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Geological & Geotechnical Consulting
19532 12th Avenue NE
Shoreline, WA 98155-1106

May 29, 2016
Project No. 16-027

Steve and Kristal Wallstrom
10841 NE 108th Street NE
Kirkland, WA 98033

Subject: Geotechnical Services Report
Planned New Single Family Residence
10841 NE 108th Street NE,
Kirkland, Washington

Dear Steve and Kristal:

This report summarizes the results of our geological and geotechnical evaluation of the property located at the above noted address in Kirkland. The property is currently occupied by a 2 story, wood frame, single family residence. It is our understanding that the property will be divided to create an additional building lot immediately to the east of the existing residence. Access will be via NE 108th Street.

Existing Conditions

The site is relatively level with a very slight southward descending slope. Elevation change over the entire approximate 320 foot long property is on the order of 7 feet. Vegetation on the site is mostly lawn grass with trees and bramble bushes along the southeastern and southern areas where the property abuts a wetland. There was no visual evidence of any standing or flowing water on the property at the time of our field work. We understand that standing water does occasionally occur on the property around the area of the existing detached garage. The property is bordered by single family residences to the east and west, by NE 108th Street to the north and by a wetland to the south and southeast.

In order to confirm subsurface conditions on this site geologic research was performed regarding existing mapping of the property, nearby surface explorations were researched and reviewed, a site reconnaissance was performed and 4 exploration pits were excavated on the site. See Figure 1 Site and Exploration Plan. The logs of the exploration pits are attached with this report.

Subsurface Conditions

On May 11, 2016, 4 exploration pits were excavated on the subject site using a mini-excavator provided by Revolution Custom Builders. See Figure 1, Site and Exploration Plan for pit locations. The pits generally encountered 1 ½ to 2 ½ feet of loose, dark brown silty fine sand with scattered and/or organics over 2 ½ to 3 ½ feet of very loose to loose, light brown to gray brown, silty, fine to very fine sand. Underlying the loose soils was medium dense to dense, brown, silty sand with gravel to gravelly sand with silt. In exploration pit EP-3 the loose soils were not penetrated due to rapid ground water intrusion and caving of the pit walls. Rapid ground water seepage was observed in EP-3 and EP-4 below a depth of 3.5 feet. These pits were located on the lower elevations of the site, nearest to the mapped wetland. Exploration pit EP-1, closest to the adjacent street did not encounter any ground water and EP-2, near the southern extension of the planned house, only had light ground water at a depth of 5.5 feet. The exploration pit logs are attached with this report.

Hydrology

As noted in the exploration pits, significant ground water intrusion into the excavations was observed in the pits south of the planned new house location. Light seepage was observed in the pit nearest the south end of the planned house and no seepage was observed in the pit at the north end of the house.

Ground water levels can generally be expected to change with the seasons becoming lower in the summer and fall and rising in the winter and spring. Due to the proximity to Forbes Creek and the adjacent wetland the observed ground water may be a permanent condition on this site. It is incumbent that the contractor be prepared to deal with high ground water conditions during construction.

Mappings

According to the Geology Map of King County, by Both, Troost and Wisher, 2007, the site is mapped near the contact between Vashon age advance outwash deposits and Pre-Fraser fine grained deposits. Both of the units have been glacially consolidated.

Seismic Hazards

The parcel is located approximately 5 miles north of the Seattle Fault Zone and 5 miles south of the South Whidbey Fault Zone. Generally there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture; 2) seismically induced landslides; 3) liquefaction; and 4) ground motion. This risk of ground rupture is very low as no fault splays have been recognized within the immediate area. Due to the flatling nature of the site and surrounding area there is no risk of a seismically induced landslide. There is a low risk of liquefaction, especially on the southern portion of the property. In the location of the planned

residence medium dense to dense granular soils were observed at the bottom of the exploration pits. These soils are not prone to liquefaction during a seismic event. Based on the encountered site conditions, and the planned construction, it is our opinion that the proposed construction will not be affected by any of these hazards other than ground motion. For this project the structural engineer should follow 2012 International Building Code recommendations for Site Class D soils.

Conclusions and Recommendations

Based on the results of our site reconnaissance, subsurface investigation and literature review, it is our opinion that the subject parcel is located in an area that is underlain by glacially consolidated sediments that will provide suitable bearing for the project. However, the bearing soils were observed at least 5 feet below existing ground surface and it will be necessary to extend the foundation loads to these underlying soils. Also, it must be noted that exploration pit EP-3, located south of the south footing line of the planned residence, did not fully penetrate through the loose soils due to rapid ground water intrusion into the pit.

The bearing soils are also fine grained and moisture sensitive. As such they will be easily disturbed, especially during inclement weather conditions. If the bearing soils become disturbed during construction it will be necessary to either remove the disturbed soils or recompact them back to a medium dense or better condition prior to footing concrete placement.

Foundations

All new building foundations must extend down through any existing fill soils or loose native soils to bear on the underlying medium dense or better silty sand sediments that were observed approximately 5 feet below existing grade. An allowable soil bearing value of 2,000 psf, a passive earth pressure of 250 pcf and a soil friction factor of 0.35 may be used in the design of these new foundations. Backfill around foundation units must be placed and compacted in lifts to a medium dense or better condition in order for the passive earth pressure value to apply. Anticipated settlement over a 20 foot span should be less than ¾ inch total and ¼ to ½ inch differential for equally loaded foundations.

If the footing trench line cannot be safely held open due to ground water and caving conditions it will be necessary to provide a structural trench to support the footings. The trench can be filled with 2 inch diameter crushed ballast rock, recycled concrete, pit run sand and gravel, or lean mix concrete. The recommended width of the trench will be dependent upon the material chosen for backfill. For lean mix concrete the trench would only need to be 6 inches wider than the planned footing width. For 2 inch diameter crushed ballast rock the trench should be a minimum of 4 feet wide. For pit run sand and gravel and recycled concrete the trench should be on the order of 10 feet wide. In all cases the footing must be centered exactly over the structural trench.

Lean mix concrete requires no compaction. Ballast rock requires compaction with the bucket of the trackhoe in 2 foot lifts. Recycled concrete and pit run sand and gravel require compaction of

maximum 10 inch thick lifts with each lift compacted to a dense and unyielding condition prior to placement of a subsequent lift.

Retaining Walls

It is our understanding that there are no planned free standing retaining walls or basement walls for this project. If any walls are planned we should be contacted to provide geotechnical design parameters for the wall.

Drainage

Due to the depth of excavation required to reach suitable bearing soils footing drains should not be required for this project.

Storm water from impermeable surfaces should be collected and discharged into a city approved storm water drainage system. On-site infiltration of storm water is not applicable for this site.

Erosion

Suitable best management practice (BMP) erosion control measures should be implemented for the project. A silt fence should be installed as per Kirkland requirements along the lower portions of the site. Soil stockpiles should be covered with plastic sheeting to contain in-situ moisture and prevent storm water runoff. Areas of disturbance should be limited to necessary construction areas. Cleared areas that are not being worked should be covered with straw mulch. A rocked construction entrance should be established at the driveway location. Typical construction entrances are on the order of 20 feet long but should be sized to meet Kirkland standards. The rocked entrance should be underlain by a non-woven filter cloth such as Mirafi 140N or equivalent.

Concrete Slab on Grade

Based on the observed conditions the existing soils in the area of the garage are loose and not suitable for concrete slab support. At a minimum 2 feet of soil beneath bottom of slab elevation should be removed and the exposed soils compacted to a firm and unyielding condition. Once the exposed soils are firmly compacted the area should be filled to grade with an easily compacted material. The on-site soils may be suitable for this use if they can be maintained near optimum moisture content. If not, then either recycled concrete or granular pit run sand or a screened product such at Type 17 should selected. Backfill should be placed in maximum 8 to 10 inch loose lifts and each lift compacted to a firm and unyielding condition prior to placement of subsequent lifts.

Slab-on-grade concrete floors where moisture vapor intrusion is unwanted should be cast atop a minimum of 6 inches of clean, coarse, sand and gravel, washed crushed rock, or washed pea gravel to act as a capillary break. It should also be protected from dampness by placement of minimum

10-mil plastic sheeting atop the capillary break layer. The plastic sheeting must be lapped and sealed to prevent moisture intrusion. In addition, any projections through the plastic sheet must be properly wrapped and sealed.

Summary

Construction monitoring and consultation services should be provided in order to verify that subsurface conditions are consistent throughout the property, will provide suitable bearing for the new footings and stability of excavation sidewalls. Other construction monitoring activities may be required by city officials. We should also review those portions of the plans and specifications that pertain to geotechnical recommendations presented herein.

Our findings and recommendations provided in this report were prepared in accordance with generally accepted principles of engineering geology and geotechnical engineering as practiced in the Puget Sound area at the time this report was submitted. We make no other warranty, either express or implied.

Respectfully submitted,

Gary A. Flowers, P.G., P.E.G.
Principal Engineering Geologist

Robert M. Pride, P.E.
Geotechnical Engineer

Attachments: Exploration Pit Logs
Figure 1: Site & Exploration Plan