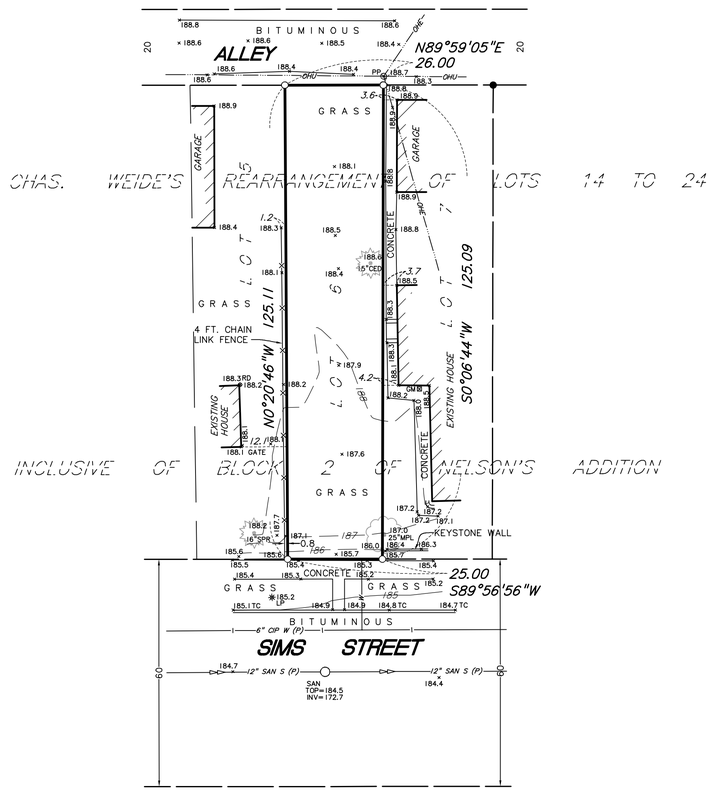
LEGEND

○	Denotes iron monument set marked with P.L.S. No. 44890
●	Denotes found iron monument
CIP	Denotes cast iron pipe
GM	Denotes gas meter
INV	Denotes structure invert
LP	Denotes light pole
OHE	Denotes overhead electric line
OHU	Denotes overhead utility line
(P)	Denotes per plan
PP	Denotes power pole
RD	Denotes roof drain
SAN	Denotes sanitary manhole
SAN S	Denotes sanitary sewer
TC	Denotes top of concrete curb
W	Denotes water line
WV	Denotes water valve
CED	Denotes Cedar tree
MPL	Denotes Maple tree
SPR	Denotes Spruce tree



BENCHMARKS (BM)

(City of St. Paul datum)

1.) Top of top nut of fire hydrant at northwest quadrant of Sims Avenue and Forest Street. (east of surveyed area)
Elevation = 185.70 feet

2.) Top of top nut of fire hydrant at northwest quadrant of Case Avenue and Mendota Street. (northwest of surveyed area)
Elevation = 189.04 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 Limited Warranty Deed Doc. No. 2091482)

Lot 6, Chas. Weide's Rearrangment of Lots 14 to 24 inclusive, of Block 2, of Nelson's Addition, Ramsey County, Minnesota

PLAT RECORDING INFORMATION

The plat of Chas. Weide's Rearrangment of Lots 14 to 24 inclusive, of Block 2, of Nelson's Addition was filed of record on June 22, 1885, in Book X of Plats, page 29.

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 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.

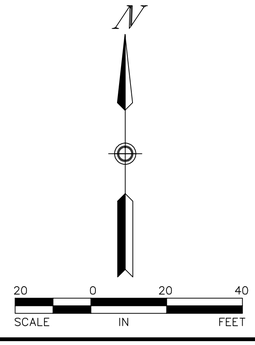
2.) Other underground utilities of which we are unaware may exist. Verify all utilities critical to construction or design.

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 212354336, 212453946 and 212864510.

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 = 3,190 square feet or 0.073 acres



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 4th 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
	MAP	

Drawing Title:
BOUNDARY, LOCATION, TOPOGRAPHIC and UTILITY SURVEY FOR:
HRA - CITY OF ST. PAUL
899 SIMS AVENUE, ST. PAUL, MN

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

Project: 2021-094-3 Bk/Pg: 1118/12	Date: 11/04/2021
Township: 29 Range: 22 Section: 28	Sheet: 1 of 1
File: 20210943001.dwg	

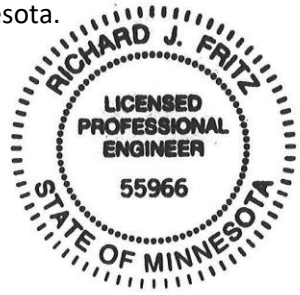
Geotechnical Evaluation Report

Saint Paul HRA Site Home Developments
Various Locations
Saint Paul, Minnesota

Prepared for

City of Saint Paul Department of Planning and Economic Development

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Richard J. Fritz, PE
Project Engineer
License Number: 55966
February 3, 2022

Project B2107713

Braun Intertec Corporation

BRAUN INTERTEC
The Science You Build On.

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
11001 Hampshire Avenue S
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

February 3, 2022 Project B2107713

Mr. Nick Boettcher
City of Saint Paul Department of Planning and Economic Development
15 Kellogg Blvd West, Room 700
Saint Paul, MN 55102

Re: Geotechnical Evaluation
Saint Paul HRA Site Home Developments
Various Locations
Saint Paul, Minnesota

Dear Mr. Boettcher:

We are pleased to present this Geotechnical Evaluation Report for the proposed development of the 11 lots at the addresses listed below.

717 Desoto St, 186 Front Ave, 899 Sims Ave, 1068 Ross Ave, 729 Burr St, 930 York Ave, 231 Front Ave, 1195 Bush Ave, 810 Atlantic St, 695 Cook Ave, and 560 Brunson St.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Richard Fritz at 651.487.7079 (rfritz@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION

Richard J. Fritz, PE
Project Engineer

Steven B. Martin, PE
Senior Engineer

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Appendix

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of the proposed Saint Paul HRA Site Home Development. The development will include single family or duplex style homes consisting of one to three levels above grade and up to one level below grade. We understand the homes will generally include wood framing above grade with masonry or cast in place concrete wall below grade. The following vacant lots are being considered for development.

717 Desoto St, 186 Front Ave, 899 Sims Ave, 1068 Ross Ave, 729 Burr St, 930 York Ave, 231 Front Ave, 1195 Bush Ave, 810 Atlantic St, 695 Cook Ave, and 560 Brunson St.

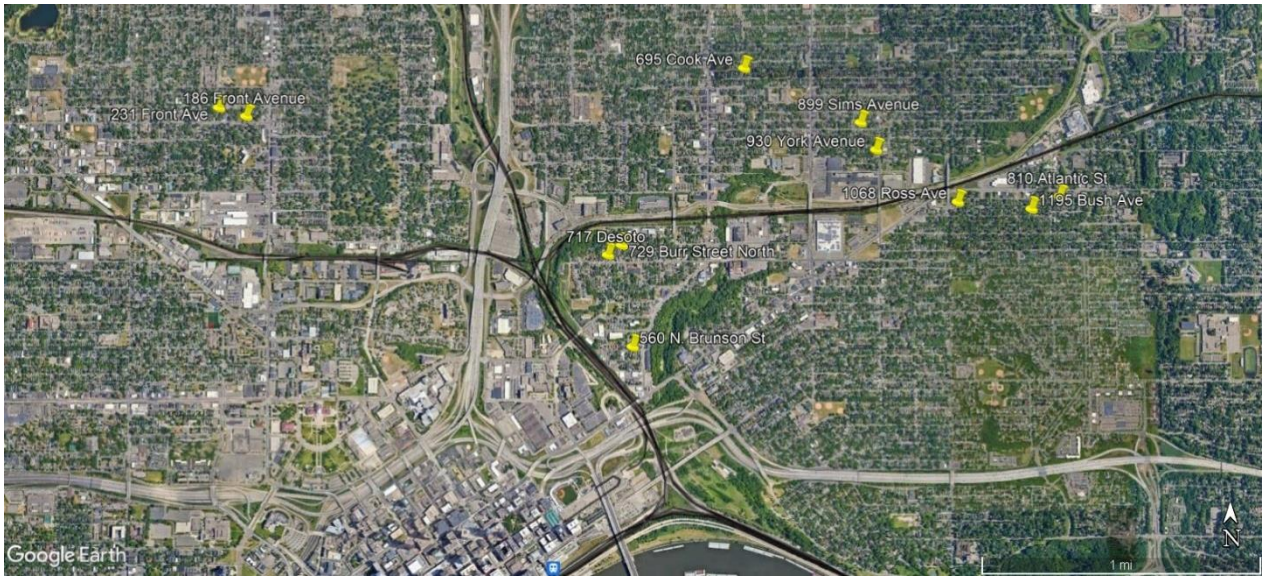
Table 1 provides project details.

Table 1. Building Description

Aspect	Description
Below grade levels	Up to one (Provided)
Above grade levels	One to three (Provided)
Wall loads (kips)	Less than 4 (Assumed)
Nature of construction	Wood framing above with poured concrete or masonry basement or foundation walls (Provided)
Cuts or fills for buildings	Less than 3 feet (Assumed)
Tolerable building settlement	Less than 1 inch (Assumed)

The map below shows the locations of all 11 proposed sites.

Figure 1. Site Location Map



Map available through Google Earth.

A.2. Site Conditions and History

Currently, the 11 sites exist as open lots in neighborhoods on the north side of Saint Paul. It is assumed that previous houses existed at these sites and have since been demolished.

A.3. Purpose

The purpose of our geotechnical evaluation was to characterize subsurface geologic conditions at selected boring locations, evaluate their impact on the project, and provide and provide geotechnical recommendations for the design and construction of the proposed residential structures.

A.4. Background Information and Reference Documents

We reviewed the following information:

- List of the proposed addresses provided by the City of Saint Paul.
- Discussions with Nick Boettcher of the City of Saint Paul regarding the proposed construction on the 11 sites.

In addition to the provided sources, we have used several publicly available sources of information including:

- Geologic Atlas of Ramsey County Minnesota, University of Minnesota, 1992.
- Aerial Imagery of the sites available through Ramsey County GIS.
- Aerial imagery of the sites available Google Earth.
- Ground surface elevations collected via LiDAR technology by the Minnesota Department of Natural Resources.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal for a Geotechnical Evaluation to the City of Saint Paul Department of Planning and Economic Development, dated August 12, 2021, and authorized on August 17, 2021. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.
- Staking and clearing the exploration location of underground utilities. We selected and staked the new exploration locations. We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.
- Performing 22 standard penetration test (SPT) borings, denoted as ST-1 to ST-22, to nominal depths of 20 feet below grade across the sites.

- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.

- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for structure subgrade preparation and the design of foundations, floor slabs, and utilities.

Our scope of services did not include environmental services or testing and our geotechnical personnel performing this evaluation are not trained to provide environmental services or testing. We can provide environmental services or testing at your request.

B. Results

B.1. Geologic Overview

The proposed sites are generally underlain with glacial soils consisting of sandy glacial outwash soils and clayey glacial till soils. However, the St. Paul area can contain isolated areas of organic deposits from previous swamps or low lying areas. We based the geologic origins used in this report on the soil types, laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Boring Results

Table 2 provides a summary of the soil boring results, in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheet in the Appendix includes definitions of abbreviations used in Table 2.

Table 2. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Topsoil fill	SM	---	▪ Predominantly SM. ▪ Dark brown to black. ▪ Thicknesses at boring locations varied from 0.2 to 2 feet. ▪ Generally moist.
Fill	SP, SP-SM, SM, SC	2 to 43 BPF	▪ General penetration resistance of 5 to 12 BPF. ▪ Generally moist. ▪ Not present in all borings. ▪ Thicknesses, where encountered, at boring locations varied from 4 to 6.5 feet. ▪ Existing fill contained variable amounts of concrete debris. ▪ At lots that previously contained homes with basements fill depths may be deeper than indicated in the borings.
Swamp deposits	PT, OL	Weight of Hammer to 6 BPF	▪ Encountered in Borings ST-3 and ST-4 performed at 186 Front Avenue. ▪ Fibrous peat and organic silt with shells. ▪ Thicknesses at boring locations varied from 14 to 18 feet.
Alluvial	ML	2 BPF	▪ Encountered below the swamp deposits in ST-3 and ST-4 at 186 Front Avenue. ▪ Generally wet.
Glacial deposits	SP, SP-SM, SM	2 BPF to 50 blows for 6 inches of penetration	▪ General penetration resistance of 16 to 20 BPF. ▪ Intermixed layers of glacial outwash and till. ▪ Variable amounts of gravel; may contain cobbles and boulders. ▪ Generally moist to wet.
	SC, CL	5 BPF to 50 blows for 6 inches of penetration	
Bedrock	Limestone	---	▪ Bedrock potentially encountered in ST-21 and ST-22. However, rock coring would be needed to confirm the presence of bedrock as the borings could have potentially met refusal on boulders or limestone floats near the bedrock surface.

*Abbreviations defined in the attached Descriptive Terminology sheet.

For simplicity in this report, we define existing fill to mean existing, uncontrolled, or undocumented fill.

B.3. Groundwater

Table 3 summarizes the depths where we observed groundwater; the attached Log of Boring sheets in the Appendix also include this information and additional details. At the time of drilling groundwater was only encountered in Borings ST-3 and ST-4 at 186 Front Avenue. The remaining sites did not encounter groundwater at the time of drilling.

Table 3. Groundwater Summary

Location	Surface Elevation	Measured or Estimated Depth to Groundwater (ft)	Corresponding Groundwater Elevation (ft)
ST-3	854	12	842
ST-4	855	13	842

B.4. Laboratory Test Results

The boring logs show the results of laboratory testing we performed, next to the tested sample depth.

The moisture content of the near surface soils varied from approximately 3 to 28 percent, indicating that the materials varied from below to well above their probable optimum moisture content.

Our mechanical analyses indicated that the near surface soils contained 2 to 96 percent silt and clay by weight.

Organic content tests indicated that the swamp deposit soils in ST-3 and ST-4 contained 4 to 17 percent organic content by weight.

Liquid limits determined for the glacial till soils in ST-15 and ST-16 ranged from 36 to 44; the plastic limits tested were 22. These results indicate that the glacial till is a lean clay.

C. Recommendations

C.1. Site Specific Recommendations

C.1.a. 717 Desoto Street

Borings ST-1 and ST-2 were performed at 717 Desoto Street. Boring ST-1 initially encountered 1 1/2 feet of topsoil over fill soils to a depth of 4 feet, Boring ST-2 encountered 1/2 foot of topsoil. Below the topsoil and fill the borings encountered layers of glacial outwash and glacial till soils. The glacial outwash and till soils are considered suitable for construction of the proposed structures on typical spread footings. The topsoil and fill soils should be removed below the proposed structure, subgrades should then be moisture conditioned and compacted prior to placing any structural fill or structures. Based on Boring ST-1 the fill soil encountered is likely suitable for reuse as structural fill. Although not encountered in Borings ST-1 and ST-2, any rubble from previous structures encountered in the fill should be separated and not reused in structural fill. Foundations can be sized for an allowable bearing capacity of 2,500 pounds per square foot (psf).

C.1.b. 186 Front Avenue

Borings ST-3 and ST-4 were performed at 186 Front Avenue. Borings ST-3 and ST-4 initially encountered about 5 to 10 inches of topsoil over about 6 1/2 feet of fill soils. Below the fill both borings encountered layers of peat over organic clay swamp deposit soils. A layer of very loose alluvial silt underlaid the swamp deposit soils in both borings. Below the swamp deposit and silt soils the borings encountered poorly graded sand glacial outwash soils.

The swamp deposit and very loose alluvial soils are not considered suitable for support of the proposed structures. Based on the depth of the unsuitable soils and the presence of groundwater at a depth of about 11 to 12 feet below the surface it is likely that structures on this site would need to be supported on a deep foundation system such as helical piers. Helical piers are typically designed by an engineer working for a specialty contractor. Due to the many proprietary systems with some competing design approaches, we recommend using a performance-based specification for helical piles, along with design-build contracting. We recommend requiring the contractor to have at least five years of experience in performing this work, and to demonstrate performing the proposed protection system(s) on at least three previous projects of similar size and scope. The specifications should require the design engineer be licensed in the project state. We can assist you with developing a list of pre-qualified contractors prior to bidding or with reviewing contractor experience as part of the bidding process.

We recommend requiring the helical piles to extend at least 5 feet below existing fill or swamp deposits. We recommend including a contingency in the project budget to account for installation difficulty and possibly additional piles.

In fine-grained, waterbearing sands, the helical piles may "run", or not achieve the anticipated torque resistance at the design depths. This can lead to piles extending significantly beyond the estimated installation depth. Therefore, we recommend including a contingency in the project budget to account for piles longer than the plan.

C.1.c. 899 Sims Avenue

Borings ST-5 and ST-6 were performed at 899 Sims Avenue. Borings ST-5 and ST-6 initially encountered about 11 and 5 inches of topsoil, respectively. Below the topsoil both borings encountered 4 feet of clayey sand fill soils. Below the fill Boring ST-5 encountered lean clay glacial till soils to a termination depth of 21 feet, and Boring ST-6 encountered poorly graded sand with silt outwash soils to an approximate depth of 16 1/2 feet with clayey sand glacial till soils encountered to a termination depth of 21 feet.

The native glacial soils are generally suitable for support of the proposed structures on typical spread footings. The existing topsoil and fill soils should be removed, and the exposed glacial soils should be moisture conditioned and compacted prior to placement of additional fill or the proposed structures. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-5 and ST-6, any rubble from previous structures encountered in the fill should be separated and not reused in structural fill. Foundations can be sized for an allowable bearing capacity of 2,500 pounds per square foot (psf).

C.1.d. 1068 Ross Avenue

Borings ST-7 and ST-8 were performed at 1068 Ross Avenue. Borings ST-7 and ST-8 initially encountered about 2 and 11 inches of topsoil, respectively. Below the topsoil both borings encountered layers of sandy glacial outwash soils to a termination depth of 21 feet. The glacial outwash soils are considered suitable for support of the proposed structures on typical spread footings. In preparation for placement of footings the exposed foundation bottoms should be moisture conditioned and surface compacted prior to placement of any structure footings. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf). Although not encountered within the borings, existing fill soils from previous structure foundation or basements should be removed and replaced prior to placement of the new proposed structures.

C.1.e. 729 Burr Street

Borings ST-9 and ST-10 were performed at 729 Burr Street. Borings ST-9 and ST-10 initially encountered 10 and 5 inches of topsoil, respectively. Below the topsoil both borings encountered about 4 feet of poorly graded sand with silt fill soils. Below the topsoil and fill both borings encountered poorly graded sand glacial outwash soils to a termination depth of 21 feet. The glacial outwash soils are considered suitable for support of the proposed structures on typical spread footings. Prior to placing structures the existing topsoil and fill should be removed from below the proposed structures, once exposed subgrade soils should be moisture conditioned and surface compacted prior to placing any structures or required structural fill. Based on the borings, the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-9 and ST-10, debris from previous structures in the fill should be separated and not reused in structural fill. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.1.f. 930 York Avenue

Borings ST-11 and ST-12 were performed at 930 York Avenue. Borings ST-11 and ST-12 initially encountered 8 and 5 inches of topsoil, respectively. Below the topsoil ST-11 encountered poorly graded sand fill soil to a depth of 4 feet with layers of glacial till and outwash soils extending to a termination depth of 21 feet. Boring ST-12 encountered silty sand fill soils to a depth of 6 1/2 feet with silty sand glacial outwash soils below. ST-12 encountered auger refusal at a depth of 11 feet, refusal was likely encountered on a cobble or boulder within the silty sand glacial outwash soils.

The native glacial soils are generally suitable for support of the proposed structures on typical spread footings. The existing topsoil and fill soils should be removed, and the exposed glacial soils should be moisture conditioned and compacted prior to placement of additional fill or the proposed structures. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Boring ST-12 encountered concrete debris within the samples recovered from the fill soils, it is likely that the quantity of debris is greater than indicated by the samples. If debris cannot be separated from the fill soils, a non-organic debris free fill soil should be imported. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.1.g. 231 Front Avenue

Borings ST-13 and ST-14 were performed at 231 Front Avenue. Borings ST-13 and ST-14 initially encountered 11 to 12 inches of topsoil, respectively, with layers of glacial outwash and glacial till soils below. The glacial outwash and till soils are considered suitable for support of the proposed structures on typical spread footings. In preparation for placement of footings, the exposed foundation bottoms should be moisture conditioned and surface compacted prior to placement of any structure footings.

Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf). Although not encountered within the borings, any existing fill soils from previous structure foundation or basements encountered, should be removed and replaced prior to placement of the new proposed structures.

C.1.h. 1195 Bush Avenue

Borings ST-15 and ST-16 were performed at 1195 Bush Avenue. Borings ST-15 and ST-16 both encountered about 1 foot of topsoil over silty sand fill soils to a depth of 4 feet below the surface. Below the fill both borings encountered layers of glacial outwash and glacial till soils to a termination depth of 21 feet. The glacial outwash and till soils are considered suitable for support of the proposed structures on typical spread footings. Prior to placing structures the existing topsoil and fill should be removed from below the proposed structures, once exposed subgrade soils should be moisture conditioned and surface compacted prior to placing any structures or required structural fill. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-15 and ST-16, debris from previous structures should be separated and not reused in the structural fill. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.1.i. 810 Atlantic Street

Borings ST-17 and ST-18 were performed at 810 Atlantic Street. Borings ST-17 and ST-18 both encountered about 11 inches of topsoil over silty sand and poorly graded sand with silt fill soils to a depth of 4 feet below the surface. Below the topsoil and fill both borings encountered poorly graded glacial outwash soils to a termination depth of 21 feet. The glacial outwash soils are considered suitable for support of the proposed structures on typical spread footings. Prior to placing structures, the existing topsoil and fill should be removed from below the proposed structures, once exposed, subgrade soils should be moisture conditioned and surface compacted prior to placing any structures or required structural fill. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-17 and ST-18, debris from previous structures should be separated and not reused in the structural fill. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.1.j. 695 Cook Avenue

Borings ST-19 and ST-20 were performed at 695 Cook Avenue. Boring ST-19 encountered 11 inches of topsoil over clayey sand and poorly graded sand fill soils to a depth of 6 1/2 feet. Below the fill Boring ST-19 encountered clayey sand glacial till to a termination depth of 21 feet. Boring ST-20 encountered about 2 feet of topsoil over lean clay and clayey sand glacial till to a termination depth of 21 feet. The glacial till soils are considered suitable for support of the proposed structures on typical spread footings.

Prior to placing structures, the existing topsoil and fill should be removed from below the proposed structures, once exposed, subgrade soils should be moisture conditioned and surface compacted prior to placing any structures or required structural fill. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-19 and ST-20, debris from previous structures should be separated and not reused in the structural fill. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.1.k. 560 Brunson Street

Borings ST-21 and ST-22 were performed at 560 Brunson Street. Borings ST-21 and ST-22 encountered 12 inches and 8 inches of topsoil, respectively, over silty sand fill soil to a depth of 4 feet. Below the fill both borings encountered poorly graded sand and poorly graded sand with silt glacial outwash soil. Boring ST-19 encountered limestone fragments within the glacial outwash soils and encountered auger refusal at a depth of 15 feet. Boring ST-22 encountered sampler refusal at a depth of 20 feet. Both borings encountered relatively high blow counts and difficult drilling. The glacial outwash soils are considered suitable for support of the proposed structures on typical spread footings. Prior to placing structures the existing topsoil and fill should be removed from below the proposed structures, once exposed, subgrade soils should be moisture conditioned and surface compacted prior to placing any structures or required structural fill. Based on the borings the existing debris free non-organic fill soils are likely suitable for reuse as structural fill. Although not encountered in Borings ST-21 and ST-22, debris from previous structures is should be separated and not reused in the structural fill. Foundations can be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf).

C.2. Site Grading and Subgrade Preparation

C.2.a. Building Subgrade Excavations (For all site except 186 Front Avenue)

We recommend removing topsoil and existing fill from below the proposed homes and their oversize areas. We also recommend having a geotechnical engineer, or an engineering technician working under the direction of a geotechnical engineer, (geotechnical representative) evaluate the suitability of exposed subgrade soils to support the proposed structure.

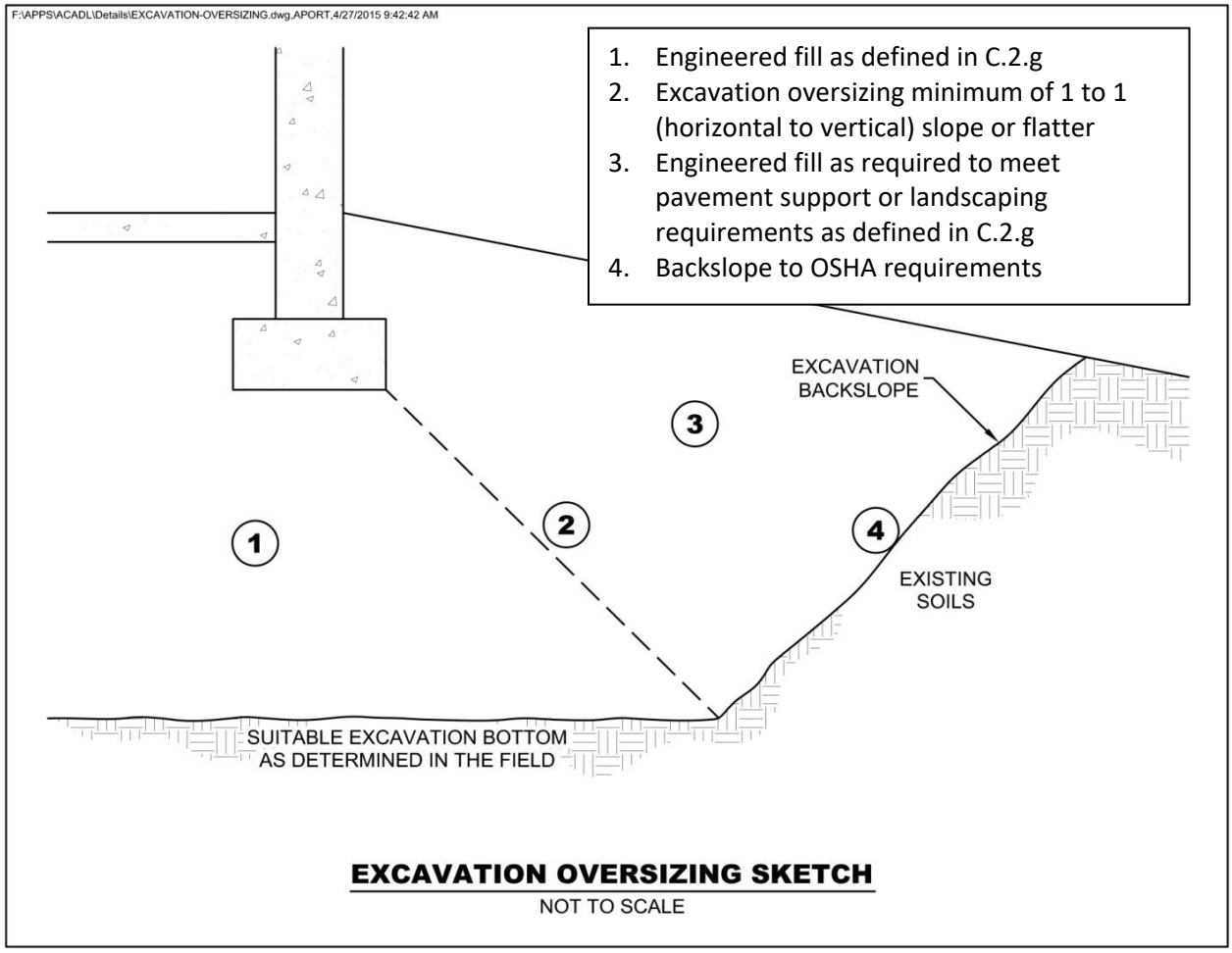
Excavation depths will vary between the borings. Portions of the excavations may also extend deeper than indicated by the borings. A geotechnical representative should observe the excavations to make the necessary field judgments regarding the suitability of the exposed soils.

Prior to the placement of engineered fill or footings, we recommend moisture conditioning and compacting the exposed soils in the bottoms of the excavations to a minimum of 98 percent of the standard Proctor. Areas that yield or pump during surface compaction may require additional subcutting.

C.2.b. Excavation Oversizing

When removing unsuitable materials below structures or pavements, we recommend the excavation extend outward and downward at a slope of 1H:1V (horizontal:vertical) or flatter. See Figure 2 for an illustration of excavation oversizing.

Figure 2. Generalized Illustration of Oversizing



C.2.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will generally consist of layers of sandy and clayey soils. These soils are typically considered Type C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1 1/2H:1V. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

C.2.d. Excavation Dewatering

Only Borings ST-3 and ST-4 encountered groundwater and the water was encountered below the assumed depths of the proposed construction. However, the more cohesive clayey and silty soils encountered on many of the sites will hold water that is allowed to drain to or collect onsite from weather events. If water is encountered in or allowed to collect within excavation onsite it should be removed promptly to prevent disturbance of the underlying soils.

C.2.e. Building Subgrade Preparation for 186 Front Avenue

Assuming helical piles are utilized for structure support at this site, we recommend stripping the surface vegetation, root zones and surficial topsoil below the proposed structures. The exposed subgrade should then be moisture conditioned and surface compacted to at least 98 percent of the standard Proctor maximum dry density prior to the placement of structural components or engineered fill. Helical piles should be utilized for support of ancillary structures (garages, decks, etc.) as well as the house.

Note that the helical designer may require additional subgrade preparation methods as part of their design.

C.2.f. Pavement and Exterior Slab Subgrade Preparation

We recommend the following steps for pavement and exterior slab subgrade preparation, understanding the sites will have grade changes of 3 feet or less. Note that project planning may need to require additional subcuts to limit frost heave.

1. Strip unsuitable soils consisting of topsoil, organic soils, vegetation, existing structures, and pavements from the area, within 3 feet of the surface of the proposed pavement grade.

2. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

3. Slope subgrade soils to areas of sand or drain tile to allow the removal of accumulating water.

4. Scarify, moisture condition and surface compact the subgrade with at least 100 percent of the standard Proctor density.

5. Place pavement engineered fill to grade and compact in accordance with Section C.2.g to bottom of pavement and exterior slab section. See Section C.6 for additional considerations related to frost heave.

6. Proofroll the pavement or exterior slab subgrade as described in Section C.2.f.

C.2.g. Pavement Subgrade Proofroll

After preparing the subgrade as described above and prior to the placement of the aggregate base, we recommend proofrolling the subgrade soils with a fully loaded tandem-axle truck. We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support pavements.

The contractor should correct areas that display excessive yielding or rutting during the proofroll, as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and recompaction, subcutting and replacement with soil or crushed aggregate, chemical stabilization and/or geotextiles. We recommend performing a second proofroll after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

C.2.h. Engineered Fill Materials and Compaction

Table 4 below contains our recommendations for engineered fill materials.

Table 4. Engineered Fill Materials*

Locations To Be Used	Engineered Fill Classification	Possible Soil Type Descriptions	Gradation	Additional Requirements
▪ Below foundations ▪ Below interior slabs	Structural fill	SP, SP-SM, SM, SC, CL	100% passing 2-inch sieve	< 2% Organic Content (OC)
▪ Drainage layer ▪ Non-frost-susceptible	▪ Free-draining ▪ Non-frost-susceptible fill	GP, GW, SP, SW	100% passing 1-inch sieve < 50% passing #40 sieve < 5% passing #200 sieve	< 2% OC
Behind below-grade walls, beyond drainage layer	Retained fill	SP, SW, SP-SM, SW-SM, SM	100% passing 3-inch sieve < 20% passing #200 sieve	< 2% OC Plasticity Index (PI) < 4%
Pavements	Pavement fill	SP, SM, SC, CL	100% passing 3-inch sieve	< 2% OC PI < 15%
Below landscaped surfaces, where subsidence is not a concern	Non-structural fill	SP, SP-SM, SM, SC, CL	100% passing 6-inch sieve	< 10% OC

* More select soils comprised of coarse sands with < 5% passing #200 sieve may be needed to accommodate work occurring in periods of wet or freezing weather.

We recommend spreading engineered fill in loose lifts of approximately 8 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 5. The project documents should specify relative compaction of engineered fill, based on the structure located above the engineered fill, and vertical proximity to that structure.

Table 5. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D698 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points	
		< 12% Passing #200 Sieve (typically SP, SP-SM)	> 12% Passing #200 Sieve (typically CL, SC, ML, SM)
Below foundations, interior slabs, and oversizing zones	98	±3	-1 to +3
Within 3 feet of pavement subgrade	100	±3	-1 to +3
More than 3 feet below pavement subgrade	95	±3	±3
Below landscaped surfaces	90	±5	±4
Adjacent to below-grade wall	95*	±3	-1 to +3

*Increase compaction requirement to meet compaction required for structure supported by this engineered fill.

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

C.2.i. Special Inspections of Soils

We recommend including the site grading and placement of engineered fill within the building pad under the requirements of Special Inspections, as provided in Chapter 17 of the International Building Code, which is part of the Minnesota State Building Code. Special Inspection requires observation of soil conditions below engineered fill or footings, evaluations to determine if excavations extend to the anticipated soils, and if engineered fill materials meet requirements for type of engineered fill and compaction condition of engineered fill. A licensed geotechnical engineer should direct the Special Inspections of site grading and engineered fill placement. The purpose of these Special Inspections is to evaluate whether the work is in accordance with the approved Geotechnical Report for the project. Special Inspections should include evaluation of the subgrade, observing preparation of the subgrade (surface compaction or dewatering, excavation oversizing, placement procedures and materials used for engineered fill, etc.) and compaction testing of the engineered fill.

C.3. Spread Footings

Table 6 below contains our recommended parameters for foundation design for all sites except 186 Front Avenue.

Table 6. Recommended Spread Footing Design Parameters

Item	Description
Maximum net allowable bearing pressure (psf)	As discussed in Sections C.1a to C.1.k above
Minimum factor of safety for bearing capacity failure	3.0
Minimum width (inches)	24 inches
Minimum embedment below final exterior grade for heated structures (inches)	42 inches
Minimum embedment below final exterior grade for unheated structures or for footings not protected from freezing temperatures during construction (inches)	60 inches
Total estimated settlement (inches)	Less than 1 inch
Differential settlement	Typically about 2/3 of total settlement*

* Actual differential settlement amounts will depend on final loads and foundation layout.

C.4. Below-Grade Walls

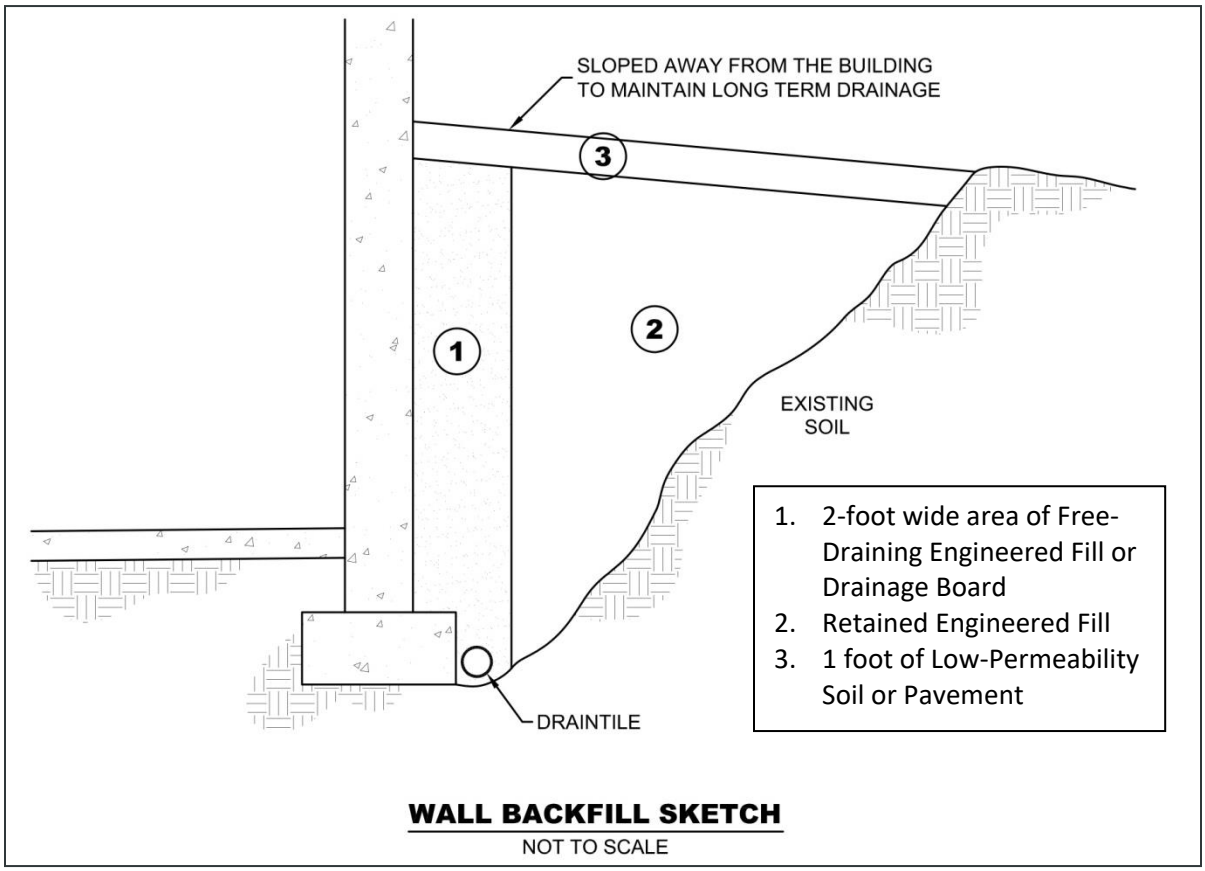
The project documents should indicate if walls need bracing prior to filling and allowable unbalanced fill heights.

C.4.a. Drainage Control

We recommend installing drain tile to remove water behind the below-grade walls, at the location shown in Figure 3. The below-grade wall drainage system should also incorporate free-draining, engineered fill or a drainage board placed against the wall and connected to the drain tile.

Even with the use of free-draining, engineered fill, we recommend general waterproofing of below-grade walls that surround occupied or potentially occupied areas because of the potential cost impacts related to seepage after construction is complete.

Figure 3. Generalized Illustration of Wall Engineered Fill



The materials listed in the sketch should meet the definitions in Section C.2.g. Low-permeability material is capable of directing water away from the wall, like clay, topsoil, or pavement. The project documents should indicate if the contractor should brace the walls prior to filling and allowable unbalanced fill heights.

As shown in Figure 3, we recommend Zone 2 consist of retained, engineered fill, and this material will control lateral pressures on the wall. However, we are also providing design parameters for using other engineered fill material. If final design uses non-sand material for engineered fill, project planning should account for the following items:

- Other engineered fill material may result in higher lateral pressure on the wall.
- Other engineered fill material may be more difficult to compact.
- Post-construction consolidation of other engineered fill material may result in settlement-related damage to the structures or slabs supported on the engineered fill. Post-construction settlement of other engineered fill material may also cause drainage towards the structure. The magnitude of consolidation could be up to about 3 percent of the wall fill thickness.

C.4.b. Configuring and Resisting Lateral Loads

Below-grade wall design can use active earth pressure conditions if the walls can rotate slightly. If the wall design cannot tolerate rotation, then design should use at-rest earth pressure conditions. Rotation up to 0.002 times the wall height is generally required for walls supporting sand. Rotation up to 0.02 times the wall height is required when wall supports clay.

Table 7 presents our recommended lateral coefficients and equivalent fluid pressures for wall design of active, at-rest and passive earth pressure conditions. The table also provides recommended wet unit weights and internal friction angles. Designs should also consider the slope of any engineered fill and dead or live loads placed behind the walls within a horizontal distance that is equal to the height of the walls. Our recommended values assume the wall design provides drainage so water cannot accumulate behind the walls. The construction documents should clearly identify what soils the contractor should use for engineered fill of walls.

Table 7. Recommended Below-Grade Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight (pcf)	Friction Angle (degrees)	Active Lateral Equivalent Fluid Pressure (pcf)	At-Rest Lateral Equivalent Fluid Pressure (pcf)	Passive Lateral Equivalent Fluid Pressure* (pcf)
Sand (SP, SP-SM)	120	32	35	55	390
Silty Sand (SM)	120	30	40	60	360
Clay (SC, CL)	125	28	45	65	345

* Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Sliding resistance between the bottom of the footing and the soil can also resist lateral pressures. We recommend assuming a sliding coefficient equal to 0.35 between the concrete and soil.

The values presented in this section are un-factored.

C.5. Interior Slabs

C.5.a. Moisture Vapor Protection

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If project planning includes using floor coverings or coatings, we recommend placing a vapor retarder or vapor barrier immediately beneath the slab. We also recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

C.5.b. Radon

In preparation for radon mitigation systems, we recommend that slabs on grade be constructed over a layer of gas permeable material consisting of a minimum of 4 inches of either clean aggregate material or sand. The aggregate material should consist of rock no larger than 2 inches and no smaller than 1/4 inch. Sand should have less than 50 percent of the particles by weight passing a #40 sieve and less than 5 percent of the particles by weight passing a #200 sieve. Above the gas permeable aggregate or sand, a polyethylene sheeting (6-mil minimum) should be placed. The sheeting should be properly lapped and penetrations through the sheeting sealed. Penetrations through the slab and foundation walls should also be sealed.

C.6. Frost Protection

C.6.a. General

Most locations will have some silty or clayey soils underlying exterior slabs and pavements. We consider silty and clayey soils moderately to highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated, due to surface runoff or infiltration, or are excessively wet in situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could affect design drainage patterns and the performance of exterior slabs and pavements, as well as any isolated exterior footings and piers.

Note that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage and irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

C.6.b. Frost Heave Mitigation

To address most of the heave related issues, we recommend setting general site grades and grades for exterior surface features to direct surface drainage away from buildings, across large paved areas and away from walkways. Such grading will limit the potential for saturation of the subgrade and subsequent heaving. General grades should also have enough “slope” to tolerate potential larger areas of heave, which may not fully settle after thawing.

Even small amounts of frost-related differential movement at walkway joints or cracks can create tripping hazards. Project planning can explore several subgrade improvement options to address this condition.

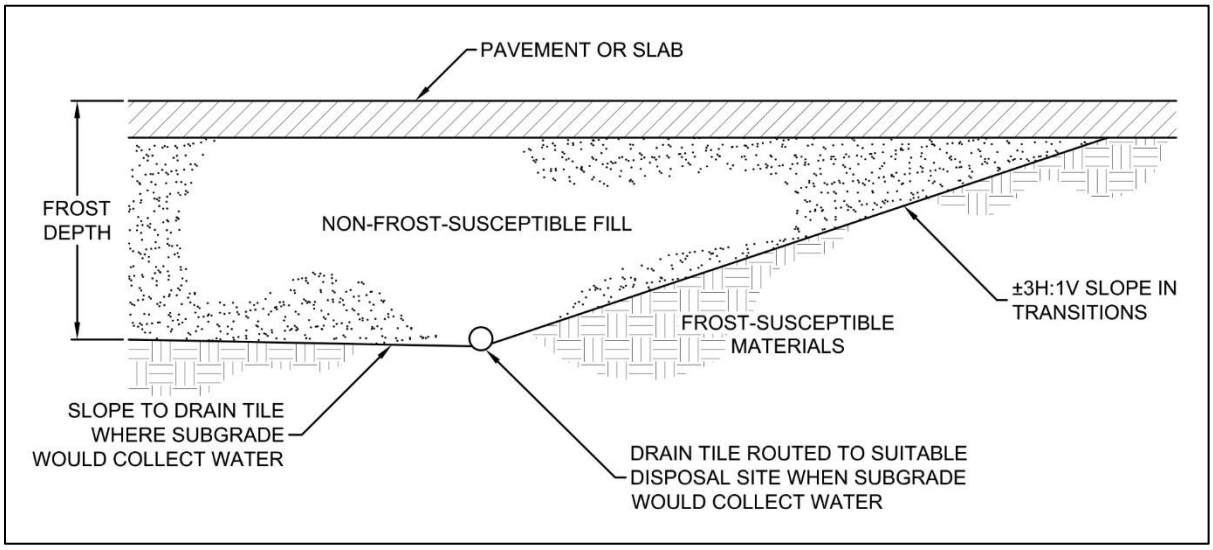
One of the more conservative subgrade improvement options to mitigate potential heave is removing any frost-susceptible soils present below the exterior slab areas down to a minimum depth of 4 feet below subgrade elevations. We recommend filling the resulting excavation with non-frost-susceptible fill. We also recommend sloping the bottom of the excavation toward one or more collection points to remove any water entering the engineered fill. This approach will not be effective in controlling frost heave without removing the water.

An important geometric aspect of the excavation and replacement approach described above is sloping the banks of the excavations to create a more gradual transition between the unexcavated soils considered frost susceptible and the engineered fill in the excavated area, which is not frost susceptible.

The slope allows attenuation of differential movement that may occur along the excavation boundary. We recommend slopes that are 3H:1V, or flatter, along transitions between frost-susceptible and non-frost-susceptible soils.

Figure 4 shows an illustration summarizing some of the recommendations.

Figure 4. Frost Protection Geometry Illustration



Another option is to limit frost heave in critical areas, such as doorways and entrances, via frost-depth footings or localized excavations with sloped transitions between frost-susceptible and non-frost-susceptible soils, as described above.

Over the life of slabs and pavements, cracks will develop and joints will open up, which will expose the subgrade and allow water to enter from the surface and either saturate or perch atop the subgrade soils. This water intrusion increases the potential for frost heave or moisture-related distress near the crack or joint. Therefore, we recommend implementing a detailed maintenance program to seal and/or fill any cracks and joints. The maintenance program should give special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

C.7. Utilities

C.7.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section C.2.g.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, organic soils or perched water at invert grades, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.7.b. Corrosion Potential

Based on our experience, the soils encountered by the borings are moderately corrosive to metallic conduits, but only marginally corrosive to concrete. We recommend specifying non-corrosive materials or providing corrosion protection, unless project planning chooses to perform additional tests to demonstrate the soils are not corrosive.

C.8. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts, and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support, or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

D. Procedures

D.1. Penetration Test Borings

We drilled the penetration test borings with a GeoProbe-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586.

We sealed penetration test boreholes meeting the Minnesota Department of Health (MDH) Environmental Borehole criteria with an MDH-approved grout. We will forward sealing records for those boreholes to the Minnesota Department of Health Well Management Section.

D.2. Exploration Logs

D.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

D.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

D.3. Material Classification and Testing

D.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

D.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

D.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.1.a. Material Strata

We developed our evaluation, analyses, and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation, and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

E.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

E.2. Continuity of Professional Responsibility

E.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

E.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

E.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

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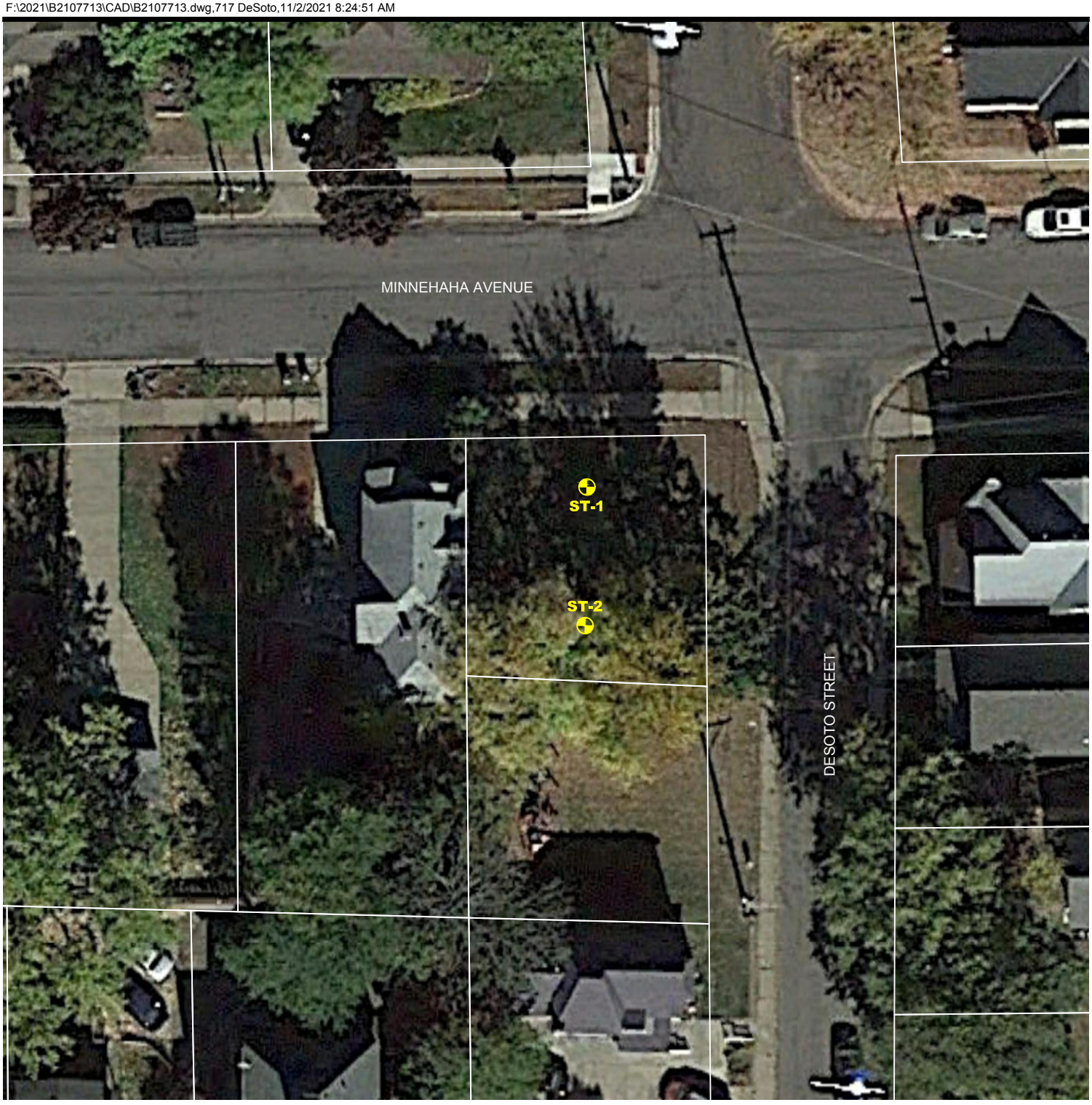

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

BRAUN INTERTEC
The Science You Build On.

11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

717 DeSoto Street

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
717 DeSoto Street
St. Paul, Minnesota

BORING: **ST-1**

LOCATION: See attached sketch

NORTHING: 162762 EASTING: 578190

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/13/21 END DATE: 09/13/21

SURFACE ELEVATION: 836.9 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
835.4		SILTY SAND (SM), fine-grained, dark brown, moist (TOPSOIL FILL)					
1.5		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, brown, moist		1-1-1 (2) 14"		6	
832.9							
4.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, brown, moist, loose to medium dense (GLACIAL OUTWASH)	5	3-3-3 (6) 10"			
				3-3-3 (6) 12"			
			10	3-5-5 (10) 16"			
				7-6-7 (13) 18"			
		With Silt lenses from 14 to 18 feet	15	6-7-3 (10) 18"			
			20	13-12-15 (27) 18"			
815.9							
21.0		END OF BORING Boring immediately grouted	25				Water not observed while drilling.
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
717 DeSoto Street
St. Paul, Minnesota

BORING: **ST-2**

LOCATION: See attached sketch

NORTHING: 162732 EASTING: 578189

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/13/21 END DATE: 09/13/21

SURFACE ELEVATION: 839.1 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
838.6							
0.5		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		POORLY GRADED SAND (SP), fine to medium-grained, with Gravel, light brown, moist, very loose to loose (GLACIAL OUTWASH)		4-3-1 (4) 8"		2	P200=4%
			5	1-1-1 (2) 6"			
				2-1-2 (3) 10"			
			10	2-3-4 (7) 15"			
827.6							
11.5		LEAN CLAY (CL), with Silt lenses, brown, moist, stiff (GLACIAL TILL)		8-6-6 (12) 18"			
825.1							
14.0		SILTY SAND (SM), fine-grained, brown, moist, medium dense (GLACIAL OUTWASH)	15	10-9-9 (18) 18"			
821.1							
18.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, light brown, moist, medium dense (GLACIAL OUTWASH)	20	5-6-8 (14) 13"			
818.1							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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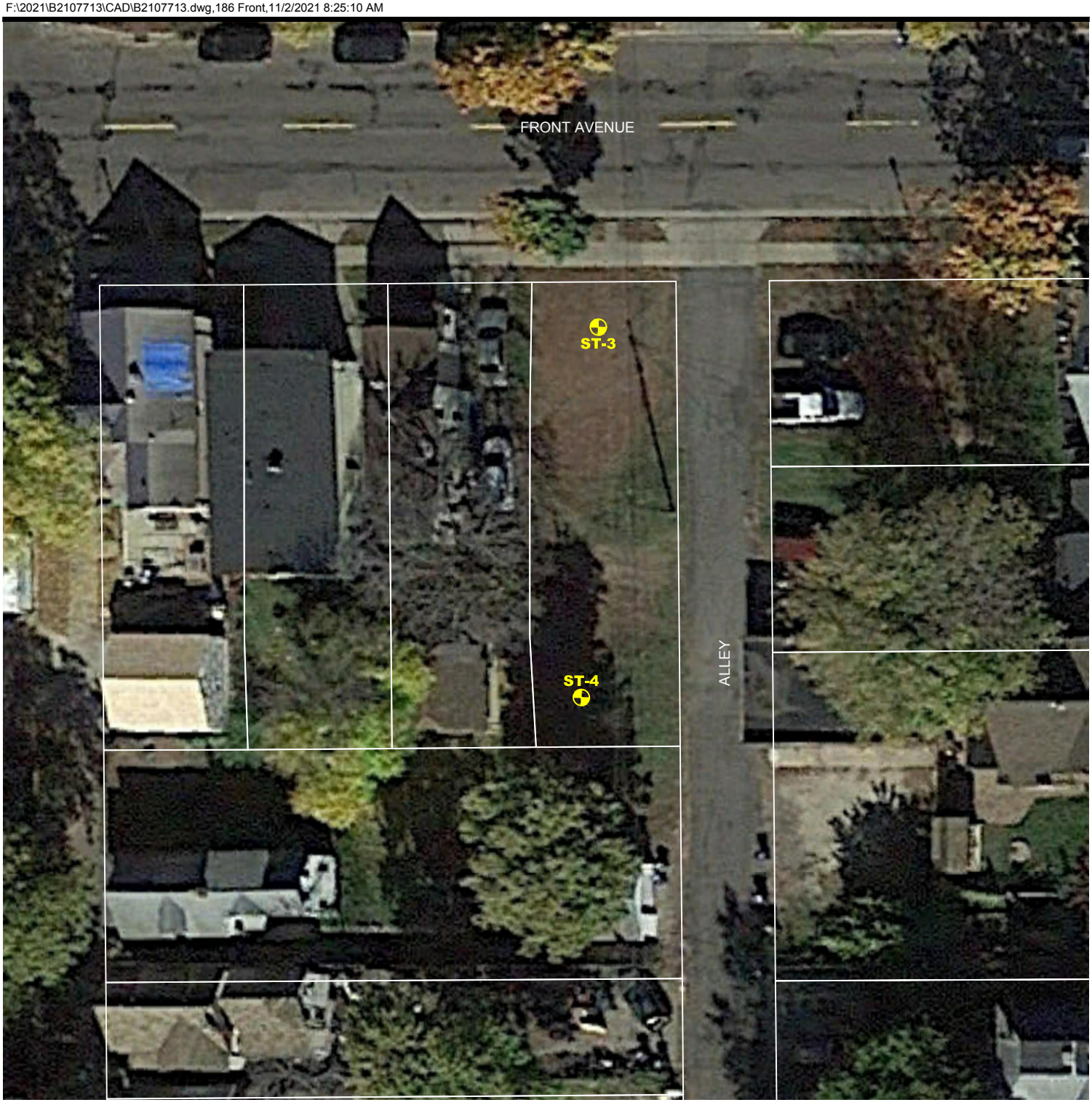

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

186 Front Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
186 Front Avenue
St. Paul, Minnesota

BORING: **ST-3**

LOCATION: See attached sketch

NORTHING: 165386 EASTING: 571269

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/13/21 END DATE: 09/13/21

SURFACE ELEVATION: 854.3 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~853.9~~ 0.4		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		FILL: SANDY LEAN CLAY (CL), with roots, dark brown, moist		2-3-3 (6) 17"			
850.3 4.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist	5	1-2-4 (6) 9"			
847.8 6.5		PEAT (PT), dark brown, moist (SWAMP DEPOSIT)		1-1-1 (2) 18"			
845.3 9.0	▽	ORGANIC CLAY (OL), with roots, and fibers, dark brown, moist to wet (SWAMP DEPOSIT)	10	0-0-1 (1) WOH/12" 18"		28	OC=4%
				0-0-0 WOH/18" 18"			
			15	0-0-0 WOH/18" 18"			
836.3 18.0		SILT (ML), fine-grained, gray, wet, very loose (ALLUVIUM)	20	0-0-2 (2) WOH/12" 18"			
833.3 21.0		POORLY GRADED SAND (SP), fine to coarse-grained, with Gravel, gray, wet, loose (GLACIAL OUTWASH)	25	3-4-5 (9) 18"			
828.3 26.0		END OF BORING Boring immediately grouted	30				Water observed at 12.0 feet with 24.5 feet of tooling in the ground while drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
186 Front Avenue
St. Paul, Minnesota

BORING: **ST-4**

LOCATION: See attached sketch

NORTHING: 165306 EASTING: 571266

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/13/21 END DATE: 09/13/21

SURFACE ELEVATION: 855.1 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
854.3		SILTY SAND (SM), fine to medium-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
0.8		FILL: SILTY SAND (SM), fine to medium-grained, brown, moist		3-3-3 (6) 6"			
851.1							
4.0		FILL: SANDY ELASTIC SILT with GRAVEL (CL), with roots, trace fibers, brown to dark brown, moist	5	2-1-1 (2) 12"		28	
848.6							
6.5		PEAT (PT), dark brown, moist (SWAMP DEPOSIT)		3-1-1 (2) 18"			
846.1							
9.0	▽	ORGANIC CLAY (OL), with Silt lenses, with roots, dark brown, moist to wet, very loose to loose (SWAMP DEPOSIT)	10	0-1-1 (2) WOH/6" 14"		94	OC=17%
				2-2-4 (6) 12"			
841.1							
14.0		SILT (ML), fine-grained, gray, wet, very loose (ALLUVIUM)	15	1-1-1 (2) 18"			
837.1							
18.0		POORLY GRADED SAND (SP), fine to medium-grained, with Gravel, brown, wet, medium dense (GLACIAL OUTWASH)	20	2-5-5 (10) 18"			
834.1							
21.0		END OF BORING Boring immediately grouted					Water observed at 13.0 feet while drilling.
			25				
			30				

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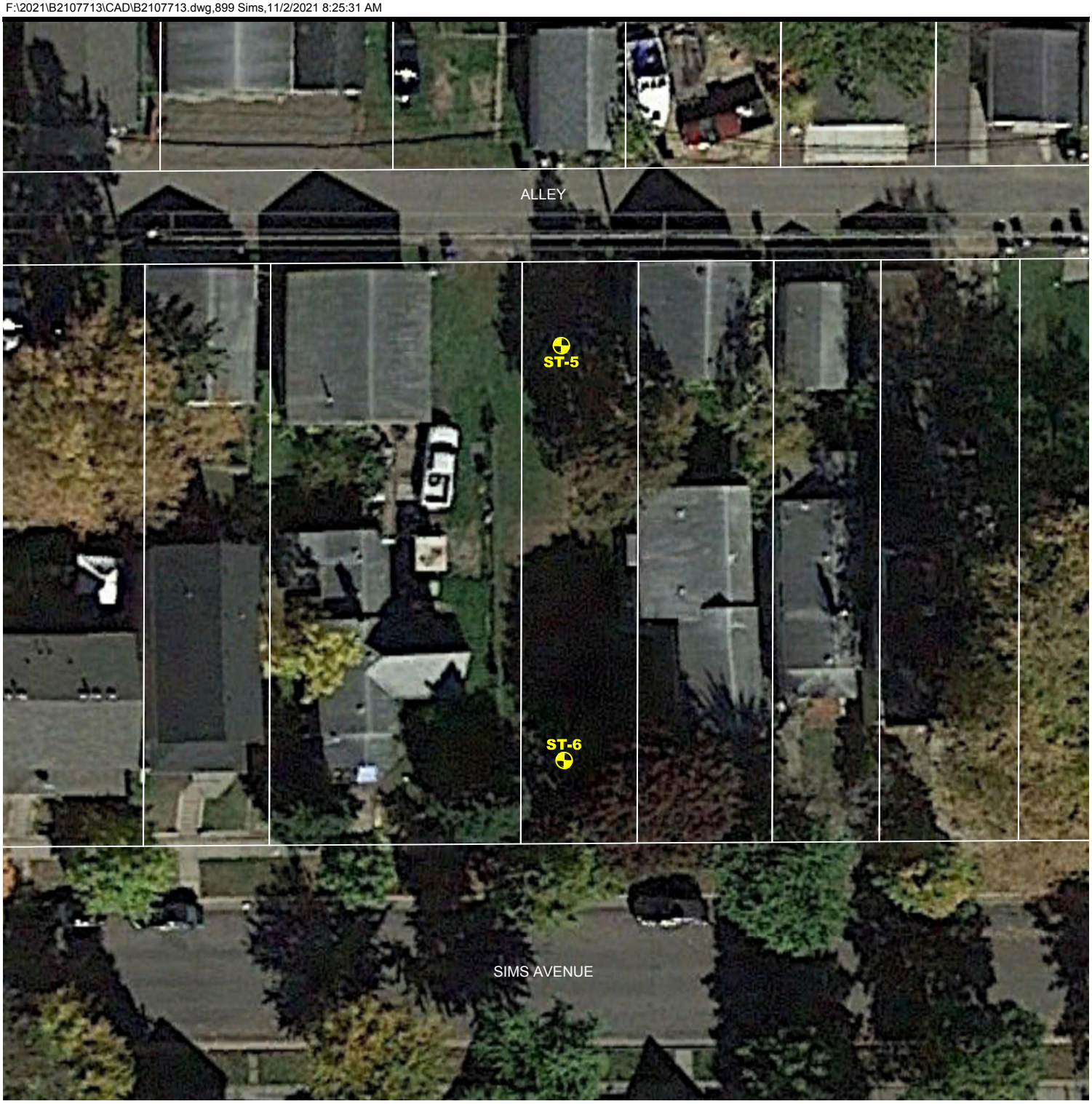

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No: B2107713

Drawing No: B2107713

Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

899 Sims Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
899 Sims Avenue
St. Paul, Minnesota

BORING: **ST-5**

LOCATION: See attached sketch

NORTHING: 165314 EASTING: 583016

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/13/21 END DATE: 09/13/21

SURFACE ELEVATION: 885.6 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
884.7		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
0.9		FILL: CLAYEY SAND (SC), trace organic, dark brown, moist		0-9-4 (13) 16"		16	
881.6							
4.0		SANDY LEAN CLAY (CL), trace Gravel, brown, moist, medium to very stiff (GLACIAL TILL)	5	0-2-3 (5) WOH/6" 16"		15	
		Sand lenses at 7 1/2 feet		2-6-8 (14) 18"			
			10	16-9-9 (18) 18"			
				13-6-5 (11) 18"			
			15	2-3-6 (9) 18"			
			20	3-4-7 (11) 18"			
864.6							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
899 Sims Avenue
St. Paul, Minnesota

BORING: **ST-6**

LOCATION: See attached sketch

NORTHING: 165225 EASTING: 583016

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/14/21 END DATE: 09/14/21

SURFACE ELEVATION: 883.6 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~883.2~~ 0.4		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		FILL: CLAYEY SAND (SC), with Gravel, brown, moist		4-6-4 (10) 12"			
879.6 4.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, trace Gravel, brown, moist, loose to medium dense (GLACIAL OUTWASH)		6-4-4 (8) 16"		7	P200=20%
			5	11-9-8 (17) 18"			
			10	15-12-11 (23) 18"			
				8-11-6 (17) 18"			
867.1 16.5		CLAYEY SAND (SC), fine to medium-grained, brown, moist, stiff to very stiff (GLACIAL TILL)	15	2-3-6 (9) 18"			
			20	9-6-7 (13) 18"			
862.6 21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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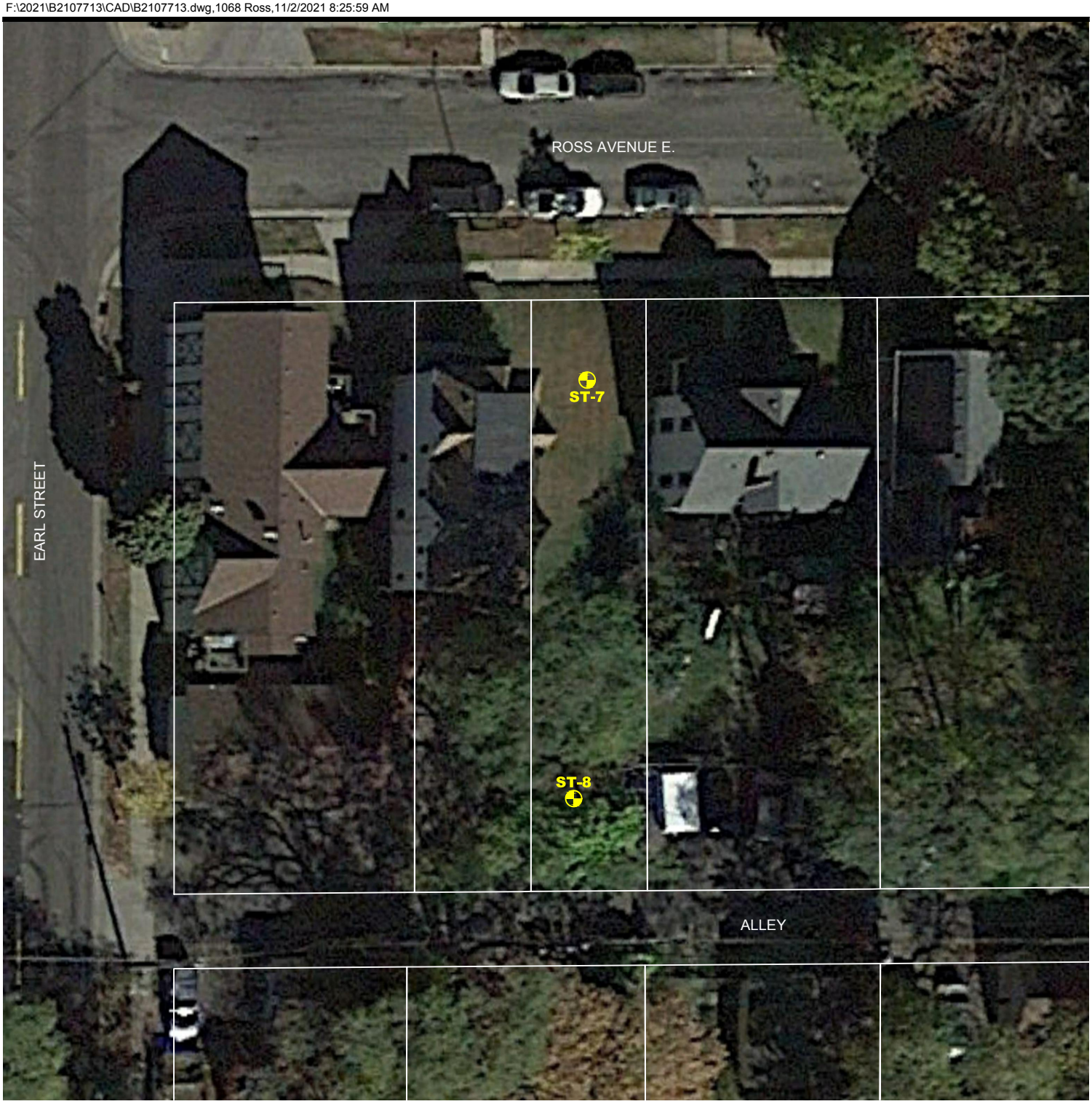

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

1068 Ross Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
1068 Ross Avenue
St. Paul, Minnesota

BORING: **ST-7**

LOCATION: See attached sketch

NORTHING: 163819 EASTING: 584883

DRILLER: M. Barber | LOGGED BY: R. Fritz | START DATE: 09/14/21 | END DATE: 09/14/21

SURFACE ELEVATION: 859.6 ft | RIG: GP-1 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
859.4							
0.2		SILTY SAND (SM), fine to medium-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, medium dense to very dense (GLACIAL OUTWASH)		6-6-6 (12) 10"		3	
5				5-5-5 (10) 7"			
				5-5-5 (10) 0"			
10				11-14-19 (33) 9"			
				9-10-8 (18) 9"			
15				11-8-8 (16) 14"			
20				15-17-14 (31) 12"			
838.6							
21.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted					
25							
30							

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
1068 Ross Avenue
St. Paul, Minnesota

BORING: **ST-8**

LOCATION: See attached sketch

NORTHING: 163729 EASTING: 584880

DRILLER: M. Barber | LOGGED BY: R. Fritz | START DATE: 09/14/21 | END DATE: 09/14/21

SURFACE ELEVATION: 861.7 ft | RIG: GP-1 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
860.8		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.9		SILTY SAND (SM), fine-grained, brown, moist, loose (GLACIAL OUTWASH)		3-2-3 (5) 16"		5	P200=12%
857.7							
4.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist (GLACIAL OUTWASH)	5	5-5-6 (11) 16"			
				5-6-7 (13) 7"			
			10	4-4-3 (7) 15"			
				3-2-5 (7) 15"			
847.7							
14.0		SILTY SAND (SM), fine-grained, brown, moist, medium dense (GLACIAL OUTWASH)	15	27-11-9 (20) 8"			
843.7							
18.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, light brown, moist, medium dense (GLACIAL OUTWASH)	20	20-14-12 (26) 15"			
840.7							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

729 Burr Street

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
729 Burr Street
St. Paul, Minnesota

BORING: **ST-9**

LOCATION: See attached sketch

NORTHING: 162928 EASTING: 578434

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/14/21 END DATE: 09/14/21

SURFACE ELEVATION: 829.5 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
828.7		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
0.8		FILL: SILTY SAND (SM), fine to medium-grained, trace Gravel, dark brown, moist		2-2-3 (5) 7"			
825.5							
4.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, very dense (GLACIAL OUTWASH)		2-2-1 (3) 8"			
			5	2-3-3 (6) 7"			
				5-4-5 (9) 10"			
			10	7-6-6 (12) 14"			
				5-4-4 (8) 16"			
			15				
			20	6-6-5 (11) 15"			
808.5							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
729 Burr Street
St. Paul, Minnesota

BORING: **ST-10**

LOCATION: See attached sketch

NORTHING: 162928 EASTING: 578501

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/14/21 END DATE: 09/14/21

SURFACE ELEVATION: 828.8 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~828.4~~							
0.4		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
		FILL: SILTY SAND (SM), fine-grained, trace Gravel, dark brown, moist		1-3-4 (7) 10"		13	
824.8							
4.0		POORLY GRADED SAND (SC), fine to medium-grained, trace Gravel, light brown, moist, very loose to loose (GLACIAL OUTWASH)	5	3-2-3 (5) 12"			
				1-1-1 (2) 8"			
			10	3-3-3 (6) 12"			
817.3							
11.5		POORLY GRADED SAND (SP), fine-grained, light brown, moist, very loose to medium dense (GLACIAL OUTWASH)		2-2-2 (4) 15"			
			15	3-3-4 (7) 15"			
			20	5-5-6 (11) 17"			
807.8							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

F:\2021\B2107713\CAD\B2107713.dwg,930 York,11/2/2021 8:26:46 AM

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No: B2107713

Drawing No: B2107713

Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

930 York Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
930 York Avenue
St. Paul, Minnesota

BORING: **ST-11**

LOCATION: See attached sketch

NORTHING: 164805 EASTING: 583319

DRILLER: M. Barber | LOGGED BY: R. Fritz | START DATE: 09/14/21 | END DATE: 09/14/21

SURFACE ELEVATION: 868.4 ft | RIG: GP-1 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
867.7		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.7		FILL: POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist		3-2-2 (4) 16"			
864.4							
4.0		CLAYEY SAND (SC), trace Gravel, brown, moist, very stiff (GLACIAL TILL)	5	9-11-10 (21) 15"		6	
				13-12-12 (24) 18"			
			10	9-13-14 (27) 18"			
				5-9-17 (26) 18"			
			15	6-9-13 (22) 17"			
850.4							
18.0		POORLY GRADED SAND (SP), fine to medium-grained, with Gravel, brown, moist, very dense (GLACIAL OUTWASH)	20	33-32-34 (66) 13"			
847.4							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
930 York Avenue
St. Paul, Minnesota

BORING: **ST-12**

LOCATION: See attached sketch

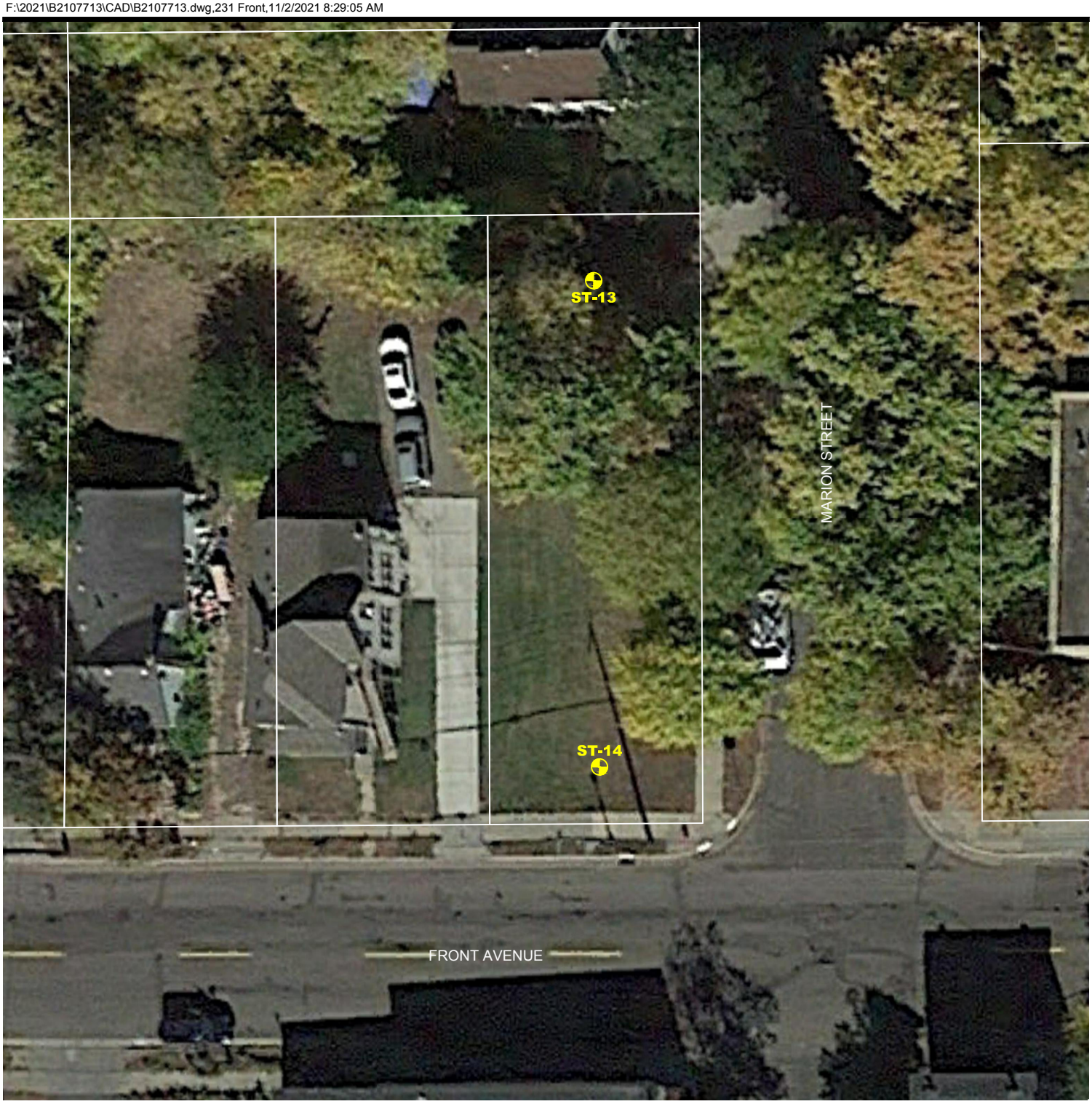
NORTHING: 164716 EASTING: 583318

DRILLER: M. Barber | LOGGED BY: R. Fritz | START DATE: 09/15/21 | END DATE: 09/15/21

SURFACE ELEVATION: 864.7 ft | RIG: GP-1 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~864.3~~ 0.4		SILTY SAND (SM), fine-grained, with concrete rubble, dark brown, moist (TOPSOIL FILL)					
		FILL: SILTY SAND (SM), fine to medium-grained, with concrete rubble, brown, moist		118-20-12 (32) 6"			
5				29-23-20 (43) 53"			
858.2 6.5		SILTY SAND (SM), fine-grained, trace Gravel, brown, moist, dense to very dense (GLACIAL OUTWASH)				4	P200=41%
10				27-27-20 (47) 16"			
853.7 11.0		END OF BORING Boring immediately grouted					Auger met refusal at 11 feet Water not observed while drilling.
15							
20							
25							
30							

F:\2021\B2107713\CAD\B2107713.dwg,231 Front,11/2/2021 8:29:05 AM



DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

231 Front Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
231 Front Avenue
St. Paul, Minnesota

BORING: **ST-13**

LOCATION: See attached sketch

NORTHING: 165568 EASTING: 570751

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/15/21 END DATE: 09/15/21

SURFACE ELEVATION: 864.5 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
863.6		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.9		POORLY GRADED SAND (SP), fine to medium-grained, light brown, moist, loose to medium dense (GLACIAL OUTWASH)		2-3-3 (6) 10"		3	P200=2%
				4-6-3 (9) 0"			
				3-3-7 (10) 8"			
				5-6-6 (12) 8"			
				9-9-7 (16) 8"			
				4-4-3 (7) 12"			
846.5							
18.0		CLAYEY SAND (SC), trace Gravel, brown, moist, very stiff (GLACIAL TILL)		13-10-10 (20) 18"			
843.5							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
231 Front Avenue
St. Paul, Minnesota

BORING: **ST-14**

LOCATION: See attached sketch

NORTHING: 165464 EASTING: 570752

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/15/21 END DATE: 09/15/21

SURFACE ELEVATION: 861.8 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
860.8		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
1.0		FILL: SANDY LEAN CLAY (CL), trace Gravel, brown, moist		5-5-5 (10) 16"		13	P200=96%
857.8							
4.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, loose (GLACIAL OUTWASH)	5	3-3-2 (5) 16"			
855.3							
6.5		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, light brown, moist, loose (GLACIAL OUTWASH)		4-5-4 (9) 12"			
			10	7-5-4 (9) 16"			
				7-5-4 (9) 12"			
847.8							
14.0		POORLY GRADED SAND (SP), fine to coarse-grained, Gravel, light brown, moist, loose to medium dense (GLACIAL OUTWASH)	15	9-5-6 (11) 10"			
			20	4-6-3 (9) 10"			
840.8							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

F:\2021\B2107713\CAD\B2107713.dwg,1195 Bush,11/2/2021 8:29:23 AM

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

1195 Bush Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
1195 Bush Avenue
St. Paul, Minnesota

BORING: **ST-15**

LOCATION: See attached sketch

NORTHING: 163691 EASTING: 586281

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/15/21 END DATE: 09/15/21

SURFACE ELEVATION: 855.8 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
854.8		POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
1.0		FILL: SILTY SAND (SM), fine to medium-grained, concrete fragments, brown, moist		6-8-5 (13) 0"			
851.8							
4.0		SANDY LEAN CLAY (CL), brown, moist, stiff (GLACIAL TILL)	5	3-6-8 (14) 14"		19	LL=44, PL=22, PI=22
				5-5-6 (11) 18"			
			10	7-7-7 (14) 18"			
844.3							
11.5		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, with Gravel, brown, moist, medium dense (GLACIAL OUTWASH)		31-18-20 (38) 15"			
			15	20-17-13 (30) 16"			
837.8							
18.0		POORLY GRADED SAND (SP), fine to medium-grained, with Gravel, light brown, moist, medium dense (GLACIAL OUTWASH)	20	7-9-10 (19) 15"			
834.8							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
1195 Bush Avenue
St. Paul, Minnesota

BORING: **ST-16**

LOCATION: See attached sketch

NORTHING: 163593 EASTING: 586291

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 852.2 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
851.2		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
1.0		FILL: SILTY SAND (SM), fine to medium-grained, trace Gravel, dark brown, moist		3-4-4 (8) 12"			
848.2							
4.0		LEAN CLAY (CL), brown, moist, very stiff (GLACIAL TILL)	5	8-9-10 (19) 16"		10	LL=36, PL=22, PI=14
845.7							
6.5		POORLY GRADED SAND (SP), fine to medium-grained, light brown to brown, moist, loose to medium dense (GLACIAL OUTWASH)		9-5-4 (9) 16"			
			10	10-8-9 (17) 0"			
				9-8-7 (15) 12"			
			15	6-6-4 (10) 12"			
			20	8-6-6 (12) 8"			
831.2							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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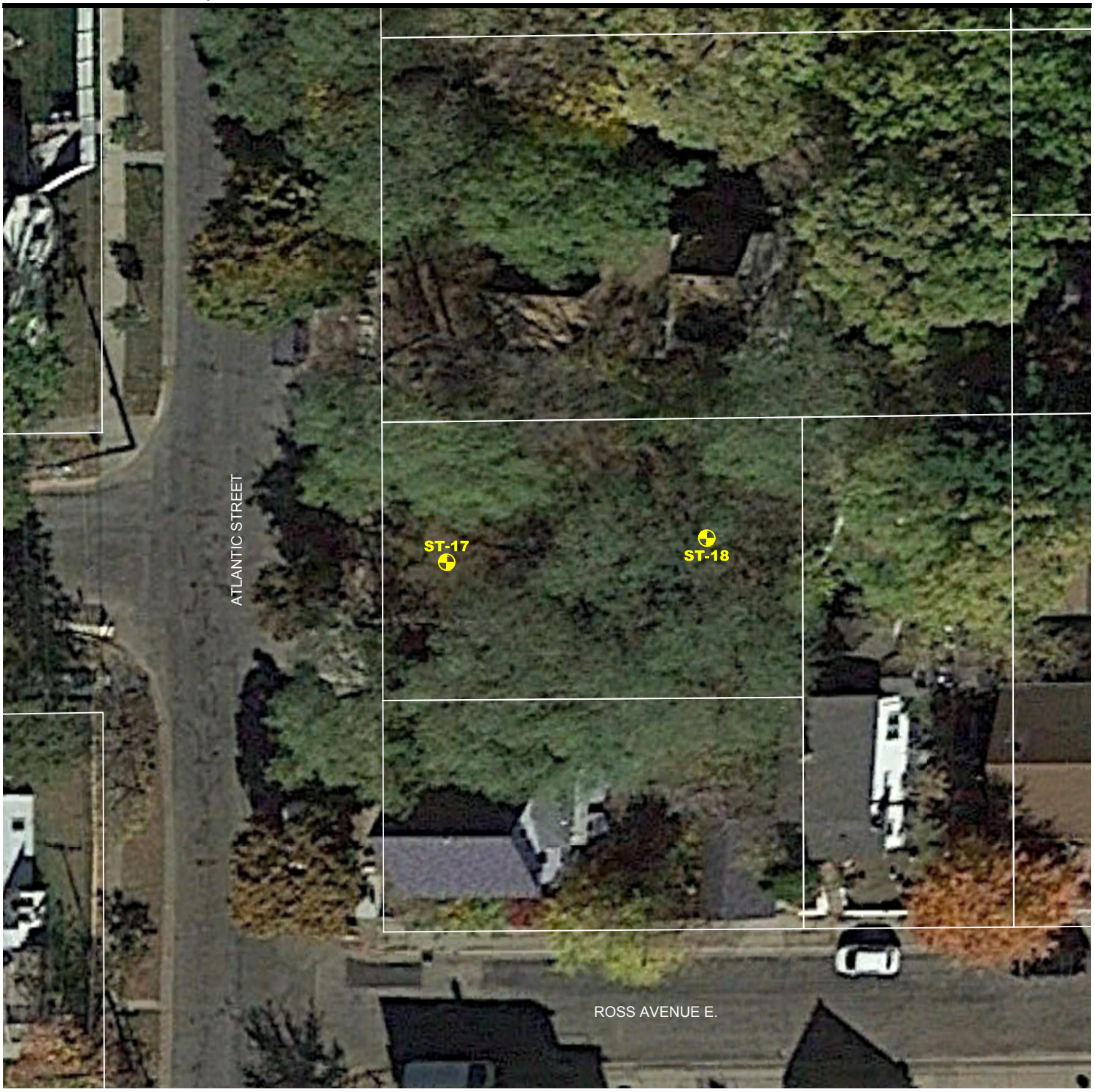

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

810 Atlantic Street

St. Paul, Minnesota

Soil Boring Location Sketch

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
810 Atlantic Street
St. Paul, Minnesota

BORING: **ST-17**

LOCATION: See attached sketch

NORTHING: 163886 EASTING: 586781

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 872.8 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
871.9		SILTY SAND (SM), fine to medium-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.9		FILL: SILTY SAND (SM), fine to medium-grained, with Clay lenses, brown, moist		1-1-1 (2) 12"		9	
868.8							
4.0		POORLY GRADED SAND (SP), fine to coarse-grained, with Gravel, brown, moist, loose to medium dense (GLACIAL OUTWASH)	5	2-3-2 (5) 10"			
				10-7-9 (16) 12"			
863.8							
9.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, medium dense to dense (GLACIAL OUTWASH)	10	21-16-11 (27) 16"			
				21-15-17 (32) 18"			
			15	31-19-21 (40) 0"			
			20	25-19-21 (40) 11"			
851.8							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
810 Atlantic Street
St. Paul, Minnesota

BORING: **ST-18**

LOCATION: See attached sketch

NORTHING: 163891 EASTING: 586837

DRILLER: M. Barber | LOGGED BY: R. Fritz | START DATE: 09/16/21 | END DATE: 09/16/21

SURFACE ELEVATION: 877.9 ft | RIG: GP-1 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
877.0		SILTY SAND (SM), fine-grained, trace roots, dark brown, moist (TOPSOIL FILL)					
0.9		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist		2-2-1 (3) 12"			
873.9							
4.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, loose to dense (GLACIAL OUTWASH)	5	6-7-5 (12) 10"			
				4-3-3 (6) 6"			
			10	6-7-10 (17) 8"			
				13-14-20 (34) 10"			
		Recovered rock fragments	15	37-36-23 (59) 1"			
			20	28-22-19 (41) 14"			
856.9							
21.0		END OF BORING					Water not observed while drilling.
		Boring immediately grouted	25				
			30				

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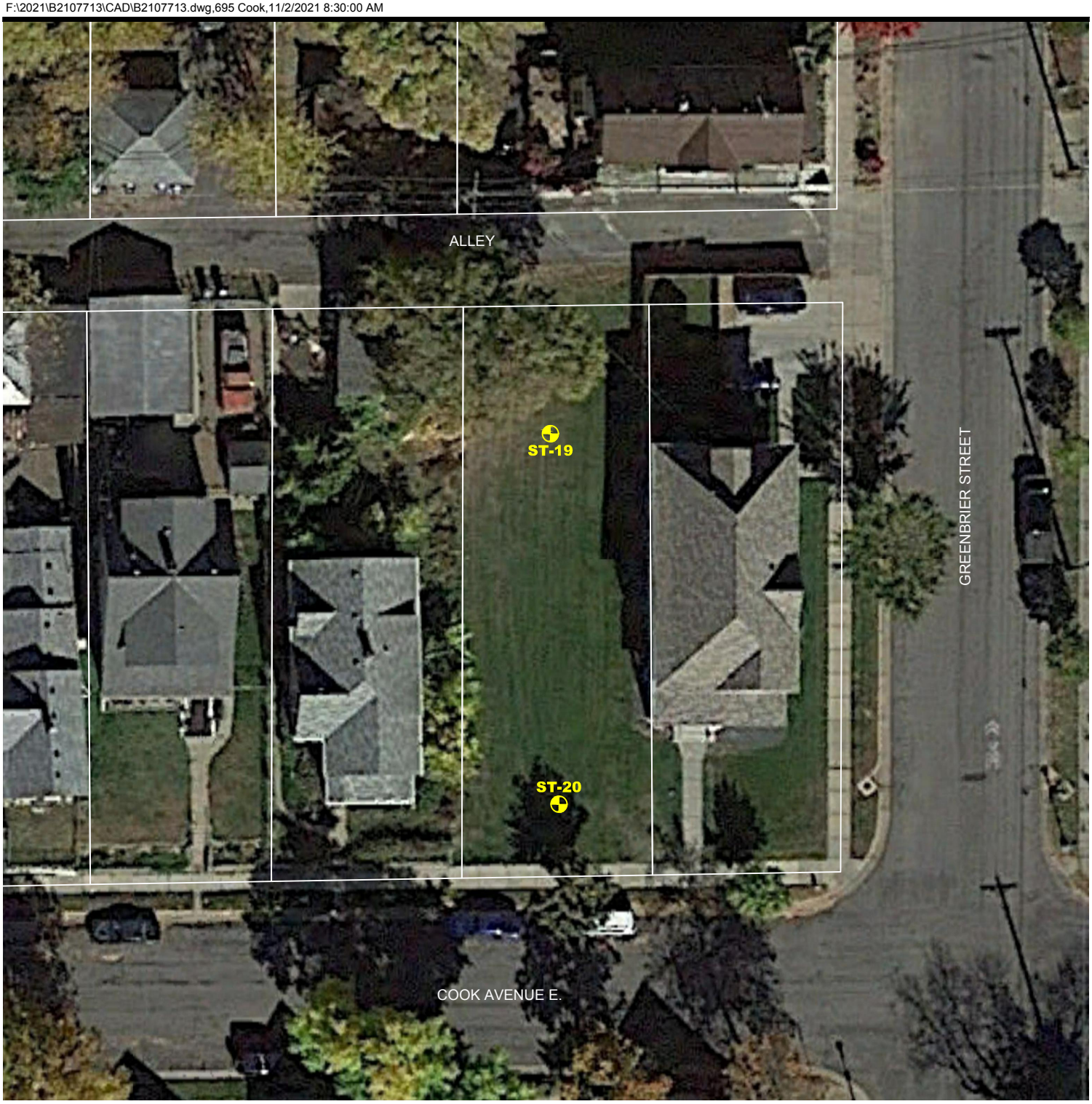

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Project No:	B2107713
Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

695 Cook Avenue

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
695 Cook Avenue
St. Paul, Minnesota

BORING: **ST-19**

LOCATION: See attached sketch

NORTHING: 166582 EASTING: 580743

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 898.6 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
897.7		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.9		FILL: CLAYEY SAND (SC), trace Gravel, brown, moist		11-12-12 (24) 14"		8	
894.6							
4.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained, brown, moist		12-12-12 (24) 12"			
892.1			5				
6.5		CLAYEY SAND (SC), trace Gravel, brown, moist, hard (GLACIAL TILL)		27-21-17 (38) 14"			
				25-17-21 (38) 18"			
			10				
				42-30-32 (62) 18"			
				39-28-42 (70) 18"			
			15				
				50/6" (REF) 6"			
877.6			20				
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
695 Cook Avenue
St. Paul, Minnesota

BORING: **ST-20**

LOCATION: See attached sketch

NORTHING: 166503 EASTING: 580745

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 894.4 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
892.4		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
2.0		LEAN CLAY (CL), trace Sand, brown, moist, medium (GLACIAL TILL)		3-4-4 (8) 14"		21	P200=95%
890.4							
4.0		CLAYEY SAND (SC), trace Gravel, brown, moist, very stiff to hard (GLACIAL TILL)		6-10-8 (18) 18"			
				14-14-12 (26) 18"			
				14-12-15 (27) 17"			
				20-21-20 (41) 18"			
				29-35-34 (69) 18"			
				50/6" (REF) 6"			
873.4							
21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.

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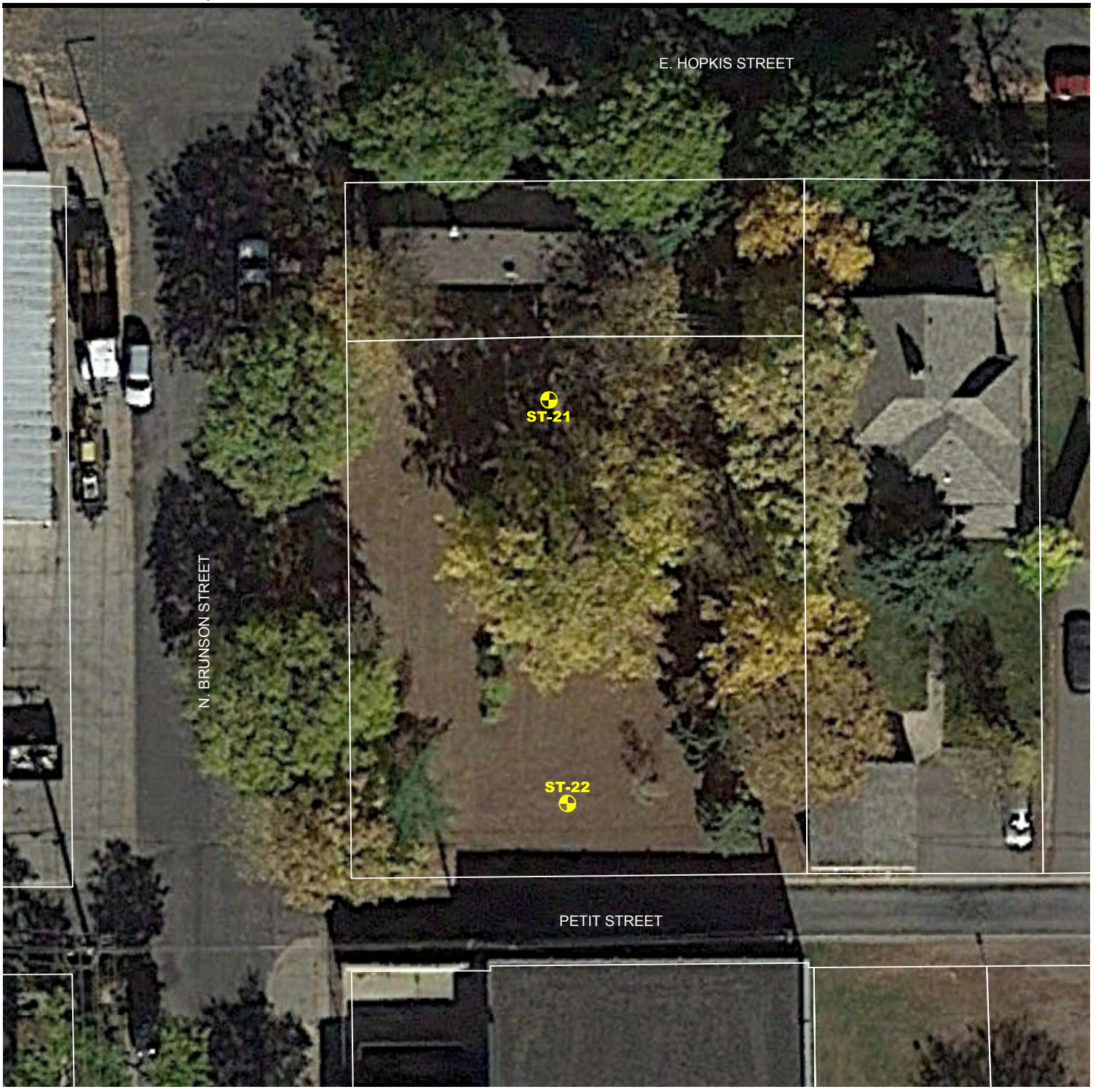

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

15' 0 30'

SCALE: 1"= 30'

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Drawing No:	B2107713
Drawn By:	JAG
Date Drawn:	9/1/21
Checked By:	RJF
Last Modified:	11/2/21

St. Paul HRA Site Home Developments

560 Brunson Street

St. Paul, Minnesota

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
560 Brunson Street
St. Paul, Minnesota

BORING: **ST-21**

LOCATION: See attached sketch

NORTHING: 161045 EASTING: 578677

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 778.8 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
777.8		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
1.0		FILL: SILTY SAND (SM), fine to medium-grained, brown, moist		2-1-2 (3) 12"		7	P200=20%
774.8							
4.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist, very loose to very dense (GLACIAL OUTWASH)	5	3-1-1 (2) 7"			
		Limestone fragments at 7 1/2 feet		14-30-21 (51) 10"			
		Clay layers from 10 feet to 12 feet	10	10-9-10 (19) 12"			
				9-10-12 (22) 15"			
763.8			15	50/6" (REF) 6"			
15.0		END OF BORING Boring immediately grouted					Auger met refusal at 15 feet Water not observed while drilling.
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2107713
Geotechnical Evaluation
Saint Paul HRA Site Home Development
560 Brunson Street
St. Paul, Minnesota

BORING: **ST-22**

LOCATION: See attached sketch

NORTHING: 160959 EASTING: 578681

DRILLER: M. Barber LOGGED BY: R. Fritz START DATE: 09/16/21 END DATE: 09/16/21

SURFACE ELEVATION: 777.1 ft RIG: GP-1 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
776.4		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.7		FILL: SILTY SAND (SM), fine to medium-grained, brown, moist		10-10-12 (22) 0"			
773.1							
4.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, trace Gravel, brown, moist, medium dense to dense (GLACIAL OUTWASH)	5	10-16-25 (41) 10"		3	P200=8%
				15-11-16 (27) 12"			
			10	10-8-8 (16) 16"			
				16-18-26 (44) 10"			
			15	28-24-14 (38) 18"			
757.1			20	50/6" (REF) 6"			Sampler refusal at 20 feet
20.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

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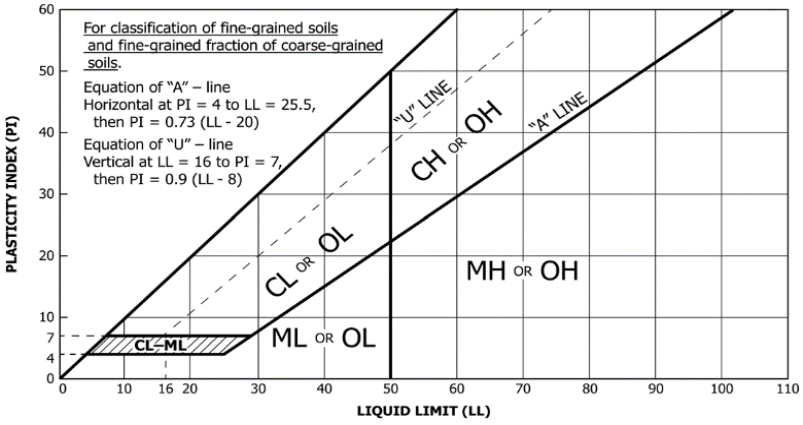
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(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])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[D]	GW	Well-graded gravel[E]
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$)[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E F G]
			Fines Classify as CL or CH	GC	Clayey gravel[E F G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[D]	SW	Well-graded sand[I]
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$)[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[F G I]
			Fines classify as CL or CH	SC	Clayey sand[F G I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" 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] / Organic silt[K L M O]
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay[K L M]
			PI plots below "A" line	MH	Elastic silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OH	Organic clay[K L M P] / Organic silt[K L M Q]
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
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. 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
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% 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	**q_p**	Pocket penetrometer strength, tsf
WD	Wet density, pcf	**q_U**	Unconfined compression test, tsf
P200	% Passing #200 sieve	**LL**	Liquid limit
MC	Moisture content, %	**PL**	Plastic limit
OC	Organic content, %	**PI**	Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L, M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent 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	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

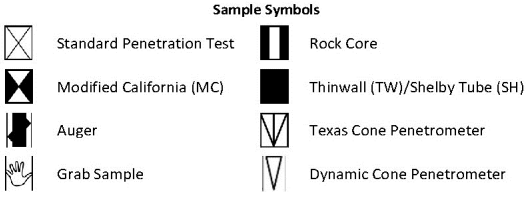
Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

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

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

Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Sample Symbols



5/2021