February 7, 2022 G-5538

Ms. Annalea Overa
Axiom Design Build
5424 Ballard Ave. NW
Seattle, Washington 98107

Subject: Geotechnical Engineering Investigation, Proposed Residence Remodeling, 4244 SE Shoreclub Drive, Mercer Island, Washington

Dear Ms. Overa:

GEO Group Northwest, Inc. is pleased to present our geotechnical engineering report for a proposed remodeling of the existing residence at the above-subject location on Mercer Island, Washington. Our services were provided per our proposal dated August 19, 2021, and authorized on August 19, 2021.

SITE DESCRIPTION

The project site is located in a residential area on Mercer Island, Washington, as illustrated in Plate 1 – Site Location Map. The project site consists of a residential lot that has a size of approximately 11,250 square feet, located in the Mercerwood neighborhood of Mercer Island, Washington. A single-family residence with a main floor and a finished daylight basement floor is present on the site. The site configuration, topography, and existing improvements are illustrated in Plate 2 – Site Plan.

PROPOSED PROJECT

We understand that a second story is planned to added to the residence, and this story will encompass most of the existing footprint of the residence. The existing footprint of the residence also will be expanded along part of its northwest side, and the existing carport will be converted to a garage. The existing exterior deck on the southeast side of the residence will be removed, and a new patio will replace the existing one on the southwest side of the residence.

GEOLOGIC OVERVIEW

According to published geologic mapping for the area[1], the site is underlain with glacial till or with non-glacial deposits dating from before the Vashon Stade of the Fraser Glaciation (the most recent glacial period in the Seattle area). These soils typically are dense to very dense where they have not been affected by weathering, groundwater, or by past disturbance.

The mapping also indicates the presence of a generally south-facing surface scarp along a steep slope nearby to the south of the site. This feature may be an indication of past landslide activity at this location.

SITE INVESTIGATION

Surface Conditions

A geologist from our firm completed a reconnaissance of the visible soil and topographic conditions at the site. We observed that the site features were essentially similar to those indicated in the topographic and boundary survey that was provided to us. We observed no indications of soil instability or movement or of water seepage or springs on the property.

We observed that exposed portions of the exterior concrete footings around the perimeter of the existing residence did not show cracks or other signs of structural distress. Portions of the perimeter footings the northwest and southwest sides of the residence, however, were not visible above existing grades.

The concrete slab under the deck off the southeast side of the residence was observed to be significantly cracked with portions of the slab being tilted and settled. Supports for the deck were observed to sit upon these slabs. Cracks and minor settlement were also observed in the concrete driveway, and we observed there is a crack that bisects the concrete floor slab of the

[1] Troost, K.G., and A.P. Wisher, Geologic Map of Mercer Island, Washington, December 2006.

carport. The planter wall along the southwest side of the residence exhibits indication of some apparent minor settlement relative to the adjacent attached brick fireplace.

Subsurface Exploration

A geologist from our firm oversaw the drilling of two exploratory soil borings (B-1 and B-2) at the site. The borings were completed by a licensed drilling contractor using a manually-portable drilling rig equipped with hollow-stem augers. The borings were drilled to a depth of approximately 20 feet below ground surface and were terminated in dense native soils. The boring locations are indicated in Plate 2 – Site Plan.

We recorded the soil conditions encountered in the borings, and checked for the presence of groundwater or seepage in the borings during drilling. Soil density or consistency was evaluated by performing Standard Penetration Tests at multiple depths in the borings during drilling. Samples of the soils encountered were collected for examination and for moisture content testing at our office. Logs of the soil and groundwater conditions encountered in the borings are provided in Attachment A to this report.

Findings

The soils encountered in boring B-1 typically consisted of medium dense silty sand and lesser sandy silt to a depth of approximately 12 feet, but included some loose to medium dense soils between about 5 and 12 feet. These soils were underlain with medium dense sand to silty sand which became dense at a depth of approximately 20 feet. Soils encountered in boring B-2 typically consisted of medium dense silty sand and sandy silt to a depth of approximately 17 feet. These soils were underlain with medium dense sand to silty sand which became dense at a depth of approximately 20 feet. Groundwater was not encountered in the borings during our activities.

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, potential landslide, and seismic hazard critical areas. According to the IGS information, no known landslides are identified on the project site or on adjacent properties.

Evaluation of Potential Landslide Hazard

During our investigation, we observed no indications of soil instability or erosion on the site property, and we observed no springs or water seepage on the site property. Groundwater also was not found in the borings completed for our investigation. We also have not observed and are not aware of there being reports of the presence of springs, water seepage, or slope instability on the lower adjacent properties to the south or the adjacent property to the northeast.

Unretained slopes steeper than 40 percent grade are present on the south and east portions of the site property. These slopes continue downward onto the adjacent properties to the west, south, southeast, and east. The on-site portions of these slopes are shown in Plate 2 – Site Plan.

In our opinion, the steep slope areas meet the criteria to be designated as potential landslide hazard areas. The areas with slopes gentler than 40 percent, however, do not meet the criteria to be designated as potential landslide hazard areas because the observed site conditions do not include indications of soil instability or erosion, or the presence of springs or water seepage.

It is our opinion that the proposed project presents minimal risk to the stability of the site or adjacent property provided that 1) a building setback distance of 25 feet is observed for new building additions that are supported on shallow, conventional concrete footings, and 2) the recommendations presented below in this report are properly implemented during project design and construction. Outward additions to the existing building footprint which are located less than 25 feet from the top of the steep slope areas should be supported on pipe pile foundation systems.

Evaluation of Seismic Hazard

In our opinion, the site has minimal susceptibility to soil liquefaction or lateral soil spreading due to seismic events based on the presence of unsaturated soils as found during our subsurface exploration activities.

Evaluation of Soil Erosion Hazard

In our opinion, the potential risk from soil erosion at the site due to the proposed project is low because of the existing developed and landscaped conditions on the site. However, exposure of the site soils, such as from construction activity, would increase the potential for soil erosion if appropriate controls are not implemented and maintained. The recommended erosion and sediment controls described later in this report will reduce the risk of soil erosion at the site to minimal levels.

Provided that proper temporary and permanent post-construction erosion and sediment controls and re-landscaping are implemented where soils have been disturbed by the project, it is our opinion that the risk of significant soil erosion at the site will be mitigated to minimal levels.

Mitigation of Impact to Geologic Hazard Areas

We have reviewed the proposed project with respect to the mitigation sequencing approach described in MICC 19.07.110. In our opinion, the proposed project incorporates the following measures which mitigate the potential impact to the landslide hazard and erosion hazard areas on the site and adjacent property:

- The proposed expansion to the residence footprint is limited to less than 250 square feet and is located a minimum of 35 feet from the top of the steep slope areas;
- The area in which the proposed expansion of the residence footprint is located currently consists of a flat concrete patio and lawn area, which avoids impacts to undeveloped portions of the site including critical area and their buffers;
- Ground disturbance associated with construction for the proposed project involves minimal grading, and the disturbed areas can be restored by new landscaping and vegetation.

SITE SEISMIC DESIGN CLASSIFICATION

In our opinion, the project site can be assigned Seismic Site Class D (Medium Dense Soil Profile), per the International Building Code 2018 Edition (IBC 2018). Our determination is based upon the findings from our subsurface investigation activities and our knowledge and understanding of the typical deeper subsurface soil conditions in the site vicinity.

The seismic design parameters applicable for the site based on this site class per IBC 2018 are as follows:

$S_s = 1.408g$	$S_{ms} = 1.408g$	$S_{ds} = 0.938g$
$S_1 = 0.489g$	S_{m1} = null	S_{d1} = null

The peak ground acceleration for the site adjusted for site class effects is = 0.663g

GEOLOGIC RISK STATEMENT

Per MICC Section 19.07.160(B)(3)), we have reviewed the project design plan sheets A0.0, A1.0, A1.1, and A1.2, dated January 28, 2022, with regard to the risk to the project associated with geologically hazardous areas. In our opinion, the geologically hazard areas will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe.

RECOMMENDATIONS

The soils encountered in the soil borings from our investigation typically were found to include medium dense soils (but with an interval of relatively loose in boring B-1 located southeast of the existing residence). These soils may undergo some settlement during and after application of additional loads, from either 1) an additional building story on existing footings, or from 2) new loads on new footings, or both. For the addition of an additional story to the existing residence footings, the amount of potential settlement is estimated to be in the range of approximately 0.25 to 0.5 inches as either total or differential settlement.

For the area southwest of the existing residence, the amount of potential settlement of new conventional footings is estimated to be in the range of up to approximately 0.5 inches as either total or differential settlement. Greater settlement is possible in the area southeast of the existing residence.

If these potential settlements described above are considered to be undesirable, we recommend that the relevant existing or new foundations be supported on small-diameter steel pipe piles.

Our recommendations regarding these and other geotechnical aspects for the proposed project are presented below in the following sections of this report.

Foundations

Conventional Concrete Footings

New conventional strip and column footings should bear directly on medium dense to dense native soils or on compacted structural fill that has been placed on a compacted subgrade of native medium dense soils. Our recommended design criteria for conventional footing foundations supported in this manner are provided below.

- Allowable bearing pressure, including all dead and live loads:
  - Compacted medium dense native soil = 2,000 psf
  - Structural fill placed on compacted medium dense native soil = 2,000 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 total settlement (in existing house footprint or to southwest) = ½ inch
- Estimated post-construction differential settlement (in existing house footprint or to southwest) = 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 compacted fill subgrade or by passive earth pressure acting on the buried portion 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)
  300 pcf, equivalent fluid weight, for structural fill or competent undisturbed native soil

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

Small-Diameter Pipe Piles

Driven small-diameter steel pipe piles (also known as pin piles) can be used to support new or existing foundations for the proposed project. The piles are driven until the resistance of the subsurface soils sufficiently retards or terminates the advancement of the piles; this condition typically is called "refusal". The depth at which refusal is achieved is dependent upon the specific combination of pipe and driving hammer that are used, and the characteristics of the subsurface soils that the pile encounters.

The following table presents design criteria for commonly-available combinations of driving hammers and pipe sizes. The allowable bearing capacities include a factor of safety of 2.

Pipe Pile Design Criteria

Pipe Diameter	Pipe Wall Thickness	Hammer Weight Class	Hammer Type	Refusal Criteria*	Allowable Capacity
2 inch	Schedule 80	90 pound	jackhammer	60 sec/inch	3 tons
2 inch	Schedule 80	140 pound	Rhino hammer	60 sec/inch	3 tons
3 inch	Schedule 40	650 pound	TB225†	12 sec/inch	6 tons
3 inch	Schedule 40	850 pound	TB325†	10 sec/inch	6 tons
4 inch	Schedule 40	850 pound	TB325†	16 sec/inch	10 tons
4 inch	Schedule 40	1100 pound	TB425†	10 sec/inch	10 tons

* = Maximum penetration rate to be sustained through at least 3 time cycles of continuous driving.
† = Teledyne hydraulic hammer model number, or equivalent.

The soil conditions encountered in the borings for our investigation are not considered to be corrosive. Therefore, it is our opinion that the piles can consist of non-galvanized pipe. Also, please note that some local jurisdictions may require that a select number of pipe piles with a diameter greater than 2 inches be load-tested during installation to verify that the piles meet the required design load.

We estimate that the maximum settlement of the pipe piles should be one-quarter (1/4) inch or less. No reduction in the pile capacities is required if the pile spacing is at least three times the pile diameter. A one-third increase in the above allowable pile capacities can be used when considering short-term transitory wind or seismic loads.

By themselves, pipe piles do not generate lateral capacities. Lateral forces can be resisted by the passive earth pressures developed from friction between grade beams or footings and the subgrade soils, or from using battered pipe piles or helical anchors. An allowable passive soil pressure of 300 pcf equivalent fluid weight, and coefficient of friction of 0.35 for the soil subgrade and the footings can be used to design the footings or grade beams for lateral resistance.

The performance of pipe piles is dependent on how and to what bearing stratum the piles are installed. Since a completed pile in the ground cannot be observed, it is critical that judgment and experience be used as a basis for determining the driving refusal and acceptability of a pile. Therefore, we recommend that we monitor the pile installation operation, collect and interpret installation data and verify achievement of pile driving refusal. We also suggest that the contractor's equipment and installation procedures be reviewed by us prior to pile installation to help mitigate problems which may delay the progress of the work.

Slab-on-Grade Floors

We recommend that new slab-on-grade floors be supported on compacted medium dense native soils or on structural fill that is placed on a subgrade of compacted medium dense native soils. Alternatively, the floors can be structurally supported by 1) connection to adjacent footings or grade beams and reinforcement with a grid of #4 steel rebar having 12" spacing on center. Structurally supported floors should be designed by a structural engineer.

To avoid moisture build-up on the subgrade, floor slabs should be placed on a capillary break, which is in turn placed on the prepared subgrade. The capillary break should consist of a layer, at least 6 inches thick, of free-draining crushed rock or gravel containing no fines and no more than five percent material finer than a No. 4 sieve. A vapor barrier should be placed over the capillary break to reduce upward transmission of water vapor through the slab, if such transmission is undesirable.

Conventional Concrete Basement and Retaining Walls

The following recommendations regarding conventional concrete basement walls and retaining walls are provided below for use if the construction of conventional concrete basement or retaining walls up to approximately 10 feet in height is proposed.

Basement walls and conventional retaining walls that are 4 feet or more in height should be supported on conventional footings or small-diameter pipe piles as discussed in the foundation recommendations presented above in this report and should be designed by a structural engineer. These walls also should be fully drained to prevent the development of lateral hydrostatic pressure against these walls.

Conventional concrete retaining walls which are free to rotate on top (unrestrained) are considered capable of yielding and should be designed using an active earth pressure. Concrete retaining walls which are restrained horizontally at the top (such as basement walls) are considered unyielding and should be designed using an at-rest earth pressure. Our recommended soil engineering parameters for fully-drained retaining wall design are as follows:

Active Earth Pressure

- 35 pcf, equivalent fluid pressure, for level ground behind the walls;
- 50 pcf, equivalent fluid pressure, for wall backslope of 2H:1V

At-Rest Earth Pressure

- 45 pcf, equivalent fluid pressure, for level ground behind the walls;
- 60 pcf, equivalent fluid pressure, for wall backslope of 2H:1V

Passive Earth Pressure

- 300 pcf, equivalent fluid pressure, for undisturbed, medium dense native soil or structural fill, and level ground in front of the wall for a distance of two times the wall height;

Base Friction

- 0.35 for competent, native soil or structural fill

Surcharge loads imposed on walls due to driveways and traffic (including that during construction), upward sloping ground, or other conditions that could impose loads against the walls, should be added to the active and at-rest earth pressures stated above. Also, downward sloping ground in proximity to the walls should be evaluated, as it may have the effect of reducing the value of the allowable passive earth pressure stated above.

To prevent the buildup of hydrostatic pressure behind conventional basement or retaining walls, we recommend that a vertical drain mat, such as Miradrain 6000 or similar product, be used to facilitate drainage adjacent to the wall. The drain mat should extend from near the finished surface grade, downward to the bottom of the wall. A drainage collection pipe consisting of rigid 4”-diameter perforated PVC pipe surrounded with gravel and geotextile filter fabric (Mirafi 140NL, or equivalent) can be laid alongside the base of the wall and sloped to an acceptable tightline connection. In addition to the drain mat, we recommend that a zone of free-draining backfill material at least 12 inches wide should be placed against the matted wall. This backfill should extend downward to the drainage collection pipe. A layer of non-woven geotextile filter fabric should separate the free-draining backfill material from the adjacent soils or fills. These recommendations are schematically illustrated in Plate 3 – Typical Retaining Wall Drainage Detail.

The top 12 inches of the fill behind the wall can consist of topsoil if desired. This material can be separated from the underlying more granular drainage material by a geotextile fabric, if desired. Alternatively, the surface can be sealed with asphalt or concrete paving. Nearby final grades should be sloped to drain away from the wall, or other measures (such as strip or ribbon drains) should be used to intercept surface water that flows toward the wall.

The backfill for conventional concrete retaining walls should be compacted to a dense condition to mitigate the potential for later ground settlement or excessive saturation. Wall backfill that also will support structures or slab should be placed and compacted as structural fill. We recommend that restrained walls not be backfilled until their restraint has been completed, unless approved by the project structural engineer. The compacting machinery that is used should be compatible with the wall's resistance capacity against the temporary loading effects produced by operation of the machinery. In this respect, the contractor should exercise care if heavy machinery such as a vibratory roller or hoe pack is used.

Surface Drainage

During construction, water should not be allowed to stand in areas where footings, slabs, or pavements are to be constructed. We recommend that ground surfaces be sealed at the end of the day by tracking over them with a piece of construction equipment or by compacting them, to reduce the potential for moisture infiltration which can degrade soil quality.

We recommend that storm water drainage from building roof areas and driveways be collected into a tightline system that conveys the water to an approved discharge location. Storm water should not be allowed to develop into concentrated flows on the ground surface, because concentrated flow can lead to soil erosion and rutting. Concentrated surface water also should not be allowed to onto the steep slope area on site and should not be directed onto adjacent properties. Final site grades should direct surface water away from buildings.

Subsurface Drainage

We recommend footing drains should be installed alongside new perimeter foundations and basement walls. The drains should consist of a 4-inch minimum diameter, perforated, rigid PVC drain pipe laid at the bottom of the footing or wall with the perforations facing downward. The drain line should be bedded on, surrounded by, and covered with a washed rock or gravel. The drain rock and pipe also should be wrapped with a layer of durable non-woven geotextile fabric. These recommendations are schematically illustrated in Plate 4 – Typical Footing Drain Detail.

The footing drain lines should be sloped at sufficient gradient to generate flow and should be tight-lined to an appropriate stormwater discharge location or collection sump system. The subsurface drainage lines should not be connected to roof downspout or other surface drainage lines.

Grading and Earthwork

Site Clearing and Erosion Control

The area where construction work will be performed should be cleared of vegetation, topsoil, organics, debris, and any other deleterious materials that are found. These materials should be hauled off site or used for landscaping, as appropriate; they should not be used as structural fill or retaining wall backfill for the project.

Temporary erosion and sedimentation controls (TESCs) should be installed as part of site clearing activities. TESCs for the project can include using silt fences, check dams, straw mulch, hay bales, and a stabilized construction entrance. The silt fences or other barrier controls should be placed along the cross-slope and down-slope boundaries of the disturbed areas to prevent sediment-laden runoff from being discharged off site. Exposed soils, including stockpiled soils, should be covered with plastic sheeting when they are not being worked.

Excavations and Slopes

Temporary excavation slopes should not be greater than the limits specified in local, state and federal government safety regulations. Temporary cuts which are greater than 4 feet in height typically can be sloped at inclinations up to 1H:1V (Horizontal: Vertical). In situations where water seepage or other adverse conditions are observed, temporary cuts in these soils may need to be made at shallower inclinations if recommended by the geotechnical engineer. If adequate space is not available to maintain open cuts per the recommendations in this report, engineered support may be required to provide lateral support to such excavations. Permanent unreinforced slopes at the site should be inclined no steeper than 2.5H:1V.

Surface runoff should not be allowed to flow over the top of slopes into excavations. During wet weather, exposed slopes should be covered with plastic sheeting to prevent erosion or softening. We recommend that a GEO Group Northwest representative be on site during excavation of cut slopes to verify anticipated geologic conditions and to evaluate slope stability, particularly if groundwater seepage, caving soils, or debris are encountered.

Subgrade Preparation

After the completion of site clearing and excavation, soils in areas to receive structural fill, concrete slabs, sidewalks, or pavements, should be prepared to a firm, unyielding condition. The prepared subgrade should be observed and approved by the geotechnical engineer. Any detected soft spots or disturbed areas should be compacted or excavated and replaced with compacted structural fill or crushed rock as directed by the geotechnical engineer.

Structural Fill

Structural fill is typically defined as earthen material that is placed below buildings (including foundations and on-grade slab floors), sidewalks, driveways, or other structures, and provides support to those structures. Soils that meet the material specifications for structural fill as presented below in this report, or are otherwise approved by the geotechnical engineer, can be used for structural fill. Material which is stored on site for later use as structural fill should be covered with plastic sheeting to protect it from moisture if its usability is sensitive to its moisture content. Structural fill material should be placed and compacted in accordance with the recommendations provided below or as otherwise approved by the geotechnical engineer during construction.

Fill Material Specifications

Material used as structural fill should not contain rocks or lumps larger than 3 inches in its greatest dimension. During wet weather, the material should be granular in character, with a fines content (passing a #200 sieve) of less than 5 percent. The material should be placed at or near its optimum moisture content. If the material is too wet to be compacted to the required degree, it will be necessary to dry the material by aeration (which may be difficult) or replace the material with an alternative suitable material in order to achieve the recommended compaction.

Compaction Specifications

Structural fill material placed under foundation footings and concrete floor slabs should be compacted to at least 90 percent of its maximum dry density as determined by ASTM D1557. Structural fill material under exterior slabs or pavements should be compacted to at least

90 percent of its maximum dry density, except for the top 12 inches of the material, which should be compacted to at least 95 percent of its maximum dry density.

Structural fill material should be spread and compacted in lifts that are 10 inches or less in thickness in an un-compacted state. The compacted fill material should be field tested by using ASTM Designations D2922 and D3017, Nuclear Probe Method, to verify that the required degree of compaction has been achieved.

Wet Weather Earthwork Considerations

We recommend that the following measures be implemented in supplement or replacement with the standard erosion and sediment control recommendations for earthwork during the wet weather season.

- Cut and fill slopes exposed during construction should be covered with plastic sheeting when they are not being worked. Soil stockpiles also should be covered when not being worked.

- Structural fill should consist of free-draining material with not more than 5% of the material passing a #10 sieve.

- Earthwork should not be performed during periods of heavy precipitation, in order to minimize rutting and tracking of soils by construction equipment traffic. Equipment that has lower potential to cause rutting or other soil disturbance should be used.

- Soil subgrades in areas where footings or slabs are to be built should be protected from softening due to standing water or to disturbance if they will be left exposed for a prolonged period. Plastic sheeting can be used for untrafficked areas. A layer of clean crushed 1.25”-size gravel, can be used in areas where light construction traffic cannot be avoided.

- Erosion control measures, such as silt fences, straw bales and wattle, etc., should be arranged to control soil erosion and sediment travel as appropriate within the project limits as well as along its downslope and cross-slope perimeter.

- Earthwork should be performed in a sequence of limited areas, where feasible, to limit the extent of exposed soil during the project.

- We recommend that we visit the project site upon completion of the installation of the perimeter erosion controls to verify their suitability. During earthwork for construction, we recommend that we visit the site if precipitation greater than 0.5 inches in a 24-hour period occurs, in order to monitor the performance of the TESC measures and monitor excavation stability. We also recommend that we visit the site during backfilling work to observe that materials are being used are appropriate for wet weather conditions and are being properly placed and compacted.

LIMITATIONS

This report has been prepared for the specific application to this site for the exclusive use of Axiom Design Build and its authorized assignees or agents. Any other use of this report is solely at the user's own risk. We recommend that this report be included in its entirety in the project contract documents for reference during construction.

Our findings and recommendations stated herein are based on field observations, our experience with similar projects, and our professional judgment. The recommendations presented in this letter are our professional opinion 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 re-evaluated and modified if appropriate.

CLOSING

We appreciate this opportunity to provide you with geotechnical engineering services. Please feel free to contact us if you have any questions.

Sincerely,

GEO Group Northwest, Inc.

Keith Johnson
Project Geologist

William Chang, PE
Principal Engineer

Plates and Attachments:

- Plate 1 – Site Location Map
- Plate 2 – Site Plan
- Plate 3 – Typical Retaining Wall Drainage Detail
- Plate 4 – Typical Footing Drain Detail

Attachment A – Boring Logs

Source: King County GIS, 2019.

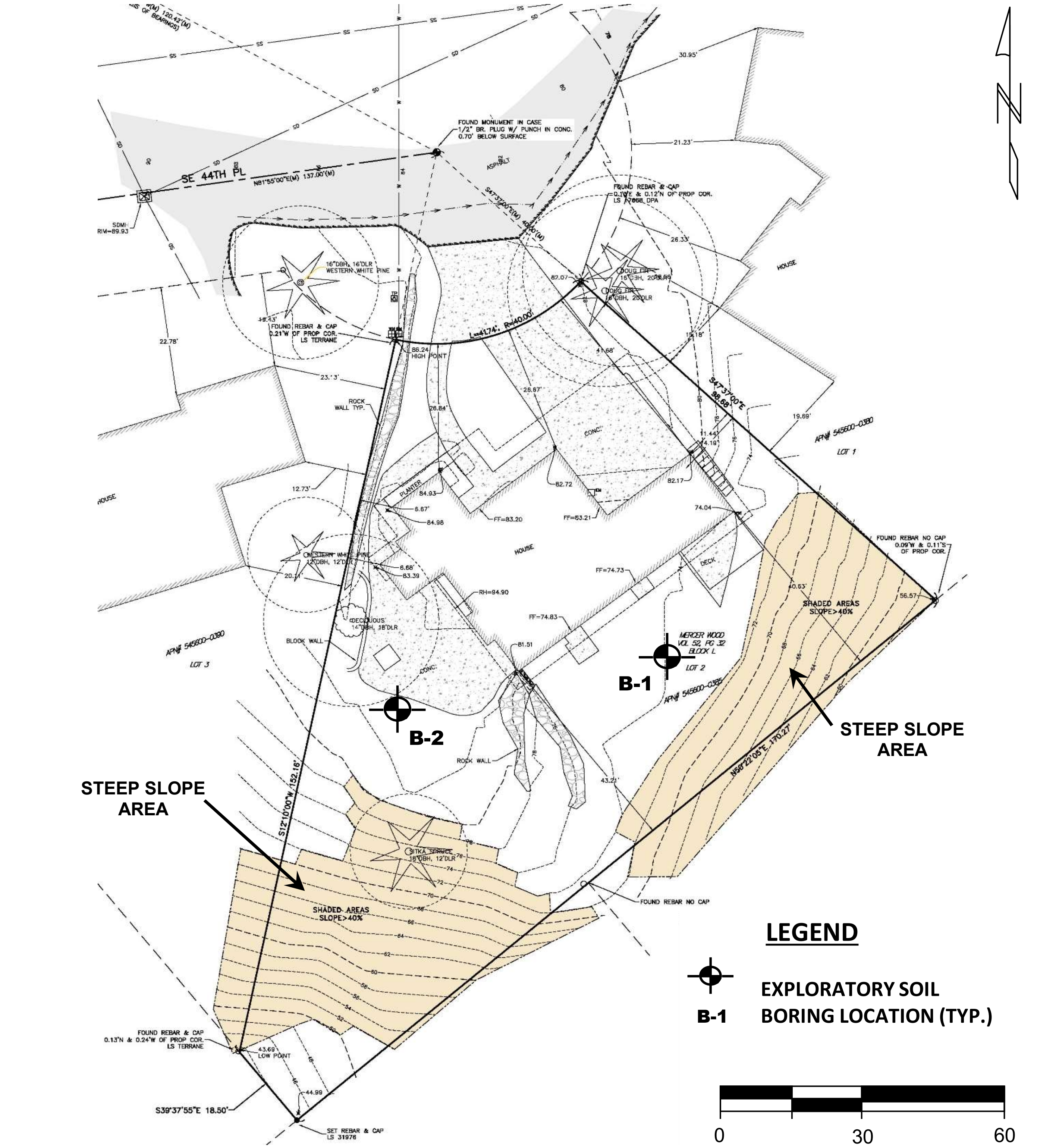
GEO Group Northwest, Inc.

Geotechnical Engineers, Geologists, &
Environmental Scientists

SITE LOCATION MAP

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DRIVE
MERCER ISLAND, WASHINGTON

SCALE:	1" = 2000'	**DATE:**	2/7/2022	**MADE:**	KJ	**CHKD:**	WC	**JOB NO:**	G-5538	**PLATE**	1



SCALE: 1 INCH = 30 FEET

Source: Boundary & Topographic Survey by Plog Engineering, dated 9/8/21.

GEO Group Northwest, Inc.

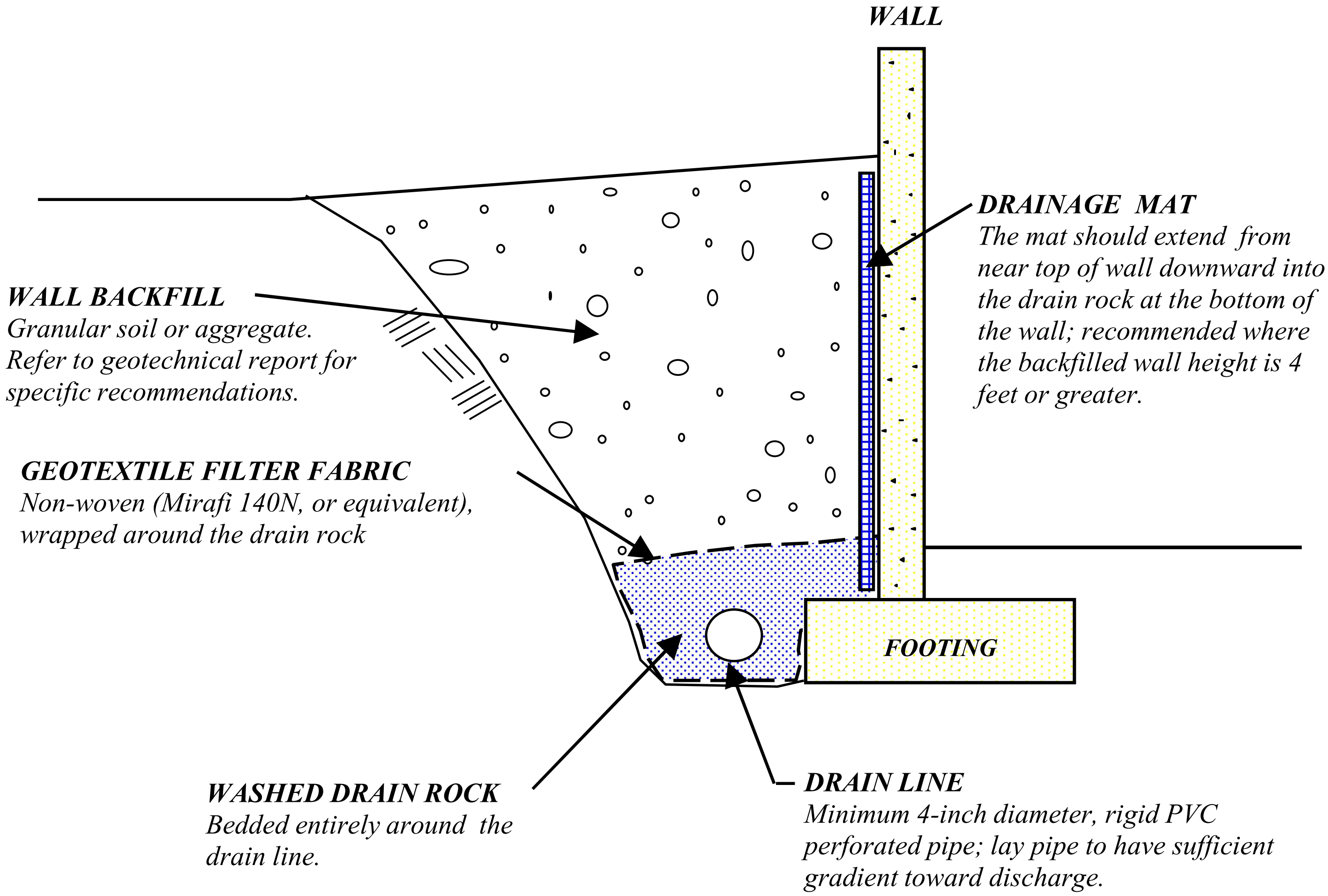
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE PLAN

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DRIVE
MERCER ISLAND, WASHINGTON

SCALE: 1" = 30'	**DATE:** 2/7/2022	**MADE:** KJ	**CHKD:** WC	**JOB NO:** G-5538	**PLATE** 2

TYPICAL RETAINING WALL DRAINAGE DETAIL



NOT TO SCALE

NOTES:

1.) Do not substitute rigid PVC pipe with flexible corrugated 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 drainage lines into the wall drainage 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.

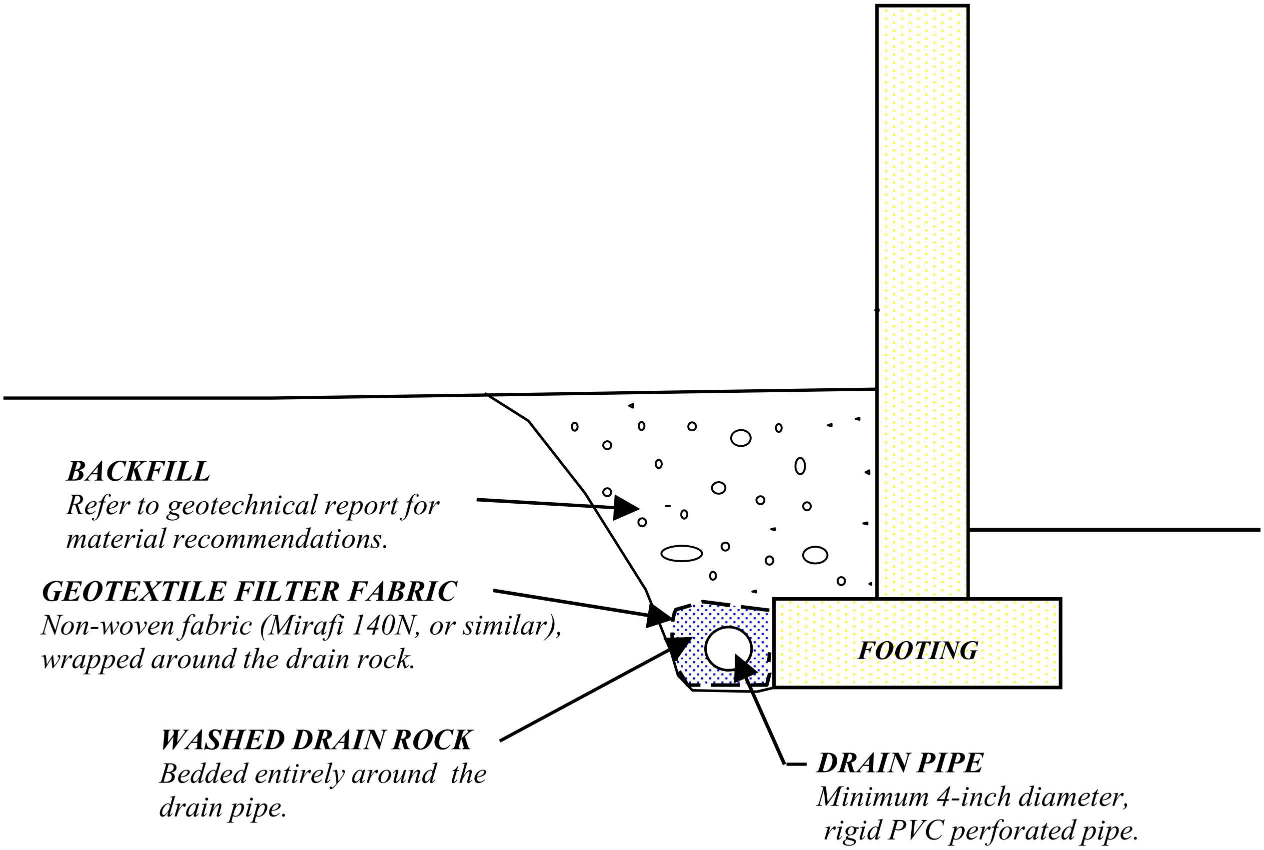
GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

TYPICAL RETAINING WALL DRAINAGE DETAIL

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DR.
MERCER ISLAND, WASHINGTON

SCALE NONE	**DATE** 2/7/2022	**MADE** KJ	**CHKD** WC	**JOB NO.** G-5538	**PLATE** 3

TYPICAL FOOTING DRAIN DETAIL



NOT TO SCALE

NOTES:

1.) Do not substitute rigid PVC pipe with flexible corrugated 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 drainage lines into the footing drainage 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.

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Geotechnical Engineers, Geologists, &
Environmental Scientists

TYPICAL FOOTING DRAIN DETAIL

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DR.
MERCER ISLAND, WASHINGTON

SCALE	NONE	**DATE**	2/7/2022	**MADE**	KJ	**CHKD**	WC	**JOB NO.**	G-5538	**PLATE**	4

ATTACHMENT A

G-5538

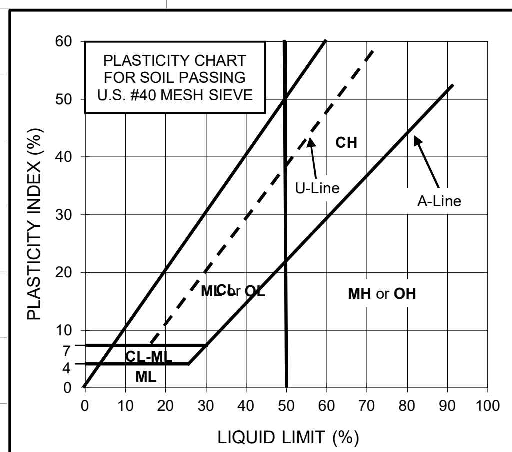
BORING LOGS

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, LEAN 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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PLATE A1

BORING NO. B - 1

Logged By: KJ — Date Drilled: 9/27/2021 — Surface Elev. 74'

Drilled By: CN Drilling

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts	Water Content %	Other Tests/ Comments
		SM-ML	Grass lawn surface. Light brown SILTY SAND to SANDY SILT, damp, medium dense, fine grained, mottled with oxide stain.			6,8,7 (N=15)	7.3	
		SM-ML	As above, damp to moist.			5,7,6 (N=13)	11.3	
5		SM-ML	As above.			4,4,7 (N=11)	21.7	
		SM-ML	As above, olive brown, slight oxide stain.			4,5,5 (N=10)	19.5	
10		SM/ML	Olive brown and grayish brown SILTY SAND and SANDY SILT, moist, loose, fine grained, gradational layering, slight oxide stain.			2,4,5 (N=9)	20.7	
		SP-SM	Light brown SAND to SILTY SAND, damp to moist, medium dense, fine grained, weakly stratified, bands of strong oxide stain.			2,6,8 (N=14)	11.7	
15		SP/SM	Pale grayish brown SAND to SILTY SAND, damp to moist, medium dense, fine grained, contains some clean sand lenses, weak to moderate oxide stain bands.			9,11,9 (N=20)	11.8	
		SP/SM	As above, moist, gradational layering.			6,8,8 (N=14)	14.9	
20		SP/SM	Brownish gray SAND and SILTY SAND, moist, dense, fine grained, occasional band of strong oxide stain.			11,17,19 (N=36)	12.7	
25			Depth of boring: 21.5 feet. Drilling Method: Hollow-stem auger. Sampling Method: 2"-O.D. standard penetration test sampler driven with 140 lb. hammer and cathead. Groundwater not encountered during drilling.					

LEGEND:
- 2" O.D. SPT Sampler
- 3" O.D. California Sampler
- ▽ Water Level noted during drilling
- ▼ Water Level measured at later time, as noted

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BORING LOG

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DRIVE
MERCER ISLAND, WASHINGTON

JOB NO. G-5538 **DATE** 11/15/2021 **PLATE** A2

BORING NO. B - 2

Logged By: KJ Date Drilled: 9/27/2021 Surface Elev. 83'
Drilled By: CN Drilling

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts	Water Content %	Other Tests/ Comments
		SP-SM	Grass lawn surface. Light brown SAND to SILTY SAND, damp, medium dense, fine grained, minor oxide stain.	I		5,12,15 (N=27)	8.4	
		SM	SILTY SAND, mottled olive brown, grayish brown, and dark grayish brown, medium dense, moist, fine grained, 10-20% fines.	I		4,7,9 (N=16)	17.9	
5		ML	Gray SILT, medium dense, moist, contains minor fine to medium grained sand, no staining.					
		SM	Brown SILTY SAND, medium dense, moist, oxide stain at contact with overlying silt.	I		5,6,8 (N=14)	15.7	
		SM	Olive brown and grayish brown SILTY SAND, moist, medium dense, fine grained, occasionally stratified, minor oxide stain, occas. sandy silt lenses.	I		5,10,12 (N=22)	23.4	
10		SM-ML	Olive brown and grayish brown SILTY SAND and SANDY SILT, moist, medium dense, fine grained, thinly bedded, no oxide stain.	I		5,6,7 (N=13)	26.6	
		SM-ML	As above, occasional bands of oxide stain.	I		8,11,13 (N=24)	23.4	
15		SM	As above, but with less silt.	I		5,8,10 (N=18)	26.9	
		SP-SM	Grayish brown and light browish gray SAND to SILTY SAND, moist, medium dense, fine grained, finely bedded, some oxide stain laminae.	I		6,11,12 (N=23)	16.5	
20		SP-SM	Grayish brown and brownish gray SAND to SILTY SAND, moist, dense, fine grained, slight oxide stain.	I		10,21,23 (N=44)	19.3	
25			Depth of boring: 21.5 feet. Drilling Method: Hollow-stem auger. Sampling Method: 2"-O.D. standard penetration test sampler driven with 140 lb. hammer and cathead. Groundwater not encountered during drilling.					

LEGEND:
- 2" O.D. SPT Sampler
- 3" O.D. California Sampler
- ▽ Water Level noted during drilling
- ▼ Water Level measured at later time, as noted

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

BORING LOG

PROPOSED RESIDENCE REMODEL
4244 SHORECLUB DRIVE
MERCER ISLAND, WASHINGTON

JOB NO. G-5538 **DATE** 11/15/2021 **PLATE** A3