

June 12, 2019

Presidential Homes
1212 – 39th Avenue Southwest
Puyallup, WA 98373

Attn: Mr. Terry Folden
(253) 208-6030
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Stormwater Feasibility Soils Report
Proposed Office Building
1212 – 39th Avenue Southwest
Puyallup, Washington
PN: 0419092021
Doc ID: PresidentialHomes.39thAveSW.SR

INTRODUCTION

This soils report presents the results of our subsurface explorations and provides our opinion regarding the feasibility of onsite infiltration for the proposed commercial development at 1212 – 39th Avenue Southwest in Puyallup, Washington. The location of the project site is shown on the attached Site Location Map, Figure 1.

Our understanding of the project is based on our discussions with you, our review of the available geologic and soils data, our May 20, 2019 site visit, and our experience in the area. The site was previously developed with an office, driveway, and accompanying structure, but both structures have since been demolished. We understand the proposed site development will include a new office building with a parking lot area and associated utilities. We anticipate the new building will consist of a one or two-story, wood-framed structure supported by conventional shallow foundations.

We understand that the City of Puyallup requires that a soils report be prepared to evaluate the feasibility of onsite infiltration in accordance with the 2012 Stormwater Management Manual for Western Washington (SWMMWW) with the 2014 Amendments.

SCOPE

The purpose of our services was to evaluate the surface and subsurface conditions at the site as a basis for providing our opinion regarding the feasibility of onsite infiltration for the proposed development in order to satisfy the City of Puyallup requirements. Specifically, our scope of services for the project included the following:

1. Conducting a geologic reconnaissance of the site area;
2. Reviewing the available geotechnical, geologic and hydrogeologic data for the site area;
3. Observing the excavation of 3 test pit explorations, and sampling the observed soils for subsequent laboratory testing, as deemed necessary;

4. Perform up to 2 grain size analyses on representative select soil samples from the explorations;
5. Determining a preliminary infiltration rate based on the grain size analysis, if appropriate;
6. Submitting one sample to an independent laboratory for cation exchange capacity and organic content testing if necessary; and
7. Preparing a written soils report summarizing our site observations and conclusions, along with the supporting data.

The above scope of work was completed in accordance with our *Proposal for Services* dated May 20, 2019. We received written notice to proceed on the same day.

SITE CONDITIONS

Surface Conditions

The site consists of a single parcel located at 1212 – 39th Avenue Southwest in Puyallup, Washington, within an area of existing commercial and residential development. The site is generally rectangular in shape, measures approximately 75 feet wide (north to south) by about 140 to 150 feet deep (north to south) and encompasses approximately 0.30 acres. The parcel is bounded by existing residential development to the west, by commercial development to the south and east, and by 39th Avenue Southwest to the north.

According to the information obtained from the Pierce County Public GIS, the site generally slopes up from north to south. The site's northern boundary is generally at grade with 39th Avenue Southwest and slopes up to the south at about 5 percent along the driveway. A short landscaping wall provides grade separation along the northern property line adjacent west of the driveway. Steeper slopes are located on the southeastern portion of the site. These slopes slope down from west to east at about 80 to 100 percent to the adjacent development's parking area and are about 2 to 4 feet in height. The total topographic relief across the site is on the order of about 6 feet. The existing site configuration and topography is shown on the attached Site and Exploration Plan, Figure 2.

Vegetation across the site mostly consists of typical grass lawn with scattered mature coniferous and deciduous trees and various other native and invasive plants and shrubs within the lawn area.

Site Soils

The Natural Resources Conservation Survey (NRCS) Web Soil Survey maps the site as being underlain by Indianola loamy sand (18B). The Indianola soils are typically derived from sandy glacial outwash, form on slopes of 0 to 5 percent, have a "slight" erosion hazard when exposed, and are included in hydrologic soils group A. An NRCS soils map for the site area is included as Figure 3.

Site Geology

The draft the *Geologic Map of the Puyallup 7.5-Minute Quadrangle, Washington* (Troost et Al.) maps the site as being underlain by Steilacoom Gravel (Qvsc_{c1}), and adjacent to Vashon recessional outwash (Qvsb₄) to the west. These glacial soils were generally deposited during the Vashon stage of the Fraser Glaciation, some 12,000 to 15,000 years ago. The Steilacoom Gravel and recessional deposits typically consist of a poorly-sorted, lightly-stratified mixture of sand and gravel that may locally



contain silt and clay that were deposited by meltwater streams issuing from the retreating ice mass. The Qvsb₄ deposits are part of the Bradley Channel, a subunit of Steilacoom gravel, outwash flood channel deposits. The recessional outwash is considered to be normally consolidated and generally exhibits moderate strength and compressibility characteristics where undisturbed. An excerpt of the above referenced geologic map is included as Figure 4.

Subsurface Explorations

On May 20, 2019, a field representative from GeoResources, LLC (GeoResources) explored shallow subsurface conditions at the site by observing the excavation of three test pit explorations at the site to depths of 4.0 feet below the existing ground surface.

Our representative logged the subsurface conditions encountered in each test pit and obtained representative soil samples. The number and location of the test pits was selected in the field based on project information provided by you at the time of excavation, our understanding of the proposed development, consideration for underground utilities, existing site conditions, and current site usage. Each test pit was backfilled with the excavated soils and bucket tamped, but not otherwise compacted.

The subsurface explorations excavated as part of this evaluation indicate the subsurface conditions at specific locations only, as actual subsurface conditions can vary across the site. Furthermore, the nature and extent of such variation would not become evident until additional explorations are performed or until construction activities have begun. Based on our experience in the area and extent of prior explorations in the area, it is our opinion that the soils encountered in the explorations are generally representative of the soils at the site.

The approximate locations of our test pits are indicated on the attached Site and Exploration Plan, Figure 2. The soils encountered were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D: 2488. The USCS is included in Appendix A as Figure A-1, while the descriptive logs of our test pits are included as Figures A-2.

Subsurface Conditions

Our explorations encountered subsurface conditions that generally disagreed with the mapped stratigraphy at the site. Our test pits generally encountered about 0.5 feet of topsoil mantling brown silty fine sand and light brown, orange iron oxide stained silt in a loose to medium dense, moist condition to the full depth explored. In test pit TP-2 we encountered gray silt with some sand in a medium dense, moist condition underlying the iron oxide stained soil and extending to the full depth explored. Test pit TP-3 in the existing gravel driveway encountered 0.2 feet of crushed rock fill in a dense, moist condition underlain by brown sand and gravel fill in a dense, moist condition. Beneath these full soils we encountered reddish brown, orange iron oxide stained silt in a loose, moist condition, which we interpret to be fill. We interpret the native soils to be consistent with recessional lacustrine deposits.

Laboratory Testing

Geotechnical laboratory tests were performed on a select sample retrieved from the explorations to determine soil index and engineering properties encountered. Laboratory testing included visual soil classification per ASTM D: 2488, moisture content determinations per ASTM D:



2216, and grain size analyses per ASTM D: 422 standard procedures. The results of our grain size analysis shows the shallow soils at the site have a fines content of 88.4 percent.

Groundwater Conditions

No groundwater was observed in any of our test pit explorations, however, orange iron oxide staining, a form of mottling, was observed at about 1.5 to 2 feet below the existing ground surface. Mottling is often indicative of the seasonal high perched groundwater table. Perched groundwater develops when the infiltration of water through a more permeable upper soil layer is slowed by a less permeable layer. We anticipate fluctuations in the local groundwater levels will occur in response to precipitation patterns, off-site construction activities, and site utilization.

CONCLUSIONS

Based on the results of our site reconnaissance, subsurface explorations and laboratory test results, the use of downspout infiltration and permeable pavement BMP's to address stormwater runoff and flow control generated by the proposed office building is not feasible.

Infiltration Recommendations

Based on our site observations and subsurface explorations, it is our opinion that stormwater infiltration via a trench or basin type system, as well as permeable pavement is not feasible within the project area. Mottling was encountered as shallow as 1.5 feet below ground surface across the site. Per Volume III, Section C, Site Suitability Criteria 5, *Depth to Bedrock, Water Table, or Impermeable Layer* of the 2012 SWMMWW, a minimum separation of 3 feet between the bottom of an infiltration basin or trench and the top of the seasonal high water mark is required. Given that a minimum infiltration facility depth is 3 feet below the existing ground surface, the minimum separation between the bottom of the infiltration facility and seasonal high groundwater cannot be met on the site; therefore, onsite infiltration of stormwater is not feasible on the site.

Per Volume V BMP T5.15, permeable pavement is not feasible if saturated conditions are encountered within 1-foot of the bottom of the storage course. Based on the evidence of a shallow perched groundwater table, and also the type of soil found at these depths, the use of permeable pavement is not feasible.

We recommend that alternative stormwater management Best Management Practices (BMPs) be implemented to manage the stormwater runoff generated by the proposed development per the 2012 SWMMWW. BMP's such as onsite dispersion per Volume III, Section 3.1.2, BMP T5.12 or connecting to the municipal storm drainage system using an onsite detention system should be utilized. All appropriate and pertinent setback criteria per the 2012 SWMMWW should be considered prior to the selection of a stormwater management BMP.

LIMITATIONS

We have prepared this report for use by Presidential Homes, Terry Folden, and other members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our subsurface

explorations, published geologic information, and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

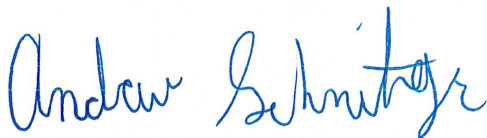
The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

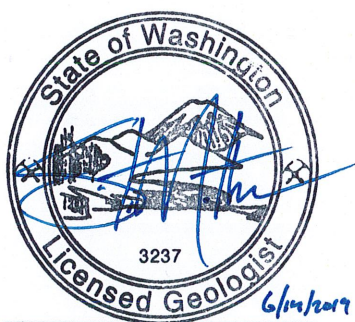


We have appreciated the opportunity to be of service to you on this project. If you have any questions or comments, please do not hesitate to call at your earliest convenience.

Respectfully submitted,
GeoResources, LLC

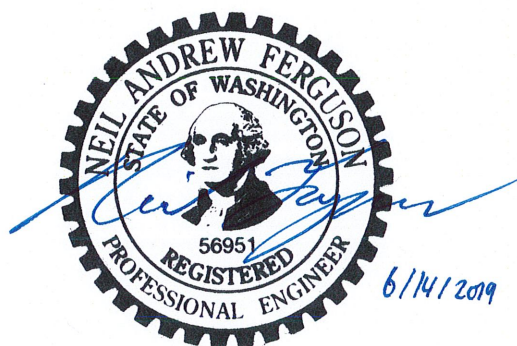


Andrew Schnitger, EIT
Engineer in Training



Seth Mattos

Seth T. Mattos, LG
Associate

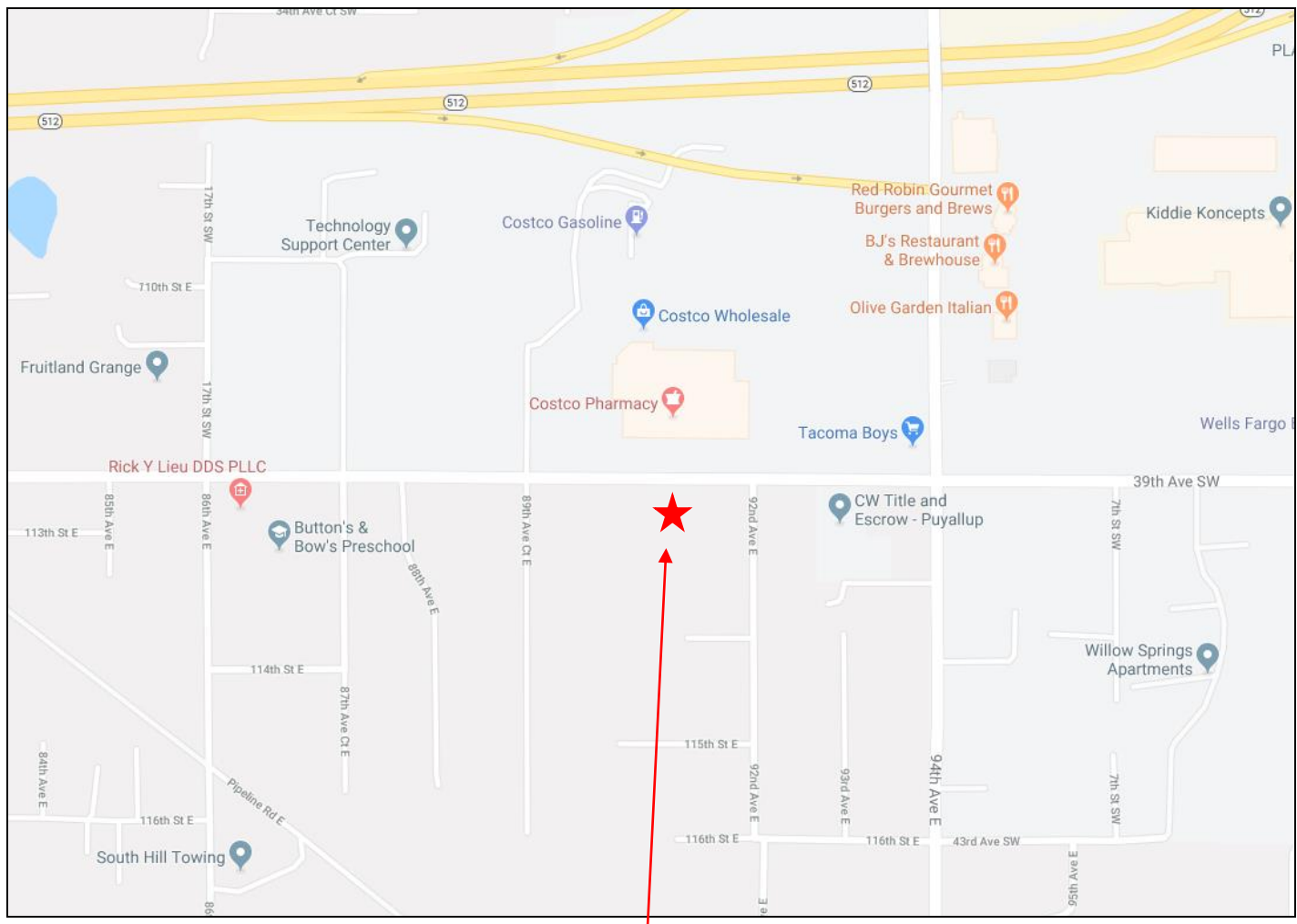


Neil A. Ferguson, PE
Project Engineer

AES:NAF:STM/aes

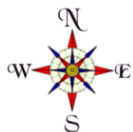
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Attachments: Figure 1: Site Location Map
 Figure 2: Site and Exploration Plan
 Figure 3: NRCS Soils Map
 Figure 4: USGS Geologic Map
 Appendix A – Subsurface Explorations
 Appendix B – Laboratory Analysis



Approximate Site Location

Map created from Google Maps (<https://maps.google.com/>)



Not to Scale



Site Location Map

Proposed Office
1212 – 39th Avenue Southwest
Puyallup, Washington
PN: 0419092021

DocID: PresidentialHomes.39thAveSW.F

June 2019

Figure 1



Approximate Site Location

Map created from Pierce County Public GIS (<https://matterhornwab.co.pierce.wa.us/publicgis/>)



Approximate location and number of test pit



Not to Scale

Site & Exploration Plan

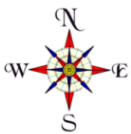
Proposed Office
1212 - 39th Avenue Southwest
Puyallup, Washington
PN: 0419092021



Approximate Site Location

Map created from Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>)

Soil Type	Soil Name	Parent Material	Slopes	Erosion Hazard	Hydrologic Soils Group
18B	Indianola loamy sand	Sandy glacial outwash	0 to 5	Slight	A



Not to Scale



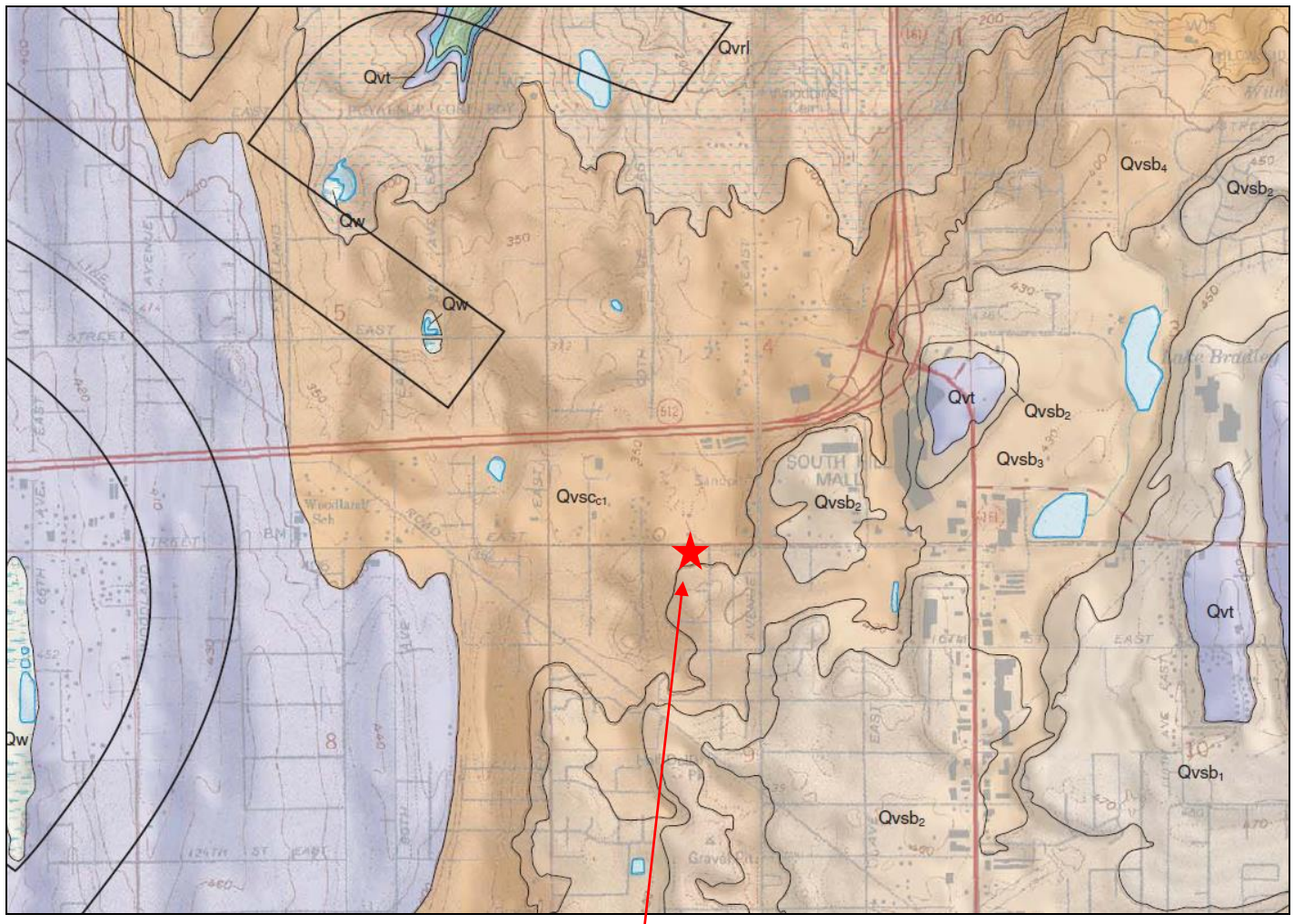
NRCS Soils Map

Proposed Office
1212 – 39th Avenue Southwest
Puyallup, Washington
PN: 0419092021

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Figure 3



Approximate Site Location

An excerpt from the draft *Geologic Map of the Puyallup 7.5-minute Quadrangle*, Washington, by K.G. Troost

QVSC _{c1}	Steilacoom Gravel
Qvsb ₄	Vashon recessional outwash



Not to Scale

Appendix A

Subsurface Explorations

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME	
COARSE GRAINED SOILS More than 50% Retained on No. 200 Sieve	GRAVEL	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL	
			GP	POORLY-GRADED GRAVEL	
	More than 50% Of Coarse Fraction Retained on No. 4 Sieve	GRAVEL WITH FINES	GM	SILTY GRAVEL	
			GC	CLAYEY GRAVEL	
	SAND	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND	
			SP	POORLY-GRADED SAND	
		More than 50% Of Coarse Fraction Passes No. 4 Sieve	SAND WITH FINES	SM	SILTY SAND
				SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% Passes No. 200 Sieve	SILT AND CLAY	INORGANIC	ML	SILT	
			CL	CLAY	
	Liquid Limit Less than 50	ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY	
			SILT AND CLAY	INORGANIC	MH
	CH	CLAY OF HIGH PLASTICITY, FAT CLAY			
	Liquid Limit 50 or more	ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT	
HIGHLY ORGANIC SOILS			PT	PEAT	

NOTES:

- Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
- Soil classification using laboratory tests is based on ASTM D2487-90.
- Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

- Dry- Absence of moisture, dry to the touch
- Moist- Damp, but no visible water
- Wet- Visible free water or saturated, usually soil is obtained from below water table

Unified Soils Classification System

Proposed Office
 1212 – 39th Avenue Southwest
 Puyallup, Washington
 PN: 0419092021

Test Pit TP-1

Location: Southwestern portion of parcel

Approximate Elevation: 400'

Depth (ft)			Soil Type	Soil Description
0	-	0.5	-	Topsoil
0.5	-	1.5	SM	Brown silty fine SAND (loose, moist)
1.5	-	4.0	ML	Light brown SILT, orange iron oxide staining at contact (medium stiff, moist)

Terminated at 4 feet below ground surface.
No caving observed at the time of excavation.
No groundwater seepage observed.
Mottling observed at 1.5 feet below existing ground surface

Test Pit TP-2

Location: Northwestern portion of parcel

Approximate Elevation: 398'

Depth (ft)			Soil Type	Soil Description
0	-	0.5	-	Topsoil
0.5	-	3.5	ML	Light brown, orange iron oxide stained SILT (medium stiff, moist)
3.5	-	4.0	ML	Gray SILT with some sand (medium stiff to stiff, moist)

Terminated at 4 feet below ground surface.
No caving observed at the time of excavation.
No groundwater seepage observed.
Mottling observed at 2.0 feet below existing ground surface

Test Pit TP-3

Location: Central portion of site, within existing gravel driveway

Approximate Elevation: 400'

Depth (ft)			Soil Type	Soil Description
0	-	0.2	-	Crushed rock (dense, moist) (fill)
0.2	-	1.5	-	Brown sand and gravel (dense, moist) (fill)
1.5	-	2.0	ML	Reddish brown, orange iron oxide stained SILT (soft, moist)
2.0	-	4.0	ML	Light brown, orange iron oxide stained SILT (medium stiff, moist)

Terminated at 4 feet below ground surface.
No caving observed at the time of excavation.
No groundwater seepage observed.
Mottling observed at 1.5 feet below existing ground surface

Logged by: AES

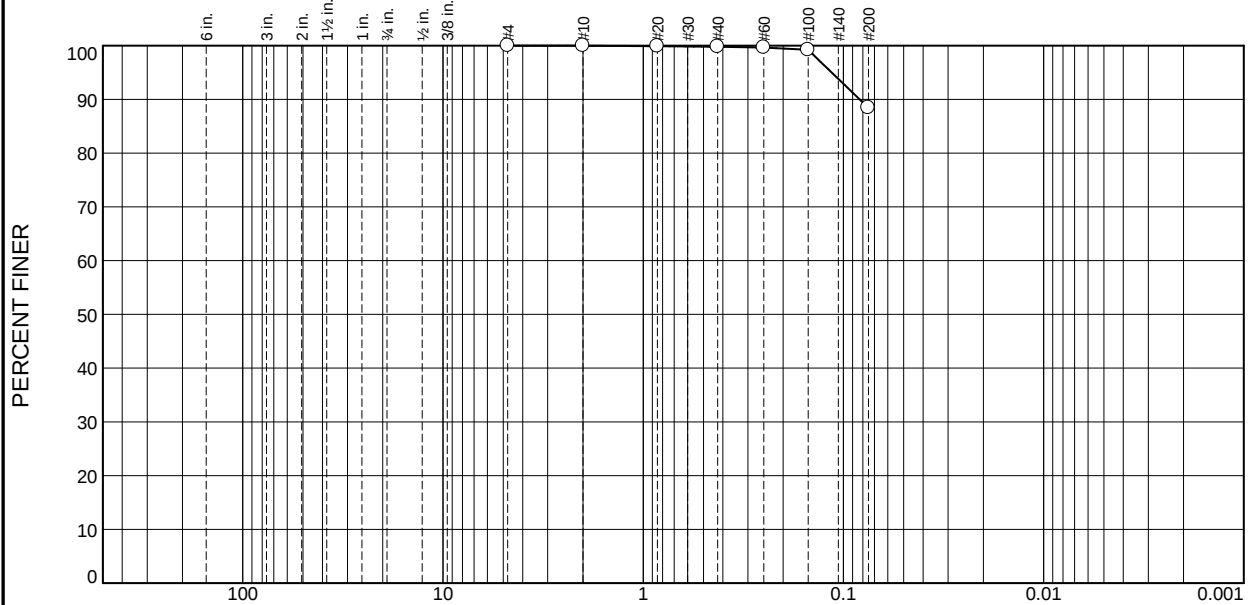
Excavated on: May 20, 2019

Test Pit Logs

Proposed Office
1212 – 39th Avenue Southwest
Puyallup, Washington
PN: 0419092021

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples.

Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	11.4	88.4	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	99.6		
#100	99.2		
#200	88.4		

* (no specification provided)

Material Description

LIGHT BROWN silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NV

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D₉₀= 0.0829 D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Date Received: 5/20/2019 Date Tested: 5/20/2019

Tested By: AES

Checked By: STM

Title: PM

Location: TP-1, S-2

Sample Number: 097472

Depth: 1.5-4

Date Sampled: 5/20/2019

GeoResources, LLC

Client: Presidential Homes

Project: Proposed Office

Fife, WA

Project No: PresHomes.39th

Figure

Tested By: _____ Checked By: _____