobbles, fine to coarse grained, yellowish brown, moist, very loose	444.5
2	18.5	**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)**, fine to coarse grained, low plasticity, brown, moist, dense	430.5
2	25.4	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist, very dense	423.6

Boring Terminated at 25.4 Feet

Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
3	3-2-1 N=3	S-1			
12	13-21-16 N=37	S-2			
18	10-15-19 N=34	S-3	15.1	23-17-6	
14	16-17-15 N=32	S-4			
5	13-14-16 N=30	S-5			
9	39-50/4" N=50/4"	S-6			
5	50/5"	S-7			

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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: paved parking space
At S-4, S-5, S-6: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with cold mix asphalt.

Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-03

Location: See Exploration Plan

Latitude: 47.1524° Longitude: -122.2932°

Elevation: 449 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)
	0.5	**TOPSOIL**	448.5
1	8.0	**(Possible Fill) SILTY SAND (SM)**, trace gravel, fine to coarse grained, orangey brown to brown, moist, medium dense	441
2	13.5	**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)**, fine to coarse grained, low plasticity, brown, moist, very dense	435.5
2	25.3	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist, very dense	423.7
		Boring Terminated at 25.3 Feet	

Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2.5		Split spoon	12	7-5-5 N=10	S-1			
5		Split spoon	4	6-6-7 N=13	S-2			
7.5		Split spoon	14	7-8-49 N=57	S-3			
10		Split spoon	9	40-50/3" N=50/3"	S-4	13.4	21-16-5	44
15		Split spoon	12	38-26-29 N=55	S-5			
20		Split spoon	5	50/5"	S-6			
25		Split spoon	4	50/4"	S-7			

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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: planter with trees and shrubs
At S-3, S-5, S-6: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with surrounding planter soil.

Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-04 / MW-01

Location: See Exploration Plan

Latitude: 47.1522° Longitude: -122.2935°

Depth (Ft.) Elevation: 450 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)	Installation Details
	0.5	**TOPSOIL**	449.5	
1	4.5	**(Possible Fill) SILTY SAND WITH GRAVEL (SM)**, with cobbles, fine to coarse grained, grayish brown, moist, medium dense	445.5	--Concrete
2	9.5	**SILTY SAND WITH GRAVEL (SM)**, grayish brown, moist, very dense at ~5 feet: orange mottling in sample	440.5	
2		**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist to wet, very dense		--Bentonite

Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2.5–4		Split spoon	13	7-8-8 N=16	S-1			
5–6.5		Split spoon	18	8-23-30 N=53	S-2			
7.5–9		Split spoon	18	34-42-43 N=85	S-3	9.2		31
10–11.5		Split spoon	7	22-43-30 N=73	S-4			
15		Split spoon	2	30-50/2" N=50/2"	S-5			
20		Split spoon	3	50/3"	S-6			
25		Split spoon	5	50/5"	S-7			

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: Inferred from Google Earth Pro

Water Level Observations
While drilling

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: planter with trees and shrubs
At S-5, S-6, S-7, S-8, S-9: rock fragments present, blow counts may be overstated.
Well Tag ID: BQU 141

Advancement Method
Hollow Stem Auger (10-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Groundwater Monitoring Well Installed

Logged by
TAH

Boring Started
03-17-2025

Boring Completed
03-17-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-04 / MW-01

Location: See Exploration Plan

Latitude: 47.1522° Longitude: -122.2935°

Depth (Ft.) Elevation: 450 (Ft.) +/-

Model Layer	Depth (Ft.) / Material Description	Elevation	Installation Details	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist to wet, very dense *(continued)*		Bentonite	30			2	50/2"	S-8			
			Sand	35			2	50/2"	S-9			
					▽							
			Screen	40			3	50/3"	S-10			
				45			4	50/4"	S-11			
	48.0	402										
	POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), fine to coarse grained, brown, wet, very dense			50			10	33-50/4" N=50/4"	S-12			
	50.8	399.2										

Boring Terminated at 50.8 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: Inferred from Google Earth Pro

Water Level Observations
▽ While drilling

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes

Advancement Method
Hollow Stem Auger (10-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Groundwater Monitoring Well Installed

Logged by
TAH

Boring Started
03-17-2025

Boring Completed
03-17-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-05

Location: See Exploration Plan

Latitude: 47.1522° Longitude: -122.2939°

Elevation: 454 (Ft.) +/-

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.5	**TOPSOIL**	453.5							
2		**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained, brown, moist, dense to very dense		Split spoon	10	12-18-20 N=38	S-1	9.9		32
2				Split spoon	4	32-50/4" N=50/4"	S-2			
2	7.0		447							
2		**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist, very dense		Split spoon	7	22-30-23 N=53	S-3			
2				Split spoon	12	30-34-40 N=74	S-4			
2	11.5		442.5							

Boring Terminated at 11.5 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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: planter with trees and shrubs
At S-4: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with surrounding planter soil.

Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-06

Location: See Exploration Plan

Latitude: 47.1524° Longitude: -122.2939°

Elevation: 451 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation	Sample Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**ASPHALT**, ~3 inches asphalt	450.75									
	0.7	**AGGREGATE BASE COURSE**, ~5 inches base course	450.33									
	4.5	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, fine to coarse grained, brown, moist, dense	446.5				3	14-19-17 N=36	S-1	6.9		11
2	10.9	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained, subangular to subrounded, brown, moist, very dense	440.1	5			12	34-32-44 N=76	S-2			
							3	50/6"	S-3			
				10			0	30-50/5" N=50/6"	S-4			

Boring Terminated at 10.9 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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: paved parking space
At S-2: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with cold mix asphalt.

Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Boring Log No. B-07

Location: See Exploration Plan

Latitude: 47.1526° Longitude: -122.2936°

Model Layer	Depth (Ft.)	Material Description	Elevation: 450 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Sample ID	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**ASPHALT**, ~3 inches asphalt	449.75									
	0.7	**AGGREGATE BASE COURSE**, ~5 inches base course	449.33									
2		**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, moist, dense to very dense				X	10	14-18-24 N=42	S-1	9.8		30
				5		X	12	30-50/6" N=50/6"	S-2			
		at ~7.5 feet: gravel content increases				X	5	50/5"	S-3			
	10.4		439.6	10		X	5	50/5"	S-4			

Boring Terminated at 10.4 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: Inferred from Google Earth Pro

Water Level Observations
Groundwater not observed

Drill Rig
EC 95 Track Drill

Hammer Type
Rope and Cathead

Driller
BORETEC 1

Notes
Surface Conditions: paved parking lot drive aisle
At S-1, S-2: rock fragments present, blow counts may be overstated.

Advancement Method
Hollow Stem Auger (8-inch O.D., 4 1/4-inch I.D.)
2-inch OD Split Spoon Sampler

Abandonment Method
Boring backfilled with bentonite upon completion and surface capped with cold mix asphalt.

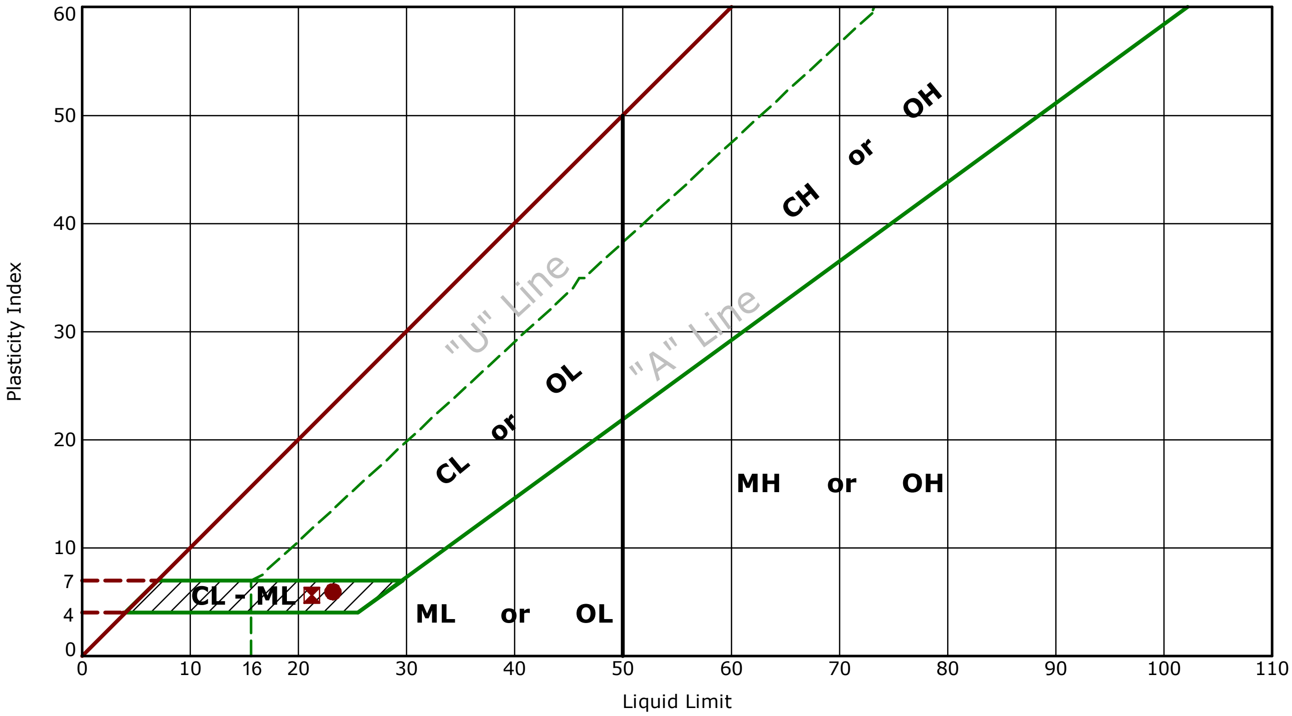
Logged by
JYB

Boring Started
03-13-2025

Boring Completed
03-13-2025

Atterberg Limit Results

ASTM D4318

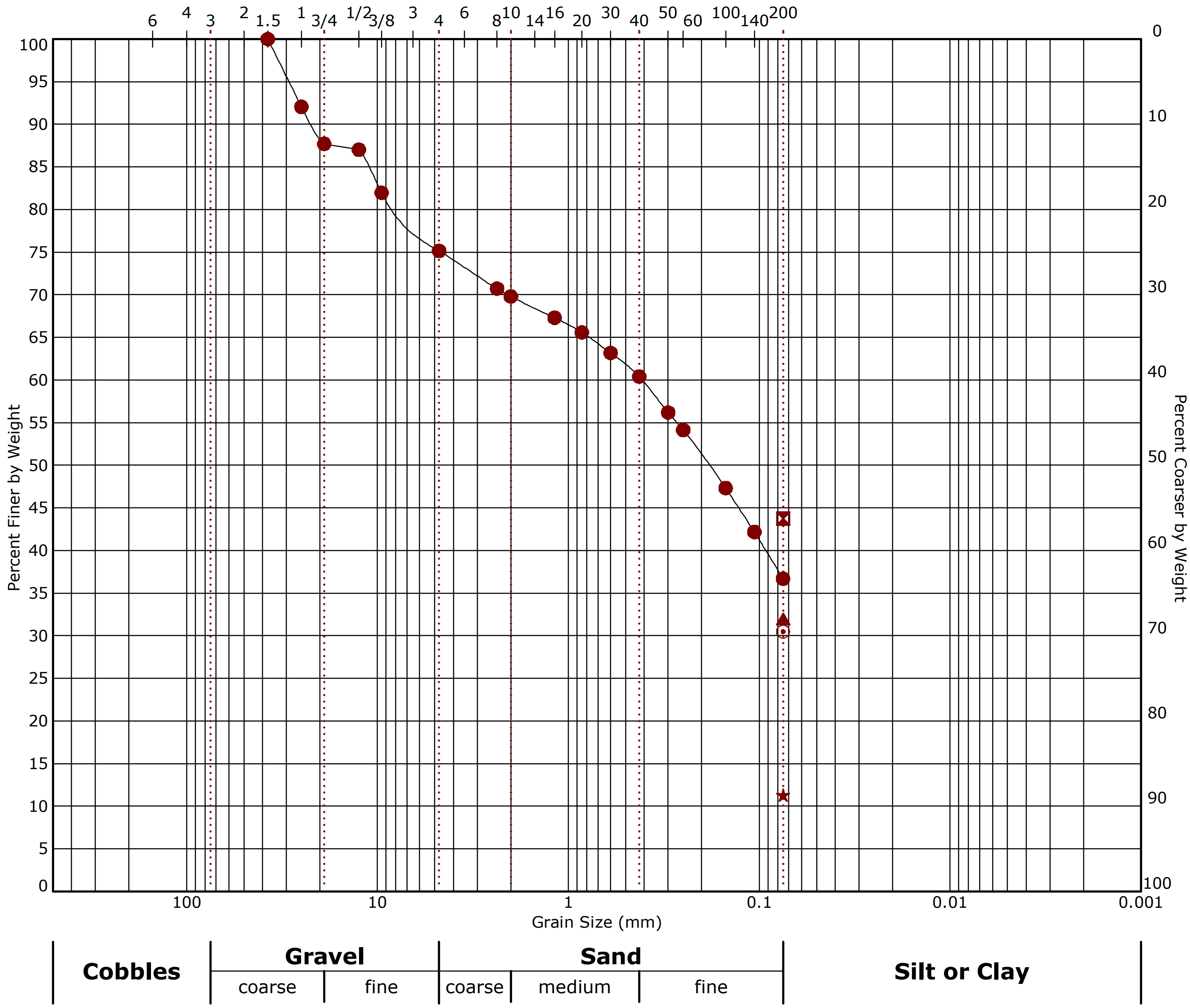


	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-02	7.5 - 9	23	17	6		SC-SM	silty clayey SAND
⊠	B-03	10 - 10.8	21	16	5	43.7	SC-SM	silty clayey SAND

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



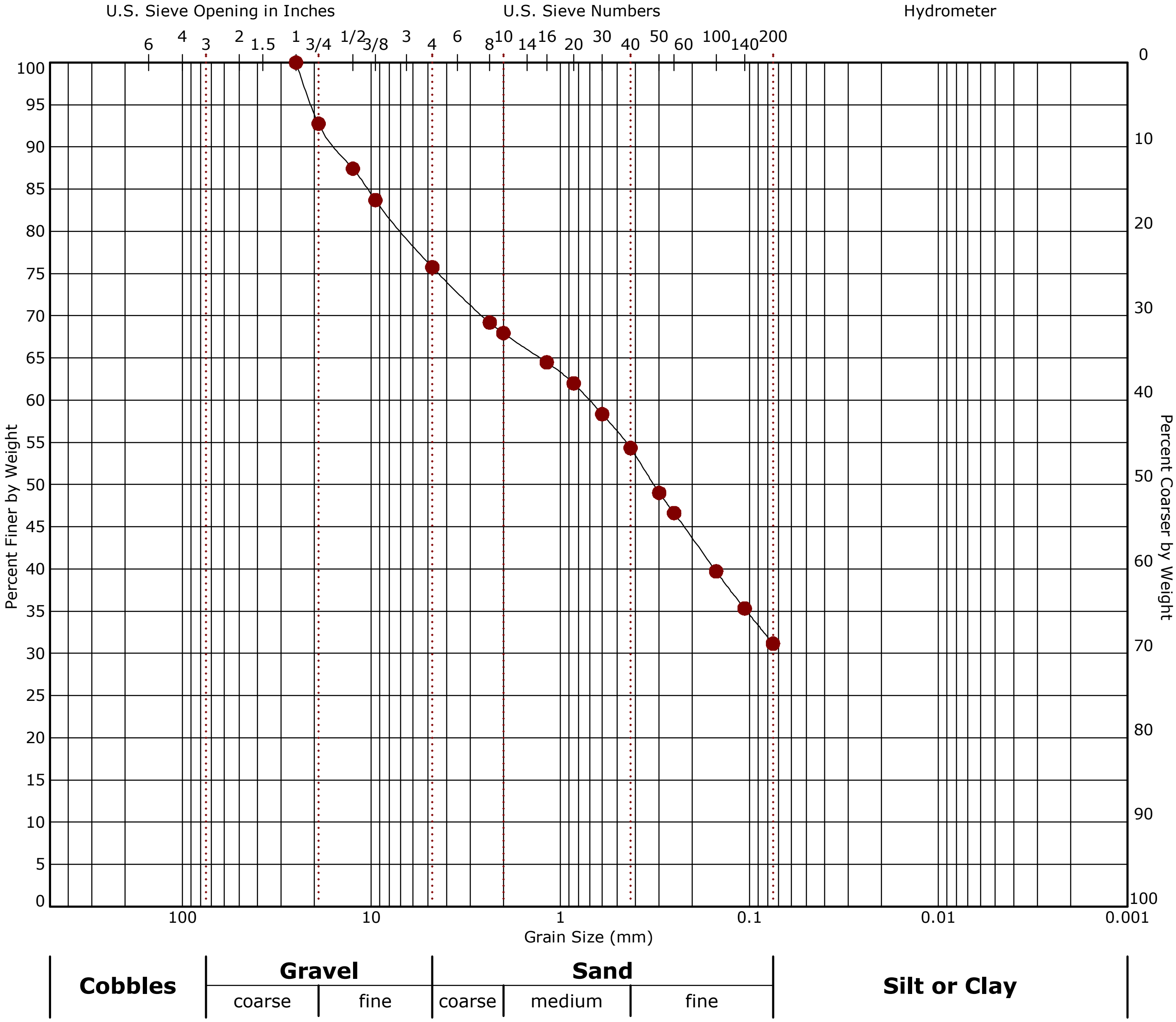
	Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
●	B-01	5 - 6.5	sily SAND with gravel	SM					
⧗	B-03	10 - 10.8	silty clayey SAND	SC-SM	21	16	5		
▲	B-05	2.5 - 4	silty SAND with gravel	SM					
★	B-06	2.5 - 4	poorly graded SAND with silt and gravel	SP-SM					
⊙	B-07	2.5 - 4	silty SAND	SM					

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-01	5 - 6.5	37.5	0.411			0.0	24.9	38.5	36.7		
⧗	B-03	10 - 10.8	0.075							43.7		
▲	B-05	2.5 - 4	0.075							32.0		
★	B-06	2.5 - 4	0.075							11.3		
⊙	B-07	2.5 - 4	0.075							30.5		

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
● MW-04	7.5 - 9	silty SAND with gravel	SM					

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● MW-04	7.5 - 9	25	0.703			0.0	24.2	44.6	31.2		

Anaheim Office
April 9, 2025
Report 25-090-0006

Terracon Consultants, Inc.
21905 64th Avenue W
Suite 200
Mountlake Terrace WA 98043

Attn: Jenna Batchelder

RE: Raising Cane's Puyallup 1360

Two samples were processed on March 31, 2024 identified as site soil take from the above mentioned site by the client from an area where a new landscape will be installed. Fertilizer and amendment recommendations were requested. The samples were analyzed for horticultural suitability, fertility and physical characteristics. The results of the analyses are attached.

Analytical Results and Comments

The samples show reactions in the moderately acid range with values of 5.5 on the pH scale. Free lime is absent. This pH range is considered lower than the preferred range for most plants. Incorporation of calcium carbonate lime is recommended for upward pH adjustment. Lime works slowly and to depth of incorporation.

In terms of fertility, nitrogen is low in both samples. Phosphorus is low in the second sample. Calcium and sulfate are below optimum in both samples. In the minor element group, copper and iron are supplied in excess as is manganese in sample 1. The additional application of these micronutrients should be avoided at this time.

Salinity (ECe), and Sodium are safely low in both samples. The sodium present in the samples is balanced by calcium and magnesium as indicated by the low sodium adsorption ratios (SAR). This balance is important in regards to soil structure and water infiltration. Boron is safely low yet nutritionally adequate in the samples.

According to the USDA Soil Classification system, the texture of the less than 2mm fraction of the soil is classified as loamy sand. The 40% particle size greater than 2mm classifies the materials as very gravelly. The high amount gravel combined with the diversity of sands indicates the soil may have potential to consolidate and compact. Organic matter content is low in the samples at 2.54-3.90% by dry weight. The average estimated infiltration rate in sample 1 is slow at 0.12 inch per hour and moderate in sample 2 at 0.32 inch per hour. Infiltration rates may vary due to differences in compaction across the site. Incorporation of an organic amendment is recommended to increase soil water and nutrient holding capacity in the site soil sample.

Recommendations

The susceptibility towards consolidation and compaction as well as poor drainage may be partially offset by incorporating organic matter. If it is determined that the gravel content of sample area 1 is representative of the site soil, it is not recommended that this soil be used for planting purposes. Alternative import specifications are included below.

4741 East Hunter Ave., Ste. A Anaheim CA 92807
(714) 282-8777 (714) 282-8575 fax
www.waypointanalytical.com

One option for improving the growing conditions would be the removal and replacement of existing soil with a more suitable import soil. This may be impractical on a large scale, but could be utilized for high profile landscape areas. The depth of soil removal will depend on the plant material selected, but for turf and groundcover 18 inches should be satisfactory. For shrubs and deep-rooted perennials, a minimum of 24 inches of soil should be removed and replaced. For specimen trees with a rootball greater than 24 inches in height, the existing soil should be removed the entire depth of the rootball and twice the diameter of the rootball. The import soil can then be used as the backfill to be placed around the rootball. The following specifications for the import soil are suggested.

Suggested Landscape Import Soil Specifications

CHEMISTRY

Reaction (pH) saturated paste	6.0-7.6
Salinity (EC_e dS/m) saturation extract	<3.0
Sodium adsorption ratio (SAR)	<6.0
Boron in saturation extract, ppm	<1.0

TEXTURE

Particle Size	USDA Sieve Size (mm)	Objective – Percent Passing
Gravel	2.0	>85%
Coarse sands	0.5	>75%
Silt plus clay	0.05*	<35%

*Use Hydrometer method

If the soil must be used for planting despite the high gravel content, a nitrogen and phosphorus fertilizer is recommended along with gypsum and lime at the time of planting. Incorporation of a nitrogen stabilized amendment or composted greenwaste product is recommended in order to help improve nutrient holding capacity and porosity. If a composted greenwaste amendment is chosen, select one low in micronutrients for the reasons mentioned above.

Surface Soil Preparation for Mass Planting and Groundcover

If feasible, prior to amending the areas where severe compaction exists, the surface soil should be ripped or tilled to a 9-inch depth. Uniformly broadcast and blend the following with existing soil to a 6-inch depth.

Amount per 1000 Square Feet		
4 cubic yards	Nitrogen Stabilized Amendment*	**All Areas**
10 lbs.	Calcium Nitrate (15.5-0-0)	**All Areas**
6 lbs.	Triple Superphosphate (0-45-0)*	**Sample Area 2**
10 lbs.	Gypsum	**All Areas**
20 lbs.	Calcium Carbonate Lime	**All Areas**

Or

Organic per 1000 Square Feet

4 cubic yards	Composted Greenwaste Amendment*	**Site Soil**
25 lbs.	Bone Meal (3-15-0)*	**Sample Area 2**
6 lbs.	Blood Meal (12-0-0)	**Site Soil**
10 lbs.	Feather Meal (12-0-0)	**Sample Area 1**
10 lbs.	Gypsum	**All Areas**

*The rate may change based on the analysis of the chosen organic amendment. This rate is based on 270 lbs. of dry weight of organic matter per cubic yard of amendment.

To Prepare Backfill for Trees and Shrubs:

- Excavate planting pits at least twice as wide as the diameter of the rootball.
- Soil immediately below the root ball should be left undisturbed to provide support but the sides and the bottom around the side should be cultivated to improve porosity.
- The top of the rootball should be at or slightly above final grade.
- The top 12 inches of backfill around the sides of the rootball of trees and shrubs may consist of the above amended soil or may be prepared as follows:

4 parts	Site Soil
1 parts	Organic Amendment*

Uniformly blended with:

Amount per Cubic Yard.

1/2 lbs.	Calcium Nitrate (15.5-0-0)	**All Areas**
1/3 lbs.	Triple Superphosphate (0-45-0)*	**Sample Area 2**
1/2 lbs.	Gypsum	**All Areas**
1 lbs.	Calcium Carbonate Lime	**All Areas**

Or

Organic per Cubic Yard.

1 1/3 lbs.	Bone Meal (3-15-0)*	**Sample Area 2**
1/3 lbs.	Blood Meal (12-0-0)	**Site Soil**
1/2 lbs.	Feather Meal (12-0-0)	**Sample Area 1**
1/2 lbs.	Gypsum	**All Areas**
1 lbs.	Calcium Carbonate Lime	**All Areas**

- Backfill below 12 inches required for 24 inch box or larger material should not contain the organic amendment, gypsum, or fertilizers.
- Ideally a weed free zone should be maintained just beyond the diameter of the planting hole. A 2-4 inch deep layer of coarse mulch can be placed around the tree or shrub. Mulch should be kept a minimum 4 inches from the trunk.
- Irrigation of new plantings should take into consideration the differing texture of the rootball substrate and surrounding soil matrix to maintain adequate moisture during this critical period of establishment.

Maintenance

For groundcover and mass planting areas, maintenance fertilization should rely primarily on a nitrogen only program supplemented with a complete fertilizer in the fall and spring. Beginning 30-60 days after planting, calcium nitrate (15.5-0-0) may be applied at a rate of 6 pounds per 1000 square feet with reapplication every 30-60 days, or as growth and color dictate. Once plants are performing satisfactorily, the frequency of fertilization may be decreased. Early fall and spring, substitute a complete fertilizer such as 16-6-8 at a rate of 6 lbs. per 1000 sq. ft. to help ensure continuing adequate phosphorus and potassium. Tree and shrubs may be fertilized with the same application rates. Irrigate after fertilizer applications.

Alternatively, organic maintenance fertilization for planting areas should rely primarily on a nitrogen only program supplemented with a complete fertilizer in the fall and spring. Blood Meal (12-0-0) provides available nitrogen fairly rapidly while materials such as Feather Meal (12-0-0), Soybean or Cotton Seed Meal (7-1-1) are slower to provide available nitrogen, but they extend the length of time they make this contribution. In order to provide a good supply of nitrogen for a 3-4 month time frame a good combination would be 6 pounds Blood Meal and 14 pounds Feather Meal per 1000 square feet. The first application should be 3-4 months after planting if soils have been amended as suggested. The long term maintenance program should consider spring and fall applications of an organic complete fertilizer such as 5-5-5- that would also supplement phosphorus and potassium nutrition to a greater extent. Follow each fertilizer with a thorough irrigation.

If we can be of any further assistance, please feel free to contact us.

Matt Schwebel (714)-552-5228
Mschwebel@waypointanalytical.com

Terracon Consultants, Inc.
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www.waypointanalytical.com

Project : Raising Cane's Puyallup 1360

Report No : **25-090-0006**
Purchase Order :
Date Recd : 03/31/2025
Date Printed : 04/04/2025

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
B-03 @ 0.5"	21	5.5	0.11	1	3	19	127	435	92	2.4	1.5	7	85	2.54	15153
	32	None		0.1		0.8	1.4	0.8	1.1	5.8	0.9	2.0	5.4		
B-05 @ 6"	17	5.5	0.12	0	3	9	113	359	74	1.7	1.4	4	173	3.90	15154
	27	None		0.1		0.4	1.5	0.8	1.1	4.9	1.1	1.4	13.2		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
0.62	0.33	0.26	0.05	0.22	0.18	0.4	66.9	12.1	14.4	15.0	56.6	9.4	4.4	Very Gravelly Loamy Sand	15153
0.67	0.37	0.40	0.01	0.19	0.41	0.6	30.6	10.1	7.8	16.2	60	11.4	4.4	Very Gravelly Loamy Sand	15154

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

Supporting Information

Contents:

Terracon
21905 64th Ave W, Ste 100
Mountlake Terrace, WA

General Notes

Sampling	Water Level	Field Tests
Modified California Ring Sampler; Grab Sample; 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

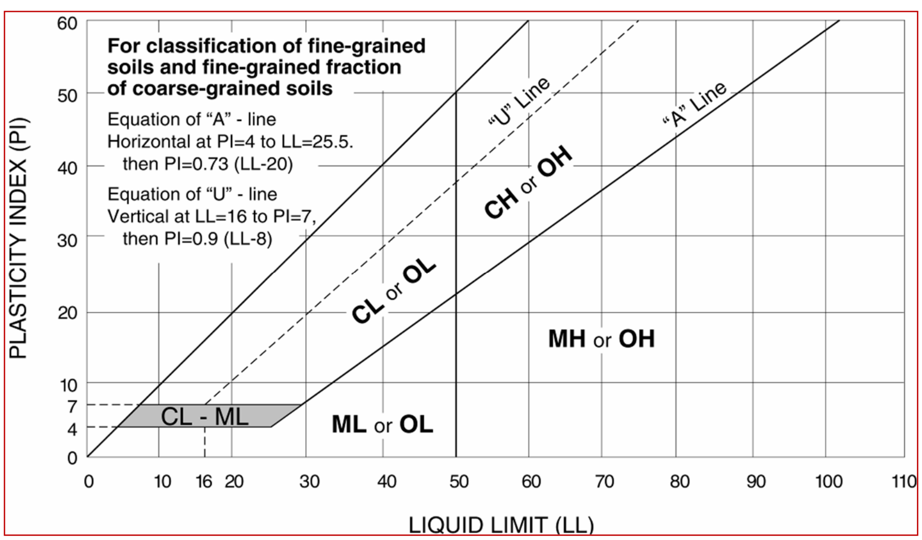
Relevance of Exploration and Laboratory Test Results

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 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.



Rock Classification Notes

WEATHERING	
Term	**Description**
Fresh	Mineral crystals appear bright; show no discoloration. Features show little or now staining on surfaces. Discoloration does not extend into intact rock.
Slightly weathered	Rock generally fresh except along fractures. Some fractures stained and discoloration may extend <0.5 inches into rock.
Moderately weathered	Significant portions of rock are dull and discolored. Rock may be significantly weaker than in fresh state near fractures. Soil zones of limited extent may occur along some fractures.
Highly weathered	Rock dull and discolored throughout. Majority of rock mass is significantly weaker and has decomposed and/or disintegrated; isolated zones of stronger rock and/or soil may occur throughout.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The rock mass or fabric is still evident and largely intact. Isolated zones of stronger rock may occur locally.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi**
Extremely strong	Can only be chipped with geological hammer. Rock rings on hammer blows. Cannot be scratched with a sharp pick. Hand specimens require several hard hammer blows to break.	>36,000
Very strong	Several blows of a geological hammer to fracture. Cannot be scratched with a 20d common steel nail. Can be scratched with a geologist's pick only with difficulty.	15,000-36,000
Strong	More than one blow of a geological hammer needed to fracture. Can be scratched with a 20d nail or geologist's pick. Gouges or grooves to ¼ inch deep can be excavated by a hard blow of a geologist's pick. Hand specimens can be detached by a moderate blow.	7,500-15,000
Medium strong	One blow of geological hammer needed to fracture. Can be distinctly scratched with 20d nail. Can be grooved or gouged 1/16 in. deep by firm pressure with a geologist's pick point. Can be fractured with single firm blow of geological hammer. Can be excavated in small chips (about 1-in. maximum size) by hard blows of the point of a geologist's pick;	3,500-7,500
Weak	Shallow indent by firm blow with geological hammer point. Can be gouged or grooved readily with geologist's pick point. Can be excavated in pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.	700-3,500
Very weak	Crumbles under firm blow with geological hammer point. Can be excavated readily with the point of a geologist's pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.	150-700

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Intensely fractured	< 2.5 inches	**Laminated**	< ½-inch
Highly fractured	2.5 – 8 inches	**Very thin**	½ – 2 inches
Moderately fractured	8 inches to 2 feet	**Thin**	2 inches – 1 foot
Slightly fractured	2 to 6.5 feet	**Medium**	1 – 3 feet
Very slightly fractured	> 6.5 feet	**Thick**	3 – 10 feet
		Massive	> 10 feet

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

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