GEOTECH
CONSULTANTS, INC.

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January 12, 2022

JN 22008

Mu Hu
c/o Atera Homes
451 Duvall Avenue N.E., Suite 115
Renton, Washington 98059

Attention : Paul Monsef
via email: *paul@aterahomes.com*

Subject: **Foundation and Critical Area Considerations, and Infiltration Feasibility Assessment**
Proposed New Residence
2448 – 72nd Avenue S.E.
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the planned redevelopment of the subject property. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this summary report.

Planning for the site development is in the initial conceptual phase. However, based on our discussions with Atera Homes, we expect that the existing rambler will be replaced with a new, larger residence having two floors. A basement will not be included in the new construction. As a result, no deep excavation is expected for the planned work.

The City of Mercer Island GIS maps the central portion of the lot as a Potential Landslide Hazard. This is the very tip of a mapped Potential Landslide Hazard area extending several lots to the south of yours. There are no steep slopes mapped on, or around, your property. This mapping of the Potential Landslide Hazard appears to be the result of some short, localized steeper slope areas on the lots to the south.

We visited the subject property on January 12, 2022 to observe the existing site conditions. The existing house is a rectangular-shaped rambler located in the center of the property. To the west of the house is a large gravel-surfaced area extending to 72nd Avenue Southeast. Along the north side of the lot is a paved access drive shared by several neighbors. There is a paved driveway extending from this shared access driveway to the garage contained in the western end of the house. The remainder of the property is covered mostly with grass and landscaping. Buried utilities (natural gas and water) are located in the western gravel area, and it is likely that the sanitary side sewer extends north from the house through the front yard or under the driveway.

The ground surface on the lot has a very gentle slope down toward the northeast. The surrounding area also generally slopes gently toward the northeast. There are some small steep slopes on the neighboring lots to the south and southeast that are localized and are less than 10 feet in height. These short slopes appear to be largely the result of excavation and filling for development and landscaping of the neighboring lots. There is no history of large-scale slope movement in this area.

The site lies over a block to the west of the steeper, taller slopes situated on the west side of the downtown area that have experienced landslides of varying sizes over the years.

We are familiar with the native subsurface conditions on the property from review of published geologic maps, explorations that our firm has completed in close proximity to the site, and the conditions exposed in a test pit excavated during our visit to the property. Geologic maps indicate that the near-surface geologic unit is glacial till, a glacially-compressed mixture of silt, gravel, and fine-grained sand. It was possible to excavate one test pit at the location shown on the attached Site Exploration Plan, avoiding marked utilities and existing site features. A log of this test pit is also attached. Beneath approximately 2 feet of loose fill, this test pit encountered topsoil and a layer of heavily-weathered silt extending to a depth of approximately 4 feet. Dense, glacially-compressed sandy silt was encountered below 4 feet. The test pit was conducted following several months of moderate to heavy rainfall, and an episode of snowmelt. Groundwater seepage was observed perched on top of the impervious dense silt in the test pit.

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 site and surrounding area are underlain by competent, glacially-compressed native soils. All foundations for the new construction should be excavated through the fill and loose soils. This may require excavation below the planned footing subgrade elevations. Where this overexcavation is necessary, it should be filled using imported clean crushed rock (quarry spalls or railroad ballast rock).

The existing fill and old topsoil should be removed from any slab areas, such as the planned garage.

The onsite soils will not be suitable for reuse as compacted fill, due to their very high silt and moisture contents. Any compacted fill placed in structural areas, or where post-construction settlement is undesirable (patios, porches, stoops, etc.) should consist of imported granular material that can be properly compacted.

The underlying glacially-compressed soils beneath the site are not susceptible to seismic liquefaction.

The site does not contain any steep slopes, nor is it near any slopes that would be susceptible to landslides. The dense, glacially-compressed soil that will support the new construction is not subject to large-scale slope movement on the gentle slopes that exist on, and around, the site. The stability of the subject property and surrounding lots will not be adversely affected by the planned development. There is also no hazard of instability in the dense soils that could pose a risk to the planned new construction. No buffer or other mitigation measures are required to address the Potential Landslide Hazard mapping of the site.

We provide the following "statement of risk" to satisfy City of Mercer Island conditions:

> "It is our professional opinion that the development practices proposed in this report for the new development would render the development as safe as if it were not located in a geologic hazard area."

Based on the results of the test pits, the site is underlain at a shallow depth by glacially-compressed silt. This soil is essentially impermeable. Often, the impermeable nature of the glacial 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. Such a perched groundwater condition was observed in our test pit. The glacially-compressed silt has no large or continuous pore spaces in the soil that can transmit water. Considering the observed soil and perched groundwater conditions, it is our professional opinion that infiltration of concentrated storm water is not feasible for this site. Attempting to infiltrate or disperse storm runoff will increase the potential for drainage problems on the downgradient properties to the north and northeast.

Even shallow crawl spaces may collect subsurface water perched on top of the dense soil. Providing perimeter footing drains, and well as installing perforated drains in a layer of gravel under the vapor barrier/retarder in the crawl space, would be prudent.

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

We recommend that continuous and individual spread footings have minimum widths of 16 and 24 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. In wet conditions, the prepared footing subgrades should be protected with several inches of clean crushed rock, in order to prevent softening or disturbance during the placement of forms and rebar.

Depending on the final site grades, 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, or compacted rock structural fill up to 5 feet in thickness 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.

The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

LIMITATIONS

This report has been prepared for the exclusive use of Mu Hu 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

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,

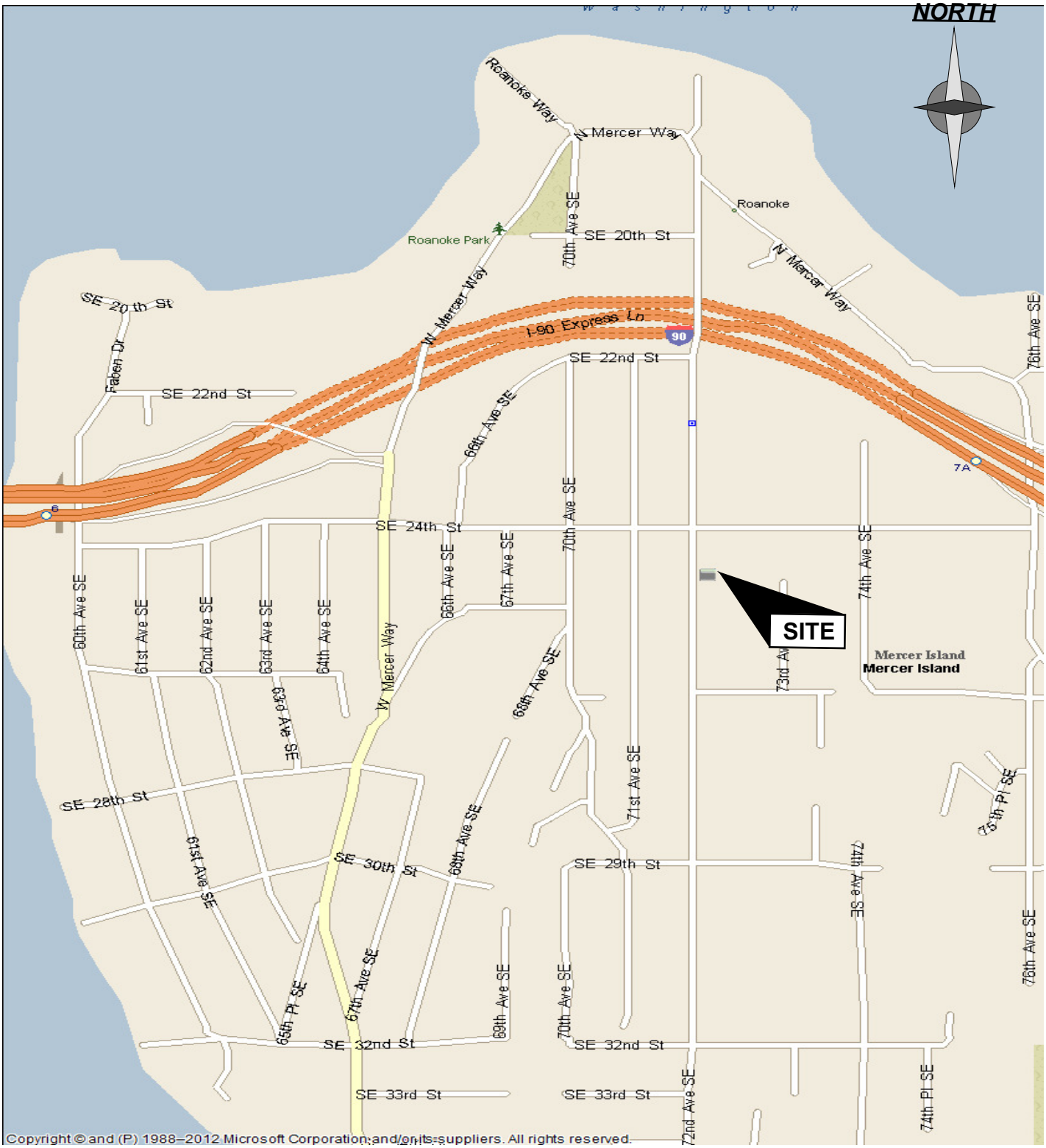
GEOTECH CONSULTANTS, INC.

1/12/2022

Marc R. McGinnis, P.E.
Principal

Attachments: Vicinity Map, Site Exploration Plan, Test Pit Log

MRM:kg



(Source: Microsoft MapPoint, 2013)

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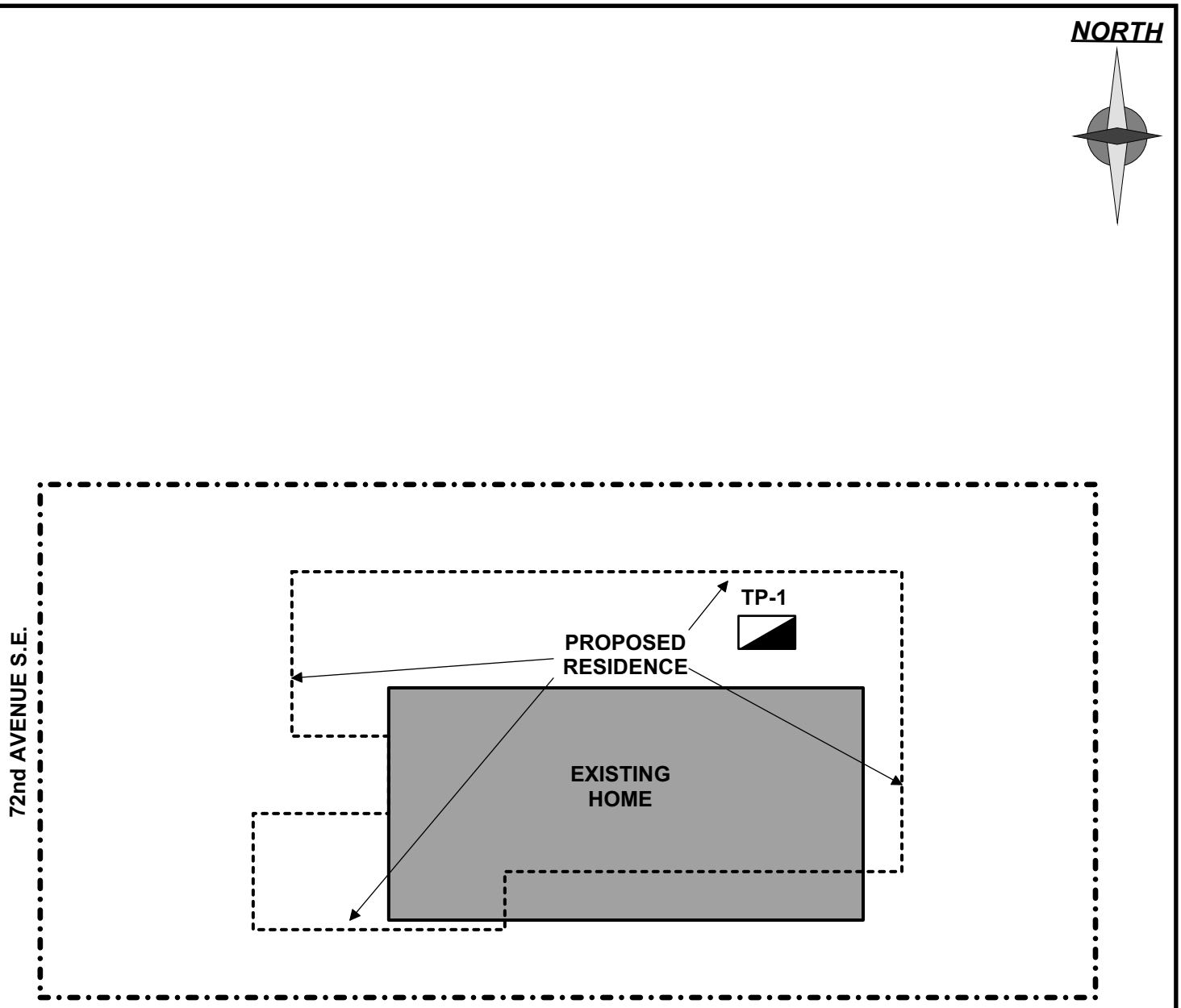
VICINITY MAP

2448 - 72nd Avenue
Mercer Island, Washington

Job No:	Date:		Plate:
22008	Jan. 2022		1



Legend:

TP-1 APPROXIMATE TEST HOLE LOCATION

(Not to Scale)

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SITE EXPLORATION PLAN

2448 - 72nd Avenue
Mercer Island, Washington

Job No:	Date:		Plate:
22008	Jan. 2022	No Scale	2

TEST PIT 1

Depth (feet)	Soil Description
0 – 2.0	Sod over brown, mottled, silty SAND, fine-grained, very moist, loose
2.0 – 2.5	Old Topsoil
2.5 – 4.0	Brown, mottled, slightly sandy SILT with old roots, low plasticity, very moist, loose
4.0 – 4.5	Grayish-brown, slightly sandy SILT, low plasticity, very moist, dense

Test Hole was terminated at a depth of 4.5 feet on January 12, 2022.
Perched groundwater seepage was observed at 3.75 feet.