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PROJECT NO.: SM 177738-E November 23, 2017

BRANTHAVEN MOUNT HOPE INC.
720 Oval Court
Oakville, Ontario
L7L 6A9

Attention: Mr. Andrew Eldebs
Development Analyst/Project Manager

HYDROGEOLOGICAL ASSESSMENT
80 MARION STREET
MOUNT HOPE, ONTARIO

Dear Mr. Eldebs,

Further to your request and information Soil-Mat Engineers & Consultants Ltd. is pleased to offer the following brief hydrogeological assessment report regarding the proposed residential development on the above noted property.

1. INTRODUCTION

We understand that the project will consist of the construction of a residential development on the subject lands, which mainly consists of open field surrounded by residential properties. The proposed development is understood to consist of approximately 125 single family lots on asphalt paved roadways. Construction would also include the installation of associated underground municipal services. The purpose of this brief hydrogeological assessment is to review the subsurface soil and groundwater conditions of the site, and provide our comments and recommendations regarding the potential impact of the proposed residential development from a geotechnical and hydrogeological point of view.

2. BACKGROUND

The proposed development is located within an area of recent and previous residential development. As such the installation of services in the area has been conducted previously. The current proposed development will connect to local sanitary, storm and water services already in place.

As noted above Soil-Mat Engineers has previously conducted a site specific test pit study for the subject lands. In addition a geotechnical investigation completed by others was provided to our office. This available information was referenced in the preparation of this hydrogeological assessment report. Specifically these include the following reports.

- "Geotechnical Investigation – Test Pit Study", SM 177738-G, dated October 19, 2017, prepared by Soil-Mat Engineers & Consultants Ltd.
- "Preliminary Geotechnical Investigation – Proposed Residential Development", SP16-180-10, dated January 5, 2017, prepared by Sirati & Partners Consultants Ltd.

As well, our observations and experiences with other projects in the area have informed our comments and recommendations.

3. SITE CONDITIONS

SITE DESCRIPTION

The project site for the proposed development is the parcel of land located at 80 Marion Street in Mount Hope. The proposed development lands also include portions of 3302 and 3306 Homestead Drive. The property is bound to the north, east and south by existing residential lands, as well as an existing fire station to the east, and to the west by agricultural lands [future development lands]. The majority of the site is mainly open field with tall grass, and some mature trees along the perimeter. According to topographical data, the ground surface slopes down to the south and south east with a total relief of approximately 4.0 metres across the site.

GEOLOGY – OVERBURDEN SOIL

Local soils identified in the Ministry of Northern Development and Mine's "Quaternary Geology of Ontario, Southern Sheet Map 2556" generally consist of silty and clay, with minor sand and gravel (derived from fine-textured glaciolacustrine deposits). This is consistent with our experience in the area of the subject site, as well as both the boreholes of the preliminary geotechnical investigation and the test pits of our study, which have generally found the overburden soils to consist of stiff to very stiff clayey silt to silty clay.

The conditions encountered in the boreholes and test pits, as reported in the referenced reports, are summarised as follows.

Topsoil

A surficial veneer of topsoil approximately 100 to 300 millimetres in thickness was encountered at all test pit locations, and approximately 200 to 450 millimeters in thickness at all borehole locations. It should be noted that the depth of topsoil must be expected to vary across the project site and from the depths encountered at the borehole locations. It should also be noted that the term 'topsoil' has been used from a geotechnical point of view, and does not necessary reflect its nutrient content or ability to support plant growth.

Clayey Silt/Silty Clay Fill

Clayey silt/silty clay fill was encountered beneath the topsoil at Test Pit No. 1. The fill was firm and contained a mixture of granular, sand and broken clay tile pipe. The fill was proven to a depth of approximately 0.6 metres. This fill was likely associated with a former septic bed present on the parcel fronting onto Homestead Drive.

Clayey Silt/Silty Clay

Native clayey silt/silty clay was encountered beneath the surficial fill material in Test Pit No. 1, and beneath the topsoil veneer in all other test pit locations. The clayey silt/silty clay soils were brown in colour, weathered, with a disturbed appearance in the upper level, and were generally stiff to very stiff in consistency. The cohesive soils were proven to termination in all test pit locations at a depth of 1.2 metres below ground surface.

The native cohesive material as encountered in the borehole logs was described as clayey silt in the upper levels, and as silty clay with depth. It is noted that the preliminary geotechnical investigation indicated the silty clay/clayey silt deposit to transition to grey in colour below a depth of about 3 to 4.6 metres, and was present to the termination of the boreholes at a depth of approximately 8.2 to 9.6 metres.

GEOLOGY – BEDROCK

Bedrock in the *Study Area* is recorded from the Ministry of Northern Development and Mine's "Bedrock Geology of Ontario, Southern Sheet Map 2544," as being Middle & Lower Silurian Sandstone and Dolostone bedrock of the Guelph Formation.

The geotechnical investigation on the subject property did not encountered bedrock within the depths of investigation, which extended up to depths of approximately 9.6

metres. Available published information indicates that bedrock is present at depths on the order of perhaps 25 to 30 metres.

GROUNDWATER CONDITIONS

Our test pit study provided an estimate of the static groundwater level of approximately 5 to 7 metres below the existing grade, consistent with the monitoring well readings of the geotechnical investigation and our past experience in the area, with groundwater generally encountered in construction excavations at depths consistent with this estimate. As such the shallow groundwater regimen is expected to be located within a depth of approximately 5 to 7 metres from ground surface. Excavations to, and slightly below these depths, have been readily advanced in the area, experiencing a relatively slow rate of infiltration, such that it has been possible to adequately control using conventional construction dewatering pumping methods.

Water well records for the area indicate depths ranging from 7.6 to 34.7 metres, with an average of over 30 metres. The majority of well records indicated drilled wells extending into the bedrock at depths of 27.4 metres or more, with a small minority of dug wells in the overburden soils. It is not expected that any of the shallow dug wells, should they in fact still exist, would be relied on for potable groundwater supply.

Based on the available information there are two predominant aquifers in the study area.

- One being located relatively shallow in the clayey silt / silty clay overburden at an estimated depth of approximately 5 to 7 metres below ground surface.
- One being much deeper in the bedrock at an estimated depth of approximately 27 to 35 metres.

4. HYDROGEOLOGICAL CONSIDERATIONS

The proposed development is within an area of residential development. The installation of municipal servicing as part of the proposed development will require only relatively shallow excavations, within the low permeability overburden soils. These excavations would be anticipated to depths on the order of perhaps 2 to 4 metres, and thus are not expected to intercept the shallow groundwater regime, noted above to be at a depth of 5 to 7 metres. Further, the low permeable silty clay overburden soils would act as an aquitard, providing an effective separation between the anticipated servicing excavations and the overburden groundwater.

The proposed development is considered to have little to no potential for minor interference with the shallow groundwater level, and no potential impact to the deeper bedrock groundwater conditions. As is typical in any development surface water will be

captured with roofs and hard surface pavements. However this should be appropriately addressed in the storm water management plan.

Given the established soil and groundwater conditions for the site, it is our opinion that there is a low potential for any effect on the local groundwater conditions as a result of the proposed development. As such local drill wells, as well as any private septic systems, would not be expected to be adversely affected by the proposed development. Based on the present information, it is recommend that further detailed hydrogeological study of the subject site is not necessary at this time.

The following recommendations are provided for consideration in the design and construction of the proposed development.

- The site grading should be designed, where possible, to accommodate storm water surface flow in a similar fashion to the present topography, i.e. surface flow from north to south.
- Given the relatively low vertical permeability of the native clayey silt/silty clay deposits the use of on-site storm water infiltration systems would not be considered feasible for the property. In fact, the low permeable overburden soils would effectively afford a barrier to significant vertical groundwater flow.
- It is anticipated that excavations for the installation of site services will extend a depth of up to perhaps 2 to 4 metres below the present ground surface. It is anticipated that such excavations will not intercept the shallow groundwater aquifer. As such, the rate of infiltration in the low permeable clayey silt/silty clay soils is anticipated to be relatively low, such that it should be possible to adequately control minor infiltration of groundwater as well as surface run off using conventional 'dewatering' techniques such as by pumping from sumps and ditches.

We trust this brief report is sufficient for your present requirements. Please feel free to contact the undersigned should you have any questions, or we may be of further service to you.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

LICENSED PROFESSIONAL ENGINEER
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