Functional Servicing and Stormwater Management Report

Upper's Lane Subdivision
Residential Development
City of Thorold, ON

Prepared for:

QuadReal Property Group (previously known as Parkbridge Lifestyle Communities Inc.)

Prepared by:
Stantec Consulting Ltd.
400-2100 Derry Road W., Mississauga, ON L5N 0B3

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Sign-off Sheet

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Prepared by _____
(Signature)
Shafqat Ali Khan Senior Project Manager, and Karlo Bobianc, M.Eng., Water Resource Designer

Reviewed by _____
(Signature)
Chris Overholt, P.Eng., Senior Associate – Community Development

Approved by _____ Khan, Shafqat Ali
Digitally signed by Khan, Shafqat Ali
DN: CN="Khan, Shafqat Ali", OU=Internal, OU=users, OU=stantec, DC=corp, DC=ads
Location: Mississauga
Reason: I am the author of this document
Date: 2026.04.02 11:39:39-04'00'
(Signature)
Shafqat Ali Khan, P.Eng., PMP Senior Project Manager – Community Development

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1.0 INTRODUCTION & BACKGROUND

Stantec Consulting Ltd. (Stantec) has been retained by QuadReal Property Group ("QuadReal", previously known as Parkbridge Lifestyle Communities Inc.), (the 'Owner') to prepare this Functional Servicing and Stormwater Management Report (FSSMR) in support of the Zoning By-Law Amendment and Draft Approval for the proposed development of the Upper's Lane Subdivision , (hereafter, the 'Site'). As amended, the subject site is zoned as Future Development 'FD',' Open Space Conservation 'OS2', Utility 'U', & Environmental Protection Two 'EP2' in the City of Thorold's Zoning By-Law No. 60-2019.

The Site is located in the City of Thorold, Ontario and is approximately 39.842 hectares (98.42 acres) in size. The Site is bounded by the future Upper's Lane Road allowance to the south, the Rolling Meadows Subdivision (RMS) and Upper's Grove Subdivision (UGS) to the west, Hydro One Corridor to the north and future employment-dedicated development lands to the east. A TransCanada Pipeline (TCPL) easement bisects the property in a northeast direction. At the time of this report preparation, RMS has an approved subdivision plan and is undergoing municipal servicing constructions; UGS is draft plan approval and is preparing detail engineering design for inclusion in the subdivision agreement. Refer to **Figure 1** for site location.

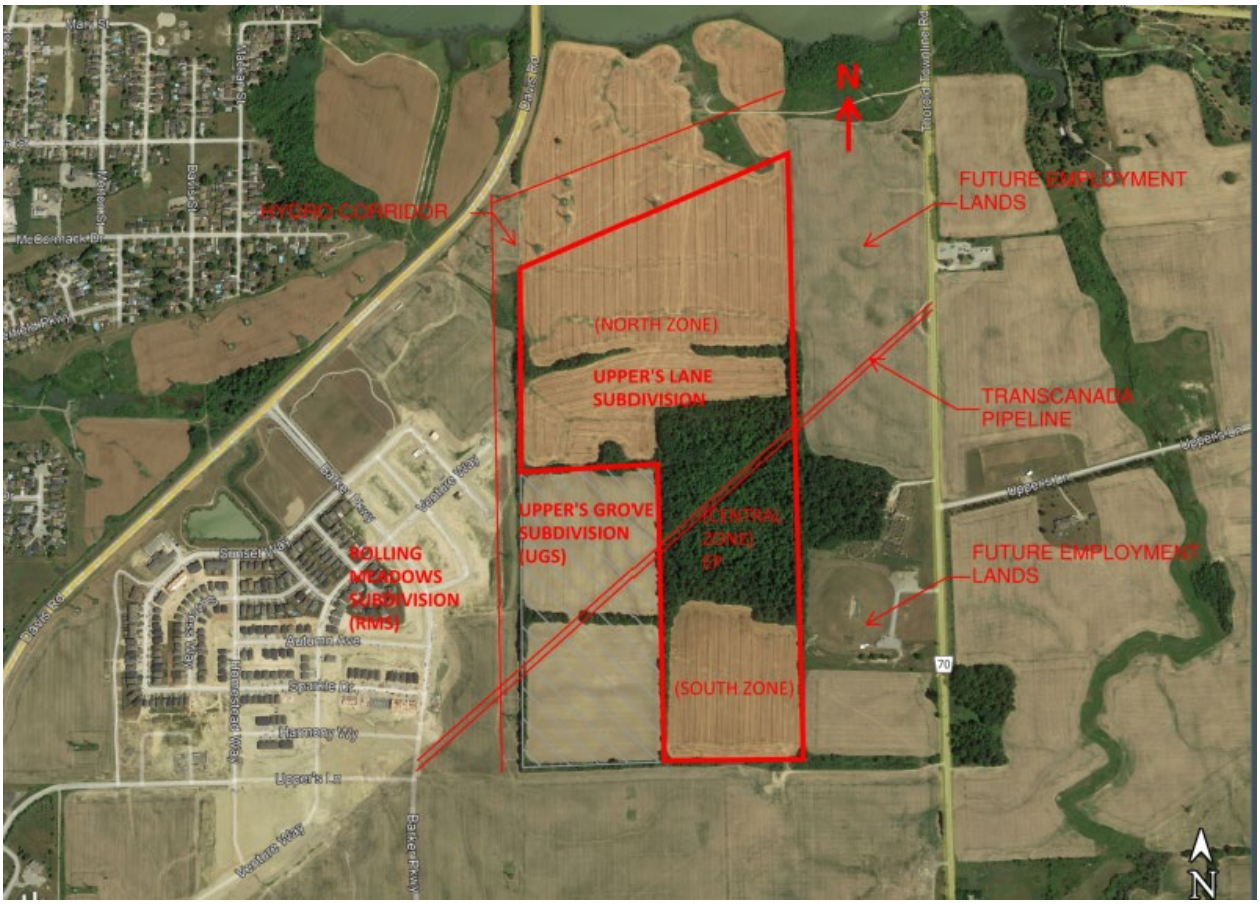


Figure 1 – Site Location Plan

The site is generally divided into three (3) zones - North, Central and South. The North zone is approximately 21.75 ha (53.75ac), Central Zone is approximately 11.25 ha (27.79 ac), and South Zone is approximately 6.75 ha (16.68 ac). The North and South Zones consist of undeveloped agricultural lands. The Central Zone is occupied by a woodlot, which is identified as an Environmental Protection (EP) area in the Town's Official Plan. Only North and South Zones have development potential. Based on Draft Plan prepared by Bousfield's Inc. the site could yield approximately 719 to 728 units, consisting of 340 townhomes, 176 Singles, 203 to 212 Mid-Rise units and a Park. The North Zone has 164 singles and 210 townhomes; the South Zone has 12 singles, 130 townhomes and from 203 to 212 mid-rise units. A conservative approach by using the higher number of units for calculating sewage and water demand has been adopted. A copy of the Draft Plan and conceptual land use plan are included in **Appendix A**.

This report examines the existing boundary servicing and grading conditions and outlines the serviceability of the development concerning storm drainage, sanitary servicing, water supply, site grading, and utilities, all in accordance with the current municipal design requirements of the City of Thorold (City), Niagara Region (Region) and Niagara Peninsula Conservation Authority (NPCA).

The following background documents were reviewed in the preparation of this report:

- Preliminary Stormwater Management Plan – Rolling Hills prepared by Upper Canada Consultants, March 2007
- Functional Servicing Report – Upper's Grove Block Plan Residential Development prepared by Counterpoint Engineering, December 2020
- Neighborhoods of Rolling Meadows Secondary Plan Sub-Watershed Study and Functional Engineering Report prepared by Westlake Inc., June 2006 [SWS]
- City of Thorold's Engineering Procedure and Materials List.
- City of St. Catharine's Engineering Standards Manual, September 2018
- Water Supply for Public Fire Protection - Fire Underwriters Survey, dated 1999.
- Stormwater Management Planning and Design Manual - Ministry of the Environment (MOE), dated March 2003 [SWMPDM]
- Rolling Meadows Secondary Plan - City of Thorold, dated April 2015.
- Low Impact Development Stormwater Management Planning and Design Guide - Toronto and Region Conservation Authority / Credit Valley Conservation, dated 2010 [LID Guide].
- Niagara Peninsula Conservation Authority Stormwater Management Guidelines, dated January 10, 2010.
- Ontario Building Code - Government of Ontario, dated 2013.
- Niagara Region Water-Wastewater Project Design Manual, August 2019
- Erosion & Sediment Control Guideline for Urban Construction - Greater Golden Horseshoe Conservation Authorities, dated 2019 [ESC Guidelines].
- Niagara Region 2021 Water and Wastewater Master Servicing Plan Update, dated December 2023.
- Geotechnical Assessment Report – Thorold Townline Road prepared by McIntosh Perry Consulting Engineers Ltd., dated January 25, 2022.
- Preliminary Stormwater Management Plan Rolling Meadows Phase 17 City of Thorold prepared by Upper Canada Consultants, 2022 [SWM-2022]
- Demonstration Site Plan, prepared by Bousfield, dated March 2026.

- Various Background and record Drawings for the adjacent roads and existing development provided by the City.

2.0 PROPOSED DEVELOPMENT

The proposed Site Plan and updated Draft Plan for the development are shown in **Appendix A**, and include the following:

- 176 single detached residential units
- 340 townhouse residential units
- 203 to 212 Mid-Rise residential Units
- 11.256 ha of Environmental Protected Area
- 28.58 ha of Developable Area

3.0 GRADING AND STORMWATER DRAINAGE

3.1 EXISTING TOPOGRAPHY

A topographic survey has been completed for the subject lands. It indicates that the Site and the surrounding area are generally flat and naturally slope downward toward the northwest. Refer to the Topographic sketch in **Appendix E**.

3.2 PROPOSED GRADING AND DRAINAGE

The Site will be graded such that drainage generally follows the existing flow pattern and ultimately outlet to the stormwater management pond located in the northwest corner of the Site, east of the Hydro One easement. The conceptual grading design, as shown in Figure GR-1, is provided to illustrate how the lands may be graded in compliance with the City's criteria. The proposed Site grading is constrained by the grade of existing/future boundary roads, adjacent development, Hydro One easement, and Environmental Protection area. The North Zone will generally be graded to drain towards the northwest, directing overland flow to drain towards the northwest corner of the Site and ultimately outlet to the Stormwater Management Pond located on the northwest corner of the Site . The South Zone is graded towards the northwest, directing overland flow towards Steet E, which connects to the Upper's Grove Subdivision and ultimately outlets to the same pond.

Landscape areas will have slope from 2% to 5% with a maximum slope of 3:1 if required. Roads will have slopes from 0.3% to 8% and driveways will have a maximum slope of 8%. The road grades are also dictated by several factors, including the depth of cover required over top of the sanitary and storm sewers, cut/fill balance calculations for the Site grading, as well as providing major storm overland flow routes through the development to the stormwater outlets.

Road grades at connections to the future Uppers Lane extension are designed to ensure that off-site drainage is generally maintained external to the property, and to maintain internal Site drainage within the property.

Final road, lot, and block grading for the Site will be determined at the detailed design stage as the development approval process is pursued.

External drainage between the Site and Thorold Townline Road will be collected and routed through the Site via a storm pipe conveyance system and flow through the proposed pond. Please refer to the Stormwater Management Report prepared by Stantec, included with this submission for details on how the external drainage area is accommodated.

4.0 ROAD NETWORK

4.1 EXISTING ROAD NETWORK

The Site is currently not abutting any urbanized roadway; a network of local and collector roads is proposed and being constructed to service the Site.

4.1.1 Road Access

Road access to the North Zone will be provided through the extension of Venture Way, an East-West collector road which connects RMS and Thorold Townline Road and the second access will be provided through Street A within Upper's Grove Subdivision, a North-South collector which will connect Uppers Lanes and Venture Way. Road access to the South Zone will be provided through extension of Uppers Lane, an East-West collector road which connects RMS and Thorold Townline Road. Secondary access is provided through local roads proposed within UGS which connects the North and South zones.

4.1.2 Proposed Road Profiles

Preliminary road profiles were established for the Site based on the proposed concept plan for the development. Proposed road grades are designed to meet the City's Municipal Design and Quality Standards. The proposed road grades are designed to match future road and adjacent lot grades at the periphery of the Site. The internal portion of the proposed development is largely determined by maintaining adequate cover over the sanitary and storm services while providing for lot grading that is reasonable from the point of view of home/building construction.

The proposed road profile design will utilize vertical curves to provide for appropriate transitions in road grades in excess of 1.5% for local roads and 1.0% for minor/major collector roads.

Grade changes in various locations throughout the Site are required to provide positive drainage for local services and to address topographic and environmental constraints. The proposed centerline road elevations are illustrated on **Figure GR-1 – Conceptual Grading Plan**.

4.1.3 Right of Way Cross Sections

Typical civil roadway cross sections for the development are provided on **Figures TYP-1 Typical Road Sections**, and summarized below:

- 16.0 m RESIDENTIAL LOCAL ROAD [Optional 1.5 sidewalk on one side]. Streets D to N
- 18.0 m RESIDENTIAL LOCAL ROAD [1.5 sidewalk on one/both sides]. Street C
- 20.0 m RESIDENTIAL MINOR COLLECTOR ROAD [1.5 sidewalk on one/both side]. Streets A and B

5.0 WASTEWATER SERVICING

5.1 EXISTING WASTEWATER SERVICING

There are existing (external) municipal sanitary sewers installed as part of RMS to the west as follows:

- The existing 300mm dia. gravity sanitary sewer draining east to west along Cristallina Drive, which is currently stubbed at 200 m south and 45 m west of the North Zone property limit.
- The existing 375mm dia. gravity sanitary sewer draining east to west along Uppers Lane, which is currently stubbed at approximately 510m west of the South Zone property limit.

The existing RMS development collects drainage along Barker Parkway which conveys flows north and ultimately west to the existing Peel Street pump station which is part of the Port Weller WWTP's catchment area.

According to the Niagara Region's 2021 Master Servicing Plan, the downstream Peel Street Pumping station (SPS) has an operational capacity of 210 L/s and Environmental Compliance Approval (ECA) (approved) firm capacity of 280 L/s. Approximately 183.55 L/s of the total flows to the SPS is from the Rolling Meadows Secondary Plan Area, which includes the Site

5.2 PROPOSED WASTEWATER SERVICING

The proposed development will utilize two sanitary service connection points. The North Zone will be serviced via the existing sanitary sewer in Cristallina Drive. The existing sanitary sewer in

Cristallina Drive will need to be extended to the east along Cristallina Drive within RMS and north along future Street A within Upper's Grove Subdivision. The North Zone has a total drainage area of 21.75 ha, which is included in the 27.52 ha drainage area (ID A84a) shown on the overall Rolling Meadows sanitary drainage plan.

The South Zone will be serviced via a future (external) sanitary sewer along Uppers Lane extension. The City owns the right-of-way for the future Uppers Lane extension. The South Zone has a total drainage area of 6.75 ha and is included in the 13.32 ha drainage area (ID EX7) shown on the overall Rolling Meadows sanitary drainage plan.

Refer to Figure SAN-1 Sanitary Drainage Plan for existing and proposed sanitary sewer layout and drainage area.

A sanitary sewer analysis was completed by Upper Canada consultants for the entire RMS and modified by Stantec for Upper's Lane Subdivision Draft Plan application. This report updates the data to reflect the most current development concept. This design information was provided by the Municipality and accounts for the full build-out of the RMS area, including all future areas associated with the subdivision. The design sheet was prepared by Upper Canada Consultants as part of the Uppers Lane design submission, and it is our understanding that it represents the approved design for the Rolling Meadows Secondary Plan Development.

The approved sanitary design sheet has been included in Appendix B for reference.

5.2.1 Estimated Sewage Flows

The updated density and flows for the Site have been highlighted on the revised sanitary design sheet, included in Appendix B. The following design criteria is excerpted from the Rolling Meadows approved design sheet provided by the City of Thorold:

- Residential Average Day Demand: 340 litres/capita/day
- Commercial/Employment Average Day Demand: 10000 litres/ha/day
- Institutional Average Day Demand: 20000 litres/ha/day
- Commercial and Institutional Peak Factor: 1.5
- Harmon's Peaking Factor: Min 2, Max 4
- Extraneous Flow Rate: 0.18 L/s/ha
- Population: 3 cap/unit for external areas
- Population: 2.6 cap/unit for Rolling Meadows Area

The following design criteria is excerpted from the Niagara Region – 2021 Water and Wastewater Master Servicing Plan Update and Niagara Region Design Criteria:

- Residential Average Day Demand: 255 litres/capita/day
- Harmon's Peaking Factor: Min 2, Max 4
- Extraneous Flow Rate: 0.286 L/s/ha
- Single Family and Semi Detached: 2.8 Persons/Unit
- Street Townhouses, Block Townhouses, and Stacked Townhouses: 2.2 Persons/Unit
- Apartments: 1.7 Persons/Unit
- Mixed Dwelling 2.5 Persons/Unit
- Commercial and Office Uses: 2.17 Persons per 100 m2

The Site is included in two larger drainage areas, ID EX7 and EX9, in the design sheet prepared by Upper Canada Consultants for the Rolling Meadows Secondary Plan (RMS) Area. Based on the original sanitary sewer design sheet prepared by Upper Canada Consultants for the (RMS) area (See Plan 0695-OSAN and design sheet 0695-OSCALC), the downstream trunk sewer segment (from A35 to Allenburg Road) conveying flows from RMS area was shown to operate at approximately 94.44% of its full-flow capacity. The total flow is 184.73 L/sec.

Subsequent revisions to the population densities for the Upper's Grove Subdivision and Upper's Lane Subdivision lands (Areas EX7 and EX9), when directly applied to to the RMS Sanitary Sewer design sheet (refer to the Rolling Meadows Sanitary Sewer Design Sheet prepared by Stantec). These revisions increased the calculated peak design flow such that the same downstream sewer segment (from MH A35 to Allenburg Road) would operate at approximately 97.8% of capacity, corresponding to a total flow of 191.21 L/s.

For comparison, the original RMS design sheet—without modifications to the QuadReal population densities—identified a downstream design flow of 184.73 L/s, representing 94.44% of the available capacity.

Based on this refined assessment, the downstream sanitary sewer is anticipated to operate within its available capacity under the revised design flows and adequate residual capacity is available to support the proposed development.

For detailed calculations, original design sheet prepared by Upper Canada Consultants and modified design sheet by Stantec please refer to the Appendix B.

5.2.2 Local Sanitary Servicing

Based on the local site topography and the proposed grading design, the Site can be serviced by a gravity sanitary sewer system. An internal sanitary sewer system will be designed in accordance with City's and Region's standards to accommodate and convey on-site and off-site flows. Sanitary pipes on Venture Way and Uppers Lane will have to be kept as low as possible to accommodate future development to the east; stubs will be provided at east property limit for future connection.

Refer to **Figure SAN-1 – Sanitary Drainage Plan** for the functional layout of the proposed sanitary design.

6.0 WATER SERVICING

6.1 EXISTING WATER SERVICING

According to the Region's Master Servicing Plan, the Site is situated in Zone 227 of Decew Water System. Based on the review of available existing infrastructure plans, the following is a general overview of the existing on-site water supply and distribution system:

- The 300 mm dia. watermain along Venture Way, which is currently stubbed at approximately 85m west of the North Zone property limit.
- The existing 200 mm dia. watermain along Uppers Lane, which is currently stubbed at approximately 510m west of the South zone property limit.

There is a proposed (external) municipal watermain in UGS to the south that would provide connection to the North Zone. It is designed as a 300mm dia. watermain along Street A, which would be stubbed at the south property limit of North Zone.

These potential watermain connection locations are shown on **Figure WM-1 Water Servicing Plan**.

6.2 PROPOSED WATER SERVICING

The internal watermain network will connect to the municipal water infrastructure on Venture Way and Street A of the UGS for the North Zone. The South Zone will be serviced by future extension of watermain on Uppers Lane. The pressure and water modeling results have not been made available from the City of Thorold to our team. The sizes of the internal watermain will be confirmed at the detailed design stage.. Nominal watermain sizes are currently shown on **Figure WM-1 Water Servicing Plan** and will be finalized in subsequent design submissions as the approval process proceeds. Fire protection and metering requirements will be designed for municipal roads and private development blocks in accordance with City and Region standards. Stubs connection to future developments to the east on Street A will be provided.

6.2.1 Estimated Water Demands

Background

The Niagara Region 2021 Water Master Servicing Plan Update (Volume 3) confirms that the DeCew Water Treatment Plant (WTP) and associated high-lift pumping facilities have sufficient treatment and pumping capacity to support projected growth to the 2051 planning horizon and beyond. The projected 2051 maximum day demand remains well below the Region's planning thresholds for expansion, and no DeCew WTP upgrades are required within the planning horizon.

While the City of Thorold does not have sufficient local storage capacity when reviewed in isolation, the Master Plan identifies that adequate conveyance capacity exists to offset local storage deficiencies through operational transfers from surplus storage at the DeCew WTP reservoir and the Niagara Falls water system. This interconnection strategy allows existing and forecast demands within Thorold to be supported without immediate localized storage expansion. System-wide storage deficits are projected to emerge at the 2051 and post-2051 horizons, which will be addressed through future regional servicing strategies.

Population and employment projections used in the Master Plan are based on the Niagara Region Official Plan (2022) and Traffic Analysis Zone (TAZ) data to 2051. The Plan does not identify site-specific population assumptions for individual developments, including the Site or the broader Rolling Meadow area. As such, actual available water servicing capacities (supply, storage, pumping, distribution, and fire flow) for the proposed development must be confirmed through detailed review and consultation with Niagara Region at the development application stage.

The City of Thorold follows the City of St. Catharines design criteria, which references Ministry of the Environment, Conservation and Parks (MECP) design guidelines. The 1998 MECP design guidelines state that governing flows shall be the greater of: a) maximum day demand plus fire flow, or b) maximum hour demand. Niagara Region standards state that design flows shall be governed by a minimum of 275 kPa under peak hour demands or a minimum of 140 kPa under simultaneous peak hour and fire flow demands. The Niagara Region guidelines shall be used as it is the more conservative approach.

Domestic Demand

Average daily demand design flows of 300 L/cap/day and peaking factors of 2 and 3.75 were used to calculate the residential maximum day and maximum hour demand. A population density of 2.8 persons/unit was used for both single family dwellings and semi-detached, 2.2 persons/units for townhouse units and 1.7 persons/unit for the midrise buildings. These values were used to remain consistent with the Region 2021 Master Servicing Plan. The calculated daily demands for the proposed development are as follows:

Residential:

- Average Day Demand = 334 L/min = 480,360 L/day
- Maximum Day Demand = 667 L/min = 960,720 L/day
- Peak Hour Demand = 1,251 L/min = 1,801,350 L/day

Refer to Appendix C for supporting water demand calculations.

Fire Demand

The City of Thorold City Wide Water Service Master Plan suggested fire flows are 50 L/s for Single Family -Dead End, 75 L/s for Residential Thorold South and 150 L/s for Residential Multi (Apartment). It should be noted that the MECP suggest that the Fire Underwriter's Survey (FUS) guidelines be considered for determining fire flow. As part of the FSR, a simplified fire flow calculation may be used for residential dwellings, not exceeding two stories in height. Using the simplified method, single family homes will require a fire flow of 6000 L/min and contiguous 2 story townhouse building will require a minimum fire flow of 8000 L/min.

As per Niagara Region design standards, the proposed development should provide adequate flow at a minimum pressure of 140 kpa/20 psi to satisfy fire flow plus peak hour demand conditions. This flow equates to 1,251 L/min + 10,000 L/min = 11,251 L/min. Therefore, the proposed watermain system design shall provide a flow of 11,251 L/min at the minimum pressure threshold of 20 psi. Based on the original watermain servicing scheme outlined for the secondary plan area and the adjacent development approved to date, it is assumed that the spine servicing has capacity to provide adequate water supply to this development.

The watermain within the City of Thorold–owned road allowance along Uppers Lane will need to be constructed to support the proposed development. In addition, coordination with the City of Thorold and the adjacent landowner will be required to extend the necessary connections from the adjoining lands to the proposed development.

Refer to **Appendix C** for design calculations and supporting documentation.

7.0 STORM SERVICING AND STORMWATER MANAGEMENT

A stormwater management (SWM) report entitled Stormwater Management Report for the Upper's Grove and Uppers Lane Residential Developments, Stantec Consulting Ltd., March 2026 has been prepared that details the SWM strategy for both the UGS and the Site lands, hereafter referred to as the SWM Report. For further details please refer to the SWM report. The following sections provide a summary of the stormwater strategy and design.

This section describes the applicable design criteria, SWM opportunities and constraints, and the proposed SWM plan. The SWM plan is considered in general accordance with the current municipal design requirements of the City of Thorold, Niagara Region, and Niagara Peninsula Conservation Authority (NPCA).

Per the background documents, a SWM pond within the Rolling Meadows development area described as 'Pond D' was previously intended to provide the ultimate water quantity control, water quality control, and erosion control for both the Site and UGS lands in addition to other areas of the Rolling Meadows development. However, Pond D is no longer being constructed for this purpose, and therefore the Site and UGS lands will be serviced by a SWM pond located in the northwest corner of the Site and an underground storm tank in the park block. For consistency, the design criteria applied to the ultimate 'Pond D' condition (as described by the SWM-2022 report) is applied to the proposed pond design. The SWM Pond has been sized in anticipation of the future buildout of both the UGS and the Site.

7.1 DESIGN CRITERIA

The Site drainage conveyance system is based on the dual drainage approach. A minor system as a storm sewer and major system as a surface/overland flow path. The design criteria applied to each system is as described in the 2015 City of St Catharines Engineering Standards Manual (ESM).

Key design criteria applied are:

- The minor drainage system is designed to accommodate the 5-year design storm.
  - The rational method is used to size the storm sewer.
  - Runoff coefficients are applied as per the 2015 City of St Catharines ESM.
  - Pipe size, material, depth, slope, velocity is as per the 2015 City of St Catharines ESM.
  - Pipe location, manhole spacing, and installation is as per the 2015 City of St Catharines ESM.
- The major drainage system is designed to accommodate the 100-year design storm.
- The Subwatershed Study indicates no requirement for water balance measures to be applied to the Site.

7.1.1 Existing Drainage Paths

It is identified that the drainage paths that traverse the Site are not critical watercourses and that the surface flow paths do not have to be maintained within the Site development plan. The external areas east of the Site, which are currently routed via the existing drainage paths, are proposed to be conveyed through the Site storm system.

7.2 SWM OPPORTUNITES AND CONSTRAINTS

SWM practices for the management of development runoff fall into the categories of water quality, erosion control and water quantity. Various SWM measures to address the above mentioned SWM practices are explored as part of this SWM Report, including source,

conveyance, and end of pipe controls. Source and conveyance controls are commonly referenced as Low Impact Development ('LID') measures. LID measures are considered a more integrated approach to SWM that looks to maintain the existing hydrology of the site after development by promoting filtration, infiltration, evaporation as well as detaining runoff. It is most effective during the small, frequent rain events that typically make up 90% of the total rainfall events experienced throughout the calendar year. During these events, LID measures absorb a portion of the runoff and treats the 'first flush' of runoff. While LID measures do not remove the need for end of pipe controls like detention ponds or oversized pipes, there can be benefits in water quality treatment and volume reduction (through infiltration).

The following table provides information on various relevant LID measures, considered for implementation as part of the Site improvements.

Table 7.1 – Potential LID Measures

LID Measure	Description	Design Considerations
Bioretention Facility	Bioretention uses the natural properties of soils, plants and associated microbial activity to infiltrate water and remove pollutants from stormwater runoff. They do this through filtration by soil media and uptake by plant roots and reduce runoff volume through evapotranspiration. The practice provides aesthetic benefits and can easily be modified to fit a wide variety of space and drainage contexts. Bioretention can be designed with full (no underdrain), partial (underdrain)or no infiltration (high groundwater).	• Can be integrated with site landscaping. • Footprint is typically 10-20% of the contributing drainage area. • Typical ratio ranges of impervious area to swale area of 5:1 to 10:1. • Location must be relatively flat. • Pre-treatment should be provided to remove sediment and debris. • High groundwater level can limit the use of this measure.
Grass Swales	Grass swales are vegetated open channels designed to convey, treat, and attenuate stormwater runoff.	• Grass swales are effective at removing pollutants assuming the velocities, from the peak flow during a 25 mm 4-hour Chicago storm, are less than 0.5 m/s at a maximum depth of 0.10 m.
Enhanced Grass Swales	Enhanced grass swales are vegetated open channels designed to convey, treat, and attenuate stormwater runoff. Check dams are incorporated into the design to help slow and filter water to enhance sediment removal, soil infiltration and evapotranspiration by plants and grass.	• Footprint is typically 5-15% of the contributing drainage area. • Typical ratio ranges of impervious area to swale area of 5:1 to 10:1.
Bioswales	Bioswales are like enhanced grass swales (vegetated open channels designed to convey, treat, and attenuate stormwater runoff); however, they incorporate an engineered bioretention soil media.	• Typical ratio ranges of impervious area to swale area of 5:1 to 10:1. • Pre-treatment should be provided to remove sediment and debris.

LID Measure	Description	Design Considerations
Infiltration Rock Trenches	Depending upon the native soil, an underdrain can be incorporated into the design. Infiltration trenches are excavations lined with geotextile fabric and filled with clean granular stone.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Often used when surface areas not available.
Underground Chambers	Underground chambers are typically open bottom storage units that convey stormwater runoff and can provide both retention storage (infiltration) and detention storage. These systems consist of open bottom chambers surrounded by clean aggregate and wrapped with geotextile fabric.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Often used when surface areas not available. • Able to detain more stormwater runoff than a trench. • Provide both infiltration and detention storage capability.
Perforated Pipe Systems	Perforated pipe systems are long infiltration trenches, that are designed for both conveyance and infiltration of stormwater runoff. They are underground stormwater conveyance systems designed to attenuate runoff volume and thereby, reduce contaminant loads to receiving waters.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Design and construction costs may be significant.
Soil Support Systems	Soil Support Systems are modular support systems that provide a sturdy and permeable ground level decking that transfers surface loads to a compacted subbase 0.4 – 1.1 m below grade without compacting the near-surface soil layers.	• The near-surface layers remain uncompacted and void ratios remain high making the near surface layers useful for stormwater detention and infiltration. • Provide suitable soil conditions for large tree growth.
Catch Basin Controls	Catch basin controls are devices to prevent floatable debris and sediments from entering the storm sewer and consist of covers, geotextile fabrics, or inserts	• Can be used in any catch basin. • Are maintained in the same manner and frequency as normal catch basins.
Amended Topsoil	Increased depth of topsoil (200 – 300 mm or more). Amended topsoil is a mixture of higher permeability materials like sand and gravel, with lower percentage of clays and a suitable amount of compost to support plant health.	• Suitable for use within a roadway boulevard. • Appropriate depths and soil mixtures can be incorporated into landscaped areas and other LID measures as applicable.

LID Measure	Description	Design Considerations
	Benefits include increased retention storage, increased infiltration and evapotranspiration, and stabilization against erosion.	

End-of-Pipe controls are implemented at the end of the major/minor collection system. These types of facilities typically include:

- Wet Pond: Designed to provide quality treatment through settling of suspended solids into the forebay (typically 1.0 to 1.5 m deep) and permanent pool of the main pond area (typically 1.5 m to 3.0 m deep). The active storage component offers extended detention and quantity control.
- Engineered Wetland: Designed to provide quality treatment through settling of suspended solids into the forebay (typically 1 m deep) and shallow permanent pool (typically 0.15 m to 0.3 m deep). The active storage component offers extended detention and quantity control.
- Dry Pond: Provide some quality treatment through detention time, and primarily provide extended detention and quantity control within the active storage component. Dry ponds, with proper pre-treatment, can also be designed as surface infiltration facilities or soakaways to help to achieve water balance/erosion control targets.
- Manufactured Treatment Device (Oil-Grit Separator or Filter): Prefabricated infrastructure units designed to settle suspended solids. Typical units designed for suspended solids are generally less effective at nutrient removal. However, some types of units are specifically designed for nutrient removal. These devices are generally acceptable for use as a pre-treatment system or as a component in a treatment train approach to address water quality.
- Oversized Pipe: Pre-manufactured pipe are oversized and equipped with orifices in the system to create pipe storage. Oversized pipes are generally used for small or isolated project areas which lack sufficient surface space to construct detention facilities. Pipe slopes are kept to a minimum to increase the amount of storage available within the pipe. Oversized pipes provide only marginal water quality benefits as some of the coarse sediment may settle.

7.2.1 Selected SWM Measures

On review of the various LID/SWM measures and end-of-pipe controls, the following LID/SWM measures are considered appropriate for the Site.

- Wet Pond
- Underground Chambers

The SWM pond and underground chambers are proposed to support both the Site and UGS developments.

7.3 EXISTING STORM SYSTEM

The Site is currently vacant and under agricultural use, with no existing permanent stormwater infrastructure within the Site boundary.

For the South Zone of the Site, the adjacent UGS development, is anticipated to proceed in advance of the Site development, therefore the UGS lands adjacent to the South Zone of the site will provide the Site with the required storm sewer connection as well as provide the major system overland flow route. Major and minor flows from the UGS are conveyed through the storm sewers and the road network in the North Zone of the Site and are ultimately managed by the proposed stormwater management facility.

7.4 PROPOSED DRAINAGE AREAS

The existing drainage area covering the Site is generally represented by the figures taken from the SWS and SWM-2022 reports which are included in Appendix D.1 of the SWM Report. As described in the SWM-2022 report, changes to the existing drainage areas varied from 2006 to 2022 based on drainage ditch construction activity within the Rolling Meadows area.

Proposed connections to existing roads are designed to ensure that off-site drainage is generally maintained external to the property, and to maintain internal Site drainage within the property. Refer to **Figure GR-1- Preliminary Grading Plan in Appendix E**.

The resultant drainage areas are illustrated on **Drawing C-203** of the SWM Report. The existing drainage pattern through the wood lot being retained is intercepted by the storm system along the associated downstream boundary with UGS and the Site. This maintains the existing drainage pattern for the wood lot and no negative impact on the wood lot is anticipated.

External drainage between the Site and Thorold Townline Road will be collected and routed through Site via a storm pipe conveyance system and flow through the proposed pond. Please refer to the Stormwater Management Report prepared by Stantec, included with this submission for details on how the external drainage area is accommodated..

The drainage areas considered are generally consistent with the conditions anticipated with the SWS and SWM-2022 reports.

7.5 PROPOSED STORM SYSTEM

As per the City of Thorold standards, storm sewers within the Site are sized to capture and convey runoff for storm events up to and including the 5-year design storm (minor storm). The storm sewers will then direct runoff to the proposed SWM Pond facility, which will be constructed as part of the UGS and is located in the northwest corner of the Site. The facility will ultimately service both developments. Refer to **Figure STM-1 – Preliminary Storm Servicing Plan** for details included in Appendix E.

Runoff in excess of the 5-year storm event (i.e., the 100-year major storm) will be conveyed via overland flow routes within the road right-of-way and other designated overland flow paths. Refer to **Figure GR-1- Preliminary Grading Plan** included in Appendix E.

In post-development conditions, the external areas east of the Site, which are currently routed via the existing drainage paths, are proposed to be conveyed through the Site via proposed stormwater conveyance infrastructure.

7.6 STORMWATER MANAGEMENT FACILITIES

The Site and UGS lands will be serviced by a SWM pond located in the northwest corner of the Site and an underground storm tank in the park block. Details of the SWM strategy and design are provided in the SWM report prepared by Stantec and included with this submission.

8.0 EXTERNAL SERVICING WORKS

As noted throughout this report, the subject site will rely on future servicing infrastructure to be completed by adjacent landowners and/or front-ended and constructed through adjoining future development lands. Accordingly, the phasing and construction of the Site, as well as the servicing works within the road rights-of-way of future development areas, will require coordination with adjacent landowners during the detailed design stage. This coordination will address servicing design, construction timing, and cost-sharing arrangements. Key servicing elements requiring coordination with future development proposals are summarized as follows:

- Venture Way extension within RMS to the North Zone for watermain and road connection.
- Stormwater Management Pond for the UGS
- Cristallina Drive extension to UGS and Street A extension within UGS for sanitary connection.
- Extension of Uppers Lane will be required to service the South Zone for sanitary and watermain.

9.0 UTILITIES

9.1 EXISTING UTILITIES

Based on available existing servicing data, the adjacent Rolling Meadows Subdivision phases are serviced by electrical, natural gas, and telecom services.

9.2 PROPOSED UTILITIES SERVICING

Adjacent Rolling Meadows Subdivision includes existing facilities for many utilities such as Gas, Hydro, phone and cable. The proposed Site will receive servicing from extension of existing utilities by respective utility companies. Utility companies will determine specific requirements through the standard application, review and design process.

10.0 EROSION AND SEDIMENT CONTROL

Prior to the initiation of any construction within the Site, a comprehensive Erosion and Sediment Control program acceptable to the City of Thorold, the Niagara Region, and the NPCA will be implemented. Appropriate drawings will be prepared at the detailed design stage and submitted to the agencies for review and approval.

An ESC plan will include all necessary siltation control facilities and will be designed in accordance with current City and NPCA guidelines. The following principles are excerpted from the guideline:

- Adopt a multi-barrier approach to provide erosion and sediment control through erosion controls first,
- Retain existing vegetation and stabilize exposed soils with vegetation where possible, erosion prevention is key in reducing sediment to downstream aquatic habitat,
- Limit the duration of soil exposure and phase construction when possible,
- Limit the size of disturbed areas by minimizing nonessential clearing and grading,
- Minimize slope length and gradient of disturbed areas,
- Maintain overland sheet flow and avoid concentrated flows,
- Store/stockpile soil away (e.g. greater than 15 meters) from watercourses, drainage features and top of steep slopes,
- Ensure contractors and all involved in ESC practices are trained in ESC Plan implementation, inspections, maintenance and repairs,
- Adjust ESC Plan at construction site to adapt to site features, and
- Assess all ESC practices before and after all rainfall and significant snowmelt events.

Below is a list of included erosion and sediment control measures that will be outlined during the construction of the Site:

- Temporary sediment control fences shall be installed prior to commencing grading or topsoil stripping activities.
- Temporary mud tracking and dust control measures at construction entrance.
- Install temporary swales with rock check dams as required.
- Surface runoff controlled through temporary swales throughout the Site along with rock check dams.

- Temporary sediment traps to reduce the release of sediment from the Site.
- Stabilize all disturbed area as soon as possible to minimize erosion.
- Stabilization of slopes greater than 5:1 using suitable method e.g., erosion control mats, tackifier and seeds, etc. as soon as possible.

All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

11.0 CONCLUSION AND RECOMMENDATIONS

Based on the findings of this report, the following conclusions are provided:

GENERAL:

- The Site is located in the City of Thorold, within the Rolling Meadows Secondary Plan. The current development Concept Plan is included in **Appendix A**.
- The Site's developable area is dissected into North zone and South zone by an Environmental Protected area.
- Detailed design of the development will follow in subsequent design submissions as the approval process proceeds.
- Several proposed service and extension of existing service projects need to be completed before the Site can be developed.

SITE GRADING:

- The topography of the site and surrounding area is generally flat and naturally slopes down towards northwest.
- A preliminary Site Grading Plan has been prepared to meet typical development standards, provide flood protection, maintain existing drainage patterns and protect local ecosystems during construction.

ROAD NETWORKS:

- The Site can be accessed via extension of existing roadway such as Venture Way and Uppers Lane. Secondary access will be provided through local roads proposed within UGS.
- Each development block and housing unit will have at least one access from the internal road network.
- All internal roads can accommodate public and private utilities.
- Streets within the proposed development will be constructed according to the City's design standards, where applicable.

WASTEWATER SERVICING:

- The internal sanitary sewer system is designed such that all sewage flows from proposed and external development will be directed towards the Peel Street SPS via a gravity based sanitary trunk sewer.
- The proposed sanitary pipe within UGS and connection to existing sanitary pipe on Cristallina need to be completed to service the North Zone.

- The existing sanitary sewer in Uppers Lane needs to be extended by approximately 510m to the east to service the South zone.

- The external sanitary sewers have been designed to accommodate the design flows from the Site. To date, no capacity concerns have been raised for the proposed development. However, the capacity of the downstream infrastructures should be assessed as the Rolling Meadow's master plan area approaches full build out.

WATER SERVICING:

- The Site can be serviced with domestic and fire water supply and distribution using conventional municipal engineering practices and compliance with City and Region Standards. This can be achieved by extension of and connection to the City's existing water distribution system.

- Individual PRVs may be required for any lots where service pressures exceed 550 kPa as required by the Ontario Building Code. This will be evaluated during future design submissions.

- It is critical that the City's and neighbor landowner's watermain extension project be completed in order to provide adequate domestic and fire demand to the development.

- Nominal watermain sizing has been provided at this phase and will be updated once the water model analysis is completed for the development.

STORM SERVICING AND STORMWATER MANAGEMENT:

- The Site can be adequately serviced with storm drainage using conventional municipal engineering practices and general compliance to Municipal Standards.

- Storm drainage areas of the Site will match proposed grading plans and can be serviced by a gravity storm sewer system.

- The SWS indicates no requirement for water balance measures to be applied to the Site.

- The SWM pond within the Site provides the ultimate water quantity control, water quality control, and erosion control for the Site.

Appendix A DRAFT PLAN/CONCEPT PLAN

North Section		Area = 21.780ha	
Unit type		**Within Blocks**	**Freehold**
6.1m (20ft) Street Townhouse	TS	122	0
7.6m (25ft) Street Townhouse	TL	35	3
8.2m (26.9ft) Bungalow TH	TB	35	15
10.7m (35ft) Single	C	50	6
11.6m (38ft) Single	B	66	3
12.8m (42ft) Single	A	38	1
Total		**346**	**28**

South Section		Area = 6.806ha	
Unit type		**Within Blocks**	**Freehold**
6.1m (20ft) Street Townhouse	TS	33	45
7.6m (25ft) Street Townhouse	TL	32	14
8.2m (26.9ft) Bungalow TH	TB	6	0
10.7m (35ft) Single	C	5	6
11.6m (38ft) Single	B	0	1
12.8m (42ft) Single	A	0	0
Total		**76**	**66**

Both Sections Total	422	94
Total Low-Rise Residential Units	**516 units**	

	MIN	MAX
Total Low-Rise Residential Units	516	516
Mid-Rise Residential Units	203	212
TOTAL UNITS	**719**	**728**

BLOCK 35
RESIDENTIAL
DEVELOPMENT
4.153 ha
76 UNITS
52 SINGLES
24 TOWNHOUSES

BLOCK 36
RESIDENTIAL
DEVELOPMENT
3.482 ha
94 UNITS
13 SINGLES
81 TOWNHOUSES

BLOCK 37
RESIDENTIAL
DEVELOPMENT
2.197 ha
62 UNITS
12 SINGLES
50 TOWNHOUSES

BLOCK 42
SWM POND
2.352 ha

BLOCK 43
PARK
1.400 ha

BLOCK 34
RESIDENTIAL
DEVELOPMENT
3.128 ha
55 UNITS
55 SINGLES
0 TOWNHOUSES

BLOCK 38
RESIDENTIAL
DEVELOPMENT
2.629 ha
59 UNITS
22 SINGLES
37 TOWNHOUSES

BLOCK 44
NATURAL HERITAGE AREA
4.602 ha

BLOCK 46
PIPELINE
0.622 ha

BLOCK 45
NATURAL HERITAGE AREA
6.032 ha

BLOCK 39
RESIDENTIAL
DEVELOPMENT
1.080 ha
24 UNITS
0 SINGLES
24 TOWNHOUSES

BLOCK 40
RESIDENTIAL
DEVELOPMENT
1.817 ha
52 UNITS
5 SINGLES
47 TOWNHOUSES

BLOCK 41
MID-RISE BLOCK
1.375 ha
203-212 UNITS*

BLOCK 47
TEMPORARY
TURNAROUND
0.083 ha

STREET A
STREET B
STREET C
PRIVATE STREET D
PRIVATE STREET E
PRIVATE STREET F
PRIVATE STREET G
PRIVATE STREET H
PRIVATE STREET I
PRIVATE STREET J
PRIVATE STREET L
PRIVATE STREET N
PRIVATE STREET O
EMERGENCY ACCESS EASEMENT
6m DRAINAGE EASEMENT
0.3m RESERVE BY OTHERS
Future Road
HYDRO ONE
PIPELINE
CRISTALLINA DRIVE
VENTURE WAY
HARMONY WAY
BARKER PKY
UPPERS LANE



KEYPLAN Subject Property

DEMONSTRATION PLAN

0 10 25 50 100 m

UPPER'S LANE

LEGEND

Subject Property

NOTES

All dimensions are in metres.
All area measurements are computer generated.
All elevations refer to Geodetic Datum.

BOUSFIELDs INC.
3 Church Street, Suite 200
Toronto, Ontario M5E 1M2
P (416) 947-9744
F (416) 947-0781

1 : 2000	March 11, 2026	22219 - 101cp
Scale	Date	Drawing Number

AREA TABLE	22219 - 90dp	February 5, 2026
Residential Singles	Lots 1-17	0.807 ha±
Townhouses	Blocks 18-33	2.047
Residential Development	Blocks 34-40	18.434
Mid-Rise Block	Block 41	1.375
SWM Pond	Block 42	2.352
Park	Block 43	1.400
Natural Heritage Area	Blocks 44-45	10.634
Pipeline	Block 46	0.622
Temporary Turnaround	Block 47	0.083
Roads		2.088
Total		**39.842 ha±**

ROADS		
20.0m R.O.W.	2,796 m	1.341
18.0m R.O.W.	404 m	0.747
Total		**2.088 ha**

UNIT COUNT		MIN	MAX
12.8 m Singles (42')	A	1	1
11.6 m Singles (38')	B	4	4
10.7 m Singles (35')	C	12	12
8.2m Bungalow Townhouse (27')		15	15
7.6m On St. Townhouse (25')		17	17
6.1m On St. Townhouse (20')		45	45
Residential Development		422	422
Mid-Rise Residential*		203	212
Total *		**719**	**728 u**

* Final Unit Count to be determind through Site Plan application

INTEGRATION TABLE

OBSERVED REFERENCE POINTS (ORP) DERIVED FROM GNSS OBSERVATIONS USING A REAL-TIME CORRECTION SERVICE AND REFERRED TO UTM ZONE 17, NAD83 (CSRS)(2010).

COORDINATES TO URBAN ACCURACY PER S.14(2) O.REG. 216/10

ORP	NORTHING	EASTING
A	4772397.23	647716.00
B	4772425.55	648239.57

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

BLOCK 35
RESIDENTIAL DEVELOPMENT
4.153 ha
75 UNITS
(plus 1 on Hold)

BLOCK 36
RESIDENTIAL DEVELOPMENT
3.482 ha
94 UNITS

BLOCK 37
RESIDENTIAL DEVELOPMENT
2.197 ha
62 UNITS

BLOCK 42
SWM POND
2.352 ha

BLOCK 43
PARK
1.400 ha

BLOCK 34
RESIDENTIAL DEVELOPMENT
3.128 ha
55 UNITS

BLOCK 38
RESIDENTIAL DEVELOPMENT
2.629 ha
59 UNITS

BLOCK 44
NATURAL HERITAGE AREA
4.602 ha

BLOCK 45
NATURAL HERITAGE AREA
6.032 ha

BLOCK 46
PIPELINE
0.622 ha

BLOCK 47
TEMPORARY TURNAROUND
0.083 ha

BLOCK 39
RESIDENTIAL DEVELOPMENT
1.030 ha
24 UNITS

BLOCK 40
RESIDENTIAL DEVELOPMENT
1.817 ha
52 UNITS

BLOCK 41
MID-RISE BLOCK
1.375 ha
203-212 UNITS*

Future Road

STREET A
STREET B
STREET C
CRISTALLINA DRIVE
VENTURE WAY
HARMONY WAY
BARKER PKY
UPPERS LANE
HONEYCRISP WAY

HYDRO ONE
PIPELINE

0.3m RESERVE BY OTHERS

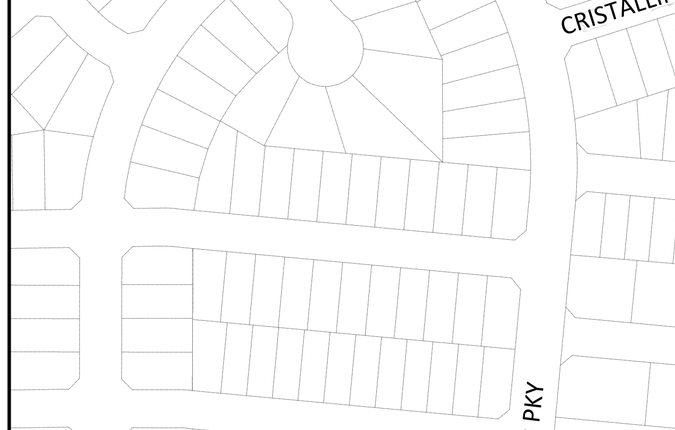
AGRICULTURE
EXISTING RESIDENTIAL

LOT 67
LOT 44
LOT 43
LOT 90
LOT 89

ROAD ALLOWANCE BETWEEN THOROLD TOWNSHIP LOTS 67 AND 68 – NOT TRAVELLED
ROAD ALLOWANCE BETWEEN THOROLD TOWNSHIP LOTS 44 AND 67 – NOT TRAVELLED
ROAD ALLOWANCE BETWEEN THOROLD TOWNSHIP LOTS 43 AND 66 – NOT TRAVELLED
ROAD ALLOWANCE BETWEEN LOTS 67 AND 90 – NOT TRAVELLED
ROAD ALLOWANCE BETWEEN LOTS 66 AND 89 – NOT TRAVELLED

PART 1 PIN 6457 – 0086 (LT)
PART 4 PIN 64057 – 0077 (LT)
PART 5 PIN 64057 – 0036 (LT)
PIN 6457 – 0045 (LT)
PIN 6457 – 0046 (LT)
PIN 64057–0020(LT)

WALKER INDUSTRIES HOLDINGS LIMITED
WALKER COMMUNITY DEVELOPMENT CORPORATION
1635405 ONTARIO INC.
DMZ Paintball and Airsoft - Field Location 2711 Townline Rd
GORDON, GLEN DOUGLAS



KEYPLAN Subject Property

LEGEND

Subject Property

NOTES

All dimensions are in metres.
All area measurements are computer generated.
All elevations refer to Geodetic Datum.

0 10 25 50 100 m

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

A, B, E, F, G, J, L - As Shown on Plan

C. This represents the Applicant's entire holding of undeveloped land in the vicinity.
D. Residential Singles, Bungalow Townhouses, On-Street Townhouses, Residential Development Blocks, Mid-Rise Residential, Park, Natural Heritage Area, Pipeline Block, Service Block, Future Road Block and Roads.
H. Piped water to be provided.
I. Clay loam soil.
K. Sanitary & storm sewers to be provided.

SURVEYOR'S CERTIFICATE

I certify that: the boundaries of the lands to be subdivided and their relationship to the adjacent lands are correctly shown.

"Please see the Original Submission" 31 01 2024
Day Month Year

Grant Bennett , O.L.S.
Stantec Geomatics Ltd.
Ontario Land Surveyors

OWNER'S AUTHORIZATION

I/we, 1000352619 Ontario Inc.
being the registered owner(s) of the subject lands hereby authorize BOUSFIELDs INC. to prepare and submit a draft plan of subdivision for approval.

Phil Busby, QuadReal Property Group LP
Director, Development
Day Month Year

DRAFT PLAN OF PROPOSED SUBDIVISION
PART OF LOT 67 AND PART OF ROAD ALLOWANCE BETWEEN 67 AND 68
(GEOGRAPHIC TOWNSHIP OF THOROLD)

CITY OF THOROLD
REGIONAL MUNICIPALITY OF NIAGARA

BOUSFIELDs INC.
3 Church Street, Suite 200
Toronto, Ontario M5E 1M2
P (416) 947-9744
F (416) 947-0781

1 : 2000	February 5, 2026	22219 - 90dp
Scale	Date	Drawing Number

Appendix B DESIGN – WASTEWATER

Project No:	160623094	**Prepared By:**	SAK
Project Name:	Upper's Lane Subdivision Residential Development	**Revised By:**	
Municipality:	City of Thorold	**Last Revised:**	March 2026
Date:	March 2026		

WASTEWATER CALCULATION - Combined sewage from Uppers Lane and Upper's Grove Developments

Site Area= 43.770 ha

Residential Unit Breakdown

No. of Single and Semis Residential Units UGS	113		
No. of Single and Semis Residential Units ULS	176		
Total Units =	289		
Population Density	2.8		
Total Population =	810		
No. of Townhouse Residential Units UGS	340		
No. of Townhouse Residential Units ULS	215		
Total Units =	555		
Population Density	2.2		
Total Population =	1221		
No. of Mid-Rise Residential Units	212		
Population Density	1.7		
Total Population =	361		
Net Population =	2392		
Avg Daily Demand (Dry Weather) =	255	litre/cap/day	*** (based on Niagara Region Master Plan Volume 4 – Section 2.4)
Residential Avg Daily Demand (Dry Weather)=	609960	litre/day	
	7.06	litre/sec	
Residential Peaking factor =	3.52		*** (based on Niagara Region Master Plan Volume 4 – Section 2.4)
Peaked Residential Flow (Dry Weather) =	24.88	litre/sec	

Wet Weather Allowance

Total Peak Flow (Dry Weather) =	24.88	litre/sec	
Infiltration Rate =	0.286	litre/sec/ha	***(based on Niagara Region Master Plan Volume 4 – Section 2.4)
total Infiltration Allowance =	12.518	litre/sec	

Total Design Flow

Total Wastewater Flow=	37.40	litre/sec

LEGEND

- **A0 / 0.00 / 00** — DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / POPULATION
- DRAINAGE AREA BOUNDARY
- EXISTING SANITARY SEWER WITH FLOW DIRECTION
- FUTURE SANITARY SEWER WITH FLOW DIRECTION

*** SEE PLAN 0695-OSCALC FOR SANITARY SEWER DESIGN SHEET**

N

TO PEEL STREET PUMPING STATION

EX 525ø SAN

HIGHWAY 58

BARKER PARKWAY

SUNSET WAY

CINNAMON STREET

BOUNTY AVENUE

VENTURE WAY

MIRACLE WAY

GOLDRICH AVENUE

VINEGOLD CT.

CRISTALLINA DRIVE

SUCCESS WAY

AUTUMN AVENUE

SPARKLE DRIVE

HOMESTEAD WAY

ELVIRA WAY

HARMONY WAY

TRANS CANADA PIPELINE

UPPER'S LANE

DELICIOUS COURT

SPRING CREST WAY

VELVET WAY

HERITAGE WAY

SELECTION HEIGHTS

BRIGHTON LANE

NIAGARA DRIVE

VANILLA TRAIL

BUTTERCREAM AVENUE

SUGAR MAY AVENUE

CONCORD DRIVE

EVER SWEET WAY

SUN HAVEN WAY

DISCOVERY DRIVE

PEACH STREET

EXPLORER WAY

FRONTIER DRIVE

OVATION DRIVE

VICTORY DRIVE

CHARM PLACE

HYDRO ONE LANDS

THOROLD TOWNLINE ROAD

ENVIRONMENTAL PROTECTION LANDS

A0	0.00	00	
A1	11.78	510	
A2	0.12	3	
A3	3.72	255	
A4	0.66	39	
A5	1.26	117	
A6	0.71	47	
A7	7.30	533	
A8	0.22	10	
A9	1.41	147	
A10	2.58	169	
A11	0.33	13	
A12	2.16	185	
A13	0.19	0	
A14	0.12	0	
A15	7.04	471	
A16	0.06	0	
A17	0.21	0	
A18	2.75	1069	
A19	1.43	515	
A20	0.21	0	
A21	14.42	699	
A22	0.80	63	
A23	0.15	0	
A24	1.36	57	
A25	2.05	130	
A26	0.18	3	
A27	0.26	8	
A28	0.91	36	
A29	0.46	16	
A30	0.57	18	
A31	0.57	16	
A32	0.35	10	
A33a	17.74	779	
A33b	0.84	INST.	
A34	5.77	304	
A35	5.06	187	
EX1	6.50	445	
EX2	6.67	481	
EX3a	13.58	803	
EX3b	2.96	INST.	
EX4a	19.04	733	
EX4b	3.11	120	
EX5a	8.14	601	
EX5b	4.83	INST.	
EX6	24.19	COMM.	
EX7	13.32	429	
EX8	19.79	COMM.	
EX9	28.60	1331	

#	REVISION	DATE	INIT
2	ISSUED FOR REVIEW	2024-09-11	B.K.
1	ISSUED FOR REVIEW	2024-08-23	B.K.
0	ISSUED FOR REVIEW	2023-02-16	B.K.

NOTES/LEGEND

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING B.K. | DESIGN B.K. | CHECKED BY M.H. | APPROVED BY .

LICENSED PROFESSIONAL ENGINEER — B. J. KAPTEYN — 100509155 — Sept 11/24 — PROVINCE OF ONTARIO

City of Thorold — Where Ships Climb The Mountain

UPPER CANADA CONSULTANTS — ENGINEERS / PLANNERS
30 Hannover Drive Unit 3
St. Catharines, Ontario
L2W 1A3
Phone: (905)688-9400
Fax: (905)688-5274

ROLLING MEADOWS
CITY OF THOROLD
OVERALL SANITARY DRAINAGE AREA PLAN

CONSULTANT FILE No.	0695
DATE	2024-09-11
PRINTED	2024-09-11
SCALE	1:3000 m
REF No.	.
DWG No.	0695-OSAN
REV	2

UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
ST.CATHARINES, ONTARIO, L2W 1A3

DESIGN FLOWS

RESIDENTIAL	340 L/Capita/Day (AVERAGE DAILY FLOW)		
INFILTRATION RATE	0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 l/S/ha)	COMMERCIAL / EMPLOYMENT	10000 L/ha/Day (Average Daily Flow)
POPULATION PER UNIT	3.0 *(Density for external drainage areas in accordance with approved 2008 Rolling Meadows Sanitary Drainage Area Plan)*	INSTITUTIONAL	20000 L/ha/Day (Average Daily Flow)
	2.6 *(Density for Rolling Meadows derived from Table 4-1 in the Niagara Region Official Plan)*	COMMERCIAL & INSTITUTIONAL PEAK FACTOR	1.5

(*) Note: For External Areas EX4a, EX4b, EX6, EX7, EX8 & EX9, population, drainage area, and average flow rates were assigned in accordance with the approved 2008 Rolling Meadows Sanitary Drainage Area Plan.

MUNICIPALITY: CITY OF THOROLD
PROJECT: ROLLING MEADOWS
PROJECT NO.: 0695

DRAINAGE AREA ID	DESCRIPTION	MANHOLES FROM M.H.	MANHOLES TO M.H.	AREA (hectares) RESIDENTIAL INCR	RESIDENTIAL ACCUM	COMM. INCR	COMM. ACCUM	INST. INCR	INST. ACCUM	POPULATION p.p.ha.	RES.POP. DENS. INCR	RES. POP. SERVED	ACCUMULATED PEAK FLOW PEAK. FACT.	RESID. FLOW (L/s)	C + I FLOW (L/s)	INFILT. FLOW (L/s)	TOTAL PEAK FLOW (mm)	DIA. PIPE (%)	SLOPE (m/s)	DESIGN FLOW VEL. (L/s)	CAP. CAPACITY	PERCENT FULL FLOW
A1	PHASE 12		A201	11.78	11.78					43.3	510	510	3.97	7.97	0.00	2.12	10.09					
A2	BARKER PARKWAY	A201	A210	0.12	11.90					21.7	3	513	3.97	8.01	0.00	2.14	10.15	250	0.25	0.61	31.03	32.7%
A3	PHASE 13		A210	3.72	3.72					68.5	255	255	4.11	4.12	0.00	0.67	4.79					
A4	BARKER PARKWAY	A210	A215	0.66	16.28					59.1	39	806	3.86	12.24	0.00	2.93	15.17	250	0.25	0.61	31.03	48.9%
EX1	PHASE 21			6.50	6.50					68.5	445	445	4.00	7.00	0.00	1.17	8.17					
EX2	PHASE 20			6.67	6.67					72.1	481	481	3.98	7.54	0.00	1.20	8.74					
A5	PHASE 13		A215	1.26	14.43					92.9	117	1043	3.79	15.55	0.00	2.60	18.15					
A6	BARKER PARKWAY	A215	A224	0.71	31.42					65.9	47	1896	3.60	26.89	0.00	5.66	32.55	375	0.12	0.56	63.39	51.3%
A7	PHASE 13		A224	7.30	7.30					73.0	533	533	3.96	8.31	0.00	1.31	9.62					
A8	BARKER PARKWAY	A224	A310	0.22	38.94					47.3	10	2440	3.52	33.77	0.00	7.01	40.77	375	0.12	0.56	63.39	64.3%
A9	BARKER PARKWAY	A310	A309	1.41	40.35					104.5	147	2587	3.50	35.59	0.00	7.26	42.86	450	0.12	0.63	103.07	41.6%
A10	PHASE 14		A309	2.58	2.58					65.5	169	169	4.17	2.78	0.00	0.46	3.24					
A11	BARKER PARKWAY	A309	A316	0.33	43.26					39.4	13	2769	3.47	37.83	0.00	7.79	45.62	450	0.12	0.63	103.07	44.3%
EX4a	EXTERNAL LANDS			19.04	19.04					38.5	733	733	3.88	11.20	0.00	3.43	14.63					
EX4b	EXTERNAL LANDS			3.11	22.15					38.5	120	853	3.84	12.90	0.00	3.99	16.89					
EX3a	PHASE 18, 19, 23			13.58	35.73					59.1	803	1656	3.65	23.77	0.00	6.43	30.20					
EX3b	PHASE 19 - SCHOOL							2.96	2.96						1.03	0.53	1.56					
A12	PHASE 14		A316	2.16	37.89				2.96	85.5	185	1840	3.61	26.17	1.03	7.35	34.55					
A13	BARKER PARKWAY	A316	A330	0.19	81.34				2.96			4609	3.28	59.45	1.03	15.17	75.65	450	0.12	0.63	103.07	73.4%
A14	BARKER PARKWAY	A330	FF-14	0.12	81.46				2.96			4609	3.28	59.45	1.03	15.20	75.67	450	0.12	0.63	103.07	73.4%
A15	PHASE 14		FF-14	7.04	7.04					66.8	471	471	3.99	7.38	0.00	1.27	8.65					
A16	BARKER PARKWAY	FF-14	A333	0.06	88.56				2.96			5080	3.24	64.74	1.03	16.47	82.24	450	0.12	0.63	103.07	79.8%
A17	BARKER PARKWAY	A333	A336	0.21	88.77				2.96			5080	3.24	64.74	1.03	16.51	82.28	450	0.13	0.65	107.28	76.7%
A18	FUTURE MIXED-USE		A336	2.75	2.75					388.6	1069	1069	3.78	15.90	0.00	0.50	16.40					
EX5a	PHASE 19 - RES.			8.14	8.14					73.8	601	601	3.93	9.30	0.00	1.47	10.76					
EX5b	PHASE 19 - SCHOOL							4.83	4.83						1.68	0.87	2.55					
EX6	EXTERNAL LANDS					24.12	24.12								4.19	4.34	8.53					
EX7	EXTERNAL LANDS			13.32	13.32					32.2	429	429	4.01	6.77	0.00	2.40	9.16					
A19	FUTURE MIXED-USE		A336		21.46	1.43	25.55		7.79	360.1	515	1545	3.67	22.31	7.14	9.86	39.32					
A20	BARKER PARKWAY	A336	BQ	0.21	113.19		25.55		7.79			7694	3.07	92.85	7.14	26.38	126.36	525	0.14	0.75	167.94	75.2%
A21	HARMONY WAY		BQ	14.42	14.42					48.5	699	699	3.89	10.71	0.00	2.60	13.31					
A22	BARKER PARKWAY	BQ	BT	0.80	128.41		25.55		7.79	78.8	63	8456	3.03	100.71	7.14	29.11	136.97	525	0.15	0.78	173.83	78.8%
A23	BARKER PARKWAY	BT	BW	0.15	128.56		25.55		7.79			8456	3.03	100.71	7.14	29.14	136.99	525	0.15	0.78	173.83	78.8%
A24	AUTUMN AVENUE		BW	1.36	1.36					42.1	57	57	4.30	0.97	0.00	0.24	1.21					
A25	PHASE 16		BW	2.05	2.05					63.4	130	130	4.21	2.15	0.00	0.37	2.52					
A26	BARKER PARKWAY	BW	BX	0.18	132.15		25.55		7.79	14.4	3	8645	3.02	102.65	7.14	29.79	139.58	525	0.15	0.78	173.83	80.3%
A27	BARKER PARKWAY	BX	BY	0.26	132.41		25.55		7.79	30.0	8	8653	3.02	102.73	7.14	29.83	139.70	525	0.15	0.78	173.83	80.4%
EX8	EXTERNAL LANDS					19.79	19.79							0.00	3.44	3.56	7.00					
EX9	EXTERNAL LANDS			28.60	28.60					46.5	1331	1331	3.72	19.47	0.00	5.15	24.61					
A28	CRISTALLINA DR.		BY	0.91	29.51		19.79			39.6	36	1367	3.71	19.95	3.44	8.87	32.26					
A29	BARKER PARKWAY	BY	BZ	0.46	162.38		45.34		7.79	33.9	16	10036	2.95	116.63	10.58	38.79	165.99	525	0.19	0.88	195.64	84.8%
A30	BARKER PARKWAY	BZ	CA	0.57	162.95		45.34		7.79	31.9	18	10054	2.95	116.81	10.58	38.89	166.28	525	0.19	0.88	195.64	85.0%
A31	BARKER PARKWAY	CA	CB	0.57	163.52		45.34		7.79	27.4	16	10070	2.95	116.96	10.58	39.00	166.54	525	0.19	0.88	195.64	85.1%
A32	BARKER PARKWAY	CB	AH	0.35	163.87		45.34		7.79	29.7	10	10080	2.95	117.07	10.58	39.06	166.70	525	0.19	0.88	195.64	85.2%
A33a	SUNSET WAY		AH	17.74	17.74					43.7	775	775	3.87	11.80	0.00	3.19	14.99					
A33b	SUNSET WAY		AH					0.84	0.84						0.29	0.15	0.44					
A34	PHASE 17			5.90	5.90					51.5	304	304	4.08	4.88	0.00	1.06	5.94					
A35	SUNSET WAY		AH	5.06	10.96					37.0	187	491	3.98	7.69	0.00	1.97	9.66					
	TO ALLENBURG RD	AH	S1508		192.57		45.34		8.63			11346	2.90	129.48	10.87	44.38	184.73	525	0.19	0.88	195.64	94.4%

**** SEE PLAN 0695-OSAN FOR SANITARY DRAINAGE AREAS***

#	REVISION	DATE	INIT
2	ISSUED FOR REVIEW	2024-09-11	B.K.
1	ISSUED FOR REVIEW	2024-08-23	B.K.
0	ISSUED FOR REVIEW	2023-02-16	B.K.

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DRAFTING B.K.
DESIGN B.K.
CHECKED BY M.H.
APPROVED BY .

LICENSED PROFESSIONAL ENGINEER — B. J. KAPTEYN — 100509155 — Sept 11/24 — PROVINCE OF ONTARIO

City of Thorold — Where Ships Climb The Mountain...

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS
30 Hannover Drive Unit 3
St. Catharines, Ontario
L2W 1A3
Phone: (905)688-9400
Fax: (905)688-5274

ROLLING MEADOWS
CITY OF THOROLD
OVERALL SANITARY SEWER DESIGN CALCULATIONS

CONSULTANT FILE No. 0695
DATE 2024-09-11
PRINTED 2024-09-11
SCALE N.T.S.
REF No. .
DWG No. 0695-OSCALC
REV 2

Rolling Meadows

Sanitary Sewer Design Sheet

Project Number:	1606 23094	**Mannings 'n' :**	0.013	**Max. Capacity (%):**	85%	**Harmon Peaking Factor:**	**Q =** Design Flow (L/s)
Date:	March 2026	**Min. Velocity (m/s):**	0.60	**Infiltration Flow (L/s):**	0.18	$M = 1+(14/(4+P^{0.5}))$	**q =** Avg. Domestic Flow (L/c/d)
Stantec Ltd.	Stantec Ltd.	**Max. Velocty m/s):**	3.00	**Max. Peaking Factor:**	4.0		**P =** Population/1000
City File Number:	N/A	**Min. Pipe Slope (%):**	0.40	**Min. Peaking Factor:**	2.0	**Design Flow:**	**I =** Infiltration Flow
Prepared By:	James Luk	**Avg. Domestic Flow, q (L/c/d):**	340			$Q = (MqP/86.4) + IA$	**A =** Gross Drainage Area (ha)

Manhole			Contributing Area			Population		Design Calculations				Capacity Calculations					
Location	U/S MH	D/S MH	Drainage Area	Accum. Area	Density (Area)	Section	Accum. Pop.	Peaking Factor	Infil. Flow	Design Flow	Total Flow	Size	Slope	Full Capacity	Full Velocity	Actual Velocity	QA/QC
			(ha)	(ha)	(p/ha)	(p)	(p)		(L/s)	(L/s)	(L/s)	(mm)	(%)	(L/s)	(m/s)	(m/s)	(%)
A1 PHASE 12		A201	11.78	11.78	43	510	510	4.0	2.12	7.97	10.09	-	-	-	-	-	-
A2 BARKER PARKWAY	A201	A210	0.12	11.90	25	3	513	4.0	2.14	8.01	10.15	254	0.25	31.02	0.61	0.55	33%
A3 PHASE 13		A210	3.72	3.72	69	255	255	4.0	0.67	4.01	4.68	-	-	-	-	-	-
A4 BARKER PARKWAY	A210	A215	0.66	16.28	59	39	807	3.9	2.93	12.25	15.18	254	0.25	31.02	0.61	0.61	49%
EX1 PHASE 21		A215	6.50	6.50	68	445	445	4.0	1.17	7.00	8.17	-	-	-	-	-	-
EX2 PHASE 20		A215	6.67	6.67	72	481	481	4.0	1.20	7.54	8.74	-	-	-	-	-	-
A5 PHASE 13		A215	1.26	1.26	93	117	117	4.0	0.23	1.84	2.07	-	-	-	-	-	-
A6 BARKER PARKWAY	A215	A224	0.71	31.42	66	47	1897	3.6	5.66	26.90	32.56	381	0.12	63.36	0.56	0.56	51%
A7 PHASE 13		A224	7.30	7.30	73	533	533	4.0	1.31	8.31	9.62	-	-	-	-	-	-
A8 BARKER PARKWAY	A224	A310	0.22	38.94	45	10	2440	3.5	7.01	33.77	40.78	381	0.12	63.36	0.56	0.59	64%
A9 BARKER PARKWAY	A310	A309	1.41	40.35	104	147	2587	3.5	7.26	35.59	42.86	457.2	0.12	103.03	0.63	0.59	42%
A10 PHASE 14		A309	2.58	2.58	66	169	169	4.0	0.46	2.66	3.12	-	-	-	-	-	-
A11 BARKER PARKWAY	A309	A316	0.33	43.26	39	13	2769	3.5	7.79	37.83	45.62	457.2	0.12	103.03	0.63	0.60	44%
EX4a EXTERNAL LANDS		A316	19.04	19.04	38	733	733	3.9	3.43	11.20	14.63	-	-	-	-	-	-
EX4b EXTERNAL LANDS		A316	3.11	3.11	39	120	120	4.0	0.56	1.89	2.45	-	-	-	-	-	-
EX3a PHASE 18, 19, 23		A316	13.58	13.58	59	803	803	3.9	2.44	12.20	14.64	-	-	-	-	-	-
EX3b PHASE 19-SCHOOL		A316	2.96	2.96		0	0	4.0	0.53	0.00	1.56	-	-	-	-	-	-
A12 PHASE 14		A316	2.16	2.16	86	185	185	4.0	0.39	2.91	3.30	-	-	-	-	-	-
A13 BARKER PARKWAY	A316	A330	0.19	84.30		0	4610	3.3	15.17	59.46	75.66	457.2	0.12	103.03	0.63	0.68	73%
A14 BARKER PARKWAY	A330	FF-14	0.12	84.42		0	4610	3.3	15.20	59.46	75.68	457.2	0.12	103.03	0.63	0.68	73%
A15 PHASE 14		FF-14	7.04	7.04	67	471	471	4.0	1.27	7.39	8.66	-	-	-	-	-	-
A16 BARKER PARKWAY	FF-14	A333	0.06	91.52		0	5081	3.2	16.47	64.75	82.25	457.2	0.12	103.03	0.63	0.70	80%
A17 BARKER PARKWAY	A333	A336	0.21	91.73		0	5081	3.2	16.51	64.75	82.29	457.2	0.13	107.24	0.65	0.72	77%
A18 FUTURE MIXED-USE		A336	2.75	2.75	389	1069	1069	3.8	0.50	15.91	16.40	-	-	-	-	-	-
EX5a PHASE 19-RES.		A336	8.14	8.14	74	601	601	3.9	1.47	9.30	10.76	-	-	-	-	-	-
EX5b PHASE 19-SCHOOL		A336	4.83	4.83		0	0	4.0	0.87	0.00	2.55	-	-	-	-	-	-
EX6 EXTERNAL LANDS		A336	24.12	24.12		0	0	4.0	4.34	0.00	8.53	-	-	-	-	-	-
EX7 EXTERNAL LANDS		A336	14.38	14.38	76	1098	1098	3.8	2.59	16.30	18.89	-	-	-	-	-	-
A19 FUTURE MIXED-USE		A336	1.43	1.43	360	515	515	4.0	0.26	8.04	8.55	-	-	-	-	-	-
A20 BARKER PARKWAY	A336	BQ	0.21	147.59		0	8364	3.0	26.57	99.77	133.48	533.4	0.14	167.87	0.75	0.83	80%
A21 HARMONY WAY		BQ	14.42	14.42	48	699	699	3.9	2.60	10.71	13.31	-	-	-	-	-	-
A22 BARKER PARKWAY	BQ	BT	0.80	162.81	79	63	9126	3.0	29.31	107.52	143.97	533.4	0.15	173.76	0.78	0.87	83%
A23 BARKER PARKWAY	BT	BW	0.15	162.96		0	9126	3.0	29.33	107.52	144.00	533.4	0.15	173.76	0.78	0.87	83%
A24 AUTUMN AVENUE		BW	1.36	1.36	42	57	57	4.0	0.24	0.90	1.14	-	-	-	-	-	-
A25 PHASE 16		BW	2.05	2.05	63	130	130	4.0	0.37	2.05	2.42	-	-	-	-	-	-
A26 BARKER PARKWAY	BW	BX	0.18	166.55	17	3	9316	3.0	29.98	109.44	146.56	533.4	0.15	173.76	0.78	0.87	84%
A27 BARKER PARKWAY	BX	BY	0.26	166.81	31	8	9324	3.0	30.03	109.52	146.68	533.4	0.15	173.76	0.78	0.87	84%
EX8 EXTERNAL LANDS		BY	19.79	19.79		0	0	4.0	3.56	0.00	7.00	-	-	-	-	-	-
EX9 EXTERNAL LANDS	PH1+FUT3	BY	29.39	29.39	44	1297	1297	3.7	5.29	19.01	24.30	-	-	-	-	-	-
A28 CRISTALLINA DR		BY	0.91	0.91	40	36	36	4.0	0.16	0.57	0.73	-	-	-	-	-	-
A29 BARKER PARKWAY	BY	BZ	0.46	217.36	35	16	10673	2.9	39.12	122.91	172.62	533.4	0.19	195.57	0.88	0.99	88%
A30 BARKER PARKWAY	BZ	CA	0.57	217.93	32	18	10691	2.9	39.23	123.09	172.90	533.4	0.19	195.57	0.88	0.99	88%
A31 BARKER PARKWAY	CA	CB	0.57	218.50	28	16	10707	2.9	39.33	123.25	173.15	533.4	0.19	195.57	0.88	0.99	89%
A32 BARKER PARKWAY	CB	AH	0.35	218.85	29	10	10717	2.9	39.39	123.35	173.32	533.4	0.19	195.57	0.88	0.99	89%
A33a SUNSET WAY		AH	17.74	17.74	44	775	775	3.9	3.19	11.80	14.99	-	-	-	-	-	-
A33b SUNSET WAY		AH	0.84	0.84		0	0	4.0	0.15	0.00	0.44	-	-	-	-	-	-
A34 PHASE 17		AH	5.90	5.90	52	304	304	4.0	1.06	4.79	5.85	-	-	-	-	-	-
A35 SUNSET WAY		AH	5.06	5.06	37	187	187	4.0	0.91	2.94	3.85	-	-	-	-	-	-
TO ALLENBURG RD	AH	S1508		248.39		0	11983	2.88	44.71	135.63	191.21	533.4	0.19	195.57	0.88	1.00	97.8%

Appendix C DESIGN – WATER

PRELIMINARY ESTIMATE of Expected Water Demand ***Feb 2026***

Upper's Lane Subdivision *Project #160623094*

Thorold, Ontario

Program Details

	Unit Type	# of Units	*Persons per Unit	Equivalent Population
Residential:	Single	176	2.8	493
	Townhouse	340	2.2	748
	Mid Rise	212	1.7	360.4
		Total Residential Population		**1601**
			Unit Count	**728**

Source: Region of Niagara 2021 -Water-Wasterwater Master Servicing Plan

TOTAL DESIGN POPULATION = **1601**

Flow Calculation

Required Design Water Demand = Peak Hourly Demand Plus Fire Flow

*Flow Rate =	**300**	litres/capita/day		*Source: he City of Thorold City Wide Water Service Master Plan*
For a total population of	**1601**	people,		
Average Day Demand:	**480,360**	litres/day		
**Applying a peaking factor of	**2.00**	(maximum day)		*Source: MOE Watermain design Guideline Table 3-1*
Maximum Day Demand =	**960,720**	litres/day		
or,	**667**	litres/minute		
*Fire Flow Demand =	**10,000**	litres/minute	**(A)**	*Source: See Fire Underwirter Survey (FUS) assessment herein.*

Peak Hourly Demand

The total flow is:	**480,360**	litres/day		
*Applying a peaking factor of	**3.75**	(peak hour)		*Source: MOE Watermain design Guideline Table 3-1*
Peak Hourly Demand =	**1,801,350**	litres/day		
or,	**1,251**	litres/minute	**(B)**	

Total water demand (on basis of Peak Hourly demand plus fire flow) = **11,251** **litres/minute**
188 **litres/second**
2972 **GPM**

PRELIMINARY ESTIMATE of Required Fire Flow ***Feb 2026***

Fire Underwriters Survey "Water Supply for Public Fire Protection", 2020 *Project #160622940*

Upper's Lane Subdivision

Thorold, Ontario

Assumptions:

1) Building 'G' analyzed. 4-unit in closest proximity to other structures

2) Wood frame construction with fire separation between each unit per OBC

3) Slab-on-grade "bungaloft" construction (loft = 50% of main level across 6-unit block)

F = 220 · C · √A

where,

F = the required fire flow in litres per minute

C = 1.0 for wood frame construction with fire wall separation

= **1.00**

A =

The total floor area in square metres (including all storeys, but excluding basements at least 50% below grade) in the building being considered. Note: for fire-resistive buildings, consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected. If the vertical openings and exterior vertical communications are properly protected (one hour rating), consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors. *

	Building G_4-unit block	
Level 1	582	sq.m.
Level 2	291	sq.m.

A = **873** **sq.m.**

F = **220 · (C) · √(A)**

= **6,500** **Lpm**

= **7,000** **Lpm** (Rounded to the nearest 1,000 L/min)

The value obtained above may be reduced by as much as 25% for occupancies having a low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Apply a reduction of **15%** (Dwellings = low hazard - limited combustibles), or **-1,050** **Lpm**

F = **5,950** **Lpm**

To the value obtained, a percentage should be added for structures exposed within 45 metres. Block 'H' assessed given it is in closest proximity to other structures relative to other Blcoks.

North side	-	21	m	-	**10%**
East side	-	3.6	m	-	**20%**
South side	-	15	m	-	**15%**
West side	-	3.6	m	-	**20%**
					65% (not to exceed 75%)

Increase = **3,868** **Lpm**

F =

7,000	Lpm
-1,000	
3,868	
9,818	**Lpm**

F =	**10,000**	**Lpm**	(Rounded to the nearest 1,000 L/min)
=	167	**Lps**	
=	2420	**GPM**	

PRELIMINARY ESTIMATE of Required Fire Flow ***Feb 2026***

Fire Underwriters Survey "Water Supply for Public Fire Protection", 2020 *Project #160623094*

Upper's Lane Subdivision

Thorold, Ontario

Exposure distances	**Suggested fire flow required** Masonry or Brick
Less than 3m	See Note "D" 6,000 L/min
3 to 10m	4,000 L/min 4,000 L/min
10.1 to 30m	3,000 L/min 3,000 L/min
Over 30m	2,000 L/min 2,000 L/min

If the buildings are contiguous, use a minimum of 8,000 L/min. Also consider Note H.

Note D: Wood frame structures separated by less than 3 metres shall be considered as one fire area

Note H: Where wood singles or shake roofs could contribute to spreading fires, add 2,000 L/min to 4,000 L/min in accordance with extent and condition.

Excerpt from Water Supply for Public Fire Proection, Fire Underwriters Survey, 1999 Edition

The proposed development consist of single family dwelling and townhouses.

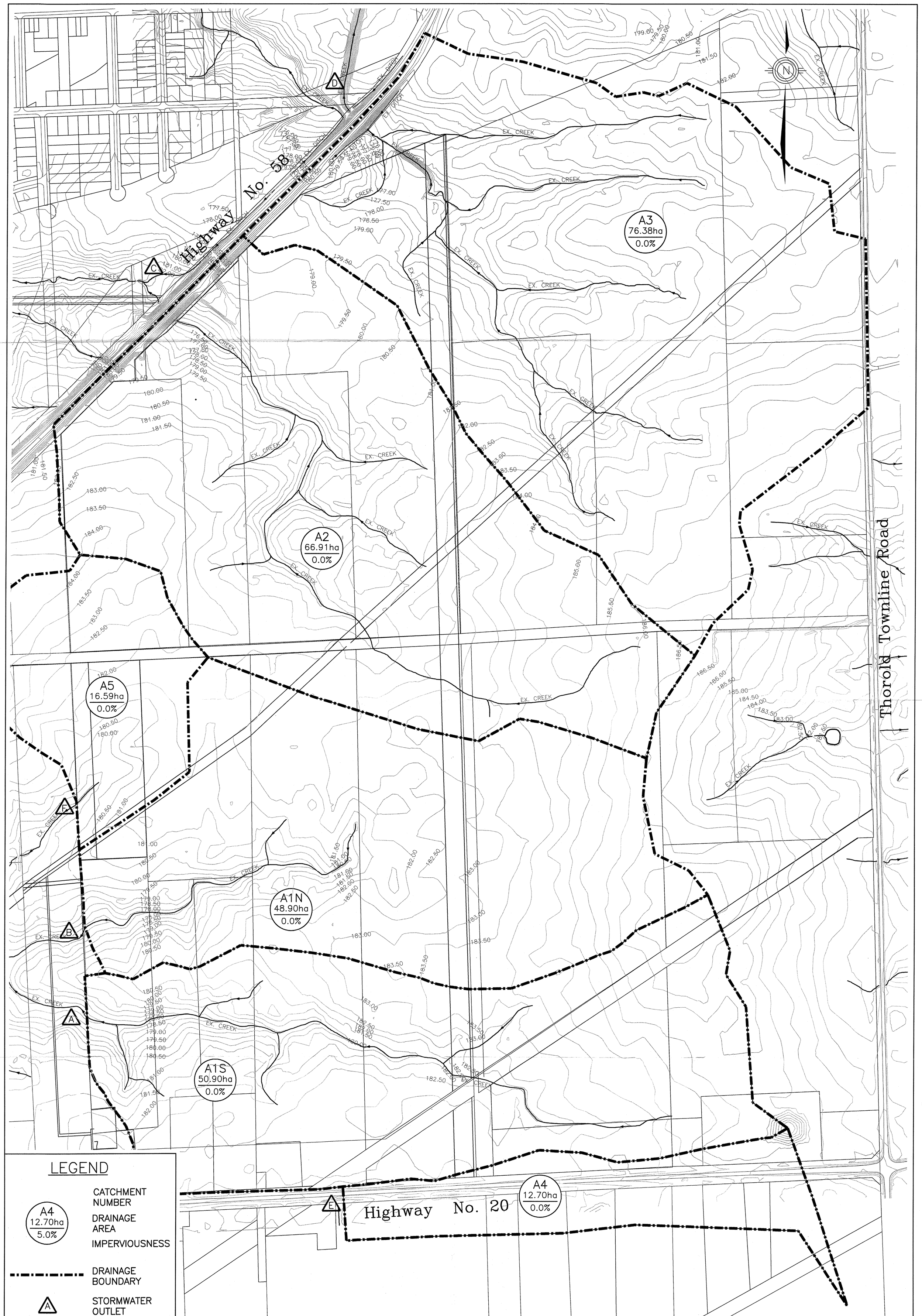
Townhouses are categorized as contiguous building s and therefore a min. fireflow of **8,000 L/min** is used.

Appendix D DESIGN – STORMWATER

Drawing 0695-EX.STM from Preliminary Stormwater Management Plan – Rolling Hills prepared by Upper Canada Consultants

Figure 2 from Preliminary Stormwater Management Plan Rolling Meadows Phase 17 City of Thorold prepared by Upper Canada Consultants, 2022 [SWM-2022]

Figure 8 from Neighborhoods of Rolling Meadows Secondary Plan Sub-Watershed Study and Functional Engineering Report prepared by Westlake Inc., June 2006 [SWS]



LEGEND

- A4 / 12.70ha / 5.0% — CATCHMENT NUMBER, DRAINAGE AREA, IMPERVIOUSNESS
- DRAINAGE BOUNDARY
- A — STORMWATER OUTLET

No	REVISIONS	DATE	BY
0	ISSUED WITH PRELIMINARY SWM REPORT		

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS
261 Martindale Road
Unit #1
St. Catharines, Ontario
L2W 1A1
Phone:(905)688-9400
Fax: (905)688-5274

PROJECT NAME: ROLLING MEADOWS

OWNER: ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 Cataract Road, RR1
FONTHILL, ONTARIO
L0S 1E6

DRAWING TITLE: EXISTING STORMWATER DRAINAGE AREAS

MUNICIPALITY: CITY OF THOROLD

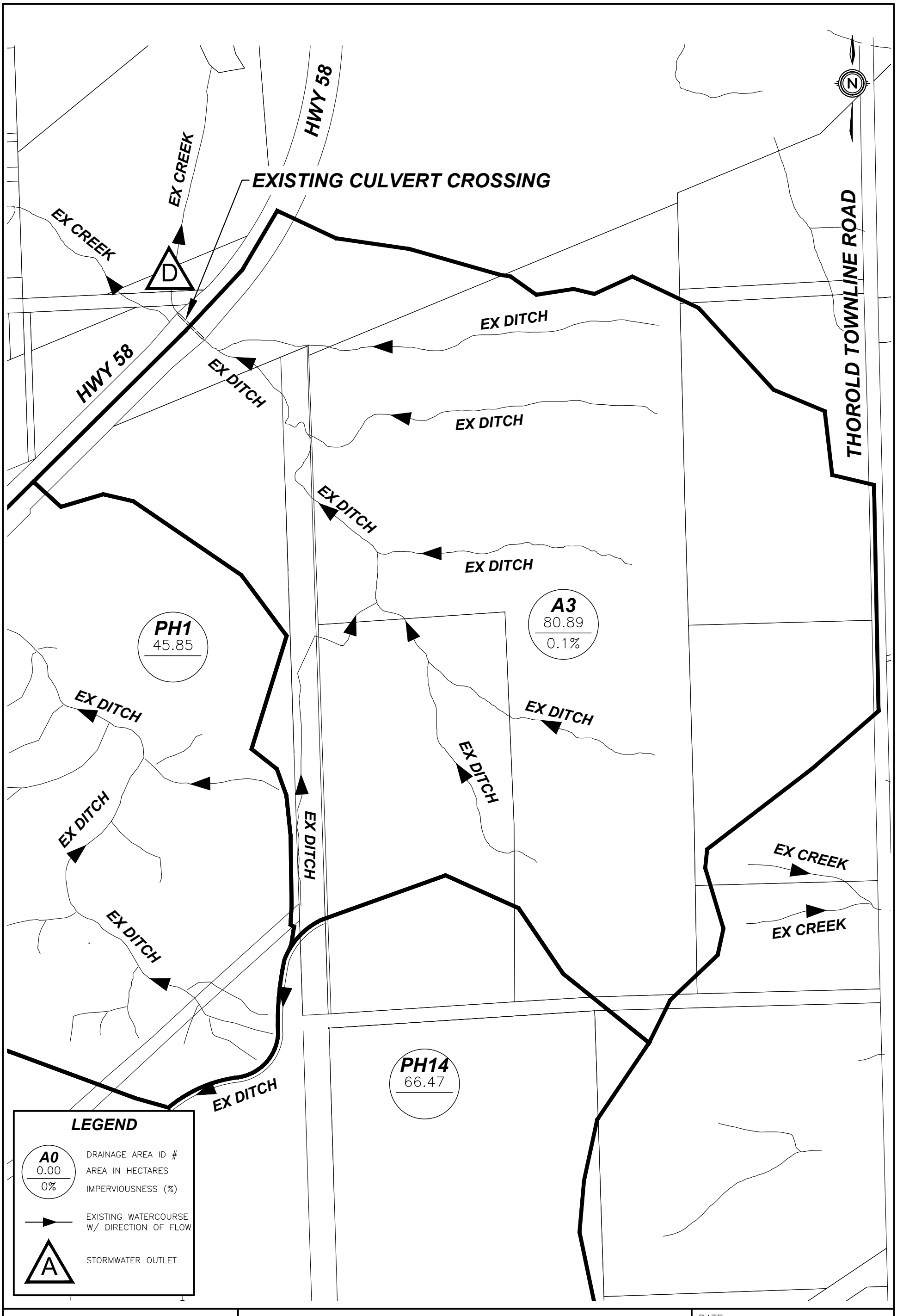
DESIGN:	DRAFTING:
MH	B.V.

DATE: MARCH 30, 2007

SCALE: 1:3000

DRAWING No: 0695-EX.STM

REV. 0



UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

ROLLING MEADOWS PHASE 17

TOWN OF THOROLD

EXISTING STORMWATER DRAINAGE AREAS

DATE	2022-05-18
SCALE	1:5000 m
REF No.	0695
DWG No.	FIGURE 2

DRAWING FILE: F:\0695_SOUTH PHASE 12+\PHASE 17\SWM\0695 SWM BASE_New Properties.dwg PLOTTED: May 19, 2022 – 11:33am PLOTTED BY: brendan

CAD REF. NAME: F:\1495\1495(FIG 08)EX-STM DRAINAGE-REVISED.DWG PLOT DATE: 29-May-06

BLACKHORSE CORNERS

30.8m CONCRETE BOX CULVERT
(2.8m x 2.2m) @ 0.5%
E.INV. = 174.72
W.INV. = 174.57

ALLANBURG ROAD

ALLANBURG ROAD

TRANS CANADA GAS PIPELINE

UPPERS LANE

Hydro One Easement

49.8m CONCRETE BOX CULVERT
(2.8m x 1.3m) @ 0.5%
E.INV. = 176.07
W.INV. = 175.79

Highway No. 58

49.3m CONCRETE BOX CULVERT
(2.8m x 1.6m) @ 0.5%
E.INV. = 175.27
W.INV. = 175.01

BEAVERDAMS CREEK

Highway No. 20

Hydro One Easement

Hydro One Easement

TRANS CANADA GAS PIPELINE

173.431
O.P.G. (FLOOD)
CONTOUR

Beaverdams Road

BEAVERDAMS CREEK

Thorold Townline Road

A	162.8	5.0%
B	70.8	5.0%
C	78.3	5.0%
D	36.5	2.0%
E	5.6	5.0%
F	17.7	5.0%
G	6.1	5.0%
H	13.6	5.0%

KEY PLAN
N.T.S.

LEGEND

- x 180.00 — PROPOSED ELEVATION
- EXISTING STORM DRAINAGE BOUNDARY
- A — EXISTING OUTLET LOCATION
- 1 / 10.0 / 5.0% — DRAINAGE AREA No. / AREA IN HECTARES / (%) IMPERVIOUSNESS

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVE GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

BENCHMARK:
CITY OF THOROLD BENCHMARK.

DESCRIPTION: C.N.Ry. BRIDGE (No.10), OVER WELLAND SHIP CANAL. TABLET IN EAST CURVED RETAINING WALL AT NORTH SIDE OF BRIDGE, 18.4 FEET WEST OF STEPS AT EAST END OF WALL, 43 FEET NORTH OF NORTH SIDE OF BRIDGE, 0.9 FOOT FROM EDGE OF CANAL.

ELEVATION: 174.314 m

REVISIONS

No.	Revision	Date	By	Approved

REGIONAL MUNICIPALITY OF NIAGARA
CITY OF THOROLD

NEIGHBOURHOODS OF ROLLING MEADOWS

EXISTING STORM DRAINAGE PLAN

WESLAKE INC.
CIVIL ENGINEERS, MUNICIPAL AND ENVIRONMENTAL PLANNERS
120 LANCING DRIVE
UNIT No. 10
HAMILTON, ONTARIO
L8W 3A1

40 0 160
METRES

SCALE: 1:4,000
DRAWN BY: M.G.
DESIGNED BY: M.G.
CHECKED BY: T.D.B.
PROJECT No. 1495
FIGURE No. 8
DATE: MAY 2006

NOT FOR CONSTRUCTION UNTIL SIGNED, STAMPED AND DATED

X-REF:F:\1495\1495-Base500.DWG

Appendix E SITE ENGINEERING FIGURES

Figure GR-1 – Preliminary Grading Plan

Figure STM-1 – Preliminary Storm Servicing Plan

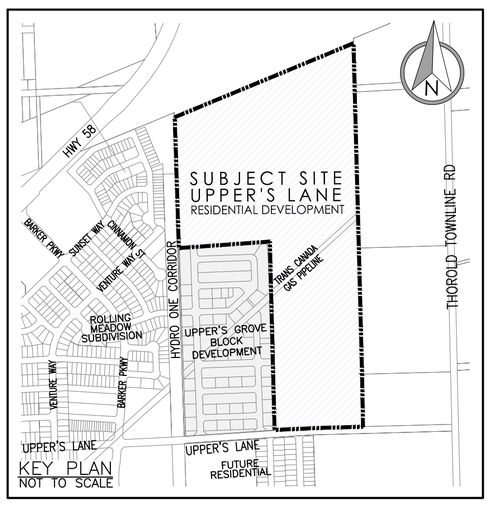
Figure SAN-1 – Preliminary Sanitary Servicing Plan

Figure WTM-1 – Preliminary Water Distribution Plan

Figure TYP-1 – Right of Way Sections

Figure – Topographic Sketch

RMS – As Constructed Drawings



Stantec

1:2000 (0, 20, 40, 60, 80, 100)

Legend

- SUBJECT LAND PROPERTY LINE
- UPPER'S GROVE BLOCK DEVELOPMENT
- 163.84 PROPOSED SPOT ELEVATION
- *163.84* EXISTING SPOT ELEVATION
- 195.0 EXISTING CONTOUR AND ELEVATION
- OVERLAND FLOW ARROW
- 3:1 SLOPE

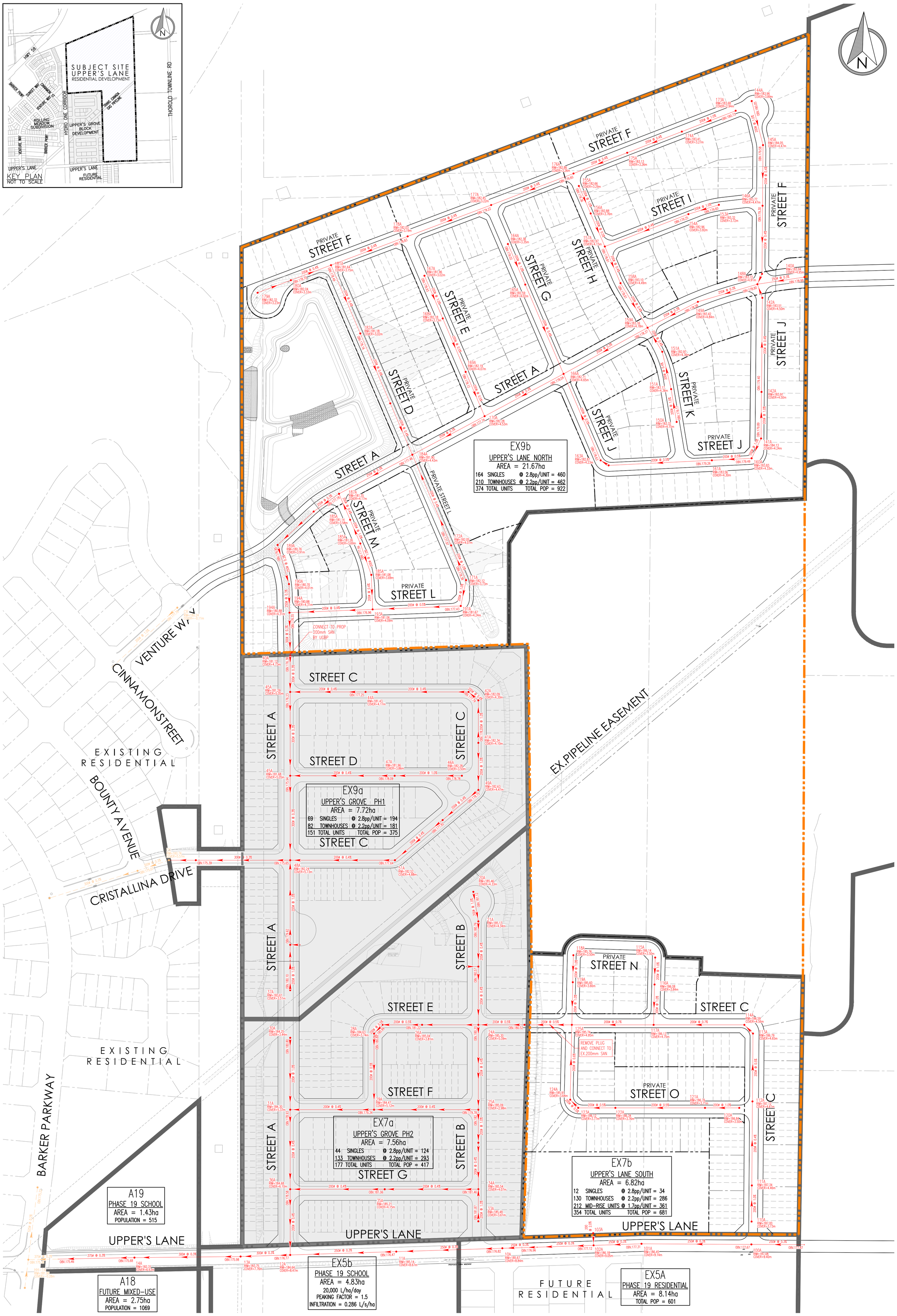
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT
CITY OF THOROLD, ONTARIO

GR-1

PRELIMINARY GRADING PLAN

March 2026

File: \\Ca0215-ppfss01\1606\Active\160623065\Drawing\sheet_files\160623065_C-FSR Grading.dwg – Revised by <Luk, James> , Mon, Mar 23, 2026 , 10:14 AM



Stantec

1:2000 0 20 40 60 80 100

Legend

- SUBJECT LAND PROPERTY LINE
- UPPER'S GROVE BLOCK DEVELOPMENT
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- SANITARY DRAINAGE BOUNDARY

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT

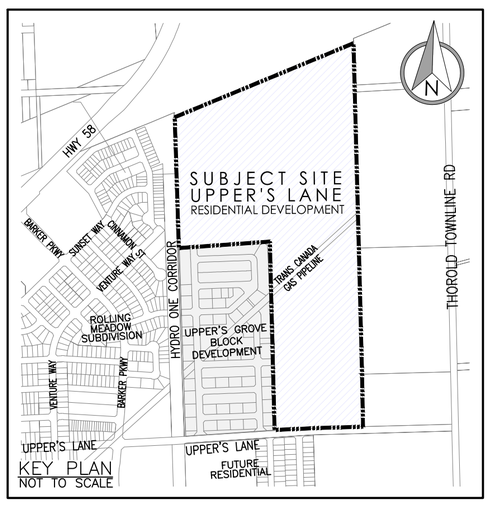
CITY OF THOROLD, ONTARIO

SAN-1

PRELIMINARY SANITARY SERVICING PLAN

March 2026

File: \\Ca0215-ppfss01\1606\Active\160623065\Drawing\sheet_files\160623065_C-FSR Servicing.dwg – Revised by <Luk, James> , Mon, Mar 23, 2026 , 10:15 AM



Stantec

0 15 30 45 60 75
1:1500

Legend

- SUBJECT LAND PROPERTY LINE
- UPPER'S GROVE BLOCK DEVELOPMENT
- EXISTING STORM MANHOLE
- STORM MANHOLE
- SINGLE/DOUBLE CATCHBASIN
- STORM DRAINAGE BOUNDARY
- 0.86ha / 0.75 — DRAINAGE AREA / RUNOFF COEFFICIENT
- OVERLAND FLOW ROUTE

EXT-1	DESCRIPTION
21.60ha	EXTERNAL DRAINAGE AREA
0.25	RUNOFF COEFFICIENT
Tc=11.0	TIME OF CONCENTRATION

EXT-1	DESCRIPTION
21.60ha	EXTERNAL DRAINAGE AREA
0.25	RUNOFF COEFFICIENT
Q5=23L/s	5-YR FLOW RATE
Q100=53L/s	100-YR FLOW RATE

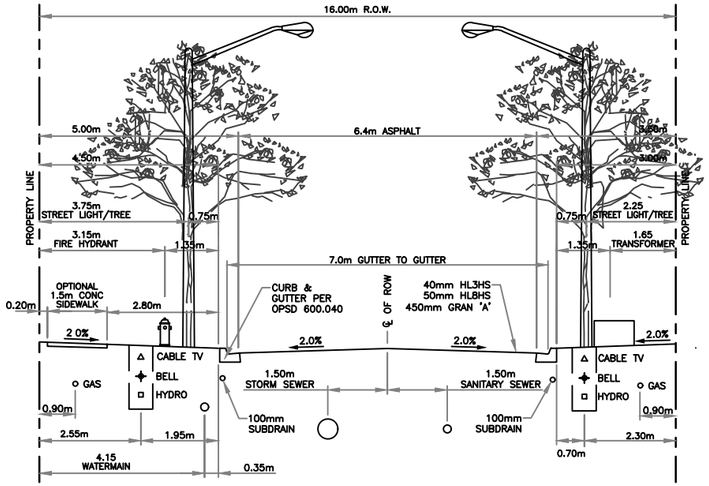
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT
CITY OF THOROLD, ONTARIO

STM-1

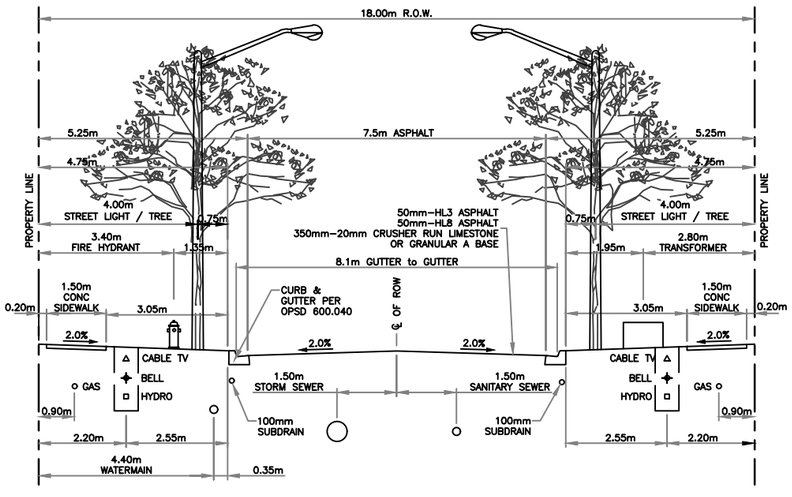
PRELIMINARY STORM SERVICING PLAN

March 2026

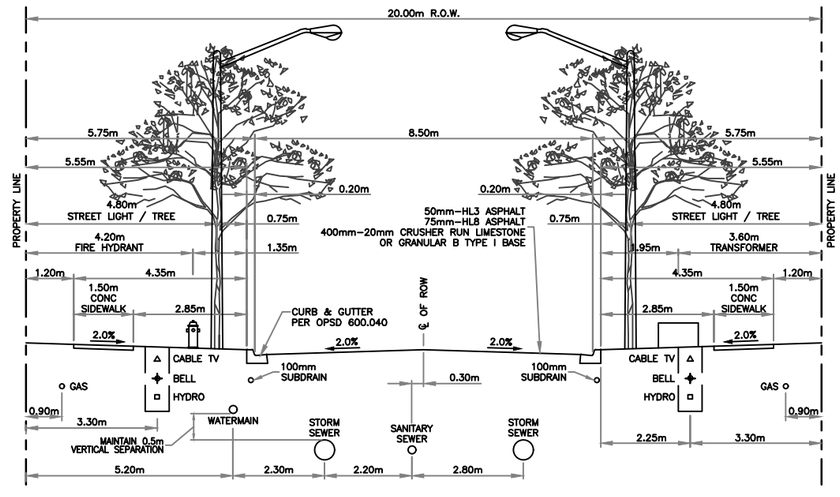
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TYPICAL 16.0m ROW CROSS-SECTION



TYPICAL 18.0m ROW CROSS-SECTION



TYPICAL 20.0m ROW CROSS-SECTION

Stantec

Legend

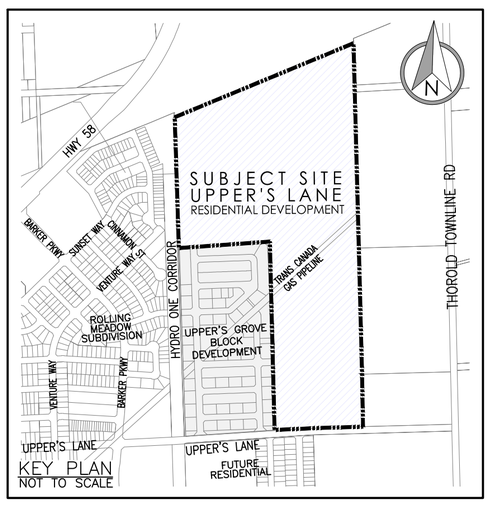
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT

CITY OF THOROLD, ONTARIO

TYP-1

TYPICAL ROAD SECTIONS

March 2026



Stantec

0 20 40 60 80 100
1:2000

Legend

SUBJECT LAND PROPERTY LINE

UPPER'S GROVE BLOCK DEVELOPMENT

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT

CITY OF THOROLD, ONTARIO

WTM-1

PRELIMINARY WATER SERVICING PLAN

March 2026

File: \\Ca0215-ppfss01\1606\Active\160623065\Drawing\sheet_files\160623065_C-FSR Servicing.dwg – Revised by <Luk, James> , Mon, Mar 23, 2026 , 10:15 AM

5/23/2023 2:17 PM



Stantec

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
300-675 COCHRANE DRIVE, WEST TOWER
MARKHAM, ONTARIO, L3R 0B8
TEL. 905.944.7777
stantec.com

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CAUTION

THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK.

UTILITIES SHOWN ARE FOR DISCUSSION PURPOSES ONLY AND PRIOR TO CONSTRUCTION SHOULD BE CONFIRMED BY A CONTRACTOR.

DRAWING COORDINATES

UTM ZONE 17, NAD83 (CSRS)

CAUTION: DRAWING COORDINATES HAVE BEEN SCALED TO GROUND LEVEL DISTANCES BASED ON THE APPROXIMATE CENTROID OF THE PARCEL.

VERTICAL DATUM

ELEVATIONS ARE GEODETIC, REFERRED TO CGVD-1928:1978 AND DERIVED FROM GNSS OBSERVATIONS USING A REAL-TIME CORRECTION SERVICE.

CLIENT/PROJECT:

PARKBRIDGE LIFESTYLE COMMUNITIES INC.

UPPER'S GROVE PHASE 1&2

THOROLD, ON

DRAWING TITLE:

TOPOGRAPHIC SKETCH

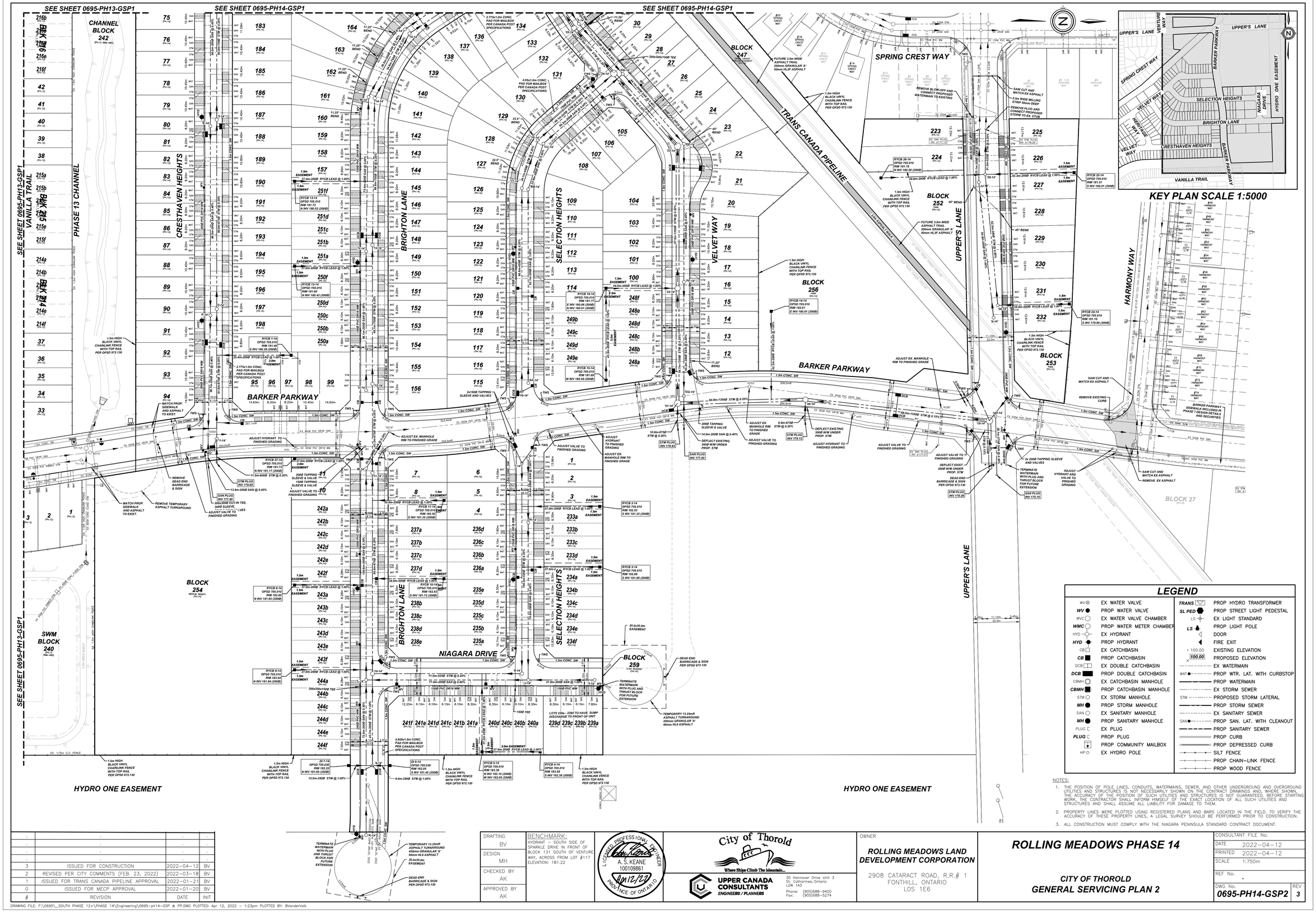
Scale 1:1250

20 0 20 40 60 80 METRES

Rev.	Description	Drawn	Chk'd	yyyy-mm-dd
0	ISSUED TO CLIENT	DP	MM	2023-05-23

PROJECT No.: 160623065 PAGE: 1 of 1

W:\Active\160623065\drawing\160623065_Y-ET_GRD_RollingMeadows_Topo.dwg



LEGEND

WV ⊗	EX WATER VALVE	TRANS	PROP HYDRO TRANSFORMER
WV ●	PROP WATER VALVE	SL PED	PROP STREET LIGHT PEDESTAL
WVC ○	EX WATER VALVE CHAMBER	LS	EX LIGHT STANDARD
WMC □	PROP WATER METER CHAMBER	LS	PROP LIGHT POLE
HYD ◇	EX HYDRANT		DOOR
HYD ◆	PROP HYDRANT		FIRE EXIT
CB □	EX CATCHBASIN	+ 100.00	EXISTING ELEVATION
CB ■	PROP CATCHBASIN	× 100.00	PROPOSED ELEVATION
DCB ▭	EX DOUBLE CATCHBASIN		EX WATERMAIN
DCB ▬	PROP DOUBLE CATCHBASIN	WAT	PROP WTR. LAT. WITH CURBSTOP
CBMH ◯	EX CATCHBASIN MANHOLE		PROP WATERMAIN
CBMH ◼	PROP CATCHBASIN MANHOLE		EX STORM SEWER
STM ○	EX STORM MANHOLE	STM	PROPOSED STORM LATERAL
MH ●	PROP STORM MANHOLE		PROP STORM SEWER
SAN ○	EX SANITARY MANHOLE		EX SANITARY SEWER
MH ●	PROP SANITARY MANHOLE	SAN	PROP SAN. LAT. WITH CLEANOUT
PLUG ⊏	EX PLUG		PROP SANITARY SEWER
PLUG ⊏	PROP PLUG		PROP CURB
	PROP COMMUNITY MAILBOX		PROP DEPRESSED CURB
HP ○	EX HYDRO POLE		SILT FENCE
			PROP CHAIN–LINK FENCE
			PROP WOOD FENCE

NOTES:

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

#	REVISION	DATE	INIT
.	.	.	.
.	.	.	.
.	.	.	.
3	ISSUED FOR CONSTRUCTION	2022–04–12	BV
2	REVISED PER CITY COMMENTS (FEB. 23, 2022)	2022–03–18	BV
1	ISSUED FOR TRANS CANADA PIPELINE APPROVAL	2022–01–21	BV
0	ISSUED FOR MECP APPROVAL	2022–01–20	BV

DRAWING FILE: F:\0695_SOUTH PHASE 12+\PHASE 14\Engineering\0695–ph14–GSP & PP.DWG PLOTTED: Apr 12, 2022 – 1:23pm PLOTTED BY: BVanderVolk

DRAFTING	BV
DESIGN	MH
CHECKED BY	AK
APPROVED BY	AK

BENCHMARK:
HYDRANT – SOUTH SIDE OF SPARKLE DRIVE IN FRONT OF BLOCK 131 SOUTH OF VENTURE WAY, ACROSS FROM LOT #117
ELEVATION: 181.22

LICENSED PROFESSIONAL ENGINEER
A. S. KEANE
100109861
PROVINCE OF ONTARIO
Apr 12/22

City of Thorold
Where Ships Climb The Mountain...

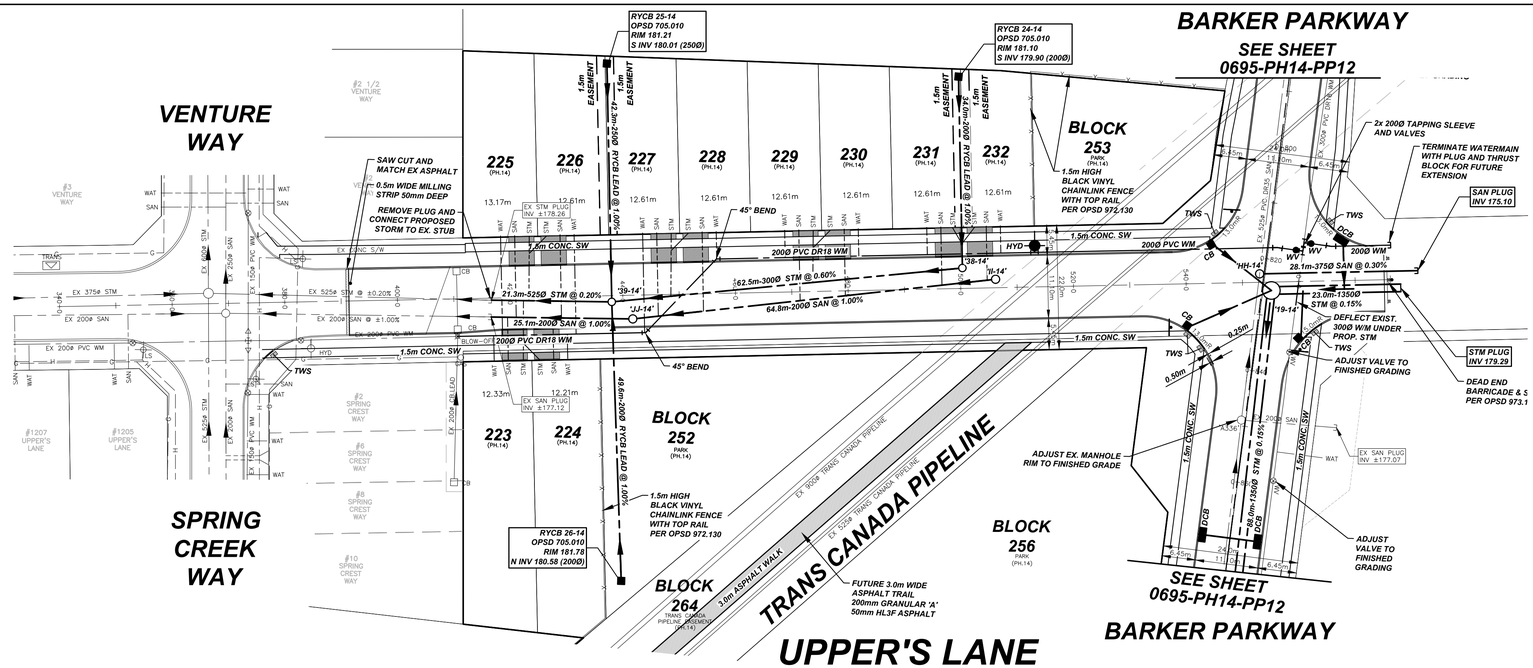
UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS
30 Hannover Drive Unit 3
St. Catharines, Ontario
L2W 1A3
Phone: (905)688–9400
Fax: (905)688–5274

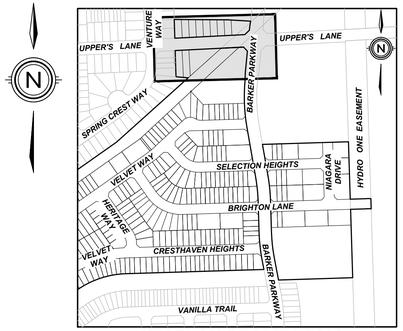
OWNER
ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 CATARACT ROAD, R.R.# 1
FONTHILL, ONTARIO
L0S 1E6

ROLLING MEADOWS PHASE 14

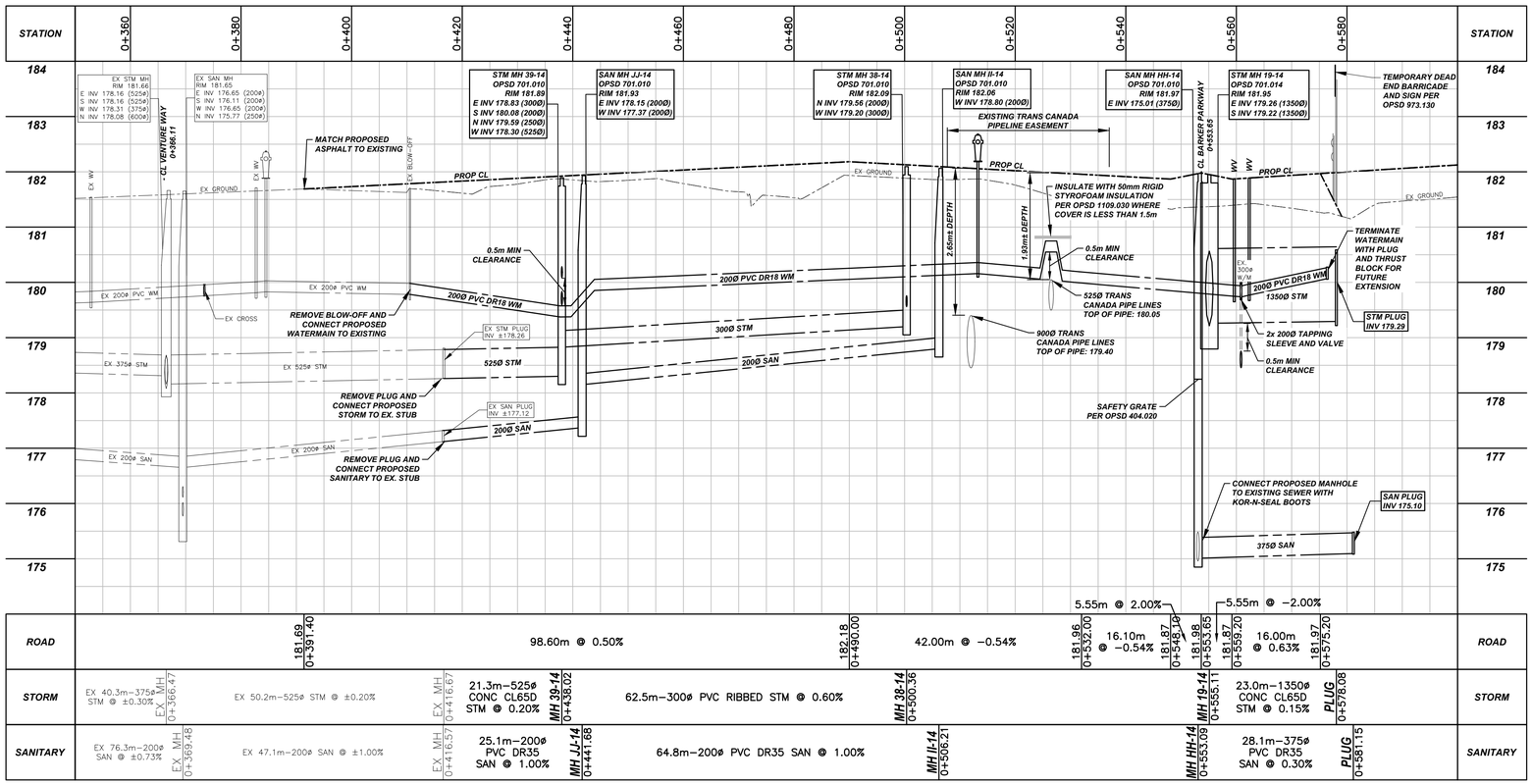
CITY OF THOROLD
GENERAL SERVICING PLAN 2

CONSULTANT FILE No.	
DATE	2022–04–12
PRINTED	2022–04–12
SCALE	1:750m
REF No.	.
DWG No.	0695-PH14-GSP2
REV	3





KEY PLAN SCALE 1:5000



#	REVISION	DATE	INIT
3	ISSUED FOR CONSTRUCTION	2022-04-12	BV
2	REVISED PER CITY COMMENTS (FEB. 23, 2022)	2022-03-18	BV
1	ISSUED FOR TRANS CANADA PIPELINE APPROVAL	2022-01-21	BV
0	ISSUED FOR MECP APPROVAL	2022-01-20	BV

NOTES:
1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING	BV
DESIGN	MH
CHECKED BY	AK
APPROVED BY	AK

BENCHMARK:
HYDRANT – SOUTH SIDE OF SPARKLE DRIVE IN FRONT OF BLOCK 131 SOUTH OF VENTURE WAY, ACROSS FROM LOT #117
ELEVATION: 181.22

LICENSED PROFESSIONAL ENGINEER A. S. KEANE 100109861 Apr 12/22 PROVINCE OF ONTARIO

City of Thorold — Where Ships Climb The Mountain...

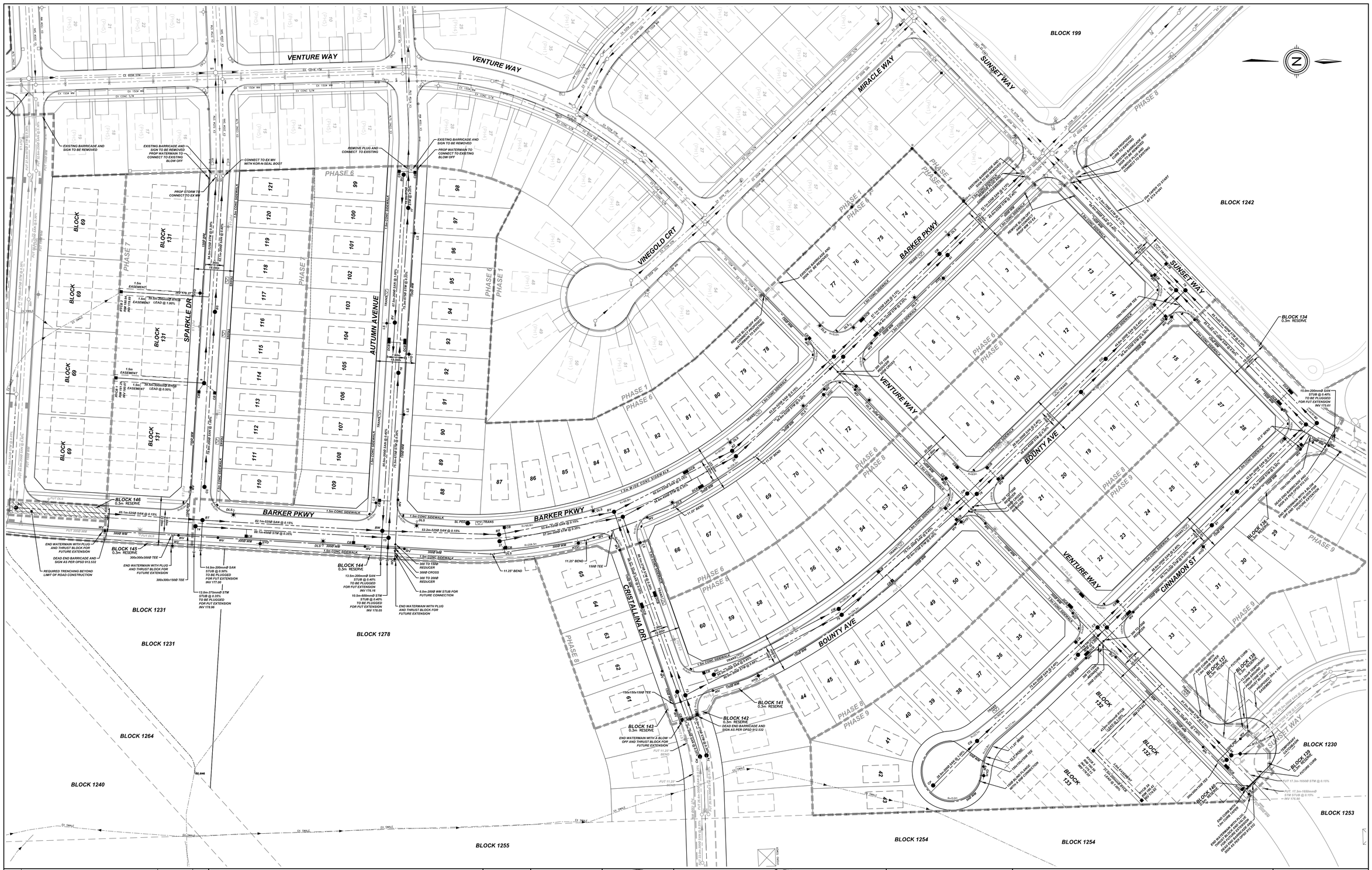
UPPER CANADA CONSULTANTS ENGINEERS / PLANNERS
30 Hannover Drive Unit 3
St. Catharines, Ontario
L2W 1A3
Phone: (905)688-9400
Fax: (905)688-5274

OWNER
ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 CATARACT ROAD, R.R.# 1
FONTHILL, ONTARIO
LOS 1E6

ROLLING MEADOWS PHASE 14
UPPER'S LANE
FROM VENTURE WAY TO BARKER PARKWAY
CITY OF THOROLD
PLAN PROFILE 13

CONSULTANT FILE No.	0695
DATE	2022-04-12
PRINTED	2022-04-12
SCALE	Hor : 1:500 m Ver : 1:50 m
REF No.	----
DWG No.	0695-PH14-PP13
REV	3

DRAWING FILE: F:\0695_SOUTH PHASE 12+\PHASE 14\Engineering\0695-ph14-GSP & PP.DWG PLOTTED: Apr 12, 2022 - 1:52pm PLOTTED BY: BVanderValk


VENTURE WAY
BARKER PKWY
SPARKLE DR
AUTUMN AVENUE
CRISTALLINA DR
VINEGOLD CRT
MIRACLE WAY
SUNSET WAY
BARKER PKWY
BOUNTY AVE
VENTURE WAY
CINNAMON ST
SUNSET WAY
BOUNTY AVE
VENTURE WAY
SUNSET WAY
BLOCK 199
BLOCK 1242
BLOCK 1231
BLOCK 1231
BLOCK 1264
BLOCK 1240
BLOCK 1278
BLOCK 1255
BLOCK 1254
BLOCK 1254
BLOCK 1253
BLOCK 1230
BLOCK 134
0.3m RESERVE
BLOCK 146
0.3m RESERVE
BLOCK 145
0.3m RESERVE
BLOCK 144
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BLOCK 143
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BLOCK 138
0.3m RESERVE
BLOCK 137
0.3m RESERVE
PHASE 6
PHASE 7
PHASE 1
PHASE 6
PHASE 1
PHASE 6
PHASE 1
PHASE 6
PHASE 6
PHASE 8
PHASE 6
PHASE 8
PHASE 8
PHASE 9
PHASE 8
PHASE 9
PHASE 9
EXISTING BARRICADE AND SIGN TO BE REMOVED
EXISTING BARRICADE AND SIGN TO BE REMOVED
PROP WATERMAIN TO CONNECT TO EXISTING BLOW OFF
CONNECT TO EX MH WITH KOR-N-SEAL BOOT
PROP STORM TO CONNECT TO EX MH
REMOVE PLUG AND CONNECT TO EXISTING
EXISTING BARRICADE AND SIGN TO BE REMOVED
PROP WATERMAIN TO CONNECT TO EXISTING BLOW OFF
END WATERMAIN WITH PLUG AND THRUST BLOCK FOR FUTURE EXTENSION
DEAD END BARRICADE AND SIGN AS PER OPSD 912.532
REQUIRED TRENCHING BEYOND LIMIT OF ROAD CONSTRUCTION
END WATERMAIN WITH PLUG AND THRUST BLOCK FOR FUTURE EXTENSION
300x300x1500 TEE
14.0m-200mmØ SAN STUB @ 0.50% TO BE PLUGGED FOR FUT EXTENSION INV 177.05
12.0m-375mmØ STM STUB @ 0.35% TO BE PLUGGED FOR FUT EXTENSION INV 178.96
13.5m-200mmØ SAN STUB @ 0.40% TO BE PLUGGED FOR FUT EXTENSION INV 176.16
10.5m-600mmØ STM STUB @ 0.40% TO BE PLUGGED FOR FUT EXTENSION INV 178.05
END WATERMAIN WITH PLUG AND THRUST BLOCK FOR FUTURE EXTENSION
300 TO 150Ø REDUCER
300Ø CROSS
300 TO 200Ø REDUCER
6.0m-200Ø WM STUB FOR FUTURE CONNECTION
1500 TEE
150x150x1500 TEE
1500 BEND
11.25° BEND
22.5° BEND
45° BEND
90° BEND
1500 WM
1200 WM
300Ø WM
200Ø WM
1.5m CONC SIDEWALK
1.5m WIDE CONC SIDEWALK
TRANS
SC PED
DLS
EX SWALE
FUT 11.25° BEND
FUT 1500 WM
FUT 3000 WM
FUT 1500 TEE
FUT 1500 BEND
FUT 3000 STM
FUT 1500 STM
FUT 1200 STM
FUT 1200 SAN
FUT 1500 SAN
FUT 3000 SAN
FUT 1200 WM
FUT 1500 WM
FUT 3000 WM
EX 1500 STM
EX 1500 SAN
EX 1500 WM
EX 1200 WM
EX 900 WM
EX 600 WM
EX CONC S/W
EX 1200 STM
EX 900 STM
EX 600 STM
EX 1200 SAN
EX 900 SAN
EX 600 SAN
EX 1200 CSP
EX 900 CSP
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EX 1500 CSP
EX 1500 CSP
EX 1500 CSP

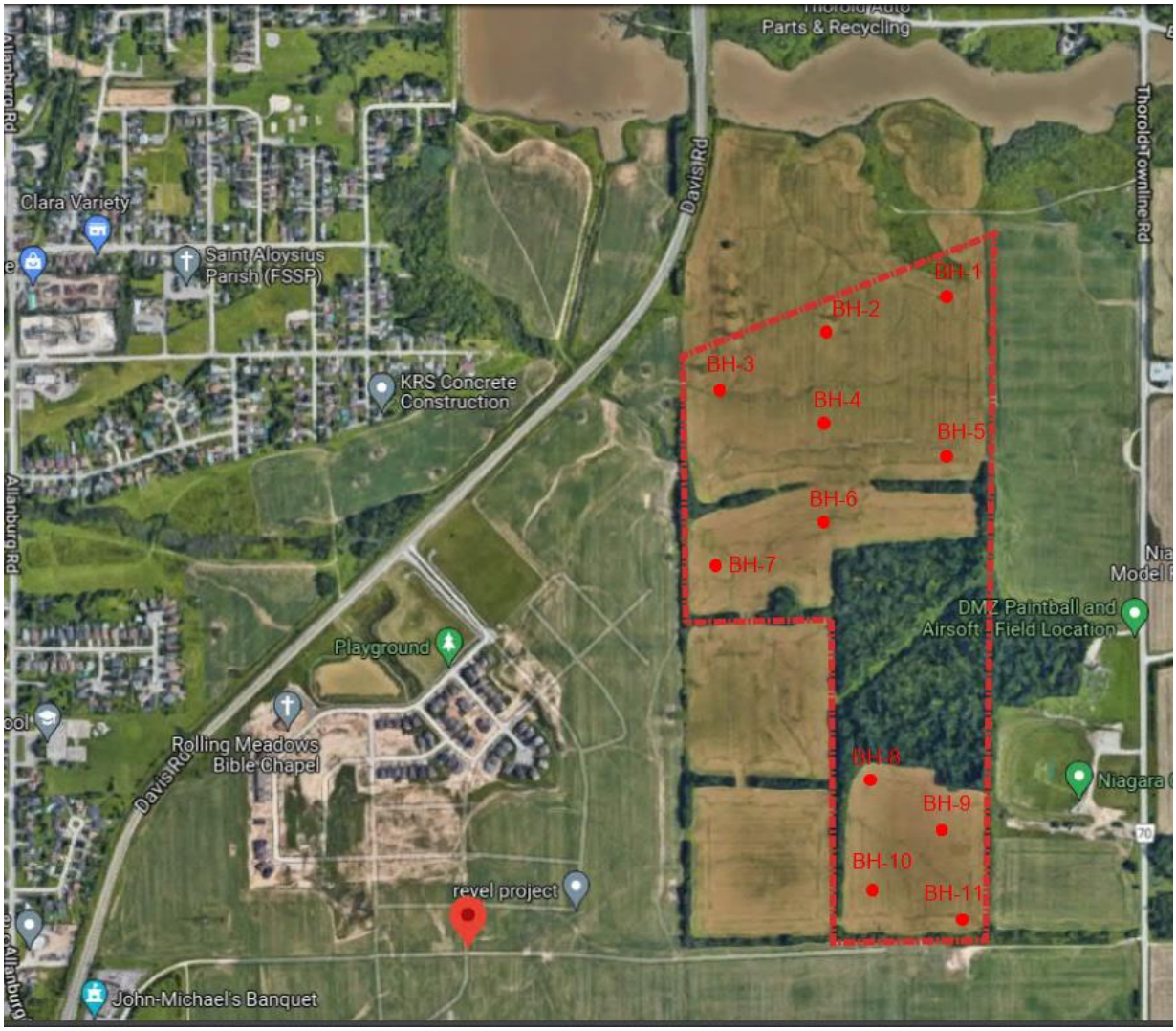
Appendix F SOIL REPORT

Geotechnical Assessment Report

Thorold Townline Road, On

Dated January 25, 2022

ENGINEERING CONSULTING SERVICES – Geotechnical Assessment Report Thorold Townline Road, Thorold, ON



Project No.: CCO-222884-00

Prepared for:

1000010896 Ontario Limited
15064 Yonge Street, 3rd Floor
Aurora, ON
ON L4G 1M2

McIntosh Perry Consulting Engineers Ltd.
6240 Highway 7, Suite 200,
Woodbridge, ON, L4H 4G3

January 25, 2022

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McINTOSH PERRY

January 25, 2022

1000010896 Ontario Limited
15064 Yonge Street, 3rd Floor
Aurora, ON
ON L4G 1M2

Attention: Mr. Laiq Siddiqui, President & CEO

Re: Preliminary Geotechnical Assessment Report
Parcel 2-Meadows Secondary Plan Area, Thorold, Ontario

1.0 INTRODUCTION

McIntosh Perry Consulting Engineers Ltd. (MPCE) was retained by 1000010896 Ontario Limited to carry out a preliminary geotechnical assessment for potential purchase of a site (Parcel 2-Meadows Secondary Plan Area), within the greater boundaries of Beaverdams Road (North), Thorold Townline Road (East), Davis Road (West) and Upper's Ln (South) ("Site").

Authorization to proceed with the geotechnical assessment was provided by Mr. Laiq Siddiqui of 1000010896 Ontario Limited on October 27th, 2021.

The purpose of the geotechnical investigation was to determine the subsurface conditions and groundwater observations at the site by means of boreholes, field, and laboratory tests. Based on the information obtained, the geotechnical characteristics of the subsurface soils are to be estimated, and site conditions described. Based on this understanding of the ground characteristics, it was required to provide a general geotechnical assessment as to the potential feasibility of the site for low-rise residential development. The potential feasibility was focussed on the following issues from a geotechnical standpoint:

- General geotechnical assessment
- Foundation load bearing
- Excavatability
- Surface drainage
- Open-cut excavation stability
- Temporary shoring
- Pavement Structures
- Buried utilities and service trenches
- Re-use of excavated material

The fieldwork and geotechnical analyses of this investigation were completed in general accordance with MPCE Quote No. PCO-222884-00, dated October 27th, 2021.

2.0 BACKGROUND INFORMATION

2.1 Geological Setting

According to the geological maps, the site is in the general physiographic region known as the Haldimand clay Plain. Heavy-textured clayey soils comprise the upper zones of the overburden. According to the surficial geology map of Southern Ontario, the site locale is indicated as comprising fine textured glaciolacustrine deposits.

According to the Ontario Geotechnical Borehole Database, underlying the clay deposit, occasional, sand/silt with boulders are also reported in the general area. The bedrock is generally indicated to be shallow.

Based on a vicinity MTO foundation report (Geocres 57-F-248C: CNR Overpass, Allanburg) the interception of a lacustrine clay deposit and, with depth, shale fragments, were also reported. No observation of groundwater was reported within about 6 m below ground surface.

McIntosh Perry Limited (MPL), a predecessor of MPCE, carried out a geotechnical investigation in an adjoining site to the west of the subject property (Report No. T1715392GE dated January 5, 2018). Following a veneer of topsoil and thin fill layer, native cohesive deposits were intercepted. Five of the nine boreholes were terminated in less than 5 m depth due to auger refusal, possibly due to inferred bedrock. All boreholes were found to be dry on completion of drilling. All boreholes were advanced to less than 6.5 m depth.

2.2 Site Description

The Site is broadly divided into two Areas, i.e., Area ‘A’ and Area ‘B’. The comparison of elevations between the two areas is not feasible as the two areas are tied to different benchmarks, each assumed to be at 100 m elevation (See Appendix for the location of the benchmarks). A Google imagery of the site is shown on Fig. 2.1. It is in a locality of newly developing residential neighbourhood east of Davis Road. In the past, the subject property is likely to have been under farming.

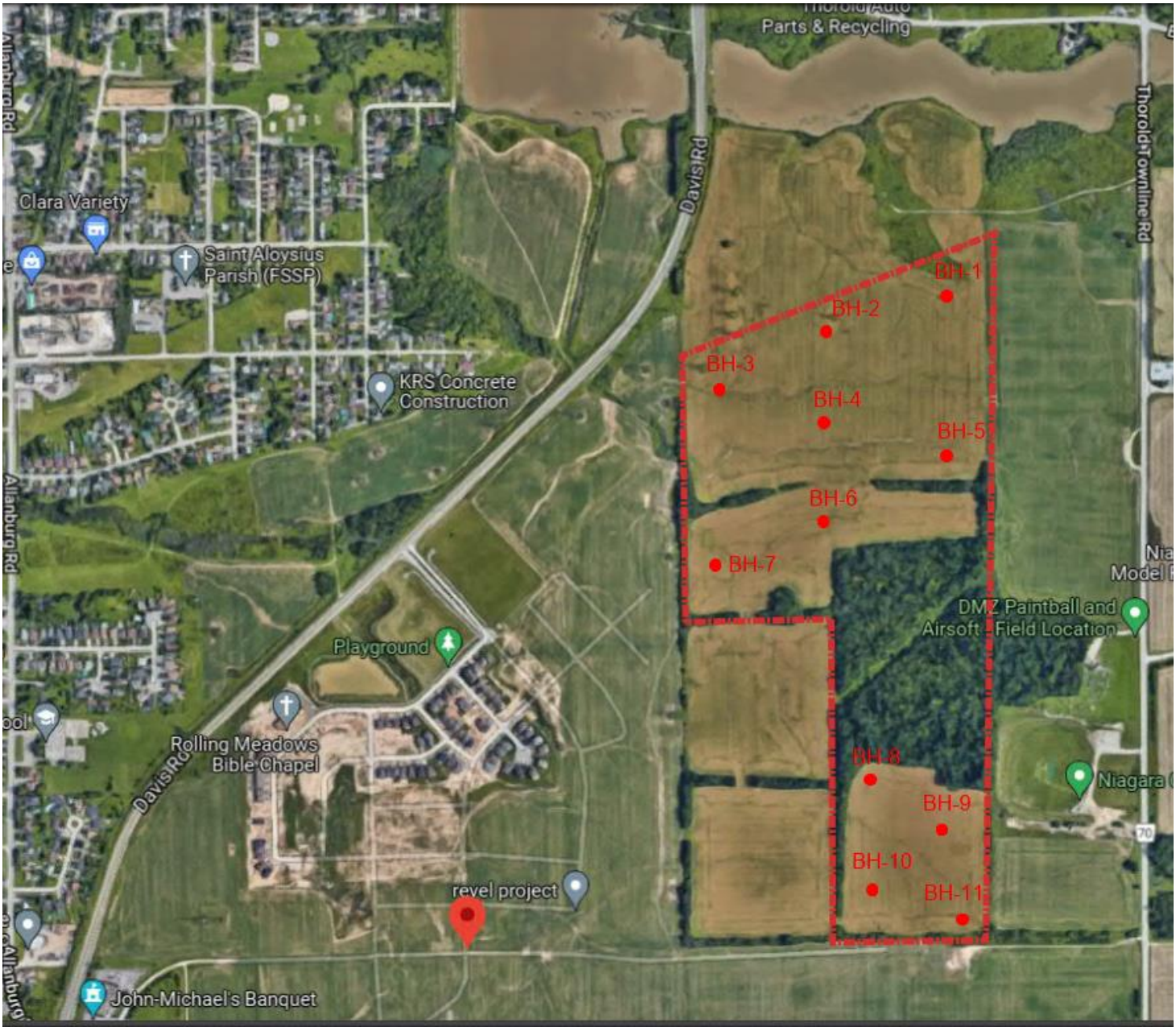


Fig. 2.1 Satellite Imagery of the Subject Site (the site boundary is shown very approximately within the dotted red perimeter)

3.0 FIELD AND LABORATORY INVESTIGATIONS

3.1 Field Investigation

Table 3-1 shows the details of the field investigation summary (see Borehole Location Plan in Appendix for approximate locations of boreholes). Applicable private and public locates were obtained prior to drilling to clear the drilling locations of buried services and utilities. All boreholes were drilled with a track mounted drill rig with solid stem augers.

Table 3-1 – Field Investigation Summary

Area	Number of Boreholes	Borehole Depth Range(m)	Borehole Collar Elevation Range [1] (m)	Period of Drilling	No. of Monitoring Wells
A	7 (BH-1A to BH-7A)	4.9 to 6.6	99.4 to 97.1	Dec 9 to Dec 10, 2021	Nil
B	4 (BH-8B to BH-11B)	3.5 to 6.6	102.1 to 100.6	Dec 9, 2021	Nil

Notes: 1 - The surface elevations at the borehole locations were surveyed by MP staff and were referenced to locality geodetic benchmarks, one for Area A and another for Area B, each with its own datum at 100 m. All boreholes were backfilled with bentonite/cuttings upon completion.

The subsurface strata were sampled at regular intervals of depth using a split-spoon sampler, following the procedure as detailed in the ASTM-D1586 for the Standard Penetration Test. SPT 'N' blow counts were recorded as per the subject ASTM procedure to obtain an indication of the compactness condition or the consistency of the sampled soil material. The SPT 'N' values thus obtained are indicated on the Record of Borehole Sheets (Refer to Appendix A). Where the consistency of the SPT split-spoon samples of a cohesive nature allowed, pocket penetrometer readings were taken, which at best approximate indices of undrained shear strength.

The groundwater level was measured in each borehole upon completion of drilling and all boreholes were found to be dry. No groundwater monitoring wells were installed.

The fieldwork was carried out under the full-time supervision of MP technical staff who directed the exploration and sampling operation, logged borehole data, and took custody of the soil samples retrieved for subsequent laboratory identification and testing. Table 3-2 presents a summary of the borehole details of the MP geotechnical investigation program.

Table 3-2 - Summary of Borehole Details (Elevations of Areas 'A' and 'B' are tied to different datums)

Area	Borehole No.	Borehole Depth (m)	Borehole Collar Elevation (m)
A	BH-1A	4.9	98.6
A	BH-2A	5.5	99.4
A	BH-3A	6.6	99.2
A	BH-4A	5.0	98.4
A	BH-5A	5.3	98.8
A	BH-6A	6.6	98.8
A	BH-7A	6.6	97.1
B	BH-8B	4.4	100.6
B	BH-9B	3.5	100.7
B	BH-10B	5.6	101.2
B	BH-11B	6.6	102.1

3.2 Laboratory Investigations

All soil samples were taken to our accredited Toronto laboratory for final visual assessment, classification, and testing. Samples were visually examined and classified in general accordance with the Unified Soil Classification System, and Canadian Foundation Engineering Manual (CFEM).

A routine laboratory testing program consisting of natural water content, grain size distribution analysis, hydrometer analysis and Atterberg Limits were carried out on selected representative soil samples. Soil descriptions and test results are documented on the borehole records, (see Appendix A, attached to this report).

The soil samples recovered during the investigation will be stored in our laboratory for a period of 30 days following the submission of the final geotechnical report, after which they will be discarded unless further instructions are received.

4.0 SUBSURFACE CONDITIONS

4.1 Overview

The overview is based on the findings of the boreholes advanced on the subject site and the findings of the laboratory investigations. The general stratigraphy within the depths investigated was topsoil underlain by native deposits. All the boreholes were terminated in a native cohesive deposit except BH 11B which was terminated in a silty sand/sandy silt

deposit underlying the native cohesive deposit. Within Area 'A', the borehole ground elevations ranged from 99.4 m to 97.1 m and the corresponding data for Area 'B' ranged from 102.1 m to 100.6 m. The borehole depths ranged from 4.9 m to 6.6 m in Area 'A' and from 3.5 m to 6.6 m in Area 'B'.

The cohesive deposit intercepted in all the boreholes, underlying topsoil, was found to be of clayey silt lithology. Based on the SPT blow counts, this deposit was found to be typically stiff or better within the depths investigated. The silty sand/sandy silt deposit predominantly intercepted in BH 11B underlying the cohesive deposit was found to be of dense/very dense compactness. Interpretive observations on these deposits will be addressed in Section 5.

Five of the eleven boreholes (both from Area 'A' and Area 'B') were terminated on auger and spoon refusal prematurely.

All boreholes were found to be dry on termination of the boreholes. However, change of groundwater conditions cannot be discounted due to extreme weather events and/or due to seasonal effects or with longer exposure of excavations.

Unless otherwise mentioned all SPT 'N' results quoted are for spoon penetrations of 300 mm as per the subject ASTM. Note should be taken of the different datums as discussed in Section 2.2.

4.2 Topsoil

The veneer of topsoil found ranged in thickness from 50 mm to 200 mm and was intercepted in all the boreholes. It should be noted that the intercepted topsoil thicknesses are location specific and could vary across the site and therefore should not be relied upon for quantity estimation.

4.3 Native Deposits

The explored thickness of the native deposits ranged from 4.8 m to 6.6 m in Area 'A' and from 3.4 m to 6.5 m in Area 'B', on termination of the boreholes.

Two grain size analysis tests in the native deposits gave the following grain size distributions shown in Table 4-1. The results of four Atterberg Limits tests from the deposit gave the following results shown in Table 4-2.

Table 4-1- Grain Size Distribution Summary – Native Deposits

Borehole No. / Sample No.	Size Fractions (%)					Moisture Content (%)
	Gravel	Sand	Silt	Clay	Fines	
BH 6A/ SS 1	0	12.7	30.0	57.3	NA	22.1
BH 11B / SS 4	5.8	36.7	NA	NA	57.5	8.3
BH 3A / SS 6	NA	NA	NA	NA	NA	33.6

Notes: NA – not applicable

As mentioned earlier, the dominant deposit intercepted is the cohesive deposit. BH 6A/SS1 and BH3A/SS6 in Table 4-1 are indicative of this cohesive deposit. These results, in conjunction with the Atterberg Limits results in Table 4-2, both indicate the tested specimens of this deposit to be clayey silt. The natural moisture contents reported for this cohesive deposit (2 results from Table 4-1 and 4 results from Table 4-2) indicate a measured moisture range of 19.3% to 33.6%.

Table 4-2 -Atterberg Limits Test Results – Cohesive Native Deposit

Borehole No./ Sample No.	Liquid Limit (Ll%)	Plastic Limit (PL%)	Plasticity Index (PI)	Moisture Content (%)
BH 4A/SS4	29	23	6	19.3
BH 6A/SS6	30	24	6	25
BH 9B/SS3	32	25	7	20.5
BH 10B/SS6	23	19	4	22.8

The SPT 'N' blow counts indicate the cohesive deposit to be typically stronger than of stiff consistency within the explored depths but the spatial distribution of SPT 'N' results with depth indicates an initial phase of increase of SPT 'N' blow count which later began to decrease with depth. The adjoining areas, Area 'A' and Area 'B' both show a similar trend (See Figs. 5.1 and 5.2).

The grain size distribution result for BH11B/SS4 shown in Table 4.1, is indicative of a fine-grained soil (the fines percentage is more than 50%). Based on the visual and tactile observations of all the retrieved SPT spoons from this fine-grained deposit indicate it to be a sandy silt/silty sand. This is further reflected by the low moisture content measurement of 8.3% reported in Table 4-1.

The SPT 'N' blow counts indicate a dense to a very dense state of compactness.

4.4 Groundwater Level Observations

No monitoring wells were installed in this investigation. At the completion of drilling of each borehole, no groundwater was observed.

5.0 GEOTECHNICAL ASSESSMENT

5.1 General

Given the objective of the client was to obtain a preliminary geotechnical assessment of the site for potential purchase, availability of specific development plans showing proposed locations would be too premature to expect at this stage. In keeping with the objective, this preliminary geotechnical assessment was of necessity scoped out comprising a limited number of widely spaced boreholes. Therefore, the ensuing preliminary geotechnical recommendations made would be very broad based. Once the proposed developments are finalized, additional targeted geotechnical investigation programs must be undertaken to develop structure location specific geotechnical recommendations.

Note should be taken of the different datums as discussed in Section 2.2.

5.2 Frost Depth and Frost Susceptibility

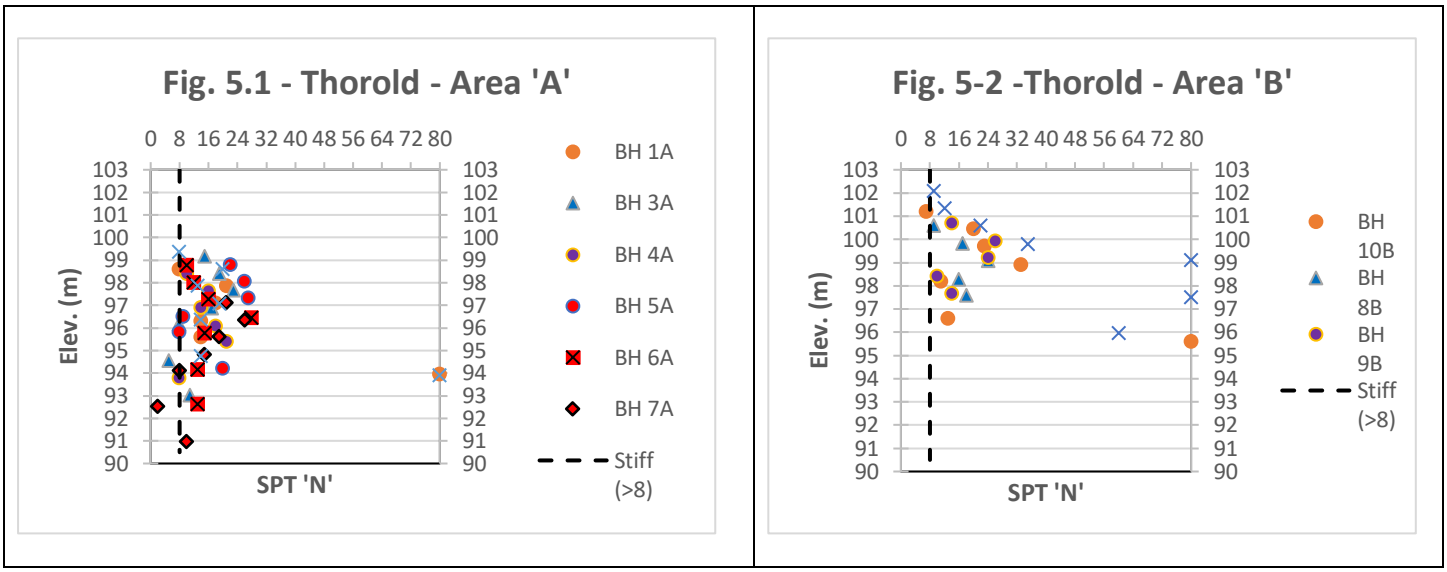
Based on OPSD 3090.101, the Frost Penetration Depth for the project area at Thorold, Ontario, is 1.1 m. Therefore, all foundation elements that are sensitive to movements (i.e., heave and subsequent post-thaw settlement) located in unheated areas should be provided with a minimum of 1.1 metres of non-frost susceptible earth cover, or equivalent thermal insulation, for frost protection. Based on the MTO Frost Classification Criteria, and the grain size distribution summary in Table 4-1 of this report, the surficial deposit is classified to be of “LOW” frost susceptibility, based on limited results.

5.3 Seismic Site Class Classification

Based on the borehole information and according to Table 4.1.8.4.A of the Building Code, the subject site can be classified as Class ‘D’ for seismic site response. However, by undertaking in-situ seismic shear wave velocity measurements, there is a potential to upgrade the seismic site class classification.

5.4 Overview of Subsoil Characterization for Geotechnical Design and Construction

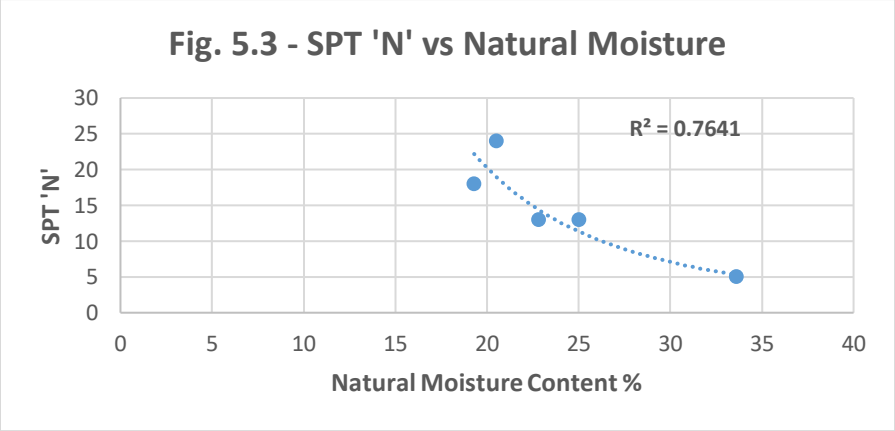
Based on the field and laboratory results discussed in Section 4 of this report, the subsurface conditions identified in this report are generally comparable with previous reported geotechnical findings for the general area which includes the subject site, and which have been briefly discussed in Section 2.1 of this report.



Based on Figures 5-1 and 5-2 which show the SPT 'N' blow counts with depth, these are indicative of increasing stiffer to higher consistency subsurface conditions which peak at a certain depth below the ground surface but then begin to show a decreasing trend of strength with deeper explored depths. Based on the reported local geology, these deposits are likely to be varved, i.e., with possible interbedding with water bearing silt seams, which will require careful attention to foundation construction detail. These issues are broadly discussed in the ensuing sections.

5.5 Potential Moisture Sensitivity

The clayey silt deposit has shown some properties such as low values of Plasticity Index (PI) (4% to 7% based on 4 test results), and relatively high moisture contents (19.3% to 33.6% based on 6 test results). These results indicate the potential vulnerability of this deposit to construction disturbance, as seen in Fig. 5.3, as an indicative trend.



5.6 Foundation Load Bearing Considerations

These subsoil profiles indicate more than adequate foundation bearing strengths that are competent to carry low-rise residential development foundation loads. Based on the SPT profiles shown on Figs. 5.1 and 5.2, shallow foundations where the underside footing elevation is just below the frost depth, i.e., 1.1 m can have factored ULS resistance of 300 kPa and SLS of 200 kPa for total settlements not exceeding 25 mm and differential settlements not exceeding 19 mm.

In view of the decreasing shear strength with depth shown on Figs 5.1 and 5.2, foundation bearing recommendations for basement foundations should be based on a site-specific basis. However, assuming a conventional basement depth below finished grade to be 2.5 m approximately, a factored ULS of 180 kPa and SLS of 125 kPa can be used as a rough guide, subject to site-specific confirmation. There is potential for these recommendations to be increased based on site specific investigations.

The general area is known to have shallow bedrock conditions based on the findings of Section 2.1 of the report and the inferred findings of this investigation wherein auger refusal was observed in several boreholes forcing premature termination of borehole advancement. However, no weathered shale was positively intercepted in the investigation. Once this competent shale conditions can be positively confirmed during detailed design, this can open-up significant promise for potential use of *shallow* caissons to carry significantly higher foundation loads. Factored SLS pressures up to 5 MPa can be carried by such caissons founded on sound shale.

5.7 Excavatability of Subsoils

Lacustrine clay deposits generally being sorted sediments, are generally not widely known to have significant volumes of cobbles and boulders. The dense sandy silt/silty sand intercepted in a predominant measure in BH11B could likely contain cobbles and boulders, although not positively intercepted. The program of boreholes undertaken did not intercept fill materials, although the presence of such materials cannot be ruled out over the site. Any presence of uncontrolled fill present could potentially contain cobbles and boulders and deleterious material. It is recommended that these issues should be addressed in the contract documentation for any proposed excavations.

5.8 Surface Drainage

In view of the thick surficial clayey silt deposit underlying the veneer of topsoil, it will result in slow infiltration of precipitation. This would lead to perched water conditions and potential for subgrade softening. Site grading that promotes sound surface runoff management is an important aspect to be addressed.

5.9 Open-Cut Excavation Stability

In view of the high moisture levels recorded for the clayey silt deposit (cohesive deposit), in accordance with the Occupational Health and Safety Act (OHSA) of Ontario, the site overburden soils are classified as OHSA Type 4 soil. For, OHSA Type 4 soil, the recommended slopes for excavation sides are 3H:1V or shallower or should be shored for steeper side slopes. The cohesive deposit could be possibly varved (consisting of interbedded thin sequence of water bearing silt, and clays) and this could imply that short-term stability should not be relied upon as an indicator for longer-term excavation stability and hence extra vigilance should be exercised for prolonged exposure of excavations.

5.10 Temporary Shoring

Temporary shoring design should take into account possible shallow bedrock, and the presence of dense to very dense sandy silt/silty sand with the possibility of intercepting cobbles and boulders in these deposits. The shoring designer should also take cognizance of the fact, of the observed decrease of SPT ‘N’ blow counts with depth, as clearly shown on Figs. 5.1 and 5.2. The shoring system must be designed by a professional engineer experienced in such work and design must comply with but not limited to OPSS.Muni 539 – Temporary Protection Systems.

5.11 Pavement Design Considerations

In the event that asphaltic concrete pavement is used for the parking areas and site access roads constructed on-site, the following are our recommendations:

- Pavement subgrade can consist of the fill materials to be encountered at the Site. Prior to placing the pavement structure, any soft, loose, or unstable soil should be removed, and the subgrade prepared as noted below:

1. Pavement subgrade should be compacted to at least 98% of the SPMDD and proof-rolled with a loaded tandem truck. Areas exhibiting more than 12 mm deflection should have the top 300 mm removed and replaced with approved drier materials.

2. Sub-grade up-fill should also be compacted to at least 98% of the standard Proctor density of the material, at or below the optimum moisture content (OMC) in lifts not exceeding 200 mm in thickness. Compaction of the in-situ soils above the OMC could result in high pore pressures resulting in rolling "waterbed" effects, which can cause damage to the pavement structure. Therefore, any material that has a moisture content higher than 2% of its OMC at this site should be dried out.

- The granular base and subbase layers should be compacted to at least 100% of the SPMDD. In the extreme cases, such as during the wet season, the top 600 mm of the sub-grade may have to be replaced by compacted granular material in order to compensate for the inadequate strength of the wet sub-grade.

- The production and placement of asphaltic concrete and granular materials shall be in accordance with applicable OPSS requirements.

- The asphaltic concrete should be compacted to at least 96% of the Marshall density.

- The required pavement structures for car parking (light duty) and site access roads (heavy duty) are provided in Table 5-1.

Table 5-1: Minimum Pavement Thicknesses

Description	Light Duty	Heavy Duty	Concrete	Materials
Asphaltic Surface Course (HL3)	35 mm	50 mm	-	Hot Mix Asphalt
Asphaltic Base Course (HL8)	50 mm	60 mm	-	Hot Mix Asphalt
Concrete	-	-	200 mm	Portland Cement Concrete
Base Course	150 mm	150 mm	150 mm	19 mm crushed limestone or pit run granular "A"
Sub-base course	200 mm	300 mm	200 mm	50 mm crushed limestone

- The pavement surface and the subgrade should be graded to direct runoff water away from the roadway and associated infrastructure.

Furthermore, we recommend the installation of sub-drains along the perimeter of the pavement and throughout low areas to prevent infiltration and accumulation of surface runoff water in the pavement structure.

Based on the potential moisture sensitivity issues discussed in Section 5.5, it would be prudent to invest in good pavement drainage measures to protect pavement subgrades from vulnerability to moisture.

5.12 Buried Utilities and Service Trenches

Due to the possible varved nature of the deposit, the issues of moisture sensitivity discussed in Section 5.5 and the unreliability of unsupported stand-up capability for long duration of the cohesive deposit, are important considerations in the design of temporary excavation support. Therefore, the use of trench boxes as temporary excavation support systems, for excavations as deep as gravity run sanitary sewer invert levels, should be carefully evaluated by the shoring designer, taking into account the above adverse issues.

5.13 Re-Use of Excavated Material

Excavated cohesive material will not be suitable as structural backfill. For use as recompacted earthfill, it will be necessary to address the high in-situ moisture levels and resulting difficulties for compaction, e.g., by discing and subjecting to aeration, to achieve required minimum engineered compaction levels.

5.14 Construction Considerations

All foundation bearing surfaces and trench bases should be placed with lean concrete mud mats soon after being inspected and approved to prevent deterioration from the elements and disturbance.

Where OPSS 1010 Granular Type 'A' or Type 'B' materials are used to enhance foundation support and/or act as drainage media, in order to prevent contamination of such media from the underlying moisture sensitive native deposits, it is recommended that a suitable geotextile be placed at the interface between the granular and the native. OPSS 1860 Class II Non-Woven geotextiles are recommended for this purpose.

The possibly varved nature of the clayey silt deposit could require benching, slope flattening, and de-pressurization of the moisture laden cohesive deposits for excavation stability. These are some options that need to be considered by the shoring designer in the mitigation of potential instability risks associated with excavations. Seepage from cut faces can be expected and such seepage should be managed by suitably filtered and strategically placed sumps. Need for some positive dewatering cannot be ruled out.

5.15 General Considerations

At the time of writing this report, no detailed design was available. Hence the recommendations given in this report are of a very broad nature, and therefore must be confirmed based on additional foundation investigations on a site-specific basis for proposed constructions in the future.

6.0 CLOSURE

We trust that the following information is sufficient for your needs. We will be pleased to discuss the salient findings of this report with you, should you wish. If you require our further services in this regard, please do not hesitate to contact our office.

Yours truly,

McIntosh Perry Consulting Engineers Ltd.







Vasantha Wijeyakulasuriya, M.Eng., P.Eng.

Senior Technical Director, Geotechnical

Zeyad Buni, P.Eng.

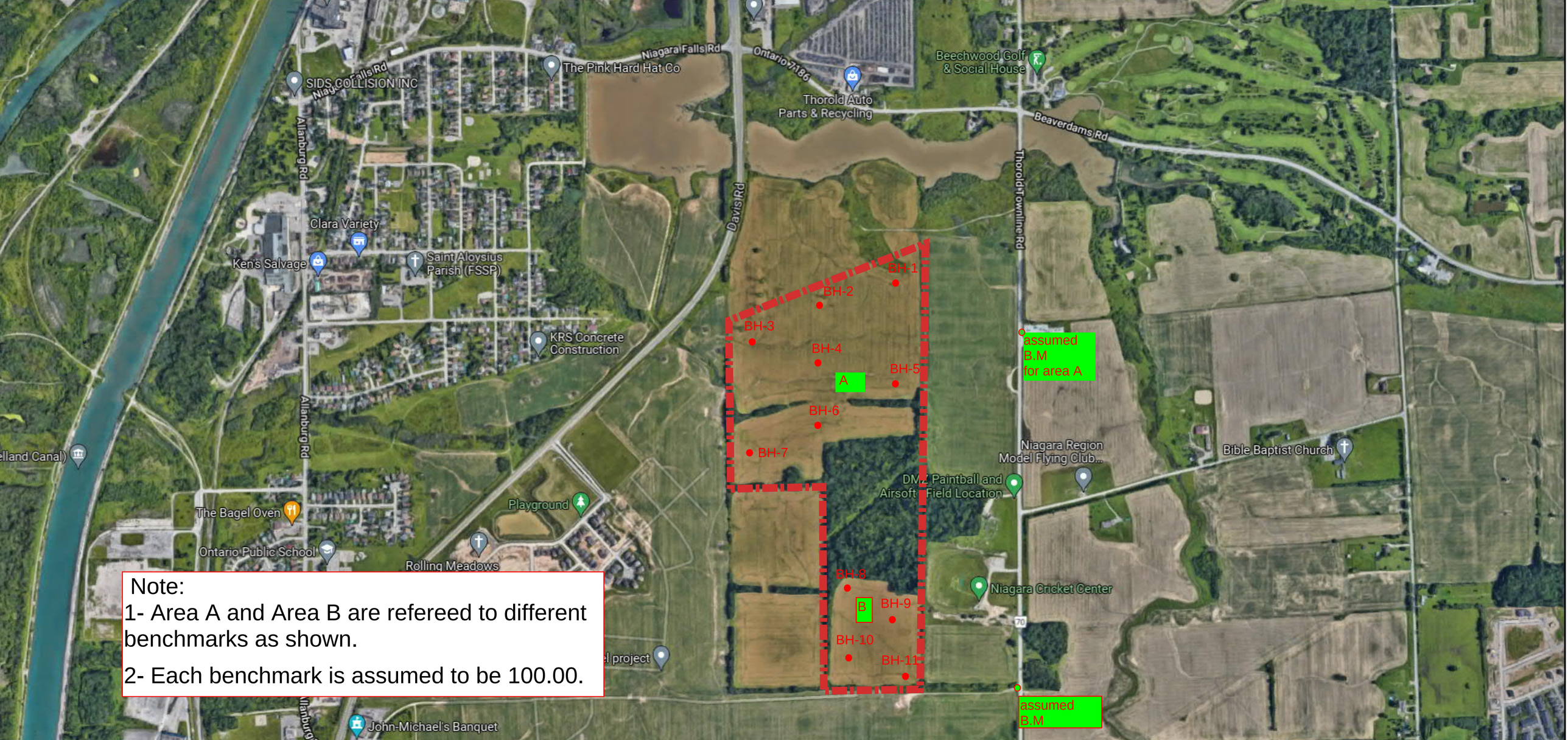
Practice Area Lead, Geotechnical



Esam Deif, P.Eng.

Vice President, Geotechnical Services

APPENDIX A



Note:

1- Area A and Area B are refereed to different benchmarks as shown.

2- Each benchmark is assumed to be 100.00.

McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-01-A
DATE: Dec. 09, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description
98.6 / 0.0			
98.5 / 0.1	1		130-mm Topsoil mixed with silty clay/ clayey silt and vegitation
	2		Firm brown CLAYEY SILT, trace of fine roots, moist Very stiff, some gravel below 0.8m.
	3		Trace of gravel below 1.5m.
	4		Stiff below 2.3m.
	5		
93.7 / 4.9	6		Auger and spoon refusal at 4.9m, stones. End of Borehole

Elevation / Depth (m): 98.0, 97.0, 96.0, 95.0, 94.0 / 0.0, 1.0, 2.0, 3.0, 4.0

SHEAR STRENGTH (kPa)
Pocket Penetrometer ▲ 50 100 150 200
Field Vane Test (kPa) and Sensitivity (S)●s
PENETRATION RESISTANCE □ Blows per 300 mm 20 40 60 80

COMBUSTIBLE VAPOUR READING (ppm) □ 250 500 750
NATURAL MOISTURE CONTENT % (X)
Unit Weight (kN/m³) ◇
w_{PL} ⊢—×—⊣ w_{LL} moisture content 10 20 30

8	221
21	221
18	221
14	147
14	147
80	

GWL | Well Log

REMARKS and Grain Size Distribution (%)
GR SA SI CL

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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-02-A
DATE: Dec. 09, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description
99.4 / 0.0			
99.3 / 0.1	1		50-mm Topsoil mixed with silty clay/ clayey silt and vegitation
	2		Firm brown CLAYEY SILT, trace of gravel, trace of fine roots. Stiff to very stiff below 0.8m.
	3		
	4		
	5		Stiff below 3.0m.
	6		Reddish grey below 4.6m.
	7		Auger and spoon reusal at 5.5 m, stones
93.9 / 5.5			End of Borehole

Elevation / Depth (m)

SHEAR STRENGTH (kPa)
Pocket Penetrometer ▲ 50 100 150 200
Field Vane Test (kPa) and Sensitivity (S)●s
PENETRATION RESISTANCE □ Blows per 300 mm 20 40 60 80

COMBUSTIBLE VAPOUR READING (ppm) □ 250 500 750
NATURAL MOISTURE CONTENT % (X)
Unit Weight (kN/m³) ◇
w_{PL} ⊢×⊣ w_{LL} moisture content 10 20 30

GWL | Well Log | REMARKS and Grain Size Distribution (%) GR SA SI CL

Depth (m)	Elevation	PENETRATION RESISTANCE	Pocket Penetrometer ▲	Field Vane Test □
0.0	99.0	8	123	
1.0	98.0	20	221	
2.0	97.0	13	221	
3.0	96.0	19	172	
4.0	95.0	14	98	
5.0	94.0	14	98	80

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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-03-A
DATE: Dec. 10, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description	Elevation	Depth (m)
99.2 / 0.0					
99.1 / 0.1	1		50-mm Topsoil mixed with silty clay/ clayey silt and vegitation		
	2		Stiff brown CLAYEY SILT, trace of topsoil and fine roots, moist Very stiff below 0.8m.	99.0	0.0
1.0				98.0	1.0
	3				
2.0				97.0	2.0
	4				
3.0	5		Firm below 3.0m.	96.0	3.0
4.0				95.0	4.0
	6		Reddish brown below 4.6m.		
5.0				94.0	5.0
6.0				93.0	6.0
92.6 / 6.6	7		Stiff brown, some stones at 6.1m. End of Borehole		

SHEAR STRENGTH (kPa)
Pocket Penetrometer ▲
50 100 150 200
Field Vane Test (kPa) and Sensitivity (S)●s
PENETRATION RESISTANCE □
Blows per 300 mm
20 40 60 80

COMBUSTIBLE VAPOUR READING (ppm) □
250 500 750
NATURAL MOISTURE CONTENT % (X)
Unit Weight (kN/m³) ◇
w_{PL} ⊢×⊣ w_{LL}
moisture content
10 20 30

Depth (m)	Penetration Resistance (Blows per 300 mm)	Pocket Penetrometer (kPa) ▲	Field Vane Test (kPa)	Combustible Vapour Reading (ppm) □	Natural Moisture Content % (X)
0.0	15	221			
1.0	19	221			
2.0	23	123			
	17	147			
3.0	8	74			
4.0					
5.0	5	25			33.6
6.0	11	74			

GWL | Well Log | REMARKS and Grain Size Distribution (%) GR SA SI CL

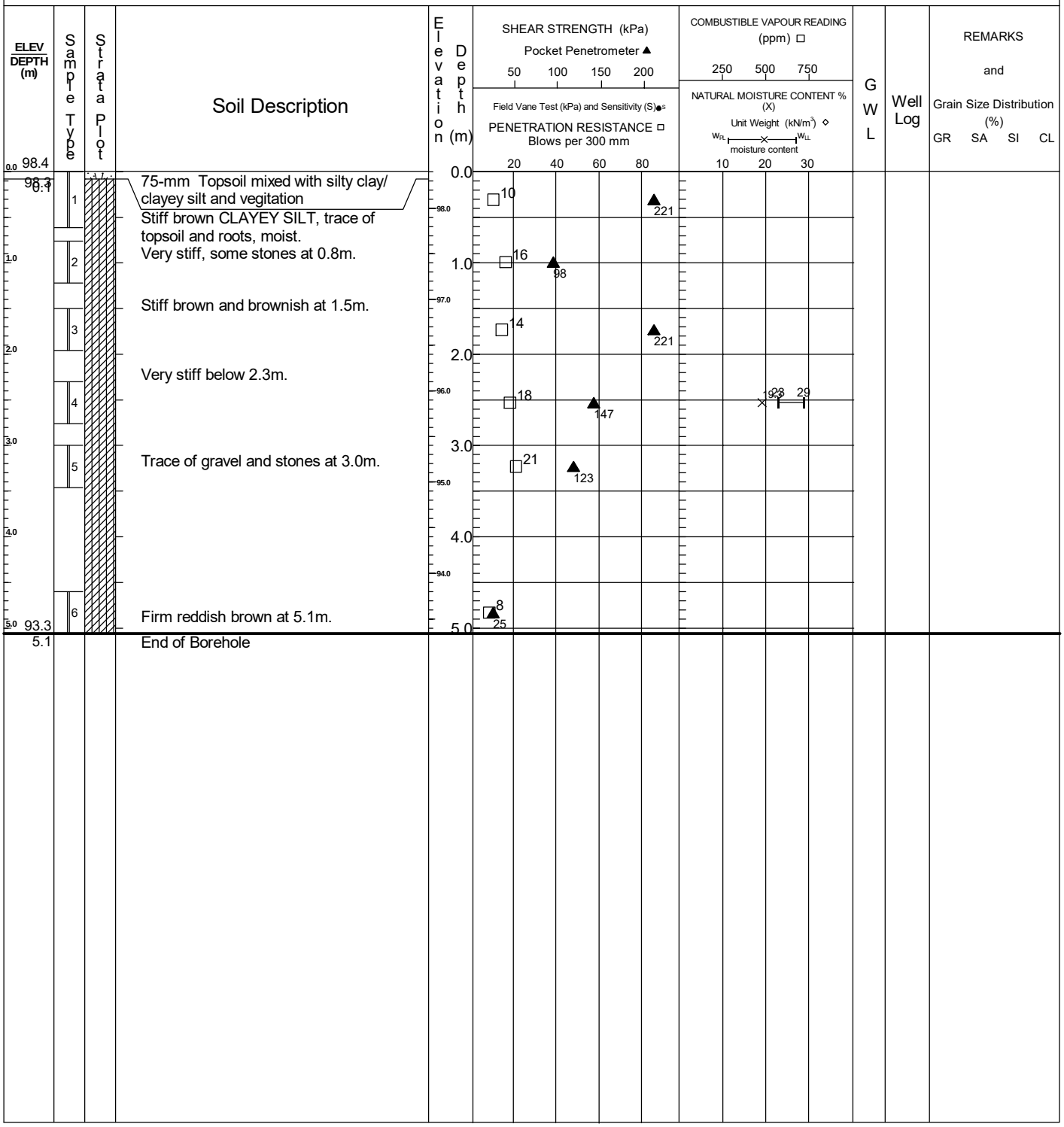
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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-04-A
DATE: Dec. 10, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P



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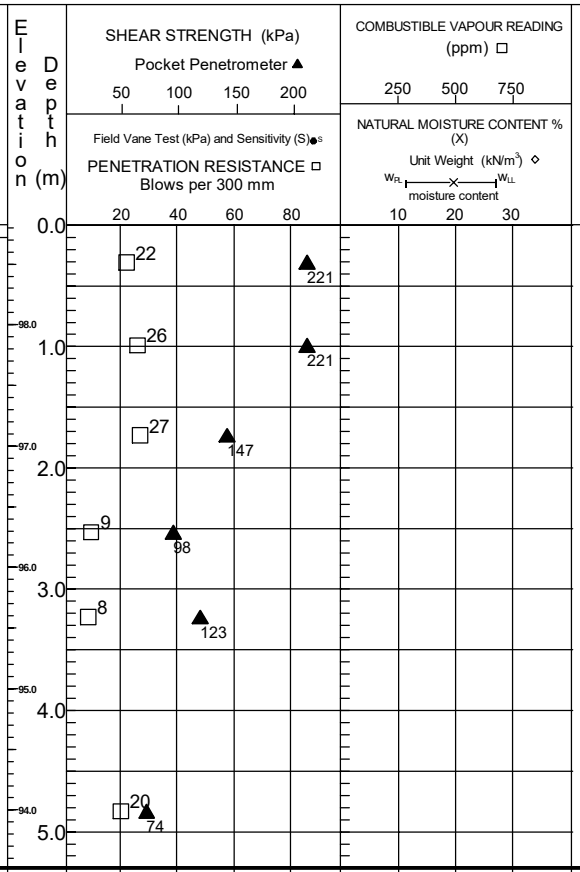
McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-05-A
DATE: Dec. 10, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description
98.8 / 0.0			
98.7 / 0.1	1		100-mm Topsoil mixed with silty clay/ clayey silt and vegitation
	2		Very stiff brown CLAYEY SILT, trace of sand, some gravel, some fine roots, moist
	3		Very stiff, trace of sand at 1.5m.
	4		Stiff at 2.3m.
	5		Firm at 3.0m.
	6		Stiff, reddish brown, trace of sand and stones at 4.6m. Auger and spoon refusal at 5.3m.
93.5 / 5.3			End of Borehole



GWL | Well Log | REMARKS and Grain Size Distribution (%) GR SA SI CL

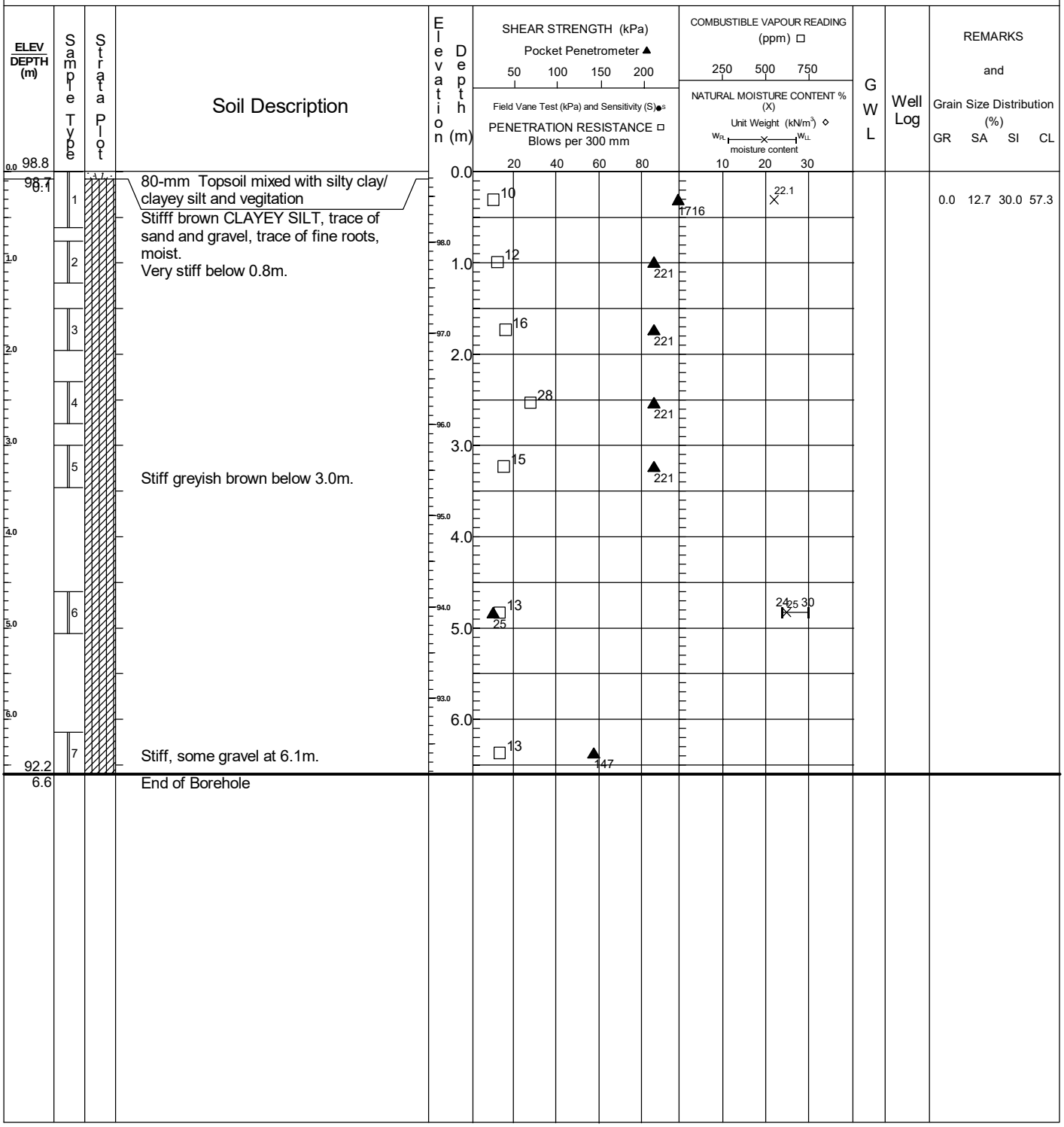
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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-06-A
DATE: Dec. 10, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P



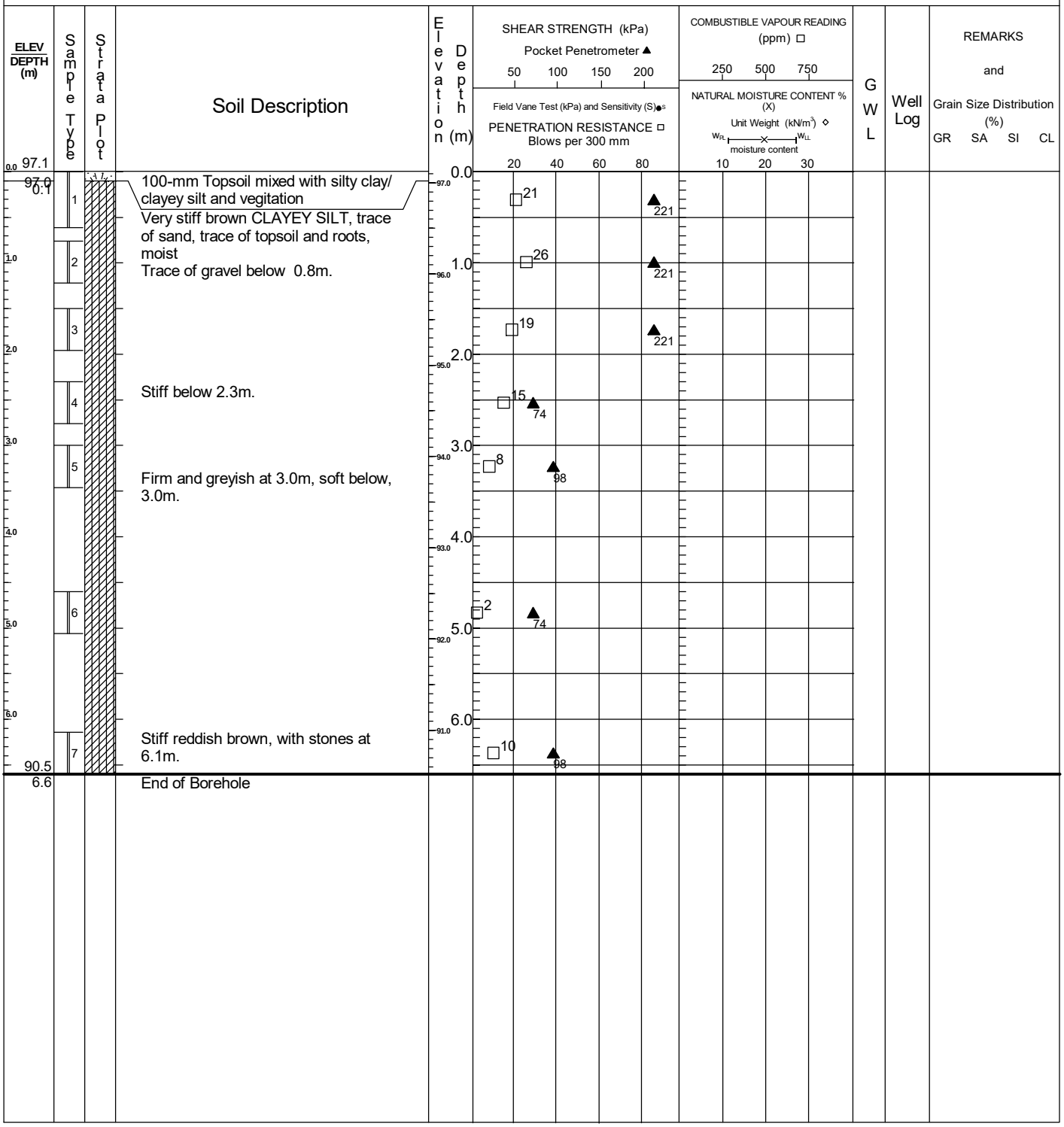
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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-07-A
DATE: Dec. 10, 21
Method: SS
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P



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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-08-B
DATE: Dec. 09, 21
Method:
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description	Elevation	Depth (m)	SHEAR STRENGTH (kPa) Pocket Penetrometer ▲ 50 100 150 200; Field Vane Test (kPa) and Sensitivity (S)●s; PENETRATION RESISTANCE □ Blows per 300 mm 20 40 60 80	COMBUSTIBLE VAPOUR READING (ppm) □ 250 500 750; NATURAL MOISTURE CONTENT % (X); Unit Weight (kN/m³) ◇; w_{PL} moisture content w_{LL} 10 20 30	GWL	Well Log	REMARKS and Grain Size Distribution (%) GR SA SI CL
100.6										
100.4 / 0.2	1		200-mm Topsoil mixed with silty clay/ clayey silt and vegitation		0.0					
			Stiff brown CLAYEY SILT, some gravel, trace of topsoil and roots, moist			9, 74				
	2		Very stiff below 0.8 m, trace of roots at 0.8m.	100.0	1.0	17, 221				
			With sand, trace of gravel below 1.5m.							
	3			99.0	2.0	24, 221				
	4			98.0		16, 221				
			Trace of sand below 3.0m.		3.0	18, 221				
	5			97.0						
			Auger and spoon refusal at 4.4m.		4.0					
96.2 / 4.4	6		End of Borehole							

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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-09-B
DATE: Dec. 09, 21
Method:
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description	Elevation	Depth (m)	SHEAR STRENGTH (kPa) Pocket Penetrometer ▲ 50 100 150 200; Field Vane Test (kPa) and Sensitivity (S)●s; PENETRATION RESISTANCE □ Blows per 300 mm 20 40 60 80	COMBUSTIBLE VAPOUR READING (ppm) □ 250 500 750; NATURAL MOISTURE CONTENT % (X); Unit Weight (kN/m³) ◇; w_{PL} moisture content w_{LL} 10 20 30	GWL	Well Log	REMARKS and Grain Size Distribution (%) GR SA SI CL
100.7										
0.0 / 100.6										
0.1	1		100-mm Topsoil mixed with silty clay/ clayey silt and vegitation		0.0	14 ▲221				
			Stiff to very stiff brown CLAYEY SILT, trace of gravel, moist	100.0						
1.0 / 99.5	2		With some gravel below 0.8m.		1.0	26 49				
1.2 / 99.2			Brown SILTY SAND/ SANDY SILT with clay, moist.							
1.5	3		Very stiff brown SILTY CLAY/ CLAYEY SILT with sand and gravel, moist.	99.0		24	20 25 32			
2.0					2.0					
	4		Stiff below 2.3m.	98.0		10 ▲221				
3.0					3.0					
97.2	5		Auger and spoon refusal at 3.5m.			14 ▲221				
3.5			End of Borehole							

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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-10-B
DATE: Dec. 09, 21
Method:
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description
101.2 / 0.0			
100.4 / 0.8	1		50-mm Topsoil mixed with silty clay/ clayey silt and vegitation
			Firm brown CLAYEY SILT, trace of fine roots, moist
1.0	2		Brown and brownish with some sand, trace of gravel below 0.8m.
	3		Very stiff below 1.5m.
2.0	4		With sand below 2.3m.
3.0	5		Stiff, trace of gravel below 3.0m.
4.0			
5.0	6		Stiff, reddish brown at 4.6m.
95.6 / 5.6	7		End of Borehole

Elevation / Depth (m)

SHEAR STRENGTH (kPa)
Pocket Penetrometer ▲ 50 100 150 200
Field Vane Test (kPa) and Sensitivity (S)●s
PENETRATION RESISTANCE □ Blows per 300 mm 20 40 60 80

COMBUSTIBLE VAPOUR READING (ppm) □ 250 500 750
NATURAL MOISTURE CONTENT % (X)
Unit Weight (kN/m³) ◇
w_{PL} ⊢—×—⊣ w_{LL} moisture content 10 20 30

GWL | Well Log | REMARKS and Grain Size Distribution (%) GR SA SI CL

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McINTOSH PERRY

PROJECT NO: CCO-222884-00
PROJECT: Geotechnical Investigation
LOCATION: Thorold Townline Rd.
Compiled By:Magdy Youssef
Checked By:
Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-11-B
DATE: Dec. 09, 21
Method:
Diameter (mm):
Easting:
Northing:

Cored Sample or Auger Sample
51 mm O.D. Split Spoon
51 mm I.D. Shelby tube
51 mm dia. Cone Pushed P

ELEV / DEPTH (m)	Sample Type	Strata Plot	Soil Description	Elevation	Depth (m)
102.1 / 0.0				102.0	0.0
102.0 / 0.1	1		100-mm Topsoil mixed with silty clay/ clayey silt and vegitation		
	2		Stiff brown CLAYEY SILT, moist Very stiff, reddish, trace of gravel, some stones below 0.8m.	101.0	1.0
	3			100.0	2.0
99.8 / 2.3	4		Dense reddish SILTY SAND/ SANDY SILT, some gravel, moist.	99.0	3.0
	5			98.0	4.0
	6		Very dense below 4.8m.	97.0	5.0
	7		Trace of clay at 6.1m.	96.0	6.0
95.5 / 6.6			End of Borehole		

SHEAR STRENGTH (kPa)
Pocket Penetrometer ▲
50 100 150 200
Field Vane Test (kPa) and Sensitivity (S)●s
PENETRATION RESISTANCE □
Blows per 300 mm
20 40 60 80

COMBUSTIBLE VAPOUR READING (ppm) □
250 500 750
NATURAL MOISTURE CONTENT % (X)
Unit Weight (kN/m³) ◇
w_{PL} — moisture content — w_{LL}
10 20 30

SHEAR STRENGTH (kPa)	PENETRATION RESISTANCE (Blows per 300 mm)	COMBUSTIBLE VAPOUR READING (ppm)	NATURAL MOISTURE CONTENT % (X)
	9		
147			
	12		
221			
	22		
221			
	35		10.1
	80		
	80		
98	60		

GWL | Well Log

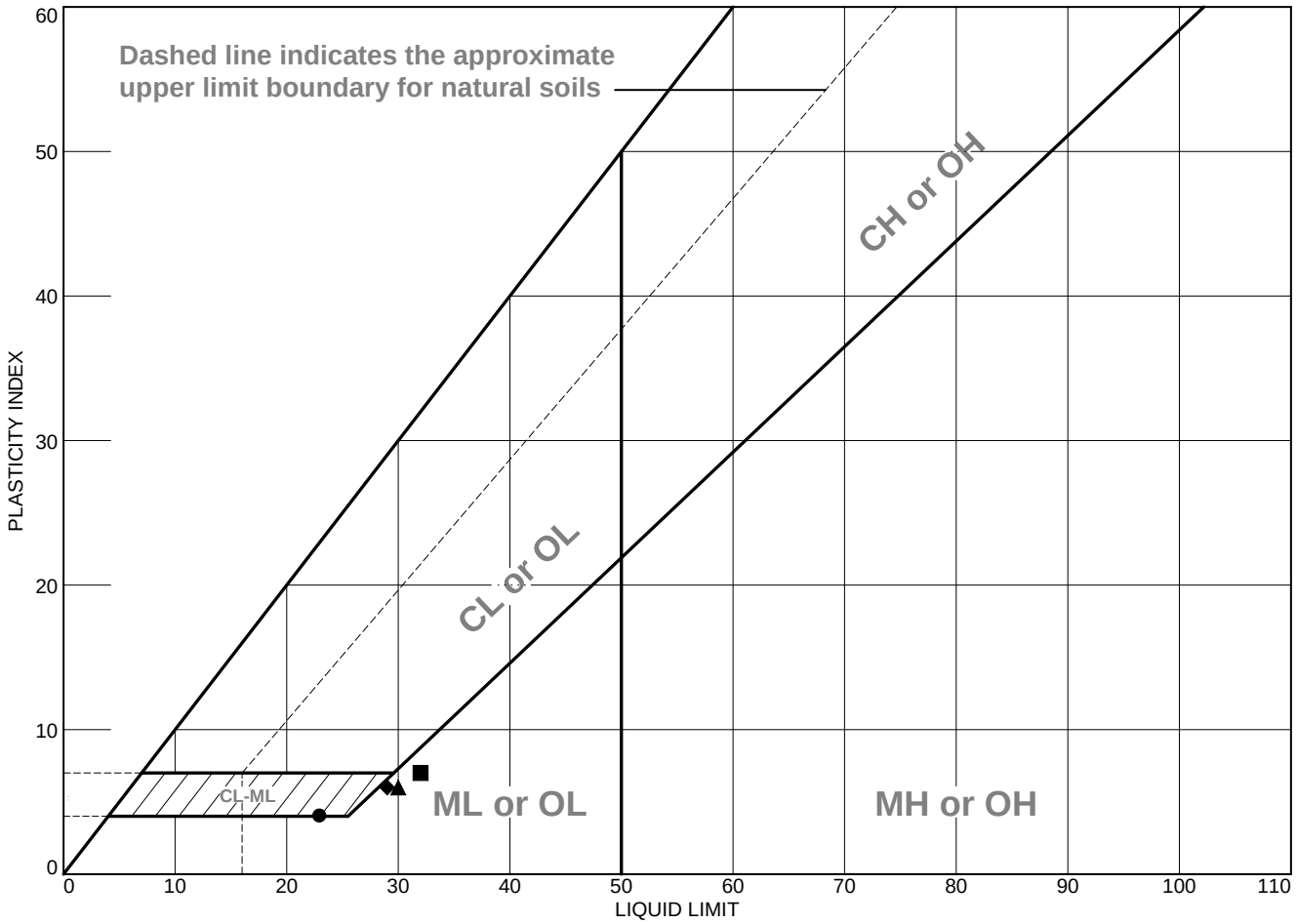
REMARKS and Grain Size Distribution (%)

GR	SA	SI	CL
5.8	36.7	(57.5)	

SOIL THOROLD TOWNLINE RD.GPJ MP_WOODBRIDGE_REVISED_DEC2021.GDT 22/1/21

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Telephone (905) 856-5200 · Fax (905) 695-0221

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Silty Clay / Clayey Silt, trace of sand and top soil	23	19	4			
■	Brown Silty Clay / Clayey Silt	32	25	7			
▲	Brown Silty Clay / Clayey Silt, trace of sand	30	24	6			
◆	Brown Silty Clay / Clayey Silt, trace of sand	29	23	6			

Project No. 222884-00 **Client:** Kettlebeck Group

Project: Upper Lane, Thorold, ON

●**Sample Number:** BH 10 SS6
■**Sample Number:** BH 9 SS3
▲**Sample Number:** BH 6 SS6
◆**Sample Number:** BH 4 SS4

Remarks:

McIntosh Perry

Vaughan, Ontario

Figure

McINTOSH PERRY

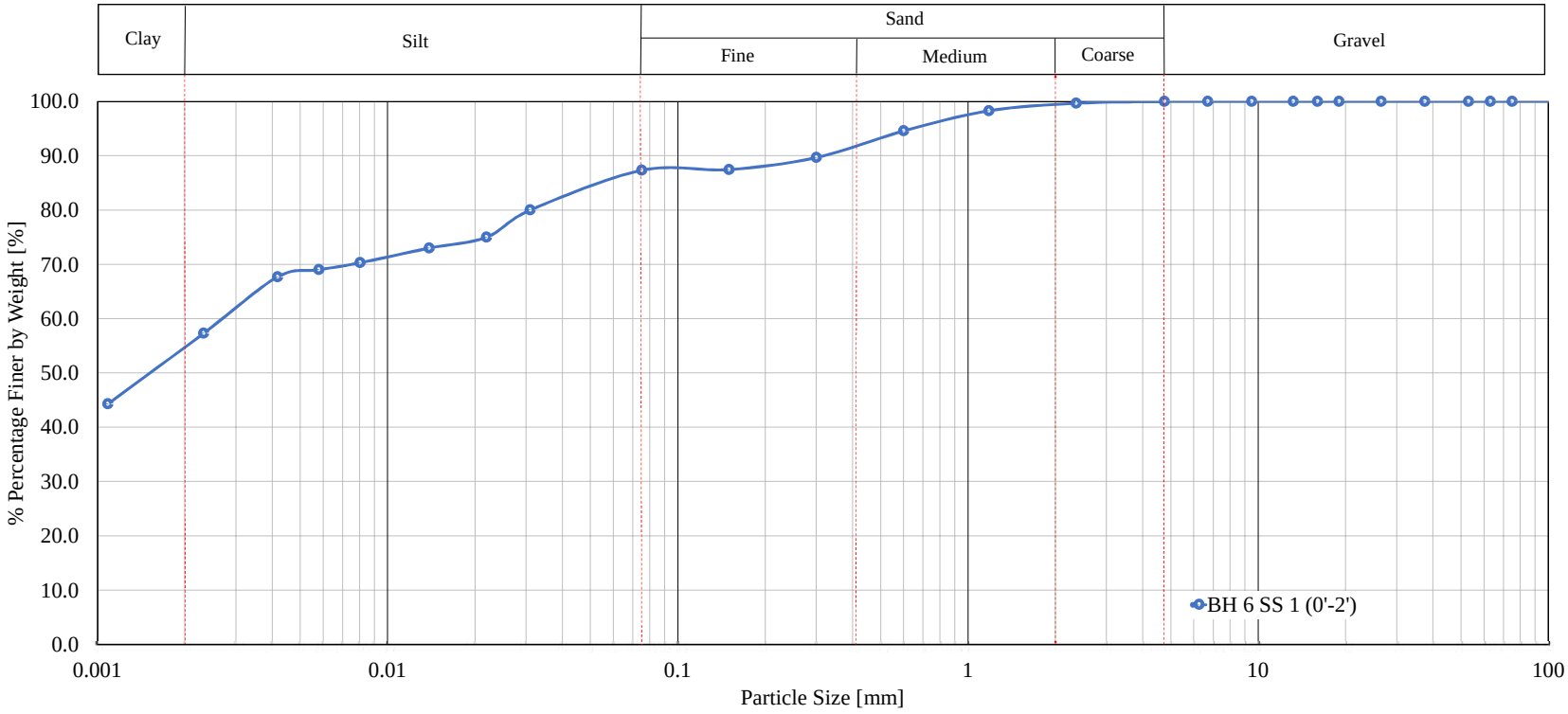
JOB NO. CCO-222884-00

DRAWING NO.

PROJECT : Geotechnical Investigation

LOCATION : Parcel 2, Upper Lane, Thorold, ON

DATE : Tuesday, January 11, 2022



Sample	Percent Gravel [%]	Percent sand [%]	Percent Silt [%]	Percent Clay [%]	Moisture Content [%]
BH 6 SS 1 (0'-2')	0.0%	12.7%	30.0%	57.3%	22.10%

McINTOSH PERRY

McINTOSH PERRY

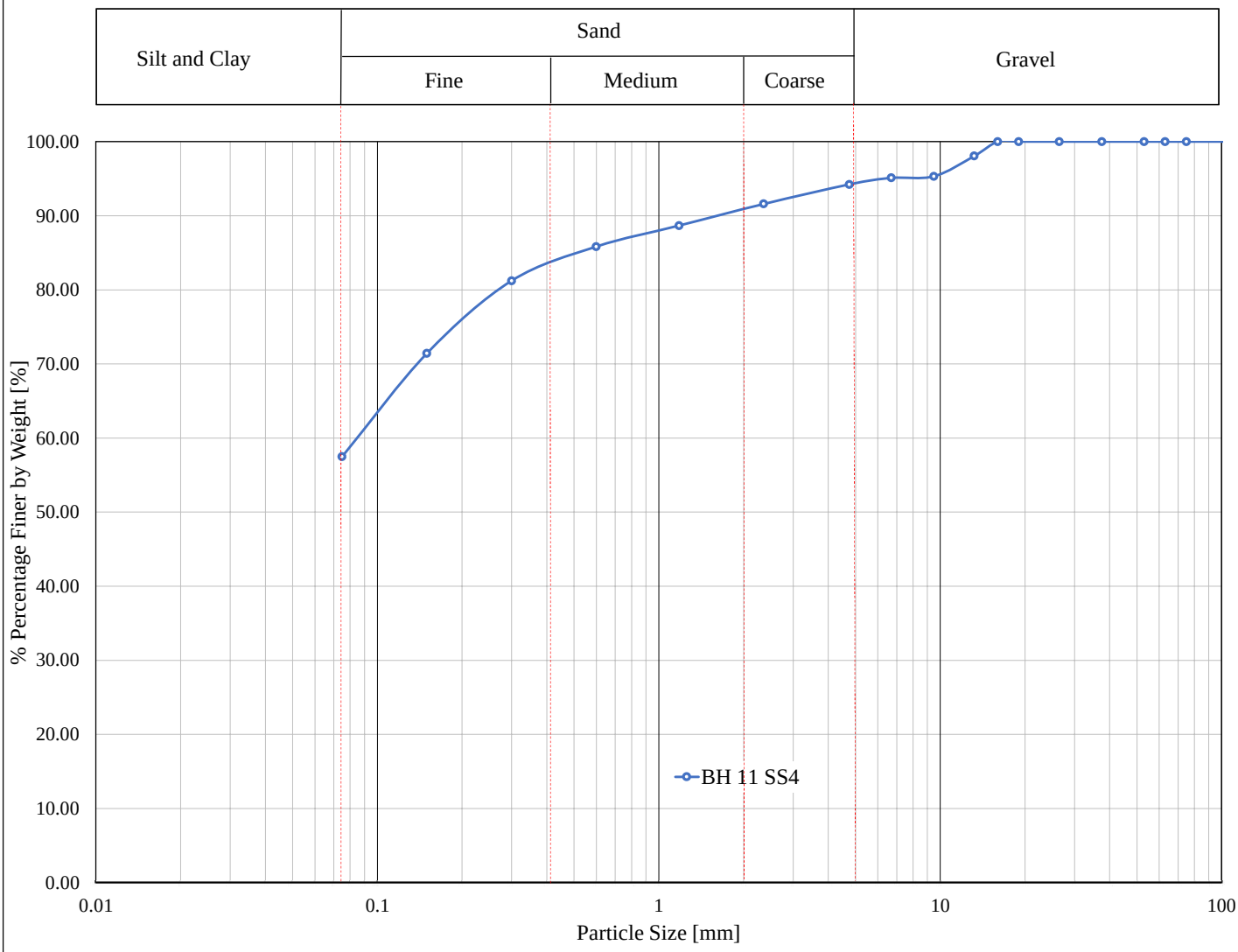
JOB NO. CCO-222884-00

DRAWING NO.

PROJECT : Circle K - Central Canada Division

LOCATION : Woodbine Ave. & Ravenshoe Rd., Georgina

DATE : Tuesday, January 11, 2022



Sample	Percent Gravel [%]	Percent sand [%]	Percent Silt and Clay [%]	Moisture Content [%]
BH 11 SS4 Reddish Sandy Clayey Silt, with some gravel	5.79%	36.73%	57.48%	8.26%