GEOTECH
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JN 23353

Kim-Um Family c/o Studio Terrain

Attention: Lauren Galante
via email: *lauren@terrainseattle.com*

Subject: **Geotechnical Engineering Report and Critical Area Report**
Proposed Deck Addition
3440 – 69th Avenue Southeast
Mercer Island, Washington

Greetings:

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

Based on discussions with Studio Terrain, we understand that the existing main level deck is proposed to be expanded approximately 3 feet to the north, and 3 feet to the west of its current footprint. New landscaping and hardscaping are proposed to be constructed in the northwestern portion of the yard area adjacent to the deck, including mortar set tile pavers for a new expanded patio space beneath the deck. Steel raised garden beds will be placed near the northwestern corner of the property. Excavations for the planned developments are not anticipated to extend more than a few feet below grade at this time.

We visited the subject property on November 6, 2023 to observe the existing site conditions and to excavate a shallow hand auger test hole. The property is rectangular shaped and comprises a total site area of 0.21 acres. The site is bordered on the north, and east, by single family parcels, to the south by Southeast Allen Street, and to the west by 69th Avenue Southeast, which appears to be undeveloped and contains a sewer utility extension for the northern neighbor. The existing residence, which consists of one above-grade floor overlying a west-facing daylight basement, is located in the approximate center of the lot. This house was reportedly constructed in 1976 and appears to be undergoing a cosmetic remodel. Garage space is located in the northeastern corner of the property, adjacent to the residence. A large, main-level deck extends off the western wall of the main level and is underlain by a basement level patio. This deck terminates near the angled wall intersection along the western wall of the residence, and a stairway descends down from the northern edge of the deck to the patio.

The ground surface on the lot, and in the vicinity, generally slopes down toward the west, trending with the general downgradient of the area. The ground surface on the developed portion of the lot slopes gently to moderately. A rockery lines the north and east perimeter of the site, where the property was likely cut down from the existing grades during the construction of the house, garage, and driveway. The grade descends through the house footprint, facilitating the differential in elevation between the main and lower floors. The grade continues out flat to gently sloped past the west face of the residence across a yard area, before sloping moderately to steeply across a relatively short, landscaped slope.

The existing deck appears to be supported on isolated shallow post foundations. Observations with respect to the existing deck supports and framing near the proposed deck addition area would indicate that it is performing adequately under its current conditions and loading.

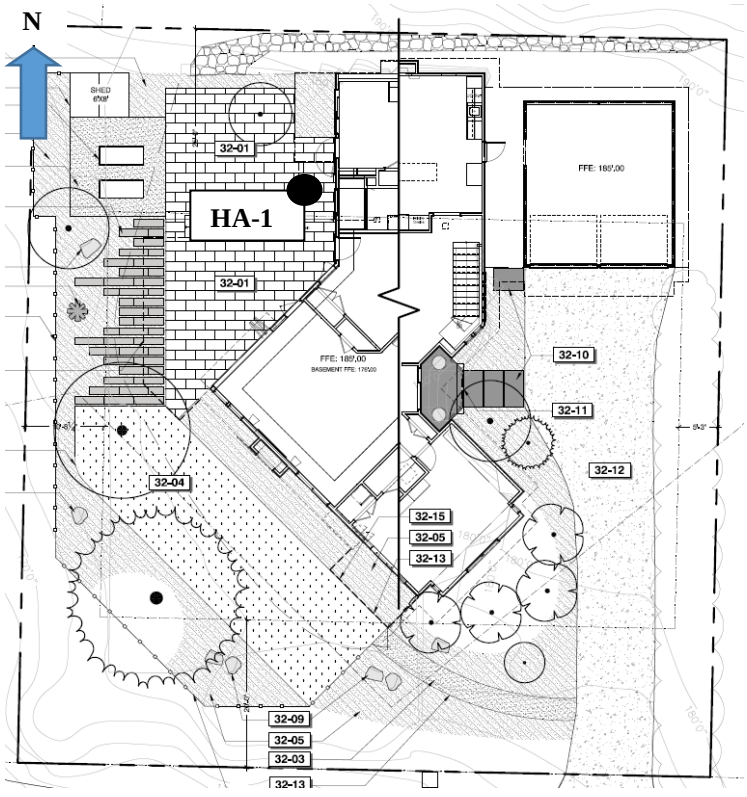
We saw no indications of recent instability on, or around, the subject property.

The City of Mercer Island GIS maps the entire site as a Potential Landslide Hazard, and Erosion Hazard. The southwestern corner of the site is mapped as a Seismic Hazard. The GIS also maps a slope located directly

adjacent to the northwestern corner of the property as a steep slope. Based on the GIS, this slope is inclined at approximately 50 to 60 percent, and is more than 20 feet tall. The Mercer Island Landslide Hazard Map notes several spring locations, as well as noted groundwater being encountered at relatively shallow depths in the vicinity of the site. Several landslides have been mapped in the area, but no information is available regarding these events. We are aware that most of the nearby springs have been piped into engineered stream systems which flow into Mercer Island's storm system. These streams were likely controlled in this manner to prevent further shallow instability in the area, as well as to allow for the residential lots to be developed. No signs of recent, deep-seated instability were observed during our time at the site.

We are familiar with the subsurface conditions on the site from: 1) the excavation of one test hole on the property near the proposed deck addition, 2) explorations conducted for the nearby residences surrounding the property, and 3) review of geologic mapping for the area. Explorations on the adjacent upslope eastern property show fill and loose, weathered native soils underlain by dense, glacially compressed silty sand, sand, and silt. Localized perched groundwater was found in the adjacent test pits to the east at variable depths ranging from 2.5 to 6 feet.

A staff geotechnical engineer from our firm excavated and logged the test hole, which was excavated near the proposed deck addition nearer to the northwestern corner of the basement. The log of the test hole is presented below. The test hole generally confirms the shallow subsurface conditions encountered within the other explorations conducted in the area. The native soils became dense below a depth of approximately 1.5 feet.



HA-1
0.0-1.5 Sod over Topsoil
1.5-2.5 Gray mottled orange, very silty SAND, very fine-grained, moist, medium-dense **[SM/ML]**
- becomes bedded, dense at 2' (**Glacial Till-like)**)
Bottom at 2.5 feet, Refusal on Till. No groundwater.

***NOTE** – Letters in brackets **[ ]** denote the USCS soil classification.

The stratification lines on the log represent the approximate boundaries between soil types at the exploration location. The log provides specific subsurface information only at the location tested. The relative densities and moisture descriptions indicated on the test hole log are interpretive descriptions based on the conditions observed during excavation.

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 hole encountered dense, native glacially compressed soils at a shallow depth beneath the ground surface, extending to the base of the test hole. These soils are similar in density and composition to soil conditions encountered in the nearby vicinity. Based on this information, it is apparent that the core of the site is comprised of this competent soil, which has a high strength and low susceptibility to deep-seated instability.

Conventional foundations bearing on the underlying competent native soil, or upon adequately compacted structural fill, will provide suitable support for the deck addition, as well as for the new mortar set patio beneath the deck and any other settlement sensitive elements related to the proposed development. While the underlying native soils are dense, and glacially compressed in nature, the composition of the native soils makes them highly moisture sensitive, and easily disturbed during construction. If wet soils are encountered during excavation for the new foundations, or foundation excavation and construction is to occur during the wet season, we recommend that a thin layer of clean rock be placed atop the prepared subgrades. This rock layer would help to provide subgrade protection during foundation construction and would aid in the pumping of any onsite water that may accumulate within the excavation.

Shallow excavations are anticipated for this project at this time. These excavations should be able to be completed using open, sloped cuts without impacting any of the adjacent properties, or needing shoring.

CRITICAL AREA STUDY (MICC 19.07)

Seismic Hazard: The glacially-compressed soils beneath the site are not susceptible to seismic liquefaction. The new foundations for the deck addition will be excavated to bear on the dense, non-liquefiable native soils found in our test hole.

Potential Landslide Hazard and Steep Slopes: The planned work will be located well away from the steeply inclined portion of the western slope. The stability of the steeply inclined area of the western steep slope, as well as the gentle to moderate site slopes, and slopes in the vicinity of the site will not be adversely affected by the relatively minimal sitework for the work related to expanding the deck and patio. No additional buffer or other mitigation measures are required to address the Potential Landslide Hazard mapping of the site.

Erosion Hazard: The site disturbance for any of the exterior work for the project will be limited and will occur primarily on flat to gently-slope 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 may 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 work during the wet season without adverse impacts to the site and neighboring lots. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

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."*

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

The proposed new foundations for the deck can be supported on conventional continuous and spread footings bearing on undisturbed, dense native soil or on structural fill placed above this competent native soil. See the section entitled ***General Earthwork and Structural Fill*** for recommendations regarding the placement and compaction of structural fill beneath structures. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer to document that adequate bearing soils have been exposed.

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.

An allowable bearing pressure of 2,000 pounds per square foot (psf) is appropriate for footings supported on competent, glacially compressed, native soil. A one-third increase in this design bearing pressure may 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 on structural fill up to 5 feet in thickness, will be about one-half-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.

LIMITATIONS

This report has been prepared for the exclusive use of the Kim-Um Family 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 sitework 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.

James H. Strange JR, P.E.
Associate

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