Westwood Village (Phase 2) Community
Brian Domm Subdivision
Hallman Subdivision

Functional Servicing Report

Project Location:

North of Blenheim Road, West of Newman Drive
Township of North Dumfries

Prepared for:

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MTE File No.: 02534-800

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by Hallman Construction Limited (Hallman) and Brian Domm (Domm) to complete a Functional Servicing Report (FSR) in support of an Official Plan Amendment, Plans of Subdivision, and Zoning By-law Amendment applications. Although separate subdivisions are proposed for each property, the lands have been comprehensively evaluated together to ensure a coordinated approach to the design and development of the Hallman and Domm lands.

The Hallman and Domm lands are located in the Township of North Dumfries and are immediately adjacent to a comprehensively planned community located in the City of Cambridge; commonly referred to as "Westwood Village – Phase 1". The lands owned by Hallman and Domm are generally in the northwestern portion of the Westwood Village Community. Refer to **Figure 1.1** for more details. These lands represent the logical extension and second phase of the Westwood Village Community. For the purpose of this report, the two Draft Plans will be reviewed as one cohesive development herein referred to as the 'subject lands'.

The subject lands comprise a total area of approximately 25.43ha, of which 8.48ha represents the Domm property and 16.95ha represents the Hallman property. Development plans for the subject lands include the construction of street-oriented residential units, multiple residential blocks, park lands, with the required roads, municipal services (storm, sanitary, and water), and open spaces. Draft Plans of Subdivision (dated February 4, 2021) for the proposed developments have been prepared by MHBC Planning and form the basis of this report. The consolidated Draft Plan has been included in **Appendix A**.

The purpose of this FSR is to prepare a servicing strategy for the proposed subdivisions, which implements the approved Cambridge West Master Environmental Servicing Plan, and outlines how the subdivisions can be developed on full municipal services, including sanitary sewage collection, domestic water, storm drainage, and utilities. This report should be read in conjunction with the *Westwood Village (Phase 2) Community – Preliminary Stormwater Management Report* (April 19, 2021) prepared by MTE.

1.2 Background Information

A Master Environmental Servicing Plan (MESP) was undertaken for the Cambridge West Community by the City of Cambridge and area landowners. The MESP was completed in November 2013 and approved by City Council on March 17, 2014. The purpose of the MESP was to guide the development of the remaining designated greenfield lands on the west side of the City. The MESP integrated environmental, servicing, transportation, and land use planning components to provide the basis for the preparation of a Community Plan for the Cambridge West Area, and for the preparation and processing of the future development applications.

The MESP outlined a preliminary municipal servicing strategy for the area, which included: sanitary, storm, and watermain servicing, along with a stormwater management (SWM) strategy. The preliminary design strategies for the proposed development have been developed to be in accordance with the recommended solutions within the MESP and are described within this report.

In June 2018, the applications of the adjacent Hallman Subdivision (30T-16104), Cachet Subdivision (30T-16103) and Huron Creek (30T-16105) proceeded through the Local Planning Appeal Tribunal (LPAT) as Case No. 170301. The resulting LPAT order provided approval of three Draft Plans of Subdivision on February 19, 2019.

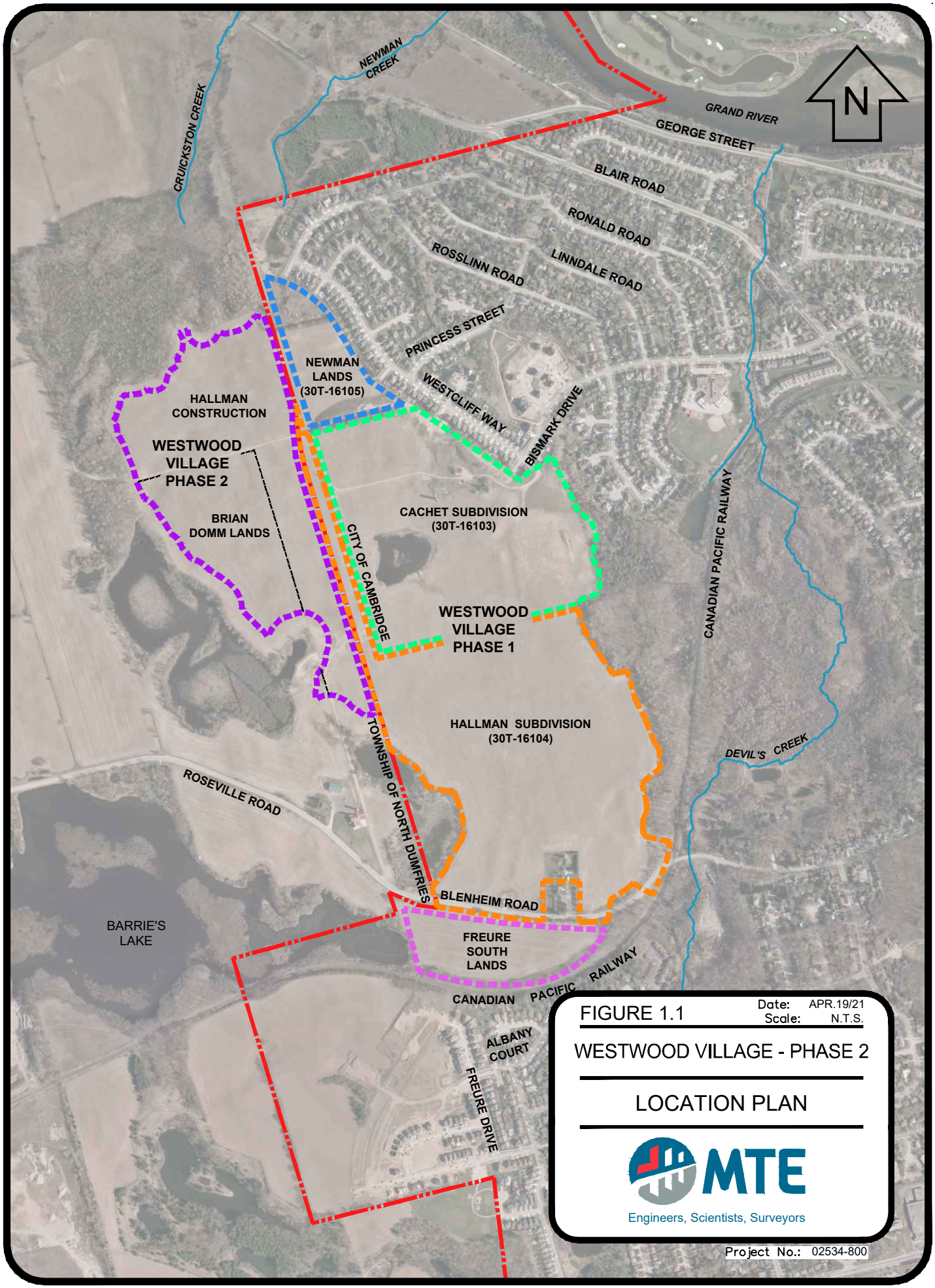

FIGURE 1.1

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WESTWOOD VILLAGE - PHASE 2

LOCATION PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 02534-800

CAD: P:\P\02534\800\02534-800-P-F1 Project: 02534-800

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2.0 Existing Conditions

2.1 Topographical Information

As previously discussed, the subject lands consist of approximately 25.43ha of land, which form the second phase of the overall Westwood Village Community. The subject lands are generally bounded by the future extension of Newman Drive and the Cachet Subdivision to the east, and by existing agricultural and woodlot/wetlands to the south, west and north. The subject lands are currently under an interim agricultural use.

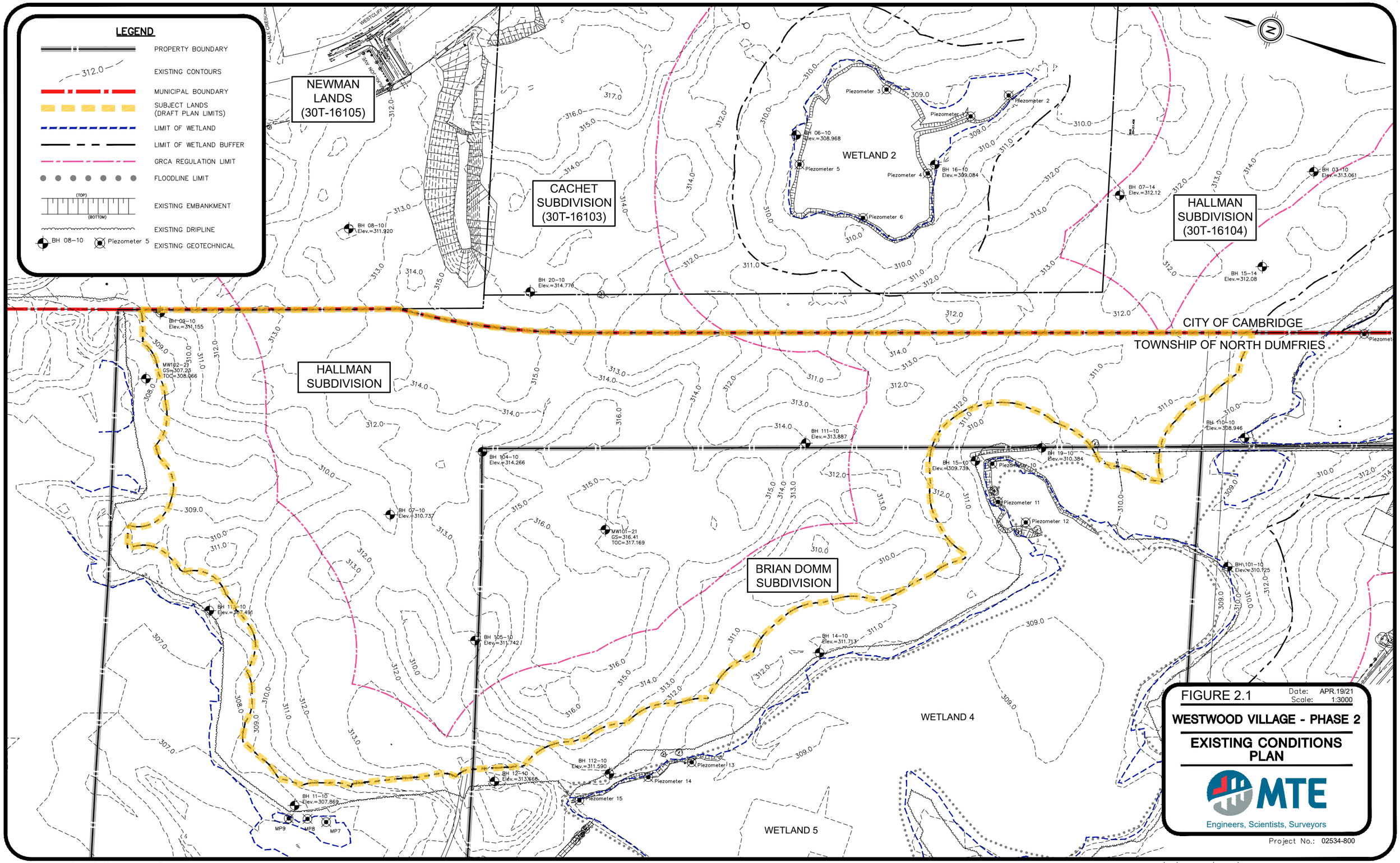
MTE conducted a detailed topographical survey of the Westwood Village lands in 2010. There was some initial survey work completed in 2005 as well as supplementary surveys completed in 2013, 2014, and 2017 through to 2020. Existing topographic conditions for the Westwood Village Community are illustrated in **Figure 2.1** and **MTE Drawing 02534-800-EC1.1.** Under existing conditions, the subject lands are moderately sloped throughout the majority of the site (generally between 2.0% and 10.0%). Existing elevations range between 307.0m near the wetland features in the north and 316.0m on the centralized hills in the central portion of the lands.

It should be noted, that as part of the Hallman Subdivision (30T-16104) and Cachet Subdivision (30T-16103) final design, an area grading contract for the entire Westwood Village Community was completed this past summer/fall. As part of this contract, the subject lands were filled and graded to a sub-grade depth. Topsoil will be placed on the sub-grade surface, and the lands will be returned to an interim agricultural use. The “existing conditions” described in this report refer to the original site conditions prior to the 2020 area grading contract.

2.2 Pre-Development Conditions

The eastern portion of the subject lands primarily drain to an existing wetland feature (Wetland 2), as illustrated in **Figure 2.1**. This feature does not have a positively draining surface outlet, rather, it recharges and drains internally. Based on monitoring data and a hydrogeological study completed as part of the MESP, it is understood that after rainfall events, the surface water inputs in this feature create a localized groundwater mound that dissipates laterally through shallow groundwater movements to the east. During drier periods, shallow groundwater flow from the west sustains the wetland level.

The northern and western portion of the subject lands drain externally towards the adjacent woodland and wetland features (Wetland 6 and Wetland 4/5) respectively. Both the northern and western portions of the subject lands are currently within the Cruickston Creek subwatershed. However, through the MESP, it was recommended that these lands be redirected to the Grand River via SWMF 2 under post-development conditions.



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2.3 Geotechnical and Hydrogeological Information

From 2010 to 2013, LVM Inc. carried out a hydrogeological investigation for the Westwood Village Community lands. The fieldwork for the investigation on the subject lands included: 13 boreholes to depths ranging from 4.88m to 11.89m, and nine (9) mini piezometers to depths ranging from 0.91m to 2.44m.

In the spring and summer of 2014, LVM also carried out a geotechnical investigation. The field work for this investigation included boreholes and handholes to accurately determine topsoil depths. Monitoring wells were installed to allow measurement of the stabilized groundwater levels and to support the existing hydrogeological data of the area.

In 2015, MTE carried out a *Supplemental Hydrogeology Study* (October 11, 2017) for the Westwood Village (Phase 1) Community. This study conducted additional fieldwork and summarizes the hydrogeological investigations performed for the development study area.

Based on the results of the detailed investigations, the subsurface stratigraphy is generally described as topsoil underlain by deposits of sand or sand and gravel underlain at depth by deposits of silt/silt till. The granular deposits are extensive in areas and are typically saturated at their base, forming a shallow overburden aquifer. Groundwater in the overburden aquifer generally flows towards the Grand River, driven by topography and surface drainage features. The overburden aquifer (ranging in elevations from 305m to 308m) is separated from the bedrock aquifer (ranging in elevations from 270m to 300m) by a thick overburden aquitard.

Composite high groundwater contours, shown in **Figure 4.2**, have been generated for the subject lands, based on collected groundwater level monitoring to date.

Refer to LVM's Geotechnical Investigation Report in **Appendix B** for more details.

3.0 Proposed Development

The Draft Plans of Subdivision for this residential development include the following:

- Single detached and Townhome residential dwellings;
- Multiple residential dwellings;
- A neighbourhood park, 2 parkettes and open space buffers;
- Walkways and emergency accesses;
- Municipal right-of-ways (ROW) with widths of 18.5m and 20.0m; and
- A wildlife corridor block.

Refer to the consolidated Draft Plans of Subdivision in **Appendix A** for more details.

3.1 Municipal Right-of-Ways

As shown in the consolidated Draft Plans of Subdivision, the proposed development will be serviced by local roads. The roadways will be constructed to a full urban cross-section, including: asphalt pavement, concrete curb and gutters, concrete sidewalks on both sides of all streets, roadway illumination, and boulevard landscaping. As part of the overall integration of the Westwood Village Community, direction was received from the Township of North Dumfries that the road cross-sections would follow typical City of Cambridge's standards, as opposed to the Township's standards.

Local roads within the subject lands will consist of either 18.5m or 20.0m right-of-way widths, as identified in **Table 3.1** below. Typical City of Cambridge road cross-sections for the 18.5m or 20.0m right-of-ways are included in **Appendix C** for reference.

Table 3.1 – Proposed Road Classification

Road	Classification	Right-of-way Width
Street A	Local	20.0m
Street B	Local	18.5m
Street C	Local	18.5m
Street D	Local	18.5m
Street E	Local	18.5m
Street F	Local	20.0m
Street G	Local	20.0m

As previously mentioned, a geotechnical investigation was completed by LVM, dated February, 2016. The proposed pavement structure outlined in this report is summarized in **Table 3.2** below.

Table 3.2 – Proposed Pavement Structure

Pavement Structure	Local Roads (mm)	Collector Roads (mm)	Bus Routes (mm)
Asphaltic Concrete - Surface	40	40	40
Asphaltic Concrete - Binder	80	100	150
Granular 'A' Base	150	150	150
Granular 'B' Sub-base	375	375	375

3.2 Wetland and Vegetation Buffers

A comprehensive analysis was undertaken in the determination of natural heritage buffers and development setbacks as part of the MESP's Natural Environmental Study (NES) report (Ecoplans 2013).

In October 2019, wetland and driplines limits along the northern and western edges of the proposed development were delineated by WSP, approved by the governing agencies, and surveyed by MTE. With wetland limits established, the appropriate buffers and setbacks were adjusted and incorporated into the existing conditions, as illustrated in the various figures and drawings included in this report.

Development setbacks, as identified in the MESP NES, were confirmed in the *Scoped Environmental Impact Study* (EIS) completed by WSP (dated April 2021) as follows;

- 50m from Provincially Significant Wetland (PSW) (marsh/pond habitats) wetland boundaries;
- 30m from PSW wetland boundaries; and
- 15m from woodland driplines (non-wetland).

These setbacks have dictated the limits of development along the entire western and northern boundaries of the subject lands. Several existing condition and design factors have influenced the overall grading, resulting in minor intrusions into the buffers in some areas. These factors include road profile/elevation, steep (3:1 max) slopes, and servicing constraints.

Refer to **Appendix D** for a summary of the encroachments into the buffers. Also, refer to the EIS completed by WSP for additional details.

3.3 Ecological Linkages / Wildlife Passage

Ecological linkages are intended to maintain or enhance connectivity within and between large natural areas, and to restore or create new defined linkage areas between natural areas where existing connectivity is degraded. The MESP identified a series of existing and proposed ecological linkages within the Westwood Village Community. One key linkage was proposed between Wetland 2 in the adjacent Westwood Village Phase 1 lands and Wetland 4 to the west of the subject lands; to be created through a formal ecological corridor. The east portion of that linkage is under construction on the adjacent lands to the east (in subdivisions 30-T16103 and 30T-16104). The west portion of that linkage is identified in the Consolidated Draft Plans as Block 15 "Wildlife Corridor" within Stage 1 of the proposed Hallman Subdivision.

As part of the final engineering design of the Hallman Subdivision (30T-16104), a culvert is to be installed at the Newman Drive crossing location to accommodate herpetofaunal/small mammal passage, as illustrated in Figures XS1.3 and XS1.4 in **Appendix D**. The Newman Drive structure will consist of a 1200mm x 3600mm concrete box culvert, embedded with 0.30m of native substrate, to provide suitable conditions for migrating herpetofauna. Continuous wildlife funnel fences will be incorporated into the ecological linkage that will also tie into the road crossing structure. Slopes along the corridor have been kept to a minimum to match into the surrounding proposed development grades.

Refer to the Scoped EIS (WSP – April 2021) for additional details.

4.0 Proposed Grading

4.1 Grading Considerations

The following is a list of grading constraints which influenced and/or governed the grading design of the subject lands:

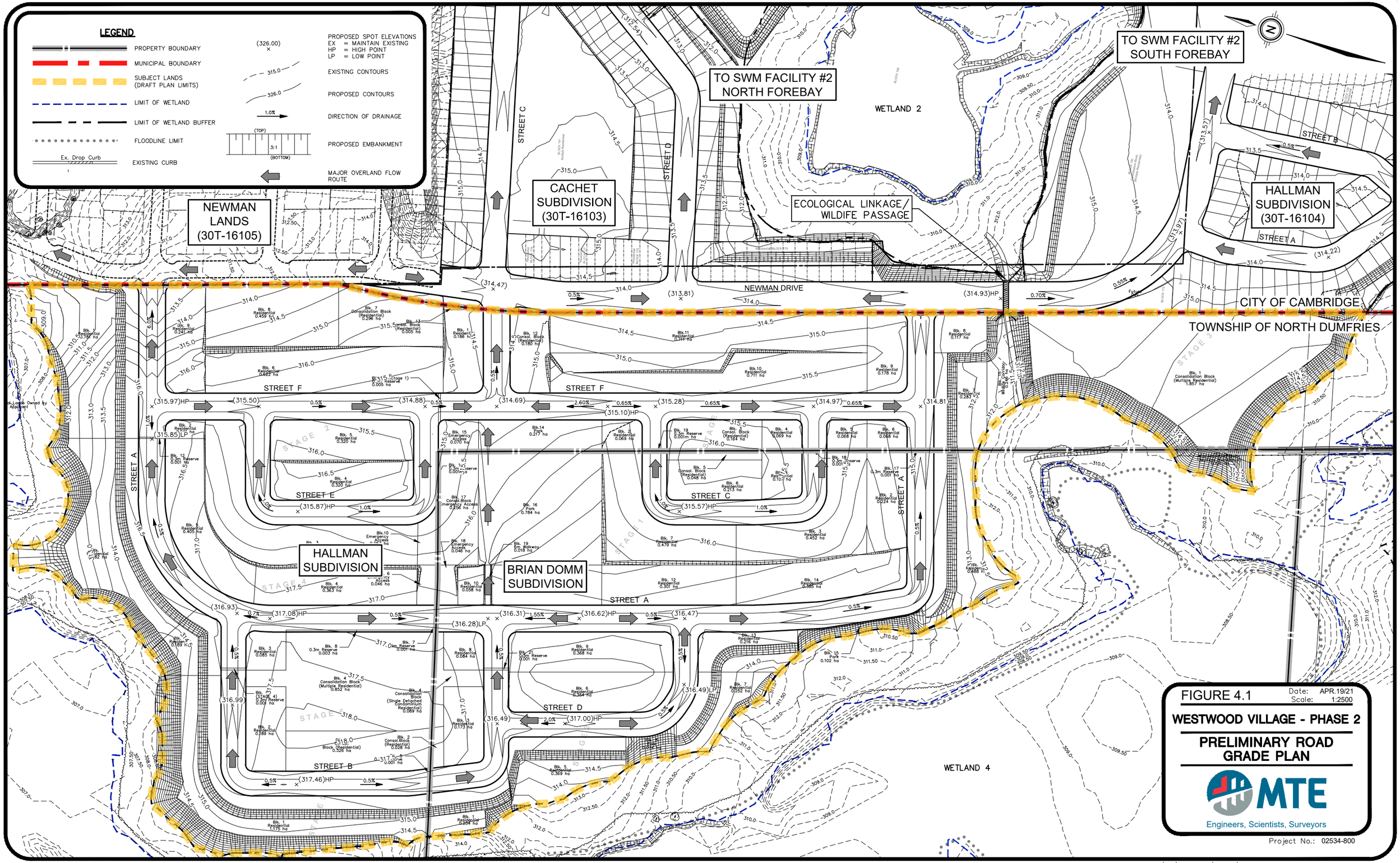
- Match the proposed centreline of road elevations of proposed Streets A and G with centreline of road elevations along the future extension of Newman Drive within the limits of the Phase 1 Community;
- Ensure compatibility with the proposed extension and grading of Newman Drive;
- Match the existing and proposed boundary grades around the perimeter of the property, while respecting the limits of existing natural heritage features;
- Minimize grading within recommended buffers associated with natural heritage features with some minor incursions in recognition of engineering design considerations;
- Ensure adequate cover is provided over municipal services;
- Ensure major storm event overland flow routes are directed towards the road right-of-ways where applicable, and towards the adjacent stormwater management facility (SWMF 2);
- Comply with City of Cambridge standards for minimum and maximum road grades;
- Ensure adequate separation between composite high groundwater and the proposed underside of house footings; and
- Ensure sidewalks and walkways are AODA compliant.

4.2 Roadworks and Lot Grading

Utilizing the proposed road layout, preliminary slopes for centreline of road ranging from 0.5% (minimum) to 6.0% (maximum) were used to complete the preliminary lot grading design. Additionally, the considerations listed in Section 4.1 were incorporated into the overall preliminary grading design and is illustrated in **Figure 4.1**.

Preliminary lot grades range from 2.5% (minimum) to 6.0% (maximum) with a combination of traditional back to front drainage, split drainage, and walk-out type lots. The preliminary finished grades have been illustrated in the enclosed **MTE Drawings 02534-800-AG1.1 to AG1.3**.

The composite high groundwater surface was modelled based on MTE's *Supplemental Hydrogeology Study* (October, 2017). The preliminary house grades and underside of footing elevations were designed to maintain a minimum vertical separation of 0.75m above the composite high groundwater elevations. This separation is illustrated in **Figure 4.2.** The groundwater throughout the development lands is generally found at an elevation between 307.0m and 309.0m. Preliminary grades, especially those near anticipated building locations, range from approximately 312.0m to 318.0m. As such, the average separation between the underside of footings and composite high groundwater is more than 3.0m.



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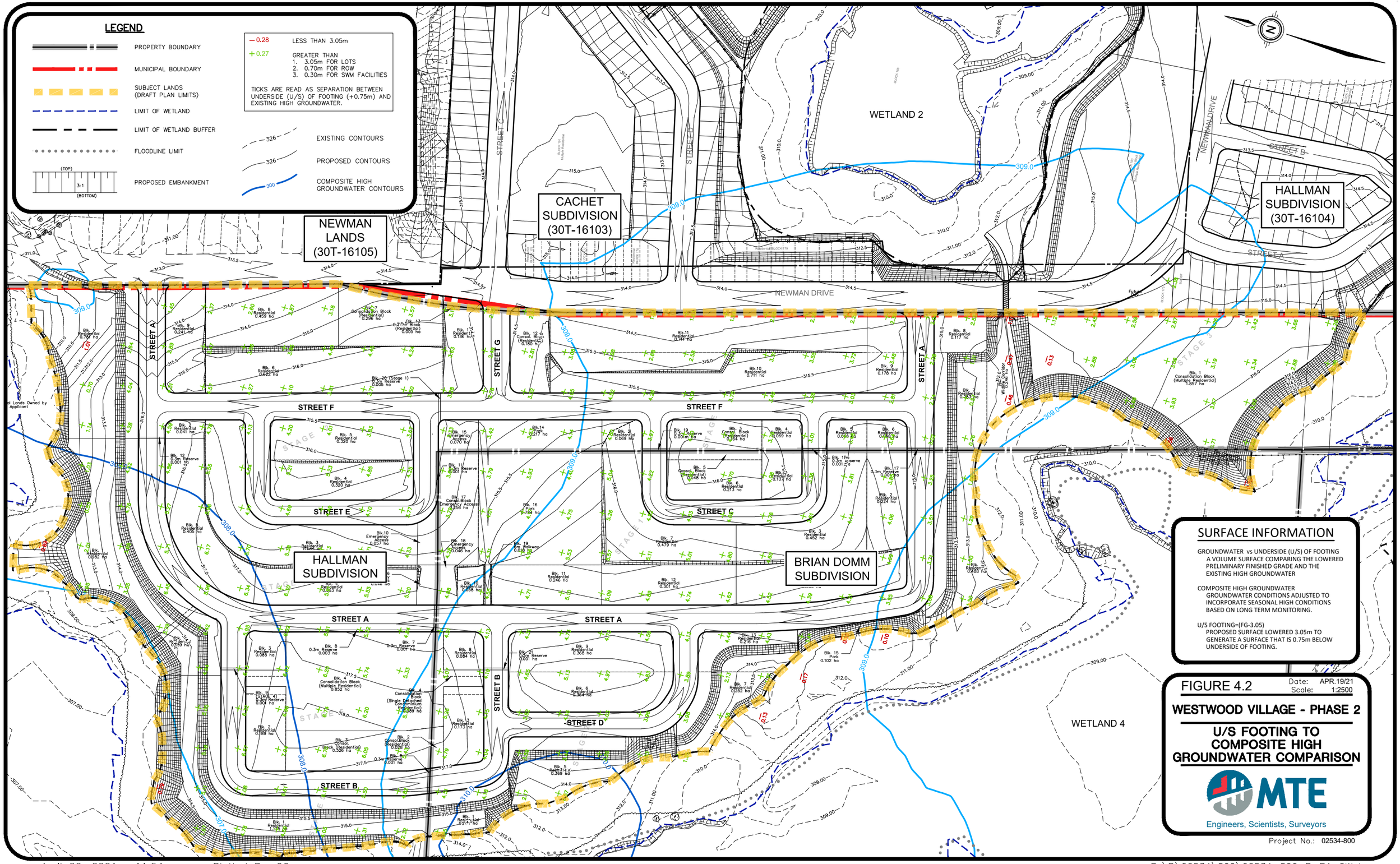

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5.0 Municipal Servicing

Final design of Westwood Village Phase 1 has been ongoing since the summer of 2019, with the 1st engineering submission for lot grading and servicing made to the City of Cambridge in the Spring of 2020. As stated previously, the Westwood Village Community has been comprehensively planned and engineered, and as such, the Township lands have been fully integrated into the servicing design of the community. Construction of local services within the Phase 1 lands of Westwood Village is anticipated for the spring/summer of 2021. An overall general plan of services which illustrates the conceptual location of the sanitary sewers, watermains, and storm sewers within the subject lands is appended as **MTE Drawing 02534-800-GP1.1**.

5.1 Sanitary Servicing

The preliminary sanitary servicing concept for the subject lands was previously included in the overall sanitary servicing design of the Westwood Village Community. The entire Community is located within the drainage area of the Galt Wastewater Treatment Plant (GWWTP). As such, sanitary sewage flow generated within the subject lands will eventually make its way to the treatment plant; where sufficient capacity exists to accommodate sanitary flow from this area.

The development of the subject lands was considered in order to adequately size the sanitary sewers along the proposed extension of Newman Drive, and all other proposed downstream sewers as part of the Westwood Village Phase 1 design. The design of the receiving sanitary sewers along Newman Drive provide for anticipated flows from the subject lands and will accommodate the proposed development size and population densities.

As part of the Westwood Village Phase 2 design, an internal sanitary sewer network was developed to ensure and confirm that previously anticipated and allocated flows were not exceeded. As a result, it is concluded that there are no capacity issues downstream of the subject lands.

The proposed drainage areas, as illustrated in **Figure 5.1**, generally flow eastward to the trunk sanitary sewer along the future extension of Newman Drive. The following drainage areas are delineated with respective population densities to determine the preliminary design peak flows:

Area 1
Consisting of approximately 21.21ha and encompassing the majority of the developable lands. This area drains to the planned sanitary sub-trunk along Newman Drive at Street G and the southern intersection of Street A. As previously discussed, the flow from this area is conveyed through the adjacent Hallman Subdivision (30T-16104).

Area 2
Consisting of approximately 2.07ha, including the southern Multiple Residential Block (Hallman Stage 3 - Block 1 and Domm Stage 3 – Block 1). Area 2 also drains to the sanitary sub-trunk within Newman Drive. Similar to Area 1, the flow from this area is conveyed through the adjacent Hallman Subdivision (30T-16104).

Area 3
Consisting of approximately 1.81ha, and includes lots near the northern intersection of Street A with Newman Drive which will drain northward to the existing sanitary sewer along Newman Drive.

Preliminary Sanitary Sewer Design Sheets have been prepared with pipe diameters and slopes for the proposed conditions. The design sheets and the corresponding drainage area plan are located in **Appendix E**.

Figure 5.2 illustrates a schematic of the sanitary sewer design, including proposed finished road grades and depths of sewers at key points in the sewer network. The 'spine' sewers located on proposed Street A, Street F, and Street G will collect and convey sanitary flows from the local streets. The depth of these sewers ranges from approximately 2.4m to 4.7m. The deepest point is located at the southern intersection of Street A and Street F. Sanitary sewers extended through the remaining local roads within the proposed road allowances are at typical depths ranging from 2.4m to 4.0m.

5.2 Water Distribution

The subject lands are located within the Township of North Dumfries, adjacent to the northwestern portion of the City of Cambridge Water Pressure Zone 3 (CAM 3). The current average operating hydraulic grade line (HGL) in CAM 3 is approximately 365.8m.

As part of the final design of the adjacent Cachet Subdivision (30T-16103) and Hallman Subdivision (30T-16104), a water distribution analysis and report has been completed that included the Township lands (subject lands). Since this report and analysis have only just recently been completed, the current Draft Plans for the subject lands have been used as input. As a result, the final report represents an accurate representation of the Westwood Village Community.

Instead of preparing a Preliminary Water Distribution report to support the Township lands Plan of Subdivision applications, the Final Water Distribution Report for the Cachet and Hallman Subdivisions located within the City of Cambridge (which includes the Township lands and the Newman Lands) can be used.

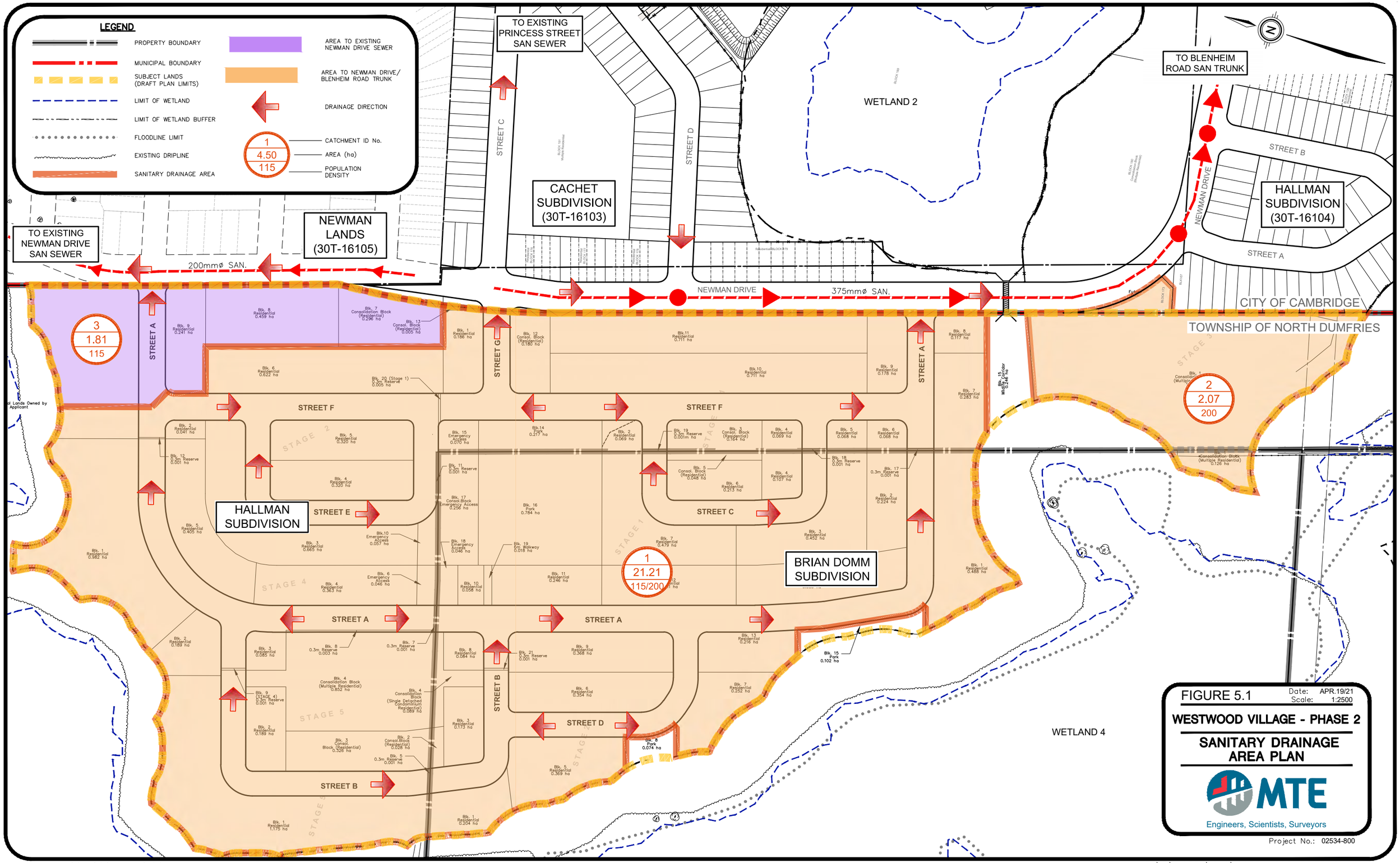
As such, the following summarizes the key points of the Final Water Distribution Report;

- Connections to the proposed 200mm/300mm diameter watermain along Newman Drive will adequately service the proposed water distribution network for the Hallman and Domm Subdivisions;
- The proposed water distribution network will adequately provide the required daily water demands and recommended *FUS* fire flows within the respective pressure guidelines; and
- The installation of pressure reducing valves is not required within the subject lands.

Refer to **Figure 5.3** for the water distribution network for the subject lands.

5.3 Storm Drainage

Similar to the original overall sanitary servicing design discussed above, the overall storm servicing design of the Westwood Village (Phase 1) Community also considered the storm servicing requirements for the subject lands. The original intent for the subject lands was to implement a fourth stormwater management facility (SWMF) to service a small drainage area, and have the majority of the subject lands drain to SWMF 2 located within the adjacent Cachet Subdivision (30T-16103). However, as part of the pre-consultation process, MTE was requested to reconsider the need for the fourth facility and determine if SWMF 2 could service all of the Township lands. The Preliminary SWM report for the Township lands confirms the feasibility of a revised strategy that includes the elimination of SWMF 4. The majority of runoff will be diverted to SWMF 2, which will outlet through a dedicated 450mm diameter storm sewer. This runoff will eventually outlet to a 750mm diameter storm sewer located on Princess Street, and ultimately to the Grand River.



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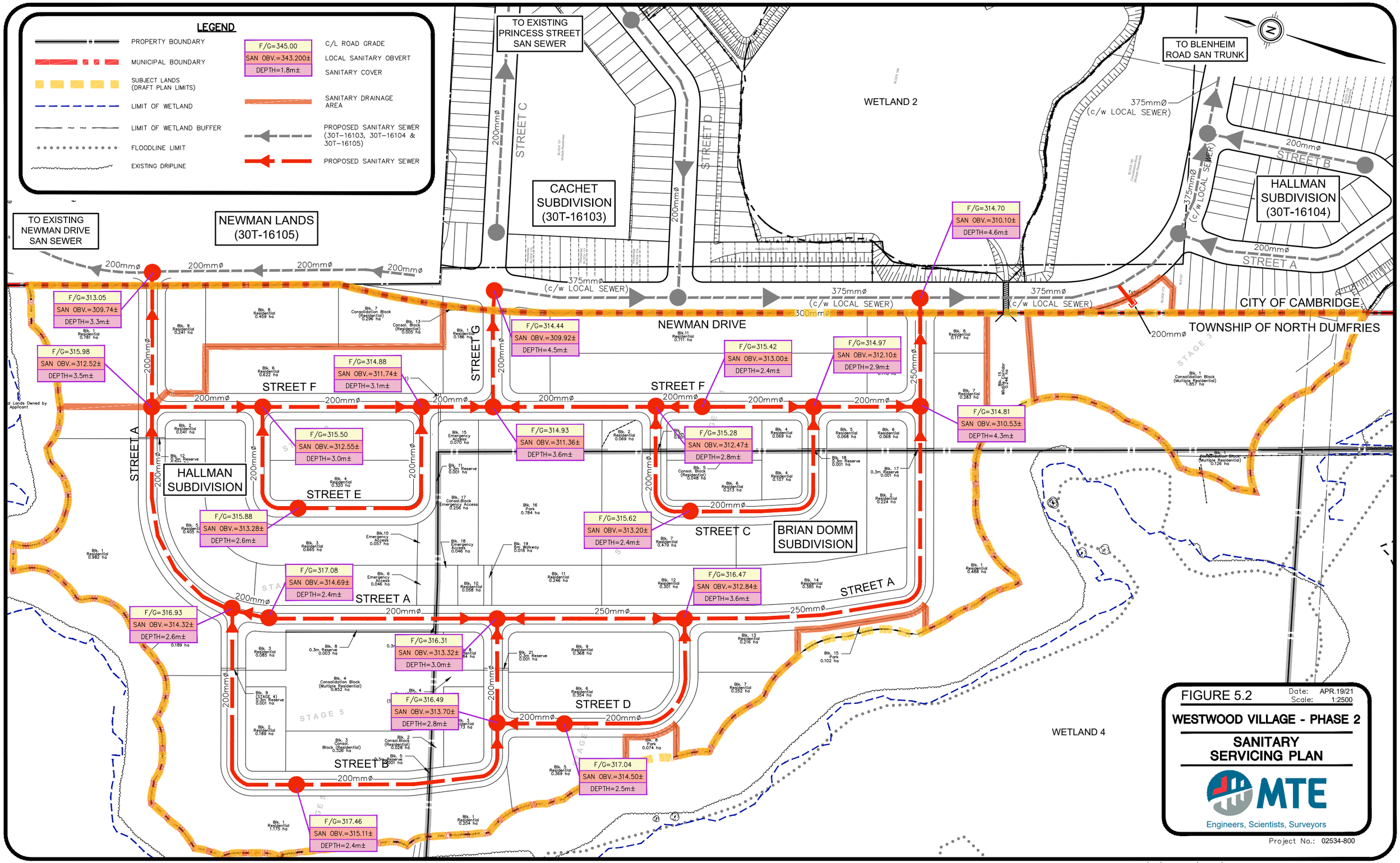

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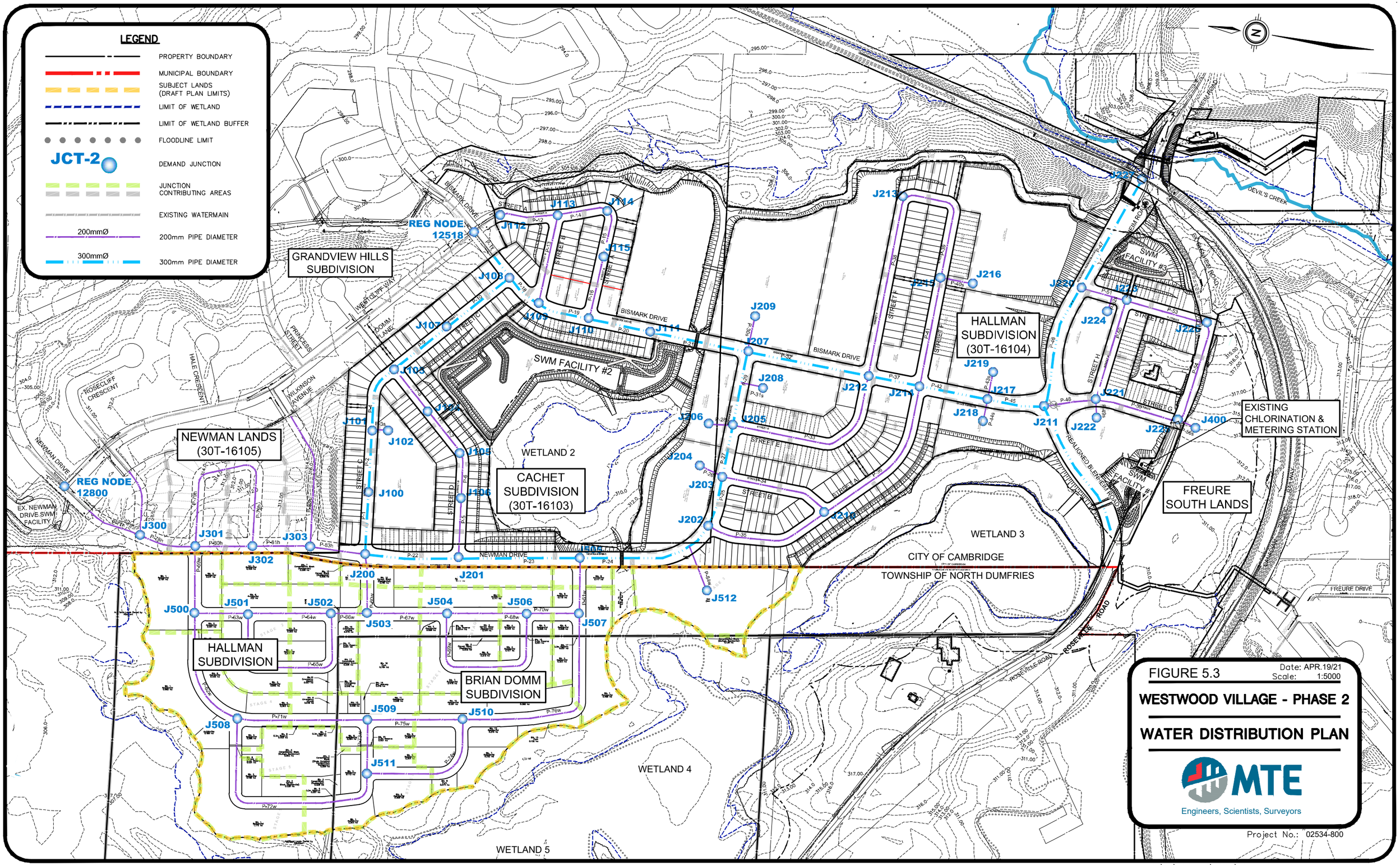

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In order to adequately size the proposed downstream storm sewers towards SWMF 2, the subject lands were incorporated as a lumped area (future development). The design of the receiving storm sewers and downstream stormwater management facility provides for anticipated flows from the subject lands based on proposed development size and anticipated impervious cover. As part of the Westwood Village Phase 2 design, the internal storm sewer network was developed to ensure and confirm that previously anticipated and allocated flows were not exceeded. As a result of this analysis, it is concluded that there are no capacity issues downstream of the subject lands and that SWMF 2 can adequately accommodate flows from the proposed development.

The proposed drainage areas, as illustrated in **Figure 5.4**, generally flow eastward to the storm sewers along the future extension of Newman Drive. The following drainage areas are delineated with respective runoff coefficients to determine the preliminary design peak flows:

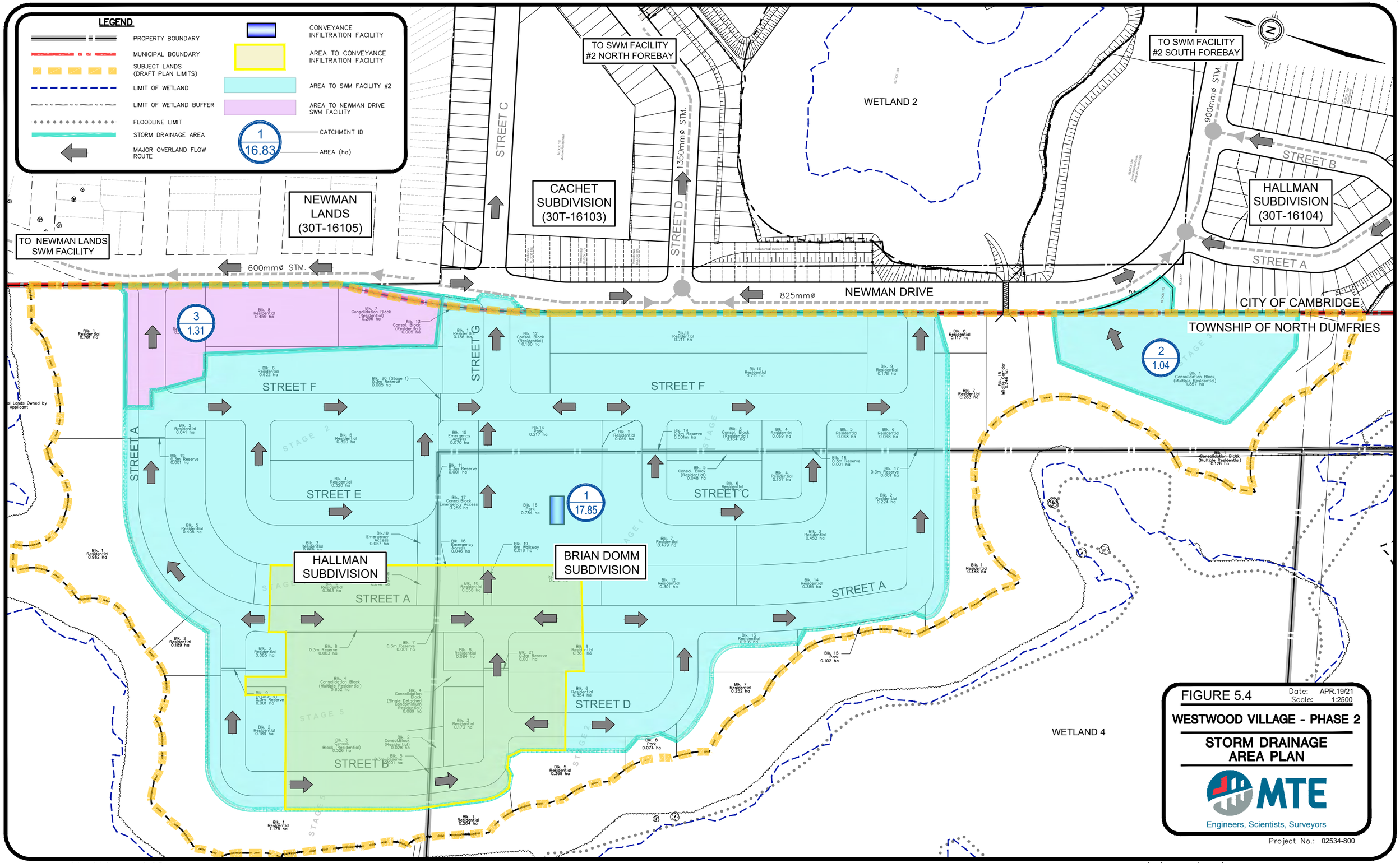
Area 1
Consisting of approximately 17.85ha and encompassing the majority of the developable lands, this area drains to the provided storm sewers along Newman Drive at Street G and the southern intersection of Street A. As previously discussed, the flow from this area is conveyed through the neighbouring Hallman Subdivision (30T-16104) and Cachet Subdivision (30T-16103) towards the northern forebay of SWMF 2.

Area 2
Consisting of approximately 1.04ha, this area represents the southern Multiple Residential Block (Hallman Stage 3 - Block 1 and Domm Stage 3 – Block 1) and also drains to the planned storm sewer fronting the subject lands along Newman Drive. Similar to Area 1, the flow from this area is conveyed through the neighbouring Hallman Subdivision (30T-16104) towards the southern forebay of SWMF 2.

Area 3
Consisting of approximately 1.31ha, this area represents lots near the northern intersection of Street A with Newman Drive which will drain northward to the existing Newman stormwater management facility; which will be retrofitted through the development of the Newman Lands Subdivision (30T-16105).

Preliminary Storm Sewer Design Sheets have been prepared with pipe diameters and slopes for the proposed conditions. The design sheets and the corresponding drainage area plan are located in **Appendix F**.

Figure 5.5 illustrates a schematic of the storm sewer design, including proposed finished road grades and depths of sewers at key points in the sewer network. The depth of these sewers ranges from approximately 1.5m to 3.5m. The deepest point is located at the northern intersection of Street A and Newman Drive.



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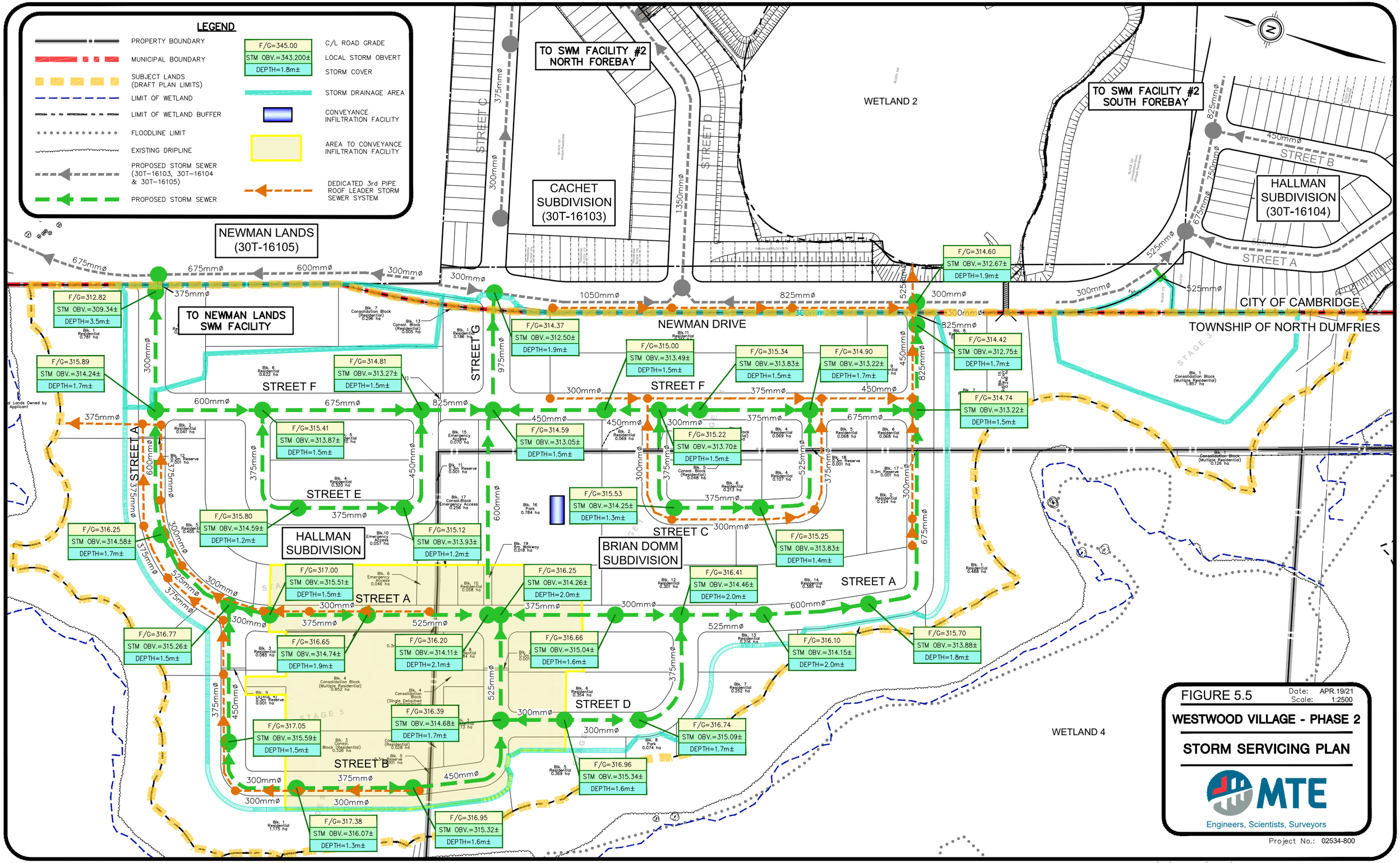

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5.4 Stormwater Management

The proposed SWM infrastructure for the subject lands will include lot level infiltration galleries, a conveyance infiltration gallery, and the proposed storm sewer network within the proposed right-of-ways. The storm sewer network is proposed to convey most of the stormwater flow to SWMF 2, located in the adjacent Cachet Subdivision (30T-16103). A small area (Area 3) will drain to the existing Newman SWMF. The SWM strategy for the proposed development is presented in the *Preliminary Stormwater Management Report* (April 19, 2021) prepared by MTE. The following summarizes the key points of the report:

- Water quantity and quality control will be provided within SWMF 2. This facility will provide quantity control of runoff from the contributing drainage area for storm events up to and including the Regional storm event.
- An Enhanced Level of water quality control will be provided in SWMF 2.
- Infiltration targets for the subject lands will be met.
- Surface water inputs to the adjacent natural areas will be maintained in the post-development condition.

Storm drainage for the proposed development will be provided through a combination of minor (piped) and major (overland) drainage systems. The proposed development area will drain via storm sewers to SWMF 2 as shown in **Figure 5.5**. The storm sewers will be designed for the 5-year storm event, with overland flow routes generally flowing through the proposed road allowances.

5.4.1 Third-Pipe Storm System

In addition to the storm sewer network described in the previous sections, a separate dedicated storm sewer is proposed to collect and convey specific roof runoff for use in the overall surface water balance of Wetland 2. Most of the roof runoff from the proposed residential blocks will be directed to individual infiltration galleries, or the proposed conveyance gallery within the park block. However, a number of roofs along Street A, Street C, and Street F will be directed to a 'third-pipe' network. Downspouts from these roofs are to be directly connected to this storm sewer system. As illustrated in **Figure 5.5**, the internal network is connected to an additional sewer along Newman Drive, which ultimately discharges into Wetland 2.

6.0 Utility Servicing

The proposed development will connect to existing services to be extended along the future extension of Newman Drive. Energy+ (electrical), Bell Canada (telephone), Enbridge Gas (natural gas), and Rogers Cable (cable television) are all expected to extend their services to the proposed development as part of the Phase 1 construction of Westwood Village. Confirmation of utility servicing will be undertaken at the appropriate time to ensure services are available prior to occupancy.

7.0 Summary

The main findings of the Functional Servicing Report for the subject lands are:

1. The subdivisions have been designed to implement the *Cambridge West Community Master Environmental Servicing Plan* (November, 2013);
2. Proposed grading – The roadworks and lot grading within the proposed development can be completed in compliance with the City of Cambridge's Design Standards while maintaining the minimum required cover over the proposed sewers, maximizing the allowable flows to existing infrastructure, minimizing the need for retaining walls, as well as minimizing grading within the buffer areas as much as possible;
3. Streets within the subdivisions will be constructed to the City of Cambridge's Design Standards;
4. Sanitary and storm sewage collection – The proposed development can be adequately serviced through the extension of the existing gravity sewers along the future extension of Newman Drive;
5. There is adequate capacity in the Galt Wastewater Treatment Plant to accommodate sanitary flow from the proposed subdivisions;
6. Water Distribution – Water supply for the proposed development can satisfactorily meet the pressure and flow demands through connections to extensions of the existing municipal water distribution system;
7. Stormwater management for most of the development will be directed to and can be accommodated by the adjacent SWMF 2 within the Cachet subdivision, as outlined in the *Preliminary Stormwater Management Report* (April 19, 2021). Area 3, as described in this report, will be directed to and can be accommodated by the existing Newman SWMF; and,
8. The proposed development can be adequately serviced through the extension of existing utilities, including: hydro, gas, cable TV, and telephone.

All of which is respectfully submitted,

MTE Consultants Inc.

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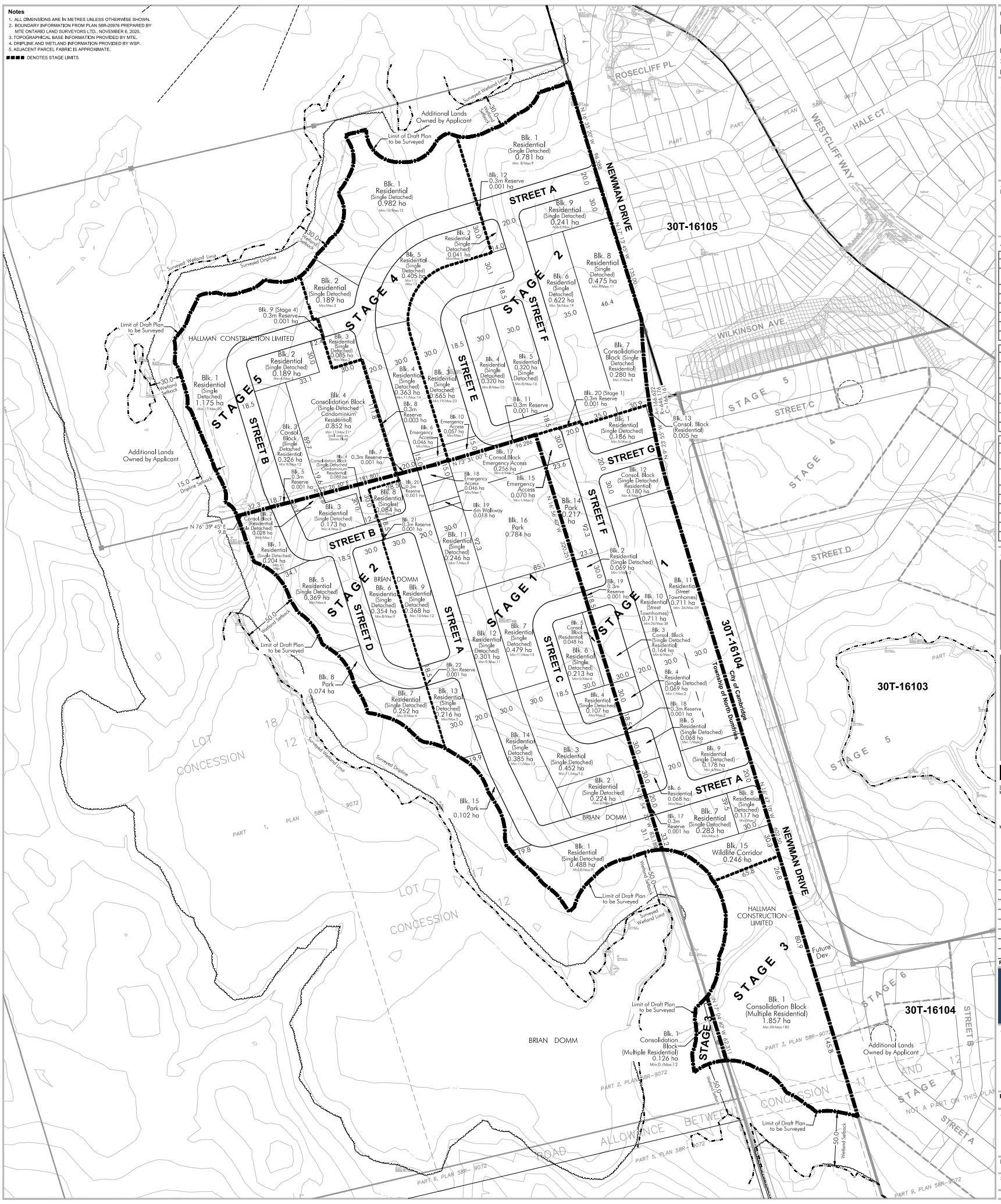
Appendix A

Draft Plans of Subdivision (Reduced)

Notes

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. BOUNDARY INFORMATION FROM PLAN 58R-20976 PREPARED BY MTE ONTARIO LAND SURVEYORS LTD., NOVEMBER 6, 2020.
3. TOPOGRAPHICAL BASE INFORMATION PROVIDED BY MTE.
4. DRIPLINE AND WETLAND INFORMATION PROVIDED BY WSP.
5. ADJACENT PARCEL FABRIC IS APPROXIMATE.

■■■■ DENOTES STAGE LIMITS

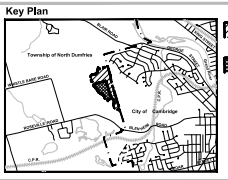


CONSOLIDATED DRAFT PLAN OF SUBDIVISION

Legal Description

PART OF LOTS 13 AND 14, CONCESSION 11
AND PART OF ROAD ALLOWANCE BETWEEN CONCESSIONS 11 & 12
TOWNSHIP OF NORTH DUMFRIES
REGIONAL MUNICIPALITY OF WATERLOO

Key Plan



Limits of Hallman Draft Plan

Limits of Domm Draft Plan

SCALE: NTS

Source: SLRN, Region of Waterloo

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. AS SHOWN	B. AS SHOWN	C. AS SHOWN
D. RESIDENTIAL, MULTIPLE RESIDENTIAL, PARK, WILDLIFE CORRIDOR		
E. AS SHOWN	F. AS SHOWN	G. AS SHOWN
H. MUNICIPAL WATER SUPPLY	I. LOAM	J. AS SHOWN
K. ALL SERVICES AS REQUIRED	L. AS SHOWN	

Area Schedule - Hallman Construction Limited 30T-_____

	STAGE 1			STAGE 2		
Description	Lots/Blks	Units	Area (ha)	Lots/Blks	Units	Area (ha)
Residential/ Consolidation Block	1-13	83-115	2.809	1-9	82-98	3.745
Park	14		0.217			
Emergency Access	15	1-2	0.070	10	1	0.057
Wildlife Corridor	16		0.246			
0.3m Reserve	17-20		0.004	11,12		0.002
Roads			1.121			1.108
Total	**20**	**84-117**	**4.467**	**12**	**83-99**	**4.912**

	STAGE 3			STAGE 4		
Description	Lots/Blks	Units	Area (ha)	Lots/Blks	Units	Area (ha)
Residential/ Consolidation Block				1-5	37-44	2.024
Multiple Residential/ Consolidation Block	1	59-185	1.857			
Emergency Access				6	1	0.046
0.3m Reserve				7-9		0.005
Roads						0.676
Total	**1**	**59-185**	**1.857**	**9**	**38-45**	**2.751**

	STAGE 5			TOTAL		
Description	Lots/Blks	Units	Area (ha)	Lots/Blks	Units	Area (ha)
Residential/ Consolidation Block	1-4	47-58	2.542	30	249-315	11.120
Multiple Residential/ Consolidation Block				1	59-185	1.857
Park				1		0.217
Wildlife Corridor				1		0.246
Emergency Access				3	3-4	0.173
0.3m Reserve	5		0.001	10		0.012
Roads			0.417			3.322
Total	**5**	**47-58**	**2.960**	**46**	**311-504**	**16.947**

Area Schedule - Brian Domm 30T-_____

	STAGE 1			STAGE 2		
Description	Lots/Blks	Units	Area (ha)	Lots/Blks	Units	Area (ha)
Residential/ Consolidation Block	1-14	88-104	3.669	1-7	26-30	1.469
Park	15,16		0.886	8		0.074
Emergency Access	17,18	5-6	0.302			
Walkway	19		0.018			
0.3m Reserve	20-22		0.003			
Roads			1.415			0.518
Total	**22**	**93-110**	**6.293**	**8**	**26-30**	**2.061**

	STAGE 3			TOTAL		
Description	Lots/Blks	Units	Area (ha)	Lots/Blks	Units	Area (ha)
Residential/ Consolidation Block				21	114-134	5.138
Multiple Residential/ Consolidation Block	1	0-12	0.126	1	0-12	0.126
Park				3		0.960
Emergency Access				2	5-6	0.302
Walkway				1		0.018
0.3m Reserve				3		0.003
Roads						1.933
Total	**1**	**0-12**	**0.126**	**31**	**119-152**	**8.480**

Total Number of Units Proposed for Entire Plan (Hallman/Domm):430-656

Unit Calculations:

Minimum Unit Yield: 13.716m (45 ft) lots backing onto Open Space
12.192m (40 ft) lots across from those lots backing onto Open Space
10.9728m (36 ft) lots for the remainder
5.5m (18 ft) units from used for street townhouse blocks
Concept Plan used for minimum number of units in multiple blocks

Maximum Unit Yield: 12.192m (40 ft) lots backing onto Open Space
10.9728m (36 ft) lots across from those lots backing onto Open Space
9.0m (30 ft) lots for the remainder
5.5m (18 ft) units from used for street townhouse blocks
100 units/ha used for maximum number of units in multiple blocks

Rev. No.	Date	Issued / Revision	By
1.	Feb.4, 2021	For Submission to Region of Waterloo;	DGS

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
200-540 BINGEMANS CENTRE DR, KITCHENER, ON, N2B 3X9 | P: 519.576.3650 F: 519.576.0121 | WWW.MHBCPLAN.COM

Approval Stamp	
Date	February 4, 2021
File No.	0800C
Plan Scale	1:1,250 (36x36)
Drawn By	D.G.S.
Checked By	P.B.
Project	Westwood Phase 2
Applicant	Hallman Construction Limited/ Brian Domm
File Name	DRAFT PLAN
Dwg No.	1 of 1
Scale Bar	0 5 10 25 50 100m

K:\0800C-Gatestone Developments-North Dumfries Lands\DP\Consolidated Draft Plan February4 2021.dwg

Appendix B

Geotechnical Investigation

LVM

Soil and Materials Engineering
Environmental Engineering
Building Science
Supply Chain Quality

MTE Consultants Inc.

Cambridge West Development
Blenheim Road
Cambridge, Ontario

Geotechnical Investigation Report

Date: February 18, 2016
Ref. N°: 160P-000345-50-09-100-GE-R-0001-00

LVM

MTE Consultants Inc.

Cambridge West Development
Blenheim Road
Cambridge, Ontario

Geotechnical Investigation Report | 160-P-0003455-0-09-100

Prepared by :

Dan Gonser, EIT
Project Manager

REGISTERED PROFESSIONAL ENGINEER
J. B. ENGLAND
2016-02-19
PROVINCE OF ONTARIO

Reviewed by :

J. B. England, P.Eng.
Senior Geotechnical Engineer

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Test results mentioned herein are only valid for the sample(s) stated in this report.

LVMs subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, Ontario
N2B 3X9
Attention: Mr. Garett Korber, P.Eng.

REVISION AND PUBLICATION REGISTER		
Revision N°	**Date**	**Modification And/Or Publication Details**
0A	2014-08-21	Draft Report Issued
00	2016-02-18	Report Issued

DISTRIBUTION	
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1 original	File

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INTRODUCTION

LVM, a division of Englobe Corp. (LVM) has been retained to carry out a geotechnical investigation for the first development phase of the Cambridge West Community, in Cambridge, Ontario at the location shown on the attached Location Plan, Drawing 1. This work was authorized by MTE Consultants Inc. on April 29, 2014 following submission of a fee proposal.

The purpose of this investigation was to advance boreholes and install monitoring wells at predetermined locations along the proposed roads and in three proposed stormwater management (SWM) facilities, to determine the subsurface soil and groundwater conditions at the site and, based on this information, prepare this geotechnical engineering report with recommendations pertaining to site preparation, site servicing, culvert design and construction, surface works, house construction, and stormwater management facilities.

1 GENERAL INFORMATION

This project involves the first phase of development for the Cambridge West Community. The current development plans encompass the Domm Farms Ltd. lands and Hallman Construction Limited lands. The site comprises farmed fields and extends from Blenheim Road, north to the rear of the properties on Westcliffe Way and from the westerly Cambridge city limit, east to the edge of the farmed fields.

It is understood that the new development will include low to high density residential blocks, internal roadways with culvert structures, stormwater management facilities, and a school block.

The first phase of the proposed subdivision development encompasses an area of approximately 65 hectares, comprising predominantly agricultural lands, with some wetland and treed areas. The wetland areas within this phase of the development are located along the west side, in the north-central and south regions. The east edge of the site comprises a treed area leading into the Devil's Creek wetlands. Devil's Creek runs in a north-south direction outside the southeast edge of the site and this phase will include a new culvert structure for the creek, constructed under the realigned Blenheim Road.

2 INVESTIGATION PROCEDURE

2.1 DESKTOP REVIEW

LVM inc. carried out a hydrogeological investigation for the proposed Cambridge West Community development. The results of the investigation have been review in preparation of this report and can be found in the following report:

- LVM inc. Hydrogeology Study Report – Cambridge West Community – Master Environmental Servicing Plan, Roseville/Blenheim Road, Kitchener, Ontario. (Project No. P-036589-0300-HD-R-0001-00, November 2013)

The relevant borehole locations from the LVM inc. investigation are illustrated on the appended Site Plan, Drawing 2 and the borehole logs are appended.

2.2 FIELD PROGRAM

The fieldwork for the geotechnical investigation was carried out between May 20 and June 4, 2014. The original program called for thirty-one boreholes; however, due to access constraints, one borehole (Borehole BH-21-14) was altered to two hand sampled boreholes (Borehole BH-21A-14 and BH-21B-14). The hand sampled boreholes were advanced with the combination of a manually powered handheld auger and by driving a 50 mm outside diameter split spoon sampler using a 31.75 kg weight free-falling 760 mm. The blows to drive the sampler each 150 mm were recorded and have been converted to SPT N-values as indicated on the appended logs.

The remaining thirty boreholes (Boreholes BH-01-14 to BH-20-14 and BH-22-14 to BH-31-14) were drilled to depths ranging between 3.5 and 11.1 m. The boreholes were located in the proposed stormwater management facility locations and spaced at approximately 200 m intervals along the proposed roads. The borehole locations were staked onsite by MTE Consultants Inc. and are shown on the appended Site Plan, Drawing 2. The boreholes were advanced with a CME-55 track-mounted drillrig equipped with continuous flight hollow stem augers supplied and operated by Geo-Environmental Drilling Ltd.

Soil samples were recovered from the boreholes at regular 0.75 and 1.50 m depth intervals using a 50 mm outside diameter split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values are plotted on the appended borehole logs.

In addition to the boreholes, fifty handholes were advanced using a handheld auger to provide accurate topsoil depths throughout the planned development. The locations of the handholes were predetermined by laying out a 100 m by 100 m grid over the site, and are shown on the appended Drawing 3. The topsoil thickness at each test hole location is in the appended Table 1.

Local utility companies were contacted prior to the start of drilling activities in order to demarcate underground utilities near the borehole locations. A private utility locator was contracted to clear the boring locations of underground utilities.

Groundwater observations and measurements were carried out in the open boreholes during and upon completion of drilling, and the observations are summarized on the appended borehole logs.

Monitoring wells were installed in eight boreholes to allow measurement of the stabilized groundwater levels and to supplement the existing hydrogeological data of the area. The installations comprised 50 mm diameter pipes with slotted and filtered screens, as well as bentonite seals near the ground surface. Details of the installations and groundwater observations and measurements are provided on the borehole logs.

The monitoring well at Borehole BH-08-14 was tagged and a completed well record was submitted to the Ministry of Environment. A licensed well technician must properly decommission all monitoring wells before construction.

The fieldwork was observed by a member of our geotechnical engineering staff who documented the drilling and sampling procedures; recorded the SPT N-values; documented the soil stratigraphies; recorded the groundwater observations; and cared for the recovered soil samples.

The borehole locations and ground surface elevations were staked and surveyed by MTE Consultants Inc. (Drawing file: Boreholes.dwg and Excel Spreadsheet: LVM proposed borehole location – stake layout ground elevations May 2014.xlsx, received May 21 and May 14, 2014, respectively). It is understood that elevations are referenced to a geodetic benchmark.

2.3 LABORATORY TESTING

The soil samples secured during this investigation were returned to our laboratory for visual examination as well as moisture content tests. The moisture content test results are plotted on the borehole logs. The geotechnical laboratory testing also included:

- five particle size distribution analyses (ASTM D422) with results plotted on Figure 1; and,
- three standard Proctor moisture-density tests (ASTM D698-07e1) with results plotted on Figures 2 to 4.

The soil samples will be stored for a period of three months from the date of sampling. After this time, they will be discarded unless prior arrangements have been made for longer storage.

3 SUMMARIZED CONDITIONS

We refer to the appended borehole logs for detailed soil descriptions and stratigraphies; results of SPT testing; moisture content profiles; and groundwater observations.

The overall subsurface stratigraphy contacted at the site generally comprises topsoil underlain by deposits of sand, or sand and gravel. Silt was contacted in localized layers and pockets across the site and a significant silt deposit was encountered in Borehole BH-08-14. Fill was contacted in Borehole BH-04-14 advanced near the former farm house at the north of the site and in the hand sampled Boreholes BH-21A-14 and BH-21B-14, advanced at the edges of Devil's Creek, on the north side of Blenheim Road.

3.1 TOPSOIL AND FILL

Organics were contacted in all boreholes advanced at the subject site overlying the native mineral soils. In addition, fifty hand auger holes were dug in a grid pattern on the site to determine an accurate depth of topsoil. The topsoil thicknesses as encountered in the boreholes and hand holes advanced during this investigation varied between 100 and 1,070 mm. At the eighty-two test hole locations, the average topsoil thickness was found to be 366 mm. The topsoil generally ranges in composition from dark brown silt to sandy silt with some gravel and cobbles and was moist to very moist at the time of fieldwork. Traces of topsoil were also encountered at depths up to 1.5 m in Boreholes BH-07-14 to BH-10-14, surrounding the wetlands to the northwest of the site.

Fill was contacted in Boreholes BH-04-14, BH-21A-14 and BH-21B-14. In Borehole BH-04-14, the fill comprises dark brown organic silt with some sand and gravel and is remaining from the farm house formerly located on the property. In the two boreholes advanced adjacent to Devil's Creek, the fill comprises material placed as bank material, and contains some layered organics to a depth of up to 1.1 m.

3.2 SILT

Silt was contacted at the subject site in two boreholes (Boreholes BH-07-14 and BH-08-14) overlying the native granular soils, and in two boreholes (Boreholes BH-13-14 and BH-24-14) layered in the native granular soils.

The silt layer in Borehole BH-07-14 extends to a depth of 0.5 m and comprises silt with some sand, and traces of gravel and topsoil. The contacted silt deposit in Borehole BH-08-14 extends to a depth of 4.9 m and ranges in composition from silt with some sand to sandy silt, and contains some topsoil to a depth of 1.5 m. SPT N-values in the silt deposit at Borehole BH-08-14 range from 3 to 6 blows per 300 mm penetration of a split spoon sampler indicating a very loose to loose relative density. The contacted silt deposit was generally wet to saturated at the time of sampling.

Silt layers were contacted in Boreholes BH-13-14 and BH-24-14 at depths of 3.2 and 4.7 m (Elevation 309.9 and 300.8 m), respectively. The silt ranges in composition from silt with some fine sand and traces of clay and gravel to fine sandy silt. SPT N-Values in the silt layers were 22 and 27, indicating compact relative densities.

3.3 SAND/SAND AND GRAVEL

Sand and/or sand and gravel deposits were contacted in all boreholes advanced at the subject site underlying the topsoil, fill or silt soils. The granular deposits were continuous to borehole termination in all of the boreholes except Boreholes BH-13-14 and BH-24-14, where silt layers were contacted in the granular soils. Traces of topsoil or organics were contacted within the granular deposits in Boreholes BH-07-14 to BH-10-14 to depths of up to 1.5 m.

The contacted sand ranged widely in composition from silty fine sand to gravelly sand. The presence of cobbles was noted at various locations and ranged from occasional to numerous. The sand located above the stabilized groundwater was moist to wet at the time of fieldwork, and became saturated below the groundwater table. SPT N-values in the sand deposit vary from 3 blows to greater than 50 blows per 300 mm indicating variable very loose to very dense relative densities. The loose and very loose sand was contacted in Boreholes BH-09-14, BH-10-14, BH-14-14, BH-19-14, BH-23-14 and BH-31-14, and extends to depths up to 3 m. Elsewhere, the sand was generally in a compact state, with blow counts most commonly in the range of 10 to 30 blows per 300 mm penetration.

Three particle size distribution analyses were completed on representative samples of the sand and the results provided on Figure 1, appended. The results show that the samples contained 2 to 12% gravel, 82 to 91% sand, and 3 to 8% fines. The selected samples all meet the OPSS 1010 Select Subgrade Material specifications, and two of the samples meet the specifications for OPSS Granular 'B' Type I aggregate. The results of one standard Proctor moisture-density test performed on a sample of the sand is plotted on Figure 3 and shows a maximum dry density of 1.770 t/m^3 at an optimum moisture content of 13.0%.

The contacted sand and gravel ranges in composition from silty sand and gravel to sand and gravel with traces of silt. Cobbles were noted at various locations and ranged from occasional to numerous. The sand and gravel located above the stabilized groundwater was variably moist to wet at the time of fieldwork, and became saturated below the groundwater table. SPT N-values in the sand and gravel deposit vary from 4 blows to greater than 50 blows per 300 mm indicating variable loose to very dense relative densities. The loose sand and gravel was contacted in Boreholes BH-10-14, located in the area of the central SWM facility. The sand and gravel was generally in a compact state, with blow counts most commonly in the range of 20 to 30 blows per 300 mm penetration.

Two particle size distribution analyses were completed on representative samples of the sand and gravel and the results provided on Figure 1, appended. The results show that the samples contained 35 to 44% gravel, 52 to 59% sand, and 4 to 6% fines. The selected samples both meet the specifications for OPSS 1010 Select Subgrade Material, and OPSS Granular 'B' Type I aggregate. The results of two standard Proctor moisture-density tests performed on samples of the sand and gravel are plotted on Figures 2 and 4 and show maximum dry densities of 2.300 and 2.130 t/m^3 at optimum moisture contents of 6.1 and 9.1%, respectively.

3.4 GROUNDWATER

Groundwater observations and measurements carried out in the open boreholes, as well as the results of moisture content testing performed on recovered samples are provided on the appended borehole logs. The shallow groundwater table was contacted across the site, which ranges from Elevation 309.0 m at the west of the site to below Elevation 300.0 m at the southeast of the site, near Devil's Creek. Monitoring wells were installed in eight of the boreholes at the site, and stabilized groundwater measurements were taken on two occasions, with the Elevations provided in the appended Table 2.

For further details on the groundwater at this site, including shallow and deep groundwater contours, cross sections and seasonal high and low groundwater elevations, we refer the reader to the aforementioned LVM inc. hydrogeological study.

4 DISCUSSION AND RECOMMENDATIONS

The current site topography can be described as hummocky with rolling hill features. The subsurface stratigraphy encountered at the site comprises topsoil overlying native deposits of sand, and sand and gravel. Silt layers were contacted in localized areas at the site and a silt deposit was encountered surficially in Borehole BH-08-14. Fill material was contacted at the north of the proposed development, in the area where a farm was formerly located. Groundwater was measured at the west of the site as high as Elevation 308.9 m, and was not found in the monitoring well installed at BH-14-14; we refer to the aforementioned LVM inc. hydrogeological study performed at the site for further groundwater information and contours.

Based on the provided preliminary site grading plan (PDF File: Cambridge West – Preliminary Site Grading Plan.pdf, received July 11, 2014), it is understood that multiple low and high density lots are currently considered for the site. Internal roadways will be constructed to connect the new development to existing roadways (i.e. Westcliff Way and Bismark Drive in the north and the realigned Blenheim Road in the south). A school block, culvert structures and stormwater management facilities are also proposed for the development.

The purpose of this investigation is to provide geotechnical recommendations pertaining to site preparation, site servicing, culvert design, surface works, house construction, and stormwater management facilities.

4.1 SITE PREPARATION

Area grading will be required to prepare the site for the proposed residential development. Based on the provided preliminary cut-fill plan (PDF file: MTE rough cut-fill contours, February 4, 2014. Received April 9, 2014), it is understood that material will generally be cut from the higher grades (i.e. hill features, central portion of site) to raise grades in lower portions of the site, generally around the exterior areas, and wetlands. It is further understood that material excavated from the proposed stormwater management facilities will be considered for reuse on-site. Based on the provided contours, it is anticipated excess soil will be generated, and will need to be removed from site and stored elsewhere for re-use.

Prior to carrying out any area grading, the existing fill in the area of the former farm house and topsoil should be removed from below the proposed residential lots and streets. To provide an approximate quantity of topsoil to be stripped, fifty handholes were dug to determine the depth of topsoil, the topsoil thickness at the handhole and borehole locations are shown in the appended Table 1. The topsoil thickness contacted at the subject site varies from 100 to 1,070 mm. At the eighty-two test locations, the topsoil was found to have an average thickness of 366 mm. We recommend that the anticipated topsoil thickness be increased by 50 mm to account for variations and some stripping of the native mineral soil. The topsoil material could be used for landscaping fill to raise grades in the front and rear yards of house lots or in park lands.

Following removal of the fill and topsoil the exposed subgrade should be inspected by a geotechnical engineer and any loosened or soft pockets subexcavated. The finished subgrade should be sloped to promote rainwater drainage. The loose silt contacted in Borehole BH-08-14, in the location of a proposed culvert structure, is not suitable to remain below the culvert and should be removed prior to placing structural fill. It should be noted, traces of topsoil and organics were found within the upper native mineral soils in Boreholes BH-07-14 to BH-10-14 and should be removed prior to fill placement. Further, loose and very loose sand was contacted surficially in Boreholes BH-10-14, BH-12-12, BH-19-14, BH-23-14 and BH-31-14, at depths up to 3 m.

The major soil likely to be generated from the cut areas will comprise sands, and sand and gravels. Based on the results of in-situ moisture contents and standard Proctor moisture-density tests, the native soils from above the stabilized groundwater table may be drier than optimum and some water may have to be added prior to reuse as structural fill or road subgrade fill. Dewatered soils are generally not considered suitable for reuse due to the high residual moisture contents. It may be possible to mix drier than optimum soils with the dewatered soils, to achieve the desired moisture content. The fine-grained silt soils found in localized areas on the site should not be reused for structural fill but can be utilized as bulk fill in backyards or landscaped areas.

The non-cohesive, granular soils should be compacted with a smooth drum vibratory roller. The number of passes required will vary depending on the equipment used, fill material type, and moisture conditions of the fill material. If the area grading is carried out during dry weather, then water may need to be added to portions of the soils in order to achieve the specified levels of compaction.

It is recommended that construction traffic (particularly earth scrapers) be minimized on the finished subgrade, and the subgrade be sloped to promote rainwater drainage. Trafficability problems may be encountered for earth scrapers in the low-lying, wet areas of the development and tracked hydraulic excavators may be needed to remove some of the topsoil.

Any fill placed beneath structures must be placed as structural fill. Structural fill placed below residential buildings (houses), must be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% standard Proctor maximum dry density (SPMDD) provided the foundations are designed as per Part 9 of the Ontario Building Code (2012). Structural fill placed below the proposed culvert structures, must be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% standard Proctor maximum dry density (SPMDD).The structural fill should extend at least 1.0 m beyond the footing edge of any structure and outwards and downwards to the subgrade level at a slope of 1 horizontal to 1 vertical. A typical detail for a structural fill pad for a residential building is illustrated on Drawing 4, appended. Fill required to raise grades below the proposed streets and driveways should be compacted to 95% SPMDD.

Where higher bearing capacities are required (greater than 75 kPa) the structural fill must be compacted to a minimum 100% SPMDD. These areas will include the school block and any proposed higher density residential buildings. Further geotechnical investigation will be necessary for the design of these structures.

Where structural fill is placed on a wet subgrade, we suggest that only coarse sand and gravel material be used for the bottom few lifts. Also, the initial lift may be up to 450 mm thick in order to ensure trafficability and minimize compaction problems associated with instability of the subgrade caused by vibratory equipment.

Full-time inspection by experienced geotechnical personnel should be carried out during fill placement and compaction to examine and approve the fill material, verify the fill pad dimensions and to carefully monitor the placement and verify the compaction by insitu density testing.

4.2 SITE SERVICING

Following site grading operations, it is anticipated that the site will be provided with services including sanitary, watermain, and storm. Based on the servicing plans provided (MTE Consultants Inc., Project number 2534-100, Figure 6, Sanitary Servicing Plan, Dated December 1, 2015) it is understood that the invert levels for the sewers will be at depths up to 11.4 m below the proposed finished grades.

The proposed invert elevations for some of the services at this site are below the depths explored as part of this investigation. Once the alignment (both vertical and horizontal) of the trunk sanitary sewer has been finalized, further geotechnical investigation will be required prior to final design to confirm soil and groundwater conditions and present more detailed geotechnical recommendations.

4.2.1 Excavations and Dewatering

All trench excavations for service installation must comply with Ontario Regulation 213/91 (Construction Projects) under the Occupational Health and Safety Act. The native soils and any material placed as fill would be classified as Type 3 soils, and temporary excavation side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation. Where saturated deposits are contacted in the trench sides, the soil would be classified as Type 4, and temporary side slopes should be cut at a minimum gradient of 3 horizontal to 1 vertical from the base of the excavation.

The trench side slopes should be regularly inspected for evidence of instability following periods of heavy rainfall, following periods of thawing, or when the trench has been left open for an extended period of time. Appropriate remedial action should be taken to ensure the continued stability of the slopes.

The proposed route of the trunk sewer could create hydraulic connections between groundwater regimes that are not presently connected. To stop the movement of groundwater along the pipe bedding, it is recommended that concrete or clay collars be installed around the pipes. The collars should be at least 1.0 m long and in place of the standard bedding material. Clay seals shall be compacted to 95% standard Proctor maximum dry density (SPMDD) as per OPSS 410.07.18. (Also OPSD 802.095 and OPSS 1205).

It is understood that the new services will be installed at depths up to 11.4 m below the proposed site grades. Based on the aforementioned site servicing plan, and hydrogeological studies groundwater contours, it is anticipated that excavations for the proposed service installations in the development will encounter groundwater.

Due to the coarse grained texture of the subgrade soils, significant groundwater inflow should be expected for the excavations extending into the groundwater table. A dewatering system installed by a specialist dewatering contractor would be required to lower the groundwater level prior to excavation.

The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.3 m below the excavation base.

A Permit to Take Water (PTTW) is required by the Ministry of Environment in the event that the daily taking of groundwater exceeds 50,000 L per day or continues for longer than 30 days. Due to the granular texture of the soils on the subject site, a PTTW will likely be required.

It is recommended that several test pits be dug during the tendering stage of the project so that prospective contractors may familiarize themselves with the soil and groundwater conditions at the site.

If required and upon request, LVM would be pleased to review the finalized site servicing plans to determine if positive dewatering would be required and to assist with preparation for securing a Permit to Take Water.

4.2.2 Pipe Bedding

The subgrade soils beneath the watermain and sewer pipes will comprise compacted approved fill placed during the area grading activities or inspected and approved native mineral soils. No support problems are anticipated for flexible or rigid pipes founded in the approved fill or compact to very dense native mineral soils.

Prior to installation of the sewers and watermain, the subgrade should be inspected by a geotechnical engineer. Any loose or soft areas noted during the inspection should be subexcavated and replaced with compacted granular material such as OPSS Granular 'A'.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become unduly wet during excavation. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe. The bedding aggregate should be compacted to a minimum 100% standard Proctor maximum dry density (SPMDD). Water and sewer lines installed outside of heated areas should be provided with a minimum 1.2 m of soil cover or equivalent insulation for frost protection.

4.2.3 Backfill

Trenches above the specified pipe bedding should be backfilled with inorganic on-site soil placed in 300 mm thick lifts and compacted to at least 95% SPMDD.

Based on the results of insitu moisture content tests and standard Proctor moisture-density tests carried out on the native overburden deposits, portions of the excavated material may require some water added prior to reuse as backfill material. Dewatered soils are generally not considered suitable for reuse as backfill due to the remaining high moisture contents and should be stockpiled or mixed with drier soils to dry the material to near the optimum moisture content for compaction prior to reuse on-site, where required.

Special attention must be paid to the effects of deep sewers in easements between buildings, and sewers near the proposed culvert structures. It is recommended that footings be placed below a line projected upwards at 45° from the trench base. Where a sewer trench intersects the structural fill pad for a structure, the backfill must be placed as structural fill, compacted to the specified degree under full time engineering supervision. Alternatively, the trench can be backfilled with non-shrinkable fill (0.4 MPa concrete).

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to direct surface runoff away from the excavations. Should construction extend into the winter season, particular attention should be given to ensure that frozen material is not used as backfill.

Frequent inspection and compaction testing by experienced geotechnical personnel should be carried out to examine and approve backfill material, and to verify that the specified degree of compaction has been achieved.

4.3 CULVERT STRUCTURES

It is understood that animal crossing culvert structures are proposed within the Cambridge West development. A new culvert structure is also proposed under Blenheim Road at the Devil's Creek crossing. Boreholes were drilled in each of the proposed culvert locations, and proposed invert elevations were provided to LVM in December 2015. Due to access constraints, the borehole for the culvert at Devil's Creek was replaced with two manually driven boreholes on opposite sides of the creek.

The culvert structures are proposed to be in the areas of Boreholes BH-08-14, BH-09-14, and BH-21A-14/BH-21B-14. We refer the reader to the appended Drawing 2, Site Plan for the approximate culvert locations.

4.3.1 Culvert Subgrade

4.3.1.1 *Newman Drive Animal Crossing*

An animal crossing culvert is proposed to be located under Newman Drive, in the area of Borehole BH-08-14. It is understood that the culvert structure will be a 3.6 m wide concrete box structure, with the bottom of the culvert proposed to be at Elevation 311.95 m. The subgrade soils in this location comprise loose silt to a depth of 4.9 m (Elevation 306.8 m), overlying compact sand to the borehole termination. A monitoring well was installed in the culvert location, and on June 15, 2014 the stabilized groundwater was found to be at Elevation 308.9 m (2.8 m below grade).

The contacted silt is not suitable to remain below the culvert structure and must be removed prior to area grading operation. The subgrade for the culvert structure is expected to comprise engineered structural fill, compacted to 100% SPMDD, placed under fulltime geotechnical supervision and verified by insitu density testing. We refer the reader to Section 4.1 Site Preparation for details on structural fill placement.

Dewatering will be required to complete excavation of the loose soil and placement of the structural fill. Surface water runoff should be directed away from open excavations.

4.3.1.2 *Bismark Drive Animal Crossing*

An animal crossing culvert is proposed to be located under Bismark Drive, in the area of Borehole BH-09-14. It is understood that the culvert structure will be a 3.6 m wide concrete box structure, with the bottom of the culvert proposed to be at Elevation 310.41 m. The subgrade soils in this location comprise topsoil to a depth of 0.4 m (Elevation 309.4 m), overlying interlayered sand and gravel and sand deposits to the borehole termination. Monitoring wells were installed at adjacent boreholes to the south and northwest (Boreholes BH-06-14 and BH-12-14) and on June 15, 2014 the stabilized groundwater was found to be at Elevation 308.1 and 308.4 m, respectively. Based on observations and moisture content tests, groundwater was suspected at approximately 1.5 m below grade (Elevation 308.2 m) at the time of fieldwork, and lowering of the groundwater temporarily for construction will not likely be required at this location.

The subgrade for the culvert structure is expected to comprise engineered structural fill, compacted to 100% SPMDD, placed under fulltime geotechnical supervision and verified by insitu density testing. We refer the reader to Section 4.1 Site Preparation for details on structural fill placement.

The proposed animal crossing culvert is located above a proposed storm sewer pipe. The trench backfill in this area must be placed as structural fill, compacted to 100% SPMDD. The structural fill should extend at least 1.0 m beyond the footing edge and outwards and downwards to the subgrade level at a slope of 1 horizontal to 1 vertical. Alternatively, the trench can be backfilled with non-shrinkable fill (0.4 MPa concrete).

Shallow excavations for construction of the foundations at the depths proposed are not expected to encounter groundwater. Any minor groundwater seepage should be handled using conventional sump pumping and trenching techniques. Surface water runoff should be directed away from open excavations.

4.3.1.3 *Blenheim Road Culvert Crossing*

A culvert is proposed to be located under Blenheim Road at Devil's Creek, in the location of Boreholes BH-21A-14 and BH-21B-14. It is understood that the culvert will be an open bottom structure with the wingwall footings near Elevation 296.0 m. Hand sampled boreholes were advanced to the north of Blenheim Road, on both sides of Devil's Creek to evaluate the subgrade conditions. The subgrade soils in these locations comprise loose organic material to a depth of 1.1 to 1.2 m (Elevation 296.8 to 297.0 m), overlying dense sand and gravel to the borehole termination.

The contacted organic material is not suitable to remain below the culvert structure and must be removed. The subgrade for the culvert structure is expected to comprise native soils or engineered structural fill, placed on an inspected and approved subgrade, compacted to 100% SPMDD, placed under fulltime geotechnical supervision and verified by insitu density testing. We refer the reader to Section 4.1 Site Preparation for details on structural fill placement.

The footings are proposed to be near the water level in the creek. Based on observations and moisture contents in the boreholes, and the aforementioned LVM inc. hydrogeological study done on the subject site, groundwater is expected to be near the ground surface in this area. Some dewatering will be necessary for construction of this culvert structure, details of which can be found in Section 4.3.3 Excavations and Dewatering.

4.3.2 Culvert Foundation Design

It is anticipated that the subgrade soils will comprise tested and approved structural fill compacted to 100% SPMDD placed during the site grading activities or inspected and approved compact inorganic native mineral soils. Fill placed below the proposed culvert structures must be placed as structural fill compacted to a minimum of 100% standard Proctor maximum dry density (SPMDD).

The structural fill should extend at least 1.0 m beyond the footing edge and outwards and downwards to the subgrade level at a slope of 1 horizontal to 1 vertical. Fill required to raise grades below the roadways is only required to be compacted to 95% SPMDD, and full time inspection is required to confirm the culvert structural fill pad size and higher degree of compaction specifications are met.

Special attention must be paid to the effects of utility trench backfill adjacent to structures. It is recommended that footings be placed below a 45 degree line projected up from the edge of the trench base. Utility trench backfill within the structural fill for the culverts must be placed as structural fill compacted to a minimum of 100% SPMDD, under full time supervision by experienced geotechnical personnel. Alternatively, the trenches can be backfilled using unshrinkable fill (low strength concrete). The Bismark Drive animal crossing culvert is proposed to be located above a storm sewer, and care should be taken to ensure the structural fill pad location and dimensions.

Footings founded on the compact to dense native mineral soil or approved structural fill compacted to 100% SPMDD may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa and a soil bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) of 150 kPa.

The footing areas must be inspected by a geotechnical engineer to confirm that the soil conditions encountered at the time of construction are suitable to support the design bearing resistances. Any loose or disturbed soils identified during the inspection should be removed from the footing areas and replaced with concrete.

All exterior footings and those exposed to freezing should be provided with 1.2 m of soil cover to provide protection from freezing. If construction extends into the winter months, all founding soil must be protected from freezing during construction.

A Site Classification 'D' should be used for earthquake load and effects in accordance with Table 4.1.8.4.A of the Ontario Building Code (2012).

Material excavated during the footing construction is expected to comprise material placed as approved structural fill during the area grading activities at the site. The material would therefore be considered suitable for reuse as foundation wall backfill. Any additional material required should comprise imported granular soils such as OPSS Granular ‘B’. The backfill should be placed in maximum 300 mm thick lifts and compacted to 95% Standard Proctor Maximum Dry Density (SPMDD). The backfill should be brought up evenly on both sides of walls not designed to resist lateral earth pressure. Over-compaction must be avoided since this could cause excessive lateral earth pressure.

4.3.3 Excavations and Dewatering

Temporary excavations for culvert installation may encounter groundwater and must comply with Ontario Regulation 213/91 (Construction Projects) under the Occupational Health and Safety Act.

The native soils and any material placed as fill will be classified as Type 3 soils, and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation as per O.Reg. 213/91 s. 234(2). Where saturated deposits are exposed in the excavation sides, the soils should be treated as Type 4 soils, and the sidewalls will have to be sloped back to 3 horizontal to 1 vertical to ensure stability.

Significant groundwater inflow should be expected for excavations extending into the sand and gravel found at Devil's Creek, in Boreholes BH-21A-14 and BH-21B-14. It is therefore recommended to dewater the soils to below the bottom of the lowest excavation prior to any excavation work for the structures.

The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the deepest excavation in order to provide a stable base. Successful dewatering operations will depend on the contractor's own experience, construction techniques, sequencing and efficiency of work force and plant. Also the dewatering system must be in compliance with the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O.Reg. 451/07).

Groundwater control mechanisms will impact the groundwater regime and therefore surrounding potable wells should be surveyed prior to construction to establish baseline readings in the wells.

A Permit To Take Water (PTTW) may be required from the Ministry of Environment (MOE). A PTTW is required by the MOE in the event that the daily taking of groundwater exceeds 50,000 L/day, or the pumping continues for longer than 30 days.

Details of a PTTW application are beyond the scope of this report. The application for a Category 3 Permit, for pumping longer than 30 days or at a rate greater than 400,000 L/day will require a supporting technical study addressing potential hydrogeological impact. A Category 2 Permit application requires signoff by a professional, but is less onerous in terms of technical study requirements.

4.4 SURFACE WORKS

4.4.1 Curbs and Sidewalk

The concrete for curb, gutter and sidewalks should be proportioned, mixed, placed, and cured in accordance with the requirements of City of Cambridge Specifications for Sidewalks and Curbs. The concrete should meet the following specifications:

Concrete Strength	30 MPa
Slump (curb)	60 mm Max
Slump (sidewalk)	70 ± 20 mm
Air Entrainment	7.0 ± 1.5%

The City of Cambridge requires a minimum 125 mm of OPSS 1010 Granular 'A' to be placed below curbs and sidewalks and the Granular 'A' must extend a least 150 mm beyond the concrete edges. The Granular 'A' should be compacted to 100% SPMDD.

During cold weather, the freshly placed concrete must be covered with insulating blankets to protect against freezing. Three test cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature, and slump tests should be made from the same batch of concrete from which test cylinders are made.

4.4.2 Pavement Design

It is understood that internal roadways and roundabouts will be constructed for the proposed development connecting the new subdivision to existing roadways. Pavement designs have been provided for various road classes. Roundabouts should be designed to the standard of the highest volume road at the intersection. The following pavement component thicknesses are recommended based on the minimum pavement design requirements for the City of Cambridge:

Table 1 Pavement Component Thicknesses (Proposed Residential Subdivision)

PAVEMENT COMPONENT	LOCAL ROADS	COLLECTOR ROADS	BUS ROUTES
Asphaltic Concrete - Surface	40 mm	40 mm	40 mm
Asphaltic Concrete - Binder	80 mm	100 mm	150 mm
Granular 'A' Base Course	150 mm	150 mm	150 mm
Granular 'B' Subbase Course	375 mm	375 mm	375 mm

The amount of Granular 'B' used in the pavement structure will depend on the subgrade conditions. If silty or saturated soils are contacted, then the subbase thickness may have to be increased. This decision should be made by a qualified geotechnical engineer at the time of street construction.

The pavement subgrade materials should be thoroughly proof-rolled prior to placement of the Granular 'B' subbase course. If the subgrade is wet or unstable, or if the road construction must be carried out during poor weather conditions, then the subbase thickness may have to be increased.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

Based on The City of Cambridge design standards, the asphaltic concrete should comprise HL3 for the surface lift, and HL8 binder (two lifts). The HL3 surface mix must not contain any recycled material (RAP) and the HL8 binder mix may contain a maximum of 20% RAP. The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The recommended Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The predominant native soils on this site are free draining, and the proposed streets are anticipated to be at a minimum 2 to 3 m above the seasonal high groundwater, as found in our hydrogeological study. Therefore, subdrains should not be required below the pavement structure across most of the site. Final design grades should be reviewed with the high groundwater contours to confirm this assumption prior to construction.

4.5 HOUSE CONSTRUCTION

4.5.1 Foundations

In general, the undisturbed compact native mineral soils or approved structural fill are considered suitable to support residential house foundations. House footings must be designed as per Part 9 of the Ontario Building Code (2012).

The exterior footings or footings in unheated areas should be provided with a minimum 1.2 m of earth cover upon final grading for frost protection.

All founding surfaces for residential dwellings on structural fill or native soils should be inspected by a geotechnical engineer prior to placing concrete. The purpose of the inspection is to ensure that the subgrade soils are capable of supporting the house foundations, and to confirm that the house envelopes do not extend beyond the limits of the structural fill pads.

Additional geotechnical investigation work would be required in order to provide recommendations for larger buildings, such as schools, or apartment buildings.

4.5.2 Basements

The house basements must be provided with perimeter weeping tile systems as per the Ontario Building Code (2012). The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe is below the bottom of the basement floor slab. The weeping tile must drain to a suitable frost-free outlet or sump as per the City of Cambridge requirements.

The portion of the exterior basement wall below finished ground level must be damp proofed as per the Ontario Building Code (2012). The free-draining granular soils are well-suited for use as basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of at rest earth pressure (k_0) may be assumed as 0.50 for cohesionless sandy soils. The bulk unit weight of the retained backfill may be taken as 21 kN/m^3 for well-compacted sandy soil. An appropriate factor of safety should be employed.

The basement floor levels must be designed at least 0.75 m above the stabilized groundwater level as per City of Cambridge requirements.

The subgrade for the basement floor slabs should comprise undisturbed native soil or well-compacted approved structural fill. A minimum 100 mm thick layer of coarse clean granular material, such as OPSS 1010 Granular Type 'A' shall be placed beneath slabs in houses as per the Ontario Building Code.

4.6 STORMWATER MANAGEMENT FACILITIES

It is understood that stormwater infiltration is proposed for this site and stormwater management (SWM) facilities are proposed in three different locations, as shown on the appended Drawing 2.

4.6.1 Central Pond

The central SWM facility is proposed as a 'wetland' design, with a permanent pool elevation of 308.3 m. The wetland cell is proposed to have a base at Elevation 308.0 m and a Regional Storm Event water level at approximately Elevation 310.7 m. The micropools and forebay areas are proposed to have a base at Elevation 306.8 m. The proposed Boreholes BH-10-14 to BH-12-14 were advanced in the area of the proposed facility and the subgrade soils comprise layered deposits of sand and sand and gravel. Groundwater was measured in monitoring wells installed during the current investigation at Elevation 308.5 m (Borehole BH-10-14) and Elevation 308.4 (Borehole BH-12-14).

Significant groundwater inflow must be expected for excavations extending into the stabilized groundwater table. The soils contacted at Elevation 306.8 m, in the boreholes advanced within the pond footprint comprise sand and gravel. Based on the results of this investigation and five particle size analyses, the general soil profile existing at the site comprises surficial topsoil overlying major native deposits of sand, and sand and gravel. Using the geometric mean of four methods of analyses the hydraulic conductivity of the soils at this site is in the range of approximately 10^{-3} to 10^{-5} m/sec.

It is recommended to dewater the soils to below the bottom of the lowest excavation prior to any excavation work for the SWM facility.

The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the deepest excavation in order to provide a stable base. Successful dewatering operations will depend on the contractor's own experience, construction techniques, sequencing and efficiency of work force and plant. Also the dewatering system must be in compliance with the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O.Reg. 451/07).

Groundwater control mechanisms will impact the groundwater regime and therefore surrounding potable wells should be surveyed prior to construction to establish baseline readings of the wells.

A Permit To Take Water (PTTW) will be required from the Ministry of Environment (MOE). A PTTW is required by the MOE in the event that the daily taking of groundwater exceeds 50,000 L/day.

Details of a PTTW application are beyond the scope of this report. The application for a Category 3 Permit, for pumping longer than 30 days or at a rate greater than 400,000 L/day will require a supporting technical study addressing potential hydrogeological impact. A Category 2 Permit application requires signoff by a professional, but is less onerous in terms of technical study requirements.

Due to the high permeability of the native soils and the groundwater conditions, excavations for the forebay and micropool areas may necessitate the use of a 'dragline excavator' to facilitate subaqueous excavations.

The native soils at the site will be classified as Type 3 soils, and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation as per O.Reg. 213/91 s. 234(2). Where saturated deposits are exposed in the excavation sides, the soils should be treated as Type 4 soils, and the sidewalls will have to be sloped back to 3 horizontal to 1 vertical to ensure stability.

The slopes of the pond, below the proposed maximum water elevation (Elevation 310.7 m) should be cut to an inclination of 3 horizontal to 1 vertical or less. Above the maximum proposed water level, the slope may be increased to a maximum level of 2 horizontal to 1 vertical. The finished slopes above the permanent water level should be topsoiled and vegetated as soon as possible after construction to minimize surface erosion. Some routine maintenance of the slope surfaces will likely be required to address minor long-term weathering and erosion.

To ensure the slopes hold their shape after excavation and to provide long term stability, we recommend that a cellular confinement system (geocells) be placed over the base and any slopes proposed to be underwater. Examples of this type of product would be Terrafix's 'Terraweb' or GeoProducts 'EnviroGrid'. The mats should be placed on a clean, smooth subgrade, free of any protrusions or boulders. The mats should be attached together, and anchored to the manufactures specifications. The mats can be backfilled with the native soils on the site, however care should be taken to remove any cobbles or boulders that may be too large for the cells. The mats should be topsoiled and vegetated as soon as possible after completion. Construction traffic is not permitted over the mats and the topsoil will need to be spread either manually or using an excavator.

If dewatering is used for construction of the SWM facility, care must be taken while deactivating the dewatering system to prevent bank instability and failure by blowout. The dewatering well points should be gradually turned off in succession, allowing time for the water to stabilize. If the water is allowed to rise at a fast rate, excess pore water pressures will build up and may lead to blowout in the bottom or side embankments of the pond.

4.6.2 Southwest Pond

The proposed southwest SWM facility is proposed as a 'wet pond' design, with a proposed permanent pool Elevation of 309.6 m. The SWM facility will have wet cell, and forebay areas that will be founded at Elevation 308.1 m. Boreholes BH-26-14 and BH-27-14 were advanced in the area of the proposed facility and the subgrade soils comprise layered deposits of sand and sand and gravel. Groundwater was measured in a monitoring well installed during the current investigation at Elevation 308.3 m (Borehole BH-26-14).

Existing grades at the borehole locations in the area of the SWM pond range from Elevation 309.0 to 309.4 m (Boreholes BH-27-14 and BH-26-14, respectively). The topsoil in the area of the SWM pond is expected to be stripped during site grading operations. Following the removal of topsoil, the subgrade should be inspected and any loose or soft pockets beneath the banks should be subexcavated. It is anticipated material will be cut from the centre of the pond and that the banks will be constructed using onsite material comprising sand or sand and gravel.

Significant groundwater inflow must be expected for excavations extending into the stabilized groundwater table. Groundwater was measured in a monitoring well installed during the current investigation at Elevation 308.3 m (Borehole BH-26-14). Based on the results of this investigation and five particle size analyses, the general soil profile existing at the site comprises surficial topsoil overlying major native deposits of sand, and sand and gravel. Using the geometric mean of four methods of analyses the hydraulic conductivity of the soils at this site is in the range of approximately 10^{-3} to 10^{-5} m/sec.

It is recommended to dewater the soils to below the bottom of the lowest excavation prior to any excavation work for the SWM facility.

The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the deepest excavation in order to provide a stable base. Successful dewatering operations will depend on the contractor's own experience, construction techniques, sequencing and efficiency of work force and plant. Also the dewatering system must be in compliance with the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O.Reg. 451/07).

Groundwater control mechanisms will impact the groundwater regime and therefore surrounding potable wells should be surveyed prior to construction to establish baseline readings of the wells.

A Permit To Take Water (PTTW) will be required from the Ministry of Environment (MOE). A PTTW is required by the MOE in the event that the daily taking of groundwater exceeds 50,000 L/day.

Details of a PTTW application are beyond the scope of this report. The application for a Category 3 Permit, for pumping longer than 30 days or at a rate greater than 400,000 L/day will require a supporting technical study addressing potential hydrogeological impact. A Category 2 Permit application requires signoff by a professional, but is less onerous in terms of technical study requirements.

If dewatering is used for construction of the SWM facility, care must be taken while deactivating the dewatering system to prevent bank instability and failure by blowout. The dewatering well points should be gradually turned off in succession, allowing time for the water to stabilize. If the water is allowed to rise at a fast rate, excess pore water pressures will build up and may lead to blowout in the bottom or side embankments of the pond.

The native soils at the site will be classified as Type 3 soils, and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation as per O.Reg. 213/91 s. 234(2). Where saturated deposits are exposed in the excavation sides, the soils should be treated as Type 4 soils, and the sidewalls will have to be sloped back to 3 horizontal to 1 vertical to ensure stability.

The slopes of the pond, below the proposed maximum water elevation should be cut to an inclination of 3 horizontal to 1 vertical or less. Above the maximum proposed water level, the slope may be increased to a maximum level of 2 horizontal to 1 vertical. The finished slopes above the permanent water level should be topsoiled and vegetated as soon as possible after construction to minimize surface erosion. Some routine maintenance of the slope surfaces will likely be required to address minor long-term weathering and erosion.

It is our understanding that the southwest SWM pond is designed as a wet pond with a permanent pond of collected stormwater. In general terms, the stabilized groundwater level is up to about 1.5 m below the design water level in the pond, and the base soil material is granular and permeable.

Based on these requirements we suggest that a pond liner be utilized. None of the contacted soils on site would be suitable for a pond liner and it will not be cost-effective to import soil for use in a liner. We recommend that a synthetic liner be used.

A geosynthetic liner such as Terrafix's Bentofix NW liner or equivalent could be used. These liners comprise a sandwiched composite of geotextiles and bentonite clay. Prior to installing the liner, a 150 mm thick layer of sand should be laid on the subgrade to protect the liner from being punctured. This sand layer should be free of all particles larger than 19mm. Liner panels should be overlapped by at least 300 mm and bentonite paste should be provided at all seams. The panels at the top of the slope should be anchored. The liner must be covered with at least 200mm of sand to protect it from damage after construction. The liner must be covered with a sand and gravel ballast to 0.5 m above the base of the pond to prevent blowout of the liner.

Prior to placing the liner the native subgrade should be checked to ensure that the exposed soils are suitable to support the liner. Following construction of the liner, it is recommended that the dewatering system be deactivated at a controlled pace under the supervision of qualified geotechnical personnel. The reason for this is to prevent blowout of the liner in the base of the pond.

4.6.3 Southeast Pond

The proposed central SWM facility is proposed as a 'dry pond' design, with the base of the pond at Elevation 305.0 m and the maximum water level around Elevation 306.8 m. Boreholes BH-29-14 and BH-30-14 were advanced in the area of the proposed facility and the subgrade soils comprise layered deposits of sand and sand and gravel. Further investigation, including the installation of a monitoring well at this location is recommended to determine the stabilized groundwater elevation.

Groundwater inflow should be expected for excavations extending into the stabilized groundwater table, and a dewater system will be required to facilitate these excavations.

The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the deepest excavation in order to provide a stable base. Successful dewatering operations will depend on the contractor's own experience, construction techniques, sequencing and efficiency of work force and plant. Also the dewatering system must be in compliance with the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O.Reg. 451/07).

Groundwater control mechanisms will impact the groundwater regime and therefore surrounding potable wells should be surveyed prior to construction to establish baseline readings of the wells.

A Permit To Take Water (PTTW) may be required from the Ministry of Environment (MOE). A PTTW is required by the MOE in the event that the daily taking of groundwater exceeds 50,000 L/day, or the pumping exceeds 30 days.

Details of a PTTW application are beyond the scope of this report. The application for a Category 3 Permit, for pumping longer than 30 days or at a rate greater than 400,000 L/day will require a supporting technical study addressing potential hydrogeological impact. A Category 2 Permit application requires signoff by a professional, but is less onerous in terms of technical study requirements.

Care must be taken while deactivating the dewatering system to prevent bank instability and failure by blowout. The dewatering points should be gradually turned off in succession, allowing time for the water to stabilize. If the water is allowed to rise at a fast rate, excess pore water pressures will build up and may lead to blowout in the bottom or side embankments of the pond.

The native soils at the site will be classified as Type 3 soils, and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation as per O.Reg. 213/91 s. 234(2). Where saturated deposits are exposed in the excavation sides, the soils should be treated as Type 4 soils, and the sidewalls will have to be sloped back to 3 horizontal to 1 vertical to ensure stability.

The slopes of the pond, below the proposed maximum water elevation (Elevation 306.8 m) should be cut to an inclination of 3 horizontal to 1 vertical or less. Above the maximum proposed water level, the slope may be increased to a maximum level of 2 horizontal to 1 vertical. The finished slopes above the permanent water level should be topsoiled and vegetated as soon as possible after construction to minimize surface erosion. Some routine maintenance of the slope surfaces will likely be required to address minor long-term weathering and erosion.

To ensure the slopes hold their shape after excavation and to provide long term stability, we recommend that a cellular confinement system (geocells) be placed over the base and any slopes proposed to be underwater. Examples of this type of product would be Terrfix's 'Terraweb' or GeoProducts 'EnviroGrid'. The mats should be placed on a clean, smooth subgrade, free of any protrusions or boulders. The mats should be attached together, and anchored to the manufactures specifications. The mats can be backfilled with the native soils on the site, however care should be taken to remove any cobbles or boulders that may be too large for the cells. The mats should be topsoiled and vegetated as soon as possible after completion. Construction traffic is not permitted over the mats and the topsoil will need to be spread either manually or using an excavator.

4.7 CONSTRUCTION INSPECTION AND TESTING

Geotechnical inspections and insitu density testing should be conducted during site grading in order to verify that all organic and otherwise deleterious soils have been properly stripped; and, to ensure that all fill materials are being adequately compacted. During servicing contracts, daily compaction testing of pipe bedding and trench backfill should be carried out.

Appropriate laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for the curbs and sidewalks. All materials and construction services required for the work should be in accordance with the applicable sections of the OPSS, City of Cambridge Specifications, and Region of Waterloo Specifications.

5 STATEMENT OF LIMITATIONS

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, LVM should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood.

The geotechnical recommendations provided in this report are intended for the use of the owner and its retained designer. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. LVM accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

Appendix 1 Drawings

Drawing 1: Site Location Plan
Drawing 2: Detailed Site Plan
Drawing 3: Topsoil Thickness Location Plan
Drawing 4: Typical Structural Fill Detail for Residential Buildings

NOTES :
1-REFERENCES : © OpenStreetMap contributors (2013).

0 250 500 750 1000 m
SCALE 1:25000

Project

Cambridge West Development

Blenheim Road, Cambridge, Ontario

Title

LOCATION PLAN

LVM
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	GEOTECHNICAL	Project manager	D.Gonser
Drawn	E.Ciochon	Scale	1 : 25000	Sequence no.	01 of 04
Checked	D.Gonser	Date	2016-02-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0003455-0-09-100	GE	001	00

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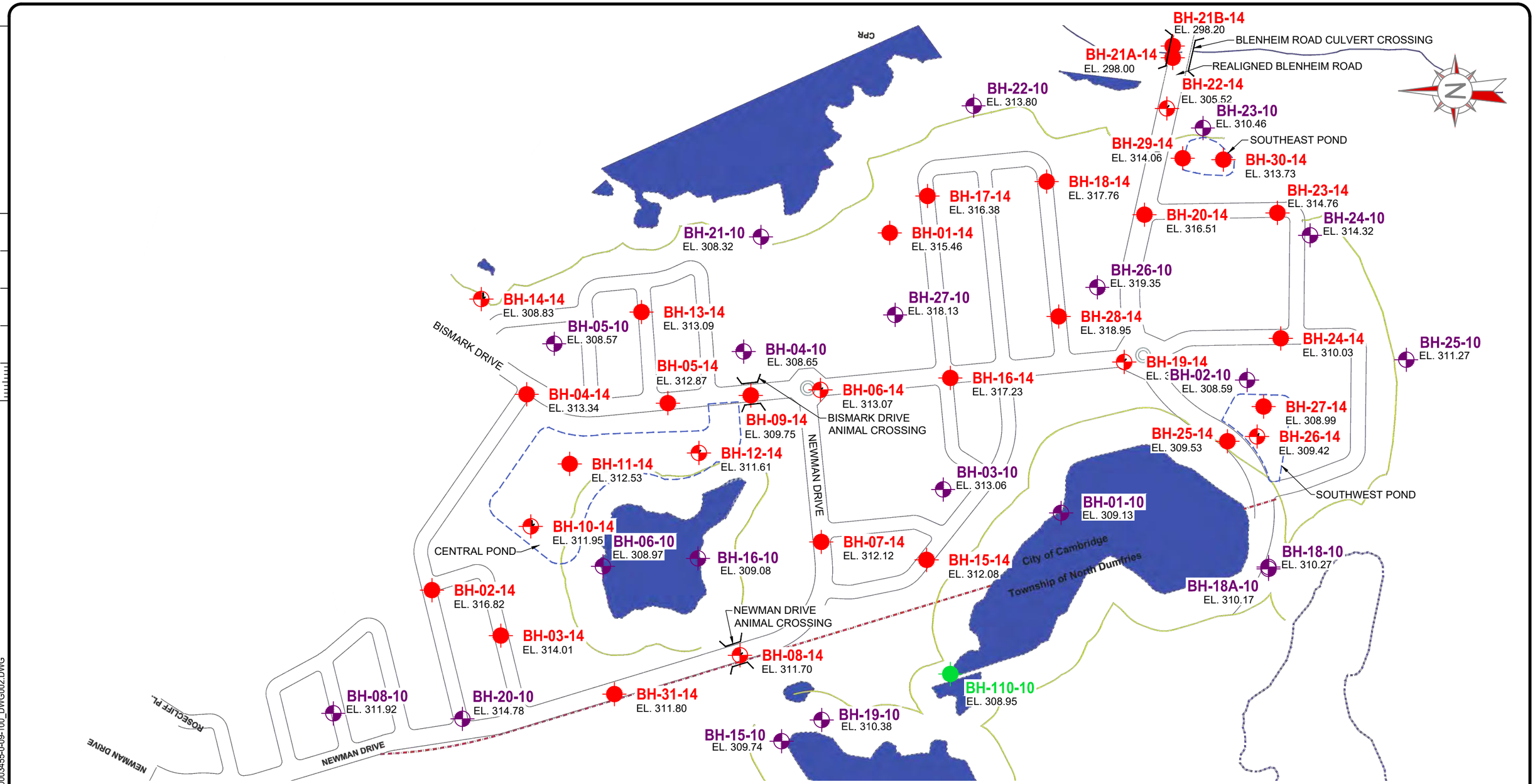

LEGEND :

- BOREHOLE LOCATION
- MONITORING WELL LOCATION
- BOREHOLE LOCATION INVESTIGATION P036589 (2010)
- BOREHOLE LOCATION INVESTIGATION P031655 (2010)
- EL. 298.00 GROUND SURFACE ELEVATION (m)
- PROPOSED SWM FACILITIES
- PROPOSED CULVERT STRUCTURE

NOTES :

1-REFERENCES: MHBC Cambridge West, Concept Plan, 2014-03-18.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 50 100 150 200 m

SCALE 1:5000

Project

Cambridge West Development

Blenheim Road, Cambridge, Ontario

Title

SITE PLAN

LVM

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared E.Ciochon	Discipline GEOTECHNICAL	Project manager D.Gonser	
Drawn E.Ciochon	Scale 1 : 5000	Sequence no. 02 of 04	
Checked D.Gonser	Date 2016-02-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0003455-0-09-100	GE	002	00

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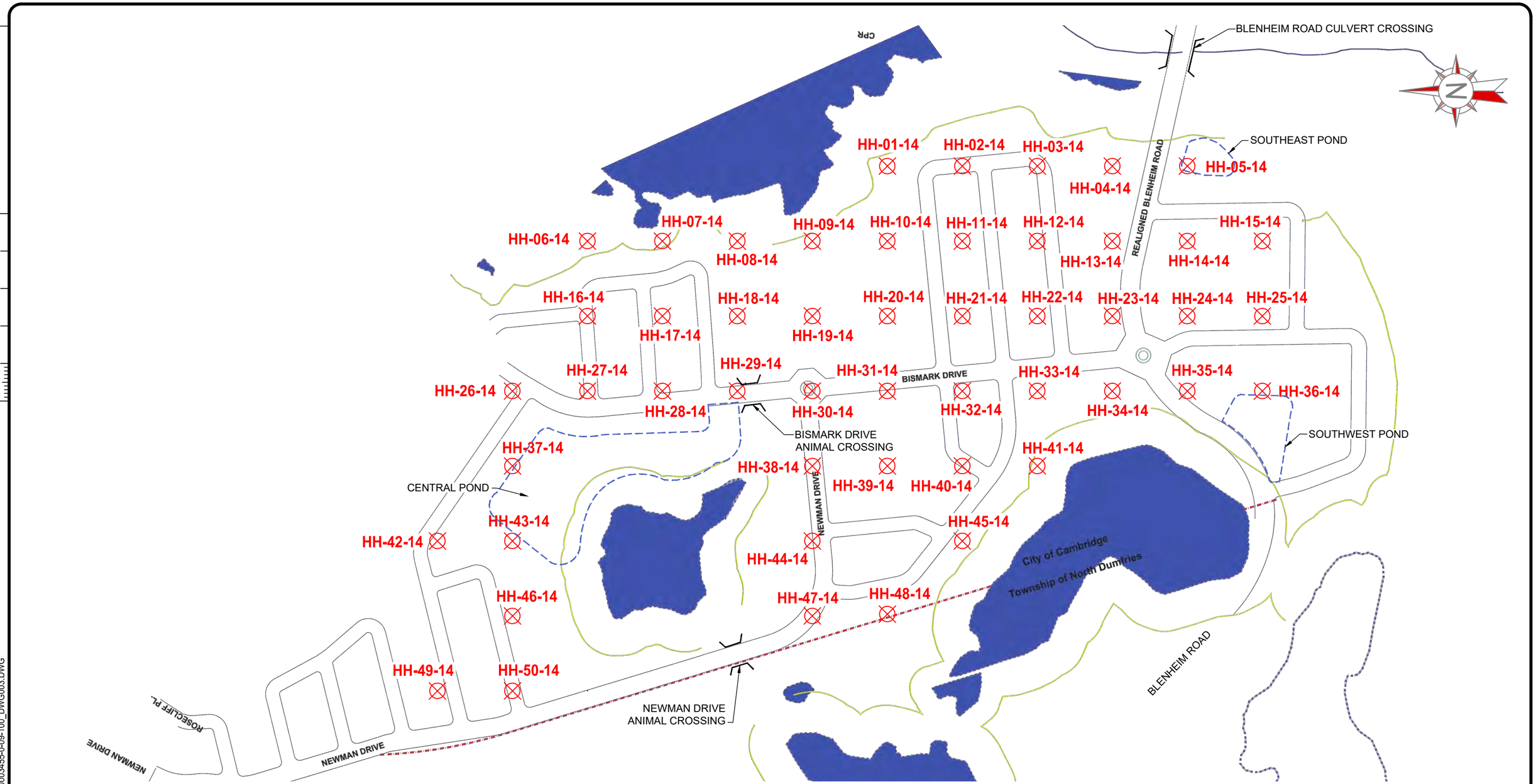

LEGEND :

- TOPSOIL THICKNESS TEST LOCATION
- PROPOSED SWM FACILITIES
- PROPOSED CULVERT STRUCTURE

NOTES :

1-REFERENCES: MHBC Cambridge West, Concept Plan, 2014-03-18.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 50 100 150 200 m

SCALE 1:5000

Project

Cambridge West Development

Blenheim Road, Cambridge, Ontario

Title

TOPSOIL THICKNESS LOCATION PLAN

LVM

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
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Prepared E.Ciochon	Discipline GEOTECHNICAL	Project manager D.Gonser	
Drawn E.Ciochon	Scale 1 : 5000	Sequence no. 03 of 04	
Checked D.Gonser	Date 2016-02-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0003455-0-09-100	GE	003	00

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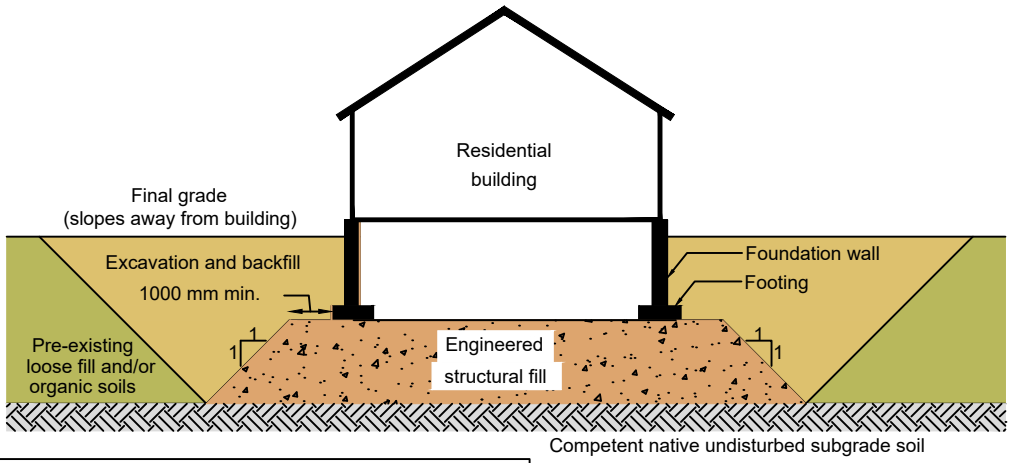
ENGINEERED STRUCTURAL FILL PAD



GENERAL REQUIREMENTS FOR ENGINEERED STRUCTURAL FILL

1. The area must be excavated of all pre-existing loose fill, topsoil, and/or organic soil until competent native undisturbed soil is reached.

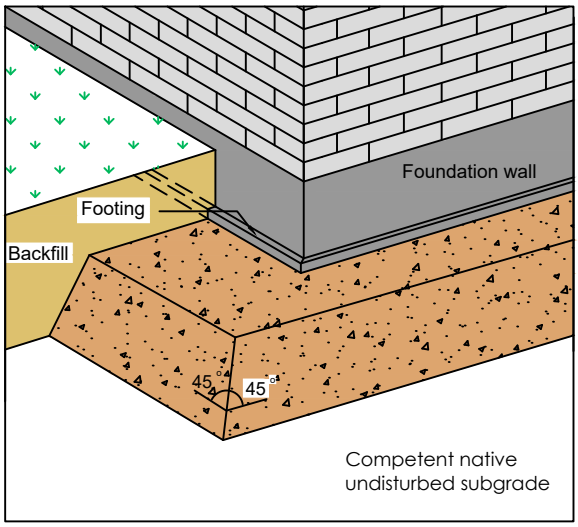
2. The excavation should allow for the structural fill to extend 1000 mm beyond the outside edge of the building footings and down to the approved subgrade soil at a slope of 1 horizontal to 1 vertical (45°).

3. The subgrade below the engineered fill should be inspected and approved by a geotechnical engineer prior to fill construction. Fill placement and compaction operations to be carried out under full-time geotechnical supervision.

4. The structural fill should comprise sand and gravel aggregate placed in 300 mm thick lifts and compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD). The exterior backfill should consist of approved inorganic soil also placed in 300 mm thick lifts and compacted to minimum 95% SPMDD.

5. All excavations must be carried out in conformance with the current Ontario Occupational Health and Safety Act and Regulations 213/91 for construction projects.

6. Exterior footings must be provided with minimum 1.2 m of soil cover for frost protection.



Project

Cambridge West Development

Blenheim Road, Cambridge, Ontario

Title

TYPICAL STRUCTURAL FILL PAD DETAIL FOR RESIDENTIAL BUILDINGS

LVM

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	GEOTECHNICAL	Project manager	D.Gonser
Drawn	E.Ciochon	Scale	NTS	Sequence no.	04 of 04
Checked	D.Gonser	Date	2016-02-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0003455-0-09-100	GE	004	00

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Appendix 2 Borehole Logs

List of Abbreviations

Boreholes BH-01-14 to BH-31-14

Borehole BH-110-10 (LVM Inc. Investigation P-036589-300, 2010)

Boreholes BH-01-10 to BH-06-10, BH-08-10, BH-15-10, BH-16-10, BH-18-10 to BH-27-10 (LVM Inc. Investigation P-031655-300, 2010)

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Core Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_L	Liquid limit
WC	Water Content Sample	I_L	Liquidity index
TP	Thinwall, Piston	I_p	Plasticity index
		PP	Pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60º cone a distance 300 mm (12 in.).
	The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description		
Cohesionless Soils	**SPT N-Value**	**Relative Density (D_r)**
Compactness Condition	(blows per 0.3 m)	(%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100
Cohesive Soils	**Undrained Shear Strength (C_u)**	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000
DTPL	Drier than plastic limit	Low Plasticity, W_L <30
APL	About plastic limit	Medium Plasticity, 30 < W_L < 50
WTPL	Wetter than plastic limit	High Plasticity, W_L > 50

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *315.46 m*

Borehole Number: BH-01-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-23*

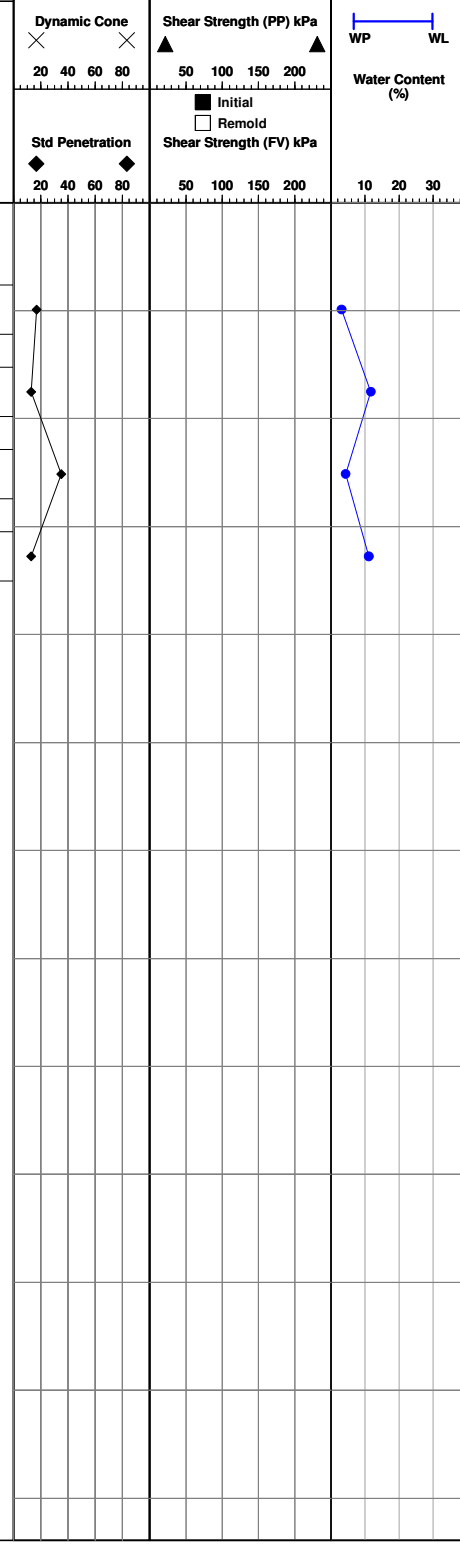
Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation		315.46				
	TOPSOIL: dark brown silt, trace sand gravel and corn roots, moist		0.00 / 315.13 / 0.33				
1	***SAND:*** compact brown sand, some gravel, trace silt, moist			SS-1	5-8 9	17	
	trace silt and gravel, very moist		313.94 / 1.52	SS-2	4-5 8	13	native backfill
2			313.17				
	SAND AND GRAVEL: dense brown sand and gravel, some silt and occasional cobbles, moist		2.29	SS-3	23-20 15	35	
3	***SAND:*** compact brown fine to coarse sand, some gravel, trace silt, moist		312.41 / 3.05	SS-4	5-6 7	13	native cave
			311.95 / 3.50				
4	Borehole terminated at 3.50 m						
5							
6							
7							
8							
9							
10							
11							
12							



Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *316.82 m*

Borehole Number: BH-02-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-20*

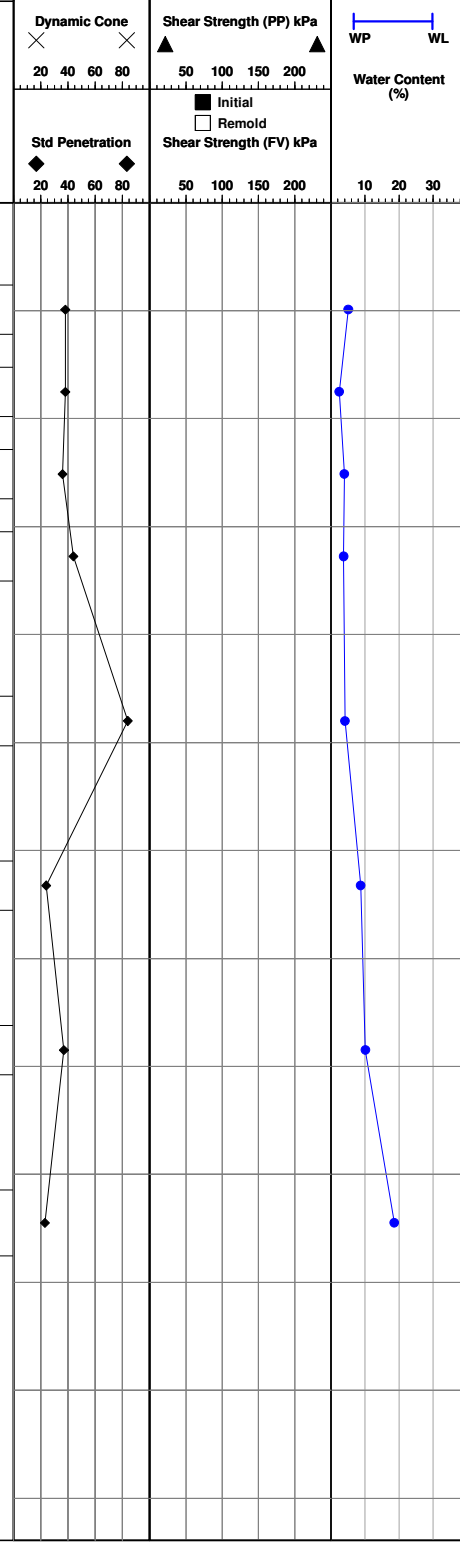
Field Tech: *D.Souter*

Drill Method: *Hollow Stem Auger*

Project: *Cambridge West Development*

Location: *Blenheim Road, Cambridge, Ontario*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation	316.82			
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist	0.00 / 316.41 / 0.41			
1	***SAND AND GRAVEL:*** dense brown sand and gravel, some silt, moist		SS-1	10-22 16	38
			SS-2	12-15 23	38
2			SS-3	14-18 18	36
3			SS-4	12-20 24	44
4	very dense	312.25 / 4.57	SS-5	40-42 42	84
5					
6	***SAND:*** compact brown fine sand, some silt, moist	310.72 / 6.10	SS-6	11-12 12	24
7			SS-7	10-22 15	37
8	very moist	308.74 / 8.08			
9	saturated	307.68 / 9.14	SS-8	8-11 12	23
	Borehole terminated at 9.75 m	307.07 / 9.75			
10					
11					
12					



Groundwater Observations and Standpipe Details

native backfill

bentonite seal

native cave

At drilling completion, dry cave at 5.79 m.

Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes: *Bulk sample AS-4A taken from 3.05 to 4.57 m.*

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *314.01 m*

Borehole Number: BH-03-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-20*

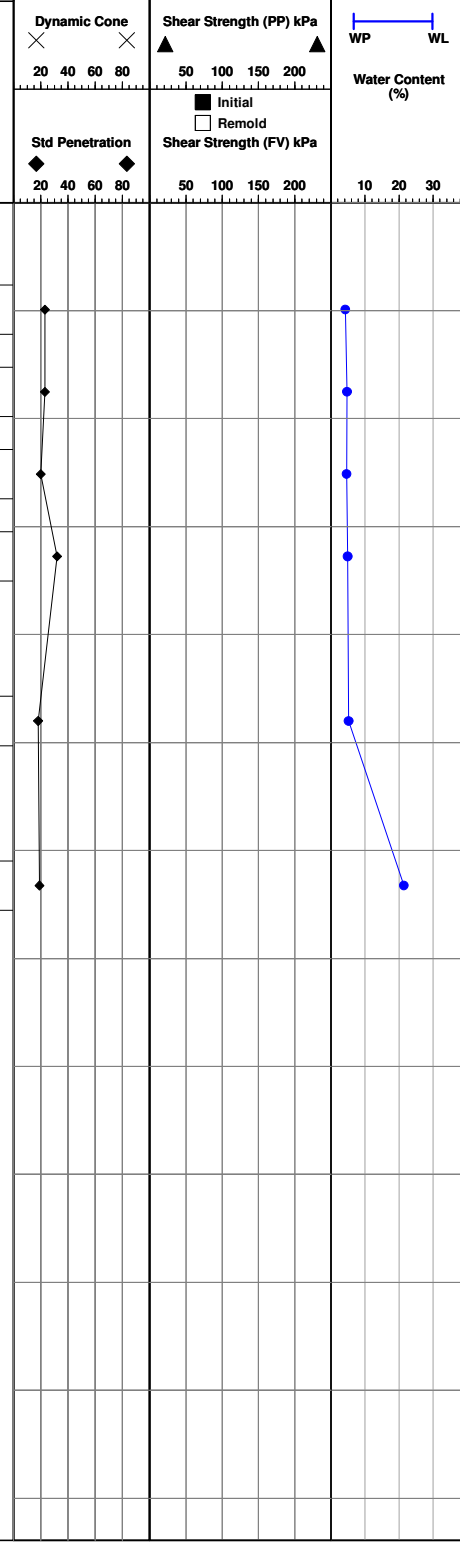
Project: *Cambridge West Development*

Field Tech: *D.Souter*

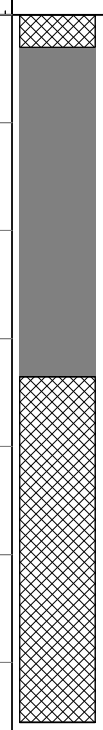
Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation	314.01			
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist	0.00 / 313.76 / 0.25			
1	***SAND:*** compact brown sand, some gravel and silt, moist	312.49 / 1.52	SS-1	10-11 12	23
2	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, moist	311.72 / 2.29	SS-2	9-11 12	23
3	***SAND:*** compact grey and brown coarse sand, some gravel, trace silt, moist	310.96 / 3.05	SS-3	9-10 10	20
	dense, gravel and coarse sand	309.44 / 4.57	SS-4	8-11 21	32
5	compact, trace gravel and silt	307.91 / 6.10	SS-5	8-8 10	18
6	fine sand, some silt, saturated; some grey sandy silt layers, wet	307.46 / 6.55	SS-6	7-9 10	19
	Borehole terminated at 6.55 m				



Groundwater Observations and Standpipe Details



At drilling completion, dry cave at 3.35 m.

Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes:

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *313.34 m*

Borehole Number: BH-04-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation	313.34			
	FILL: dark brown silt (topsoil), some sand and gravel, moist	0.00 / 313.11 / 0.23			
1	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, moist	311.82 / 1.52	SS-1	7-8 9	17
2	***SAND:*** compact brown medium sand, some silt, trace gravel, moist	311.05 / 2.29	SS-2	5-7 7	14
	trace silt and gravel, very moist	310.29 / 3.05	SS-3	4-5 6	11
3	medium to coarse sand	308.77 / 4.57	SS-4	5-5 6	11
4	fine sand, trace silt	307.24 / 6.10	SS-5	6-7 10	17
6	gravelly coarse sand, some silt, saturated	305.72 / 7.62	SS-6	6-9 12	21
7	silty fine sand, some dark grey stains	304.20 / 9.14	SS-7	3-4 6	10
9	brown, wet to saturated	303.43 / 9.91	SS-8	6-10 12	22
10	saturated	302.98 / 10.36	SS-9	3-6 8	14
	Borehole terminated at 10.36 m				

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

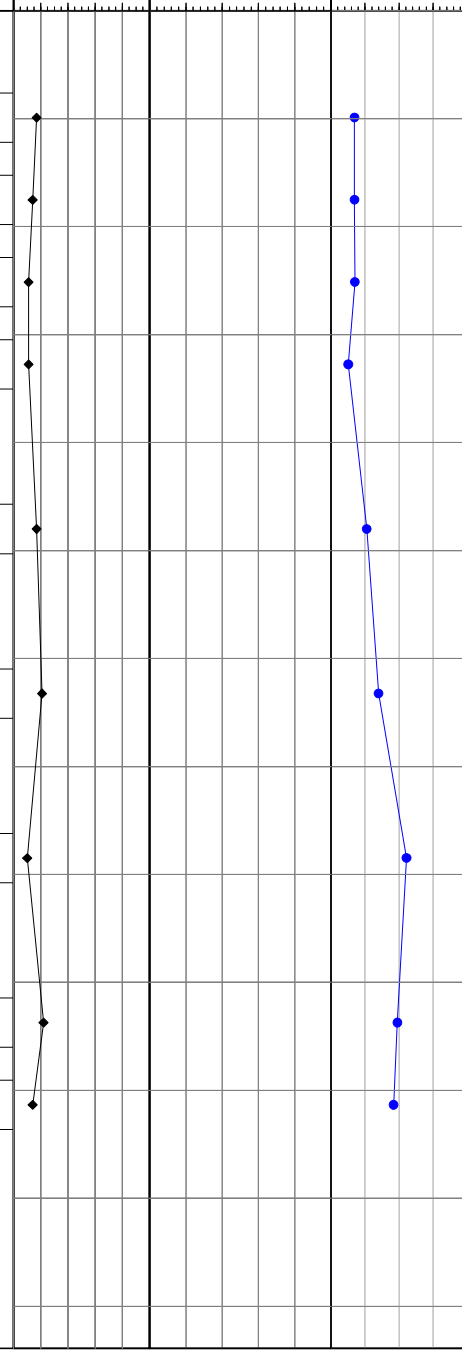
Shear Strength (PP) kPa: 50 100 150 200

Initial / Remold

Shear Strength (FV) kPa: 50 100 150 200

WP WL

Water Content (%): 10 20 30



Groundwater Observations and Standpipe Details

native backfill

bentonite seal

native cave

At drilling completion, wet cave at 5.49 m.

Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes: *Bulk sample AS-4A taken from 3.05 to 4.57 m.*

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *312.87 m*

Borehole Number: **BH-05-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (WP – WL; 10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		312.87							
	TOPSOIL: dark brown silt, some sand and gravel, moist		0.00 / 312.67 / 0.20							native backfill
1	***SAND:*** compact brown gravelly sand, some silt, moist			SS-1	5-7 10	17				bentonite seal
				SS-2	6-8 8	16				
2			310.58							
	SAND AND GRAVEL: compact brown sand and gravel, some silt, moist		2.29	SS-3	6-10 16	26				
3	very dense		309.82 / 3.05	SS-4	25-50 /150 mm					
4										native cave
	saturated		308.30 / 4.57	SS-5	10-14 21	35				
5										
6			306.77							
	SAND: dense brown coarse sand, some silt and gravel, saturated		6.10 / 306.32 / 6.55	SS-6	11-15 16	31				
	Borehole terminated at 6.55 m									At drilling completion, dry cave at 2.13 m.
7										
8										
9										
10										
11										
12										

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes: *Bulk sample AS-3A taken from 2.29 to 3.05 m.*

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *313.07 m*

Borehole Number: **BH-06-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-22*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		313.07						
	TOPSOIL: dark brown silt, some sand and gravel, trace corn roots, moist		0.00 / 312.79 / 0.28						
	SAND AND GRAVEL: compact brown sand and gravel, some silt, occasional cobbles, moist			SS-1	9-12 13				
				SS-2	7-9 10				
	dense		310.78 / 2.29	SS-3	8-10 25				
				SS-4	12-15 16				
	compact, very moist		308.50 / 4.57						
	wet to saturated		308.19 / 4.88	SS-5	8-10 18				
	saturated		306.97 / 6.10	SS-6	9-11 10				
	Borehole terminated at 6.55 m		306.52 / 6.55						

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

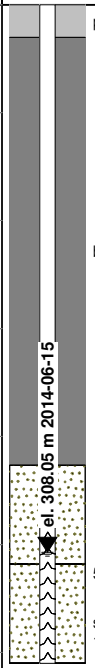
Shear Strength (PP) kPa: 50 100 150 200

Shear Strength (FV) kPa: 50 100 150 200

Initial / Remold

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details



protective cover and concrete

bentonite seal

50 mm pipe

sand pack
1.52 m slotted screen

July 9, 2014
groundwater at Elevation
307.86 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *312.12 m*

Borehole Number: BH-07-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

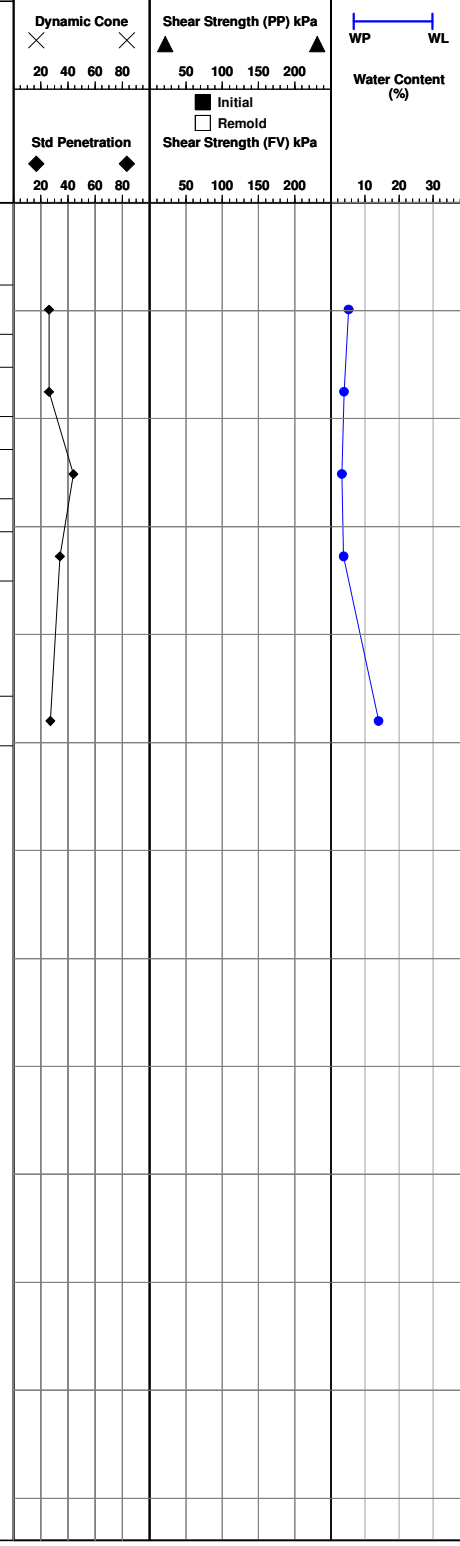
Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation	312.12			
	TOPSOIL: dark brown silt, some sand, gravel and corn roots, moist	0.00 / 311.97 / 0.15			
	SILT: brown silt, some sand, trace gravel and topsoil, moist	311.66 / 0.46	SS-1	8-10 16	26
1	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt and cobbles, moist		SS-2	9-12 14	26
2	dense	309.83 / 2.29	SS-3	15-18 26	44
3		308.77 / 3.35	SS-4	32-21 13	34
	SAND: compact brown coarse sand, some silt, trace gravel, moist				
4	dark brown silty sand, some gravel, saturated	307.85 / 4.27	SS-5	8-12 15	27
5	brown, trace cobbles	307.24 / 4.88			
	Borehole terminated at 5.03 m	307.09 / 5.03			



Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, dry cave at 2.29 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

EQ-09-Ge-72 R.1 18.02.2011

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EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *311.70 m*

Borehole Number: **BH-08-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-22*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa (Initial, Remold)	Water Content (%) (WP–WL)
	Ground Elevation		311.70						
	TOPSOIL: dark brown silt, trace sand, gravel and corn roots, moist		0.00 / 311.29 / 0.41						
	SILT: dark brown silt, some topsoil and sand, wet to saturated			SS-1	2-1 2				
	loose brown sandy silt, saturated		310.18 / 1.52	SS-2	2-3 3				
	wet		309.41 / 2.29	SS-3	3-2 2				
	mottled grey and brown, wet		308.65 / 3.05	SS-4	2-3 3				
	some saturated gravel and silty sand in spoon		307.13 / 4.57	SS-5	4-5 5				
	SAND: compact brown gravelly sand, some silt, saturated		306.82 / 4.88	SS-6	5-8 10				
				SS-7	4-6 9				
	Borehole terminated at 8.08 m		303.62 / 8.08						

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 (Initial / Remold)

Water Content (%): WP – WL; 10 20 30

Groundwater Observations and Standpipe Details

July 9, 2014
shallow standpipe dry, groundwater at Elevation 308.49 m in deep standpipe.

Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes: *Bulk sample AS-3A taken from 2.29 to 3.05 m.*

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *309.76 m*

Borehole Number: **BH-09-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (10 20 30)
	Ground Elevation		309.76						
	TOPSOIL: dark brown silt, some sand and gravel, moist		0.00 / 309.40 / 0.36						
1	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, trace topsoil, moist			SS-1	6-10 11	21			
	silty sand and gravel, wet		308.24 / 1.52	SS-2	6-5 6	11			
2			307.47						
	SAND: loose grey and brown coarse sand, some gravel, trace silt		2.29	SS-3	2-4 5	9			
3			306.71						
	SAND AND GRAVEL: compact grey and brown sand and gravel, some silt, saturated		3.05	SS-4	3-5 6	11			
4			305.19						
	SAND: compact brown silty sand, some gravel, saturated		4.57	SS-5	5-10 10	20			
6			303.66						
	greenish brown coarse sand, some silt and gravel		6.10 / 303.21	SS-6	6-9 11	20			
	Borehole terminated at 6.55 m		6.55						
7									
8									
9									
10									
11									
12									

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, wet cave at 1.83 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *311.95 m*

Borehole Number: **BH-10-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-22*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

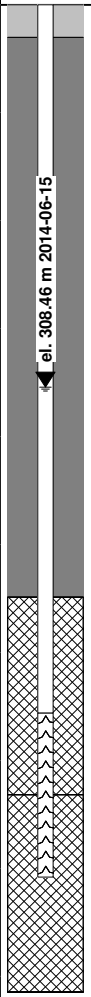
SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		311.95						
	TOPSOIL: dark brown silt, some sand and gravel, trace corn roots, moist		0.00 / 310.88						
1	***SAND:*** loose brown and dark brown silty sand, some gravel, trace topsoil, very moist		1.07 / 310.43	SS-1	2-2 2				
	brown silty fine sand, trace clay and gravel, very moist to wet		1.52 / 309.66	SS-2	1-2 4				
2	coarse sand, trace silt and gravel, moist		2.29 / 308.90	SS-3	3-4 4				
3	compact, some gravel		3.05 / 308.60	SS-4	3-5 5				
	wet		3.35 / 307.38						
4	***SAND AND GRAVEL:*** loose grey/brown coarse sand and fine gravel, trace silt, saturated		4.57 / 305.85	SS-5	2-2 2				
5	***SAND:*** compact grey/brown medium sand, trace silt and gravel, saturated		6.10 / 302.81	SS-6	3-5 6				
6				SS-7	6-4 6				
7									
8									
9	Borehole terminated at 9.14 m		9.14						
10									
11									
12									

Dynamic Cone: 20 40 60 80 — Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200 — Initial / Remold — Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP — WL; 10 20 30

Groundwater Observations and Standpipe Details



protective cover and concrete

bentonite seal

native cave (sand pack)
50 mm pipe
1.52 m slotted screen.

July 9, 2014
groundwater at Elevation
308.25 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes: *Bulk sample AS-8 taken at 9.14 m (moisture content=14.2%).*

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *312.53 m*

Borehole Number: **BH-11-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

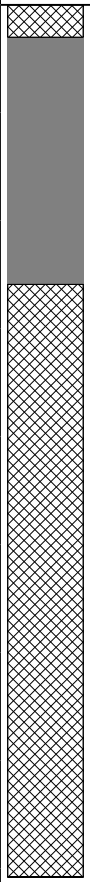
Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (WP – WL; 10 20 30)
	Ground Elevation		312.53						
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist		0.00 / 312.33						
	some gravel		0.20 / 312.12						
	SAND AND GRAVEL: compact brown sand and gravel, some silt, moist to very moist		0.41	SS-1	5-7 17	24			
1				SS-2	7-9 18	27			
2			310.24						
	SAND: compact brown coarse sand, trace silt and gravel, very moist		2.29	SS-3	6-7 8	15			
3			309.48						
	some gravel		3.05	SS-4	6-7 8	15			
4			307.96						
	SAND AND GRAVEL: compact brown sand and gravel, some silt, saturated		4.57	SS-5	9-11 12	23			
5									
6			306.43						
	SAND: compact brown silty fine sand, saturated		6.10	SS-6	8-9 11	20			
7									
8			304.45	SS-7	6-7 8	15			
	Borehole terminated at 8.08 m		8.08						
9									
10									
11									
12									

Groundwater Observations and Standpipe Details



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Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *311.61 m*

Borehole Number: **BH-12-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-22*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200; Initial / Remold)	Water Content (%) (10 20 30; WP – WL)	Groundwater Observations and Standpipe Details
	Ground Elevation		311.61							
	TOPSOIL: dark brown silt, some sand and gravel, trace corn roots, moist		0.00 / 311.23 / 0.38							protective cover and concrete
1	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, moist to very moist			SS-1	6-10 13					
			310.09 / 1.52							
2	dense, trace silt, numerous cobbles, moist			SS-2	12-20 22					
			309.32 / 2.29							
	compact, grey and brown			SS-3	8-12 14					bentonite seal
3			308.56 / 3.05							el. 308.38 m 2014-06-15
	saturated		308.26 / 3.35	SS-4	8-8 8					
4	***SAND:*** compact brown coarse sand, some gravel, trace silt, saturated		307.04							
	SAND AND GRAVEL: dense brown and grey coarse sand and fine gravel, trace silt, saturated		4.57 / 306.73 / 4.88	SS-5	8-12 19					sand pack 50 mm pipe 1.52 m slotted screen
5	yellowish brown sand and coarse gravel, some silt									
6			305.51							
	compact greyish brown sand and gravel, some silt		6.10 / 305.06	SS-6	8-10 10					native cave
	Borehole terminated at 6.55 m		6.55							July 9, 2014 groundwater at Elevation 308.19 m.
7										
8										
9										
10										
11										
12										

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *313.09 m*

Borehole Number: **BH-13-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		313.09						
	TOPSOIL: dark brown silt, some sand and gravel, trace corn roots, moist		0.00 / 312.63						
	SAND: compact grey and brown coarse sand, some gravel, trace silt, moist		0.46	SS-1	6-9 10	19			
				SS-2	7-9 9	18			
				SS-3	7-8 9	17			
	fine sand, some silt		310.04 / 3.05	SS-4	8-11 11	22			
	SILT: compact brown fine sandy silt, moist		309.89 / 3.20						
	wet		309.66 / 3.43						
	SAND: compact brown fine sand, trace silt, moist		308.52 / 4.57	SS-5	10-12 15	27			
	layers of grey/brown silt, some sand, clay and gravel, moist		306.99 / 6.10	SS-6	11-12 16	28			
	silty fine sand, wet		306.54 / 6.55						
	dense brown, saturated		305.47 / 7.62	SS-7	13-18 22	40			
	wet		303.95 / 9.14	SS-8	11-13 16	29			
	Borehole terminated at 9.60 m		303.49 / 9.60						

Dynamic Cone: 20 40 60 80 — Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200 — Initial / Remold — Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL — 10 20 30

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, dry cave at 6.40 m.

Reviewed by: *D.Gonser*

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Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *308.83 m*

Borehole Number: **BH-14-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-22*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (WP – WL; 10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		308.83							
	TOPSOIL: dark brown silt, trace sand, moist		0.00 / 308.52 / 0.30							protective cover and concrete
1	***SAND:*** loose brown coarse sand, some gravel, trace silt, moist			SS-1	4-4 4					
	medium sand, trace silt and gravel		307.31 / 1.52	SS-2	2-3 3					
2	fine sand, some silt		306.54 / 2.29	SS-3	3-3 5					bentonite seal
	silty fine sand, very moist		306.24 / 2.59							
3	compact fine sand, some silt, moist		305.63 / 3.20	SS-4	3-5 5					
4										
				SS-5	5-6 7					
5	silty fine sand, trace gravel, very moist to wet		303.90 / 4.93							
	loose to compact, wet		303.50 / 5.33	SS-6	4-6 4					sand pack 50 mm pipe 1.52 m slotted screen
6	some silt, trace sand and clay layers, very moist to wet		302.73 / 6.10	SS-7	5-6 6					native cave
	fine sand, trace silt, moist		302.43 / 6.40							June 15 and July 9, 2014. Monitoring well dry.
	Borehole terminated at 6.55 m		302.28 / 6.55							
7										
8										
9										
10										
11										
12										

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *312.08 m*

Borehole Number: **BH-15-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-21*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (WP – WL; 10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		312.08							
	TOPSOIL: dark brown silt, some gravel, trace sand, very moist		0.00 / 311.57							
	SAND AND GRAVEL: compact brown sand and gravel, some silt, moist		0.51 / 310.56	SS-1	7-8 9					native backfill
1										bentonite seal
	SAND: compact brown sand, some silt, trace gravel, moist to very moist		1.52 / 309.79	SS-2	5-6 8					
2	some gravel, trace silt, moist		2.29 / 309.03	SS-3	7-11 12					
3	very dense coarse sand, very moist		3.05 / 308.27	SS-4	16-22 32					native cave
	saturated		3.81 / 307.96	SS-5	12-10 8					
4	compact brown and dark brown sand, some silt, trace gravel, saturated		4.12 / 307.81							
	Borehole terminated at 4.27 m		4.27							At drilling completion, dry cave at 2.44 m.
5										
6										
7										
8										
9										
10										
11										
12										

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *317.23 m*

Borehole Number: **BH-16-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-23*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		317.23							
	TOPSOIL: dark brown silt, trace sand, gravel and corn roots, moist		0.00 / 316.90 / 0.33							native backfill
1	***SAND AND GRAVEL:*** dense brown sand and gravel, some silt, occasional cobbles, moist			SS-1	5-11 20	31				bentonite seal
2				SS-2	16-16 16	32				
				SS-3	5-16 20	36				
3	compact		314.18 / 3.05	SS-4	16-12 11	23				
4										
	dense, coarse sand and gravel, trace silt		312.66 / 4.57	SS-5	20-26 16	42				
5										
6				SS-6	9-15 19	34				native cave
7			309.61							
	SAND: dense brown sand, some silt, moist		7.62	SS-7	8-17 28	45				
8										
9			308.09							
	dense light brown fine sand, trace silt, moist		9.14 / 307.63	AS-8						
	Borehole terminated at 9.60 m		9.60							At drilling completion, dry cave at 2.29 m.
10										
11										
12										

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) / Shear Strength (FV) kPa: 50 100 150 200 — Initial / Remold

Water Content (%): WP – WL; 10 20 30

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *316.38 m*

Borehole Number: **BH-17-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-23*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (10 20 30)
	Ground Elevation		316.38						
	TOPSOIL: dark brown silt, trace sand, gravel and roots, moist		0.00 / 316.07 / 0.30						
1	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt, occasional cobbles, moist			SS-1	3-6 12	18			
	dense		314.86 / 1.52	SS-2	7-15 17	32			
2				SS-3	13-17 23	40			
3	***SAND:*** compact brown coarse sand, some gravel, trace silt, moist		313.33 / 3.05	SS-4	8-8 10	18			
4									
	dense medium sand, trace silt and gravel		311.81 / 4.57	SS-5	9-12 18	30			
5									
6	compact, some gravel		310.28 / 6.10	SS-6	8-11 13	24			
7									
	coarse sand		308.76 / 7.62	SS-7	12-10 12	22			
8	Borehole terminated at 8.08 m		308.30 / 8.08						
9									
10									
11									
12									

Dynamic Cone / Std Penetration; Shear Strength (PP) / Shear Strength (FV) kPa: Initial, Remold; Water Content (%): WP, WL

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave

At drilling completion, dry cave at 4.57 m.

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Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *317.76 m*

Borehole Number: **BH-18-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-23*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		317.76						
	TOPSOIL: dark brown silt, trace sand, gravel and roots, moist		0.00 / 317.40 / 0.36						
1	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt, moist		316.54 / 1.22	SS-1	13-14 12	26			
	occasional cobbles		316.24 / 1.52						
	dense			SS-2	11-16 18	34			
2			315.47 / 2.29						
	compact sand, some silt, wet		315.17 / 2.59	SS-3	7-11 13	24			
	some gravel, trace silt, moist		314.71 / 3.05						
3	***SAND:*** compact brown coarse sand, some gravel, trace silt, moist			SS-4	10-11 16	27			
4									
5				SS-5	10-12 12	24			
6			311.66 / 6.10						
	grey/brown			SS-6	11-12 12	24			
7			310.14 / 7.62						
	brown fine sand, some silt, very moist		309.68	SS-7	9-12 14	26			
8	Borehole terminated at 8.08 m		8.08						
9									
10									
11									
12									

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200

Shear Strength (FV) kPa: 50 100 150 200

Initial / Remold

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, dry cave at 5.49 m.

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Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *312.99 m*

Borehole Number: **BH-19-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-27*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		312.99						
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist		0.00 / 312.63 / 0.36						
1	***SAND:*** loose brown medium sand, some silt, trace gravel, moist			SS-1	4-4 4				
				SS-2	4-4 5				
2			310.70						
	SAND AND GRAVEL: very dense brown sand and gravel, some silt, occasional cobbles, moist		2.29	SS-3	21-30 33				
3	dense		309.94 / 3.05	SS-4	22-14 20				
4									
	compact, saturated		308.42 / 4.57	SS-5	12-12 14				
5									
6			306.89						
	SAND: compact brown silty fine sand, saturated		6.10 / 306.44	SS-6	9-10 12				
	Borehole terminated at 6.55 m		6.55						
7									
8									
9									
10									
11									
12									

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial / Remold
Shear Strength (FV) kPa: 50 100 150 200
Water Content (%): WP – WL; 10 20 30

Groundwater Observations and Standpipe Details

protective cover and concrete

bentonite seal

sand pack
50 mm pipe
1.52 m slotted screen

native cave

July 9, 2014
groundwater at Elevation
308.31 m.

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Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *316.51 m*

Borehole Number: **BH-20-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa (Initial, Remold)	Water Content (%) (WP, WL)
	Ground Elevation		316.51						
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist		0.00 / 316.15 / 0.36						
1	***SAND:*** compact brown sand, some silt, trace gravel, moist			SS-1	5-8 8	16			
				SS-2	4-5 6	11			
2			314.22 / 2.29						
	SAND AND GRAVEL: dense brown sand and gravel, trace silt and cobbles, moist			SS-3	16-24 18	42			
3	compact to dense		313.46 / 3.05	SS-4	11-14 14	28			
4									
5				SS-5	11-13 15	28			
6			310.41 / 6.10						
	SAND: compact brown coarse sand, some gravel, trace silt, moist			SS-6	6-9 9	18			
7									
	gravelly sand, saturated		308.89 / 7.62	SS-7	5-6 10	16			
8									
9	silty fine sand		307.37 / 9.14	SS-8	7-6 7	13			
10									
	fine sand, some silt, moist to very moist		305.84 / 10.67	SS-9	7-10 12	22			
11	Borehole terminated at 11.13 m		305.38 / 11.13						
12									

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, dry cave at 6.71 m.

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Sheet: *1 of 1*

Notes:

Ground Elevation: *298.00 m*

Borehole Number: BH-21A-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-06-04*

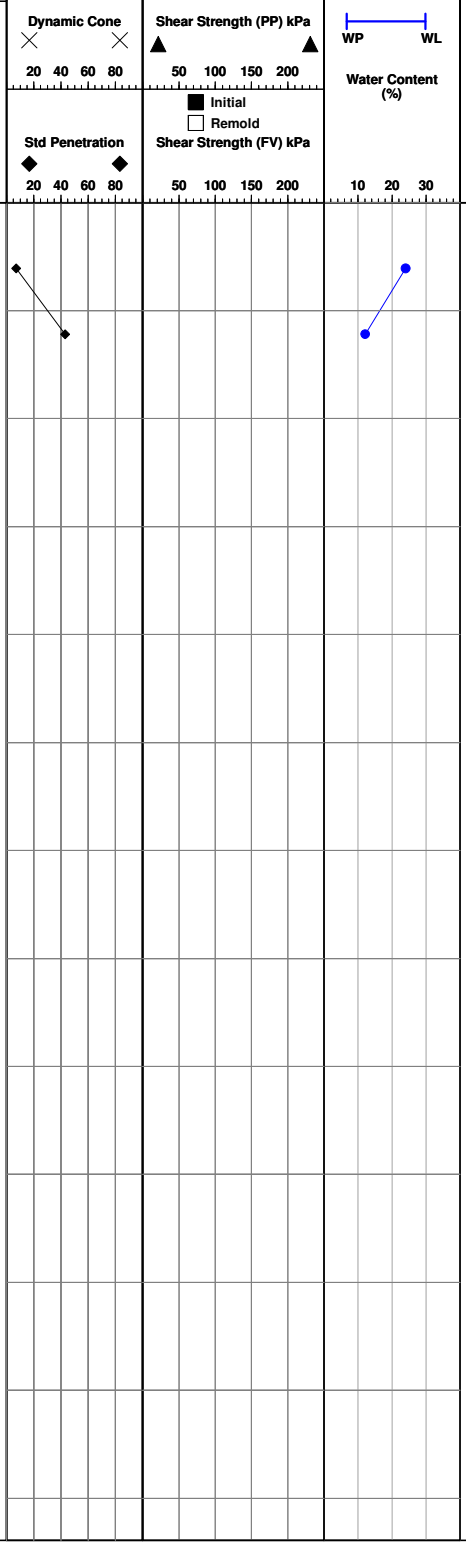
Project: *Cambridge West Development*

Field Tech: *D.Gonser*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hand Sampled Borehole*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation		298.00				
	FILL: dark brown organic silt (topsoil), moist		0.00				
	light brown silty fine sand to silty clay		297.39 / 0.61	SS-1	3-3 4-3		native backfill
1	some layered organics and roots		297.24 / 0.76				
	SAND: brown silty fine sand, trace clay and gravel, very moist		296.93 / 1.07	SS-2	6-21 22-50		
	SAND AND GRAVEL: dense brown to grey sand and gravel, trace silt, saturated		296.78 / 1.22	SS-3	50 /125 mm		At drilling completion, wet cave at 1.07 m.
2	Borehole terminated at 1.65 m		296.35 / 1.65				
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							



Vertical Scale = 1 : 70.0

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Sheet: *1 of 1*

Notes:

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EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *298.20 m*

Borehole Number: **BH-21B-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-06-04*

Project: *Cambridge West Development*

Field Tech: *D.Gonser*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hand Sampled Borehole*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation		298.20				
	FILL: dark brown organic silt (topsoil), very moist		0.00 / 298.05				native backfill
	light brown silty fine sand, very moist		0.15 / 297.59	SS-1	1-2 1-3		
1	saturated		0.61 / 296.98	SS-2	16-12 20-35		
	SAND AND GRAVEL: dense brown sand and gravel, some silt, saturated		1.22 / 296.68	SS-3	31-50 /75 mm		At drilling completion, water level at 0.71 m.
2	Borehole terminated at 1.52 m		1.52				

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200

Initial / Remold

Shear Strength (FV) kPa: 50 100 150 200

WP WL

Water Content (%): 10 20 30

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Notes:

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *305.52 m*

Borehole Number: **BH-22-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-27*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa	Water Content (%) WP–WL
	Ground Elevation		305.52						
	TOPSOIL: dark brown silt, some sand, gravel and cobbles, moist		0.00 / 305.11						
	SAND: compact brown medium sand, trace silt and gravel, moist		0.41	SS-1	3-6 8				
1				SS-2	9-10 11				
2				SS-3	6-8 9				
3	some gravel and silt, wet		302.47 / 3.05	SS-4	12-12 13				
	fine sand, some silt		302.01 / 3.50						
4									
	SILT: compact brown silt, some fine sand, trace clay and gravel, very moist		300.80 / 4.72	SS-5	15-17 10				
5	***SAND:*** compact brown fine sand, some silt, wet		300.49 / 5.03						
6	saturated		299.42 / 6.10	SS-6	6-6 7				
7			298.20	SS-7	4-5 7				
	Borehole terminated 7.32 m		7.32						

Groundwater Observations and Standpipe Details

- protective cover and concrete
- bentonite seal
- sand pack
- el. 300.09 m 2014-06-15
- 50 mm pipe
- 1.52 m slotted screen
- native cave
- July 9, 2014 groundwater at Elevation 299.95 m

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *314.76 m*

Borehole Number: **BH-23-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		314.76						
	TOPSOIL: dark brown silt, trace sand and gravel, moist		0.00 / 314.45 / 0.30						
1	***SAND:*** loose brown sand, some silt, trace gravel, very moist			SS-1	2-2 2	4			
	compact, very moist to wet		313.24 / 1.52	SS-2	2-5 6	11			
2			312.47						
	SAND AND GRAVEL: compact brown sand and gravel, trace silt and cobbles, moist		2.29	SS-3	13-10 11	21			
3	very dense, numerous cobbles		311.71 / 3.05	SS-4	30-37 30	67			
4			310.49						
	SAND: dense brown coarse sand, some gravel, trace silt, moist		4.27	SS-5	19-20 22	42			
5									
6	medium sand		308.66 / 6.10	SS-6	13-16 17	33			
7			307.14						
	compact fine sand, some silt, wet		7.62	SS-7	12-13 15	28			
8									
9			305.62						
	dense, saturated		9.14	SS-8	10-16 17	33			
10				SS-9	9-13 21	34			
	Borehole terminated at 10.40 m		304.40 / 10.36						
11									
12									

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial / Remold
Shear Strength (FV) kPa: 50 100 150 200
Water Content (%): WP – WL; 10 20 30

Groundwater Observations and Standpipe Details

- native backfill
- bentonite seal
- native cave
- At drilling completion, dry cave at 4.57 m.

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Sheet: *1 of 1*

Notes: *Bulk sample AS-2A taken from 1.52 to 2.29 m.*

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *310.03 m*

Borehole Number: **BH-24-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (WP – WL; 10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		310.03							
	TOPSOIL: dark brown silt, trace sand and gravel, moist		0.00 / 309.80 / 0.23							
1	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt and cobbles, moist		308.51	SS-1	6-10 15					native backfill
2	***SAND:*** compact brown fine to coarse sand, some silt, saturated		1.52 / 307.74	SS-2	5-6 10					
	coarse sand, trace gravel and silt		2.29 / 307.29	SS-3	5-7 12					
3	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, occasional cobbles, saturated		2.74	SS-4	6-9 10					native cave
4			305.76	SS-5	10-12 14					
	Borehole terminated at 4.27 m		4.27							At drilling completion, wet cave at 1.98 m.
5										
6										
7										
8										
9										
10										
11										
12										

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

LVM

Ground Elevation: *309.53 m*

Borehole Number: BH-25-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

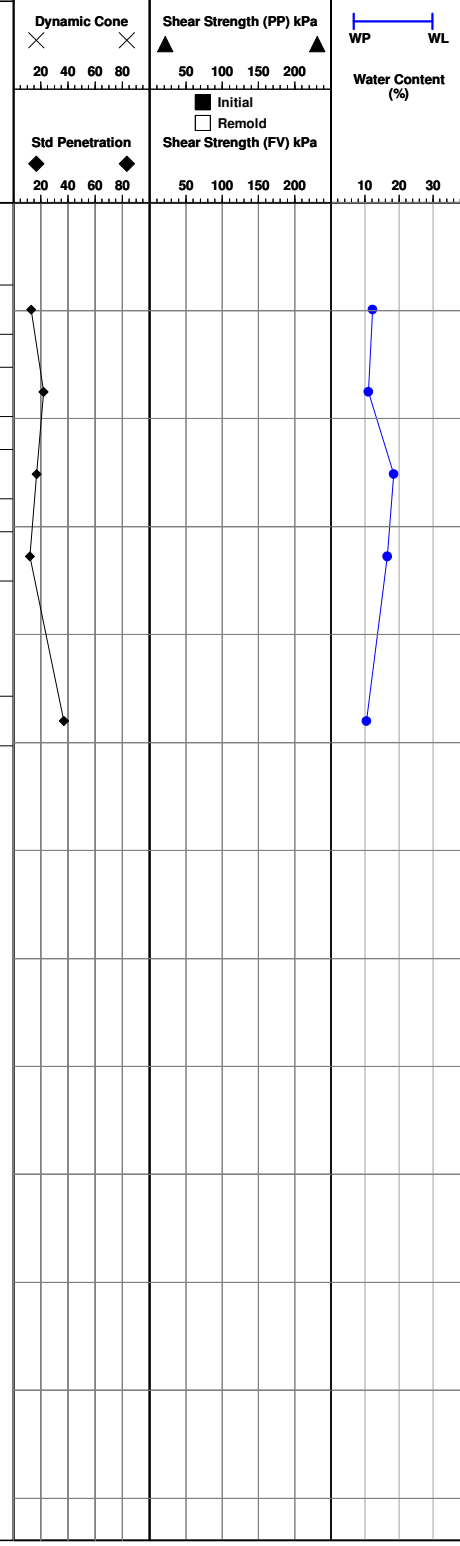
Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation	309.53				
	TOPSOIL: dark brown silt, trace sand, gravel, corn roots and cobbles, moist	0.00 / 309.17 / 0.36				native backfill
1	brown silty sand, some gravel, moist	308.77 / 0.76	SS-1	5-6 7	13	
	SAND AND GRAVEL: compact brown sand and gravel, some silt, saturated	308.01 / 1.52	SS-2	8-10 12	22	
2	occasional cobbles	307.24 / 2.29				
	SAND: compact grey and brown coarse sand, some gravel, trace silt, saturated		SS-3	6-8 9	17	
3			SS-4	5-6 6	12	native cave
4		304.96 / 4.57				
	dense		SS-5	8-12 25	37	
5	Borehole terminated at 5.03 m	304.50 / 5.03				At drilling completion, wet cave at 1.00 m.



Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes:

EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *309.42 m*

Borehole Number: **BH-26-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-27*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

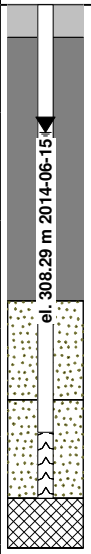
SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa (Initial, Remold)	Water Content (%) (WP, WL)
	Ground Elevation		309.42						
	TOPSOIL: dark brown silt, trace sand, gravel and corn roots, moist		0.00 / 309.19 / 0.23 / 308.81						
	SAND: brown silty sand, moist		0.61						
1	***SAND AND GRAVEL:*** compact grey and brown sand and gravel, some silt, wet to saturated			SS-1	11-12 14				
				SS-2	8-11 11				
2			307.13						
	SAND: compact brown fine to coarse sand, some silt and gravel, saturated		2.29	SS-3	6-6 9				
3			306.37						
	SAND AND GRAVEL: compact grey/brown sand and gravel, some silt and occasional cobbles, saturated		3.05	SS-4	5-6 12				
4			304.85						
	dense		4.57	SS-5	10-11 24				
5	Borehole terminated at 5.03 m		304.39 / 5.03						
6									
7									
8									
9									
10									
11									
12									

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 (Initial / Remold)

Water Content (%): 10 20 30 (WP, WL)

Groundwater Observations and Standpipe Details



protective cover and concrete

bentonite seal

sand pack
50 mm pipe
0.61 m slotted screen

native cave

July 9, 2014
groundwater at Elevation
308.19 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *308.99 m*

Borehole Number: **BH-27-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-27*

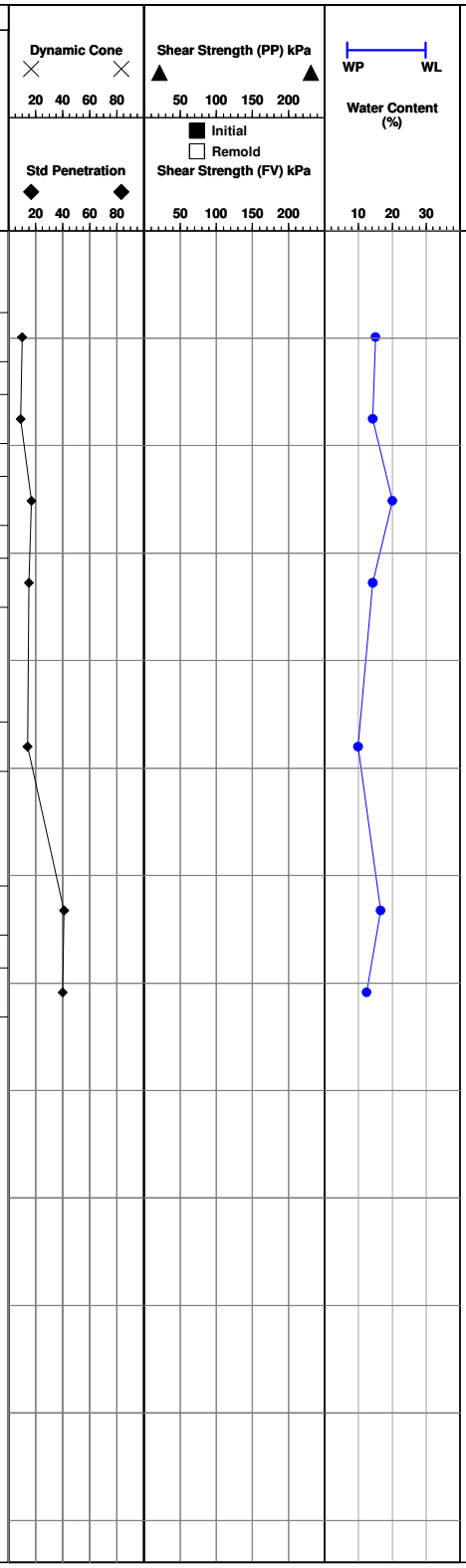
Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		308.99			
	TOPSOIL: dark brown silt, trace sand, gravel and corn roots, moist		0.00 / 308.81 / 0.18			
	SAND: grey/brown silty sand, trace roots, moist		308.58 / 0.41	SS-1	4-5 5	10
	compact brown coarse sand, some gravel and silt, saturated		307.47 / 1.52	SS-2	3-4 5	9
	compact		306.70 / 2.29	SS-3	11-7 10	17
	SAND AND GRAVEL: compact brown sand and gravel, some silt, saturated		305.94 / 3.05	SS-4	8-7 8	15
	grey		304.42 / 4.57	SS-5	4-6 8	14
	dense, trace silt		302.89 / 6.10	SS-6	9-21 20	41
				SS-7	7-16 24	40
	Borehole terminated at 7.32 m		301.67 / 7.32			



Groundwater Observations and Standpipe Details

bentonite seal

native cave

At drilling completion, wet cave at 0.76 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *318.95 m*

Borehole Number: **BH-28-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-23*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content (%)
	Ground Elevation		318.95						
	TOPSOIL: dark brown silt, trace sand, gravel and corn roots, moist		0.00 / 318.67 / 0.28						
1	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, moist			SS-1	5-6 6	12			
	trace silt		317.43 / 1.52	SS-2	6-8 9	17			
2	dense, coarse sand and gravel		316.66 / 2.29	SS-3	9-17 13	30			
3	compact		315.90 / 3.05	SS-4	7-10 14	24			
4	very dense, occasional cobbles		314.38 / 4.57	SS-5	36-25 31	56			
5									
6	dense		312.85 / 6.10	SS-6	11-21 20	41			
7	very dense		311.33 / 7.62	SS-7	43-36 31	67			
8									
9	***SAND:*** compact brown fine sand, some silt, trace gravel, wet		309.81 / 9.14	SS-8	10-13 15	28			
10									
	silty fine sand, saturated		308.28 / 10.67	SS-9	12-13 15	28			
11	Borehole terminated at 11.13 m		307.82 / 11.13						
12									

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200

Initial / Remold

Shear Strength (FV) kPa: 50 100 150 200

WP WL

Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

native backfill

bentonite seal

native cave

At drilling completion, dry cave at 3.35 m.

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes: *Bulk sample AS-4A taken from 3.05 to 4.57 m.*

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *314.06 m*

Borehole Number: **BH-29-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

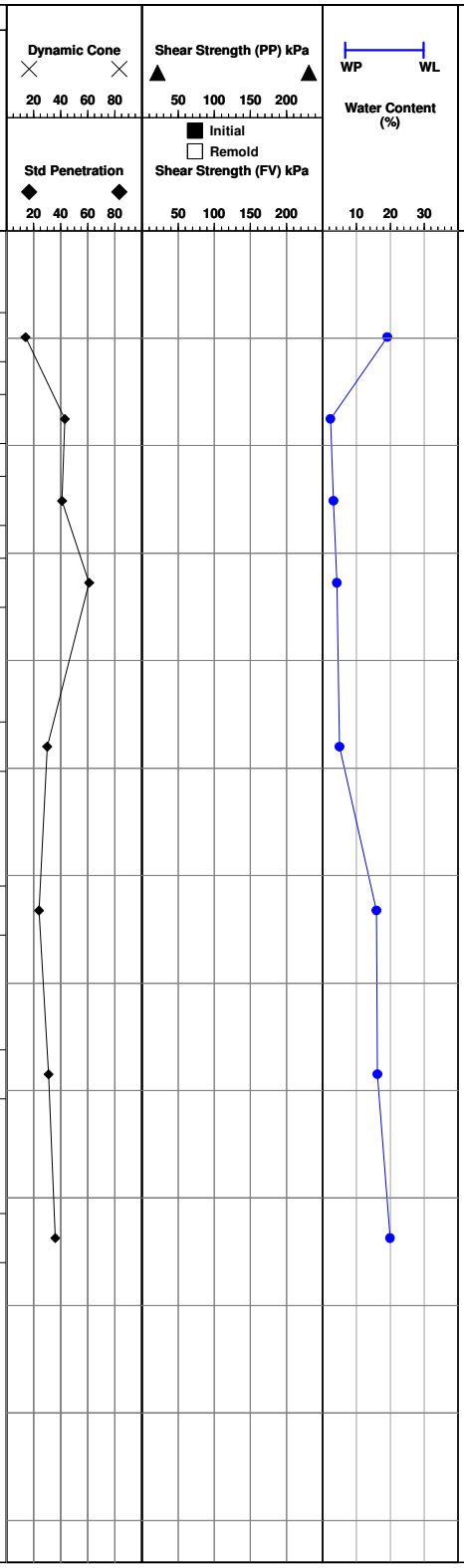
Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE					
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation		314.06				
	TOPSOIL: dark brown silt, some sand, trace gravel and corn roots, moist		0.00 / 313.81 / 0.25				native backfill
1	***SAND:*** compact brown sand, some gravel and silt, moist to very moist		312.84 / 1.22	SS-1	6-7 7	14	
2	***SAND AND GRAVEL:*** dense brown sand and gravel, trace silt and cobbles, moist			SS-2	8-21 22	43	bentonite seal
				SS-3	16-18 23	41	
3	***SAND:*** very dense brown coarse sand, some gravel, trace silt and cobbles, moist		311.01 / 3.05	SS-4	13-21 40	61	
4							
	dense		309.49 / 4.57	SS-5	16-15 15	30	
5							
6	compact fine sand, trace silt, moist		307.96 / 6.10	SS-6	9-9 15	24	
	wet		307.51 / 6.55				native cave
7							
	dense silty fine sand, saturated		306.44 / 7.62	SS-7	10-14 17	31	
8	fine sand, some silt, wet		306.13 / 7.92				
9							
	saturated		304.92 / 9.14	SS-8	8-14 22	36	
	Borehole terminated at 9.60 m		304.46 / 9.60				At drilling completion, dry cave at 3.96 m.
10							
11							
12							



Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

Ground Elevation: *313.73 m*

Borehole Number: BH-30-14

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-26*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Groundwater Observations and Standpipe Details
	Ground Elevation	313.73				
	TOPSOIL: dark brown silt, some sand and gravel, moist	0.00 / 313.48 / 0.25				native backfill
1	***SAND:*** compact brown sand, some gravel, trace silt, moist		SS-1	5-5 10	15	
		312.21 / 1.52				
2	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt and cobbles, moist		SS-2	6-9 10	19	bentonite seal
		311.44 / 2.29				
	dense, numerous cobbles		SS-3	9-15 15	30	
3	very dense	310.68 / 3.05	SS-4	50 /125 mm		
4		309.16				
5	***SAND:*** dense brown coarse sand, some gravel, trace silt, moist	4.57	SS-5	9-18 15	33	
6	silty fine sand, very moist to wet	307.63 / 6.10	SS-6	6-10 23	33	native cave
7		306.11				
	moist to very moist	7.62	SS-7	12-20 21	41	
8	moist	305.81 / 7.92				
9		304.59				
	silty fine sand	9.14	SS-8	7-15 16	31	
	Borehole terminated at 9.60 m	304.13 / 9.60				At drilling completion, dry cave at 3.05 m.
10						
11						
12						

Dynamic Cone (20 40 60 80) / Std Penetration (20 40 60 80)

Shear Strength (PP) kPa (50 100 150 200) / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)

Water Content (%) (WP – WL; 10 20 30)

Reviewed by: *D.Gonser* **Drafted by:** *E.Ciochon* **Sheet:** *1 of 1*

Notes: *Bulk sample AS-4A taken from 3.05 to 4.57 m, moisture content = 6.4%.*

Vertical Scale = 1 : 70.0

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EQ-09-Ge-72 R.1 18.02.2011

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Vertical Scale = 1 : 70.0

EQ-09-Ge-72 R.1 18.02.2011

Ground Elevation: *311.80 m*

Borehole Number: **BH-31-14**

Job N°: *P-0003455-0-09-100*

Drill Date: *2014-05-20*

Project: *Cambridge West Development*

Field Tech: *D.Souter*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Method: *Hollow Stem Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) (10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		311.80							
	TOPSOIL: dark brown and black silt, some sand, trace gravel and corn roots, moist		0.00 / 311.44 / 0.36							
1	***SAND:*** very loose brown silty fine to coarse sand, trace gravel, very moist		310.58 / 1.22	SS-1	1-2 1	3				native backfill
	some silt, moist		309.97 / 1.83	SS-2	1-6 9	15				bentonite seal
2	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt, moist			SS-3	20-12 12	24				
3	***SAND:*** loose grey and brown sand, some silt and gravel, saturated		308.75 / 3.05	SS-4	4-4 4	8				
4										
	compact, brown, trace silt and gravel		307.23 / 4.57	SS-5	6-8 8-8	16				
5										native cave
6	gravelly coarse sand, some silt		305.70 / 6.10	SS-6	6-8 9	17				
7				SS-7	7-8 10	18				
	Borehole terminated at 7.32 m		304.48 / 7.32							At drilling completion, wet cave at 3.20 m.
8										
9										
10										
11										
12										

Reviewed by: *D.Gonser*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

Borehole Number: 110-10

Ground Elevation: *308.95 m*

Project: *Supplementary Borehole Drilling - Cambridge West*

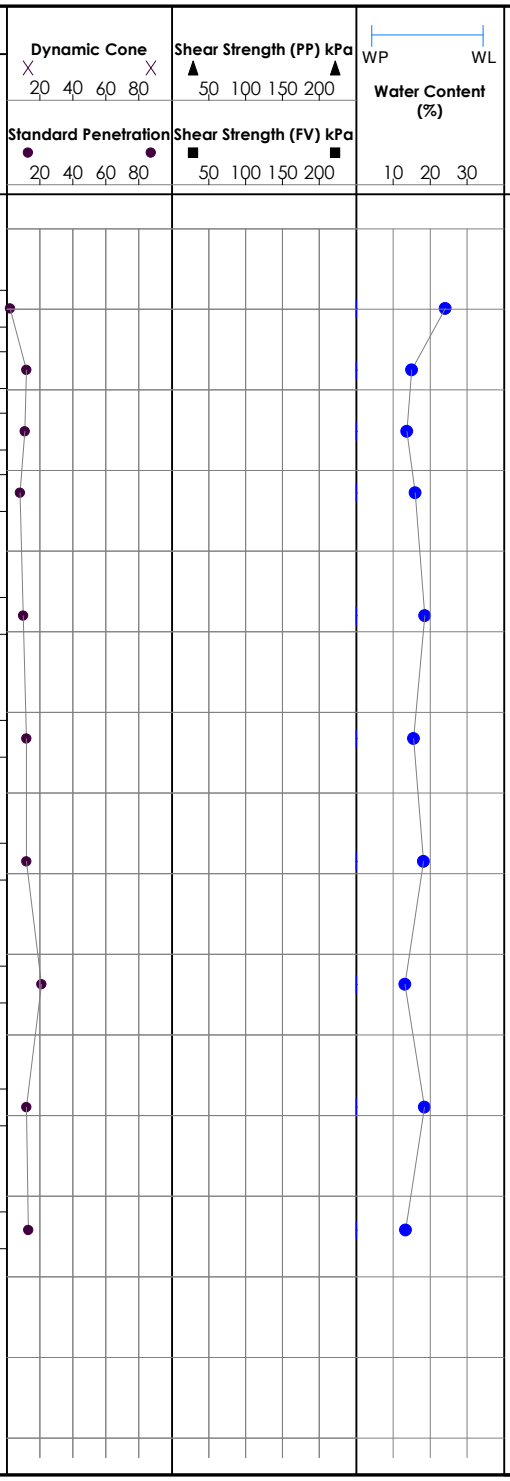
Job No.: *P036589-300*

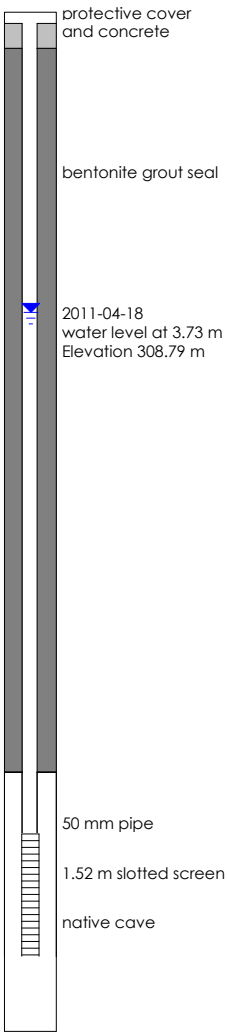
Location: *Roseville Road / Blenheim Road, Cambridge, Ontario*

Drill Date: *2010-10-18*

Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		308.95
0.00	***TOPSOIL:*** dark brown silt, moist		
1.00	***SILT:*** grey silt, trace sand adn clay, very moist		308.00
2.00	***SAND:*** very loose to compact brown fine to coarse sand, some silt, saturated		307.00
3.00	grey, saturated		306.00
4.00			305.00
5.00			304.00
6.00			303.00
7.00			302.00
8.00			301.00
9.00			300.00
10.00			299.00
11.00			298.00
12.00	***SILT TILL:*** compact grey silt, trace sand and fine gravel, moist		297.00
13.00	Borehole terminated at 12.65 m		296.00
14.00			295.00
15.00			294.00

Number	Type	N-Value
1	SS	2
2	SS	12
3	SS	11
4	SS	8
5	SS	10
6	SS	12
7	SS	12
8	SS	21
9	SS	12
10	SS	13





Reviewed by: *CHelmer*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RMcMillan*

Sheet: *1 of 1*

Drafted by: *SMeteer*

Borehole Number: 01-10

Ground Elevation: *309.13 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

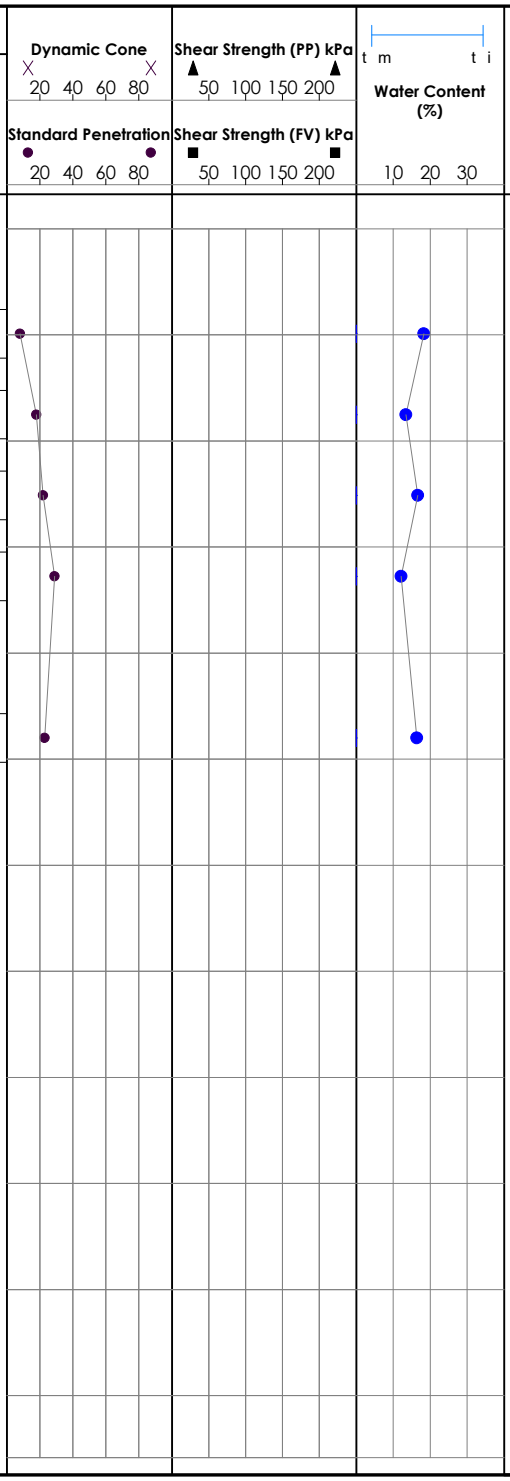
Drill Date: *February 11, 2010*

SOIL PROFILE

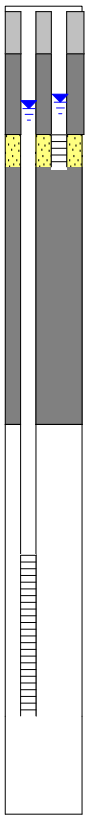
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		309.13
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** firm brown clayey silt, trace sand, APL		308.00
2.00	***SAND:*** compact brown fine to coarse sand, some silt, trace fine gravel, saturated		307.00
3.00	***SAND AND GRAVEL:*** compact brown sand and gravel, some silt, saturated		306.00
4.00			305.00
5.00			304.00
6.00			303.00
7.00			302.00
	Borehole terminated at 7.62 m		
8.00			301.00
9.00			300.00
10.00			299.00
11.00			298.00

SAMPLE

Number	Type	N-Value
1	SS	8
2	SS	18
3	SS	22
4	SS	29
5	SS	23



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 02-10

Ground Elevation: *308.59 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

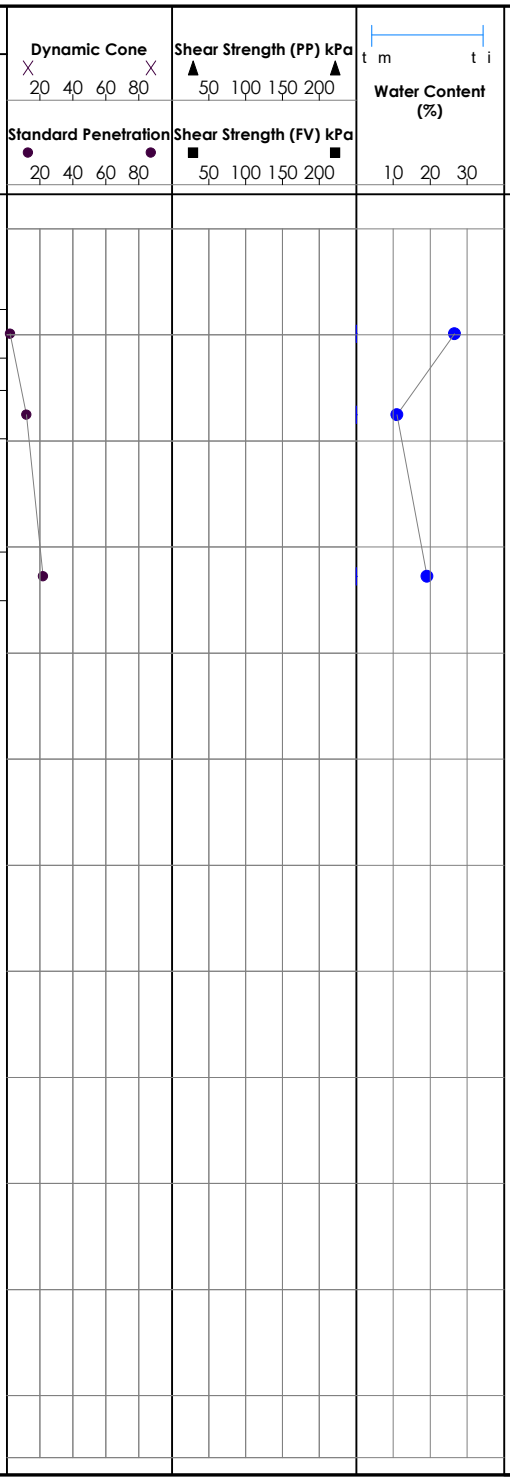
Drill Date: *February 11, 2010*

SOIL PROFILE

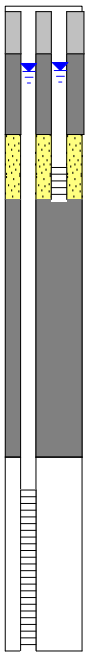
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		308.59
0.00	***TOPSOIL:*** black peaty topsoil, WTPL		
	SILT: very loose brown silt, some sand and organics		308.00
1.00			
	SAND AND GRAVEL: compact brown sand and gravel, some silt, saturated		307.00
2.00	some cobbles		
			306.00
3.00			
	frequent cobbles		305.00
4.00			
			304.00
5.00			
			303.00
6.00	Borehole terminated at 6.10 m		
			302.00
7.00			
			301.00
8.00			
			300.00
9.00			
			299.00
10.00			
			298.00
11.00			
			297.00

SAMPLE

Number	Type	N-Value
1	SS	2
2	SS	12
3	SS	22



Groundwater Observations and Standpipe Details



protective cover and concrete

bentonite seal

19 mm pipe

0.30 m slotted filter

sand pack

bentonite seal

2010-03-14
upper standpipe water level at 0.62 m Elev. 307.97 m
lower standpipe water level at 0.62 m Elev. 307.97 m

50 mm pipe

1.52 m slotted screen

native cave

At drilling completion, water level at 0.61 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 03-10

Ground Elevation: *313.06 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

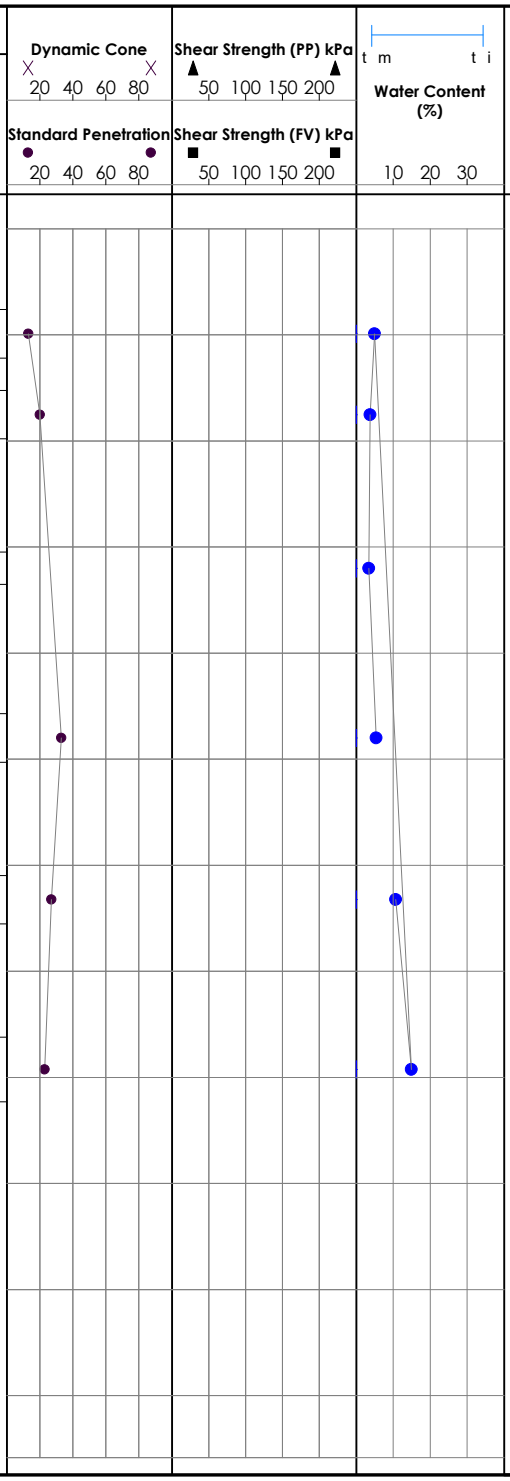
Drill Date: *February 11-12, 2010*

SOIL PROFILE

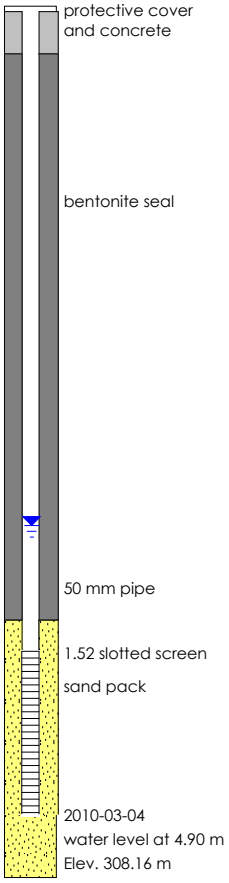
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		313.06
0.00	***TOPSOIL:*** dark brown silt, frozen		
	SAND: compact rusty brown fine to coarse sand, trace silt and fine gravel, damp		
1.00			312.00
	some gravel		
2.00			311.00
3.00	***SAND AND GRAVEL:*** very dense brown sand and gravel		310.00
4.00			309.00
5.00	moist		308.00
	saturated		
6.00			307.00
	some silt		
7.00			306.00
	SILT: compact grey silt, trace clay; some sand layers, saturated		
8.00			305.00
	Borehole terminated at 8.23 m		
9.00			304.00
10.00			303.00
11.00			302.00

SAMPLE

Number	Type	N-Value
1	SS	13
2	SS	20
3	SS	27\150mm
4	SS	33
5	SS	27
6	SS	23



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 04-10

Ground Elevation: *308.65 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

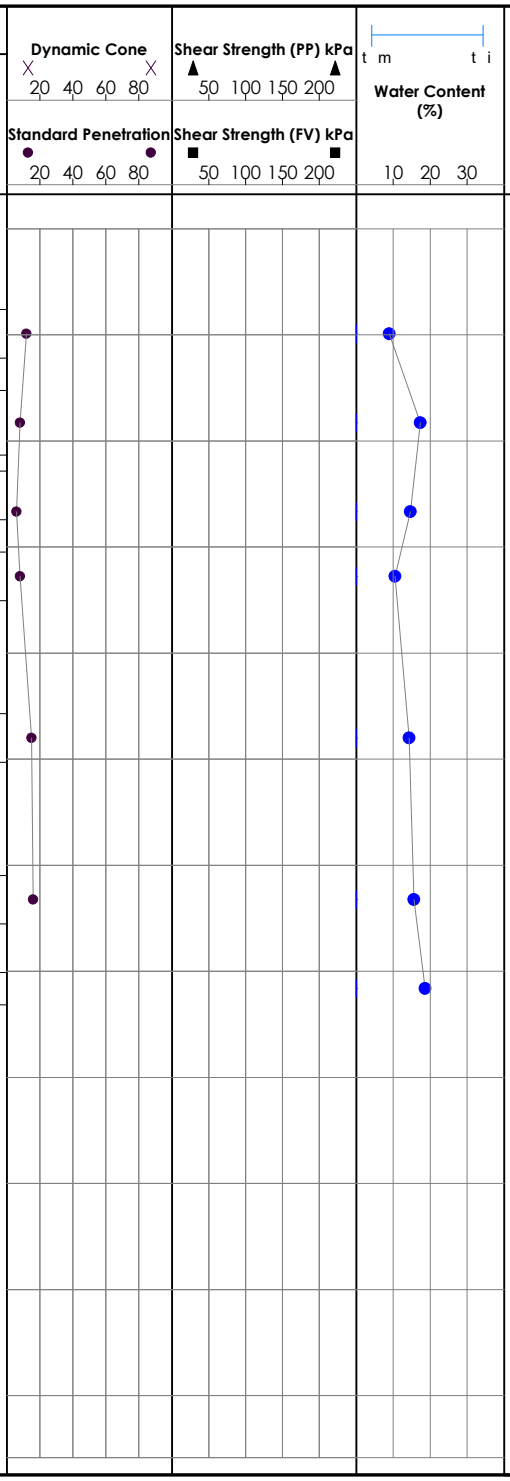
Drill Date: *February 12, 2010*

SOIL PROFILE

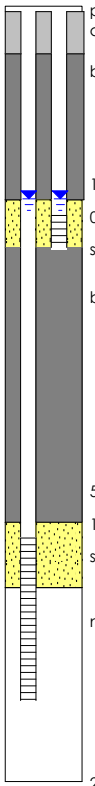
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		308.65
0.00	***TOPSOIL:*** dark brown silt, frozen		
	SAND: compact brown silty sand, some gravel, moist		308.00
1.00			
			307.00
2.00	trace organics		
	some gravel, saturated		
			306.00
3.00			
			305.00
4.00			
	trace silt		304.00
5.00			
			303.00
6.00			
			302.00
7.00	***SILT:*** compact grey silt, trace fine sand, wet		
	Borehole terminated at 7.32 m		301.00
8.00			
			300.00
9.00			
			299.00
10.00			
			298.00
11.00			

SAMPLE

Number	Type	N-Value
1	SS	12
2	SS	8
3	SS	6
4	SS	8
5	SS	15
6	SS	16
7	SS	14\150mm



Groundwater Observations and Standpipe Details



2010-03-04
upper standpipe
water level at 1.82 m
Elev. 306.83
lower standpipe
water level at 1.82 m
Elev. 306.83 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 05-10

Ground Elevation: *308.57 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

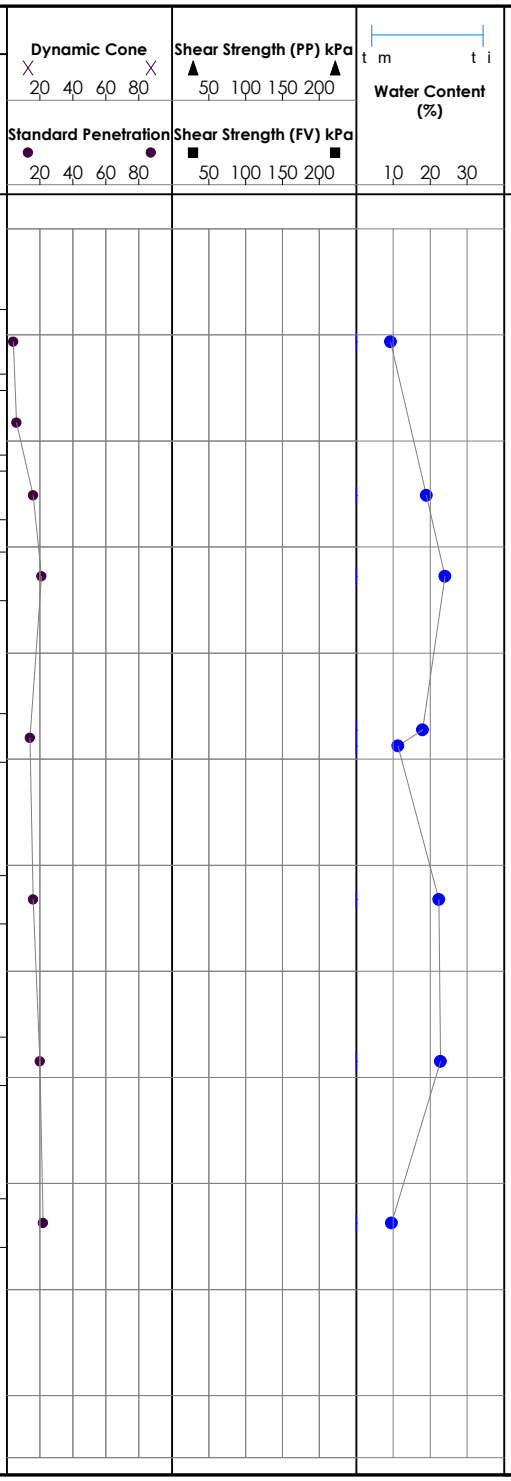
Drill Date: *February 12, 2010*

SOIL PROFILE

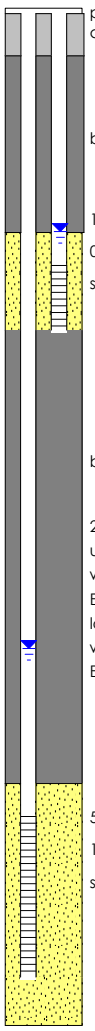
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		308.57
0.00	***FILL:*** loose brown and rusty brown sand and silty sand, damp to moist		
2.00	***SILT:*** compact grey silt, trace sand, saturated		
3.00	trace clay		
5.00	***SAND:*** compact brown fine sand, trace silt, damp		
6.00	saturated		
8.00	some gravel		
9.00	Borehole terminated at 9.60 m		

SAMPLE

Number	Type	N-Value
1	SS	4
2	SS	6
3	SS	16
4	SS	21
5	SS	14
6	SS	16
7	SS	20
8	SS	22



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 06-10

Ground Elevation: *308.97 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

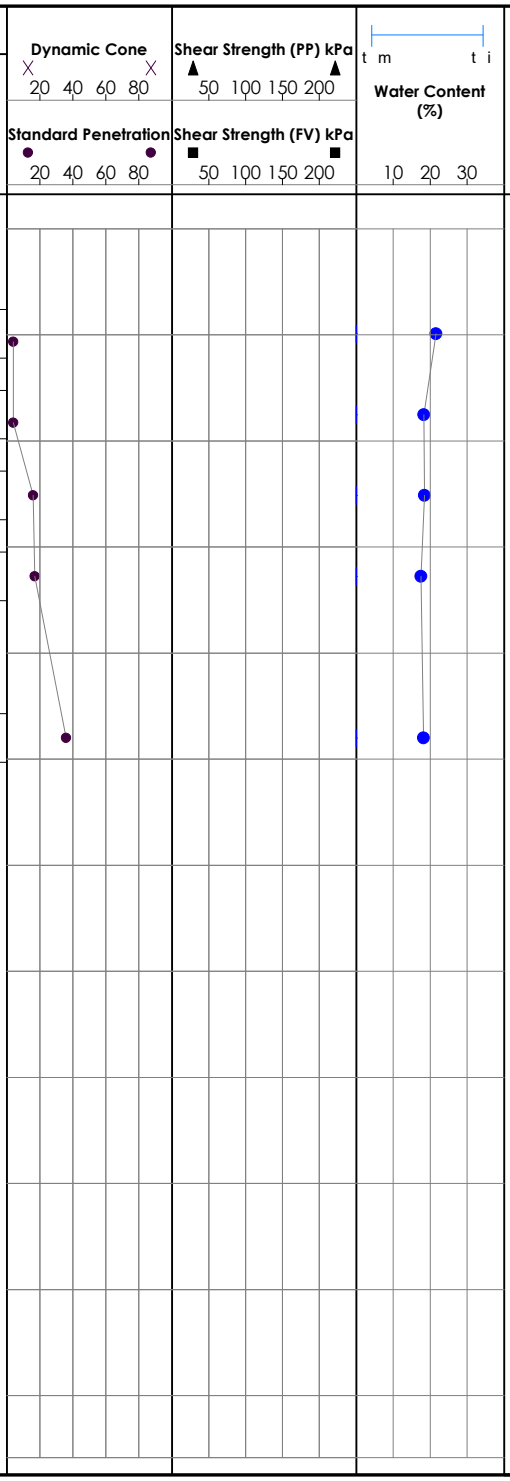
Drill Date: *February 12, 2010*

SOIL PROFILE

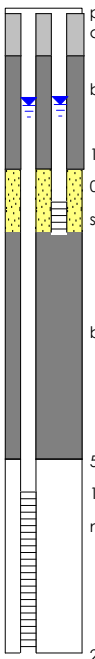
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		308.97
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** loose brown silt, some sand and clay, very moist to wet		308.00
2.00	***SAND:*** loose grey fine to coarse sand, some silt and gravel, saturated		307.00
3.00			306.00
4.00			305.00
5.00			304.00
6.00	Borehole terminated at 6.10 m		303.00
7.00			302.00
8.00			301.00
9.00			300.00
10.00			299.00
11.00			298.00

SAMPLE

Number	Type	N-Value
1	SS	4
2	SS	4
3	SS	16
4	SS	17
5	SS	36



Groundwater Observations and Standpipe Details



2010-03-04
upper standpipe
water level at 0.91 m
Elev. 308.06 m
lower standpipe
water level at 0.92
Elev. 308.05 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 08-10

Ground Elevation: *311.92 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

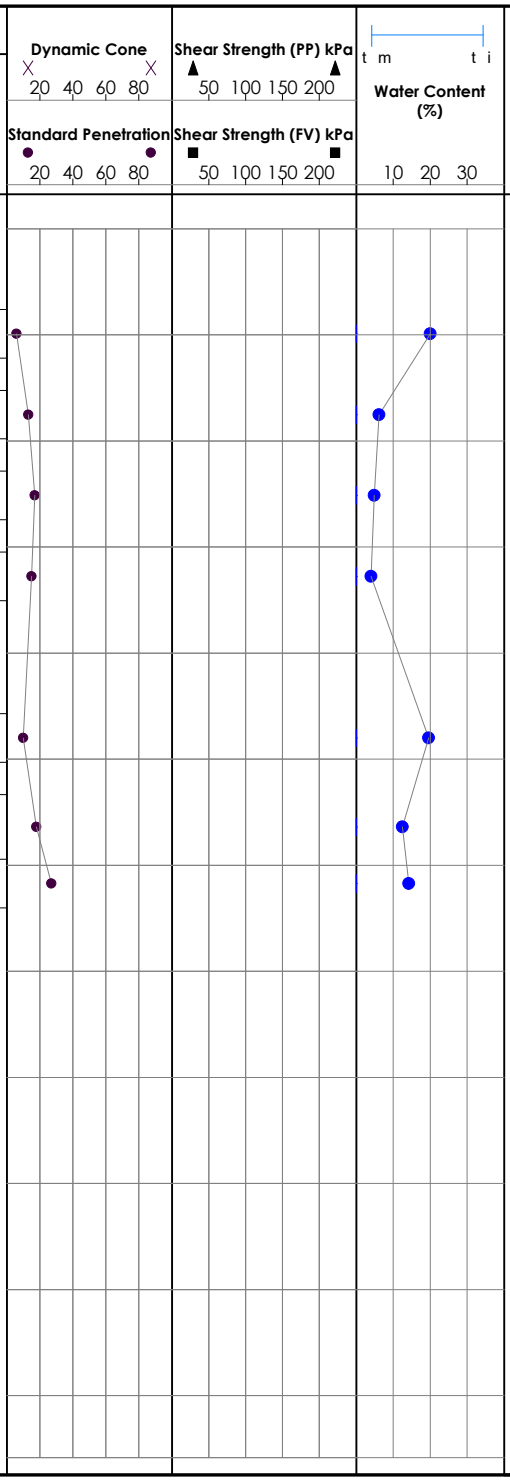
Drill Date: *February 16, 2010*

SOIL PROFILE

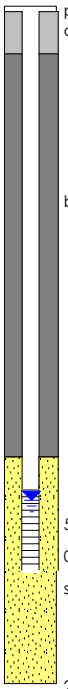
Depth (m)	Description	Symbol	Elevation (m)
0.00	Ground Elevation		311.92
	TOPSOIL: dark brown silt, frozen		
1.00	***SILT:*** loose brown silt, trace sand and clay, moist		311.00
	SAND: compact brown fine to coarse sand, trace silt and fine gravel, damp		
2.00			310.00
3.00			309.00
4.00			308.00
	saturated		
5.00			307.00
	SILT TILL: compact brown sandy silt, some gravel, moist		
6.00			306.00
	Borehole terminated at 6.40 m		
7.00			305.00
8.00			304.00
9.00			303.00
10.00			302.00
11.00			301.00

SAMPLE

Number	Type	N-Value
1	SS	6
2	SS	13
3	SS	17
4	SS	15
5	SS	10
6	SS	18
7	SS	27



Groundwater Observations and Standpipe Details



2010-03-04
water level at 4.66 m
Elev. 307.26 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 15-10

Ground Elevation: *309.74 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

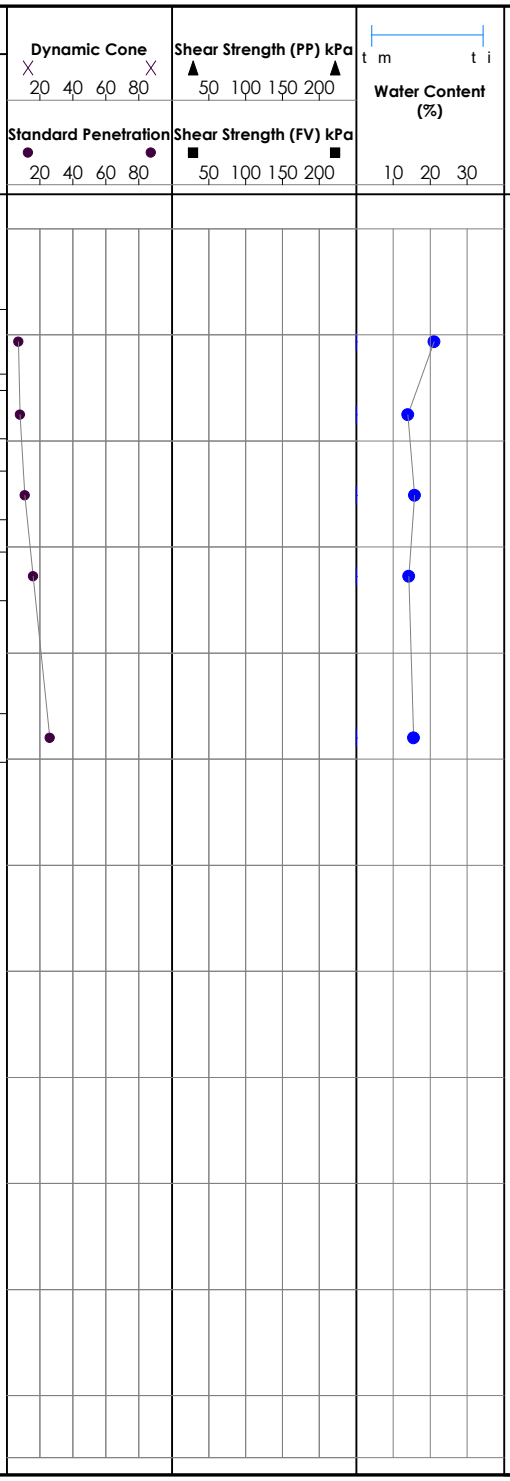
Drill Date: *February 18, 2010*

SOIL PROFILE

Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		309.74
0.00	***TOPSOIL:*** dark brown silt, frozen		
	SILT: firm brown silt, some clay, trace sand and gravel, APL		309.00
1.00	***SAND:*** loose brown fine to coarse sand, trace silt, moist		308.00
2.00	saturated		
	compact		307.00
3.00			
	SAND AND GRAVEL: compact brown sand and gravel, trace silt, saturated		306.00
4.00			
			305.00
5.00	Borehole terminated at 5.03 m		
			304.00
6.00			
			303.00
7.00			
			302.00
8.00			
			301.00
9.00			
			300.00
10.00			
			299.00
11.00			

SAMPLE

Number	Type	N-Value
1	SS	7
2	SS	8
3	SS	11
4	SS	16
5	SS	26



Groundwater Observations and Standpipe Details

2010-03-04
water level at 1.40 m
Elev. 308.34 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 16-10

Ground Elevation: *309.08 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

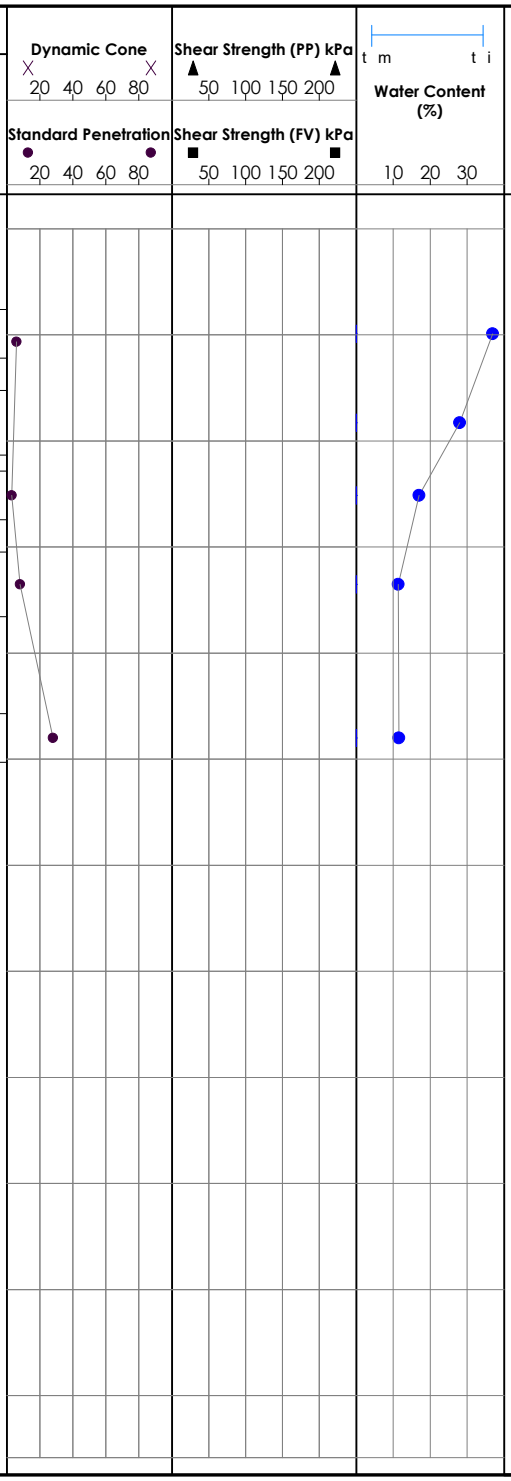
Drill Date: *February 18, 2010*

SOIL PROFILE

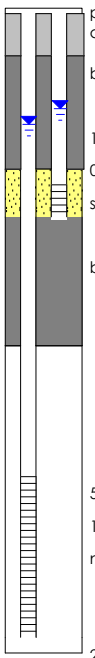
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		309.08
0.00	***PEAT:*** firm black amorphous peat, WTPL		
1.00			308.00
2.00	***SAND:*** very loose brown silty sand, saturated; trace gravel		307.00
3.00			306.00
4.00	***SAND AND GRAVEL:*** compact brown sand and gravel, some cobbles and silt, saturated		305.00
5.00			304.00
6.00	***SAND:*** brown sand, trace silt and fine gravel, saturated		303.00
	Borehole terminated at 6.10 m		
7.00			302.00
8.00			301.00
9.00			300.00
10.00			299.00
11.00			298.00

SAMPLE

Number	Type	N-Value
1	SS	6
2	SS	WH
3	SS	3
4	SS	8
5	SS	28



Groundwater Observations and Standpipe Details



2010-03-04
upper standpipe
water level at 0.95 m
Elev. 308.13 m
lower standpipe
water level at 1.10 m
Elev. 307.98 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 18-10

Ground Elevation: *310.17 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

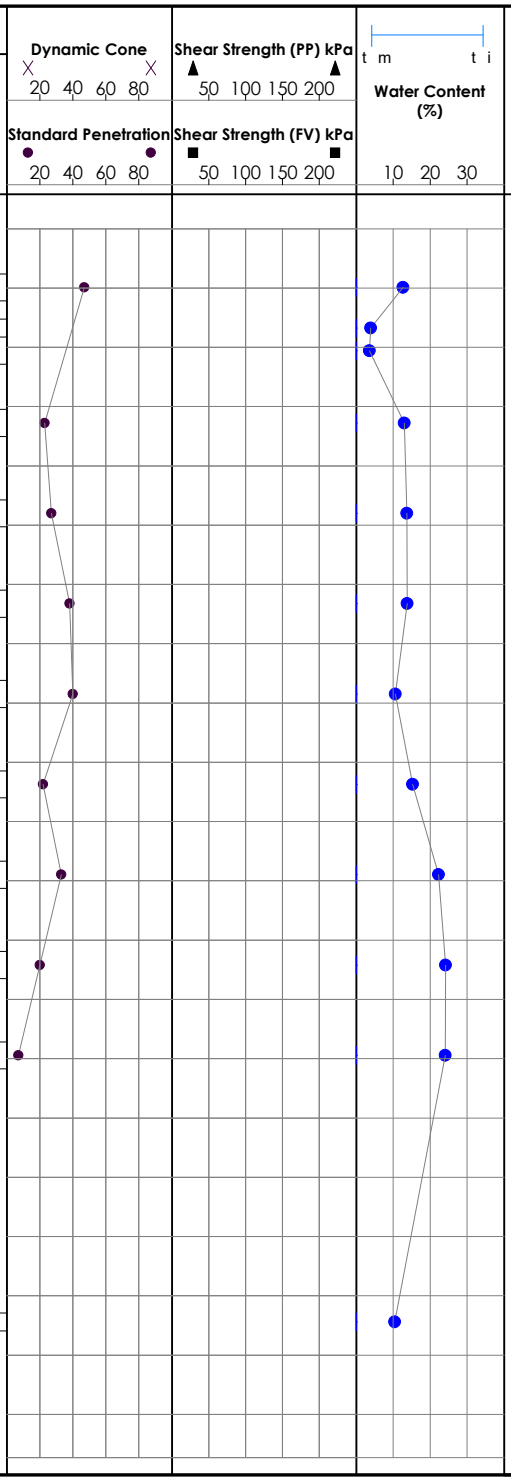
Drill Date: *February 24, 2010*

SOIL PROFILE

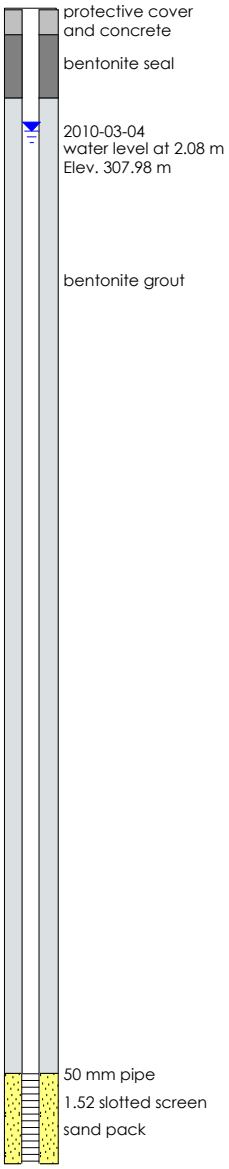
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		310.17
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** brown silt, some sand and gravel, moist		309.00
2.00			308.00
3.00	***SAND AND GRAVEL:*** dense to very dense brown sand and gravel, some cobbles, trace silt, damp		307.00
4.00	saturated		306.00
5.00	***SAND:*** compact brown fine to coarse sand, some gravel, trace silt, saturated		305.00
6.00	trace fine gravel		304.00
7.00	***SAND AND GRAVEL:*** dense brown sand and gravel, trace silt, saturated		303.00
8.00			302.00
9.00	***SAND:*** compact brown fine to coarse sand, trace silt, saturated		301.00
10.00	***SILT:*** dense brown fine sandy silt, saturated		300.00
11.00			299.00
12.00	grey, saturated		298.00
13.00			297.00
14.00			296.00
15.00			295.00
16.00			294.00
17.00			293.00
18.00	***SILT TILL:*** very dense grey silt, some sand and gravel, moist		292.00
19.00			291.00
20.00	Borehole terminated at 19.51 m upon auger refusal on bedrock or boulder		290.00

SAMPLE

Number	Type	N-Value
1	SS	47
2	SS	32\150mm
3	AS	
4	SS	23
5	SS	27
6	SS	38
7	SS	40
8	SS	22
9	SS	33
10	SS	20
11	SS	7
12	SS	10\25mm



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 18A-10

Ground Elevation: *310.27 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

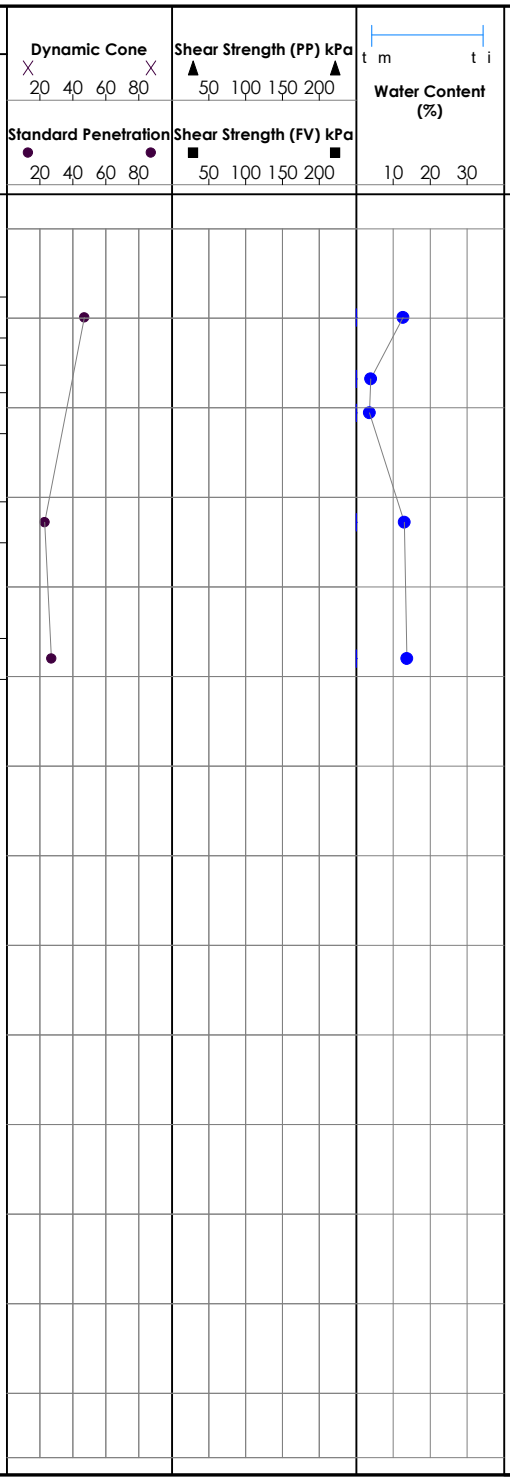
Drill Date: *March 2, 2010*

SOIL PROFILE

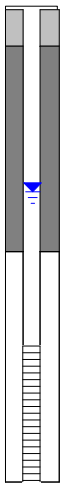
Depth (m)	Description
	Ground Elevation (310.27)
0.00	***TOPSOIL:*** dark brown silt, frozen
1.00	***SILT:*** brown silt, some sand and gravel, moist
2.00	***SAND AND GRAVEL:*** dense to very dense brown sand and gravel, some cobbles, trace silt, damp
3.00	saturated
	SAND: compact brown fine to coarse sand, some gravel, trace silt, saturated
4.00	trace fine gravel
5.00	Borehole terminated at 5.33 m

SAMPLE

Number	Type	N-Value
1	SS	47
2	SS	32\150mm
3	AS	
4	SS	23
5	SS	27



Groundwater Observations and Standpipe Details



2010-03-04
water level at 2.08 m
Elev. 308.19 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 19-10

Ground Elevation: *310.38 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

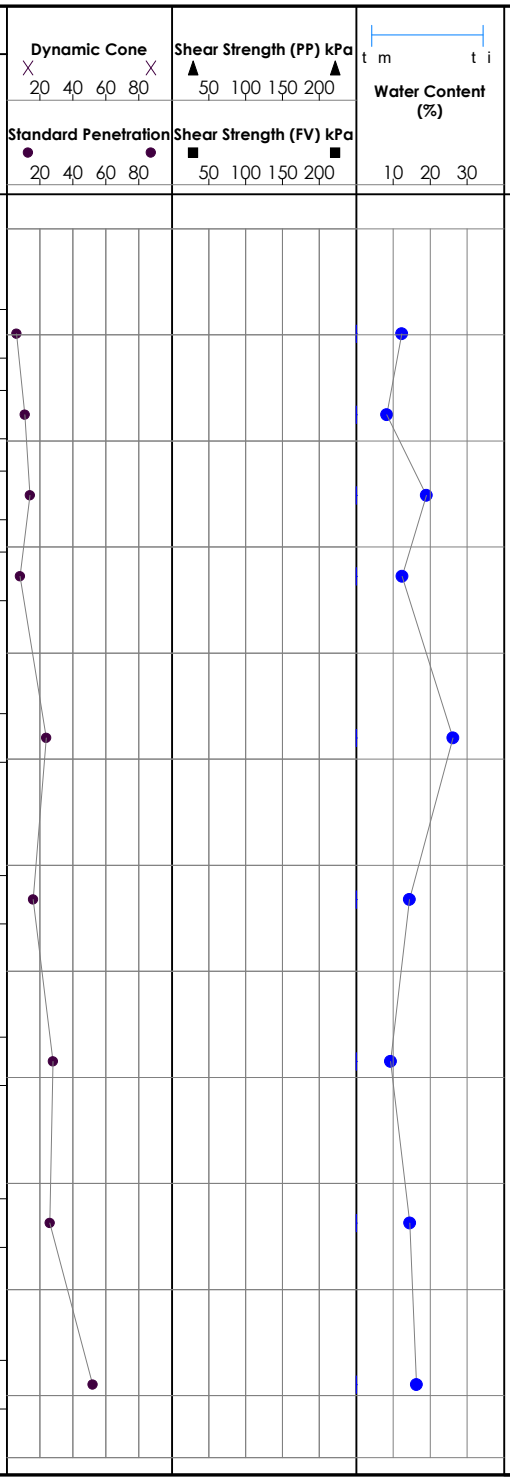
Drill Date: *February 25, 2010*

SOIL PROFILE

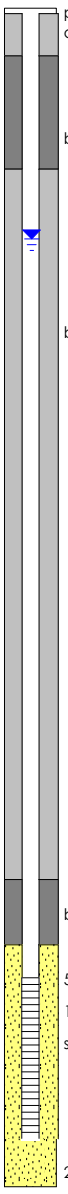
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		310.38
0.00	***FILL:*** brown sandy silt, trace gravel and topsoil, frozen		
1.00	***TOPSOIL:*** dark brown silt, moist		309.00
	SAND AND GRAVEL: compact brown silty sand and gravel, damp		
2.00	***SAND:*** loose to compact brown fine to coarse sand, some silt, trace fine gravel, saturated		308.00
3.00			307.00
4.00			306.00
	SAND AND GRAVEL: compact grey fine to coarse sand and gravel, trace silt, saturated		
5.00			305.00
6.00	***SAND:*** compact grey fine to coarse sand, trace silt and fine gravel, saturated		304.00
7.00			303.00
8.00	***SILT TILL:*** compact grey silt, some sand, clay and gravel, moist		302.00
9.00			301.00
10.00	very dense		300.00
11.00	Borehole terminated at 11.13 m		299.00

SAMPLE

Number	Type	N-Value
1	SS	6
2	SS	11
3	SS	14
4	SS	8
5	SS	24
6	SS	16
7	SS	28
8	SS	26
9	SS	52



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 20-10

Ground Elevation: *314.78 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

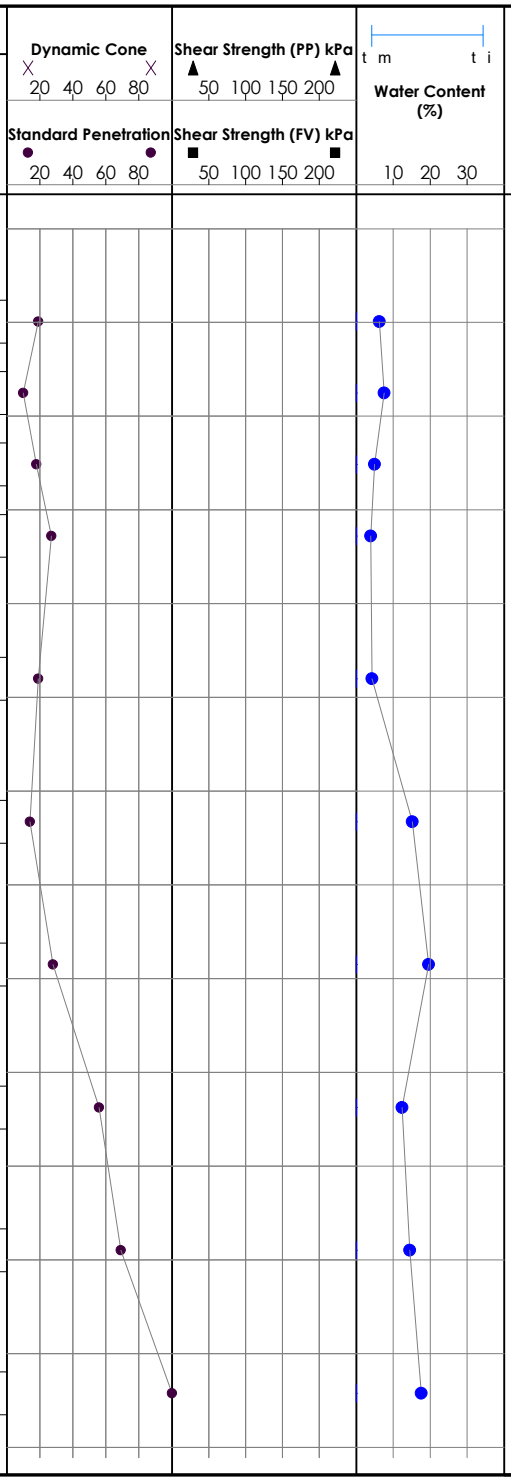
Drill Date: *February 25, 2010*

SOIL PROFILE

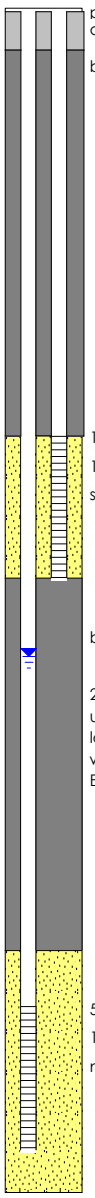
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		314.78
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** brown silt, some sand and gravel, frozen		314.00
2.00	***SAND AND GRAVEL:*** compact brown silty sand and gravel, damp		313.00
3.00	***SAND:*** compact brown fine to coarse sand, trace silt and gravel, damp		312.00
4.00	compact brown fine to coarse sand, trace silt, damp; some gravel		311.00
5.00	occasional brown silt layers, moist		310.00
6.00	***SILT:*** compact brown silt, trace fine sand, moist		309.00
7.00	brown fine sandy silt, saturated		308.00
8.00	brown sand and gravel layers, saturated		307.00
9.00	***SILT TILL:*** very dense grey silt, some sand, clay and gravel, moist		306.00
10.00			305.00
11.00			304.00
12.00	***SILT:*** very dense grey silt, some fine sand, saturated		303.00
13.00	Borehole terminated at 12.65 m		302.00

SAMPLE

Number	Type	N-Value
1	SS	19
2	SS	10
3	SS	18
4	SS	27
5	SS	19
6	SS	14
7	SS	28
8	SS	56
9	SS	69
10	SS	114



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 21-10

Ground Elevation: *308.32 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

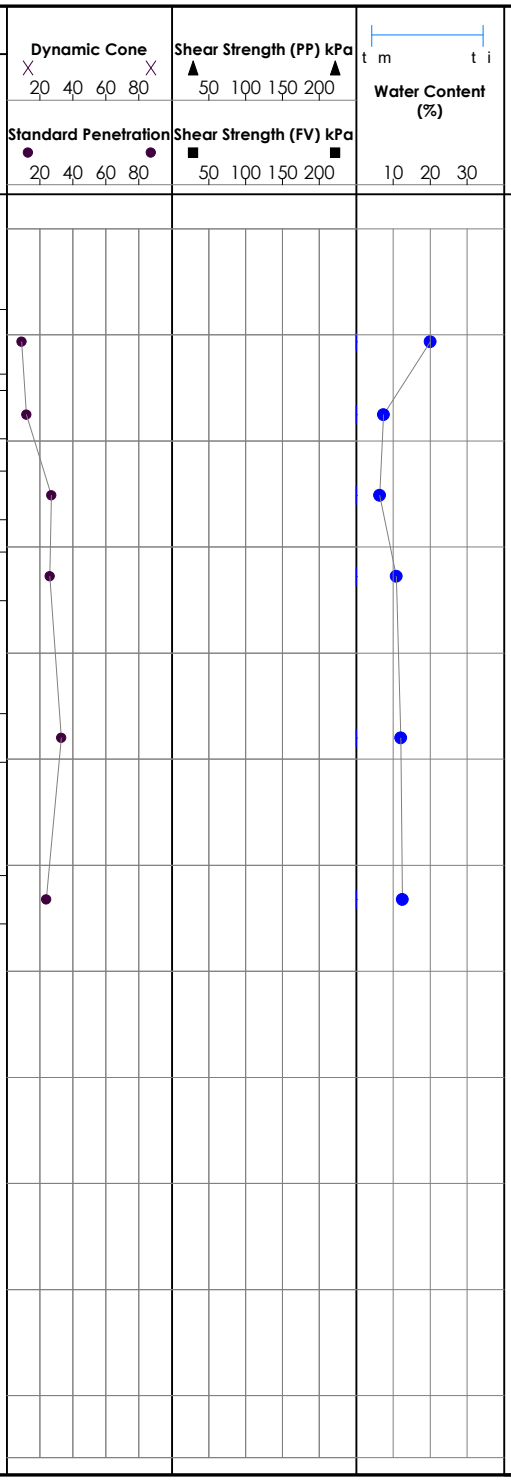
Job No.: *P031655-300*

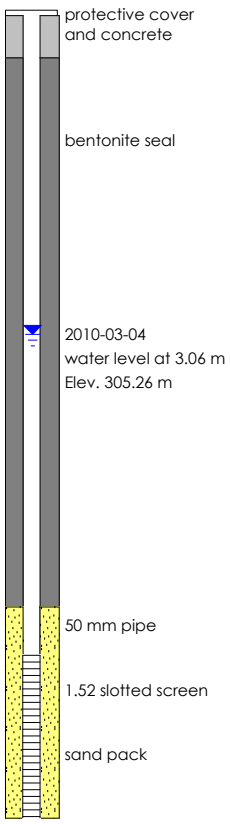
Location: *Blenheim Road, Cambridge, Ontario*

Drill Date: *February 26, 2010*

Depth (m)	Description	Elevation (m)
	Ground Elevation	308.32
0.00	***TOPSOIL:*** dark brown silt, frozen	
	SILT: brown silt, trace sand and gravel, frozen	
1.00	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt, damp	307.00
2.00		306.00
3.00	saturated	305.00
4.00		304.00
5.00	***SAND:*** compact brown fine to coarse sand, trace silt and fine gravel, saturated	303.00
6.00		302.00
7.00		301.00
	Borehole terminated at 7.62 m	
8.00		300.00
9.00		299.00
10.00		298.00
11.00		297.00

Number	Type	N-Value
1	SS	9
2	SS	12
3	SS	27
4	SS	26
5	SS	33
6	SS	24





Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 22-10

Ground Elevation: *313.80 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

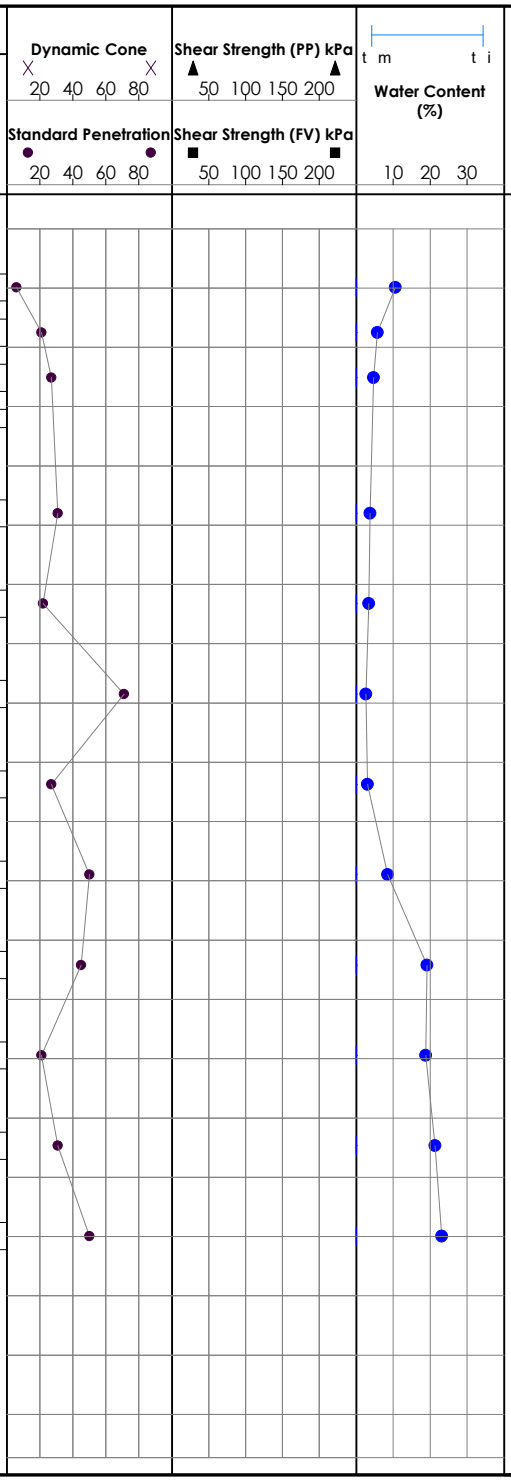
Drill Date: *Feb 26 and Mar 1, 2010*

SOIL PROFILE

Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		313.80
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** loose reddish brown silt, some sand, moist		312.00
2.00	***SAND:*** compact brown fine to coarse sand, trace silt, damp		311.00
3.00	***SAND AND GRAVEL:*** compact to dense brown fine to coarse sand and gravel, some cobbles, trace silt, damp		310.00
4.00	***SAND:*** compact brown fine to coarse sand, trace silt and fine gravel, damp		309.00
5.00	some gravel, damp		308.00
6.00	very dense brown fine to coarse sand, some gravel, trace silt, damp		307.00
7.00	compact brown fine to coarse sand, trace gravel and silt, damp		306.00
8.00	***SAND AND SILT:*** dense to very dense light brown fine sand and silt, moist		305.00
9.00	dense, brown, moist		304.00
10.00	***SAND:*** compact brown to reddish brown silty fine sand, saturated		303.00
11.00	***SILT:*** dense brown silt, trace fine sand, saturated, dilatant		302.00
12.00	dense to very dense grey and brown silt, saturated		301.00
13.00	***SAND:*** dense brown fine sand, some silt, saturated		300.00
14.00	Borehole terminated at 17.22 m		299.00
15.00			298.00
16.00			297.00
17.00			296.00
18.00			295.00
19.00			294.00
20.00			293.00

SAMPLE

Number	Type	N-Value
1	SS	6
2	SS	21
3	AS	27
4	SS	*
5	SS	31
6	SS	22
7	SS	71
8	SS	27
9	SS	50
10	SS	45
11	SS	21
12	SS	31
13	SS	50



Groundwater Observations and Standpipe Details

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes: **Sampler bouncing on cobble*

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 23-10

Ground Elevation: *310.46 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

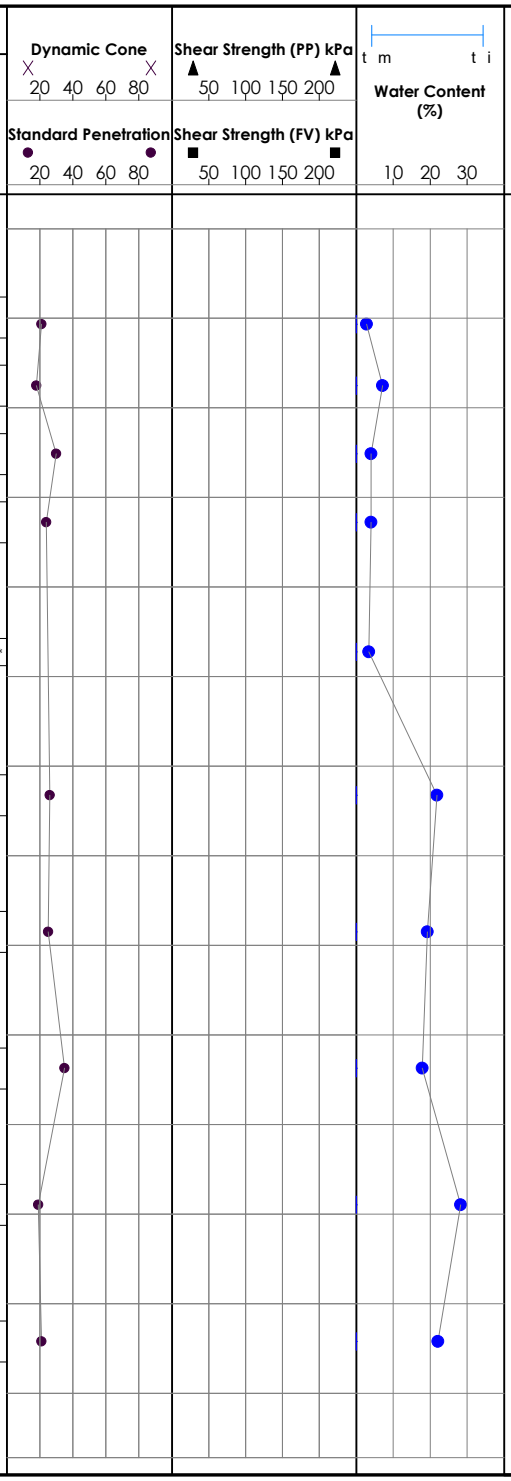
Drill Date: *March 1, 2010*

SOIL PROFILE

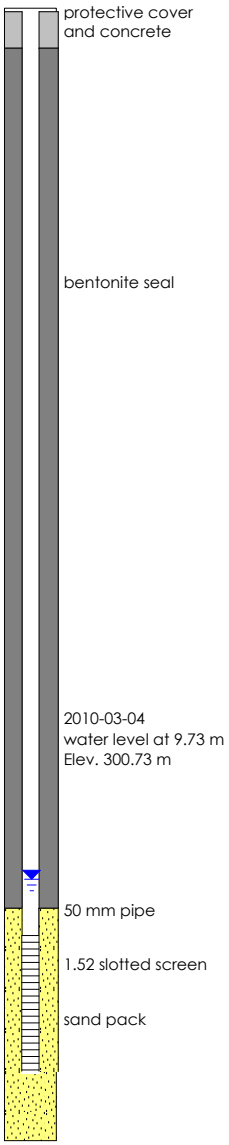
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		310.46
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** brown silt, trace sand and gravel, moist		309.00
2.00	***SAND AND GRAVEL:*** compact brown sand and gravel, trace silt, damp; some cobbles		308.00
3.00			307.00
4.00			306.00
5.00	boulders		305.00
6.00	***SILT:*** compact brown silt, trace fine sand, moist		304.00
7.00	some gravel		303.00
8.00	some fine sand layers, saturated		302.00
9.00	***SAND:*** dense brown silty fine sand, saturated		301.00
10.00			300.00
11.00	compact		299.00
12.00			298.00
13.00	Borehole terminated at 12.65 m		297.00

SAMPLE

Number	Type	N-Value
1	SS	21
2	SS	18
3	SS	30
4	SS	24
5	SS	50\150mm*
6	SS	26
7	SS	25
8	SS	35
9	SS	19
10	SS	21



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes: **Sampler bouncing on gravel*

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 24-10

Ground Elevation: *314.32 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

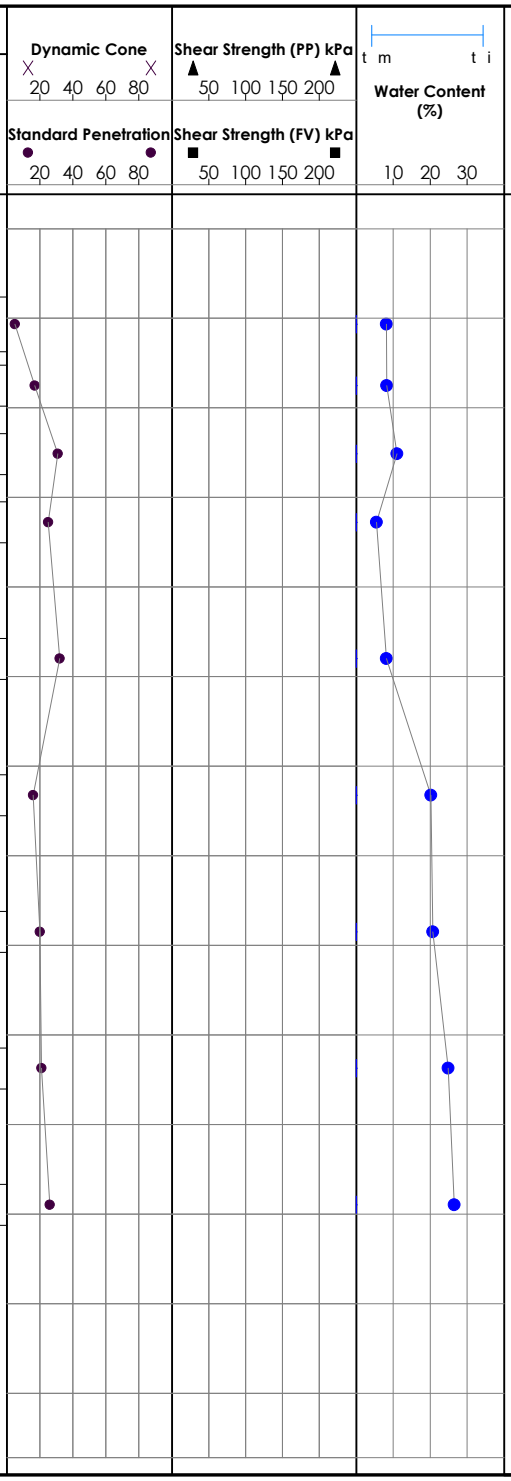
Drill Date: *March 1, 2010*

SOIL PROFILE

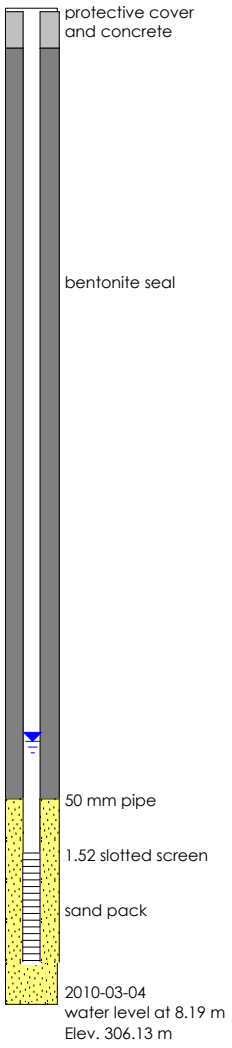
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		314.32
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** loose brown sandy silt, damp		313.00
2.00	***SAND:*** compact brown fine to medium sand, trace fine gravel and silt, damp		312.00
3.00	***SAND TILL:*** compact to dense brown silty fine sand, trace fine gravel, moist		311.00
4.00	***SILT:*** compact brown fine sandy silt, trace gravel, damp		310.00
5.00	dense, damp to moist		309.00
6.00	compact brown silt, trace fine sand, very moist		308.00
7.00			307.00
8.00	saturated, dilatant		306.00
9.00			305.00
10.00			304.00
11.00	Borehole terminated at 11.13 m		303.00
12.00			302.00
13.00			301.00

SAMPLE

Number	Type	N-Value
1	SS	5
2	SS	17
3	SS	31
4	SS	25
5	SS	32
6	SS	16
7	SS	20
8	SS	21
9	SS	26



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 25-10

Ground Elevation: *311.27 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

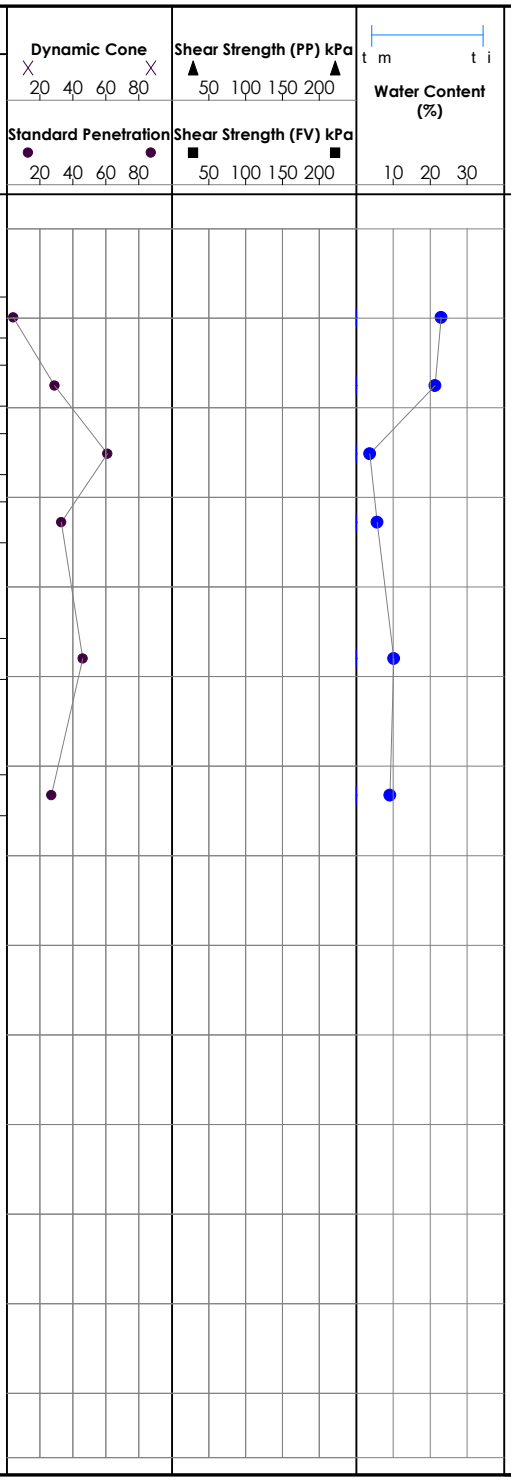
Drill Date: *March 2, 2010*

SOIL PROFILE

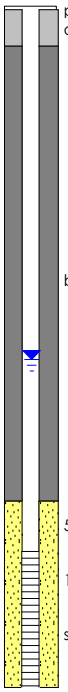
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		311.27
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** loose brown to dark brown silt, some clay, trace sand, moist		310.00
2.00	***SAND AND GRAVEL:*** compact brown fine to coarse sand and gravel, trace silt, some cobbles, damp		309.00
3.00	very dense		308.00
	dense		
4.00			307.00
	saturated		
5.00			306.00
6.00			305.00
7.00			304.00
8.00	Borehole terminated at 7.62 m		303.00
9.00			302.00
10.00			301.00
11.00			300.00
12.00			299.00
13.00			298.00

SAMPLE

Number	Type	N-Value
1	SS	4
2	SS	29
3	SS	61
4	SS	33
5	SS	46
6	SS	27



Groundwater Observations and Standpipe Details



2010-03-04
water level at 3.95 m
Elev. 307.32 m

Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 26-10

Ground Elevation: *319.35 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

Drill Date: *March 2, 2010*

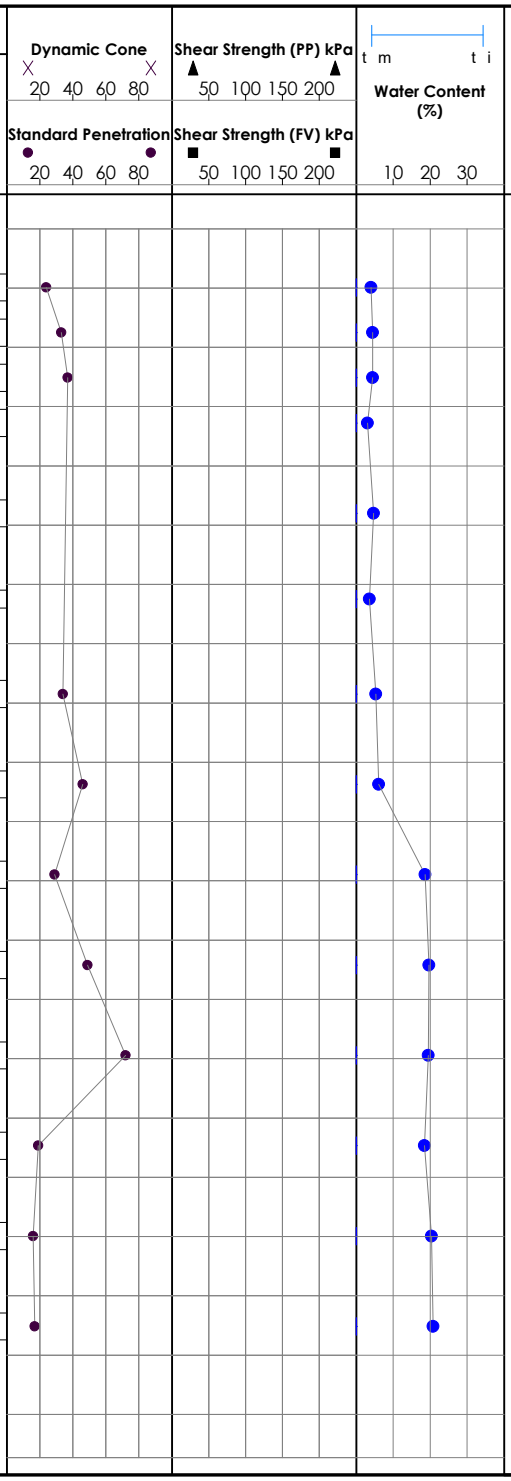
SOIL PROFILE

Depth (m)	Description
	Ground Elevation (319.35)
0.00	***TOPSOIL:*** dark brown silt, frozen
1.00	***SILT:*** brown sandy silt, moist
2.00	***SAND AND GRAVEL:*** dense brown fine to coarse sand and gravel, trace silt, damp
3.00	some sand layers, damp
4.00	some cobbles
	very dense
5.00	
6.00	
7.00	***SILT:*** dense brown silt, some fine sand, damp to moist
8.00	
9.00	
10.00	
11.00	compact, moist
12.00	
13.00	dense brown fine sandy silt, wet, dilatant
14.00	very dense silt, trace to some fine sand, wet, dilatant
15.00	
16.00	compact, trace fine sand, saturated
17.00	***SILT AND SAND:*** compact brown silt and fine sand, saturated
18.00	
19.00	Borehole terminated at 18.75 m
20.00	

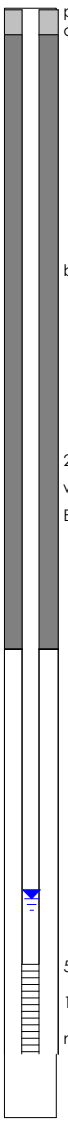
Elevation (m): 318.00, 317.00, 316.00, 315.00, 314.00, 313.00, 312.00, 311.00, 310.00, 309.00, 308.00, 307.00, 306.00, 305.00, 304.00, 303.00, 302.00, 301.00, 300.00, 299.00

SAMPLE

Number	Type	N-Value
1	SS	24
2	SS	3
3	AS	37
4	SS	15\75mm*
5	SS	35\75mm
6	SS	38\150mm
7	SS	34
8	SS	46
9	SS	29
10	SS	49
11	SS	72
12	SS	19
13	SS	16
14	SS	17



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes: **Sampler bouncing on gravel*

Field Tech.: *RM/KT*

Sheet: *1 of 1*

Drafted by: *SM*

Borehole Number: 27-10

Ground Elevation: *318.13 mASL*

Project: *Scoped Hydrogeology Study - Cambridge West Community*

Job No.: *P031655-300*

Location: *Blenheim Road, Cambridge, Ontario*

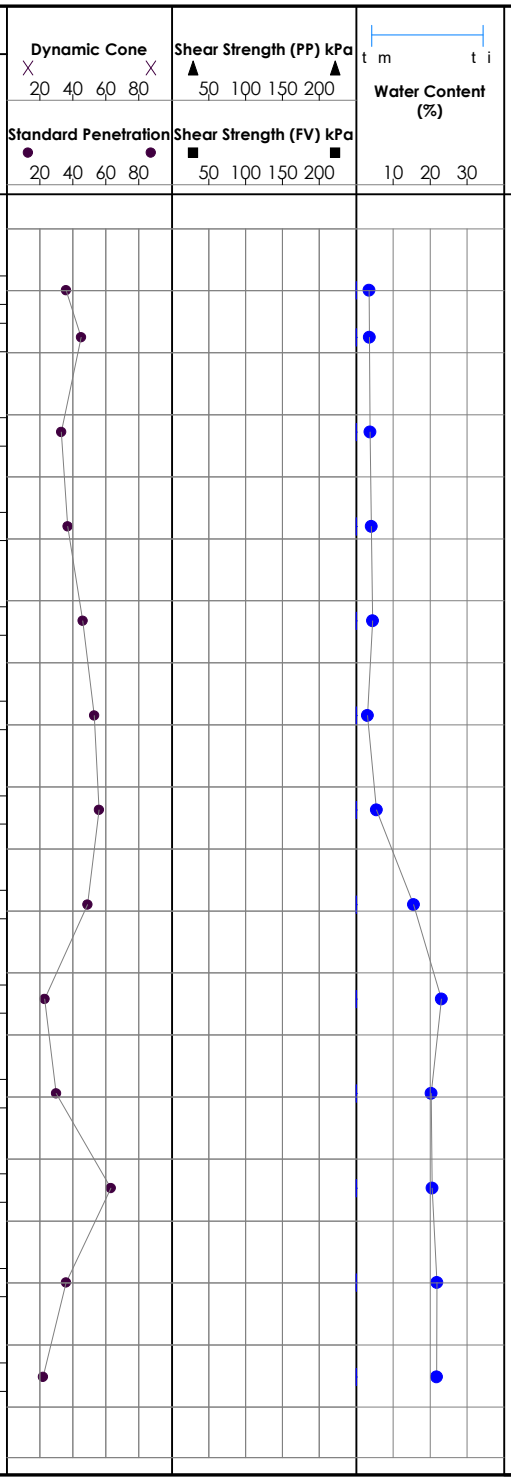
Drill Date: *March 10, 2010*

SOIL PROFILE

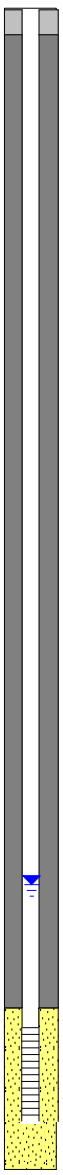
Depth (m)	Description	Symbol	Elevation (m)
	Ground Elevation		318.13
0.00	***TOPSOIL:*** dark brown silt, frozen		
1.00	***SILT:*** brown silt, trace sand and clay, frozen		317.00
2.00			316.00
3.00	***SAND AND GRAVEL:*** dense brown sand and gravel, some cobbles, trace silt, damp		315.00
4.00	***SAND:*** dense brown fine to coarse sand, some fine gravel, trace silt, damp		314.00
5.00			313.00
6.00			312.00
7.00			311.00
8.00	very dense		310.00
9.00	very dense brown fine to medium sand, trace silt, damp; some brown silt layers, moist		309.00
10.00			308.00
11.00	dense brown silty fine to medium sand, moist; some sand layers, damp		307.00
12.00	compact brown silty fine sand, saturated		306.00
13.00			305.00
14.00	some silt layers		304.00
15.00	dense to very dense, saturated		303.00
16.00			302.00
17.00			301.00
18.00	grey		300.00
19.00	Borehole terminated at 18.75 m		299.00

SAMPLE

Number	Type	N-Value
1	SS	36
2	SS	45
3	SS	33
4	SS	37
5	SS	46
6	SS	53
7	SS	56
8	SS	49
9	SS	23
10	SS	30
11	SS	63
12	SS	36
13	SS	22



Groundwater Observations and Standpipe Details



Reviewed by: *CH*

Drill Method: *Hollow Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *SM*

Appendix 3 Tables

Table 1: Topsoil Thicknesses
Table 2: Groundwater Elevation

TABLE 1
TOPSOIL THICKNESSES

Cambridge West Development
Blenheim Road
Cambridge, Ontario

Test Hole Number	Topsoil Thickness (mm)
BH-01-14	330
BH-02-14	410
BH-03-14	250
BH-04-14	230
BH-05-14	200
BH-06-14	280
BH-07-14	460
BH-08-14	410
BH-09-14	360
BH-10-14	1070
BH-11-14	410
BH-12-14	380
BH-13-14	460
BH-14-14	300
BH-15-14	510
BH-16-14	330
BH-17-14	300
BH-18-14	360
BH-19-14	360
BH-20-14	360
BH-21A-14	610
BH-21B-14	150
BH-22-14	410
BH-23-14	300
BH-24-14	230
BH-25-14	360
BH-26-14	230
BH-27-14	180

Test Hole Number	Topsoil Thickness (mm)
BH-28-14	280
BH-29-14	250
BH-30-14	250
BH-31-14	330
HH-01-14	610
HH 02-14	410
HH 03-14	560
HH 04-14	150
HH 05-14	580
HH 06-14	480
HH 07-14	130
HH 08-14	710
HH 09-14	230
HH 10-14	180
HH 11-14	560
HH 12-14	250
HH 13-14	660
HH 14-14	230
HH 15-14	230
HH 16-14	360
HH 17-14	530
HH 18-14	480
HH 19-14	560
HH 20-14	360
HH 21-14	710
HH 22-14	330
HH 23-14	250
HH 24-14	230

Test Hole Number	Topsoil Thickness (mm)
HH 25-14	100
HH 26-14	360
HH 27-14	250
HH 28-14	230
HH 29-14	380
HH 30-14	230
HH 31-14	480
HH 32-14	200
HH 33-14	280
HH 34-14	230
HH 35-14	200
HH 36-14	460
HH 37-14	230
HH 38-14	360
HH 39-14	640
HH 40-14	460
HH 41-14	300
HH 42-14	360
HH 43-14	130
HH 44-14	300
HH 45-14	360
HH 46-14	360
HH 47-14	610
HH 48-14	460
HH 49-14	690
HH 50-14	230
Average	**366**
Median	**360**

TABLE 2
GROUNDWATER ELEVATION

Cambridge West Development
Blenheim Road
Cambridge, Ontario

Monitoring Well	Groundwater Elevation (m) June 15, 2014	Groundwater Elevation (m) July 9, 2014
BH-06-14	308.05	307.86
BH-08-14 shallow	308.89	Dry
BH-08-14 deep	308.68	308.49
BH-10-14	308.46	308.25
BH-12-14	308.38	308.19
BH-14-14	Dry	Dry
BH-19-14	308.46	308.31
BH-22-14	300.09	299.95
BH-26-14	308.29	308.19

Appendix 4 Figures

Figure 1: Particle Size Distribution Analyses

Figure 2 to 4: Standard Proctor Moisture-Density Test Results

PARTICLE SIZE ANALYSIS

Project: Cambridge West Development

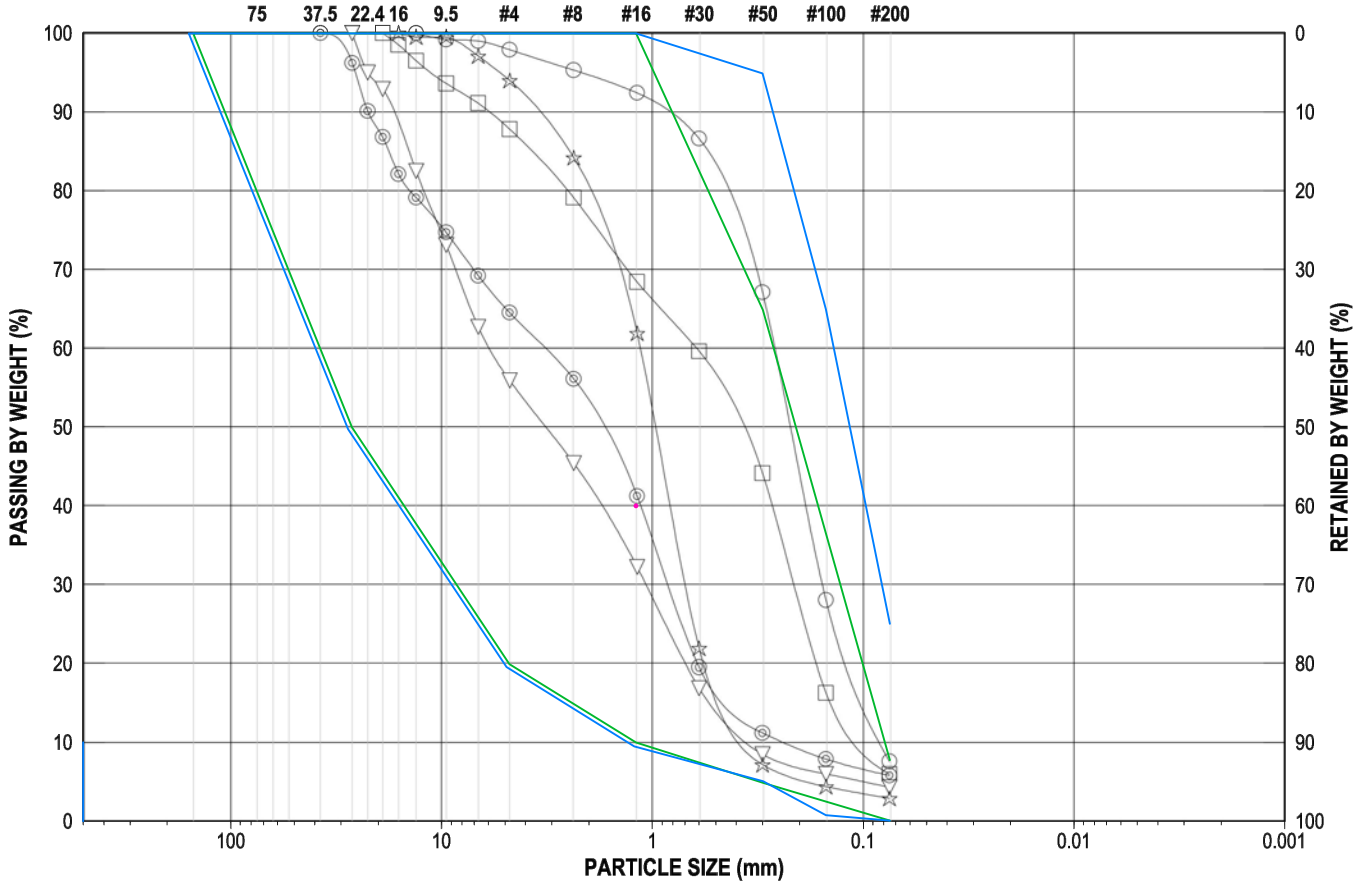
Figure No : 1

Location: Blenheim Road, Cambridge, Ontario

File No : P-0003455-0-09-100

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



Symbol	Borehole n°	Sample n°	Depth (m)	Description
○	BH-01-14	SS-2	1.52 - 1.98	SAND, trace Gravel and Silt
□	BH-01-14	SS-4	3.05 - 3.51	SAND, some Gravel, trace Silt
▽	BH-12-14	SS-3	2.29 - 2.74	SAND and GRAVEL, trace Silt
☆	BH-26-14	SS-5	4.57 - 5.03	SAND, trace Gravel and Silt
◎	BH-29-14	SS-4	3.05 - 3.51	SAND and GRAVEL, trace Silt
				OPSS 1010 Select Subgrade Material
				OPSS 1010 Granular 'B' Type 1

Y:\Style_LVM_Ontario\Lab Lab_Particle_Size_LVM_Ontario.STY - Printed: 2014-06-30T13:19:34

FIGURE NO. 2

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT Cambridge West Development

LOCATION Blenheim Road, Cambridge, Ontario JOB NO.P-0003455-0-09-100

SAMPLED FROM BH-02-14 BS-4a depth 3.0 - 4.6 m

DATE SAMPLED 2014-05-20 SAMPLED BY D.Souter

DATE TESTED 2014-06-14 TESTED BY J.Taylor

SOIL TYPE Sand and Gravel, some Silt MOISTURE CONTENT 5.0%

REMARKS

METHOD LS - 706

PROCEDURE: 1☐ 2☐ 3☑

Procedure 1 (Mold ø - 101.6 mm)
Procedure 2 (Mold ø - 101.6 mm)
Procedure 3 (Mold ø - 152.4 mm)

MAXIMUM DRY DENSITY 2.300 t/m³

OPTIMUM MOISTURE 6.1%

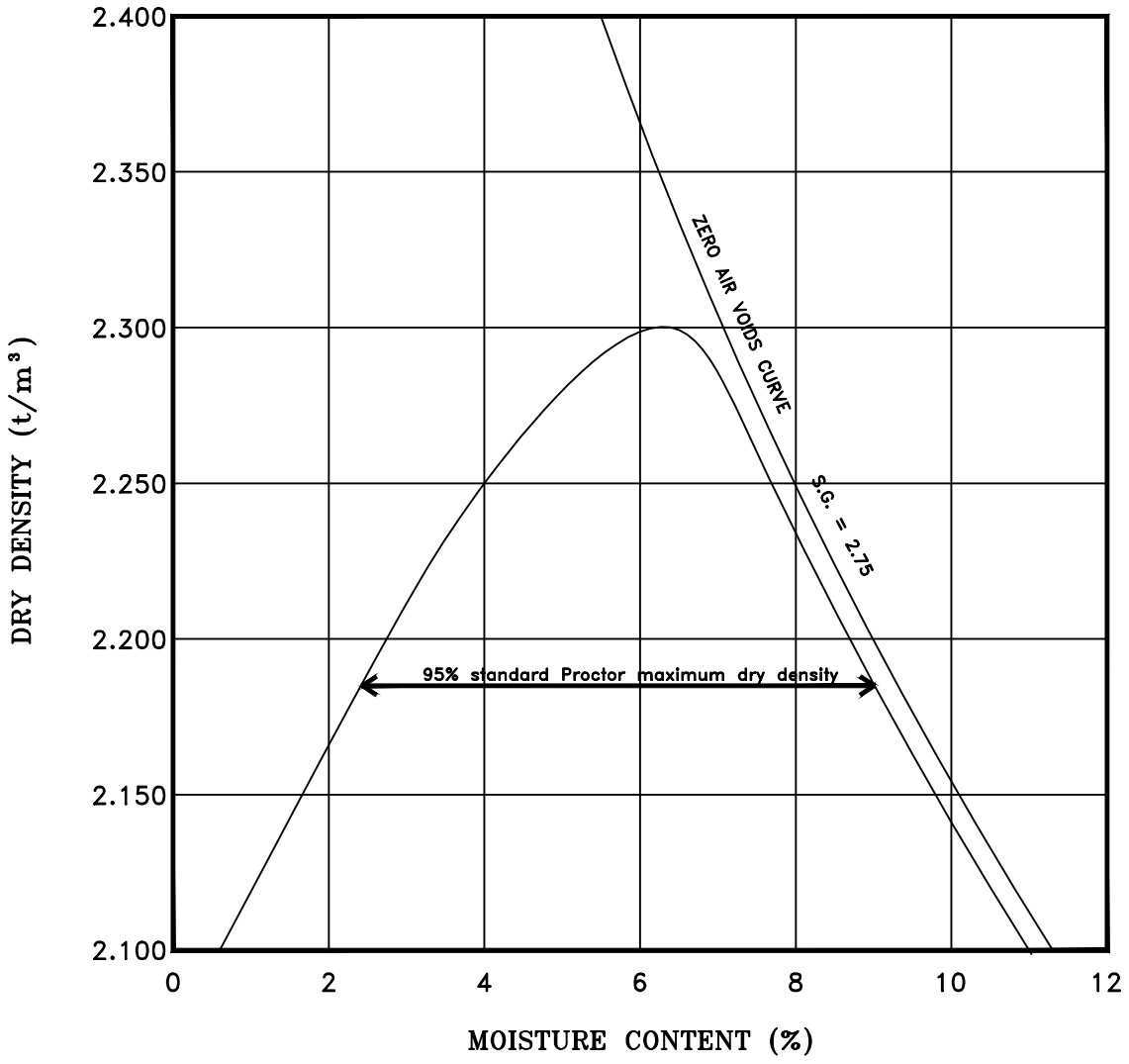


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FIGURE NO. 3

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT Cambridge West Development

LOCATION Blenheim Road, Cambridge, Ontario JOB NO.P-0003455-0-09-100

SAMPLED FROM BH-14-14 BS-4a depth 3.0 - 4.6 m

DATE SAMPLED 2014-05-22 SAMPLED BY D.Souter

DATE TESTED 2014-06-16 TESTED BY K.F.

SOIL TYPE Sand, trace Gravel and Silt MOISTURE CONTENT 7.4%

REMARKS

METHOD LS - 706

PROCEDURE: 1☑ 2☐ 3☐

Procedure 1 (Mold ø - 101.6 mm)
Procedure 2 (Mold ø - 101.6 mm)
Procedure 3 (Mold ø - 152.4 mm)

MAXIMUM DRY DENSITY 1.770 t/m³

OPTIMUM MOISTURE 13.0%

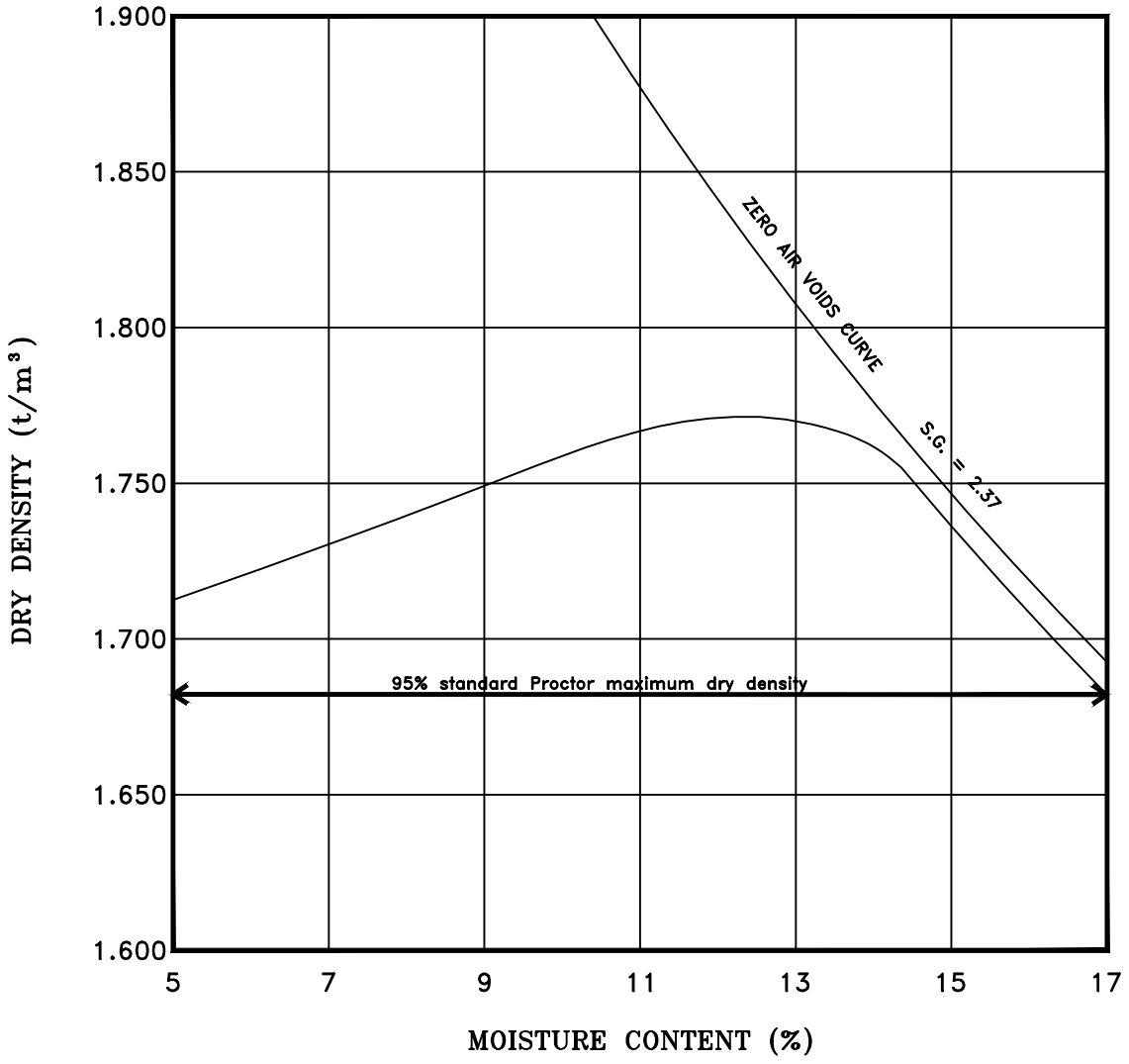

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FIGURE NO. 4

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT Cambridge West Development

LOCATION Blenheim Road, Cambridge, Ontario JOB NO.P-0003455-0-09-100

SAMPLED FROM BH-28-14 BS-4a depth 3.0 - 4.6 m

DATE SAMPLED 2014-05-23 SAMPLED BY D.Souter

DATE TESTED 2014-06-16 TESTED BY K.F.

SOIL TYPE Sand and Gravel, trace Silt MOISTURE CONTENT 3.6%

REMARKS

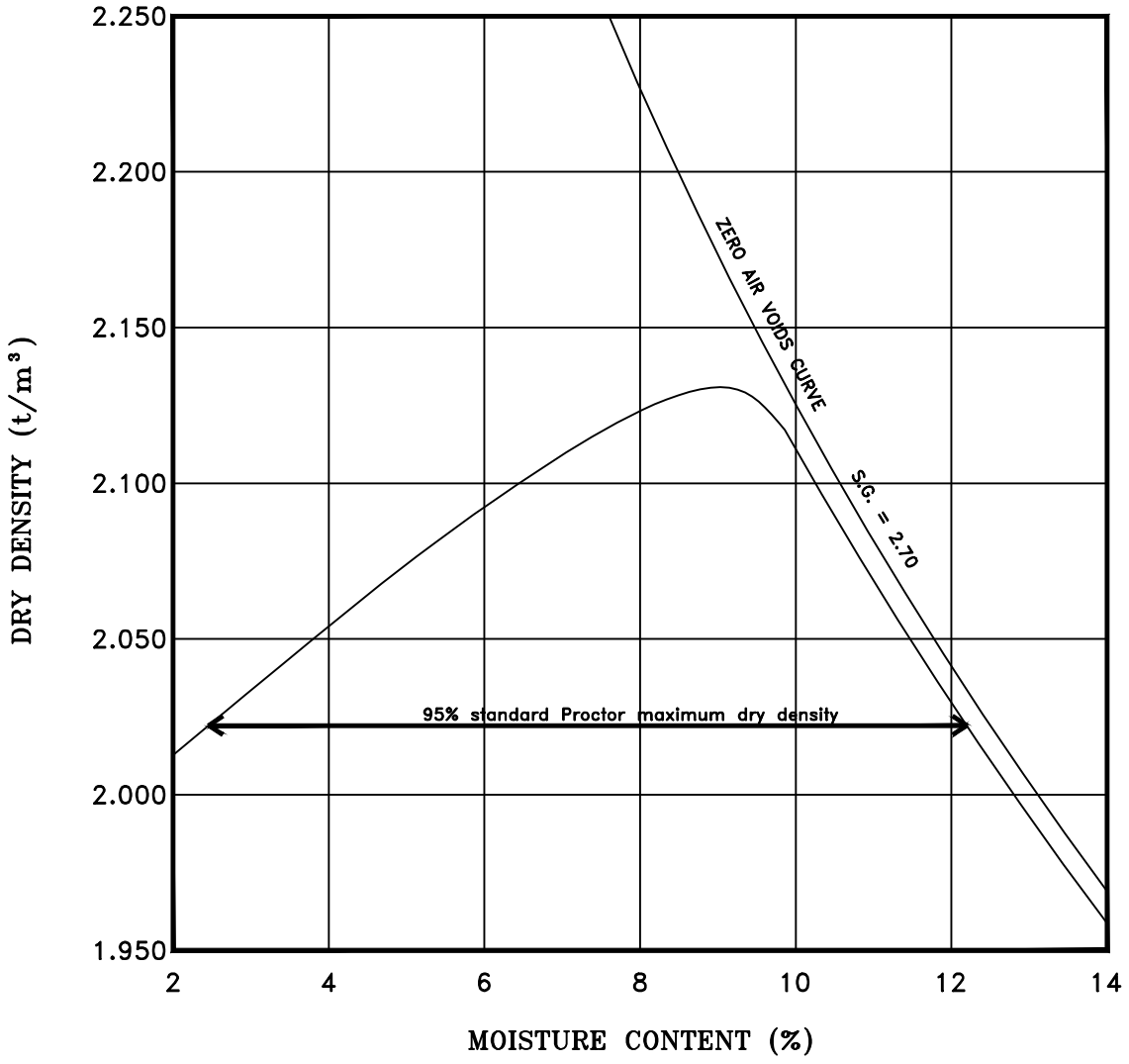
METHOD LS - 706

PROCEDURE: 1☐ 2☐ 3☑

Procedure 1 (Mold ø - 101.6 mm)
Procedure 2 (Mold ø - 101.6 mm)
Procedure 3 (Mold ø - 152.4 mm)

MAXIMUM DRY DENSITY 2.130 t/m³

OPTIMUM MOISTURE 9.1%



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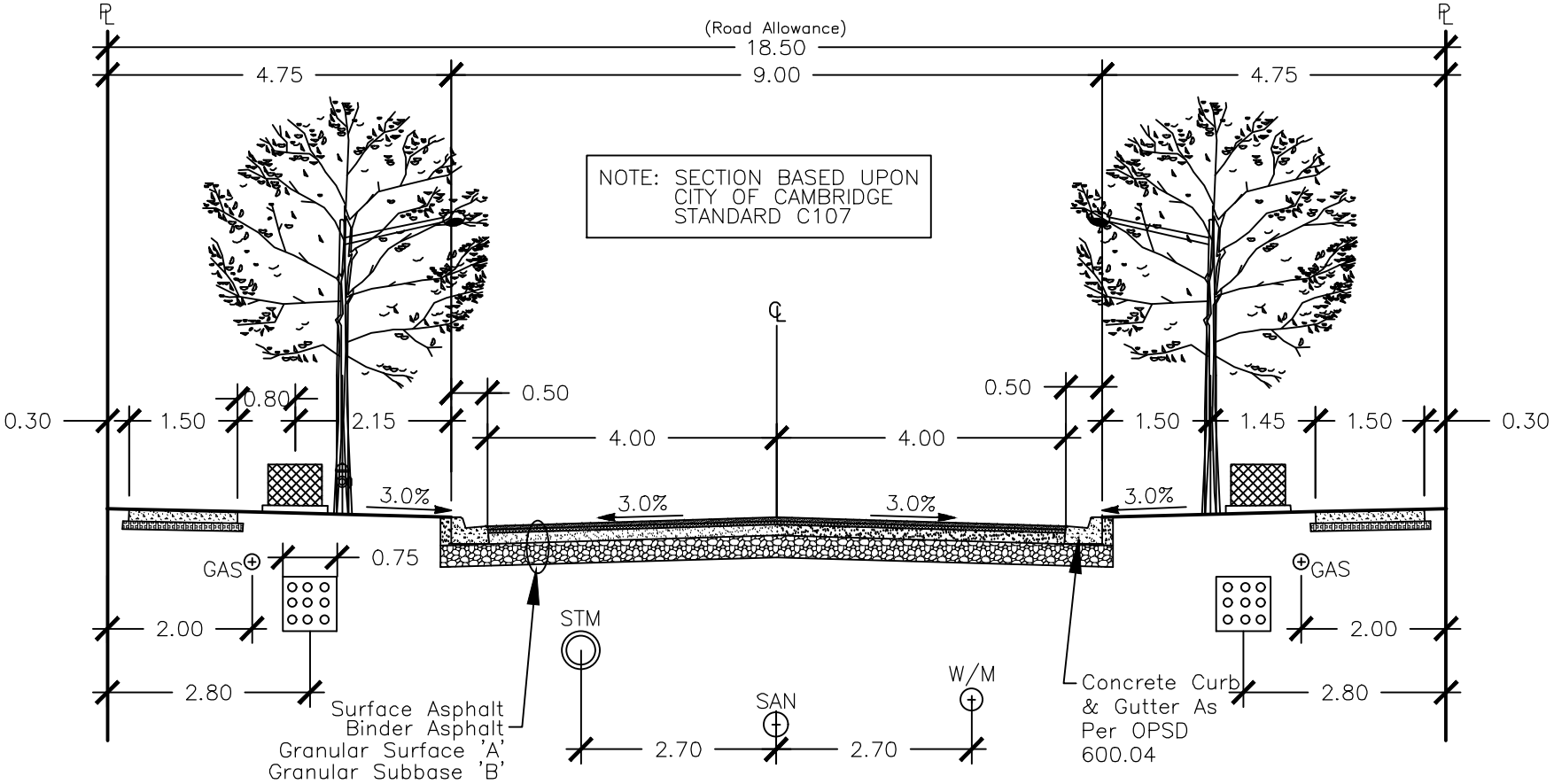
Appendix C

Typical ROW Cross-Sections



UTILITY	MIN. COVER
SANITARY	2.4m
STORM	1.5m
WATER	2.0m
HYDRO	0.9m
BELL	0.75m
CABLE	0.75m
GAS	0.6m

ROAD STRUCTURE SHALL BE:	
HL3 SURFACE ASPHALT	40mm
HL8 BINDER ASPHALT	80mm
GRAN 'A' BASE COURSE	150mm
GRAN 'B' SUBBASE COURSE	375mm

RG1.1

Date: DEC.16/20
Scale: N.T.S.

WESTWOOD VILLAGE - PHASE 2

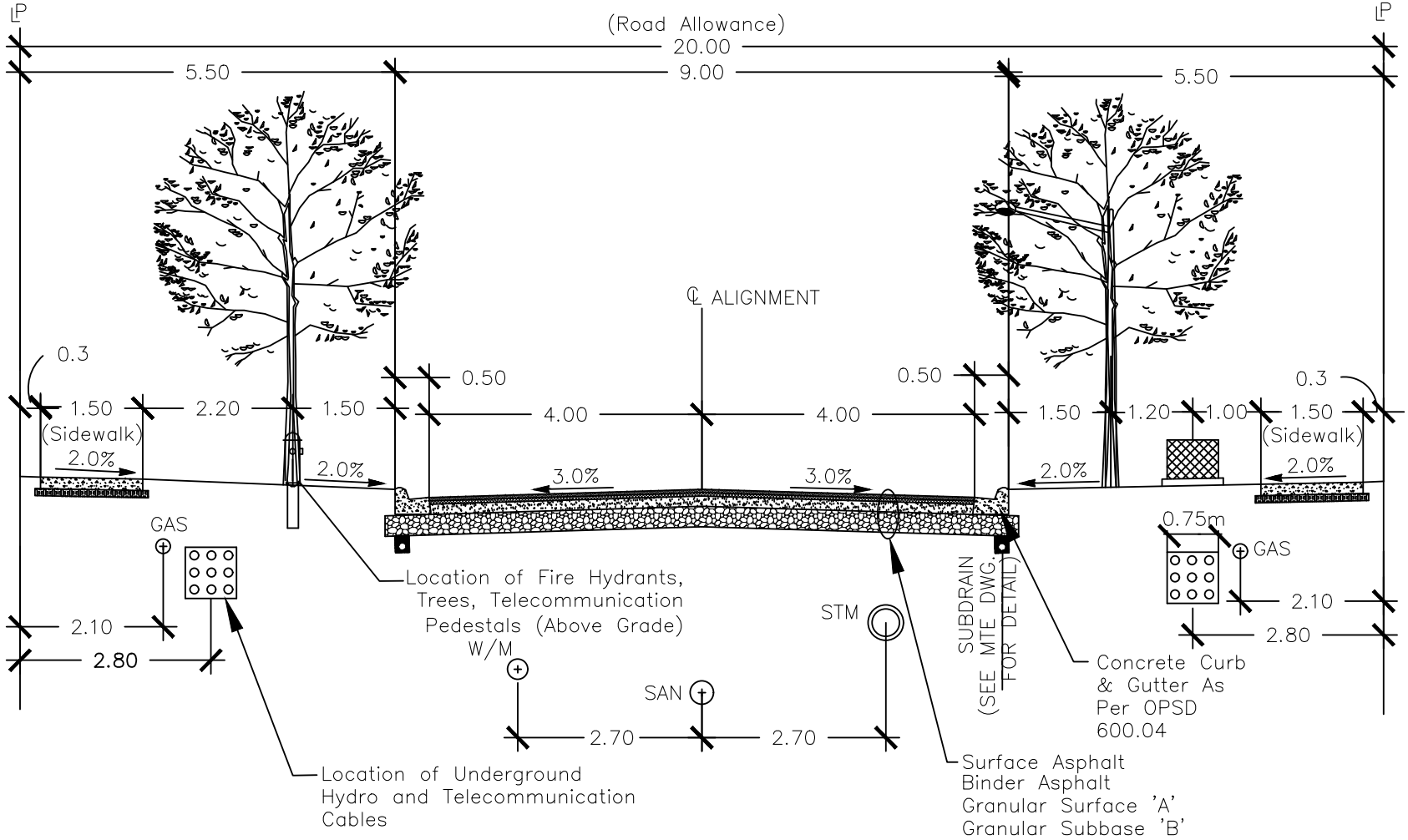
MODIFIED ROAD SECTION
18.5m RIGHT-OF-WAY c/w
SIDEWALK BOTH SIDES

MTE
Engineers, Scientists, Surveyors

Project No.: 02534-800

April 23, 2021 — 8:29 a.m. — Plotted By: CCarre

P:\P\02534\800\02534-800-P-RG1.dwg



UTILITY	MIN. COVER
SANITARY	2.5m
STORM	1.5m
WATER	2.0m
HYDRO	0.9m
BELL	0.75m
CABLE	0.75m
GAS	0.6m

ROAD STRUCTURE:	
HL3 SURFACE ASPHALT	40mm
HL8 BINDER ASPHALT	80mm
GRAN 'A' BASE COURSE	150mm
GRAN 'B' SUBBASE COURSE	375mm

RG1.2

Date: DEC.16/20
Scale: N.T.S.

WESTWOOD VILLAGE - PHASE 2

20.0m RIGHT-OF-WAY

MTE
Engineers, Scientists, Surveyors

Project No.: 02534-800

December 17, 2020 — 6:52 p.m. — Plotted By: CCarre

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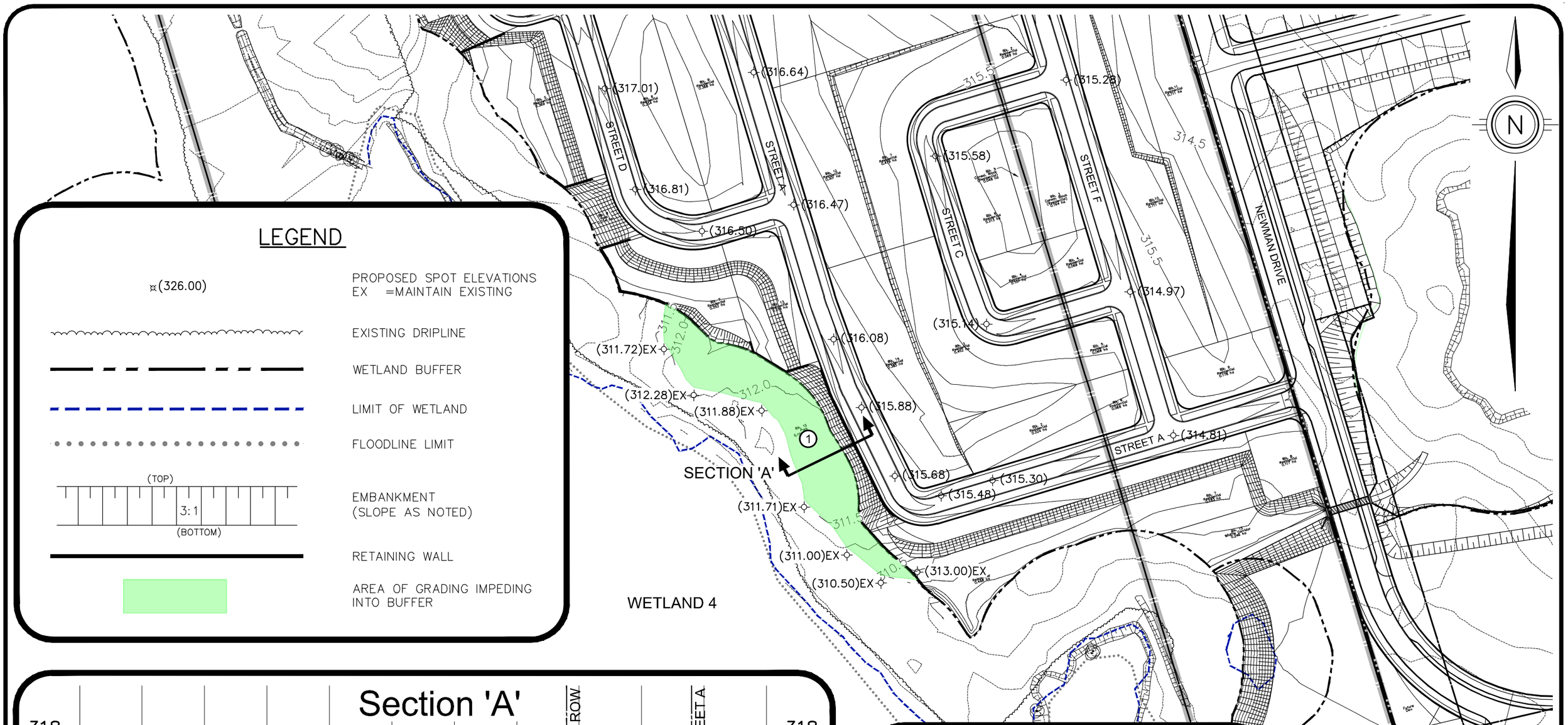
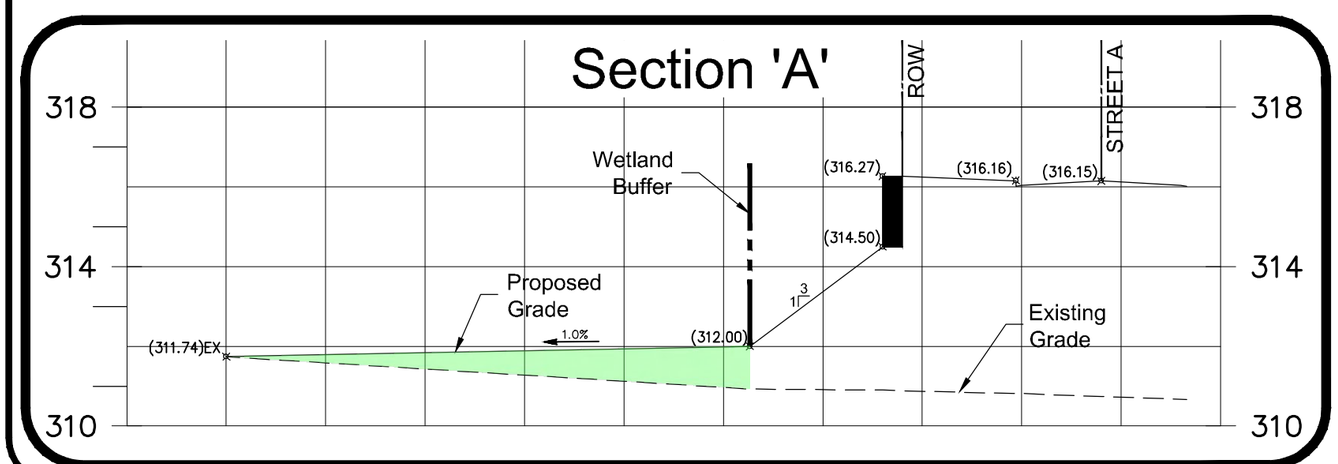
Appendix D

Buffer Encroachment Summary & Wildlife Passage



LEGEND

¤(326.00)	PROPOSED SPOT ELEVATIONS EX =MAINTAIN EXISTING
	EXISTING DRIPLINE
	WETLAND BUFFER
	LIMIT OF WETLAND
	FLOODLINE LIMIT
(TOP) 3:1 (BOTTOM)	EMBANKMENT (SLOPE AS NOTED)
	RETAINING WALL
	AREA OF GRADING IMPEDING INTO BUFFER



AREA OF GRADING ENCROACHMENT INTO BUFFER

AREA I.D. No.	AREA (sq.m)
1	4123.5 sq.m

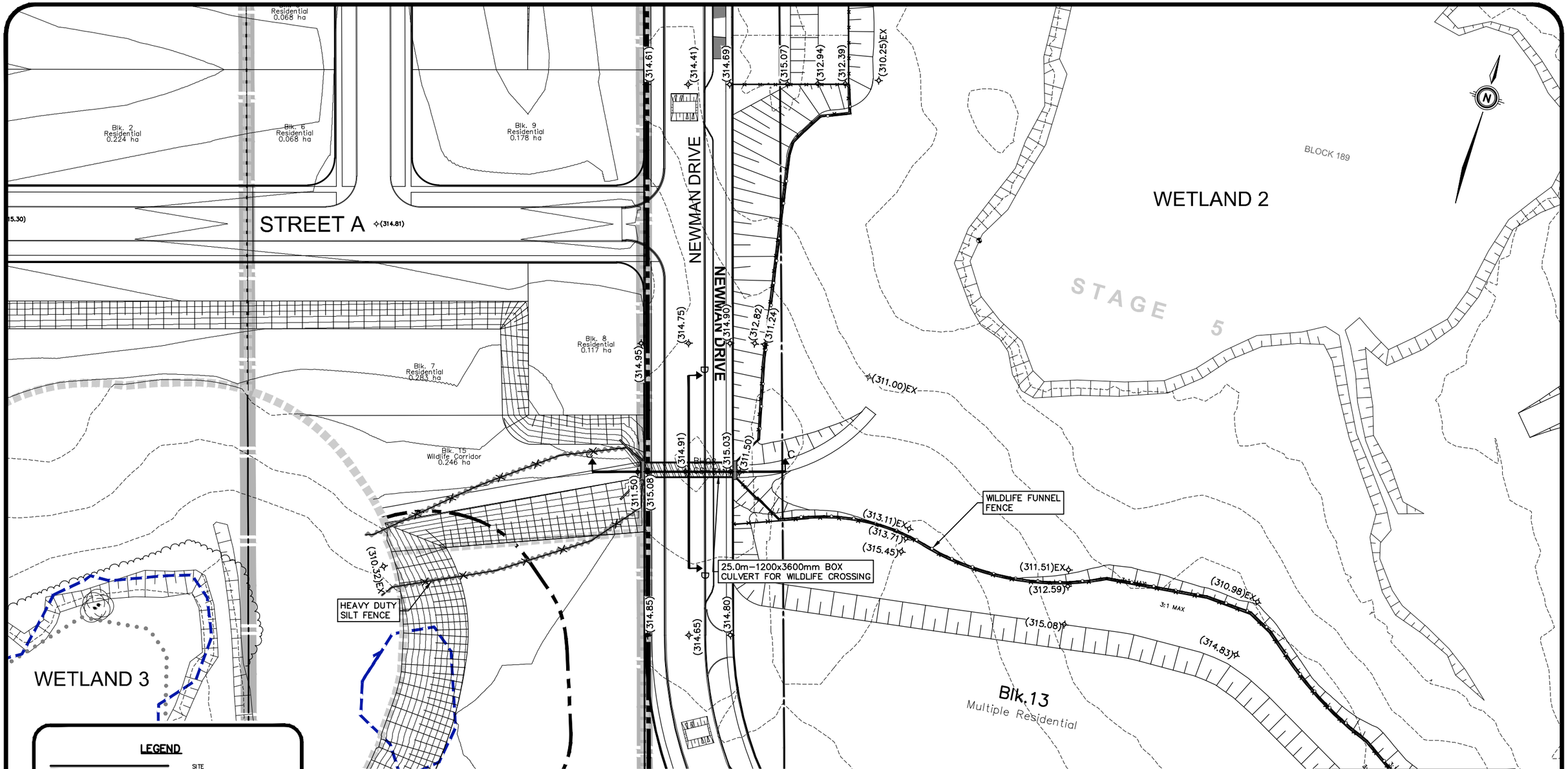
FIGURE AG1.1 Date: APR.09/21 Scale: 1:750

WESTWOOD VILLAGE - PHASE 2

GRADING IMPACTS TO WESTERN BUFFER

MTE Engineers, Scientists, Surveyors

Project No.: 02534-800



LEGEND

	SITE BOUNDARY
x(326.00)	PROPOSED SPOT ELEVATIONS EX =MAINTAIN EXISTING
	MUNICIPAL BOUNDARY
	ENVIRONMENTAL BUFFER
	LIMIT OF WETLAND
(TOP) 3:1 (BOTTOM)	EMBANKMENT (SLOPE AS NOTED)
	WILDLIFE FUNNEL FENCE (MIN. 0.6m)
	HEAVY DUTY SILT FENCE

FIGURE XS1.3 Date: APR.09/21 Scale: 1:1000

WESTWOOD VILLAGE - PHASE 2

NEWMAN DRIVE WILDLIFE CROSSING PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 02534-800

April 11, 2021 — 2:42 p.m. — Plotted By: CCarre

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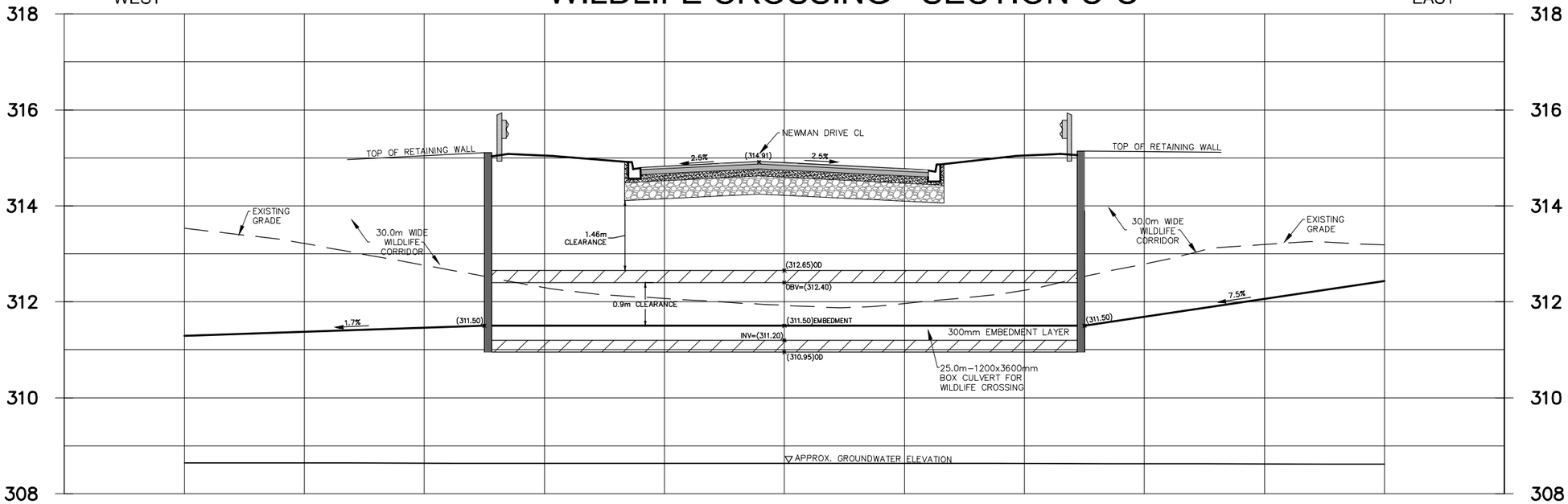
WILDLIFE CROSSING - SECTION C-C



WILDLIFE CROSSING - SECTION D-D

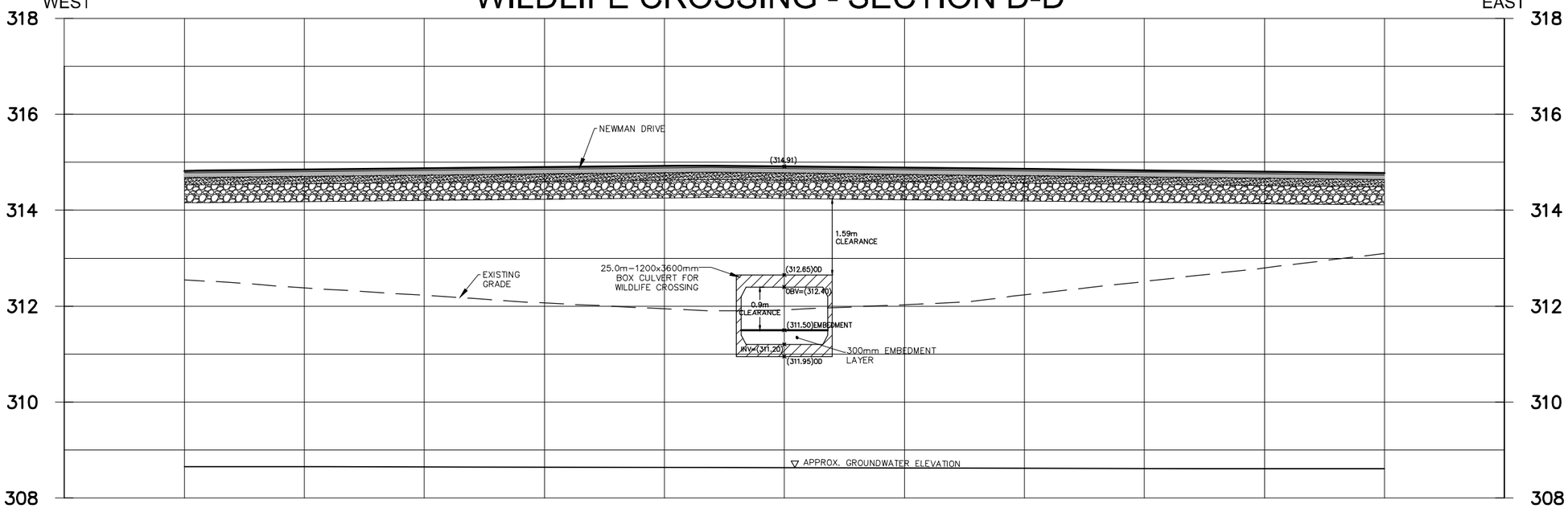


FIGURE XS1.4

Date: APR.09/21
Scale: H-1:200, V-1:100

WESTWOOD VILLAGE - PHASE 2

NEWMAN DRIVE WILDLIFE CROSSING

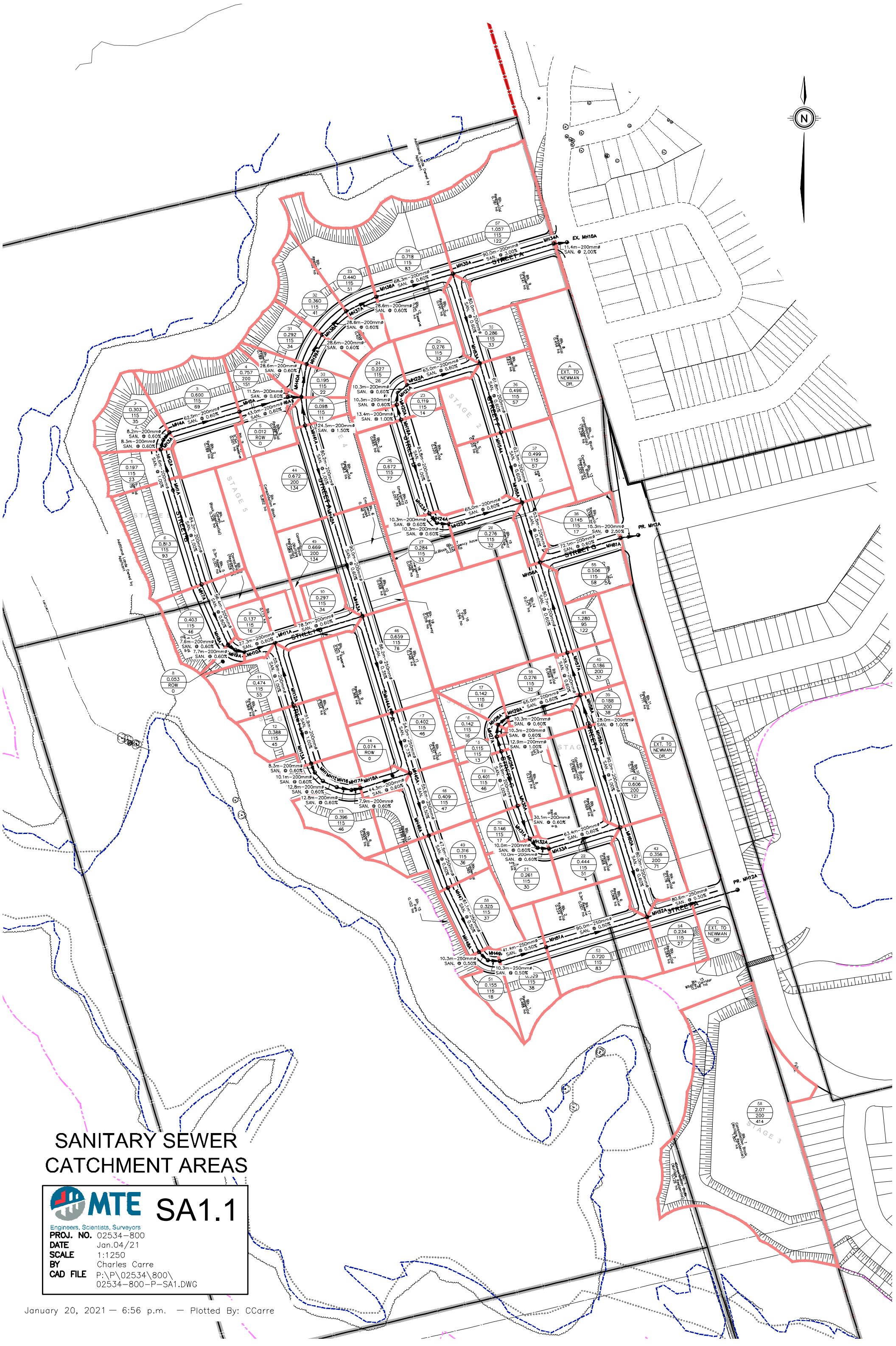
CROSS-SECTION

MTE
Engineers, Scientists, Surveyors

Project No.: 02534-800

Appendix E

Proposed Sanitary Sewer Analysis



SANITARY SEWER CATCHMENT AREAS

MTE Engineers, Scientists, Surveyors

SA1.1

PROJ. NO.	02534-800
DATE	Jan.04/21
SCALE	1:1250
BY	Charles Carre
CAD FILE	P:\P\02534\800\ 02534-800-P-SA1.DWG

January 20, 2021 — 6:56 p.m. — Plotted By: CCarre

Westwood Village Phase 2

Township of
North Dumfries, Ontario

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 02534-800
Date: January 4, 2021
Design By: CJC
Checked By: GMK
File: Q:\02534\800\SAN\02534-800 Sanitary Sewer Design Sheet.xlsx

Drainage Area Plan No: SA1.1

Design Parameters

Average Daily Flow				Mannings "*n*"	0.0130
Residential	0.00347	L/s/c		Min. Velocity	0.8 m/sec
Resid. Density	3.5	p/unit	(single/semi)	Max. Velocity	3.0 m/sec
	3.0	p/unit	(towns)	Residential Harmon Peaking Factor (F)	
Commercial	1.5	L/s/ha		Residential Areas Infiltration	0.20 L/s/ha
Industrial	1.0	L/s/ha		Extraneous Flow - Infiltration	2.03L/mm.dia/100m/hr.
Inst. / School	2.5	L/s/ha			

LOCATION				RESIDENTIAL AREAS and POPULATION							SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN						ERRORS
		MANHOLE LOCATION		0.003 L/s/person			CUMMULATIVE		PEAK FACTOR	PEAK RES.	HECTARES AND FLOW OF EACH ZONING									TOTALS- C-I FLOW				TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	% PIPE FULL
											2.50 *L/s/ha*			1.50 *L/s/ha*			1.00 *L/s/ha*													
STREET	AREA NO.	FROM MH	TO MH	AREA	DENSITY	POPUL.	AREA	POPUL.	"F"	FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW		AREA	CUMUL AREA	INFIL FLOW							
				ha	*p/ha*	1000s	ha	*1000s*		*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*m*	*%*	*mm*	*L/sec*	*m/s*	
Drainage Area to Hallman Lands (South through Newman Drive)																														
STREET B	1	1A	2A	0.197	115	0.023	0.20	0.023	4.3731	0.3438		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.20	0.20	0.0394	0.3832	36.6	1.00	200	32.7818	1.044	1.17%
	2	2A	4A	0.303	115	0.035	0.50	0.058	4.3020	0.8584		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.30	0.50	0.1000	0.9584	16.5	0.60	200	25.3927	0.809	3.77%
	3	4A	5A	0.600	115	0.069	1.10	0.127	4.2142	1.8498		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.60	1.10	0.2200	2.0698	62.5	0.60	200	25.3927	0.809	8.15%
	4	5A	6A	0.757	200	0.151	1.86	0.278	4.0924	3.9464		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.76	1.86	0.3714	4.3178	43.0	0.60	200	25.3927	0.809	17.00%
	5	6A	40A	0.012		0.000	1.87	0.278	4.0924	3.9464		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.01	1.87	0.3738	4.3202	11.5	0.60	200	25.3927	0.809	17.01%
	6	1A	7A	0.813	115	0.093	0.81	0.093	4.2515	1.3793		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.81	0.81	0.1626	1.5419	84.2	1.00	200	32.7818	1.044	4.70%
	7	7A	8A	0.403	115	0.046	1.22	0.140	4.2008	2.0384		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.40	1.22	0.2432	2.2816	56.4	0.60	200	25.3927	0.809	8.99%
	8	8A	10A	0.053		0.000	1.27	0.140	4.2008	2.0384		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.05	1.27	0.2538	2.2922	15.3	0.60	200	25.3927	0.809	9.03%
	9	10A	11A	0.137	115	0.016	1.41	0.156	4.1858	2.2600		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.14	1.41	0.2812	2.5412	27.3	0.60	200	25.3927	0.809	10.01%
	10	11A	43A	0.297	115	0.034	2.18	0.244	4.1151	3.4879		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.30	2.18	0.4354	3.9233	78.5	0.60	200	25.3927	0.809	15.45%
STREET D	11	12A	11A	0.474	115	0.055	0.47	0.055	4.3070	0.8147		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.47	0.47	0.0948	0.9095	55.9	1.00	200	32.7818	1.044	2.77%
	12	12A	13A	0.388	115	0.045	0.39	0.045	4.3244	0.6696		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.39	0.39	0.0776	0.7472	51.9	1.00	200	32.7818	1.044	2.28%
	13	13A	18A	0.396	115	0.046	0.78	0.090	4.2556	1.3314		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.40	0.78	0.1568	1.4882	51.9	0.60	200	25.3927	0.809	5.86%
	14	18A	45A	0.074		0.000	0.86	0.090	4.2556	1.3314		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.07	0.86	0.1716	1.5030	44.3	0.60	200	25.3927	0.809	5.92%
STREET C	15	26A	27A	0.115	115	0.013	0.12	0.013	4.4022	0.2020		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.12	0.12	0.0230	0.2250	12.9	1.00	200	32.7818	1.044	0.69%
	16	27A	28A	0.142	115	0.016	0.26	0.030	4.3558	0.4467		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.14	0.26	0.0514	0.4981	10.3	0.60	200	25.3927	0.809	1.96%
	17	28A	29A	0.142	115	0.016	0.40	0.046	4.3221	0.6882		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.14	0.40	0.0798	0.7680	10.3	0.60	200	25.3927	0.809	3.02%
	18	29A	58A	0.276	115	0.032	0.68	0.078	4.2721	1.1507		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.28	0.68	0.1350	1.2857	65.0	0.60	200	25.3927	0.809	5.06%
	19	26A	30A	0.401	115	0.046	0.40	0.046	4.3217	0.6915		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.40	0.40	0.0802	0.7717	48.9	1.00	200	32.7818	1.044	2.35%
	20	30A	31A	0.146	115	0.017	0.55	0.063	4.2935	0.9372		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.15	0.55	0.1094	1.0466	30.1	0.60	200	25.3927	0.809	4.12%
	21	31A	33A	0.261	115	0.030	0.81	0.093	4.2522	1.3710		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.26	0.81	0.1616	1.5326	20.0	0.60	200	25.3927	0.809	6.04%
	22	33A	60A	0.444	115	0.051	1.25	0.144	4.1968	2.0967		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.44	1.25	0.2504	2.3471	63.4	0.60	200	25.3927	0.809	9.24%
STREET E	23	19A	20A	0.119	115	0.014	0.12	0.014	4.4005	0.2090		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.12	0.12	0.0238	0.2328	13.4	1.00	200	32.7818	1.044	0.71%
	24	20A	22A	0.227	115	0.026	0.35	0.040	4.3338	0.5984		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.23	0.35	0.0692	0.6676	20.6	0.60	200	25.3927	0.809	2.63%
	25	22A	53A	0.276	115	0.032	0.62	0.072	4.2806	1.0625		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.28	0.62	0.1244	1.1869	65.0	0.60	200	25.3927	0.809	4.67%
	26	19A	23A	0.672	115	0.077	0.67	0.077	4.2726	1.1457		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.67	0.67	0.1344	1.2801	83.8	1.00	200	32.7818	1.044	3.91%
	27	23A	25A	0.284	115	0.033	0.96	0.110	4.2321	1.6145		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.28	0.96	0.1912	1.8057	20.6	0.60	200	25.3927	0.809	7.11%
	28	25A	55A	0.276	115	0.032	1.23	0.142	4.1990	2.0643		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.28	1.23	0.2464	2.3107	65.0	0.60	200	25.3927	0.809	9.10%

LOCATION				RESIDENTIAL AREAS and POPULATION							SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN						ERRORS
		MANHOLE LOCATION		0.003 L/s/person			CUMMULATIVE		PEAK FACTOR	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING									TOTALS C-I FLOW				TOTAL VOLUME FLOW					FULL FLOW VELOCITY	
											2.50 L/s/ha			1.50 L/s/ha			1.00 L/s/ha													
STREET	AREA NO.	FROM MH	TO MH	AREA	DENSITY	POPUL.	AREA	POPUL.	"F"		AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW		AREA	CUMUL AREA	INFIL FLOW		LENGTH	SLOPE	PIPE SIZE	CAPACITY		% PIPE FULL
				ha	p/ha	1000s	ha	1000s		L/sec	ha	ha	L/sec	ha	ha	L/sec	ha	ha	L/sec	L/sec	ha	ha	L/sec	L/sec	m	%	mm	L/sec	m/s	
STREET F	35	35A	53A	0.286	115	0.033	4.26	0.553	3.9515	7.5775		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.29	4.26	0.8516	8.4291	80.0	0.60	200	25.3927	0.809	33.20%
	36	53A	54A	0.496	115	0.057	5.38	0.681	3.9013	9.2219		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.50	5.38	1.0752	10.2971	61.8	0.60	200	25.3927	0.809	40.55%
	37	54A	55A	0.499	115	0.057	5.88	0.739	3.8810	9.9467		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.50	5.88	1.1750	11.1217	62.3	0.60	200	25.3927	0.809	43.80%
	38	55A	56A	0.145	115	0.017	7.25	0.897	3.8300	11.9204		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.15	7.25	1.4504	13.3708	53.5	0.60	200	25.3927	0.809	52.66%
	40	58A	57A	0.186	200	0.037	1.05	0.152	4.1888	2.2155		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.19	1.05	0.2098	2.4253	38.0	0.60	200	25.3927	0.809	9.55%
	41	57A	56A	1.280	95	0.122	2.33	0.274	4.0950	3.8938		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	1.28	2.33	0.4658	4.3596	80.7	0.60	200	25.3927	0.809	17.17%
	39	59A	58A	0.188	200	0.038	0.19	0.038	4.3382	0.5660		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.19	0.19	0.0376	0.6036	28.0	1.00	200	32.7818	1.044	1.84%
	42	59A	60A	0.606	200	0.121	0.79	0.159	4.1829	2.3049		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.61	0.79	0.1588	2.4637	90.0	1.00	200	32.7818	1.044	7.52%
	43	60A	52A	0.356	200	0.071	2.40	0.374	4.0359	5.2374		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.36	2.40	0.4804	5.7178	80.0	0.60	200	25.3927	0.809	22.52%
STREET A	29	41A	40A	0.098	115	0.011	0.10	0.011	4.4095	0.1724		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.10	0.10	0.0196	0.1920	24.5	1.50	200	40.1493	1.279	0.48%
	30	40A	39A	0.195	115	0.022	2.16	0.312	4.0714	4.4021		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.20	2.16	0.4324	4.8345	28.6	0.60	200	25.3927	0.809	19.04%
	31	39A	38A	0.292	115	0.034	2.45	0.345	4.0518	4.8530		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.29	2.45	0.4908	5.3438	28.6	0.60	200	25.3927	0.809	21.04%
	32	38A	37A	0.360	115	0.041	2.81	0.387	4.0292	5.4048		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.36	2.81	0.5628	5.9676	28.6	0.60	200	25.3927	0.809	23.50%
	33	37A	36A	0.440	115	0.051	3.25	0.437	4.0035	6.0733		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.44	3.25	0.6508	6.7241	28.6	0.60	200	25.3927	0.809	26.48%
	34	36A	35A	0.718	115	0.083	3.97	0.520	3.9655	7.1519		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.72	3.97	0.7944	7.9463	68.3	0.60	200	25.3927	0.809	31.29%
	44	41A	42A	0.672	200	0.134	0.67	0.134	4.2062	1.9616		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.67	0.67	0.1344	2.0960	80.2	1.00	200	32.7818	1.044	6.39%
	45	42A	43A	0.669	200	0.134	1.34	0.268	4.0988	3.8146		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.67	1.34	0.2682	4.0828	90.0	0.60	200	25.3927	0.809	16.08%
	46	43A	44A	0.659	115	0.076	4.18	0.588	3.9369	8.0360		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.66	4.18	0.8354	8.8714	86.2	0.50	250	42.0285	0.857	21.11%
	47	44A	45A	0.402	115	0.046	4.58	0.634	3.9188	8.6277		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.40	4.58	0.9158	9.5435	54.0	0.50	250	42.0285	0.857	22.71%
	48	45A	46A	0.409	115	0.047	5.85	0.772	3.8698	10.3621		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.41	5.85	1.1692	11.5313	55.6	0.50	250	42.0285	0.857	27.44%
	49	46A	47A	0.316	115	0.036	6.16	0.808	3.8578	10.8164		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.32	6.16	1.2324	12.0488	47.5	0.50	250	42.0285	0.857	28.67%
	50	47A	48A	0.325	115	0.037	6.49	0.845	3.8458	11.2817		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.33	6.49	1.2974	12.5791	61.1	0.50	250	42.0285	0.857	29.93%
	51	48A	50A	0.155	115	0.018	6.64	0.863	3.8403	11.5029		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.16	6.64	1.3284	12.8313	20.6	0.50	250	42.0285	0.857	30.53%
	52	50A	51A	0.329	115	0.038	6.97	0.901	3.8287	11.9710		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.33	6.97	1.3942	13.3652	41.4	0.50	250	42.0285	0.857	31.80%
	53	51A	52A	0.720	115	0.083	7.69	0.984	3.8045	12.9885		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.72	7.69	1.5382	14.5267	90.0	0.50	250	42.0285	0.857	34.56%
	54	52A	PR. 12A	0.234	115	0.027	10.33	1.385	3.7044	17.7998		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.23	10.33	2.0654	19.8652	80.6	0.50	250	42.0285	0.857	47.27%
STREET G	55	56A	61A	0.506	115	0.058	10.09	1.229	3.7404	15.9537		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.51	10.09	2.0174	17.9711	72.1	0.60	200	25.3927	0.809	70.77%
		61A	PR. 2A			0.000	10.09	1.229	3.7404	15.9537		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.00	10.09	2.0174	17.9711	15.3	2.50	200	51.8325	1.651	34.67%
MULTI BLOCK	56		STUB	2.070	200	0.414	2.07	0.414	4.0150	5.7679		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	2.07	2.07	0.4140	6.1819	11.9	0.60	200	25.3927	0.809	24.35%
Drainage Area to Newman Lands (North through Newman Drive)																														
STREET A	57	34A	33A	1.057	115	0.122	1.06	0.122	4.2194	1.7797		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	1.06	1.06	0.2114	1.9911	90.0	3.00	200	56.7797	1.808	3.51%
		33A	EX. 15A			0.000	1.06	0.122	4.2194	1.7797		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	0.00	1.06	0.2114	1.9911	11.4	2.00	200	46.3604	1.476	4.29%

Appendix F

Proposed Storm Sewer Analysis

STORM SEWER CATCHMENT AREAS

MTE

Engineers, Scientists, Surveyors

ST1.1

PROJ. NO.	02534-800
DATE	Jan.20/21
SCALE	1:1000
BY	Charles Carre
CAD FILE	P:\P\02534\800\ 02534-800-P-ST1.DWG

February 1, 2021 — 7:42 p.m. — Plotted By: CCarre

Westwood Village Phase 2

Township of
North Dumfries, Ontario

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 02534-800
Date: February 1, 2021
Design By: CJC
Checked By: GMK
File: Q:\02534\800\STM\02534-800 Storm Sewer Design Sheet.xlsx

Drainage Area Plan No: ST1.1

Design Parameters

5 YEAR STORM (City of Cambridge parameters)

Q=kAIR, k=0.00278
Intensity (I) = a/(tc+b)^c
a = 1219.8
b = 10.5
c = 0.8230

Manning's "n" 0.013
Min. Velocity 0.800 m/s
Max. Velocity 6.000 m/s

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/sec*	*mm*	*m*	*%*	*L/sec*	*m/s*	*%*
Drainage Area to SWM Facility #2 - North Forebay																	
STREET B	1	MH1	MH5	0.266	0.60	0.160	0.160	10.000	1.258	101.558	44.898	300	77.9	0.50	68.378	0.9673	66
	2	MH5	MH7	0.595	0.60	0.357	0.517	11.258	0.956	96.700	138.376	450	78.3	0.50	201.600	1.2676	69
		MH7	MH50				0.517	12.214	0.292	93.339	133.566	450	23.7	0.50	201.600	1.2676	66
	3	MH1	MH8	0.546	0.60	0.328	0.328	10.000	1.181	101.558	92.159	375	87.1	0.50	123.977	1.1225	74
	4	MH8	MH12	0.306	0.60	0.184	0.511	11.181	0.945	96.984	137.332	450	77.3	0.50	201.600	1.2676	68
		MH12	MH13				0.511	12.126	0.326	93.638	132.594	450	26.5	0.50	201.600	1.2676	66
	5	MH13	MH14	0.519	0.60	0.311	0.995	12.452	0.673	92.540	255.158	525	63.5	0.50	304.100	1.4048	84
		MH14	MH54				0.995	13.125	0.160	90.367	249.164	525	15.0	0.50	304.100	1.4048	82
STREET D	7	MH15	MH17	0.294	0.60	0.176	0.176	10.000	0.793	101.558	49.624	300	50.2	0.50	68.378	0.9673	73
	8	MH17	MH22	0.240	0.60	0.144	0.320	10.793	1.087	98.433	87.360	375	79.3	0.50	123.977	1.1225	70
	9	MH22	MH57	0.094	0.60	0.056	0.377	11.880	0.226	94.482	98.614	375	16.9	0.50	123.977	1.1225	80
	6	MH15	MH16	0.288	0.60	0.173	0.173	10.000	0.530	101.558	48.611	300	43.6	1.00	96.701	1.3680	50
		MH16	MH13				0.173	10.530	0.117	99.445	47.600	300	9.6	1.00	96.701	1.3680	49
PARK OVERLAND		MH53	MH74		0.60	0.000	2.302	13.360	1.208	89.633	571.597	675	153.9	0.65	677.704	1.8938	84
STREET C	10	MH32	MH33	0.112	0.60	0.067	0.067	10.000	0.248	101.558	18.904	300	12.3	0.50	68.378	0.9673	28
	11	MH33	MH34	0.147	0.60	0.088	0.155	10.248	0.142	100.558	43.286	300	8.7	0.50	68.378	0.9673	63
	12	MH34	MH35	0.158	0.60	0.095	0.250	10.390	0.126	99.996	69.303	375	8.7	0.50	123.977	1.1225	56
	13	MH35	MH36	0.223	0.60	0.134	0.384	10.515	0.607	99.504	105.840	375	45.9	0.50	123.977	1.1225	85
		MH36	MH76				0.384	11.122	0.210	97.200	103.390	375	15.8	0.50	123.977	1.1225	83
	14	MH32	MH37	0.407	0.60	0.244	0.244	10.000	0.812	101.558	68.697	375	56.1	0.50	123.977	1.1225	55
	15	MH37	MH41	0.819	0.60	0.491	0.736	10.812	1.000	98.362	200.423	525	90.0	0.50	304.100	1.4048	66
		MH41	MH79				0.736	11.812	0.102	94.719	193.000	525	9.1	0.50	304.100	1.4048	63

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/sec*	*mm*	*m*	*%*	*L/sec*	*m/s*	*%*
STREET E	16	MH23	MH27	0.711	0.60	0.427	0.427	10.000	0.957	101.558	120.010	375	82.5	0.65	141.356	1.2799	85
		MH27	MH69				0.427	10.957	0.112	97.814	115.585	375	9.6	0.65	141.356	1.2799	82
	17	MH23	MH28	0.648	0.60	0.389	0.389	10.000	0.961	101.558	109.376	375	81.5	0.65	141.356	1.2799	77
	18	MH28	MH31	0.609	0.60	0.365	0.754	10.961	0.703	97.799	204.315	450	71.1	0.70	238.537	1.4998	86
		MH31	MH72				0.754	11.664	0.095	95.238	198.966	450	9.6	0.70	238.537	1.4998	83
STREET F	23	MH44	MH68	0.247	0.60	0.148	1.261	14.526	0.754	86.181	301.074	600	65.0	0.35	363.254	1.2847	83
		MH68	MH69				1.261	15.281	0.175	84.100	293.804	600	15.0	0.35	363.254	1.2847	81
	24	MH69	MH70	0.476	0.60	0.286	1.973	15.455	0.565	83.633	457.166	675	56.6	0.40	531.635	1.4856	86
	25	MH70	MH71	0.451	0.60	0.271	2.244	16.020	0.469	82.165	510.726	675	52.5	0.50	594.386	1.6610	86
		MH71	MH72				2.244	16.489	0.086	80.989	503.417	675	9.6	0.50	594.386	1.6610	85
	26	MH72	MH73	0.215	0.60	0.129	3.127	16.575	0.463	80.777	699.721	825	49.3	0.35	849.215	1.5886	82
		MH73	MH74				3.127	17.038	0.040	79.657	690.020	825	4.3	0.35	849.215	1.5886	81
	27	MH77	MH76	0.155	0.60	0.093	0.093	10.000	0.454	101.558	26.162	300	24.6	0.50	68.378	0.9673	38
	28	MH76	MH75	0.180	0.60	0.108	0.585	11.332	0.508	96.431	156.262	450	42.7	0.50	201.600	1.2676	78
	29	MH75	MH74	0.102	0.60	0.061	0.646	11.840	0.956	94.621	169.370	450	81.5	0.50	201.600	1.2676	84
	30	MH77	MH78	0.506	0.60	0.304	0.304	10.000	1.080	101.558	85.408	375	78.4	0.50	123.977	1.1225	69
	31	MH78	MH79	0.035	0.60	0.021	0.325	11.080	0.132	97.357	87.538	375	9.6	0.50	123.977	1.1225	71
	32	MH79	MH80	0.412	0.60	0.247	1.307	11.914	0.875	94.364	341.739	675	68.7	0.25	420.294	1.1745	81
		MH80	MH66				1.307	12.789	0.145	91.436	331.136	675	11.3	0.25	420.294	1.1745	79
STREET A	19	MH51	MH50	0.097	0.60	0.058	0.058	10.000	0.553	101.558	16.373	300	31.2	0.80	86.492	1.2236	19
	20	MH50	MH49	0.092	0.60	0.055	0.630	12.505	0.235	92.365	161.185	525	20.1	0.50	304.100	1.4048	53
	21	MH49	MH47	0.302	0.60	0.181	0.811	12.740	0.612	91.595	205.816	525	55.4	0.50	304.100	1.4048	68
	22	MH47	MH45	0.503	0.60	0.302	1.113	13.352	0.906	89.656	276.412	600	72.2	0.30	336.308	1.1894	82
		MH45	MH44				1.113	14.259	0.268	86.946	268.056	600	21.2	0.30	336.308	1.1894	80
	33	MH51	MH52	0.738	0.60	0.443	0.443	10.000	0.817	101.558	124.567	375	73.1	0.70	146.692	1.3282	85
	34	MH52	MH53	0.793	0.60	0.476	0.919	10.817	0.835	98.342	250.234	525	90.0	0.70	359.816	1.6622	70
	35	MH55	MH54	0.647	0.60	0.388	0.388	10.000	0.832	101.558	109.207	375	83.5	1.00	175.330	1.5875	62
		MH54	MH53		0.60	0.000	1.384	13.284	0.076	89.868	344.424	525	9.6	0.90	407.993	1.8847	84

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/sec*	*mm*	*m*	*%*	*L/sec*	*m/s*	*%*
	36	MH55	MH56	0.339	0.60	0.203	0.203	10.000	0.488	101.558	57.220	300	41.7	1.00	96.701	1.3680	59
		MH56	MH57				0.203	10.488	0.113	99.612	56.123	300	9.6	1.00	96.701	1.3680	58
	37	MH57	MH58	0.383	0.60	0.230	0.810	12.106	0.681	93.704	210.243	525	61.9	0.50	304.100	1.4048	69
	38	MH58	MH60	0.408	0.60	0.245	1.055	12.787	0.995	91.444	267.180	600	78.8	0.30	336.308	1.1894	79
	39	MH60	MH64	0.389	0.60	0.233	1.288	13.782	0.978	88.348	315.254	675	81.3	0.30	460.409	1.2866	68
	40	MH64	MH65	0.411	0.60	0.247	1.535	14.760	0.795	85.523	363.591	675	68.0	0.30	460.409	1.2866	79
		MH65	MH66				1.535	15.555	0.258	83.370	354.438	675	22.0	0.30	460.409	1.2866	77
	41	MH66	MH67	0.293	0.60	0.176	3.018	15.813	0.640	82.696	691.323	825	68.0	0.35	849.215	1.5886	81
		MH67	PR. MH263				3.018	16.454	0.112	81.075	677.780	825	12.5	0.40	907.849	1.6983	75
STREET G	42	MH74	MH81	1.677	0.40	0.671	6.746	17.078	0.458	79.561	1486.801	975	71.8	0.60	1735.912	2.3250	86
		MH81	PR. MH258				6.746	17.536	0.102	78.490	1466.781	975	15.9	0.60	1735.912	2.3250	84
Roof Leader Collection System (East to Wetland 2) (Using 2-Year IDF Parameters)																	
	Lot Area			Roof Area													
NEWMAN DRIVE	0.282	PR. MH645	PR. MH646	0.121	0.98	0.119	0.119	10.000	1.681	72.984	24.024	300	89.0	0.50	68.378	0.9673	35
	0.276	PR. MH646	PR. MH647	0.119	0.98	0.116	0.235	11.681	1.461	67.315	43.845	300	90.0	0.50	68.378	0.9673	64
	0.259	PR. MH647	PR. MH649	0.111	0.98	0.109	0.344	13.143	1.320	63.148	60.222	300	90.0	0.55	71.715	1.0146	84
STREET C	0.115	MH84	MH85	0.049	0.98	0.048	0.048	10.000	0.340	72.984	9.797	300	14.0	0.50	68.378	0.9673	14
	0.118	MH85	MH86	0.051	0.98	0.050	0.098	10.340	0.280	71.749	19.514	300	14.0	0.50	68.378	0.9673	29
	0.168	MH86	MH92	0.072	0.98	0.071	0.169	10.620	1.254	70.769	33.125	300	72.2	0.50	68.378	0.9673	48
	0.474	MH84	MH87	0.204	0.98	0.200	0.200	10.000	1.137	72.984	40.381	300	68.7	0.50	68.378	0.9673	59
	0.081	MH87	MH88	0.035	0.98	0.034	0.234	11.137	0.419	69.037	44.725	300	25.9	0.50	68.378	0.9673	65
	0.101	MH88	MH89	0.043	0.98	0.043	0.276	11.555	0.211	67.704	51.844	300	13.5	0.50	68.378	0.9673	76
	0.107	MH89	MH90	0.046	0.98	0.045	0.322	11.767	0.202	67.054	59.720	375	13.5	0.50	123.977	1.1225	48
	0.342	MH90	MH94	0.147	0.98	0.144	0.466	11.969	0.970	66.444	85.702	375	70.5	0.50	123.977	1.1225	69
STREET F	0.219	MH91	MH92	0.094	0.98	0.092	0.092	10.000	1.473	72.984	18.657	300	72.8	0.50	68.378	0.9673	27
	0.294	MH92	MH93	0.126	0.98	0.124	0.385	11.874	0.886	66.729	71.193	375	61.7	0.50	123.977	1.1225	57
	0.26	MH93	MH94	0.112	0.98	0.110	0.495	12.760	0.935	64.181	87.953	375	68.3	0.50	123.977	1.1225	71
	0.191	MH94	MH97	0.082	0.98	0.080	1.041	13.694	0.761	61.724	177.962	450	68.0	0.55	211.440	1.3295	84
STREET A	0.071	MH95	MH96	0.031	0.98	0.030	0.030	10.000	0.592	72.984	6.049	300	21.2	0.50	68.378	0.9673	9
	0.221	MH96	MH97	0.095	0.98	0.093	0.123	10.592	1.698	70.864	24.154	300	90.0	0.50	68.378	0.9673	35
		MH97	PR. MH649			0.000	1.164	14.455	0.696	59.879	193.051	450	67.6	0.65	229.860	1.4453	84
		PR. MH649	HW650			0.000	1.508	15.151	0.333	58.299	243.555	525	31.2	0.50	304.100	1.4048	80

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/sec*	*mm*	*m*	*%*	*L/sec*	*m/s*	*%*
Roof Leader Collection System (To Northeastern Wetland) (Using 2-Year IDF Parameters)																	
STREET B		MH98	MH100	0.180	0.98	0.176	0.176	10.000	2.241	72.984	35.662	300	131.4	0.50	68.378	0.9673	52
		MH100	MH102	0.035	0.98	0.034	0.211	12.241	0.349	65.646	38.314	300	20.8	0.50	68.378	0.9673	56
		MH102	MH103	0.129	0.98	0.126	0.337	12.589	1.345	64.654	60.375	375	90.0	0.50	123.977	1.1225	49
		MH103	MH104	0.029	0.98	0.028	0.366	13.935	0.304	61.127	61.894	375	20.5	0.50	123.977	1.1225	50
STREET A		MH104	MH119		0.98	0.000	0.366	14.239	2.578	60.390	61.147	375	173.0	0.50	123.977	1.1225	49
	0.281	MH110	MH111	0.121	0.98	0.118	0.118	10.000	1.702	72.984	23.939	300	90.0	0.50	68.378	0.9673	35
	0.089	MH111	MH112	0.038	0.98	0.038	0.156	11.702	0.532	67.252	29.046	300	29.6	0.50	68.378	0.9673	42
	0.052	MH112	MH113	0.022	0.98	0.022	0.178	12.234	0.404	65.667	32.347	300	23.1	0.50	68.378	0.9673	47
	0.064	MH113	MH114	0.028	0.98	0.027	0.205	12.637	0.452	64.520	36.602	300	26.7	0.50	68.378	0.9673	54
	0.064	MH114	MH115	0.028	0.98	0.027	0.232	13.090	0.441	63.289	40.632	300	26.7	0.50	68.378	0.9673	59
	0.064	MH115	MH116	0.028	0.98	0.027	0.259	13.531	0.432	62.139	44.536	300	26.7	0.50	68.378	0.9673	65
	0.064	MH116	MH117	0.028	0.98	0.027	0.286	13.963	0.432	61.059	48.323	300	27.2	0.50	68.378	0.9673	71
	0.173	MH117	MH118	0.074	0.98	0.073	0.359	14.395	0.813	60.020	59.621	375	54.2	0.50	123.977	1.1225	48
		MH118	MH119		0.98	0.000	0.359	15.208	0.181	58.174	57.787	375	12.0	0.50	123.977	1.1225	47
EASEMENT		MH119	HW120		0.98	0.000	0.724	16.817	0.445	54.879	110.082	375	58.2	2.00	247.954	2.2450	44
Drainage Area to Newman Lands (North through Newman Drive)																	
STREET A	43	MH44	MH42	0.459	0.60	0.275	0.275	10.000	0.508	101.558	77.475	300	88.6	5.50	226.783	3.2083	34
		MH42	EX. MH14				0.275	10.508	0.180	99.531	75.928	375	12.7	0.50	123.977	1.1225	61

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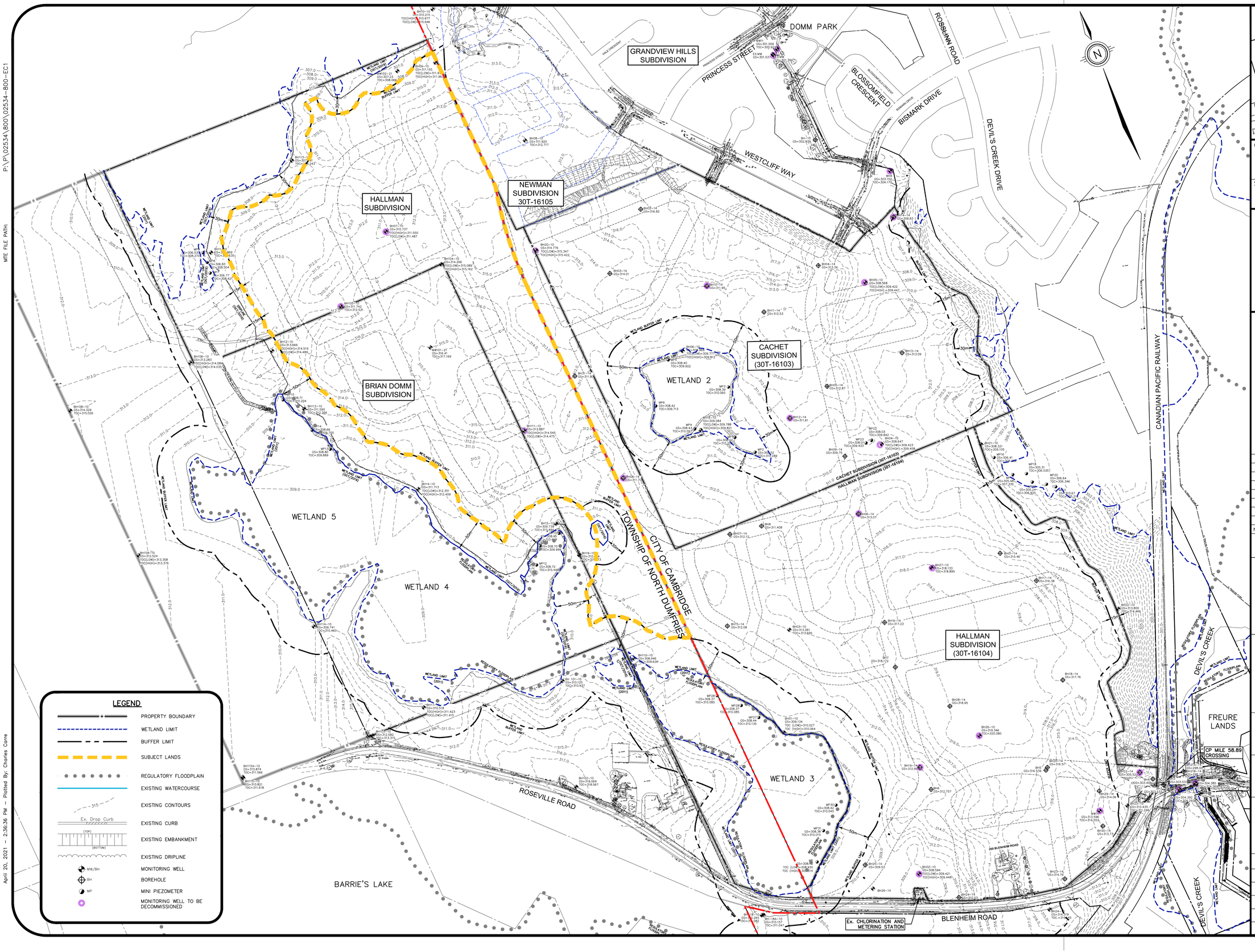
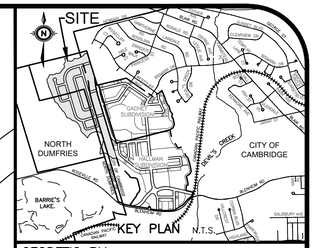
April 20, 2021 – 2:36:36 PM – Plotted By: Charles Carre



LEGEND

- PROPERTY BOUNDARY
- WETLAND LIMIT
- BUFFER LIMIT
- SUBJECT LANDS
- REGULATORY FLOODPLAIN
- EXISTING WATERCOURSE
- EXISTING CONTOURS (315)
- EXISTING CURB (Ex. Drop Curb)
- EXISTING EMBANKMENT (TOP) (BOTTOM)
- EXISTING DRIPLINE
- MONITORING WELL (MW/BH)
- BOREHOLE (BH)
- MINI PIEZOMETER (MP)
- MONITORING WELL TO BE DECOMMISSIONED



GEODETIC BM ELEV. =300.480m

STATION 00119663308

CONCRETE CYLINDER WITH TOPOGRAPHICAL TABLET ON NORTH SIDE OF GRANT STREET, 10.9m EAST OF INTERSECTION WITH KENMORE AVENUE, IN GRASSED AREA BETWEEN ROADWAY AND SIDEWALK, 1.6m NORTH OF ROADWAY, 1.0m WEST FROM CONCRETE LIGHT STANDARD AND 19.6m FROM CENTRELINE OF DRIVEWAY TO No. 56 GRANT STREET.

SITE BENCHMARK ELEV. =306.341m

CUT CROSS IN CONCRETE SIDEWALK ON EAST CORNER OF BISMARK DRIVE AND WESTCLIFF WAY INTERSECTION. LOCATED APPROX. 14.7m SOUTH EAST ALONG WESTCLIFF WAY CENTRELINE FROM INTERSECTION AND 8.4m NORTH EAST ALONG BISMARK DRIVE CENTRELINE FROM INTERSECTION.

NOTE TO CONTRACTOR :

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1.	ISSUED FOR APPROVAL	GMK	APR.19/21

TOWNSHIP of NORTH DUMFRIES

MTE

Engineers, Scientists, Surveyors

519-743-6500

OWNER

HALLMAN CONSTRUCTION LIMITED

675 RIVERBEND DRIVE KITCHENER

PROJECT

WESTWOOD VILLAGE PHASE 2

Cambridge Ontario

DRAWING

EXISTING CONDITIONS PLAN (OVERALL)

Project Manager G.KORBER	Project No. 02534-800
Design By CJC	Checked By
Drawn By KAT	Checked By CJC
Surveyed By MTE	Drawing No. EC1.1
Date Dec.02/20	
Scale 1:2500	Sheet of

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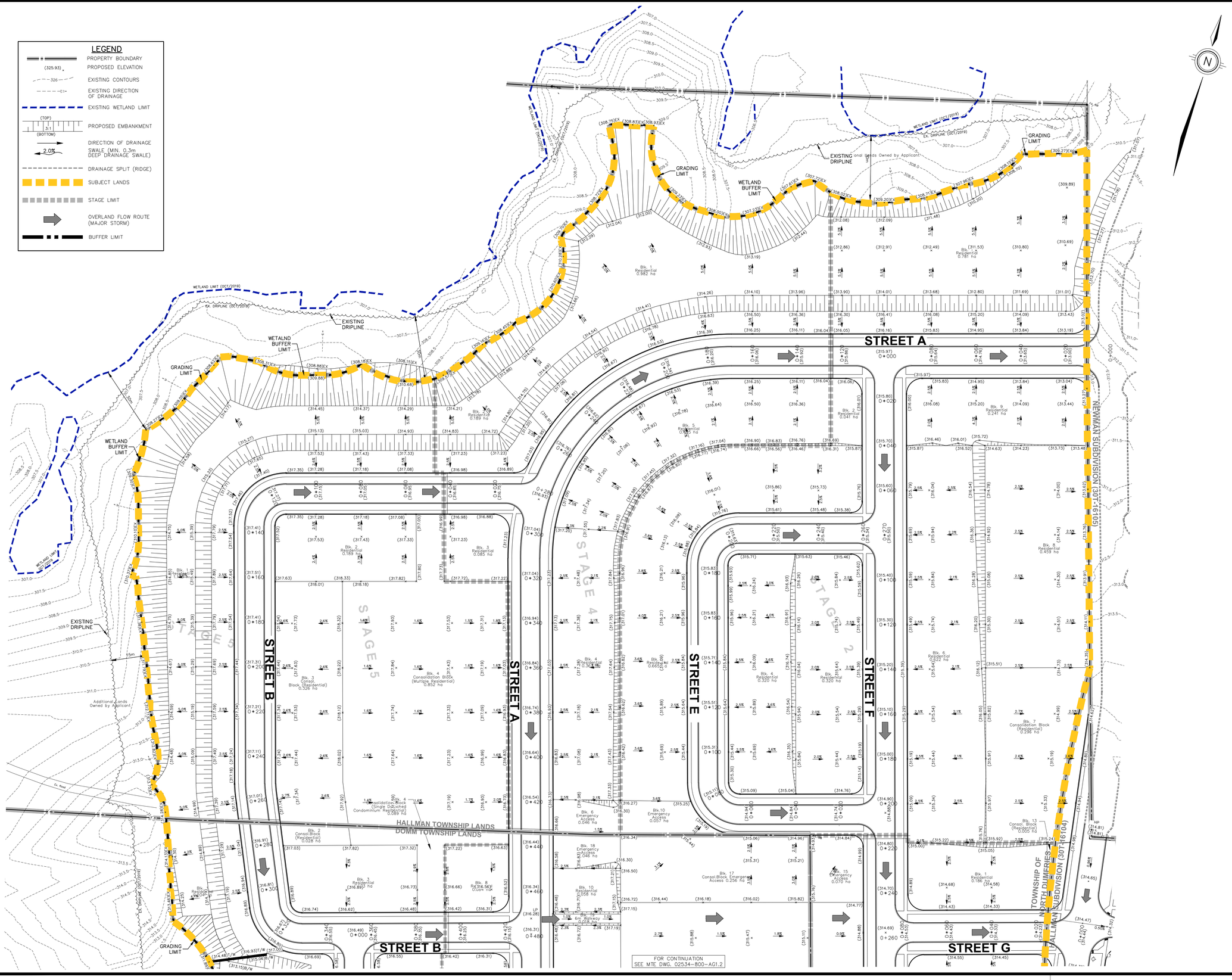
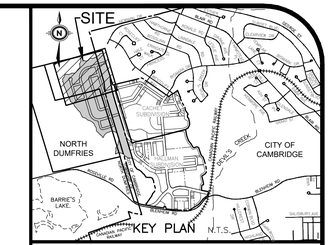
MTE FILE PATH:

April 23, 2021 – 9:49:42 AM – Plotted By: Charles Carre

LEGEND

- PROPERTY BOUNDARY
- (325.93) PROPOSED ELEVATION
- 326 EXISTING CONTOURS
- EXISTING DIRECTION OF DRAINAGE
- EXISTING WETLAND LIMIT
- (TOP) 3:1 (BOTTOM) PROPOSED EMBANKMENT
- 2.0% DIRECTION OF DRAINAGE SWALE (MIN. 0.3m DEEP DRAINAGE SWALE)
- DRAINAGE SPLIT (RIDGE)
- SUBJECT LANDS
- STAGE LIMIT
- OVERLAND FLOW ROUTE (MAJOR STORM)
- BUFFER LIMIT





GEODETIC BM ELEV. =300.480m

STATION 00119663308
CONCRETE CYLINDER WITH TOPOGRAPHICAL TABLET ON NORTH SIDE OF GRANT STREET, 10.9m EAST OF INTERSECTION WITH KENMORE AVENUE, IN GRASSED AREA BETWEEN ROADWAY AND SIDEWALK, 1.6m NORTH OF ROADWAY, 1.0m WEST FROM CONCRETE LIGHT STANDARD AND 19.6m FROM CENTRELINE OF DRIVEWAY TO No. 56 GRANT STREET.

SITE BENCHMARK ELEV. =306.341m

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TOWNSHIP of NORTH DUMFRIES

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
HALLMAN CONSTRUCTION LIMITED
675 RIVERBEND DRIVE KITCHENER

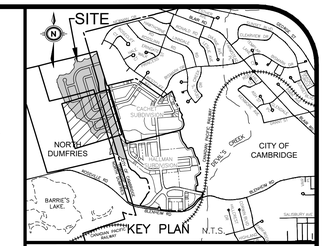
PROJECT
WESTWOOD VILLAGE PHASE 2
Cambridge Ontario

DRAWING
AREA GRADING PLAN No. 1

Project Manager G.KORBER	Project No. 02534-800
Design By CJC	Checked By GMK
Drawn By KAT/AXH	Checked By GMK
Surveyed By MTE	Drawing No. AG1.1
Date Dec.09/20	
Scale 1:750	Sheet of

LEGEND

- PROPERTY BOUNDARY
- (325.93) PROPOSED ELEVATION
- 326 EXISTING CONTOURS
- EXISTING DIRECTION OF DRAINAGE
- EXISTING WETLAND LIMIT
- (TOP) 3:1 (BOTTOM) PROPOSED EMBANKMENT
- DIRECTION OF DRAINAGE
- 2.0% SWALE (MIN. 0.3m DEEP DRAINAGE SWALE)
- DRAINAGE SPLIT (RIDGE)
- SUBJECT LANDS
- STAGE LIMIT
- OVERLAND FLOW ROUTE (MAJOR STORM)
- BUFFER LIMIT



GEODETIC BM ELEV. =300.480m
STATION 00119663308
CONCRETE CYLINDER WITH TOPOGRAPHICAL TABLET ON NORTH SIDE OF GRANT STREET, 10.9m EAST OF INTERSECTION WITH KENMORE AVENUE, IN GRASSED AREA BETWEEN ROADWAY AND SIDEWALK, 1.6m NORTH OF ROADWAY, 1.0m WEST FROM CONCRETE LIGHT STANDARD AND 19.6m FROM CENTRELINE OF DRIVEWAY TO No. 56 GRANT STREET.

SITE BENCHMARK ELEV. =306.341m
CUT CROSS IN CONCRETE SIDEWALK ON EAST CORNER OF BISMARK DRIVE AND WESTCLIFF WAY INTERSECTION. LOCATED APPROX. 14.7m SOUTH EAST ALONG WESTCLIFF WAY CENTRELINE FROM INTERSECTION AND 8.4m NORTH EAST ALONG BISMARK DRIVE CENTRELINE FROM INTERSECTION.

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TOWNSHIP of NORTH DUMFRIES

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
HALLMAN
CONSTRUCTION LIMITED
675 RIVERBEND DRIVE KITCHENER

PROJECT
WESTWOOD VILLAGE PHASE 2
Cambridge Ontario

DRAWING
AREA GRADING PLAN No. 2

Project Manager G.KORBER	Project No. 02534-800
Design By CJC	Checked By GMK
Drawn By KAT/AXH	Checked By GMK
Surveyed By MTE	Drawing No. AG1.2
Date Dec.09/20	
Scale 1:750	Sheet of

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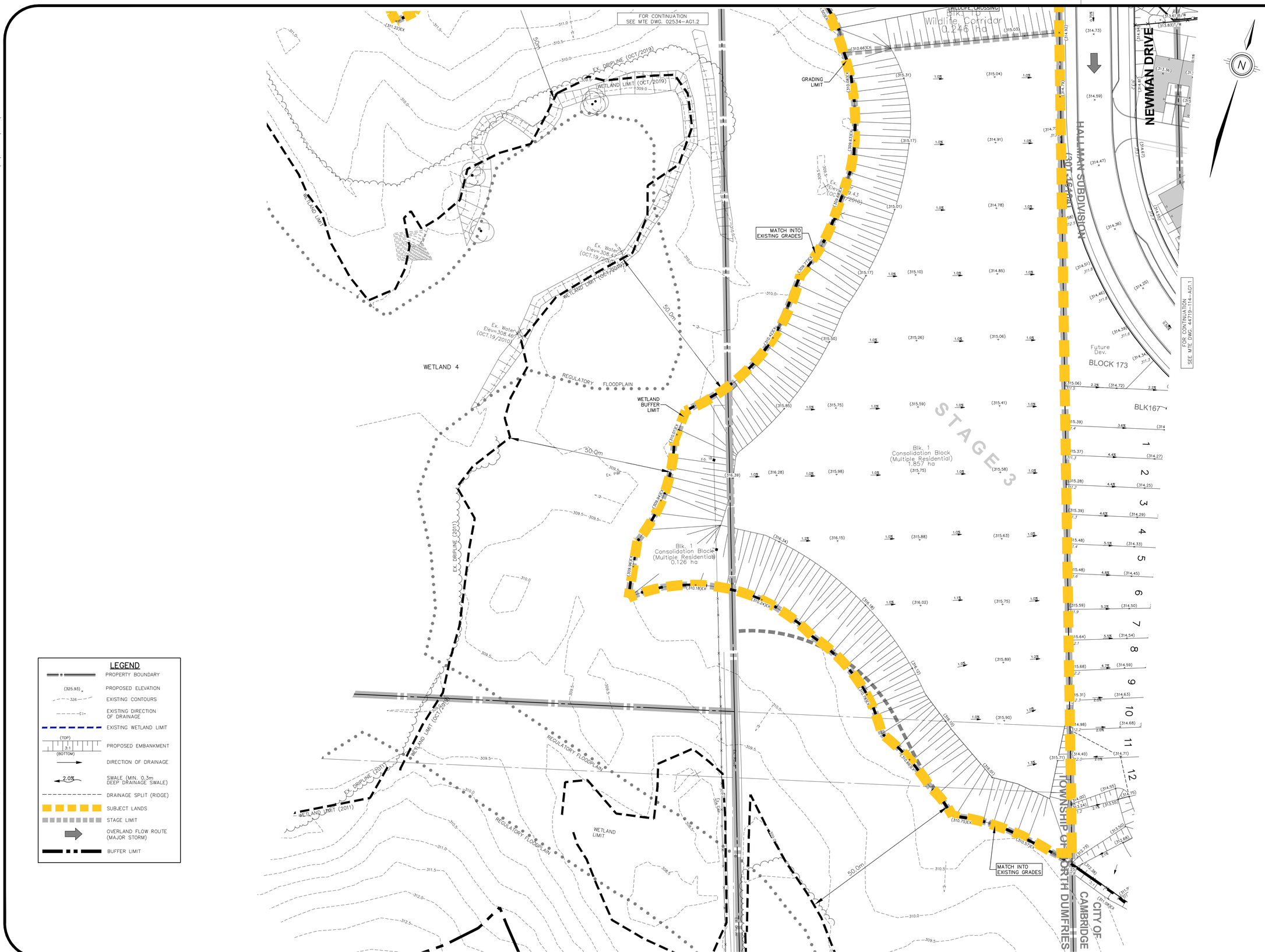

LEGEND

- PROPERTY BOUNDARY
- (325.93) PROPOSED ELEVATION
- 326 EXISTING CONTOURS
- EXISTING DIRECTION OF DRAINAGE
- EXISTING WETLAND LIMIT
- (TOP) 3:1 (BOTTOM) PROPOSED EMBANKMENT
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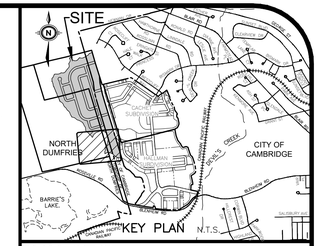
- DRAINAGE SPLIT (RIDGE)
- SUBJECT LANDS
- STAGE LIMIT
- OVERLAND FLOW ROUTE (MAJOR STORM)
- BUFFER LIMIT



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CUT CROSS IN CONCRETE SIDEWALK ON EAST CORNER OF BISMARK DRIVE AND WESTCLIFF WAY INTERSECTION. LOCATED APPROX. 14.7m SOUTH EAST ALONG WESTCLIFF WAY CENTRELINE FROM INTERSECTION AND 8.4m NORTH EAST ALONG BISMARK DRIVE CENTRELINE FROM INTERSECTION.

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TOWNSHIP of NORTH DUMFRIES

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
HALLMAN CONSTRUCTION LIMITED
675 RIVERBEND DRIVE KITCHENER

PROJECT
WESTWOOD VILLAGE PHASE 2
Cambridge Ontario

DRAWING
AREA GRADING PLAN No. 3

Project Manager G.KORBER	Project No. 02534-800
Design By CJC	Checked By GMK
Drawn By KAT/AXH	Checked By GMK
Surveyed By MTE	Drawing No. AG1.3
Date Dec.09/20	
Scale 1:500	Sheet of

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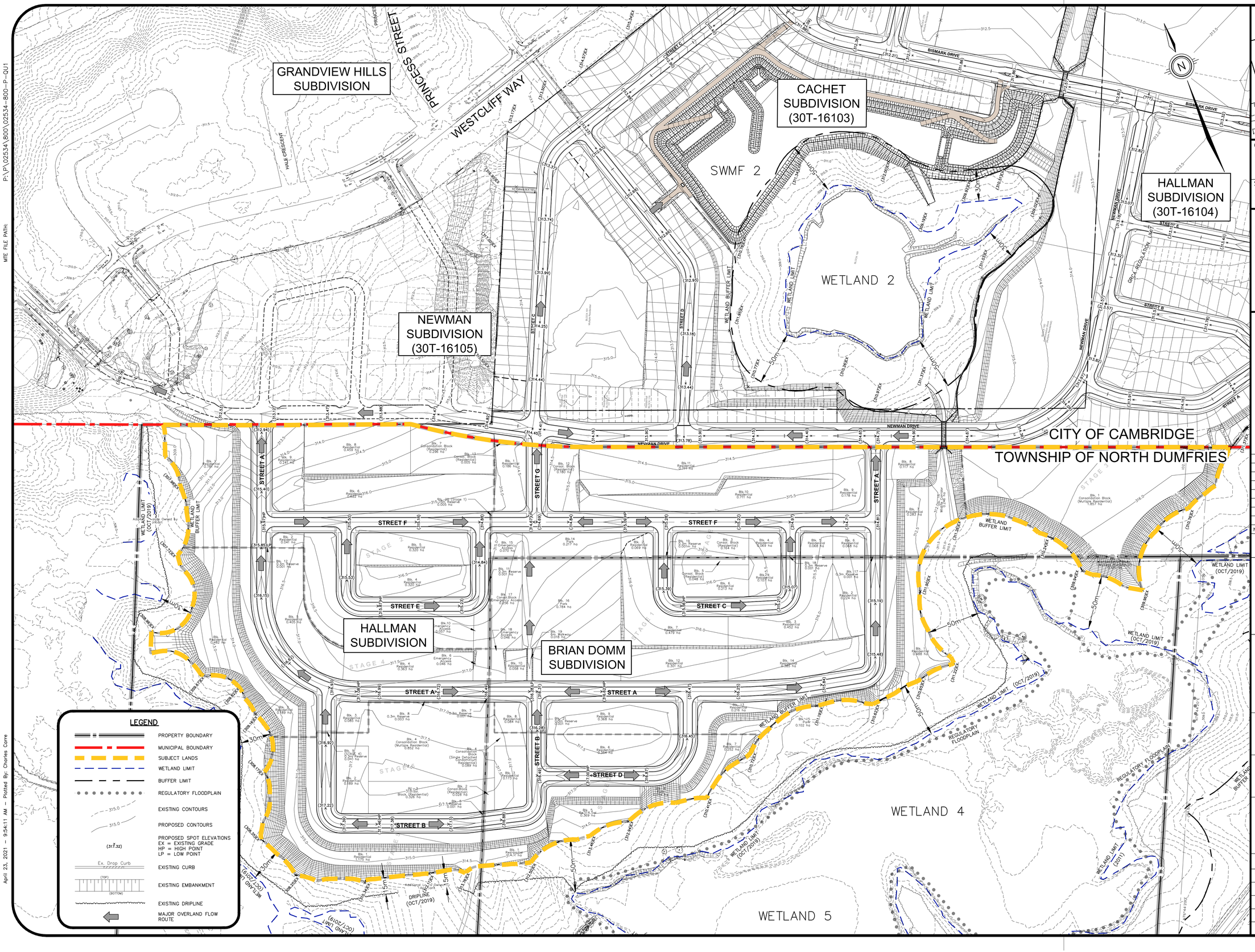

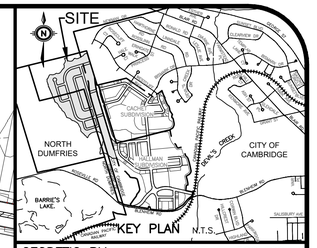

GEODETIC BM ELEV. =300.480m
STATION 00119663308
CONCRETE CYLINDER WITH TOPOGRAPHICAL TABLET ON NORTH SIDE OF GRANT STREET, 10.9m EAST OF INTERSECTION WITH KENMORE AVENUE, IN GRASSED AREA BETWEEN ROADWAY AND SIDEWALK, 1.6m NORTH OF ROADWAY, 1.0m WEST FROM CONCRETE LIGHT STANDARD AND 19.6m FROM CENTRELINE OF DRIVEWAY TO No. 56 GRANT STREET.

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TOWNSHIP of NORTH DUMFRIES

MTE
Engineers, Scientists, Surveyors
519-743-6500

OWNER
HALLMAN CONSTRUCTION LIMITED
675 RIVERBEND DRIVE KITCHENER

PROJECT
WESTWOOD VILLAGE PHASE 2
Cambridge Ontario

DRAWING
FINISHED GRADE CONTOUR PLAN

Project Manager G.KORBER	Project No. 02534-800
Design By	Checked By
Drawn By KAT	Checked By
Surveyed By MTE	Drawing No. QU1.1
Date Dec.16/20	
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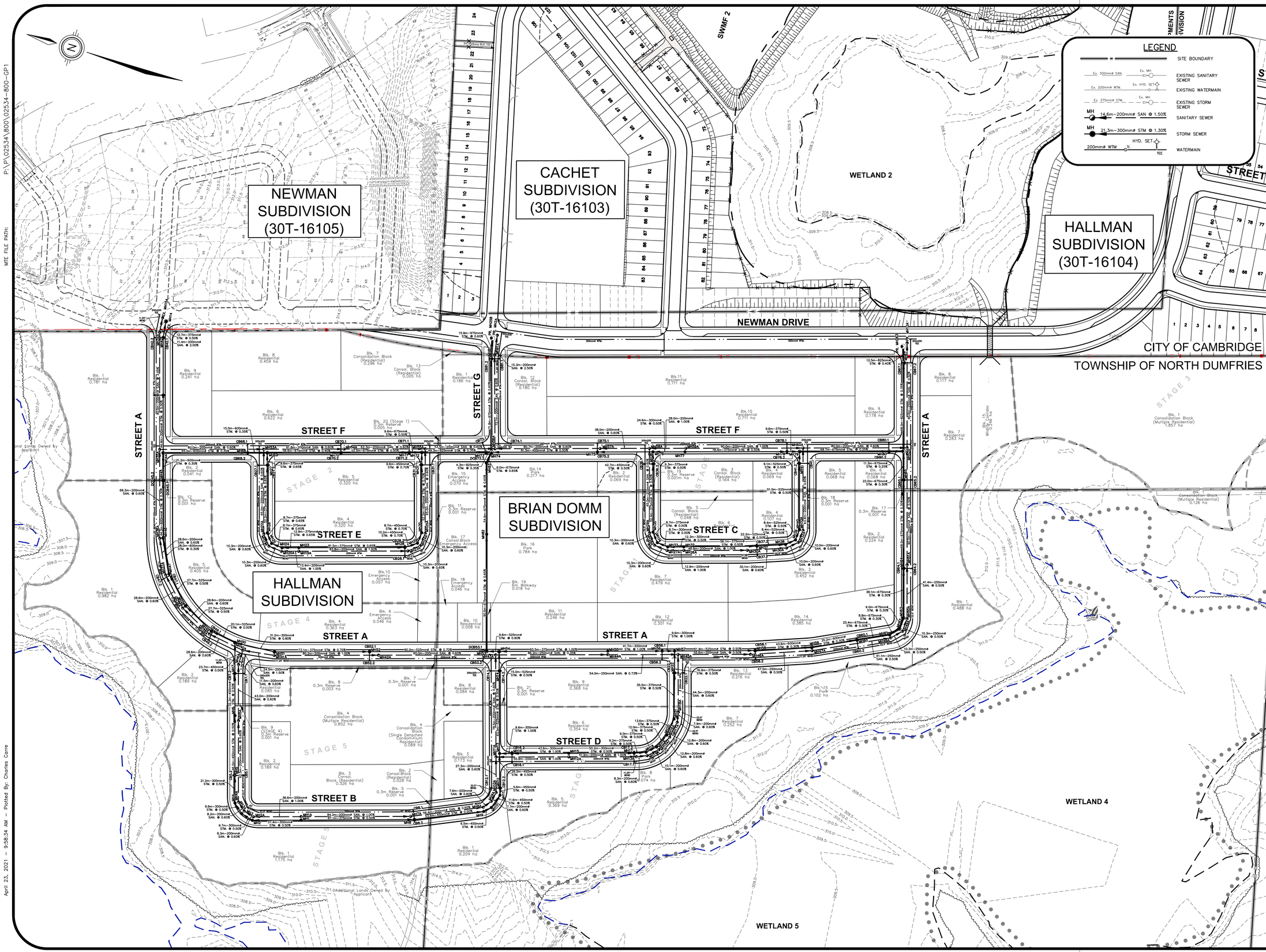

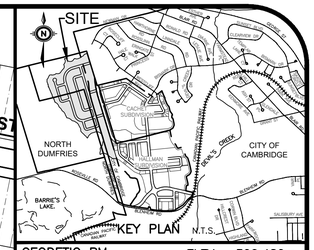

GEODETIC BM ELEV. =300.480m
STATION 00119663308
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TOWNSHIP of NORTH DUMFRIES

MTE
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OWNER
HALLMAN CONSTRUCTION LIMITED
675 RIVERBEND DRIVE KITCHENER

PROJECT
WESTWOOD VILLAGE PHASE 2
Cambridge Ontario

DRAWING
PLAN OF GENERAL SERVICES

Project Manager G.KORBER	Project No. 02534-800
Design By CJC	Checked By GMK
Drawn By AXH	Checked By CJC
Surveyed By MTE	Drawing No. GP1.1
Date Dec.02/20	
Scale 1:1000	Sheet of

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