

Geotechnical Evaluation Report

Proposed Utility Building
Building 7
4801 Veterans Drive
St. Cloud, Minnesota

Prepared for

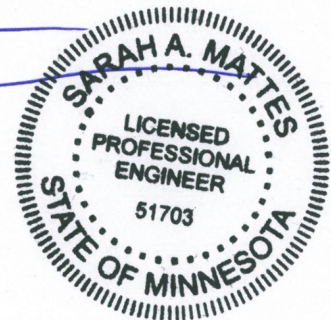
VA Medical Center

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.



Sarah A. Mattes, PE
Project Engineer
License Number: 51703
October 23, 2014



Project B14-07603

Braun Intertec Corporation

October 23, 2014

Project B14-07603

Mr. Brian Sjaheim
VA Medical Center
4801 Veterans Drive
St. Cloud, MN 56301

Re: Geotechnical Evaluation
Proposed Utility Building
4801 Veterans Drive
St. Cloud, Minnesota

Dear Mr. Sjaheim:

We are pleased to present this Geotechnical Evaluation Report for the proposed utility building. A summary of our results and recommendations is presented below. More detailed information and recommendations follow the Table of Contents.

Summary of Results

We completed one soil boring near the proposed utility building. The boring initially encountered existing silty sand fill to a depth of 2 feet. Below the existing fill, the boring encountered glacially-deposited sand and gravel to termination depth of 21 feet. Penetration resistance values recorded in the glacial sand and gravel indicated they were locally loose to dense but medium dense overall.

Groundwater was observed to be down approximately 8½ feet as our boring was advanced. Seasonal and annual fluctuations of groundwater should also be anticipated.

Summary of Recommendations

The geologic materials present at anticipated structure subgrade elevations generally appear suitable for support of footings and earth-supported slabs. We recommend stripping all surface vegetation, root zone, topsoil and existing fill from the construction area. Based on the boring, we estimate the excavations will likely extend to a depth of about 2 feet.

If subgrade preparation is completed as recommended in the attached report, it is our opinion the proposed utility building can then be supported on footings designed for a net allowable bearing pressure up to 3,000 pounds per square foot (psf).

Remarks

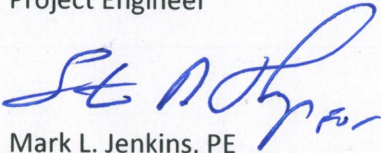
Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please call Sarah Mattes at (320) 202-7224 or email smattes@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

A handwritten signature in blue ink, reading "Sarah Mattes", with a long horizontal flourish extending to the right.

Sarah A. Mattes, PE
Project Engineer

A handwritten signature in blue ink, reading "Mark L. Jenkins", with a stylized flourish.

Mark L. Jenkins, PE
Associate Principal/ Senior Engineer

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Boring Location Sketch

Log of Boring Sheets

Descriptive Terminology

A. Introduction

A.1. Project Description

It is our understanding that the VA Medical Center is planning to construct a utility building located off the east side of Building 7 on the St. Cloud campus. The proposed building will be approximately 11 feet by 11 feet.

A.2. Purpose

The purpose of this geotechnical evaluation is to characterize subsurface geologic conditions at selected exploration locations and evaluate their impact on the design and construction of the building foundations and slab.

A.3. Background Information and Reference Documents

To facilitate our evaluation, Mr. Brian Sjaaheim of VA engineering staff provided us with preliminary project plans for the proposed utility building prepared by JLG Architects dated February 22, 2013. We also relied on a geologic atlas to aid in soil classification as well as project information provided by Mr. Brian Asche of JLG Architects.

A.4. Site Conditions

Currently, the site is a relatively steep slope that slopes down toward the west (near Building 7) and is primarily grass covered.

A.5. Scope of Services

Our scope of services for this project was originally submitted to Mr. Brian Sjaaheim of the VA Medical Center who provided authorization to proceed. Tasks performed in accordance with our authorized scope of services included:

- Performing a reconnaissance of the site to evaluate equipment access to exploration locations.

- Staking and clearing exploration locations of underground utilities.
- Performing one penetration test boring to 20 feet.
- Preparing this report containing a sketch, exploration log, a summary of the geologic materials encountered, and recommendations for structure subgrade preparation and the design of foundations and slab.

A.6. Boring Location and Elevation

We staked exploration locations by measuring dimensions from the nearby building with a tape at approximate right angles. Surface elevations were measured using a surveyor's level. We referenced surface elevations to the floor slab of Building 7, whose elevation was assigned to be at elevation 200.0.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our penetration test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of penetration resistance tests performed within them and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1.b. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were 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 and other in-situ testing performed for the project, and (4) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Geologic Profile

B.2.a. Geologic Materials

The boring completed for the proposed utility building initially encountered existing silty sand fill to a depth of 2 feet. Below the existing fill, the boring encountered glacially-deposited sand and gravel to termination depth of 21 feet.

Penetration resistance values recorded in the glacial sand and gravel ranged from 9 to 34 blows per foot (BPF) but generally exceeded 11 BPF, indicating they were locally loose to dense but medium dense overall.

B.2.b. Groundwater

Groundwater was observed to be down approximately 8½ feet as our boring was advanced. This depth corresponds to elevations 190½ based on our assigned datum.

Seasonal and annual fluctuations of groundwater should also be anticipated.

C. Basis for Recommendations

C.1. Design Details

C.1.a. Building Structure Loads

It is our understanding that the proposed utility building is planned to be supported on 2-foot concrete piers. According to the engineer of record, Mr. Asche of JLG Architects, column loads associated with the utility building will not exceed 20 kips per column.

C.1.b. Anticipated Grade Changes

Existing ground surface elevations are within approximately 1 to 2 feet of the proposed grades. Based on the provided plans, it appears the utility building will be built into the hill side along the east side of Building 7. Three tiered segment block retaining walls will also be constructed on the slope.

C.1.c. Precautions Regarding Changed Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the

project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Design and Construction Considerations

The geotechnical issues influencing design and construction of the utility building appear to be limited. The geologic materials present at anticipated structure subgrade elevations generally appear suitable for support of footings and grade-supported slabs.

- Existing fill was initially encountered in the boring located near the utility building. The existing fill appears to have received some compaction effort however, may not have been placed and compacted with the intention of supporting foundations or floor slabs. Existing fill can be variable and can contain soft and/or loose zones undetected by our borings. Therefore, it is our opinion that the existing fill is unsuitable for building support. Therefore, it should be completely removed from the building footprint.
- Below the existing fill, the boring encountered poorly-graded sand which is not considered to be frost-susceptible. However, lenses or pockets of frost-susceptible silty or clayey materials can be present in these soils, hand auger borings should be completed after removing the topsoil to check for the presence of frost-susceptible soils. If frost-susceptible soils are encountered, they be removed to a depth of at least 5 feet, and replaced with non-frost-susceptible material.
- On-site soils free of organics can be considered for reuse as backfill and fill. Non-frost susceptible sands, with less than 5 percent by weight particles passing the #200 sieve, should be used beneath the building floor slab.

D. Recommendations

D.1. Building Subgrade Preparation

D.1.a. Excavations

We recommend stripping all vegetation, roots, topsoil and existing fill from the proposed building footprint and oversize area. We anticipate excavations to remove unsuitable soils will likely extended to approximately 2 feet. Furthermore, we recommend removing any frost susceptible soils, if encountered,

to a depth of at least 5 feet below proposed final grade. We recommend that a geotechnical engineer or engineering technician observe and evaluate the soils exposed in the bottoms of excavations to determine if the soils are suitable for support of excavation backfill, additional required fill, and the project's structural design loads.

Excavation depths will vary from boring locations. Portions of the excavations may also be deeper than indicated by the borings.

D.1.b. Selecting Excavation Backfill and Additional Required Fill

On-site soils free of organic soil and debris can be considered for reuse as backfill and fill. Imported material needed to replace excavation spoils or balance cut and fill quantities, may consist of gravel, sand and silty sand. Non-frost susceptible sands, with less than 5 percent by weight particles passing the #200 sieve, should be used beneath the utility building slab.

D.1.c. Placement and Compaction of Backfill and Fill

We recommend spreading backfill and fill in loose lifts of approximately 8 inches. We recommend compacting backfill and fill in accordance with the criteria presented below in Table 1.

Table 1. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D 698 – standard Proctor)	Moisture Content Variance from Optimum, percentage points
Below foundations	98	-3 to +3 for sand soils -1 to +3 for clay soils
Below slabs	95	
Below landscaped surfaces	90	

D.2. Footings

D.2.a. Embedment Depth

For frost protection, we recommend embedding unheated footings 60 inches below the lowest exterior grade.

D.2.b. Net Allowable Bearing Pressure

We recommend sizing footings to exert a net allowable bearing pressure of 3,000 pounds per square foot (psf), including all transient loads. This value includes a safety factor of at least 3.0 with regard to bearing capacity failure.

D.2.c. Settlement

We estimate that total and differential settlements among the footings will amount to less than 1 and ½ inch, respectively, under the assumed loads.

D.3. Grade Supported Slabs

D.3.a. Subgrade Preparation

The proposed utility building slab will bear on native sands. Because the sands were noted as being locally loose, provisions should be made by the contractor to surface compact the slab subgrade to densify and enhance subgrade uniformity and strength, and limit the potential for settlement prior to placing additional fill (non-frost susceptible) or concrete.

D.3.b. Frost Considerations

After removing existing fill, our boring in the area of the slab encountered poorly-graded sand which is not considered to be frost-susceptible. However, lenses or pockets of frost-susceptible silty or clayey materials can be present in these soils. We recommend that a series of hand auger borings be completed after removing the topsoil to check for the presence of frost-susceptible soils. If frost-susceptible soils are encountered, we recommend they be removed to a depth of at least 5 feet, and replaced with non-frost-susceptible material. Backfill material used below slab subgrades should meet MnDOT Specification 3149.2B2 for Select Granular Borrow. Sand meeting this gradation will need to be imported. We recommend compacting backfill material below slab subgrades to a minimum of 98 percent of standard Proctor maximum dry density.

D.3.c. Subgrade Modulus

We recommend using a modulus of subgrade reaction, k , of 200 pounds per square inch per inch of deflection (pci) to design the slabs.

D.3.d. Placement and Compaction of Backfill and Fill

Subgrades supporting slabs should therefore be prepared in accordance with the recommendations provided above in Section D.1.

D.4. Construction Quality Control

D.4.a. Excavation Observations

We recommend having a geotechnical engineer observe all excavations related to subgrade preparation and spread footing and slab-on-grade construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations, and the adequacy of required excavation oversizing.

D.4.b. Materials Testing

We recommend density tests be taken in excavation backfill and additional required fill placed below spread footings and slab-on-grade construction.

We also recommend slump, air content and strength tests of portland cement concrete.

D.4.c. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained. Frost should not be permitted to penetrate below footings.

E. Procedures

E.1. Penetration Test Borings

The penetration test borings were drilled with a truck-mounted core and auger drill equipped with hollow-stem auger. The borings were performed in accordance with ASTM D 1586. Penetration test samples were taken at 2 1/2- or 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs.

E.2. Material Classification and Testing

E.2.a. Visual and Manual Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Standard Practice D 2488. A chart explaining the classification system is attached. Samples were placed in jars or bags and returned to our facility for review and storage.

E.3. Groundwater Measurements

The drillers checked for groundwater as the penetration test borings were advanced, and again after auger withdrawal. The boreholes were then backfilled or allowed to remain open for an extended period of observation as noted on the boring logs

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

Our evaluation, analyses and recommendations were developed 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, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected 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 additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

F.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall,

flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

F.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

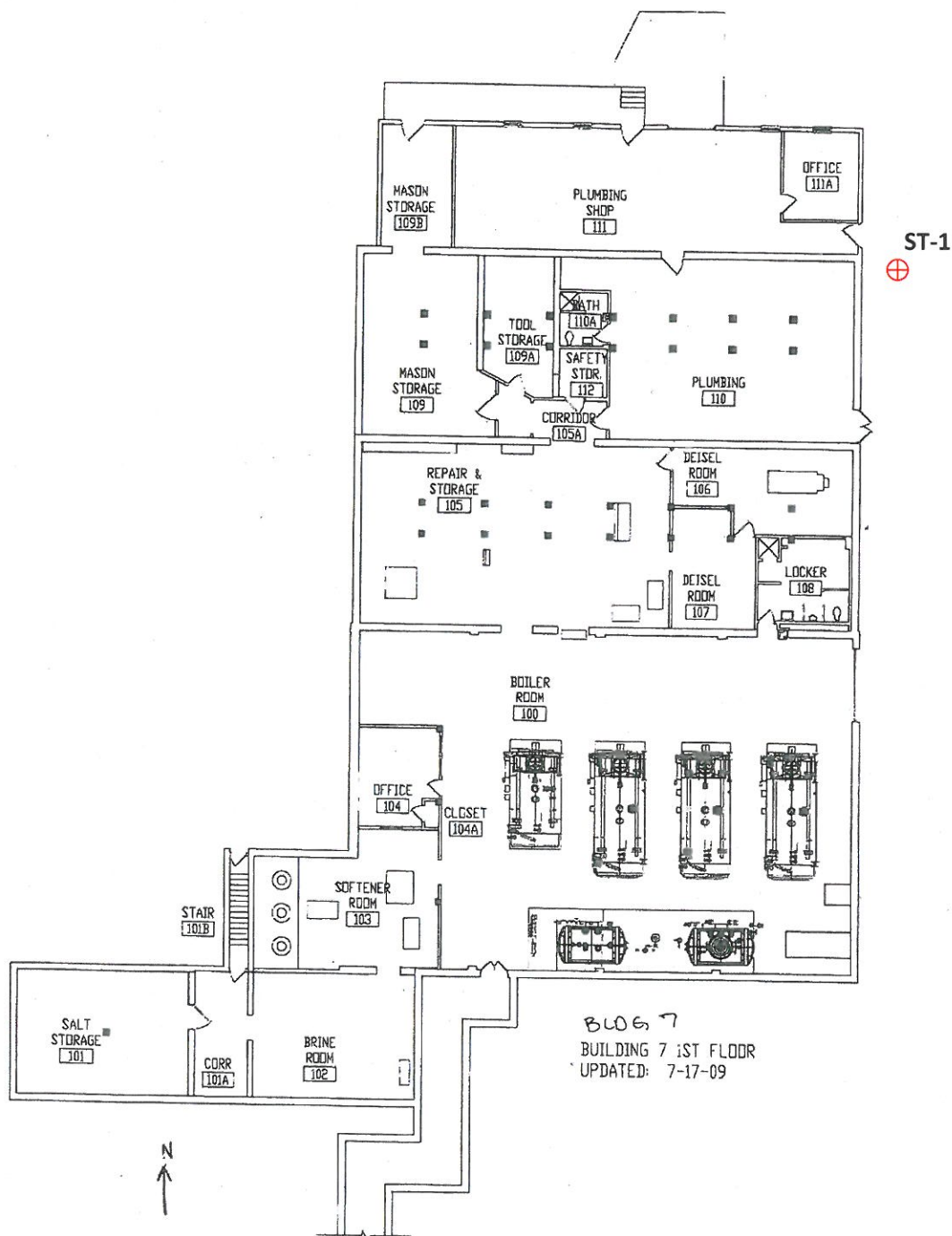
F.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed. 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.

F.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



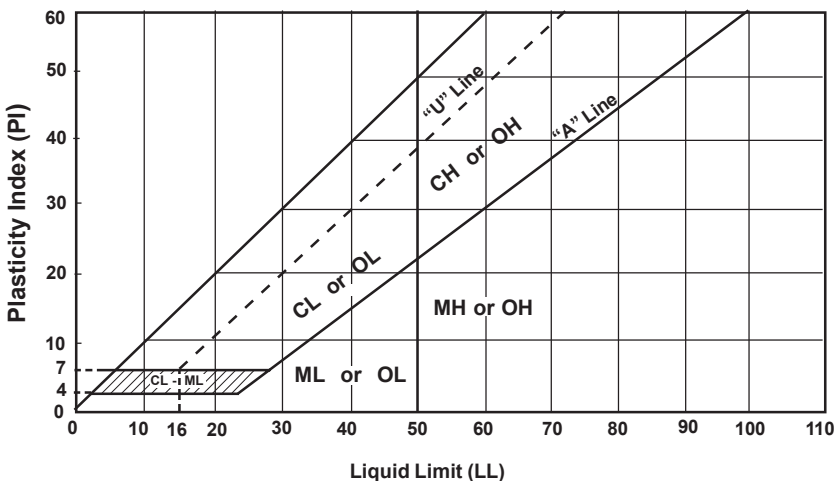
(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2014\07603.GPJ BRAUN_V8_CURRENT.GDT 10/23/14 09:26

Braun Project B14-07603 Geotechnical Evaluation Demolish Trestle at Boiler Plant 4801 Veterans Drive St. Cloud, Minnesota					BORING: ST-1 LOCATION: 20' N of Staked Location. See sketch.		
DRILLER: R. Hansen		METHOD: 3 1/4" HSA, Autohammer		DATE: 10/7/14		SCALE: 1" = 4'	
Elev. feet	Depth feet	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes	
199.0	0.0						
197.0	2.0	FILL	FILL: Silty Sand with Gravel, fine- to coarse-grained, dark brown, moist.				
		SP	POORLY GRADED SAND, fine- to medium-grained, light brown, moist, medium dense to loose. (Glacial Outwash)	19			
				9			
192.0	7.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with Gravel, brown, wet, medium dense. (Glacial Outwash)	14	▽		
189.5	9.5	SP	POORLY GRADED SAND with GRAVEL, brown, waterbearing, medium dense. (Glacial Outwash)	11			
				18			
184.5	14.5	GP	POORLY GRADED GRAVEL, fine- to coarse-grained, gray, wet, dense, medium dense. (Glacial Outwash)	34			
178.0	21.0			13			
END OF BORING. Water observed at 10 feet while drilling. Water observed at 8 1/2 feet with 19 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 6 Water not observed to cave-in depth of Boring then backfilled.							

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^a					Soils Classification	
					Group Symbol	Group Name ^b
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines ^e	$C_u \geq 4$ and $1 \leq C_c \leq 3$ ^c	GW	Well-graded gravel ^d	
			$C_u < 4$ and/or $1 > C_c > 3$ ^c	GP	Poorly graded gravel ^d	
	Gravels with Fines More than 12% fines ^e	Fines classify as ML or MH	GM	Silty gravel ^{d f g}		
		Fines classify as CL or CH	GC	Clayey gravel ^{d f g}		
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines ⁱ	$C_u \geq 6$ and $1 \leq C_c \leq 3$ ^c	SW	Well-graded sand ^h	
			$C_u < 6$ and/or $1 > C_c > 3$ ^c	SP	Poorly graded sand ^h	
	Sands with Fines More than 12% ⁱ	Fines classify as ML or MH	SM	Silty sand ^{f g h}		
		Fines classify as CL or CH	SC	Clayey sand ^{f g h}		
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line ^j	CL	Lean clay ^{k l m}	
			PI < 4 or plots below "A" line ^j	ML	Silt ^{k l m}	
		Organic	Liquid limit - oven dried < 0.75	OL	Organic clay ^{k l m n}	
			Liquid limit - not dried < 0.75	OL	Organic silt ^{k l m o}	
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{k l m}	
			PI plots below "A" line	MH	Elastic silt ^{k l m}	
		Organic	Liquid limit - oven dried < 0.75	OH	Organic clay ^{k l m p}	
			Liquid limit - not dried < 0.75	OH	Organic silt ^{k l m q}	
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat	

- a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

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

Particle Size Identification

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

Relative Density of Cohesionless Soils

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

Consistency of Cohesive Soils

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

Drilling Notes

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

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

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

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

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

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

TW indicates thin-walled (undisturbed) tube sample.

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