Earth Solutions NW LLC

• Geotechnical Engineering
• Construction Monitoring
• Environmental Sciences

May 8, 2015
ES-3903

Highlands Builders Group
7683 Southeast 27th Street #353
Mercer Island, Washington 98040

Attention: Mr. Greg Heiser

Subject: Infiltration Evaluation and Soil Bearing Recommendations
1932 Market Street
Kirkland, Washington

Dear Mr. Heiser:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter to a provide infiltration evaluation and soil bearing recommendations for the subject site.

Project Description

We understand the subject site will be developed with two single-family residences and associated improvements. It is being proposed that runoff from roof downspouts will be collected and infiltrated into the underlying native soils through a series of infiltration trenches at various locations on the site. The infiltration system is proposed for construction at a depth of approximately four to six feet below the existing ground elevation.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this letter.

SITE CONDITIONS

Surface

The site is located on the east side of Market Street, and north of 19th Avenue in Kirkland, Washington. The site consists of a single tax parcel which is slightly elevated above the street elevation by approximately four feet. A single-family residence occupies the west portion of the lot; and lawn area is prevalent across the remainder of the subject site.

The overall site topography ascends towards the east from street elevation with approximately 12 feet of total elevation change across the site.

Subsurface

Three test pits were excavated in the proposed infiltration areas for purposes of performing infiltration testing, characterizing, and classifying the soil conditions. Please refer to the test pit logs attached to this letter for a more detailed description of the subsurface conditions. Test Pits TP-1 and TP-3 were located in the west portion of the site; and TP-2 was located in the east-central portion of the subject site.

Loose topsoil was encountered at the test pit locations to a depth of approximately eight inches below existing grade. Underlying the topsoil, medium dense silty sand with gravel (Unified Soil Classification SM) was encountered extending to approximately two to three feet below existing grade. ESNW observed silty sand with gravel (SM) weathered glacial till at approximately three feet below existing site elevations at the test pit locations. The weathered glacial till transitioned to an unweathered condition at approximately three feet in depth, which was observed extending to the limits of exploration (eight feet below existing site elevations).

The geologic map of the area identifies glacial till (Qgt) deposits throughout the site and surrounding areas. The soil conditions encountered during our fieldwork were generally consistent with the geologic and soil designations; particularly where we observed cemented silty sand with gravel soil which is indicative of glacial till.

Groundwater

Groundwater seepage was not observed at the time of our fieldwork (May 5, 2015). No indication of a seasonal near surface groundwater table was observed in the test pits. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months. Perched groundwater should be expected in excavations made during the winter, spring and early summer months.

Infiltration Evaluation

A representative of ESNW was on-site on May 5, 2015 to perform infiltration testing. Our fieldwork consisted of observing and logging a total of three test pits and performing in-situ EPA Falling Head testing at the locations within the area of the proposed infiltration systems. Based on the conditions encountered during our fieldwork, the site is underlain primarily by re-worked native fill soils underlain by undisturbed native glacial till soil.

Based on the results of our infiltration testing within the proposed infiltration system areas, an average measured infiltration rate of zero inches per hour was observed. The lack of infiltration is due to the presence of cemented glacial till soil.

Based on the results of our in-situ infiltration testing, in our opinion infiltration of stormwater at the subject site as proposed is not feasible. We recommend an alternate means of stormwater management be pursued on the subject site.

Foundations

Based on the results of our study, the proposed residential structures can be supported on conventional spread and continuous footings bearing on competent native soils, re-compacted native soils, or structural fill. Based on the soil conditions encountered at the test pit locations, competent native soils suitable for support of foundations should be encountered at depths of between two to four feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with structural fill, may be necessary.

Provided foundations will be supported as described above, the following parameters can be used for design of new foundations:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Limitations

The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test sites may exist, and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

We trust this information meets you needs. If you have any questions or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

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STATE OF WASHINGTON
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REGISTERED
PROFESSIONAL ENGINEER
5/8/15

Stephen H. Avril
Project Geologist

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Principal

Test Pit Logs

ES-3903

TP-1

Topsoil 0' - 8"

Brown Silty Sand with Gravel, Medium Dense, Moist (Fill) 8"- 2.5'
Brown Silty Sand with Gravel, Dense, Moist (Weathered Glacial Till) 2.5'- 3.5'
(Becomes Unweathered) 3.5' - 7.5'

TP-2

Topsoil 0'-8"
Brown Silty Sand with Gravel, Medium Dense, Moist (Fill) 8"-3'
Brown Silty Sand with Gravel, Dense, Moist (Weathered Glacial Till) 3' - 4.5'
(Becomes Unweathered) 4.5' - 8'

TP-3

Topsoil 0' - 8"
Brown Silty Sand with Gravel, Medium Dense, Moist (Fill) 8" - 2'
Brown Silty Sand with Gravel, Dense, Moist (Weathered Glacial Till) 2' - 3.5'
(Becomes Unweathered) 3.5' - 5'