



Stantec Consulting Ltd.
100-300 Hagey Boulevard, Waterloo ON N2L 0A4

August 16, 2024
File: 161414394

Attention: Don Mason
1734234 Ontario Limited
1858 Avenue Road
Toronto, ON M5M 3Z5

Dear Don,

Reference: Terms of Reference
Hydrogeological Investigation in Support of Land Development Approvals
Smithville Block Plan Area 3A, Township of West Lincoln, Ontario

Terms of Reference

Stantec Consulting Ltd. (Stantec) is pleased to provide 1734234 Ontario Limited (Client) with the proposed work plan to complete a hydrogeological assessment of the Block Plan Area 3A lands located in Smithville, Ontario (Site) (Figure 1). As shown on Figure 1, the portion of the Site delineated by the red line is owned by the Client, with the lands located immediately to the east (delineated by the green line) and northwest (delineated by the blue line) of the Site being currently owned by others. The present objective will be to perform a detailed (field based) hydrogeological investigation of the Client owned lands together with a desktop-level evaluation of the east and northwest lands to support development approvals for the entire Block Plan Area. Hydrogeological field investigations of the east and northwest lands will be completed by others in the future.

The work program outlined below will be completed to assess baseline groundwater conditions throughout the Site and evaluate how the form and/or function of the hydrogeological system could be impacted by future development. The evaluation will also provide recommended mitigation measures to be employed throughout the Site to maintain pre-development groundwater functions under post-development conditions. Specifically, Stantec has designed the work plan to address requirements as outlined in the *Conservation Authority Guidelines to Support Development Applications – Hydrogeological Assessment Submissions* (June 2013) and to address hydrogeological related expectations as provided in the Township of West Lincoln (2023) *Draft Comprehensive Block Plan and MESP Terms of Reference*.

Stantec understands that the Site will be developed into low density residential areas accompanied with stormwater management facilities. The development is to be serviced by municipal water and storm and sanitary sewer infrastructure.

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Stantec will perform the following tasks:

- Desktop-level review of existing geological and hydrogeological conditions throughout the Site (i.e., Client owned lands together with non-owned lands to the east and northwest) using information provided in publicly available subwatershed and/or hydrogeological studies completed near the Site as well as pertinent environmental documents published by the Niagara Peninsula Conservation Authority (NPCA), Township of West Lincoln, Niagara Region, Ministry of Environment, Conservation and Parks (MECP) (specifically the Water Well Information System), Ontario Geological Survey (OGS), and the Niagara Peninsula Source Protection Committee (NPSPC). The information obtained from these sources will be used to develop a conceptual model of the hydrogeological system, which will include the identification of hydrostratigraphic/aquifer units, groundwater depths and flow regimes (in the vertical and horizontal directions), groundwater recharge and discharge zones/features (including Significant Groundwater Recharge Areas) and areas of high aquifer vulnerability (i.e., Highly Vulnerable Aquifers). This conceptual model will then be used by Stantec to obtain a better understanding of hydrogeological conditions throughout the Site and identify those areas where more detailed investigation is required (e.g., installation of monitoring wells).
- Stantec coordinated the installation of monitoring wells at 12 locations throughout the Site as shown on Figure 1. Nine of the locations consist of a single monitoring well, with the three other locations consisting of a multi-level monitoring well installation (i.e., a shallow overburden and deeper bedrock monitoring well). The purpose of drilling these boreholes and equipping them with monitoring wells is to confirm subsurface soil conditions, depth to water table and seasonal high groundwater elevations, groundwater flow direction across the Site, groundwater flow / exchange between the overburden and shallow bedrock (i.e., confirmation of recharge and/or discharge conditions), and background groundwater quality. This previously mentioned information is required to i) evaluate groundwater interactions with the previously mentioned on-Site surface water features, 2) identify the potential need and level of effort for future construction dewatering, and 3) provide a preliminary assessment of what areas of the Site may be available for the use of post-development low impact development (LID) stormwater infiltration measures.
- Install a total three drive-point piezometers into the headwater drainage feature / watercourse located near the southeast corner of the Site (identified for 'Conservation' in the Smithville Master Community Plan) (DP101-23 and DP102-23, Figure 1) and the waterbody / natural heritage feature positioned along the northern property boundary (DP103-23, Figure 1) to assess the hydraulic relationship between the shallow groundwater system and these surface water features (i.e., identification of vertical hydraulic gradients beneath the watercourse substrates and evaluate recharge / discharge function of the watercourse). Stantec will also perform at least two rounds of spot flow measurements in the watercourse (ideally during the summer months) to identify / confirm the water gaining (discharge) and losing (recharge) function of this feature.

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- Survey of monitoring well and drive-point piezometer top-of-pipe elevations to a geodetic benchmark. This information is required to accurately assess direction of groundwater flow across the Site.
- Purging / development of monitoring wells and drive-point piezometers to remove construction residues and establish clean connection between well screen and surrounding aquifer material. Concurrently, perform in-situ hydraulic response testing on each of the monitoring wells to calculate the horizontal hydraulic conductivity of the subsurface deposits and estimate groundwater flow velocities and potential groundwater contributions to the on-Site surface water features.
- Collection of groundwater level measurements from the 15 on-Site monitoring wells (installed at 12 locations) and three drive-point piezometers using a combination of manual and automated techniques (i.e., water level measurements recorded continuously at 60-minute intervals using data loggers) to determine the depth to groundwater, horizontal and vertical hydraulic gradients, and to observe seasonal variability in groundwater table fluctuations. Continuous monitoring of groundwater levels will occur for two years to capture seasonal groundwater fluctuations and confirm the high water table condition (i.e., which typically occurs during the spring freshet - March to May).
- Perform in-situ permeability testing of on-Site surficial soils using a Guelph Permeameter, with these data being used to complete a preliminary assessment of the soil suitability for LID stormwater management practices. Stantec is proposing that in-situ permeability testing will occur at six locations throughout the Site.
- Stantec will sample eight of the monitoring wells for general inorganic chemistry, metals, petroleum hydrocarbons, and volatile organic compounds to determine pre-development groundwater quality conditions beneath the Site, with these data serving as a benchmark for the assessment of potential future development impacts to groundwater quality.
- Complete a monthly pre- and post-development water balance using the Thornthwaite and Mather method to evaluate potential land use change effects to the infiltration and runoff function of the Site.
- A review of the proposed land use activities for conformity with Source Water Protection requirements as stipulated in the Clean Water Act.

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- Using the previously mentioned information gathered from the desktop-level and field investigations, provide a comprehensive analysis and discussion of these data and a subsequent assessment of the potential hydrogeological constraints to development in the Site (i.e., impacts that development could have on existing groundwater flow conditions and infiltration/recharge function, groundwater-surface water interactions, and groundwater quality), as well as an evaluation of what mitigation measures are available that could be utilized to address these constraints. This information will be presented in a Hydrogeological Assessment report.

Regards,

Stantec Consulting Ltd.

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Attachment: Figure 1 – Groundwater Monitoring Network

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