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Subject: **Foundation Design Criteria and Evaluation of Infiltration Feasibility**
Proposed Lanctot Residence
4603 – 89th Avenue Southeast
Mercer Island, Washington

Greetings:

This report presents our geotechnical conclusions related to foundation design and the feasibility of onsite infiltration of storm water for the planned development of the vacant lot. On January 26, 2022, the undersigned principal geotechnical engineer visited the site to assess the subsurface conditions. The existing residence is undeveloped, and is covered with trees and underbrush. A treehouse likely associated with the adjacent southern lot (#4609), which is developed, is located in the center of the site. A walking trail adjoins the northern boundary of the lot. The ground surface on the site and in the general vicinity slopes only gently downward toward the east. There are no steep slopes or mapped Critical Areas on, or near, the site.

A test hole was excavated in center of the eastern half of the lot. This test hole extended to a depth of 4 feet. The following is a log for that test hole:

Depth (feet)	Description
0 – 1.0	Forest Duff and Topsoil
1.0 – 2.0	Orangish-brown, gravelly, silty SAND, fine-grained, very moist, loose
2.0 – 4.0	Light gray, gravelly, silty SAND, fine-grained, very moist, dense (Glacial Till)

No groundwater seepage was observed in the test hole.

Geologic mapping indicates that the site and vicinity are underlain by Glacial Drift, a glacially-compressed mixture of gravel, silt, and fine-grained sand. Glacial Drift soils can also include Glacial Till, which was encountered in the test hole. The test hole did not expose near-surface seepage. However, the Glacial Till soils are essentially impervious, and it is relatively common to encounter seasonal groundwater perched on top of the Glacial Till, particularly following extended wet weather. The presence of Ellis Pond to the east of the site is consistent with the presence of impervious soils and shallow groundwater in the vicinity.

CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions observed in the test hole and surrounding excavations, and our previous experience with other projects in the immediate vicinity, 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 glacial till. This may require overexcavation below the planned footing grades. We recommend that the footings be excavated using a smooth bucket, 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.

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 C (very dense soil).

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 very dense soil known to underlie this area, and which was observed in the test hole is glacially compressed. 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. A 1997 study published by U.S. Geologic Survey (USGS) in cooperation with the Washington Department of Ecology (WDOE) determined the infiltration capacity of various Washington till soils to vary between 0.0005 and 0.005 inches/hour. We have found similar extremely low infiltration rates in Pilot Infiltration Tests (PITs) our firm has conducted in glacial till soils. 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.

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 Till and then flow laterally.

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

Respectfully submitted,

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