February 18th, 2022 G-5514

Mr. Jesse Tam
Phone: (206) 948-9902
Email: jesset28@aol.com

Subject: **Geotechnical Engineering Investigation & Soil Infiltration Evaluation**
Proposed Short-Plat
4833 – 90th Ave SE
Mercer Island, Washington

Dear Mr. Tam:

At your request, GEO Group Northwest, Inc., conducted a geotechnical engineering investigation and soil infiltration evaluation for the proposed short-plat at the above-subject location in Mercer Island, Washington**.** The scope of our services included review of the area geologic map; assessment of subsurface soil and groundwater conditions; pilot infiltration testing; and preparation of this report of our findings, conclusions, and recommendations.

SITE CONDITIONS

Site Description

The project site is located in Mercer Island, Washington, as illustrated in *Plate 1 – Site Location Map*. The site is rectangularly shaped and consists of approximately 41,110 square feet (0.94 acres). The existing residence is located in the central region of the property. In general, the site features level topography, however, when nearing the west property line, the site begins to slope westerly at low to moderate inclinations down to Island Crest Way below. The majority of this moderately-inclined slope area is west of the property line in the City right-of-way. The existing site configuration and topography are illustrated in *Plate 2 – Site Plan,* and *Plate 3 – Site Geologic Hazards Map*. The site is bounded by residential developed properties to the north and south, Island Crest Way to the west, and by 90th Avenue Southeast to the east. A gravel driveway extending from 90th Avenue Southeast enters the property along the east property line.

Proposed Development

At this time, we understand that the existing site is proposed to be divided into four individual lots. In this case, we anticipate that a total of up to four single-family residences will be built on the project site. This report has been prepared to be applicable to construction of typical wood-frame single-family residences having 1 to 3 stories including a basement. We recommend that specific plans for the parcels should be reviewed by the geotechnical engineer, to evaluate whether the conclusions and recommendations in the report remain applicable and supplemental or revised recommendations should be provided where appropriate.

SITE INVESTIGATION

Geologic Overview

According to the area geologic map, the site soils are identified as Vashon subglacial till (Qvt) from the Fraser Glaciation. Glacial till is described as a very compact mixture of sand, silt, clay, and gravel deposited under glacial ice during the Fraser glaciation period. Glacial till typically has a weathered zone of loose to medium dense soil on top, underlain by dense, unweathered till.

Subsurface Investigation

On January 21st, 2022, Garrett Dean, Staff Engineering Geologist from our firm, visited the site to perform a visual reconnaissance of the site and investigate the subsurface soil conditions. In addition to our reconnaissance, we oversaw the excavation of five exploratory test pits throughout the site (TP-1 through TP-5). The boring locations are illustrated on *Plate 2 – Site Plan*.

The soils encountered the test pits typically consisted of a thin surface veneer of organic-rich silty sand topsoil, underlain by medium dense to very dense silty sand with some gravel to the total depth of the test pits which ranged between approximately 3 to 3.5 feet below the ground surface (bgs). A minor amount of fill material was encountered near the surface in test pit TP-1. A small amount of groundwater seepage was encountered at a depth of approximately 2.5 feet in test pit TP-1. For additional information about the soils encountered, please refer to the test pit logs attached as *Appendix A* to this report.

GEOLOGIC HAZARD AREAS REVIEW

We reviewed available geologic hazard areas information on the City of Mercer Island Information and Geographic Services (IGS) website. The information indicates that the project site is located within erosion and landslide hazard critical areas. According to the IGS information, no known landslides are identified on the project site or immediate adjacent vicinity. The erosion and landslide hazard areas at the site are limited to the moderately-inclined, sloping region at the west margin of the site and are identified in *Plate 3 – Site Geologic Hazards Map*.

Landslide Hazard Area Evaluation

During our investigation, we observed no indications of soil instability or erosion within the hazard area or other areas of the site. No water seepage was observed in test pits TP-3 and TP-4, which were located within or directly adjacent to the mapped landslide hazard area. The slope in the hazard area is approximately 12 to 16 feet in vertical height and per the mapping provided by the City of Mercer Island IGS, is less than 40 percent grade, which excludes the feature's designation as a 'steep slope' status. The slope and hazard area are well-vegetated with native shrubs, trees, and groundcover. No water seepage was observed at the slope's toe or face.

We find the presence of very dense, glacially consolidated soils at shallow depths throughout the project site to be a mitigating factor in regards to the potential for landsliding at the site. Therefore, in our opinion, the risk of landsliding or soil movement at the site can be considered very low based on these observed site conditions.

Erosion Hazard Area Evaluation

During our investigation we did not observe signs of rutting or downslope soil movement at the site or erosion hazard area. We observed the site as a whole, including the moderately-inclined slope region at the west extent of the site, to be well-vegetated with various native shrubs, trees, and groundcover. This vegetated condition is a mitigating factor with regards to soil erosion at the site in our opinion.

Provided that the proper temporary and permanent erosion and sediment controls, provided in this report, are implemented where soils have been disturbed during and post development, it is our opinion that the risk of significant soil erosion at the site can be considered minimal.

SOIL INFILTRATION EVALUATION

Soil Infiltration Testing

Test pit TP-5 was used to perform soil infiltration testing using the small Pilot Infiltration Test procedure described in the December 2014 edition of the Washington Department of Ecology Stormwater Management Manual for Western Washington. The test was performed at a depth of approximately 26 inches below the existing ground surface at the location.

Following the soaking period, the testing consisted of taking water level measurements until one hour of essentially steady water levels were measured. Afterward, the water supply was shut off, and the drop of the water level was measured at regular intervals for a period of 90 minutes. The test data is presented in *Appendix B* to this letter.

Approximately 1.5 inches of water was observed in the test pit at 8:50am the following morning, which was approximately 17 hours after the testing was completed. The test pit was excavated further to check for the presence of a hydraulic restrictive layer. A hydraulically restrictive layer was encountered at approximately 3 feet of depth in TP-5. Based on observations of soil conditions in the other four test pits that were excavated on site (TP-1 through TP-4), the presence of the hydraulically restrictive layer can be assumed to underly the entirety of project site.

Testing Results

At test pit TP-5, a measured infiltration rate of 3.21 in/hr was obtained for the steady flow portion of the testing, and a measured infiltration rate of 0.61 in/hr was obtained for the falling head portion of the testing.

We used the falling head values to calculate design infiltration rates for the test location. We applied a correction factor of 0.28 to account for soil variability, test method used, and long-term maintenance considerations. <u>The resulting design infiltration rate is calculated to be **0.17 in/hr**.</u>

Infiltration Feasibility

In our opinion, infiltration feasibility at the subject location is limited first by the high fines content in the weathered soil horizon and is additionally hindered by the presence of hydraulically restrictive hardpan glacial till which was encountered at relatively shallow depths in the test pits. As mentioned previously in the Subsurface Investigation and Soil Infiltration Testing sections above, hydraulically restrictive glacial till was encountered at depths ranging between 3 to 3.5 feet below the ground surface in the test pits.

CONCLUSIONS AND RECOMMENDATIONS

Soil Infiltration Feasibility Evaluation

The results from our subsurface investigation conclude that the site soils contain a high fraction of fines and are relatively impermeable. In our opinion, infiltration as a stormwater bmp for the site is not feasible. Dispersion in the backyards is not recommended due to potential impacts to the neighboring properties. We recommend that drainage from the proposed development be discharged into the existing stormwater drainage system if available, or otherwise discharged to an approved alternative.

Seismicity Evaluation

In accordance with the 2018 International Building Code, the site classification is Site Class D (stiff soil). Glacially consolidated soils have a high shear strength and the potential for landslides, liquefaction and/or lateral spreading during a strong motion earthquake can be considered negligible. In our opinion, the site is stable and the risk of a surface rupture, resulting from a large magnitude seismic event, is very low. No seismic mitigation measures are recommended, with the exception of the addition of design criteria for seismically induced soil loads on permanent below-grade basement and retaining walls.

Foundations

Soils that are anticipated to be acceptable for building support were encountered at a depth of approximately 2.5 to 3.5 feet bgs throughout the project site. Based upon this information, it is our opinion that new foundations for the project can consist of conventional concrete strip and column footings that bear directly on dense native soils or on compacted structural fill that has been placed on a subgrade of dense native soils. Our recommended design criteria for conventional footing foundations supported on native soils or structural fill are provided below.

- Allowable bearing pressure, including all dead and live loads:
    - Undisturbed, medium dense or dense soil = 2,500 psf
    - Structural fill placed on medium dense or dense soil = 2,500 psf

- Minimum depth to base of perimeter footing below adjacent exterior grade = 18 inches

- Minimum depth to bottom of interior footings below top of floor slab = 12 inches

- Minimum width of wall footings = 16 inches

- Minimum lateral dimension of column footings = 24 inches

- Estimated post-construction settlement = ½ inch

- Estimated post-construction differential settlement across building width = ½ inch

A one-third increase in the above allowable bearing pressures can be used when considering short-term transitory wind or seismic loads.

Lateral loads against the building foundations can be resisted by friction between the foundation and the supporting subgrade or by passive earth pressure acting on the buried portions of the foundations. For the latter case, the foundations must be poured "neat" against the existing undisturbed soil or be backfilled with compacted structural fill. Our recommended parameters are as follows:

- Passive Pressure (Lateral Resistance)
    - 350 pcf, equivalent fluid weight, for structural fill or competent undisturbed native soil

- Coefficient of Friction (Friction Factor)
    - 0.35 for structural fill or competent undisturbed native soil

Conventional Retaining and Basement Walls

Conventional concrete retaining or basement walls may be supported on spread footing foundations which are supported per the recommendations provided above in this report. Walls that are restrained horizontally are considered unyielding and should be designed for lateral soil pressure under the at-rest condition. Walls that are free to rotate should be designed for an active lateral soil pressure.

- <u>At-Rest Soil Pressure</u>

  Walls supported horizontally (i.e., floor framing) are considered unyielding and should be designed under the at-rest condition. We recommend using a design lateral soil pressure with an equivalent fluid density of 45 pcf for level ground above the wall.

- <u>Active Soil Pressure</u>

  Cantilever walls designed to yield an amount equal to 0.002 times the wall height should be designed under an active soil pressure condition. We recommend using a design lateral soil pressure with an equivalent fluid density of 35 pcf for level ground above the wall.

- <u>Seismic Earth Pressure</u>

  In addition to the above triangular lateral soil pressures, a rectangular pressure of 8H should be added for permanent below grade walls to account for seismically induced dynamic soil loads. Where H is the overall height of the wall in feet.

- <u>Passive Earth Pressure and Base Friction</u>

  The available passive earth pressure that can be mobilized to resist lateral forces may be assumed to be equal to 350 pcf equivalent fluid weight for both undisturbed soils and engineered structural fill. The base friction that can be generated between concrete and undisturbed bearing soils or engineered structural fill may be based on an assumed 0.35. The soil design parameters are allowable values and include a safety factor of 2.

The active and at-rest design pressures are based on a fully drained wall condition and do not include the effects of surcharges. For sloped ground above walls, a surcharge equivalent to

50 percent of the soil height above the wall (soil unit weight 125 pcf) should be used in addition to the above soil pressure. Traffic and construction equipment surcharge may be considered as a uniform surcharge equivalent to two (2) feet of soil acting over the full depth of the active pressure. Below grade walls should be drained to prevent the buildup of hydrostatic pressure behind the wall, as discussed in the Drainage section of this report. Restrained walls designed should be backfilled after completing their lateral restraint is in place or per the approval of the structural design engineer.

Concrete Slabs-on-Grade

Slab-on-grade floors should be constructed on a firm, unyielding subgrade. During preparation of the slab subgrade, any areas of the subgrade that have been disturbed by construction activity should be either re-compacted or excavated and replaced with compacted structural fill. We recommend that structural fill placed below slab-on-grade floors conform to the earthwork and grading recommendations provided in this report.

To avoid moisture build-up on the subgrade, the floor slab should be placed on a capillary break, which is in turn placed on the prepared subgrade. The capillary break should consist of a 6”-minimum thickness layer of crushed rock or gravel that contains no more than five percent material finer than a No. 4 sieve. A vapor barrier, such as a 10-mil plastic membrane, should be placed over the capillary break and taped or sealed to minimize water vapor transmission upward through the slab, if post-construction vapor transmission is undesirable.

Drainage

Water should not be allowed to stand in areas where footings, slabs, or pavements are to be constructed. Final site grades should provide drainage away from the building structure. Drainage should be installed against below-grade walls to prevent moisture intrusion and a buildup of hydrostatic pressure. To facilitate drainage behind below grade walls, we recommend installing a vertical drain mat (sheet drain) such as Miradrain 6000, or equivalent, with a footing drain at the base of the wall, as illustrated in *Plate 4 – Typical Basement Wall Drainage*. Wall backfill against the vertical drain mat should be compacted to a minimum of 90 percent of the material’s maximum dry density to mitigate clogging of the filter fabric.

Footing drains, consisting of a 4-inch minimum diameter, rigid perforated drain pipe, should extend around new perimeter foundations and be installed behind new basement and retaining walls. Footing drains should be bedded in washed drain rock and the rock wrapped with geotextile filter fabric, such as Mirafi 140N, or equivalent, as illustrated *Plate 5 – Typical Footing Drain*. The drain rock should extend above the base of the vertical drain mat. Roof and other drain lines should not be connected to the footing drain system. We recommend installing a sump pump system if the footing drain system cannot drain by gravity to a discharge location. Installation of clean-outs are recommended to allow periodic maintenance of the drain system.

Grading and Earthwork

Erosion Control

Temporary erosion and sedimentation controls (TESCs), such as silt fences, should be installed down-gradient of the areas to be disturbed to prevent sediment-laden runoff from being discharged off site. Surface runoff should not be allowed to flow over the top of slopes into excavations. During wet weather, exposed soils should be covered with plastic sheeting or straw mulch. Stockpiled soils should be covered with plastic tarps. For permanent erosion control disturbed soils should be landscaped and mulched upon completion of the site work.

A construction entrance consisting of 2- to 4-inch size crushed rock should be installed to prevent tracking onto the street. The construction entrance area should be cleared and grubbed prior to rock placement and we recommend underlaying the rock with a woven geotextile such as Mirafi 500X, or equivalent, to provide separation between the rock and subgrade soil.

Excavations and Slopes

Temporary excavation slopes should not be greater than the limits specified in local, state and federal government safety regulations. We recommend that temporary cuts greater than 4 feet in height be sloped at inclinations up to 1H:1V (Horizontal: Vertical) in loose to medium dense soils. Temporary excavations in the very dense, hardpan soils can be sloped near vertical under the observation of the geotechnical engineer. Permanent cut and fill slopes should be inclined no steeper than 2.5H:1V. Steeper permanent fill slopes can be achieved with the use of geogrid for lateral reinforcement. Slopes that are to be maintained or mowed should be sloped at 3H:1V, or less. Excavation work for the project should not extend below a 1H:1V line extending from the property lines in loose to medium dense soils, in order to avoid affecting the adjacent properties.

Fill slopes should consist of granular material compacted to a minimum of 90 percent of the material's maximum dry density. If supporting structural elements, the fill should be compacted to the structural fill specification of 92 percent.

Based on the subsurface findings, groundwater seepage is expected. If significant water seepage or other adverse conditions are encountered, excavation should be halted, and the geotechnical engineer should be contacted to review the site conditions.

Structural Fill

Structural fill is defined as fill soil supporting building foundations, floor slabs, pavements, sidewalks or other structures. Structural fill should be free of organic and other deleterious substances and have a maximum fragment size of 3 inches. The site soils contain appreciable proportions of fines may be difficult to achieve compaction during wet weather, depending on the material's moisture content. Therefore, during wet weather, we recommend using a free-draining granular material containing no more than 5 percent fines content (silt and clay-size particles passing the No. 200 mesh sieve). Other materials, such as recycled crushed concrete or crushed rock may be used.

Structural fill should be placed and compacted at or near the material's optimum moisture content and in lifts that are 10 inches thick or less. Below slab-on-grade floors, foundations, and other structural elements, structural fill should be compacted to a minimum of 92 percent of the material's maximum dry density, as determined by ASTM Test Designation D-1557 (Modified Proctor). For driveways, structural fill should be compacted to 90 percent, with the exception of the top 12 inches which should be compacted to 95 percent. Fill behind retaining walls and next to building foundation walls should be compacted to a minimum of 90 percent (92 percent if supporting structural elements; if supporting pavements, the top 12 inches should be compacted to 95 percent).

Utility trench backfill within the City right-of-way should be compacted to the specifications required by the City, sewer or water district. Observation and compaction testing may be required at the time of fill placement to document and verify that the compaction specifications are achieved.

LIMITATIONS

The findings and recommendations stated herein are based on field observations, our experience on similar projects and our professional judgment. The recommendations presented herein are our professional opinions derived in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area and within the project schedule and budget constraints. No warranty is expressed or implied. In the event that site conditions are found to differ from those described in this report, we should be notified so that the relevant recommendations in this report can be reevaluated and modified if appropriate.

CLOSING

We appreciate the opportunity to provide you with geotechnical engineering services for this project. Please do not hesitate to contact us if you have any questions regarding this report.

Sincerely,

GEO Group Northwest, Inc.

Garrett Dean, G.I.T.
Staff Engineering Geologist

William Chang, P.E.
Principal Engineer

Attachments:

Plate 1 – Site Location Map
Plate 2 – Site Plan
Plate 3 – Site Geologic Hazards Map
Plate 4 – Typical Basement Wall Drain
Plate 5 – Typical Footing Drain
Appendix A – USCS Soil Classification & Test Pit Logs
Appendix B - Pilot Infiltration Test Data & Calculations

Source: King County iMap, 2022

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE LOCATION MAP

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

SCALE	NONE	DATE	2/18/2022	MADE	GD	CHKD	WC	JOB NO.	G-5514	PLATE	1

LEGEND

TP-1 Test Pit Number & Approximate Location

0 30' 60'

Approx. Scale: 1 inch = 60'

N

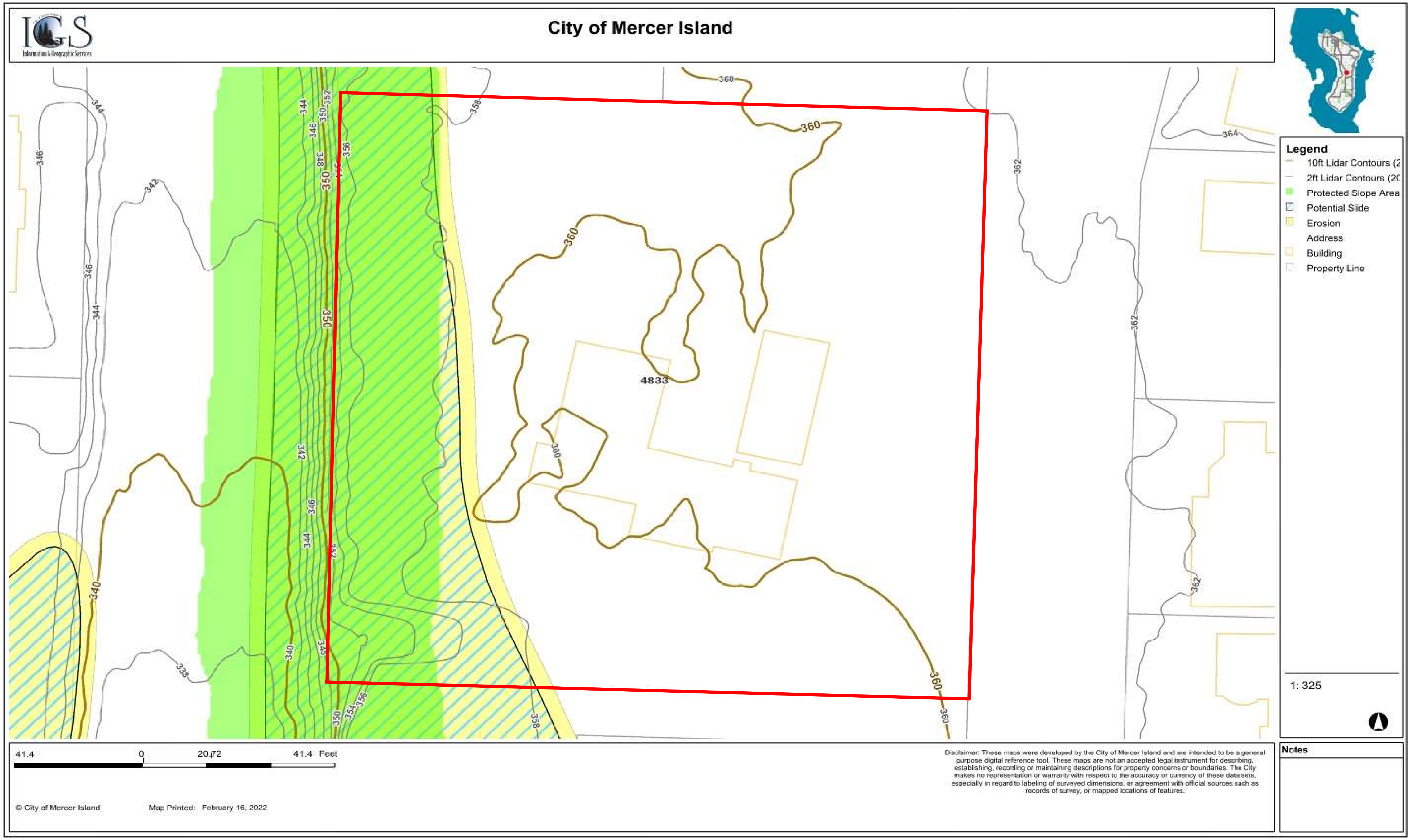
This Site Plan Adapted From City of Mercer Island GIS Portal, Retrieved February, 2022.

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE PLAN

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

SCALE	DATE	MADE	CHKD	JOB NO.	PLATE
As Shown	2/18/22	GD	WC	G-5514	2



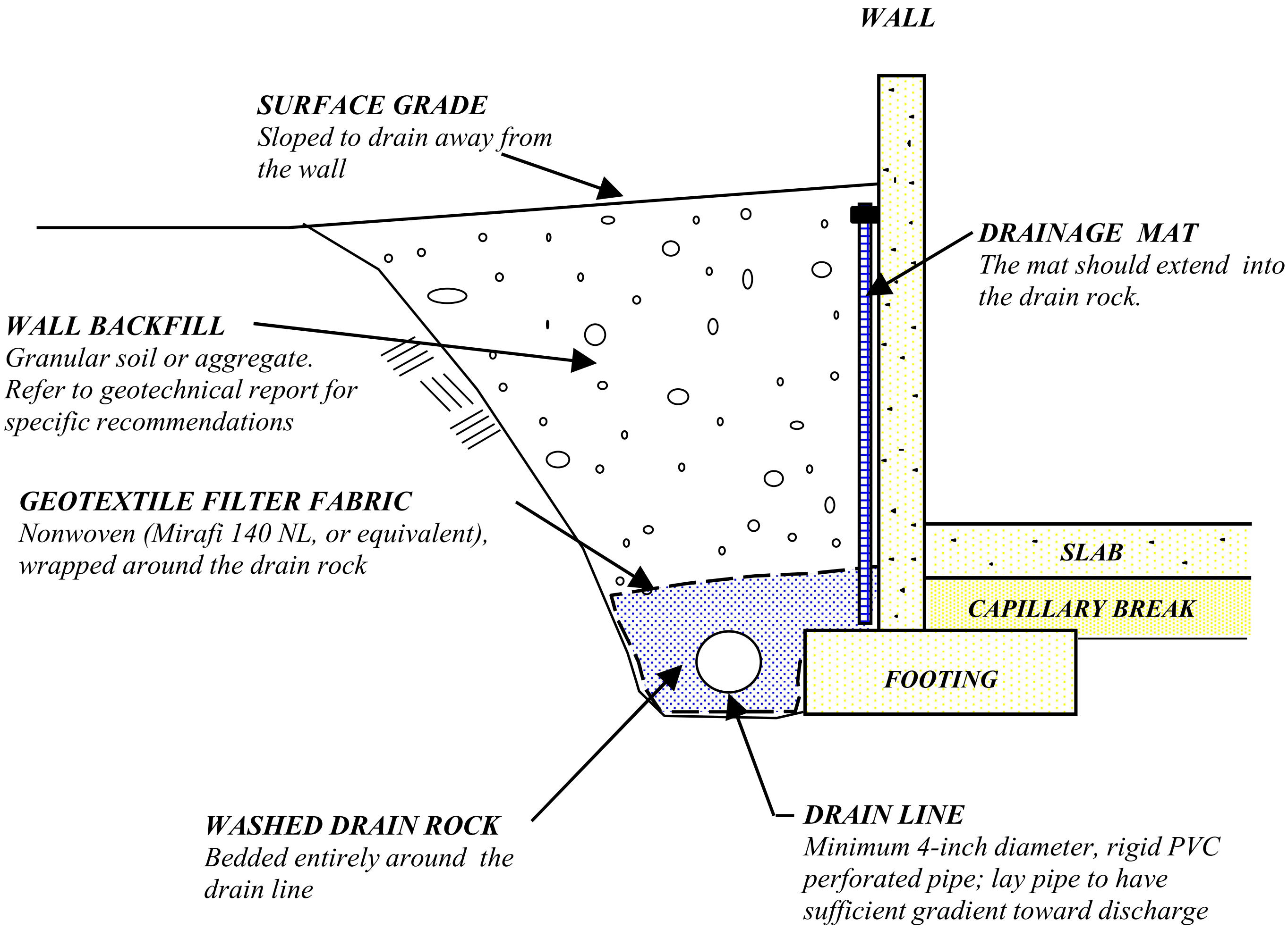
GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE GEOLOGIC HAZARDS MAP

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

SCALE	AS SHOWN	DRAWN BY	GD	CHECKED BY	WC	DATE	2/18/2022	PROJECT NO.	G-5514	PLATE	3

TYPICAL BASEMENT WALL DRAIN



NOT TO SCALE

NOTES:

1.) Do not replace rigid PVC pipe with flexible corrugated plastic pipe.

2.) Perforated PVC pipe should be tight jointed and laid with perforations oriented downward. The pipe should be gently sloped to provide flow toward the tightline or discharge location.

3.) Do not connect other drain lines into the footing drain system.

4.) Backfill should meet structural fill specifications if it will support driveways, sidewalks, patios, or other structures. Refer to the geotechnical engineering report for structural fill recommendations.

5.) Surface grade above the backfill can be covered with a layer of relatively impermeable topsoil or pavement or slab to reduce infiltration of surface water into the backfill and drainage system

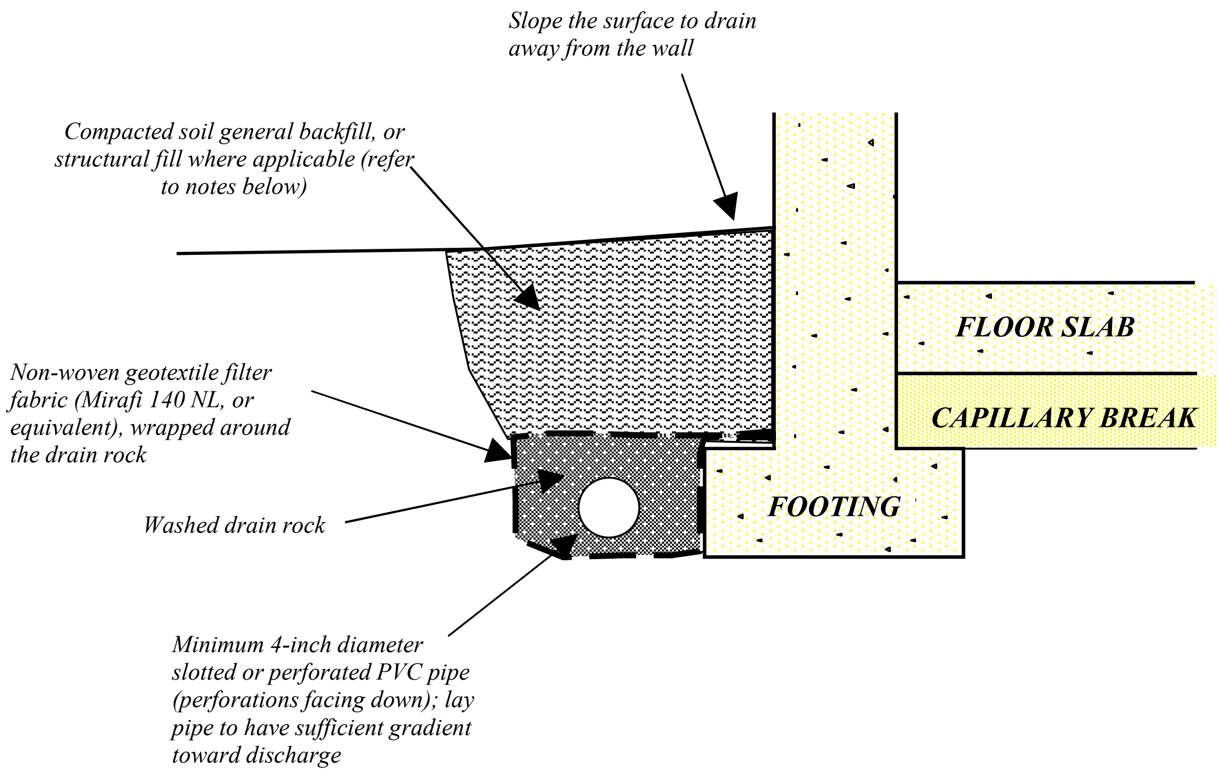
GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

TYPICAL BASEMENT WALL DRAIN

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

SCALE NONE	**DATE** 2/18/2022	**MADE** GD	**CHKD** WC	**JOB NO.** G-5514	**PLATE** 4

TYPICAL FOOTING DRAIN



NOT TO SCALE

NOTES:

1.) Perforated or slotted rigid PVC pipe should be tight jointed and laid with perforations or slots down, and with positive gradient toward discharge location(s). The pipe should be placed at or slightly above the elevation of the bottom of the footing. Do not replace rigid PVC pipe with flexible corrugated plastic pipe.

2.) Do not connect other drainage lines to the footing drain lines. Drain line cleanouts should be installed at appropriate locations to allow inspection and maintenance of the lines after construction.

3.) If the backfill will support sidewalks, driveways, patios, or other structures, it should be compacted to at least 90% of its maximum dry density based on the Modified Proctor test method, except that the top 12 inches of the backfill should be compacted to at least 95% of the maximum dry density.

4.) The geotextile filter fabric should be placed around the drain rock as shown, and not wrapped directly around the pipe.

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

TYPICAL FOOTING DRAIN
PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

SCALE: NONE	DATE: 2/18/2022	MADE: GD	CHKD: WC	JOB NO. G-5514	PLATE 5

APPENDIX A

G-5514

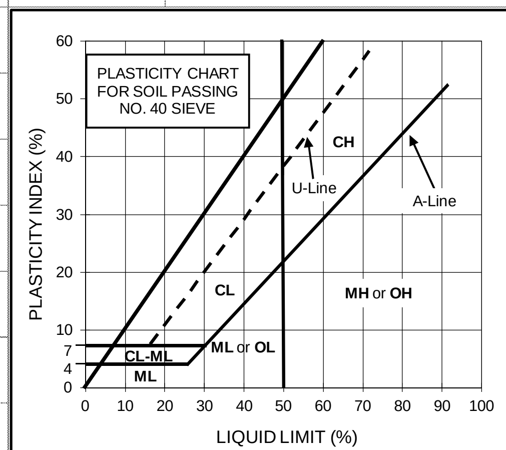
USCS SOIL CLASSIFICATION & TEST PIT LOGS

GEO Group Northwest, Inc.

SOIL CLASSIFICATION & PENETRATION TEST DATA EXPLANATION

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS More Than Half by Weight Larger Than No. 200 Sieve	GRAVELS (More Than Half Coarse Fraction is Larger Than No. 4 Sieve)	CLEAN GRAVELS (little or no fines)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	CONTENT OF FINES BELOW 5%	Cu = (D60 / D10) greater than 4 Cc = $(D30)^2$ / (D10 * D60) between 1 and 3
			GP	POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES LITTLE OR NO FINES		CLEAN GRAVELS NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (with some fines)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	GM: ATTERBERG LIMITS BELOW "A" LINE. or P.I. LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		GC: ATTERBERG LIMITS ABOVE "A" LINE. or P.I. MORE THAN 7
	SANDS (More Than Half Coarse Fraction is Smaller Than No. 4 Sieve)	CLEAN SANDS (little or no fines)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	CONTENT OF FINES BELOW 5%	Cu = (D60 / D10) greater than 6 Cc = $(D30)^2$ / (D10 * D60) between 1 and 3
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		CLEAN SANDS NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (with some fines)	SM	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE with P.I. LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE with P.I. MORE THAN 7
FINE-GRAINED SOILS Less Than Half by Weight Larger Than No. 200 Sieve	SILTS (Below A-Line on Plasticity Chart, Negligible Organics)	Liquid Limit < 50%	ML	INORGANIC SILTS, ROCK FLOUR, SANDY SILTS OF SLIGHT PLASTICITY		
		Liquid Limit > 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOIL		
	CLAYS (Above A-Line on Plasticity Chart, Negligible Organics)	Liquid Limit < 50%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, CLEAN CLAYS		
		Liquid Limit > 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS (Below A-Line on Plasticity Chart)	Liquid Limit < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		Liquid Limit > 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS		



SOIL PARTICLE SIZE				
FRACTION	U.S. STANDARD SIEVE			
	Passing		Retained	
	Sieve	Size (mm)	Sieve	Size (mm)
SILT / CLAY	#200	0.075		
SAND				
FINE	#40	0.425	#200	0.075
MEDIUM	#10	2.00	#40	0.425
COARSE	#4	4.75	#10	2.00
GRAVEL				
FINE	0.75"	19	#4	4.75
COARSE	3"	76	0.75"	19
COBBLES	76 mm to 203 mm			
BOULDERS	> 203 mm			
ROCK FRAGMENTS	> 76 mm			
ROCK	>0.76 cubic meter in volume			

GENERAL GUIDANCE FOR ENGINEERING PROPERTIES OF SOILS, BASED ON STANDARD PENETRATION TEST (SPT) DATA

SANDY SOILS				SILTY & CLAYEY SOILS		
Blow Counts N	Relative Density, %	Friction Angle ϕ, degrees	Description	Blow Counts N	Unconfined Strength q_u, tsf	Description
0 - 4	0 -15		Very Loose	< 2	< 0.25	Very soft
4 - 10	15 - 35	26 - 30	Loose	2 - 4	0.25 - 0.50	Soft
10 - 30	35 - 65	28 - 35	Medium Dense	4 - 8	0.50 - 1.00	Medium Stiff
30 - 50	65 - 85	35 - 42	Dense	8 - 15	1.00 - 2.00	Stiff
> 50	85 - 100	38 - 46	Very Dense	15 - 30	2.00 - 4.00	Very Stiff
				> 30	> 4.00	Hard

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APPEND A1

TEST-PIT: TP-1

LOGGED BY GD **LOG DATE:** 1/21/2022 **GROUND ELEV.** 360 feet +/-

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
0–1.5	SM	Silty SAND, dark brown, loose, moist; with some subrounded gravel, organics, small roots, glass bottle, wood fragments (**topsoil/fill**)	S1	34.0	Probe 30" at 0'
1.5–3	SM	Silty SAND, brown to brownish-gray, dense, damp; with some subrounded gravel, minor cobbles (**weathered till**)	S2	14.7	Probe 4" at 1.5'; Probe 3.5" at 2.5'
3–3.1	SM	Silty SAND, brownish-gray, very dense, damp; with some subrounded gravel, minor cobbles, mottling (**glacial till**)	S3	18.5	Probe 0.5" at 3'

Total depth = 3.1 feet
Minor groundwater seepage encountered at approximately 2.5 feet.

TEST PIT: TP-2

LOGGED BY GD **LOG DATE:** 1/21/2022 **GROUND ELEV.** 360 feet +/-

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
0–1.2	SM	Silty SAND, dark brown, loose, moist; with some subrounded gravel, organics, small roots, (**topsoil**)	S1	16.2	Probe 18" at 0'; Probe 18" at 1'
1.2–2.8	SM	Silty SAND, brown to gray, loose to medium dense, damp; with some subrounded gravel, minor cobbles, minor mottling, roots (**weathered till**) -becomes gray at 1.5'	S2	16.1	Probe 3" at 2'
2.8–3.5	SM	Silty SAND to Sandy SILT, gray, very dense, damp; with some subrounded gravel, mottling (**glacial till**)	S3	17.8	Probe 5" at 3'; Probe 0.5" at 3.5'

Total depth = 3.5 feet
No groundwater encountered.

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

TEST PIT LOGS

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

JOB NO. G-5514 **DATE** 2/18/22 **APPEND.** A2

TEST-PIT: TP-3

LOGGED BY GD **LOG DATE:** 1/21/2022 **GROUND ELEV.** 358 feet +/-

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
0–1	SM	Silty SAND, dark brown, loose, moist; with some subrounded gravel, organics, small roots, (**topsoil**)			Probe 30" at 0'; Probe 6" at 1'
1–2.6	SM	Silty SAND, brown to brownish-gray, dense, damp; with some subrounded gravel and cobbles (**weathered till**)	S1	20.7	Probe 4" at 2'
2.6–3	SM	Silty SAND, gray, very dense, damp; with some subrounded gravel, minor cobbles, mottling (**glacial till**)	S2	17.1	Probe 0.5" at 2.8'
		Total depth = 3.0 feet No groundwater encountered			

TEST PIT: TP-4

LOGGED BY GD **LOG DATE:** 1/21/2022 **GROUND ELEV.** 358 feet +/-

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
0–1.2	SM	Silty SAND, dark brown, loose to medium dense, moist; with some subrounded gravel, organics, small roots (**topsoil**)			Probe 20" at 0.5'
1.2–2.8	SM	Silty SAND, brownish-gray, medium dense, damp; with some subrounded gravel, minor cobbles, minor mottling (**weathered till**)	S1	13.2	Probe 10" at 1.7'
2.8–3.3	SM	Silty SAND to Sandy SILT, gray, very dense, damp; with some subrounded gravel, mottling (**glacial till**)	S2	15.8	Probe 4.5" at 3' Probe 0" at 3.3'
		Total depth = 3.3 feet No groundwater encountered.			

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TEST PIT LOGS

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

JOB NO. G-5514 **DATE** 2/18/22 **APPEND.** A3

TEST-PIT: TP-5

LOGGED BY GD LOG DATE: 1/21/2022 GROUND ELEV. 360 feet +/-

DEPTH ft.		USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
1		SM	Silty SAND, dark brown, loose, moist; with some subrounded gravel, organics, small roots, (**topsoil**)			Probe 25" at 0'
2		SM	Silty SAND, brown, dense, damp; with some subrounded gravel (**weathered till**)	S1	28.7	
				S2	38.2	Probe 0" at 2.1'
3		SM	Silty SAND, gray, very dense, damp; with some subrounded gravel, minor cobbles, mottling (**glacial till**)	S3	25.3	Probe 1" at 3'
4			Total depth = 3.0 feet No groundwater encountered. Pilot infiltration test performed at depth of approximately 26 inches.			
5						
6						
7						

TEST PIT:

LOGGED BY LOG DATE: GROUND ELEV.

DEPTH ft.		USCS	SOIL DESCRIPTION	SAMPLE No.	Water %	OTHER TESTS/ COMMENTS
1						
2						
3						
4						
5						
6						
7						

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TEST PIT LOGS

PROPOSED SHORT-PLAT
4833 - 90TH AVE SE
MERCER ISLAND, WASHINGTON

JOB NO. G-5514 DATE 2/18/22 APPEND. A4

APPENDIX B

G-5514

PILOT INFILTRATION TEST DATA & CALCULATIONS

Pilot Infiltration Test Data

4833 - 90th Ave SE
Mercer Island, Washington

Test Pit TP-5

Time	Time Interval (minutes)	Water Level (inches)	Water Level Change (inches)	Flow Reading (sec/gal)	Comments/Remarks
7:30	- -	- -	- -	17.14	Start adding water. Flow approximately 3.50 gpm
8:12	42	12	12	75.00	Flow reduced to approximately 0.8 gpm
9:12	60	12	0	75.00	
10:12	60	12	0	75.00	
11:12	60	12	0	75.00	
12:12	60	12	0	75.00	
13:12	60	12	0	200.00	Flow reduced to approximately 0.3 gpm
14:12	60	12	0	200.00	

Time	Time Interval (minutes)	Water Level (inches)	Water Level Change (inches)	Comments/Remarks
15:12	- -	12 1/4	0	
15:22	10	12	- 1/4	
15:32	10	11 3/4	- 1/4	
15:42	10	11 1/4	- 1/2	
15:52	10	11	- 1/4	
16:02	10	10 5/8	- 3/8	
16:12	10	10 1/4	- 3/8	
16:22	10	10	- 1/4	
16:32	10	9 3/4	- 1/4	
16:42	10	9 1/2	- 1/4	
8:50	928	1 1/2	-8	End of readings and testing.

Test performed on January 20th, 2022.
Water level data is vertical height of water in pit.

Pilot Infiltration Test Calculations

4833 - 90th Ave SE
Mercer Island, Washington

Test Pit TP-5

Steady-State Calculation:

Pit Dimensions: 4 ft x 3 ft = 12 sqft

Average Steady Flow Rate: 0.40 gpm

0.40 gpm x (60 min/hr) = 24 gph

24 gph x (1 cuft / 7.48 gal) = 3.21 cuft/hr

3.21 cuft/hr / 12 sqft = 0.2675 ft/hr = 3.21 in/hr **Field Rate = 3.21 in/hr**

Correction Factor: 0.28

Design infiltration rate: 3.21 in/hr x (0.28)

= 0.90 in/hr

Design Rate = 0.90 in/hr

Test performed on January 20th, 2022.

Pilot Infiltration Test Calculations

4833 - 90th Ave SE
Mercer Island, Washington

Test Pit TP-5

Falling Head Calculation:

Time interval: 15:12 to 08:50 (1058 minutes)

Total change in water level: 12.25 in - 1.5 in = 10.75 in

Overall infiltration rate: 10.75 in / 17.63 hrs = 0.61 in/hr

Field Rate = 0.61 in/hr

Correction Factor: 0.28

Design infiltration rate: 0.61 in/hr x (0.28)

= 0.17 in/hr

Design Rate = 0.17 in/hr

Test performed on January 20th, 2022.