GEOTECH
CONSULTANTS, INC.

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JN 23449

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Subject: **Geotechnical and Critical Area Report**
Proposed Remodel/Expansion of Existing Residence
8456 North Mercer Way
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the planned work associated with the remodel of your existing home. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this summary report.

Based on the preliminary plans prepared by Sturman Architects, we understand that the existing residence will undergo a remodel. As a part of this work, a new covered deck will extend west and north from the northwestern quarter of the main floor of the residence. This new deck will be supported on isolated posts and new foundations. A patio may be established at the basement level, below the new covered deck. The unfinished basement and crawl space area in the northeastern portion of the house will be converted to new bedrooms, a bathroom, mechanical room, and a hallway. This will necessitate temporary excavation in the existing crawl space for the construction of the new interior spaces.

The City of Mercer Island GIS maps your entire lot to lie within a Potential Landslide Hazard, Seismic Hazard, and Erosion Hazard areas. There are no steep slopes mapped on, or around, your property.

SITE CONDITIONS

We visited the subject property on December 28, 2023 to observe the existing conditions and to conduct subsurface explorations in the areas of the proposed work. The subject lot is situated on the north end of Mercer Island, a few lots removed from the shore of Lake Washington. It is accessed by a shared driveway extending from North Mercer Way, which is located two lots to the south of the site.

Your residence consists of a main floor overlying a north-facing west-facing daylight basement that underlies the western half of the house, as well as the northern half of the eastern portion of the residence. The basement in the eastern portion appears to have been created by excavating out a deep crawl space to create gym and storage space. An attached garage extends south from the southwestern portion of the house. A main floor deck extends outward from the western portion of the structure.

Outside of the house, other than the driveway and some patio/walkway areas, the site is covered primarily with landscaping. The ground surface on the property generally slopes downward toward the north at a gently to moderate inclination. The natural grade has been modified on the site by the excavation necessary for the driveway and garage, in addition to filling along the north side of the house to create a level area for the northern patio. There are no steep slopes on, or near, the site. We saw no indications of recent slope movement on the site. Landslides have been mapped on steeper areas that lie to the east of your site. From our 37+ years of experience on Mercer Island, we know that the area of these previously documented landslides is usually underlain by fill and/or weathered silt soils, which are different from the soil conditions encountered beneath your property.

The houses on the surrounding lots are set back from the common property lines.

During our visit to the site, our firm conducted explorations at the locations indicated on the attached Site Exploration Plan. Test Hole 1 was conducted at the northwest corner of the existing perimeter house foundation. We completed Test Hole 2 in the existing crawl space of the east portion of the house, where the new basement expansion will be completed. Test Hole 3 was conducted near the northern, downslope, edge of the planned exterior covered deck. Logs of the test holes are attached to the end of this report. Test Hole 1 revealed a layer of topsoil, below which was loose, heavily-weathered, slightly gravelly, slightly silty sand. The existing perimeter footing of the house was poured on this loose soil, which extended to 2 feet below the footing. At a depth of 3 feet, the native soil became less weathered, and was medium-dense. It became dense at a depth of 4.5 feet. This dense soil is glacially compressed, and would be referred to as glacial drift. Similar conditions were exposed in the other two test holes. Test Hole 2 was completed by excavating into a small cut slope that remains in the crawl space from when the new gym/storage space was created under the east portion of the house. The geologic layering was readily apparent in this soil exposure. In Test Hole 3, the native topsoil was overlain by approximately 12 inches of fill. We saw no indications of organics or landslide debris in the test holes.

Seepage or wet soil conditions were not encountered to the maximum 5-foot depth of the test holes.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test holes conducted around the planned work area encountered competent, glacially-compressed soils within the planned development area. The new foundations for the remodel/expansion of the house should be excavated to bear on this dense soil. The test holes indicate that excavation of 3.5 to 4.5 feet below the existing grade will be necessary to reach competent bearing soils.

Seismic Hazard: The glacially-compressed soils beneath the area of the residence and garage are not susceptible to seismic liquefaction. The foundations for the new construction will also bear on these non-liquefiable soils. No additional mitigation is required to address the mapped Seismic Hazard.

Potential Landslide Hazard: The existing residence and planned new construction are not close to any steep or tall slopes. The dense to very dense, glacially-compressed soils that underlie the site are not susceptible to instability, even during a strong earthquake. The stability of the gently- to moderately-inclined ground on, and around, the site will not be adversely affected by the shallow excavations needed for the new development. No buffer or other mitigation measures are required to address the Potential Landslide Hazard mapping of the site.

Erosion Hazard: The site disturbance for the proposed development will be limited, and will occur primarily on gently-sloped ground. The mapped Erosion Hazard can be mitigated by implementing proper temporary erosion control measures that will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any work areas. Existing ground cover and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Small soil stockpiles should be covered with plastic during wet weather. Soil and mud should not be tracked onto the adjoining streets, and silty water must be prevented from traveling off the site. It should be possible to complete the planned remodel/expansion during the wet season without adverse impacts to the site and neighboring lots. As with any construction project, it can be necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

Once we have reviewed the final plans for the development incorporating the recommendations of this report, we can provide a “statement of risk” to satisfy City of Mercer Island conditions.

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).

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake 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 dense soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of the absence of near-surface groundwater.

CONVENTIONAL FOUNDATIONS

An allowable bearing pressure of 2,500 pounds per square foot (psf) is appropriate for new and existing footings supported on dense, 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-quarter-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.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	40 pcf (Compacted Free-Draining Backfill)
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.40
Soil Unit Weight	130 pcf (Compacted Free-Draining Backfill)

Where: pcf is Pounds per Cubic Foot, and Active and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure. This applies only to walls with level backfill.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

Per IBC Section 1803.5.12, a seismic surcharge load need only be considered in the design of walls with a retention height of 6 feet or more.

For walls backfilled with compacted fill, the recommended seismic surcharge pressure for this project is 8**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

It is important that the backfill consists of coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent.

A footing drain construction in general accordance with the attached detail should be installed at the base of backfilled walls.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with

any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

LIMITATIONS

This report has been prepared for the exclusive use of John and Lena Ehrhardt, and their representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

1/10/2024
Marc R. McGinnis, P.E.
Principal

Attachments:

- Vicinity Map
- Site Exploration Plan
- Test Hole Logs
- Footing Drain Detail

cc: **Sturman Architects** – Logan Galyan
via email: logan@sturmanarchitects.com

MRM:kg

(Source: Microsoft MapPoint, 2013)

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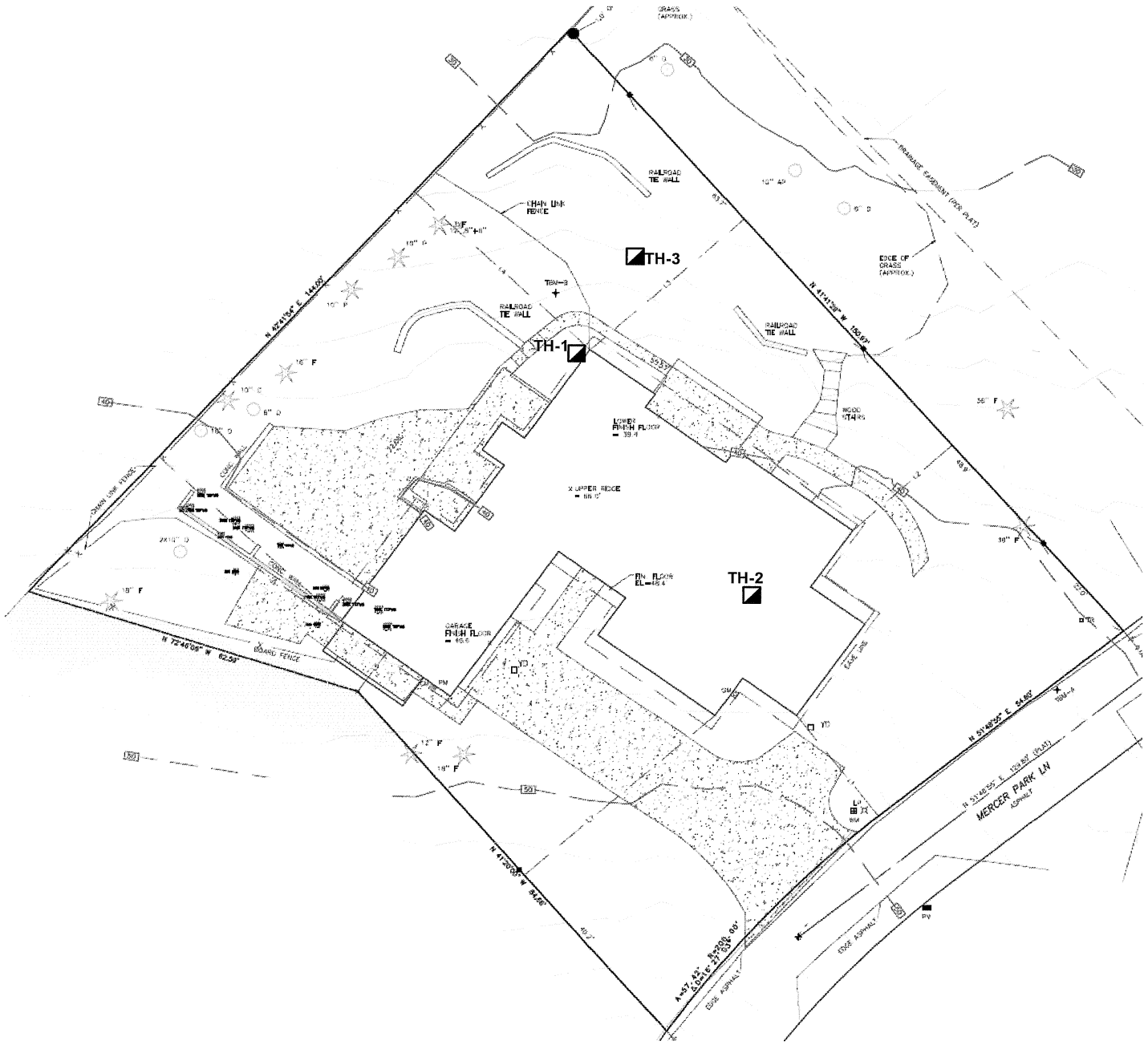
VICINITY MAP

8456 North Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
23449	Jan. 2024		1



Legend:

Test Hole Location

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SITE EXPLORATION PLAN

8456 North Mercer Way
Mercer Island, Washington

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TEST HOLE 1

Depth (feet)	Soil Description
0 – 1.0	TOPSOIL -bottom of existing footing at 1.0 feet
1.0 – 3.0	Orangish-brown, slightly gravelly, slightly silty SAND, fine-grained, moist, loose
3.0 – 5.0	Tan, slightly gravelly, slightly silty SAND, fine-grained, moist, medium-dense -becomes dense at 4.5 feet (Glacial Drift)

Test Hole was terminated at a depth of 5.0 feet on December 28, 2023.
No groundwater seepage was observed.

TEST HOLE 2

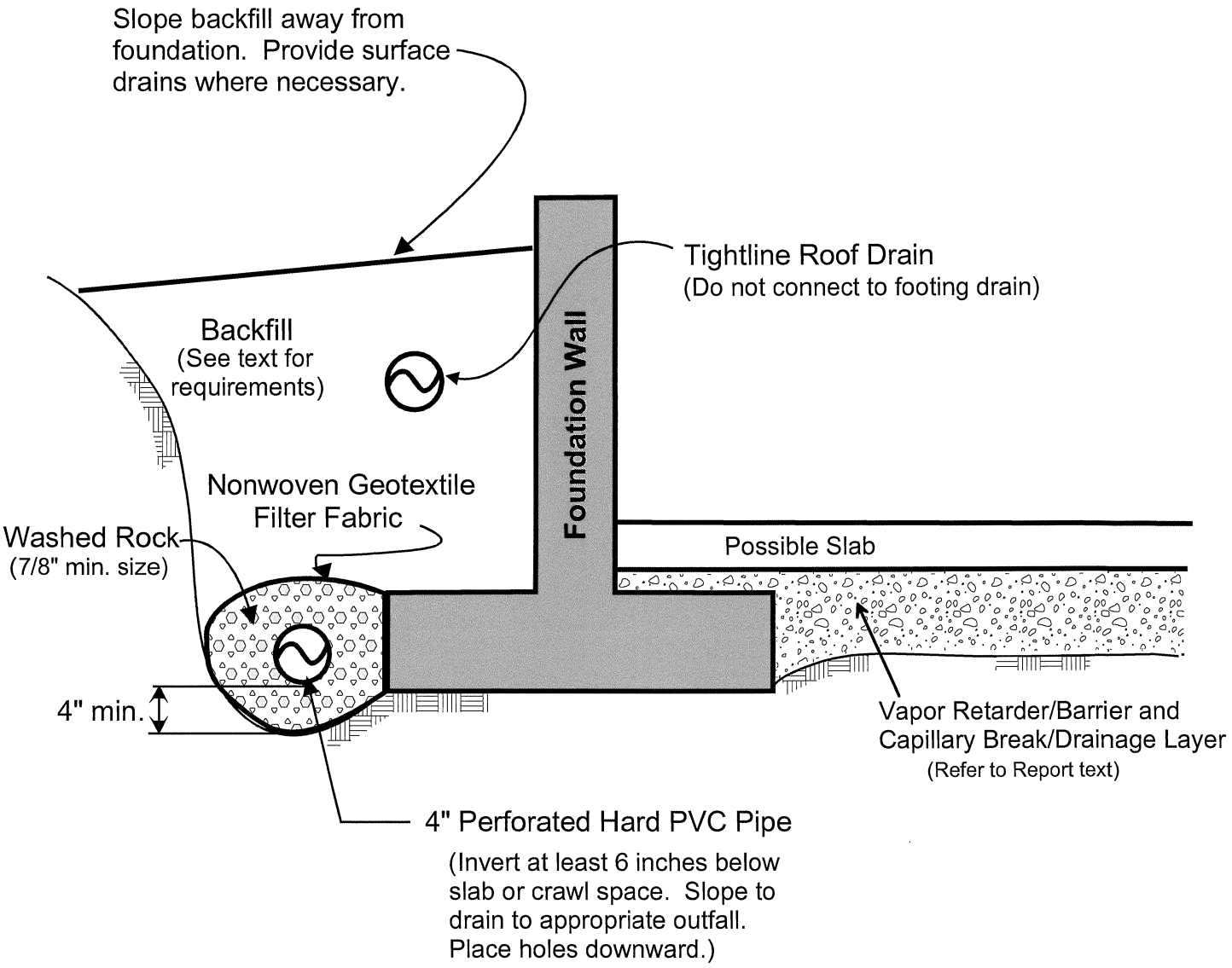
Depth (feet)	Soil Description
0 – 2.0	Orangish-brown, slightly gravelly, slightly silty SAND, fine-grained, moist, loose
2.0 – 5.0	Tan, slightly gravelly, slightly silty SAND, fine-grained, moist, medium-dense -becomes dense at 3.5 feet (Glacial Drift)

Test Hole was terminated at a depth of 5.0 feet on December 28, 2023.
No groundwater seepage was observed.

TEST HOLE 3

Depth (feet)	Soil Description
0 – 1.0	Brown, silty SAND, fine-grained, loose (FILL)
1.0 – 3.0	Orangish-brown, slightly gravelly, slightly silty SAND, fine-grained, moist, loose
3.0 – 5.0	Tan, slightly gravelly, slightly silty SAND, fine-grained, moist, medium-dense -becomes dense at 4.5 feet (Glacial Drift)

Test Hole was terminated at a depth of 5.0 feet on December 28, 2023.
No groundwater seepage was observed.



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.

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FOOTING DRAIN DETAIL

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Mercer Island, Washington

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