February 24, 2015

Towerhill Developments Inc.
c/o Innovative Planning Solutions
150 Dunlop Street East, Suite 201
Barrie, Ontario L4M 1H2

Attn: Mr. Cameron Sellers

Re: Addendum #1 - Geotechnical Investigation Report
Proposed Residential Development
Fallis Line, Cavan-Millbrook, Ontario
Geo-Logic Project No. G024822A1

Dear Mr. Sellers:

This letter should be considered Addendum No. 1 to the Geo-Logic report entitled "Geotechnical Investigation Report – Proposed Residential Development – Fallis Line, Cavan-Millbrook, Ontario", dated April 2014, under Geo-Logic Project No. G024822A1.

Commentary was received from the Township of Cavan-Monaghan by letter addressed to IPS and dated December 11, 2014. The following points provide the Township's comments in relation to the Geotechnical Report in *italics*, and Geo-Logic's response to each:

- *"The geotechnical report should comment on whether the Township's pavement structures standard is sufficient or should be upgraded."*

  Based on the soil encountered during our fieldwork, and based on appropriate preparation of the subgrade throughout (see recommendations in our Report), the Township's pavement structures standard (for both asphalt depths and granular depths) are considered sufficient.

- *"The Geotechnical Investigation Report anticipates that groundwater encountered during construction can be controlled by pumping. However, the Report also refers to other more intensive means of dewatering. The Report should provide more definite analysis of the groundwater issue."*

  Based on information provided by Mr. Peter Zourntos of Valdor Engineering by phone-call dated Feb 23, 2015, Geo-Logic understands that the trenching for utilities shall be a maximum depth of only 6 to 7m below existing grade (versus the max. 10m previously referenced in our Report). It is recommended that the depth of servicing and corresponding trenching be minimized as much as possible, to minimize the groundwater control measures required.

It is recommended that a Permit to Take Water (PTTW) be obtained from the MOECC in advance of construction, to allow for dewatering in excess of 50,000 litres/day.

It is recommended that trench plugs be installed at appropriate locations along the trench alignments, to minimize and control any flow of groundwater along the trench bedding and backfill materials. Note that concrete plugs for the shallower watermain trench are susceptible to differential movement and heaving in relation to surrounding soils, particularly where the plugs are located within the frost penetration depth (1.5 to 1.6m). Clay plugs should be used in such instances, utilizing frost tapers to minimize differential movement within the frost zone.

If trenching encounters overly wet or loose bedding subgrade, bedding material should consist of High Performance Bedding (HPB) or HL-8 stone, wrapped in non-woven geotextile fabric equivalent to Terrafix 200R and placed in accordance with manufacturer's specifications. Based on local knowledge and previous experience in the area, it is expected that artesian (pressurized) groundwater conditions exist in a confined aquifer located at depth below this area. It is also known that the aquitard (ie, confining) soil layer within which excavations for this construction will occur, can be "leaky", in that it can allow upwards leakage of the pressurized groundwater into excavations via hydraulically-conductive seams/lenses of sand. If such conditions are encountered within the trenching subgrade, it is recommended that the bedding layer consist of HPB or HL-8 stone.

Past construction experiences in the area encountered groundwater conducted through localized sand and/or gravel lensing and seams within the till material, in a lateral and down-gradient flow that became evident once excavations intersected such lensing/seams. It is noted that previous excavations encountering such inflows of groundwater have dealt with it through excavation pumping and re-direction of flows on a temporary basis (during construction), and installation of subdrains channelled to appropriate, frost-free outlets on a longer-term basis. As an example of such a zone, see BH-5 at 4.6 to 6.1m depth – this suggests a zone of increased grain size including gravel, that exhibits an elevated moisture content indicating saturation and possibly a zone that would conduct increased levels of groundwater inflow into an excavation that intersects it. It is noted that well points are not generally considered feasible in such highly-localized lateral groundwater flow conditions.

Based on the test pitting, isolated and localized zones of groundwater infiltration were encountered in some test pits, but the majority of them remained free of any seepage during their excavation. Test pit TP-20 exhibited seepage throughout the full depth of the test pit, and caving of its walls. In this area, and any others encountering saturated sandy soils, such soils will be considered Type 4 by OHSA, and unsupported excavations in such soils require sloping of 3H:1V to the base of the excavation.

To maximize the ability to control groundwater flow into the trenching as it progresses, consideration should be given to beginning the trenching in the most down-gradient areas of the project.

It is recommended that a test dig be performed during construction tendering, to allow interested contractors the opportunity to view for themselves the subsurface conditions at representative locations of the project. This will increase the ability for them to assess their own capabilities regarding such conditions. It is strongly recommended that the contractor retain an appropriate groundwater / dewatering professional to make their own assessments regarding groundwater conditions, its potential impacts on construction, and strategies to appropriately control such groundwater.

We trust that this letter report meets with your immediate requirements. Should you have any questions, please contact our office.

Yours Truly,
Geo-Logic

Garnet Brenchley, P.Eng.