



PROJECT No.: SM 302139-G

September 2, 2022

FENGATE ASSET MANAGEMENT
2275 Upper Middle Road East
Oakville, Ontario
L6H 0C3

Attention: Anthony Girolami
Development Manager, Real Estate

**HYDROGEOLOGICAL CONSIDERATIONS
PROPOSED COMMERCIAL DEVELOPMENT
3054 HOMESTEAD DRIVE
MOUNT HOPE, ONTARIO**

Dear Mr. Girolami,

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

1. INTRODUCTION

We understand that the project will consist of the construction of a new commercial development consisting of five [5] slab on grade warehouse structures, along with site servicing, and asphalt paved driveways and parking areas. The purpose of this brief is to review the subsurface soil and groundwater conditions of the site based on existing information on 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 currently of agricultural use, east of the Hamilton Airport and related facilities, and north and west of existing residential dwellings. It is understood the current proposed development will connect to local sanitary, and water services already in place.

It is noted that geotechnical investigations and environmental site assessments previously completed by others was provided to our office. As well, our office more recently conducted site investigation works on the property at 9174 Airport Road, immediately south of the subject site and understood to be planned to be incorporated into the development lands. This available information was referenced in the preparation of this hydrogeological assessment report. Specifically, these include the following reports.

- “Preliminary Geotechnical Investigation – Airport Business Park”, File No. 7-20-0114-01, dated February 3, 2021, prepared by Terraprobe Inc.
- “Supplemental Borehole Investigation – Airport Business Park”, File No. 7-19-0114-42, dated February 18, 2021, prepared by Terraprobe Inc.
- “Phase II Environmental Site Assessment – Airport Business Park”, File No. 1-20-0114-42, dated February 2, 2021, prepared by Terraprobe Inc.
- “Geotechnical Investigation and Environmental Sampling, Proposed Commercial Development, 9184 Airport Road, Mount Hope [Hamilton], Ontario” SM 302139-G, dated April 12, 2022.

Additionally, Soil-Mat Engineers have completed numerous geotechnical investigations and hydrogeological assessments, and been involved with numerous developments in the near vicinity to the project lands, including industrial/commercial buildings around the airport to the west, and residential developments to the south. 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 3054 Homestead Drive in Mount Hope, Hamilton. The property is bound to the north by existing agricultural lands, to the east and south by existing residential lands, and to the west by Hamilton Airport and related shipping and maintenance facilities. The majority of the site is mainly open field with tall grass, and scrub vegetation and some mature trees along the perimeter. The site topography is gently undulating across the site, with an overall drop in grade of approximately 4 metres from central portion of the site to north, and roughly 1 to 1.5 metres from the central portion of the site to the south.

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 our experience in the area, 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, as reported in the referenced reports, are summarised as follows.

Topsoil

Topsoil was noted to be cultivated and intermixed with the on site soils from the ongoing agricultural use on the property, resulting in the exact depths to be indistinct, though estimated in the range of approximately 200 to 400 millimetres. 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 fill was encountered beneath the topsoil at Borehole No. 9 [Terraprobe]. The fill was noted to contain traces of gravel, construction debris, sand, and topsoil, and was noted to be in a loose to compact state. The fill was proven to a depth of approximately 1.8 metres. The location of the fill deposit potentially correlates to the location of a former dwelling or structure, and so is likely isolated on the site.

Clayey Silt/Silt

Native clayey silt/silt was encountered beneath any surficial fill and/or topsoil at all borehole locations. The upper levels of the native soils were noted to be reworked and disturbed in appearance, likely a result of the historical agricultural land use, as well as being subject to freeze and thaw. The clayey silt/silt contained traces of sand and gravel, with occasional sandy seams. The fine grained soils were noted to have a higher clay content in the upper levels, and were generally brown in colour, transitioning to grey at depths between approximately 3.0 to 3.8 metres below the existing ground surface. The fine grained soils were proven to termination at the borehole locations at a depths of approximately 5.0 to 8.1 metres below ground surface.

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 investigations on the subject property did not encounter bedrock within the depths of investigation in the test pits or boreholes, which extended up to depths of approximately 9.6 metres. Available published information, and our experience in the area, indicates that bedrock is present at depths on the order of perhaps 25 to 30 metres, well below the depths of the proposed development.

GROUNDWATER CONDITIONS

Monitoring wells were installed with readings taken as part of the original geotechnical investigation and ESA work completed by TERRAPROBE, with additional readings taken by our forces on August 8, 2022, summarized as follows.

Borehole No.	Ground Surface Elevation (m)	Elevation of Well Screen (m)	Depth / Elevation of Water Level in Well (m)					
			January 8, 2021*		January 14, 2021*		August 8, 2022	
			Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
6	233.9	230.9-227.8	0.4	233.5	0.5	233.4	3.4	230.5
8	234.5	231.5-228.4	0.2	234.3	0.2	234.3	N/A**	N/A**
9	235.1	232.1-229.0	3.0	232.1	2.5	232.6	N/A**	N/A**
17	233.3	230.3-227.2	3.3	230.0	3.00	230.3	N/A**	N/A**

Notes: *Measurements were taken by Terraprobe as part of their original investigation works.

**Wells could not be located due to the height of vegetation throughout property at the time of visit.

It is noted that the shallow January groundwater readings encountered in Borehole Nos. 6 and 8 are likely influence by shallow near surface water 'trapped' above the low permeable overburden soils, noted to have greater clay content in the upper levels, and not actually indicative of the static groundwater elevation. The August 8th reading from the Borehole 6 reading supports this as well. Based on our experience in the area, and on the observations in the above noted investigation, the groundwater is expected to be present at depths of approximately 2 to 3 metres below the existing grade. Seasonal fluctuations should be anticipated. Excavations to, and 1 to 2 metres 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 6.1 to 46.0 metres, with an average of over 30 metres. The majority of well records indicated drilled wells extending into the bedrock at depths of 22.4 metres or more, with a small minority of dug wells in the overburden soils, mainly consisting of observations wells, and only one drinking water well. 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, and one possible isolated aquifer.

- One being located relatively shallow in the clayey silt / silty clay overburden at an estimated depth of approximately 2 to 5 metres below ground surface.
- One, possibly isolated aquifer located within a sand seam at depths of approximately 12 to 16 metres below the grade, with the only indication of this aquifer approximately 350 metres north of the site.
- One being much deeper in the bedrock at an estimated depth of approximately 20 to 35 metres. This is noted to be the primary aquifer for potable supply wells in the area.

4. HYDROGEOLOGICAL CONSIDERATIONS

The subsurface soil conditions, as described above, consist of clayey silt / silt deposits. The clay content is generally in the range of approximately 14 to 27 per cent, based on the information provided to our office. The clay content tends to vary, and appears to decrease with depth based on the referenced geotechnical report by Terraprobe, along with occasional more sandy seams. This is consistent with our experience in the area. These clayey soils would generally be characterised as cohesive material of low to medium plasticity, and low permeability, on the order of 10^{-7} to 10^{-8} cm/sec. The horizontal permeability may be one or two orders of magnitude higher, depending on the presence of more permeable seams in the stratified material (such as the silt seams mentioned above), however would still be considered as an overall low permeable deposit. This deposit would not represent a productive water bearing layer, or aquifer, but rather would be considered as an aquitard providing a hydraulic break from the shallow groundwater regime to the underlying bedrock aquifer from which any potable water wells in the area would draw water.



The proposed development is noted to consist of simple slab on grade commercial development. Based on the current conceptual Grading Plan provided to our office (Odan/Detech Group Inc. Project No. 21218, Drawing No. 3), the proposed final grades are generally at the existing grades, to up to approximately 1 to 4 metres above the existing grade, with the greatest raise in grade in the lowest areas of the site [Building A at the north end]. The noted exception is Building 'B' and the surrounding area, where localized areas will be lowered below the existing grade, on the order of 0.5 to 2 metres.

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 3 metres, and thus are expected to at most, minimally intercept the shallow groundwater regime, noted above to be at a depth of 2 to 3 metres. The rate of infiltration would be relatively slow and thus should be readily controlled for a short construction period, such as for the installation of service pipes, inlet/outlet structures, stormwater chambers, etc. The groundwater infiltration for the proposed servicing works, would be expected at rates well below 50,000 Litres per day, such that an EASR or PTTW would not be required. This will require appropriate planning and execution of construction by the contractor, potentially limiting the length of open excavation based on actual conditions experienced at the time of construction. However, in the long-term the groundwater level must be expected to reach equilibrium at the levels indicated above.

With respect to the completed project, based on the proposed grades, there is negligible potential for interaction with groundwater. As noted above, the slab on grade buildings are generally proposed at elevations above the current grades, with Building B noted to be lowered. In any case, the proposed grades are above the anticipated static groundwater levels. There may be potential for near surface shallow water, associated with surface water 'trapped' above the low permeable clay soils, however this would be readily accounted for in the site drainage and stormwater management plan. Such water would be associated with surface runoff and storm events, and would not be considered as 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 drilled 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 recommended 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 central portion of the site to the north and south.
- Given the relatively low vertical permeability of the native clayey silt 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 3 metres below the present ground surface. It is anticipated that such excavations will not greatly 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 construction 'dewatering' techniques such as by pumping from sumps and ditches.
- Within excavations that intercept the shallow groundwater aquifer, these trenches may potentially create a "French Drain" and either raise or lower the near surface groundwater level along the pipe/service route. Consequently, if the aquifer is exposed in the service trench, measures will have to be implemented to mitigate/eliminate groundwater interference. These would include clay 'cut-offs' within the service trench fill encasing the pipe/service. This would not necessarily be required across the entire site, but would be a factor of actual service depths, and the depth of groundwater at these locations.
- In the event underground stormwater storage tanks are to be considered in the proposed development, they should be designed to be water tight with appropriate waterproofing membranes included, and adequately ballasted.

5. GROUNDWATER IMPACT AND MITIGATION PLAN

From a review of available well records, there are numerous well records located in all directions around the subject site. From a review of these well records, the majority of any wells for drinking water purposes were noted to be at depths on the order of 22 to 46 metres below the existing grades, with only one exception of a well approximately 16 metres in depth, located approximately 350 metres to the north of the subject property. All other recorded wells were noted to be monitoring/observation wells. Given the depths of these wells, the majority of which are into the bedrock below, as well as considering the low permeability of the overburden soils, the proposed construction, noted to be of limited depths would be extremely unlikely affect any existing wells by means of any shallow excavations in the silty clay overburden.

Where unforeseen groundwater infiltration volumes are noted into service trench excavations during construction, our office should be contacted to access the extent and likely source of groundwater infiltration. Depending on the nature of the groundwater infiltration, the provision of 'clay cut offs' within the service trench backfill along the sanitary and storm sewer mains may be required at regular intervals (typically between or at each manhole), in order to prevent or mitigate interference with the shallow groundwater regime. Additionally, where unforeseen groundwater infiltration is encountered within a proposed structure, revisiting the design of foundations and permanent perimeter drainage systems may be warranted, either through raising design slab elevations, or creating a more robust drainage system.

While not expected based on the established site conditions and construction, as outlined above, in the event that complaints arise from neighbouring well owners as a possible result of construction activities, the owner shall:

- Respond to the well owner within 48 hours and arrange to conduct an onsite investigation in regards to the source of the water level interference, with the City notified of the results of the site visit. Our office should be contacted to provide comment and assistance with such assessments, where warranted.
- A technical memo should be provided to the City and affected well owner(s) within 2 weeks of the site visit with a professional opinion provided by a Professional Engineer or Professional Geologist as to whether the result of the water well interference is a result of onsite dewatering. If it is determined that onsite construction activities are responsible for impacting neighbouring wells, a temporary water supply must be provided to the affected property, at no cost to the complainant(s).
- Upon completion of site grading and servicing construction, where the site activities have been determined to have caused interference with nearby water wells, a technical memo shall be provided to the City with monitoring data and results, to ensure water supplies have been satisfactorily restored to these well owners.

6. GENERAL COMMENTS

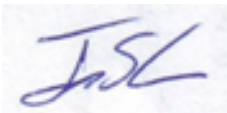
The comments provided in this document are intended only for the guidance of the design team. The material in it reflects SOIL-MAT ENGINEERS' best judgment in light of the information available to it at the time of preparation. The information presented concerning subsurface soil and groundwater conditions are descriptive of conditions at the borehole locations only, the information in which had been provided to our office. There may be conditions in the study area which are not represented by these investigations. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. SOIL-MAT ENGINEERS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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.



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