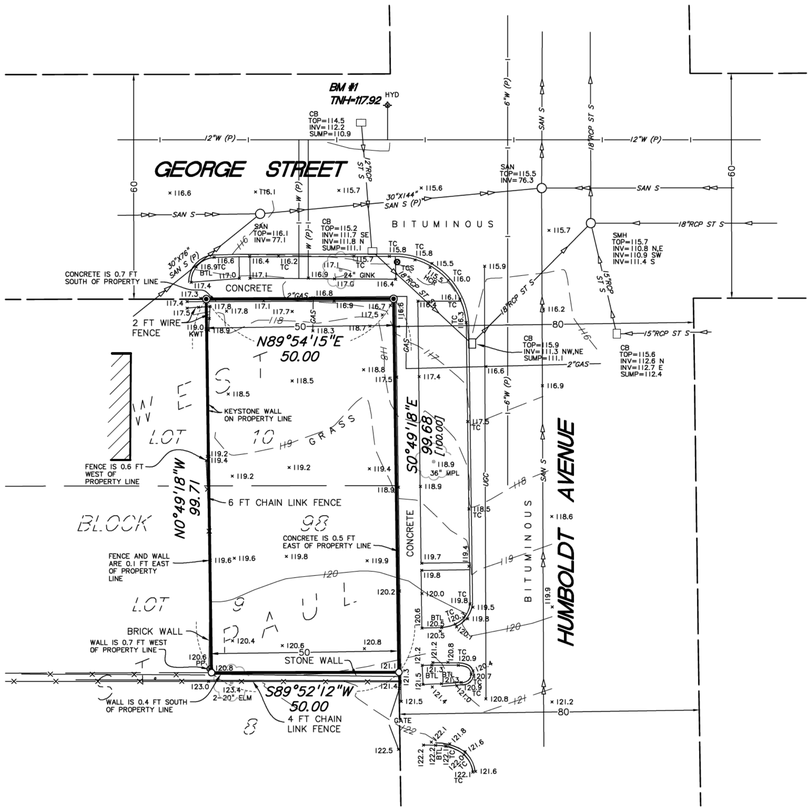

BENCHMARKS (BM)
(City of Saint Paul datum)

1.) Top of top nut of fire hydrant in the northwest quadrant of Humboldt Ave. and George St.
Elevation = 117.92 feet

2.) Top of top nut of fire hydrant in the northwest quadrant of Hall Ave. and George St. (west of surveyed area)
Elevation = 131.24 feet

NOTE: Elevations shown are based on City of St. Paul datum. Add 694.10 feet to convert to mean sea level datum.

DESCRIPTION OF PROPERTY SURVEYED
(Per Warranty Deed Document No. 4137164)

The East 50 feet of Lots 9 and 10, Block 98, West St. Paul, according to the recorded plat thereof, and situate in Ramsey County, Minnesota.

PLAT RECORDING INFORMATION

The plat of WEST ST. PAUL was filed of record on May 29, 1856.

[ ] Bearings and/or dimensions listed within brackets are per plat or record documents.

TITLE COMMITMENT

This survey was prepared without the benefit of current title work. Easements, appurtenances, and encumbrances may exist in addition to those shown hereon. This survey is subject to revision upon receipt of a current title insurance commitment or attorney's title opinion.

GENERAL NOTE

1.) Survey coordinate and bearing basis: Assumed

UTILITY NOTES

1.) Utility information from plans and markings was combined with observed evidence of utilities to develop a view of the underground utilities shown hereon. However, lacking excavation, the exact location of underground features cannot be accurately, completely and reliably depicted. In addition, Gopher State One Call locate requests from surveyors may be ignored or result in an incomplete response. Where additional or more detailed information is required, excavation and/or a private utility locate request may be necessary.

2.) Other underground utilities of which we are unaware may exist. Verify all utilities critical to construction or design.

3.) Some underground utility locations are shown as marked onsite by those utility companies whose locators responded to our Gopher State One Call, ticket numbers 212383074, 212462561 and 212865225.

4.) Contact GOPHER STATE ONE CALL at 651-454-0002 (800-252-1166) for precise onsite location of utilities prior to any excavation.

AREA

Gross = 4,985 square feet or 0.11 acres

LEGEND

○	Denotes iron monument set marked with P.L.S. No. 44890
◉	Denotes 1.17 inch diameter copper magnetized marker with disc cap affixed stamped LS-44890 set
BTL	Denotes beaver tail curb
CB	Denotes catch basin
HCR	Denotes disabled ramp
HYD	Denotes fire hydrant
INV	Denotes invert elevation
KWT	Denotes top of keystone wall
(P)	Denotes per plan
PP	Denotes power pole
RCP	Denotes reinforced concrete pipe
SAN	Denotes sanitary manhole
SAN S	Denotes sanitary sewer
SMH	Denotes storm manhole
ST S	Denotes storm sewer
SWT	Denotes top of stone wall
TC	Denotes top of concrete curb
TCS	Denotes traffic control sign
W	Denotes water line
GINK	Denotes Ginkgo tree
MPL	Denotes Maple tree

N

20 0 20 40
SCALE IN FEET

I hereby certify that this survey, plan, or report was prepared by me or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.

Dated this 22nd day of November, 2021

SUNDE LAND SURVEYING, LLC
By: Leonard F. Carlson
Leonard F. Carlson, P.L.S. Minn. Lic. No. 44890

Revision	By	Date
	NDN	

Drawing Title:
BOUNDARY, LOCATION, TOPOGRAPHIC and UTILITY SURVEY FOR:
HRA - CITY OF ST. PAUL
6 GEORGE ST. W., ST. PAUL, MN

SUNDE LAND SURVEYING
www.sunde.com
Main Office:
9001 East Bloomington Freeway (35W) • Suite 118
Bloomington, Minnesota 55420-3435
952-881-2455 (Fax: 952-888-9526)

Project: 2021-094-B Bk/Pg: 1117/32	Date: 10/22/2021
Township: 028 Range: 22 Section: 08	Sheet: 1 of 1
File: 2021094B001.dwg	

GEOTECHNICAL EXPLORATION REPORT

PROJECT:

Proposed Single Family Home
6 George Street W
St. Paul, MN

PREPARED FOR:

[redacted]

PREPARED BY:

Haugo GeoTechnical Services
2825 Cedar Avenue S.
Minneapolis, MN 55407

Haugo GeoTechnical Services Project: 19-0364

June 24, 2019

Table of Contents

1.0 INTRODUCTION

1.1 Project Description

[redacted] is proposing to construct a single-family home at 6 George Street W in St. Paul, MN. We understand the new home will be a "green affordable home" with overall plan dimensions of about 34 feet by 26 feet. We understand the new home will have a basement level and 2 stories above grade.

Haugo Geotechnical Services we retained, by a different user, to perform a geotechnical exploration for the project. Two soil borings were completed for that user who elected to not complete the project. We understand that the original user provided the soil boring logs to [redacted] who has elected to continue the project.

1.2 Purpose

The purpose of this geotechnical exploration was to characterize subsurface soil and groundwater conditions and evaluate the suitability of the soils to support the proposed construction.

1.3 Site Description

The project site is located at 6 George Street W in St. Paul, Minnesota. The lot was vacant at the time of our exploration and the ground surface was sparsely covered with grass. Topography of the site was relatively flat and level with ground surface elevations at the soil boring locations ranging from about 812 to 813 feet mean sea level (MSL).

1.4 Scope of Services

Our services were performed in accordance with Haugo GeoTechnical Services, LLC (HGTS) Proposal 19-0364 dated April 25, 2019 and under the terms of our General Conditions. Our scope of services was limited to the following tasks:

- Completing two (2) standard penetration soil borings each extending to a nominal depth of 20 feet.
- Sealing the borings in accordance with Minnesota Department of Health requirements.
- Obtaining GPS coordinates and ground surface elevations at the soil boring location.
- Visually classifying samples recovered from the soil boring.
- Performing up to (2) moisture content tests on selected samples.
- Preparing soil boring logs describing the soil types/classifications and results of water level measurements.
- Preparing an engineering report summarizing the current soil conditions and recommendations for foundation design and construction.

1.5 Documents Provided

To aid in our evaluation, we were provided 3-plan sheets prepared by Energy Panel Structures (EPS) dated October 12, 2018 with revisions dated April 8, 2019. The plan sheets include a foundation plan, elevation views and main floor and 2nd floor plans.

1.6 Locations and Elevations

The soil boring locations were selected jointly by the original user and HGTS based on the anticipated construction. The approximate locations of the soil borings are shown on Figure 1, "Soil Boring Location Sketch", in the Appendix. The sketch was prepared by HGTS using a Google Earth image as a base.

The ground surface elevations at the boring locations were obtained by HGTS using GPS measuring equipment. Elevations were based on MN County Coordinate System mean sea level using the GEOID09 (Conus) model. GPS coordinates at the boring locations are provided in Figure 1 in the Appendix.

2.0 FIELD PROCEDURES

Two (2) standard penetration test borings were advanced on May 28, 2019 by HGTS with a rotary drilling rig, using continuous flight augers to advance the boreholes. Representative samples were obtained from the borings, using the split-barrel sampling procedures in general accordance with ASTM Specification D-1586. In the split-barrel sampling procedure, a 2-inch O.D. split-barrel spoon is driven into the ground with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampling spoon the last 12 inches of an 18-inch penetration is recorded as the standard penetration resistance value, or "N" value. The results of the standard penetration tests are indicated on the boring log. The samples were sealed in containers and provided to HGTS for testing and soil classification.

Soil samples recovered from the borings were classified in general accordance with ASTM 2488, "Description and Identification of Soils (Visual/Manual Procedures).

A field log of each boring was prepared by the HGTS drill crew. The logs contain visual classifications of the soil materials encountered during drilling, as well as the driller's interpretation of the subsurface conditions between samples and water observation notes. The final boring logs included with this report represent an interpretation of the field logs and include modifications based on visual/manual method observation of the samples.

The soil boring logs, general terminology for soil description and identification, and classification of soils for engineering purposes are also included in the appendix. The soil boring logs identify and describe the materials encountered, the relative density or consistency based on the Standard Penetration resistance (N-value, "blows per foot") and groundwater observations.

The strata changes were inferred from the changes in the samples and auger cuttings. The depths shown as changes between strata are only approximate. The changes are likely transitions, variations can occur beyond the location of the boring.

3.0 RESULTS

3.1 Soil Conditions

The soil borings encountered about ½ foot, or less, of topsoil fill at the surface. The topsoil consisted of poorly graded sand with silt or silty sand that was black in color and contained some roots.

Below the topsoil, boring SB-1 encountered existing Fill that extended to about 6 ½ feet below the surface. The existing fill consisted of poorly graded sand with silt that was greyish brown in color and clayey sand that was dark brown that contained trace amounts of gravel and was dark brown in color.

Below the topsoil, boring SB-2 encountered existing Fill that extended to about 19 feet below the surface. The existing fill primarily consisted of poorly graded sand that was brown in color and silty and clayey sand that contained pieces of Limestone and was dark brown and black in color.

3.2 Bedrock Conditions

Below the Fill the soil borings encountered weathered Limestone bedrock at about 6 ½ and 19 feet below the ground surface. The borings were further advanced until auger refusal in what appeared to be sound Limestone bedrock at about 8 ½ and 19 ½ feet below the ground surface.

Based on a brief review of the Geologic Atlas of Ramsey County, Minnesota Geological Survey, County Atlas Series C-7, Plates 2 and 7, the bedrock below the site is likely limestone associated with the Platteville & Glenwood Formation.

3.3 Groundwater

Groundwater was not encountered in the soil borings while drilling and sampling or after removing the augers from the boreholes. Groundwater appears to be below the depths explored by our borings. Deeper borings along with groundwater monitoring wells or piezometers would be required to more accurately determine water levels.

Water levels were measured on the dates as noted on the boring logs and the period of water level observations was relatively short. Seasonal and annual fluctuations in the groundwater levels should be expected.

3.4 OSHA Soil Classification

The existing fill encountered in the borings consisted of silty clayey sand, poorly graded sand with silt and poorly graded sand corresponding to the ASTM Classification of SC-SM, SP-SM, and SP. The existing fill will generally be Type C soil under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines.

The borings also encountered Limestone bedrock which will generally be type "A" soils under OSHA guidelines.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Proposed Construction

The project includes the construction of a new house at 6 George Street W in St. Paul, Minnesota. We understand the new home will included a basement level with 2 stories above grade. Below grade construction is anticipate to consist cast in-place concrete foundation walls supported on cast in-place concrete footing. Since the new home will be a "green affordable home" the footings and foundation wall could utilize insulated concrete forms. Above grade construction is anticipated to consist of wood framing a pitched roof and asphalt shingles. Based on the assumed construction, we anticipate perimeter footings loads on the order of 1 to 2 kips per lineal foot and column loads, if any, will be less than 50 kips.

We assume the main floor will bear slightly above the existing site grade and will be at or near elevation 813 feet and the basement floor grade will be about 8 feet lower at about elevation 804 feet.

We have attempted to describe our understanding of the project. If the proposed loads exceed these values, the proposed grades differ by more than 2 feet from the assumed values or if the design or location of the proposed building changes, we should be informed. Additional analyses and revised recommendations may be necessary.

4.2 Discussion

General Based on a brief review of historical aerial photographs available on Google Earth, it appears a structure existed on the property that was removed sometime between June 2010 and April 2012. Although our borings did not encounter remnants of the former structure, there is that potential. We recommend that any building remnants, if encountered, be removed from within the proposed building and oversize areas and be properly disposed of off-site.

The two (2) soil borings completed for this project encountered about ½ foot, or less, of topsoil underlain by existing fill that extended to depths ranging from about 6 ½ to 19 feet below the ground surface. The borings encountered the apparent bedrock surface at those depths and met with refusal on more competent bedrock at about 8 ½ to 19 ½ feet below the surface.

The vegetation and topsoil are not suitable for foundation support will need to be removed from below the proposed building and oversize areas.

The Fill encountered in the borings consisted of a mix of poorly graded sand, clayey sand and silty clayey sand that contained pieces of limestone. The Fill was mostly black in color indicating the Fill was organic or contained organic materials. Organic soils or soils containing organic materials generally compressible and are not suitable for foundation support. As with the topsoil and vegetation, the Fill will also need to be removed from within the proposed building and oversize areas. Engineered fill would then be placed to establish foundation grades.

Excavations to remove the Fill will likely extend to depths about 19 feet below the ground surface. At typical excavation side-slope of 1:1 the excavation will extend about 19 feet or more beyond the edges of the footings. In addition the sols could slough further increasing those distances. Excavations could extend onto the adjacent properties posing a significant risk of undermining structures on those properties. If site constraints will not allow excavations with these dimensions shoring will be required.

The depth to bedrock varied significantly between the 2 boring and the reason for that is unknown. The actual soil and bedrock profile across the site could have a significant impact on foundation construction costs and because of that it may appropriate to perform test pits or additional soil borings to further evaluate site soil and bedrock conditions.

Foundations Partially on Bedrock & Partially on Soil The new home will likely include a basement level that will bear about 8 feet below the ground surface. At that depth we anticipate that bedrock will be encountered and excavations into the rock will be required. The bedrock appeared to be fairly weathered nearer the rock surface becoming more competent with depth. Rock cores were not performed as part of this project. In the absence of rock cores, contractors bidding on the project should be aware the bedrock will be encountered and that conventional/typical excavation techniques may not be appropriate for foundation construction. Additional drilling including rock coring could be performed to confirm bedrock quality prior to construction.

The bedrock encountered in the borings in our opinion is generally suitable for foundation support. However bedrock was not encountered at a consistent depth/elevation across the site and because if that there is a potential for portions of the home to be supported on bedrock while other portions could be supported on compacted engineered fill (soil) following soil corrections. Footings bearing on bedrock will likely not settle while the portion of the foundations supported on compacted soil could. This could result in about 1 inch or more of differential settlement.

To minimize the effects of potential differential settlement we recommend over-excavating the bedrock and placing a minimum 1 foot "sand cushion" between the bottom of the footing and top of the bedrock.

Groundwater Groundwater was not encountered in the soil borings completed for this evaluation and appears to be below the depths explored by our borings. We do not anticipate that groundwater will be encountered during construction. However, groundwater is often found perched above the bedrock surface. We anticipate that groundwater, if encountered, can be controlled with sumps and pumps.

4.3 Building Pad Preparation

Excavation We recommend that all vegetation, topsoil, existing fill be removed from below the proposed building and oversize areas. We further recommend all remnants of any previously demolished structures, if any, including footings, floor slabs, foundation walls and underground utilities be removed from within the proposed building and oversize areas. Table 1 below summarizes the anticipated excavation depths at the boring locations. Excavation depths may vary and could be deeper.

Table 1. Anticipated Excavation Depths

Boring Number	Measured Surface Elevation (feet)	Anticipated Excavation Depth (feet)*	Anticipated Excavation Elevation (feet)*
SB-1	812.0	6 ½	805 ½
SB-2	813.0	19 ½	793 ½

* = Excavation elevations were rounded to nearest ½ foot.

Oversizing If the excavation extends below the proposed footing elevation, the excavation requires oversizing. We recommend the perimeter of the excavation be extended a foot outside the proposed footprint for every foot below footing grade (1H:1V oversizing). The purpose of the oversizing is to provide lateral support of the foundation.

Shoring Excavations to remove the Fill will likely extend to depths about 19 feet below the ground surface. At typical excavation side-slope of 1:1 the excavation will extend about 19 feet or more beyond the edges of the footings. In addition the sols could slough further increasing those distances. Excavations could extend onto the adjacent properties posing a significant risk of undermining structures on those properties. If site constraints will not allow excavations with these dimensions shoring will be required.

Fill Material We anticipate that additional fill/backfill will be required to attain site grades. We recommend that additional fill required to attain site grades can consist of any mineral soil provided it is free of debris, organic soil or other unsuitable materials. We recommend granular material meeting the ASTM Classification SP or SP-SM soils for ease in compaction and to provide a uniform subgrade.

The topsoil, existing fill soils, organic soils or soils that are black in color that are excavated for construction of the building are not suitable for use or reuse as structural fill or backfill.

Backfilling We recommend that backfill placed to attain site grades be compacted to a minimum of 95 percent of its standard Proctor density (ASTM D 698). Granular fill (with less than 12% passing the #200 sieve) should be placed within 65 percent to 105 percent of its optimum moisture content as determined by the standard Proctor. Remaining fill soils, if used, should be placed within 3 percentage points above and 1 percentage point below its optimum moisture content as determined by the standard Proctor. All fill should be placed in thin lifts and be compacted with a large self-propelled vibratory compactor operating in vibratory mode.

Foundations We recommend the perimeter footings bear a minimum of 42 inches below the exterior grade for frost protection. Interior footings may be placed immediately below the slab provided construction does not occur during below freezing weather conditions. Foundation elements in unheated areas (i.e. deck or porch footings) should bear at least 5 feet below exterior grade for frost protection.

We anticipate the foundations and floor slabs will bear on compacted engineered fill or sound bedrock. With the building pad prepared as recommended it is our opinion the footings can be designed for a net allowable bearing pressure up to 2,000 pounds per square foot (psf).

As noted in the Discussion section, bedrock was not encountered at a consistent depth/elevation across the site and because if that there is a potential for portions of the home to be supported on bedrock while other portions could be supported on compacted engineered fill (soil) following soil corrections. Footings bearing on bedrock will likely not settle while the portion of the foundations supported on compacted soil could. This could result in about 1 inch or more of differential settlement.

To minimize the effects of potential differential settlement we recommend over-excavating the bedrock and placing a minimum 1 foot "sand cushion" between the bottom of the footing and top of the bedrock.

With the building pad prepared as recommended we anticipate that total and differential settlements will be less than 1 inch and ½ inch respectively across an approximate 30 foot span.

4.4 Interior Slabs

The anticipated floor subgrade will consist of granular engineered fill. It is our opinion a modulus of subgrade reaction, k, of 200 pounds per square inch of deflection (psi) may be used to design the floor.

If floor coverings or coatings less permeable than the concrete slab will be used, we recommend that a vapor retarder or vapor barrier be placed immediately beneath the slab. Some contractors prefer to bury the vapor barrier or vapor retarder beneath a layer of sand to reduce curling and shrinkage, but this practice often traps water between the slab and vapor retarder or barrier. Regardless of where the vapor retarder or vapor barrier is placed, we recommend consulting the floor covering manufacturer regarding the appropriate type, use and installation of the vapor retarder or vapor barrier to preserve the warranty.

We recommend following all state and local building codes in regards to a radon mitigation plan beneath interior slabs.

4.5 Below Grade Walls

Foundation walls or below grade (basement) walls will have lateral loads from the surrounding soil transmitted to them. We recommend general waterproofing of the below grade walls. We recommend either placing drainage composite against the backs of the exterior walls or backfilling adjacent to the walls with sand having less than 50 percent of the particles by weight passing the #40 sieve and less than 5 percent of the particles by weight passing the #200 sieve. The sand backfill should be placed within 2 feet horizontally of the wall. We recommend the balance of the backfill for the walls consist of sand however the sand may contain up to 20 percent of the particles by weight passing the #200 sieve.

We recommend installing drain tile behind the below grade walls, adjacent to the wall footing and below the slab elevation. Preferably the drain tile should consist of perforated pipe embedded in gravel. A geotextile filter fabric should encase the pipe and gravel. The drain tile should be routed to a storm sewer, sump pump or other suitable disposal site.

Active earth pressures can be used to design the below grade walls if the walls are allowed to rotate slightly. If wall rotation cannot be tolerated, then below grade wall design should be based on at-rest earth pressures. We recommend soil parameters found below in Table 2, be used for below grade/retaining wall design. These design parameters are based on the assumptions that the walls are drained, there are no surcharge loads within a horizontal distance equal to the height of the wall and the backfill is level.

Table 2. Soil Parameters

Soil Type	Estimated Unit Weight (pcf)	Estimated Friction Angle (degrees)	At-Rest Pressure (pcf)	Active Soil Pressure (pcf)	Passive Soil Pressure (pcf)
Sand (SP or SP-SM)	125	32	55	35	400
Other Soil (SM, SC, SC-SM, CL)	135	28	70	50	375

Resistance to lateral earth pressures will be provided by passive resistance against the wall footings and by sliding resistance along the bottom of the wall footings. We recommend a sliding coefficient of 0.35. This value does not include a factor of safety.

4.6 Exterior Slabs

Exterior slabs will likely be underlain by silty or clayey soils which are considered moderately to highly frost susceptible. If these soils become saturated and freeze, significant heave may occur. This heave can be a nuisance in front of doors and at other critical grade areas. One way to help reduce the potential for heaving is to remove the frost-susceptible soils below the slabs down to bottom of footing grades, and replace them with non-frost-susceptible backfill consisting of sand having less than 5 percent of the particles by weight passing the number 200 sieve.

If this approach is used and the excavation bottoms terminate in non-free draining granular soil or near the bedrock, we recommend a drain tile be installed along the bottom outer edges of the excavation to collect and remove any water that may accumulate within the sand. The bottom of the excavation should be graded away from the building.

If the banks of the excavations to remove the frost-susceptible soils are not sloped, abrupt transitions between the frost-susceptible and non-frost-susceptible backfill will exist along which unfavorable amounts of differential heaving may occur. Such transitions could exist between exterior slabs and sidewalks, between exterior slabs and pavements and along the slabs themselves if the excavations are confined to only the building entrances. To address this issue we recommend sloping the excavations to remove frost-susceptible soils at a minimum 3:1 (horizontal:vertical) gradient.

An alternative method of reducing frost heave is to place a minimum of 2 inches of extruded polystyrene foam insulation beneath the slabs and extending it about 4 feet beyond the slabs. The insulation will reduce frost penetration into the underlying soil and reduce heave. Six to 12 inches of granular soil is typically placed over the insulation to protect it during construction.

Another alternative for reducing frost heave is to support the slabs on frost depth footings. A void space of at least 4 inches should be provided between the slab and the underlying soil to allow the soil to heave without affecting the slabs.

4.7 Site Grading and Drainage

We recommend the site be graded to provide positive run-off away from the proposed building. We recommend landscaped areas be sloped a minimum of 6 inches within 10 feet of the building and slabs be sloped a minimum of 2 inches. In addition, we recommend downspouts with long splash blocks or extensions.

We recommend the lowest floor grades be constructed to maintain at least a 2-foot separation between the lowest floor slab and 100-year flood levels of any adjacent surface water features such as wetlands, ponds or creeks.

4.8 Utilities

We anticipate that new utilities will be installed (water and sanitary sewer services) as part of this project. We further anticipate that new utilities will bear at depths ranging from about 7 to 10 feet below the ground surface. At these depths, we anticipate that the pipe will likely bear on the bedrock surface which in our opinion is generally suitable for pipe support. Some bedrock removal should be anticipated and contractors should be aware that conventional/typical excavation techniques may not be appropriate for utility installations

We recommend bedding material be thoroughly compacted around the pipes. We recommend trench backfill above the pipes be compacted to a minimum of 95 percent beneath slabs and pavements, the exception being within 3 feet of the proposed pavement subgrade, where 100 percent of standard Proctor density is required. In landscaped areas, we recommend a minimum compaction of 90 percent.

Groundwater was not encountered in the soil borings and we do not anticipate that groundwater will be encountered during utility construction. However, groundwater is often found perched above the bedrock surface. We anticipate that groundwater, if encountered, can be controlled with sumps and pumps.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Excavation

The existing fill encountered in the borings consisted of silty clayey sand, poorly graded sand with silt and poorly graded sand corresponding to the ASTM Classification of SC-SM, SP-SM, and SP. The existing fill will generally be Type C soil under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines.

Temporary excavations in Type C soils should be constructed at a minimum of 1 ½ foot horizontal to every 1 foot vertical within excavations. Slopes constructed in this manner

may still exhibit surface sloughing. If site constraints do not allow the construction of slopes with these dimensions then temporary shoring may be required.

The borings also encountered Limestone bedrock which will generally be type "A" soils under OSHA guidelines.

5.2 Observations

A geotechnical engineer should observe the excavation subgrade to evaluate if the subgrade soils/bedrock are similar to those encountered in the borings and adequate to support the proposed construction.

5.3 Backfill and Fills

We recommend that fill and backfill be placed in lifts not exceeding 4 to 12 inches, depending on the size of the compactor and materials used.

5.4 Testing

We recommend density tests of backfill and fills placed for the proposed house foundation. Samples of the proposed materials should be submitted to our laboratory prior to placement for evaluation of their suitability and to determine their optimum moisture content and maximum dry density (Standard Proctor).

5.5 Winter Construction

If site grading and construction is anticipated to proceed during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading and placement of fill. No fill should be placed on frozen soil and no frozen soil should be used as fill or backfill.

Concrete delivered to the site should meet the temperature requirements of ASTM and/or ACI. Concrete should not be placed on frozen soil. Concrete should be protected from freezing until the necessary strength is obtained. Frost should not be permitted to penetrate below the footings.

6.0 PROCEDURES

6.1 Soil Classification

The drill crew chief visually and manually classified the soils encountered in the borings in general accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedure)". Soil terminology notes are included in the Appendix. The samples were returned to our laboratory for review of the field classification by a soils engineer. Samples will be retained for a period of 30 days.

6.2 Groundwater Observations

Immediately after taking the final samples in the bottom of the boring, the hole was checked for the presence of groundwater. Immediately after removing the augers from the borehole the hole was once again checked and the depth to water and cave-in depths were noted.

7.0 GENERAL

7.1 Subsurface Variations

The analyses and recommendations presented in this report are based on data obtained from a limited number of soil borings. Variations can occur away from the borings, the nature of which may not become apparent until additional exploration work is completed or construction is conducted. A reevaluation of the recommendations in this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional foundation costs and it is suggested that a contingency be provided for this purpose.

It is recommended that we be retained to perform the observation and testing program during construction to evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs, specifications and construction methods. This will allow correlation of the soil conditions encountered during construction to the soil borings and will provide continuity of professional responsibility.

7.2 Review of Design

This report is based on the design of the proposed structure as related to us for preparation of this report. It is recommended that we be retained to review the geotechnical aspects of the design and specifications. With the review, we will evaluate whether any changes have affected the validity of the recommendations and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

7.3 Groundwater Fluctuations

We made water level measurements in the borings at the times and under the conditions stated on the boring logs. The data was interpreted in the text of this report. The period of observation was relatively short and fluctuations in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw, drainage, and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

7.4 Use of Report

This report is for the exclusive use of [redacted] and her design team to use to design the proposed structure and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties

regarding this report. The data, analysis and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

7.5 Level of Care

Haugo GeoTechnical Services, LLC has used the degree of skill and care ordinarily exercised under similar circumstance by members of the profession currently practicing in this locality. No warranty expressed or implied is made.

APPENDIX

Legend

Approximate Soil Boring Location

N
W
E
S

GPS Boring Locations

Boring Number	Elevation (US Survey Feet)	Northing Coordinate	Easting Coordinate
SB-1	812.0	150618.205	577151.606
SB-2	813.0	150593.563	577174.871

Referencing Minnesota County Coordinates Basis – Hennepin County (GEOID09 Conus model)

Haugo GeoTechnical Services, LLC
2825 Cedar Avenue S.
Minneapolis, MN 55407

Soil Boring Location Sketch
6 George Street W
St. Paul, Minnesota

Figure #: 1
Drawn By: RD
Date: 5/31/19
Scale: None
Project #: 19-0364

HAUGO GEOTECHNICAL SERVICES
Haugo GTS
2825 Cedar Ave South
Minneapolis, MN 55407
Telephone: 612-729-2959

BORING NUMBER SB-1

CLIENT Trotts-Binns Construction
PROJECT NAME 6 George Street W
PROJECT NUMBER 19-0364
PROJECT LOCATION St. Paul, MN
DATE STARTED 5/28/19 **COMPLETED** 5/28/19
GROUND ELEVATION 812 ft **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS - 45
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger/Split Spoon
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NA **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES Auger met refusal at 8.5 feet.
AFTER DRILLING --- Not Encountered with Cave-In Depth of 7 feet

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONT. (%)	NOTES
0		Poorly Graded Sand with Silt, black, wet. (Topsoil/FILL)	AU 1				
		Poorly Graded Sand with Silt, fine grained, greyish brown, moist. (FILL)					
		Clayey Sand, trace Gravel, dark brown, wet. (FILL)	SS 2		5-5-4 (9)		
5			SS 3		6-8-4 (12)		
		Weathered Limestone, yellow. (Bedrock)	SS 4		23-8-9 (17)		

Bottom of borehole at 8.5 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

HAUGO GEOTECHNICAL SERVICES
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BORING NUMBER SB-2

CLIENT Trotts-Binns Construction
PROJECT NAME 6 George Street W
PROJECT NUMBER 19-0364
PROJECT LOCATION St. Paul, MN
DATE STARTED 5/28/19 **COMPLETED** 5/28/19
GROUND ELEVATION 813 ft **HOLE SIZE** 3 1/4 inches
DRILLING CONTRACTOR HGTS - 45
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger/Split Spoon
AT TIME OF DRILLING --- Not Encountered
LOGGED BY NA **CHECKED BY** PG
AT END OF DRILLING --- Not Encountered
NOTES Auger met refusal at 19.3 feet.
AFTER DRILLING --- Not Encountered with Cave-In Depth of 16 feet

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONT. (%)	NOTES
0	Silty Sand, trace Roots, black, wet. (Topsoil/FILL)					
	Poorly Graded Sand, fine grained, brown, moist. (FILL)	AU 5				
		SS 6		1-1-1 (2)		
	Silty and Clayey Sand, with Limestone pieces, dark brown and black, moist to wet. (FILL)					
5		SS 7		1-2-11 (13)		
		SS 8		4-4-6 (10)		
10		SS 9		8-9-10 (19)		
		SS 10		8-8-7 (15)		
15		SS 11		4-4-4 (8)		
		SS 12		50/3"		
	Weathered Limestone, yellow. (Bedrock)					
	Bottom of borehole at 19.3 feet.					

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

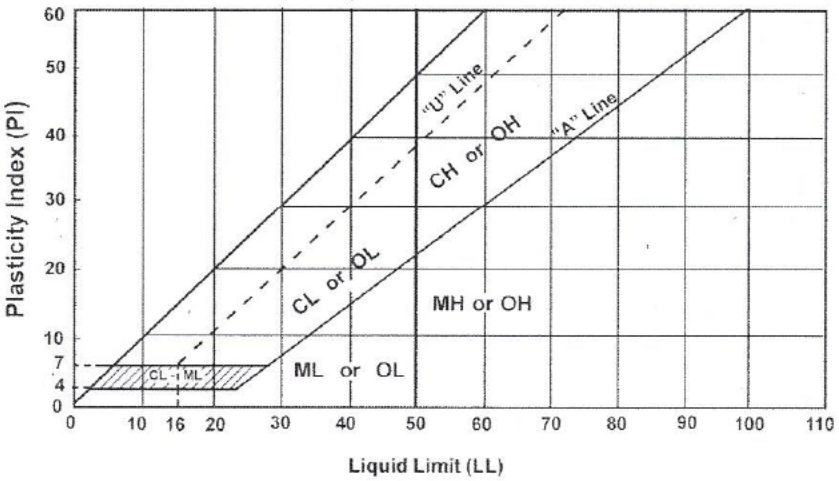
HAUGO GEOTECHNICAL SERVICES

Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils 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 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [f]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [f]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	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-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. 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
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. 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
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 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.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.