GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

March 3, 2022

JN 22059

Mary Smersh
via email: smersh007@comcast.net

Subject: **Geotechnical Engineering Study and Critical Area Considerations**
Proposed Smersh Residence
2423 – 60th Avenue Southeast
Mercer Island, Washington

Greetings:

This report presents our geotechnical conclusions related to the planned development of the subject property. On February 7, 2022, the undersigned principal geotechnical engineer visited the site to assess the subsurface conditions. The property is an undeveloped, rectangular-shaped lot situated on the western side of 60th Avenue Southeast. A developed property having an address of 2421 – 60th Avenue Southeast is situated between the site and the shore of Lake Washington. The driveway for this neighboring residence extends through the south portion of the subject site from 60th Avenue Southeast. The subject lot is currently covered mostly with mown grass. Outside of the paved driveway, the ground surface over the majority of the lot is covered with mown grass. With the exception of the western 20 to 25 feet of the site, the ground surface slopes only ever so slightly downward toward the west. The western edge of the site slopes moderately (15 to 25 percent) down to the backfilled retaining wall of the neighboring western house. This short slope is less than 10 feet in height. This moderately-sloped western portion of the property, west of the proposed development, is mapped on the Mercer Island's GIS as a Potential Landslide Hazard and an Erosion Hazard. We saw no indications of erosion or slope instability on, or around, the site. From our 35 years of experience on Mercer Island, we know of no large-scale slope movement in the area surrounding the site.

Three test pits were excavated on the site, at the approximate locations shown on the attached Site Exploration Plan. Logs of the three test pits are attached. Beneath the existing grass, all three of the test holes encountered an approximate 2-foot layer of loose, weathered, slightly clayey silt. Beneath this loose, weathered soil, the test holes revealed dense to very dense, glacially-compressed silt and very silty sand.

Geologic mapping indicates that the site and vicinity are underlain by Glacial Drift, a glacially-compressed mixture of gravel, silt, and fine-grained sand. This geologic mapping is consistent with the conditions encountered in the test pits. Perched groundwater seepage was observed at a depth of 3 feet in Test Pit 1.

CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions observed in the test holes, it is our professional opinion that conventional foundations can be utilized for the proposed residence. All footing areas will have to be excavated down to the dense, native soil. We recommend that the footings be excavated using a smooth bucket or grade bar, in order to prevent the subgrade disturbance that can result from the teeth on an excavator's bucket. Where overexcavation below the planned footing grades is necessary, the additional excavation can be backfilled to the planned footing grade using compacted quarry spalls or railroad ballast rock. In wet conditions, the footing subgrades should be protected with a layer of clean crushed gravel, in order to prevent disturbance and softening of the bearing soils during the placement of foundation forms and rebar.

Discussion of Critical Areas (MICC 19.07)

As noted above, per the Mercer Island GIS, the site is designated as a potential Landslide Hazard and Erosion Hazard. No Steep Slope or Seismic Hazard Areas are located on the site. A discussion of specific hazard areas is given below.

Erosion Hazard Area: The western edge of the site is steeper than 15 percent, so that area meets the City of Mercer Island's criteria for an Erosion Hazard Area. No buffers are needed per the MICC for Erosion Hazard Areas, nor do we believe any are needed for this project. Excavation and construction of the project can readily be accomplished without adverse to the site and surrounding properties by exercising care and being proactive with the maintenance and potential upgrading of the erosion control system through the entire construction process. Proper erosion control implementation will be important to prevent adverse impacts to the site and neighboring properties. The temporary erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered during the site work. One of the most important considerations, particularly during wet weather, is to immediately cover any bare soil areas to prevent accumulated water or runoff from the work area from becoming silty in the first place. Any cut slopes and soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface.

Landslide Hazard Areas: There are several criteria for being a Landslide Hazard Area based on the MICC. The first several criteria are as follow:

1. Areas of historic failures.
2. Areas with all three of the following characteristics:
   a. Slopes steeper than 15 percent; and
   b. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
   c. Springs or ground water seepage.
3. Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements.
4. Areas potentially unstable because of rapid stream incision and stream bank erosion.
5. Any slope that is 40 percent or greater measured over a 30-foot horizontal run (Steep Slope).

In our professional opinion, none of these criteria are met for this site. While the western edge of the site slopes moderately down toward the neighboring property, it is not steep and is not taller than 10 feet. The proposed development will not adversely impact the stability of the site or the surrounding properties. The dense to very dense soils underlying the site are not susceptible to instability on the short, gently- to moderately-sloped ground on the site and the neighboring lots.

No mitigation measures, such as buffers or stabilization walls, are necessary to provide stability for the planned development and to avoid adverse impacts to the stability of the neighboring properties.

Statement of Risk: In order to satisfy the City of Mercer Island's requirements, a statement of risk is required. As such, we make the following statement:

It is our professional opinion that the recommendations presented in this report for this project will render the development as safe as if it were not located in a geologically hazardous area, and will not adversely impact critical areas on adjacent properties.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking, cleaning, and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a build up of excessive water vapor within the planned structure.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type D (stiff soil profile).

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The very dense soil that will support the foundations is not susceptible to seismic liquefaction under the ground motions of the MCE.

CONVENTIONAL FOUNDATIONS

The proposed residence can be supported on conventional continuous and spread footings bearing on undisturbed, dense soil, or on compacted crushed rock structural fill placed above this competent native soil. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer or building inspector to document that adequate bearing soils have been exposed.

We recommend that continuous and individual spread footings have minimum widths of 12 and 16 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

Depending on the encountered soil conditions, overexcavation may be required below the footings to expose competent native soil. Unless lean concrete is used to fill an overexcavated hole, the overexcavation must be at least as wide at the bottom as the sum of the depth of the overexcavation and the footing width. For example, an overexcavation extending 2 feet below the bottom of a 2-foot-wide footing must be at least 4 feet wide at the base of the excavation. If lean concrete is used, the overexcavation need only extend 6 inches beyond the edges of the footing.

An allowable bearing pressure of 2,500 pounds per square foot (psf) is appropriate for footings supported on competent native soil. A one-third increase in this design bearing pressure can be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil will be less than one inch, with differential settlements on the order of one-half-inch in a distance of 25 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.40
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

EVALUATION OF INFILTRATION FEASIBILITY

The dense to very dense soil known to underlie this area, and which was observed in the test holes, is glacially compressed. Our review of published geologic maps confirms that the near-surface geologic unit in this area is Glacial Drift (aka hardpan), which is consistent with the observed soil conditions. There are no large or continuous pore spaces in the glacial till soils that can transmit water. This soil is essentially impermeable, preventing downward percolation of water, which often causes a perched water table to form following extended heavy rainfall. Often, the impermeable nature of the Glacial Drift till causes a shallow seasonal perched water table to form where the ground surface is not covered by an impervious layer. This is a common problem in the wet season throughout the Pacific Northwest, and shallow seepage was observed in the test holes.

Considering the observed soil and the likelihood of at least periodic shallow perched groundwater conditions, it is our professional opinion that infiltration of concentrated storm water is infeasible for this site. Attempting to infiltrate stormwater on the site would only increase the potential for surface and subsurface drainage problems on neighboring properties, as any infiltrated water will perch on top of the Glacial Drift and then flow laterally toward the adjacent western property, which is downgradient of the site.

DRAINAGE CONSIDERATIONS

Footing drains should be used where: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or, (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

A typical footing drain detail is attached to the end of this report.

As a minimum, a vapor retarder, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Also, we recommend providing a few inches of free draining gravel underneath the vapor retarder to prevent shallow perched seepage from building up to a level that it rises above the top of the vapor retarder.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to the building should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Mary Smersh, and her representatives for specific application to this project and site. Our recommendations and conclusions are based on the site materials observed and on previous experience with sites that have similar observed conditions. The conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the limited scope of our services. No warranty is expressed or implied.

Please contact us if you have any questions regarding this report.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

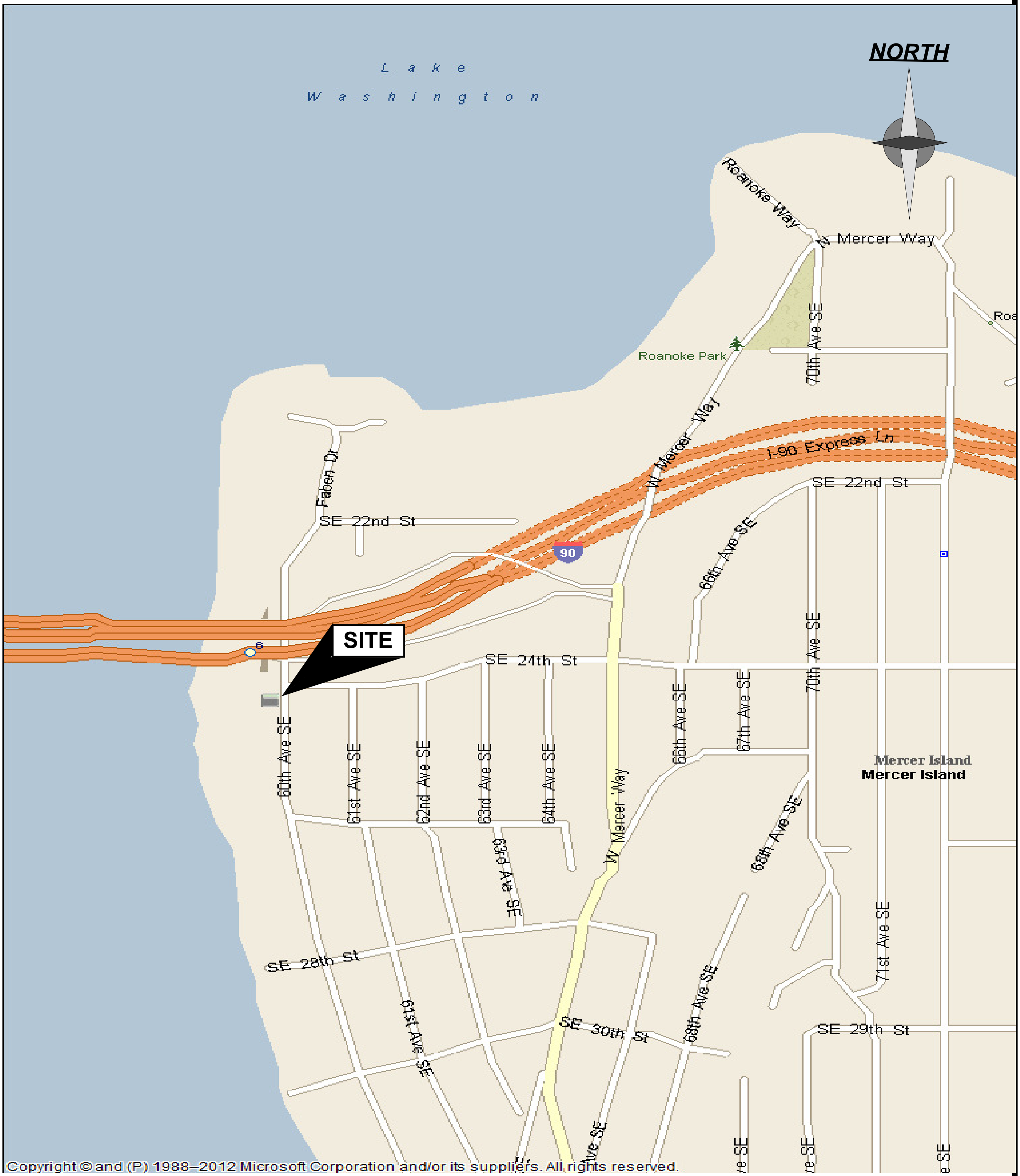
3/03/2022

Marc R. McGinnis, P.E.
Principal

Attachments:

- Vicinity Map
- Site Exploration Plan
- Test Pit Logs
- Typical Footing Drain

cc: Sturman Architects – Brad Sturman and Kati Eitzman
via email: brads@sturmanarchitects.com & kati@sturmanarchitects.com



(Source: Microsoft MapPoint, 2013)

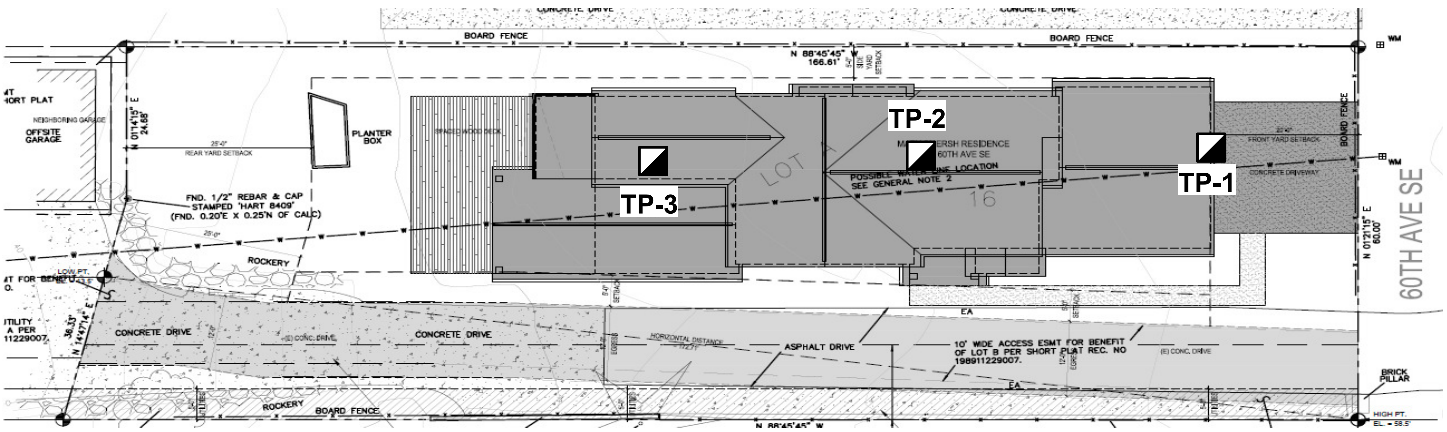
GEOTECH CONSULTANTS, INC.

VICINITY MAP

2423 - 60th Ave. S.E.
Mercer Island, WA

Job No:	Date:		Plate:
22059	Feb. 2022		1

PROJECT
NORTH



Legend:

◪ **TP-1** APPROXIMATE TEST PIT LOCATION

(Not to Scale)

GEOTECH
CONSULTANTS, INC.

SITE EXPLORATION PLAN

2423 - 60th Ave. S.E.
Mercer Island, WA

Job No:	Date:		Plate:
22059	Feb. 2022	No Scale	2

TEST PIT 1

Depth (feet)	Soil Description
0 – 2.0	Grass over Brownish-gray, mottled, slightly clayey SILT, low plasticity, very moist, loose
2.0 – 3.0	Brownish-gray, slightly clayey SILT, low plasticity, very moist, dense
3.0 – 3.5	Brownish-gray, slightly gravelly, very silty SAND, fine-grained, very moist, very dense

Test Hole was terminated at a depth of 3.5 feet.
Slight perched groundwater seepage was observed at 3 feet.

TEST PIT 2

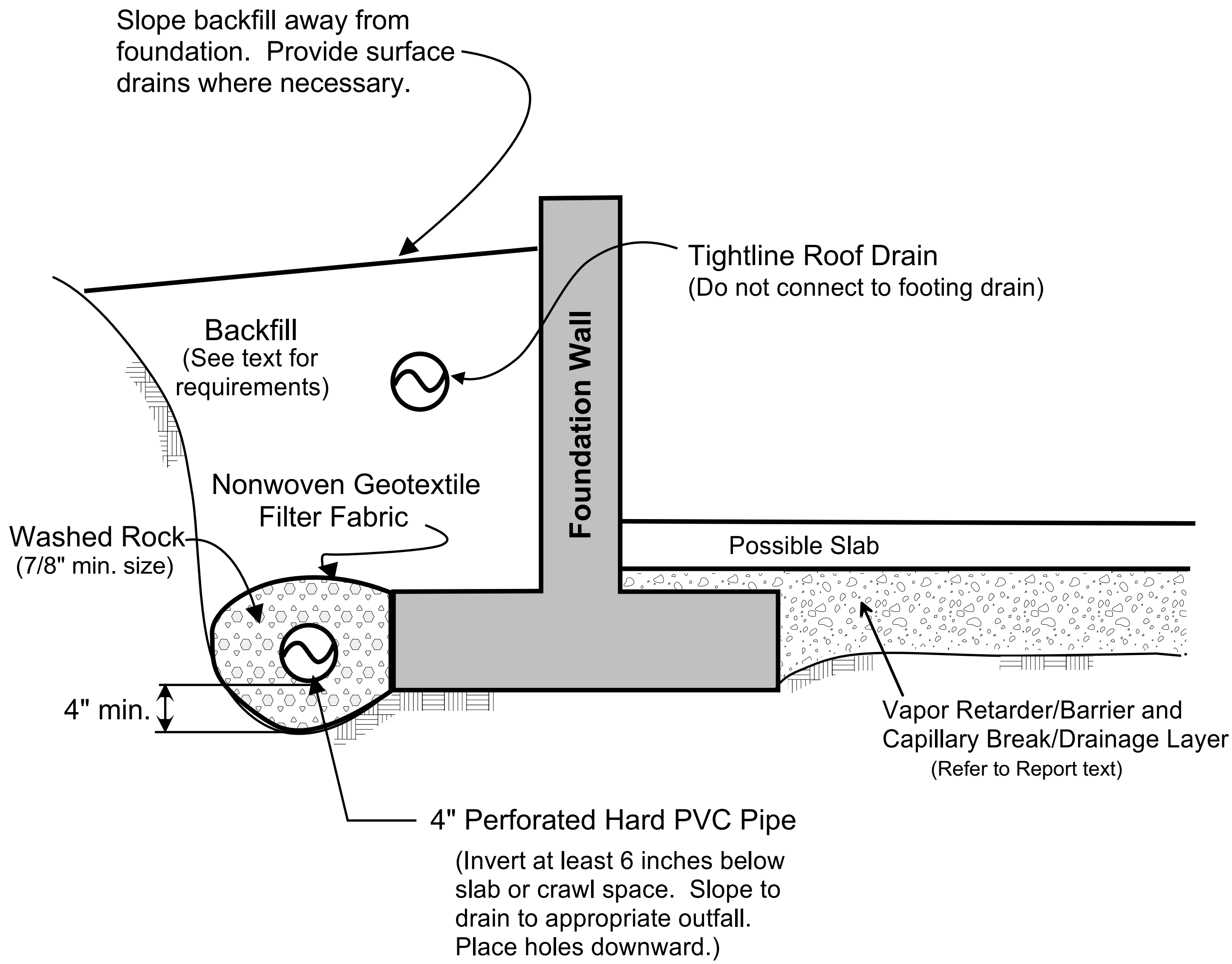
Depth (feet)	Soil Description
0 – 2.0	Grass over Brownish-gray, mottled, slightly clayey SILT, low plasticity, very moist, loose
2.0 – 3.0	Brownish-gray, slightly clayey SILT, low plasticity, very moist, dense

Test Hole was terminated at a depth of 3.0 feet.
No groundwater seepage was observed in test hole.

TEST PIT 3

Depth (feet)	Soil Description
0 – 2.0	Grass over Brownish-gray, mottled, slightly clayey SILT, low plasticity, very moist, loose
2.0 – 3.0	Brownish-gray, slightly gravelly, very silty SAND, fine-grained, very moist, very dense

Test Hole was terminated at a depth of 3.0 feet.
No groundwater seepage was observed in test hole.



NOTES:

(1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.

(2) Refer to report text for additional drainage, waterproofing, and slab considerations.

GEOTECH
CONSULTANTS, INC.

TYPICAL FOOTING DRAIN

2423 - 60th Ave. S.E.
Mercer Island, WA

Job No:	Date:		Plate:
22059	Feb. 2022		