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Geotechnical Desk Study
White Church Secondary Plan
White Church Road East and Upper James Street, Hamilton, Ontario

Prepared for:

White Church Landowners Group
% SCS Consulting Group Ltd.
30 Centurian Drive, Suite 100
Markham, Ontario
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Landtek File: 23354
December 8, 2023

EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	The '*White Church Secondary Plan'* is to consist of the development of detached and semi-detached town home, townhouse, high density and residential condominium developments. Community parks, stormwater management ponds and an institutional and community centre block are also included.
Report Deliverables	The purposes of the Geotechnical Desk Study were to outline of the history of the site, review and summarize publicly geological and geotechnical information for the site, and provide a factual summary of potential geotechnical issues, with consideration towards the outline understanding of site development.

SITE DETAILS AND SETTING

UTM 17T Coordinates	589500, 4777650; and, 590890, 4778000	**Site Area (approx.)**	300 + 25 hectares

Site Description	The area comprises primarily of agricultural land used for arable purposes. Existing residential properties fringe the area, following the Municipal road corridors that form the area boundaries, with the existing Southern Pines Golf and Country Club is located in the northwestern corner. The site is bounded to the south by the Greenbelt
Site Topography	The site area is typical of a glacially influenced horizon, with an undulating topography ranging locally between 220 m and 230 m Geodetic elevation.
Site History	In 1875, the site is identified as being a total of 19 parcels of land under different land ownership. The site appears to be used, in part, as private residences and orchards, particularly along the White Church Road East and Airport Road corridors. The 1954 aerial photograph shows residential expansion has occurred along the Consultation Lands' perimeter where following Municipal road corridors, though still of a rural density. Limited rural, residential development and modification continues around the Municipal road corridors throughout the latter part of the 20th century, but the primary use remains agricultural.
Geology	Any fill present at the site will have been associated with the agricultural history of the area, historical construction of existing residential properties and limited, localized grading works. In the south, clayey and silty till soils underlie organic soils and extend to significant depths. Sands and gravels are also noted at depth. Glacio-lacustrine silts and clays underlie in the north, to depths of approximately 5.0 m to 8.0 m. Bedrock comprises of limestone and dolostone of the Guelph Formation, underlying at depths of approximately 40.0 m below ground level.
Hydrology	A number of natural watercourses and land drains cross the site area. The drainage catchment is generally towards the southwest and the Welland River and towards Twenty Mile Creek to the northeast.
Hydrogeology	Groundwater within superficial soils is anticipated either as a locally limited regime associated with discontinuous but more permeable silty and sandy layers within the glacial till deposits, or as a local regime within the deeper and more continuous sand and gravel deposits. A wider, regional regime is expected within the deeper limestone and dolostone bedrock underlying the site.

DESK-BASED ENGINEERING CONSIDERATIONS

The geology to be anticipated will present conditions favourable conditions that could support town home and townhouse development with the application of an appropriate, shallow-seated foundation solution. In the event of higher loads being required for more significant structures, and where multiple basement levels may be proposed, then alternative foundation solutions may be required. Such alternatives my include raft foundations, pile supported raft foundations or deeper-seated piles.

It is expected that at-grade or the lowest (i.e., basement) floor slab level may be constructed using slab-on-grade methods.

Considering an inclusion of one level of heated, habitable basement for residential town homes and townhouses, shallow groundwater is likely to be encountered locally rather and across the wider area in its entirety. On this basis, all subsurface areas above "*seasonally highest*" groundwater levels will require damp proofing. Any subsurface structure seated below the "*seasonally highest*" groundwater level will require waterproofing as the City of Hamilton does not allow the discharge of groundwater into the Municipal storm system.

A geotechnical investigation should be undertaken to accurately determine soil and groundwater conditions beneath the site, and to establish the appropriate founding depths for the site development and the associated bearing capacities.

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1.0 INTRODUCTION

Landtek Limited (herein "*Landtek*") is pleased to submit this Geotechnical Desk Study report for the Consultation Lands of the proposed White Church Secondary Plan, located around White Church Road East and Upper James Street in Hamilton, Ontario. The work was authorized by Mr. Matt Johnston of Urban Solutions Planning & Land Development (herein "*Urban Solutions*"), acting on behalf of the White Church Landowners Group, on November 17, 2023.

This Geotechnical Desk Study has been completed as part of an ongoing due-diligence Geotechnical Investigation being undertaken by Landtek for the Consultation Lands. The report is presented as an interim data review of currently available information in advance of the completion of the more detailed investigation and subsequent release of the associated Geotechnical Investigation report.

It is understood that the White Church Secondary Plan is to consist of the development of detached and semi-detached townhome, townhouse, high density and residential condominium developments. Community parks, stormwater management ponds and an institutional and community centre block are also included.

It is anticipated that the development plan will also include for a maximum of one level of heated, habitable basement for townhouse and detached dwelling structures, though at-grade elements may be also included. Higher density areas will likely include for one to three levels of basement parking.

Private and Municipally-adopted services and grade pavement structures are also expected, and it is anticipated that the site will be fully cleared of any existing surface and subsurface structures to enable development. It is also anticipated that the development plan will respect the current topography of the Consultation Lands such that no significant grade changes are required.

The primary objectives of this desk-based investigation were:

- To provide an outline of the history of the site and immediate surroundings;
- To review and summarize publicly geological and geotechnical information regarding the site and its locale; and
- To provide a factual review and summary of potential geotechnical issues pertaining to the site, with consideration towards the development of the site.

This report has been prepared for the White Church Landowner Group, their nominated consultants, engineers, designers and project managers to provide a desk-based review of publicly available information pertaining to the due diligence appraisal for the proposed development of the White Church Secondary Plan, located around White Church Road East and Upper James Street in Hamilton, Ontario.

Further dissemination of this report is not permitted without Landtek's prior written approval. Further details of the limitations of this report are presented in Appendix A.

2.0 SITE SETTING AND BACKGROUND

2.1 Sources of Information

- County Map of the Township of Glanford, 1875;
- Aerial Orthophotography of Southern Ontario: 1934, 1954, 1964, 1984, 1995 and 1999;
- Google Earth Pro Aerial Orthophotography (1985 to 2022) and associated IntelliSat data;
- Hamilton Topographic Map: *https://www.arcgis.com/apps/mapviewer/index.html?webmap=f7d95cb5e6cf4b2bab83432633c8ac5e*; and,
- Niagara Peninsula Conservation Authority: online Watershed Explorer.

2.2 Site Location

The Consultation Lands comprises of two areas located in Hamilton, Ontario, primarily between Airport Road in the north, White Church Road East in the south, Miles Road in the east and Upper James Street in the west. A smaller land parcel is located to the north of Airport Road. The larger parcel is centred at approximate grid reference 589500, 4777650 (UTM 17T coordinates), with the small land parcel centred at approximate grid reference 590890, 4778000.

The site location is shown in Figure 2.2.1 following.

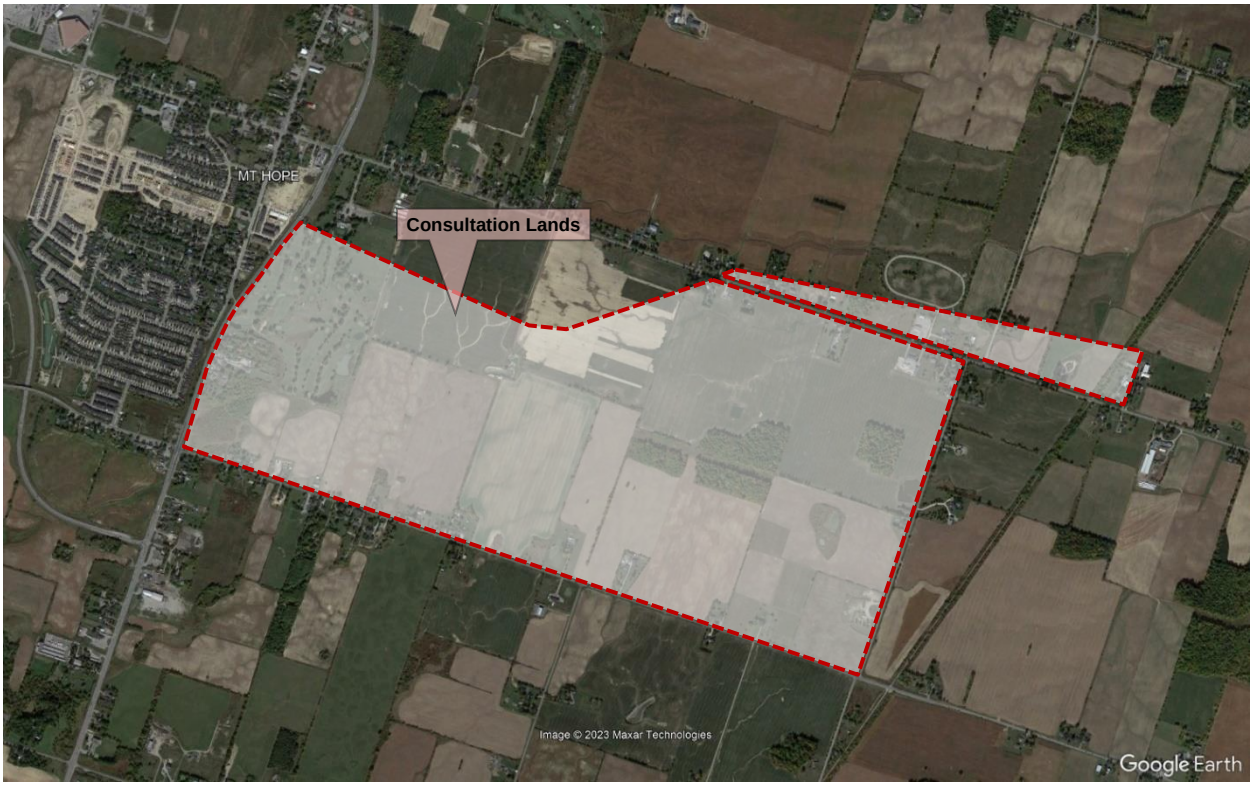

Figure 2.2.1: *Aerial image of the development site as indicated, and surrounding area.*

2.3 Site and Surrounding Area Description

The larger Consultations Lands area is approximately 300 hectares in plan area and is located to the north of White Church Road East. The area comprises primarily of agricultural land used for arable purposes. Existing residential properties fringe the area, following the Municipal road

corridors that form the area boundaries, with the existing Southern Pines Golf and Country Club is located in the northwestern corner.

The smaller area of the Consultation Lands is approximately 25 hectares in plan area and located to the north of Airport Road and too, comprises primarily of agricultural lands with residential properties fringing the southern boundary along Airport Road.

Based on the information obtained from the Greenbelt Foundation stewards Ontario's Greenbelt, the site is bounded to the south by the Greenbelt.

2.4 Site Topography

The site area is typical of a glacially influenced horizon, with an undulating topography ranging locally between 220 m and 230 m Geodetic elevation, but generally around 225 m Geodetic elevation and of shallow gradients in the order of approximately 2° to 5°.

The lower elevations of around 220 m are noted in north and east of the Consultation Lands, with the higher elevations of up to 230 m more central to the Consultation Lands area.

2.5 Site History

According to the 1875 County Atlas for the Glanford Township, the site is identified as being a total of 21 parcels of land under different land ownership. The site appears to be used, in part, as private residences and orchards, particularly along the White Church Road East and Airport Road corridors.

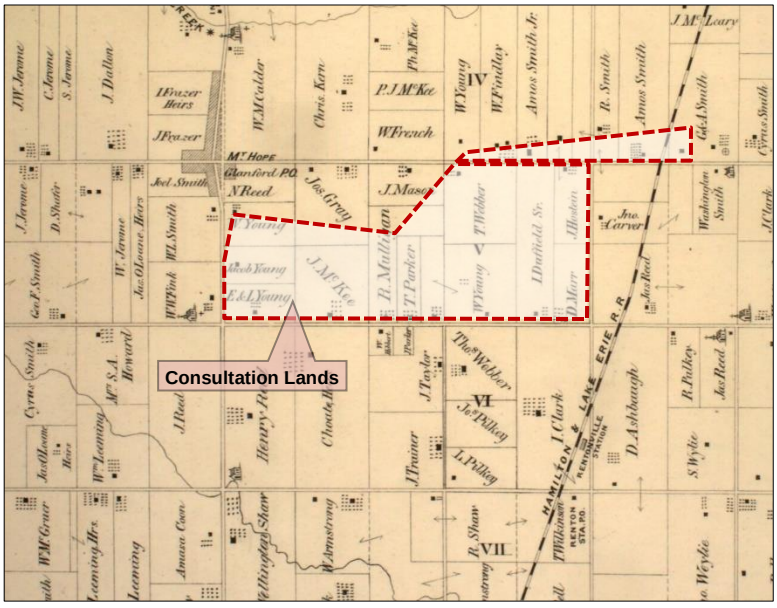

Figure 2.5.1: *Extract of the 1875 County Atlas: Glanford Township*

It is understood from historical documentation that the Consultation Lands have been generally undeveloped and used for variable agricultural purposes as far back as publicly available, historical records show. The 1875 County Atlas also shows the fringes of the Consultation Lands to be lined by residential smallholdings and orchards. Mount Hope is noted to be established as a small hamlet to the northwest of the Consultation Lands, comprising of properties bounding the Airport Road and Upper James Street intersection.

The 1954 aerial photograph shows in more detail the extents of the Consultations Lands' use for agricultural purposes. Residential expansion has occurred along the Consultation Lands' perimeter, where following Municipal road corridors, though still remains of a rural density. The golf and country club is noted to have not been developed at this point, with its current footprint being of agricultural use.

Limited rural, residential development and modification continues around the Municipal road corridors throughout the latter part of the 20th century but the primary use as agricultural land is maintained.

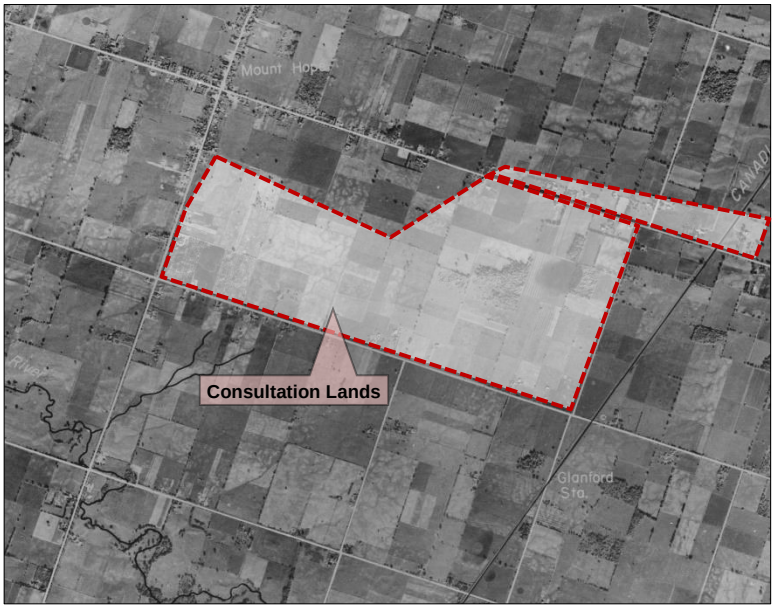

Figure 2.5.2: *Extract of the 1954 aerial photograph*

Mount Hope, located to the northwest of the Consultation Lands, also continues to expand during this period, having already becoming significantly more expansive since the 1875 County Atlas footprint.

The golf and country club is noted to have been developed initially in the late 1970's and as smaller course. A phase of course upgrading was undertaken in the early 2000's.

3.0 SITE CHARACTERIZATION

3.1 Sources of Information

The following sources have been referenced for identification of the geology, surface water bodies, groundwater and general environmental setting of the site:

- County Map of the Township of Glanford, 1875;
- Niagara Peninsula Conservation Authority: online Watershed Explorer Tool;
- Ontario Division of Mines Map P0993 "*Quaternary Geology of the Grimsby Area*", 1975;
- Ontario Division of Mines Map P0536 "*Drift Thickness, Grimsby Sheet"*, 1969;
- Ontario Geological Survey Map P2401 "*Bedrock Topography Series, Grimsby Area, Southern Ontario*", 1981;
- Ontario Division of Mines Map M2343 "*Palaeozoic Geology, Grimsby*", 1976;
- MECP Well Records online database: *https://www.ontario.ca/page/map-well-records*;
- Ontario Geological Survey Borehole Logs 853155 and 853160; and,
- MECP Water Well Records 6803966, 6803967 and 6808140.

3.2 Site Geology

3.2.1 Fill Material

There are no geological publications available that could identify the presence of fill materials across the site area. However, publicly-available reports for investigations completed within the site locale indicate fill materials to be in the order of 0.3 m to 0.6 m in thickness and consist primarily of reworked native soils associated with agricultural use (ploughed soil horizons etc.).

It is anticipated that any fill present at the site will have been associated with the agricultural history of the area, historical construction of existing residential properties and limited, localized grading works.

3.2.2 Superficial Geology

Historical records indicate the Consultation Lands to be underlain by clayey and silty till soils of the Pleistocene Halton Till in the south ("*7*" on Figure 3.2.2.1) underlying a veneer of organic soils associated with historical agricultural use. The glacial deposits are indicated to underlie the site area to significant depths below ground level (approximately 23.0 m). Sands and gravels are also noted at depths of approximately 18.0 m to 2.0 m below ground level.

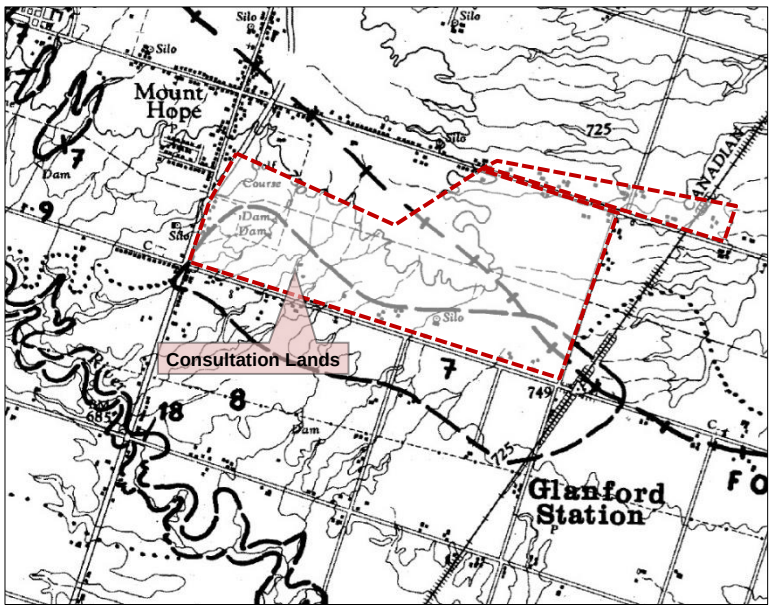

Figure 3.2.2.1: *Extract of Map P0993 "Quaternary Geology of the Grimsby Area*

The Consultation Lands are indicated to be underlain glacio-lacustrine silts and clays of the Lake Warren deposits in the north ("*9*" on Figure 3.2.2.1) underlying the organic soils. The

Lake Warren deposits are indicated to underlie the site area to depths of approximately 5.0 m to 8.0 m below ground level.

The glacial moraine crest of the Fort Erie Moraine is also noted to transect the site on a northwest-southeast orientation, corresponding to the highpoint, approximately 230 m Geodetic elevation noted to be central to the Consultation Lands area.

Historical boreholes confirm the general soil profiles reported. Clayey and silty till deposits that include variable fractions of sand and gravel are noted in the area and are reported to be of a generally very stiff to hard consistency. Dense silts are also noted, with softer clay soils encountered underlying at depths of approximately 8.0 m to 10.0 m below ground level.

3.2.3 Bedrock Geology

Bedrock underlying the site comprises primarily of light brown limestone with some locally noted dolostone of the Guelph Formation. Bedrock topography commentaries and reported drift thicknesses within the vicinity of the site indicate bedrock to be present at depths of approximately 40.0 m below ground level.

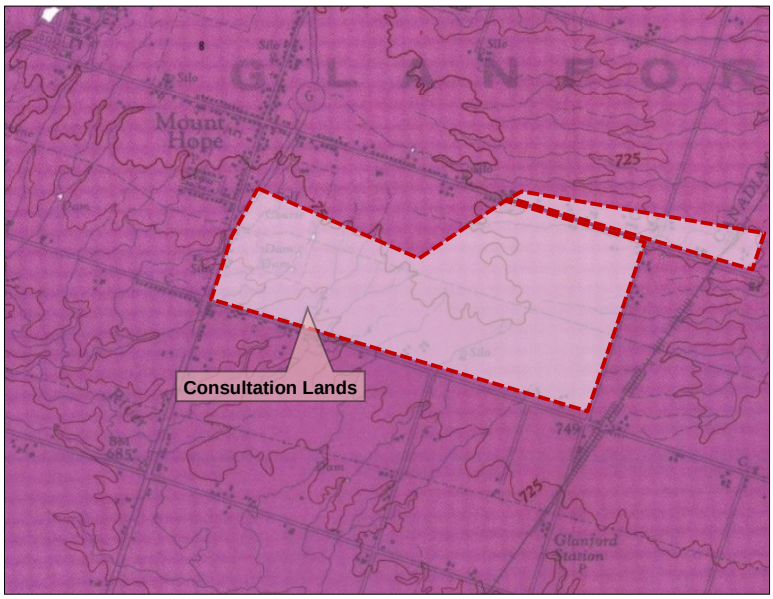

Figure 3.2.3.1: *Extract of Map P2401 "Bedrock Topography Series, Grimsby"*

Historical boreholes confirm that bedrock is encountered at depths in the order of 36.0 m to 38.0 m below ground level. The bedrock is expected to be initially weakened by fracturing associated with glacial rebound, becoming more competent relatively quickly (i.e., within approximately 0.5 m from bedrock contact).

3.2.4 Previous Investigation Information

Landtek has completed a number of investigations in and around the Mount Hope and White Church Road East/Highway 6 area.

The ground conditions encountered by these investigations generally confirm the soil profile reported by the various publications available, with locally limited fill materials and disturbed native soils being encountered to approximately 0.4 m depth. The native soils generally comprise of stiff and very stiff glacial tills, compact to very dense silts and glaciolacustrine clays proven to depths of at least 6.5 m below ground level.

3.3 Hydrology

The Niagara Peninsula Conservation Authority (herein "*NPCA*") identifies on its watershed map, a number of natural land drains crossing the entirety of the site area, particularly focusing on the south and west of the Consultation Lands area.

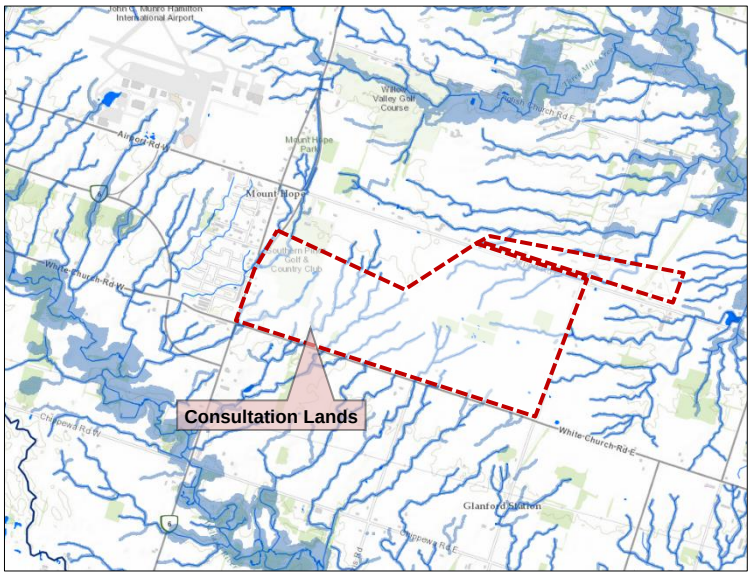

Figure 2.5.1: *Extract of the NPCA Watershed Map: Consultation Lands area*

The drainage catchment is generally towards the southwest and the Welland River, situated approximately 1.7 m to the southwest of the site at its closest point.

The drainage catchment is noted to transition towards the northeast in the northeastern corner of the site, leading towards Twenty Mile Creek situated approximately 1.0 km to the northeast of the site at its closest point. This change in drainage is noted to be associated with the elevation changes created by the Fort Erie Moraine crest that transects the site.

No evidence of ground movements associated with flood or creek flow activity was noted within the Consultation Lands boundary during the aerial photography review.

3.4 Hydrogeology

Groundwater within superficial soils is anticipated either as a locally limited regime associated with discontinuous but more permeable silty and sandy layers within the glacial till deposits, or as a local regime within the deeper and more continuous sand and gravel deposits. A wider, regional regime is expected within the deeper limestone and dolostone bedrock underlying the site.

The presence of shallow and locally limited groundwaters is confirmed by the previous Geotechnical Investigations completed by Landtek in and around the Mount Hope and White Church Road East/Highway 6 area. The investigation data reports boreholes terminating within the till soils being generally dry or yielding limited groundwater seepages at depths of approximately 3.0 m to 5.0 m depth below ground level. Groundwater, where encountered, was noted to have static resting depths in the order of 1.6 m to 3.7 m below ground level.

It should be noted that seasonal variations will influence the groundwater present beneath the Consultation Lands aera, including those perched water levels within native soils and any fill materials.

4.0 DESK-BASED ENGINEERING CONSIDERATIONS

4.1 General Foundation Considerations

4.1.1 Shallow Foundations in Soils

Based on the publicly available information for the Consultation Lands, the agreeance of that information by the findings of Geotechnical Investigations completed by Landtek in the area, it is considered by Landtek that the geology to be anticipated beneath the site will present conditions favourable conditions that could support town home and townhouse development with the application of an appropriate, shallow-seated foundation solution.

It is expected such residential structures will include for a maximum of one level of heated habitable basement, though at-grade elements may be included. As such, the foundations are likely to be seated at depths between approximately 1.2 m to 2.5 m below ground level, within native soils and on the assumption that no grade raising is proposed.

As with most residential developments in the eastern Hamilton, particularly the Stoney Creek area, the foundations are anticipated to comprise standard strip or pad foundations and the native till deposits may adequately support geotechnical reactions at the Serviceability Limit State (herein "*SLS*") and factored geotechnical resistances at the Ultimate Limit State (herein "*ULS*") for such foundations, usually in the order of 100 kPa to 150 kPa at the SLS and 150 kPa to 225 kPa at the ULS, though these values may be locally higher.

4.1.2 Alternative and Deeper Foundation Considerations

In the event of higher loads being required for more significant structures, and where multiple basement levels may be proposed, then alternative foundation solutions may be required. Such alternatives my include raft foundations, pile supported raft foundations or deeper-seated piles.

Deeper foundation solutions could comprise of end-bearing piles seated within the underlying bedrock, but ultimately the final foundation design will be subject to the loading requirements of the structure and a more detailed cost analysis at the foundation optioneering stage.

4.1.3 Site Seismic Classification

Based on the ground information available for the Consultation Lands and in accordance with Table 4.1.8.4.A. of the current OBC, the area is expected to yield a general Site Class D, though local variation may be experienced based on soil type and saturation.

Improved seismic site classifications (i.e., Class 'B' or 'A') may be achieved through the completion of a shear wave velocity test at the more detailed investigation stages using Multi-channel Analysis of Surface Waves (herein "*MASW*") methodologies, particularly as some foundations are likely to be seated at depth as a result of multi-basement levels associated with the proposed structure(s).

4.1.4 Damp Proofing and Waterproofing

Considering the inclusion of one level of heated, habitable basement for residential town homes and townhouses, shallow groundwater is likely to be encountered locally rather and across the wider area in its entirety. This is a result of the nature of the till and glacio-lacustrine deposits underlying the site and their natural, lateral and vertical variability in permeability.

On this basis and in accordance with Ontario Building Code (herein "*OBC*") requirements, all subsurface areas above "*seasonally highest*" groundwater levels will require damp proofing.

The Corporation of the City of Hamilton (herein "*City of Hamilton*") does not allow the discharge of groundwater into the Municipal storm system and therefore, positive perimeter drainage cannot be installed at a depth below the "*seasonally highest*" groundwater level. Any subsurface structure (i.e., basement walls, floor slabs, elevator pits etc.) seated below the "*seasonally highest*" groundwater level will require waterproofing per the current OBC requirements. Such waterproofing should also allow for a buffer zone (nominally 1.0 m to 1.5 m above the given groundwater level.

4.2 General Floor Slab Considerations

It is expected that at-grade or the lowest (i.e., basement) floor slab level may be constructed using slab-on-grade methods, though local remediation may be required for at-grade floor slabs where existing fill materials or locally softer, native soils may be present.

Based on the information available and previous Geotechnical Investigation data, the subgrade support conditions are expected to consist primarily of native clayey and silty soils, that should provide competent conditions for placing vapour barrier materials.

4.3 General Subsurface Concrete Considerations

Experience in the area indicates that the native soils generally have a low to mild sulphate environment and a low chloride concentration. This may be locally variable, particularly along the perimeters of the Consultation Lands where Municipal road corridors may have been exposed to winter maintenance and salting activities. In general however, it is anticipated that subsurface concrete mix designs may adopt the characteristics for general use (GU), normal Portland cement.

4.4 General Excavation Considerations

All temporary excavations and unbraced side slopes in the soils will be required to conform to standards set out in the Occupational Health and Safety Act, Ontario Regulation 213/91 "*Construction Projects*" (herein "*OHSA*"). The subsurface soils anticipated to be encountered during excavation within the Consultation Lands are expected to behave as "*Type 2*" and "*Type 3"* materials, with the very still and hard glacial till soils typically representing Type 2 soils and any existing fill materials, the firm and stiff clays and the compact silts typically being representative of Type 3 soils.

Based on the anticipated depths of excavation required for townhomes and townhouses with one level of heated, habitable basement, it is expected that foundation elements for the proposed structure will be seated within the level at which limited water seepage was encountered. As such, it is anticipated that excavations at the site will not encounter significant groundwater volumes, rather locally limited, perched or surface infiltrating groundwaters and, therefore temporary groundwater (i.e., construction) dewatering for such structure developments will not be required during the construction process.

For higher loaded structures where multiple basement levels and deeper foundations will be constructed, it is expected that groundwater will be encountered such that construction dewatering will be required.

Ultimately, groundwater seepage is expected to be variable and will depend upon the depth of the excavations, the time of year, and precipitation levels preceding construction. It is expected that any water seepages encountered during the proposed excavation work should be able to be controlled by pumping from sumps at the base of the excavation. The daily pumping rate would ultimately be dependent on the size of the excavation as well as the rate of water inflow.

5.0 CLOSURE

This report is provided to give an indication of anticipated ground conditions at the site based on the historical records available. As such, the findings are purely indicative and the geotechnical investigation currently being undertaken will more accurately determine soil and groundwater conditions beneath the site. The site-specific information will be then used to establish the appropriate founding depths and their associated bearing capacities.

The Limitations of Report, as stated in Appendix A, are an integral part of this report.

We trust this report will be of assistance with the preliminary assessment for the development area. Should you have any questions, please do not hesitate to contact our office.

Yours sincerely,

LANDTEK LIMITED

James Dann, B. Eng. (Hons.), ACSM
Manager, Geotechnical Projects

Ralph Di Cienzo
Consulting Engineer

APPENDIX A

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the Boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical, desk-based investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in referenced boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of boreholes referenced may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Additionally, any bedrock contact depths throughout the site may vary significantly from what was encountered at the exact borehole locations. Contractors bidding on the project, or undertaking construction on the site should make their own interpretation of the factual borehole information, and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report make reference to those at the time of survey, and may have changed between that point and the time of report authoring. The elevations should not be used by any other parties for any other purpose.

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. Landtek Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek Limited be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.