Northgate and Erbsville Kartway Subdivisions

Beaver Creek Meadows District

Waterloo, Ontario

Functional Servicing Report

Project Location:
East of Erbsville Road
West of Beaver Creek Road
South of Conservation Drive
Waterloo, Ontario

Prepared for:
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July 5, 2017
Revised: July 17, 2020

MTE File No.: 39502-104

Engineers, Scientists, Surveyors.

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MTE Drawing No. 39502-104 AG1.1 ..... Encl.
MTE Drawing No. 39502-104 QU8.1 ..... Encl.
MTE Drawing No. 39502-104 XS1.1 ..... Encl.

1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate) and 1455136 Ontario Inc. (Erbsville Kartway), to prepare a Functional Servicing Report (FSR) in support of Plans of Subdivision, Plan of Condominium (Vacant Land Condominium), and Zoning By-law amendment applications. The Northgate and Erbsville Kartway properties are collectively referred to herein as the 'Subject Lands'.

This FSR was originally submitted in July 2017, to support the Northgate and Erbsville Kartway Subdivision applications. Since that time, comments have been received from review Agencies and this report has been updated to address those comments. This report has also been revised to support the revised Draft Plan of Subdivision, as it has been an iterative process to develop this plan based on input from all disciplines of the project team.

The Subject lands are within the City of Waterloo and are comprised of 2 parcels; lands owned by Northgate and lands owned by Erbsville Kartway. The Northgate lands are approximately 49.29ha and the Erbsville Kartway lands are approximately 6.43ha, for a total area of 55.72ha. The Northgate Lands (49.29ha) consists of 34.08ha located within the proposed subdivision and 15.21ha of open space lands along Beaver Creek, identified as "additional lands" that are outside the boundaries of the subdivision.

The North Waterloo Scoped Subwatershed Study (NWSSS), dated November 2013 was undertaken for the Beaver Creek Meadows District by the City of Waterloo and area landowners. The NWSSS informed the preparation of the District Plan and related policy and provides background and an environmental framework that is to be considered in preparing more detailed reports in support of development applications. The NWSSS was intended to reflect the goals of the overall Laurel Creek Watershed Study (LCWS) and be used to guide the development of these lands.

A Municipal Class Environmental Assessment (EA) was undertaken for upgrades to Beaver Creek Road and Conservation Drive within the North Waterloo lands, by Stantec Consulting, on behalf of the City of Waterloo, and was completed December 14, 2015. The EA was completed in order to review and implement infrastructure upgrades required for the proposed developments within the Beaver Creek Meadows District and other lands in the vicinity.

The Subject Lands are located within the Beaver Creek Meadows District, for which the City of Waterloo has an approved District Plan. The Northgate lands are currently used for interim agricultural purposes and the Erbsville Kartway lands are currently developed with a single detached dwelling and the business Erbsville Kartway being a go-cart track open to the public. The location of the subject lands is illustrated in **Figure 1.1.**

A Draft Plan of Subdivision for the proposed development has been prepared by MHBC Planning Ltd. (July 14, 2020) and forms the basis for this functional servicing report. The Draft Plan of Subdivision include single family residential blocks, multiple residential blocks, a potential mixed use block, stormwater management blocks, sanitary pumping station blocks, park blocks, open space blocks, walkways, emergency access and service corridor blocks, and municipal right-of-ways.

Please refer to **Appendix A** - **MHBC – Draft Plan Consolidation, dated July 14, 2020**.

This report recommends a grading and servicing strategy for the proposed Subject Lands and outlines how the subdivision can be developed on full municipal services, including sanitary sewers, domestic water distribution, storm sewers, drainage and utilities.

This report is prepared in support of the revised Draft Plan dated July 14, 2020. All agency comments received to date for the Draft Plan of Subdivision Submission dated July 4, 2017 have been addressed and this report has been updated accordingly.

1.2 Background Reports

This report should be read in conjunction with the following supporting documents:

- *Beaver Creek Road and Conservation Dr.*
  Upgrades and Extension of Municipal Services
  Class Environmental Assessment – (EA) Stantec (December, 2015)

- *The North Waterloo Scoped Subwatershed Study –Stantec et Al (November, 2013)*

- *Northgate & Erbsville Kartway Subdivisions, Beaver Creek Meadows District Waterloo*
  Environmental Impact Study – NRSI (July 2020)

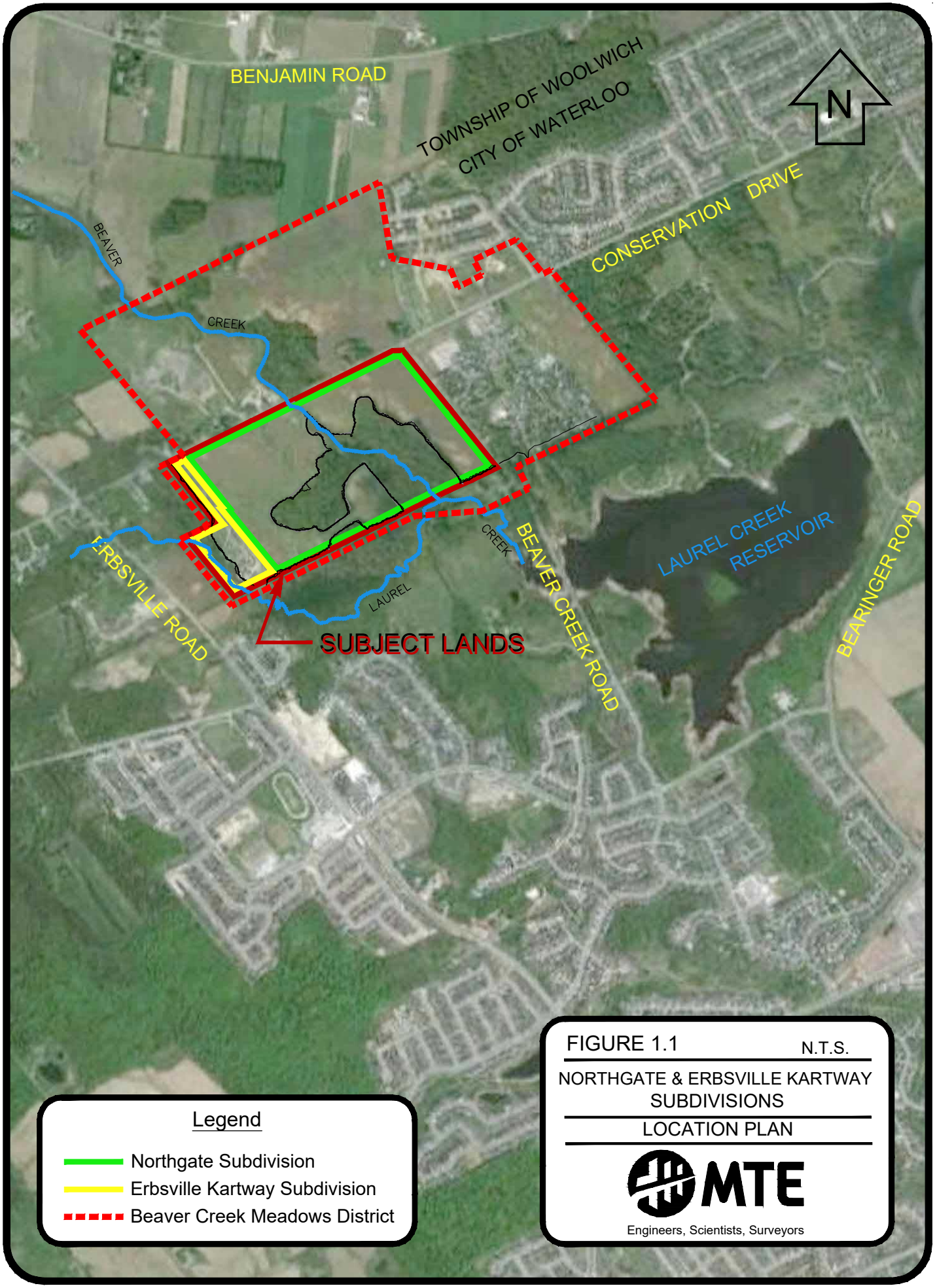
- *Beaver Creek Meadows Communal Stormwater Management*
  Final Stormwater Management Report – MTE (June 2020)

- *Beaver Creek Meadows Communal Stormwater Management*
  Final Study Report – MTE (June 2020)

- *Northgate and Erbsville Kartway Subdivision*
  Beaver Creek Meadows District, Waterloo
  Preliminary Stormwater Management Report – MTE (July 17, 2020)
  (Including technical memo for Alternate SWMF and Chloride Impact Assessment)

- *Northgate and Erbsville Kartway Subdivision*
  Beaver Creek Meadows District, Waterloo
  Preliminary Noise Report – MTE (July 17, 2020), and

- *Northgate and Erbsville Kartway Subdivision*
  Beaver Creek Meadows District, Waterloo
  Hydrogeology Study - MTE (July 17, 2020)



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May 20, 2020 — 3:50 p.m. — Plotted By: RBrezo

2.0 Existing Conditions

2.1 Topographical Information

The Subject Lands consist of 55.72 ha of land, which are used for interim agricultural purposes, open space and the Erbsville Kartway. The open space areas are comprised of some forested areas adjacent to Beaver Creek, being a surface water feature which flows from north to south across the middle of the Northgate Lands.

The soils are generally sandy and well-drained, as the area is located along the eastern flank of the Waterloo Moraine or Waterloo Sand Hills (NWSSS 2013).

MTE conducted a detailed topographical survey of the Subject Lands in 2010. Existing topographic conditions for the subject lands as well as the surrounding lands are shown on **Figure 2.0** and the enclosed **MTE Drawing No. 39502-104 EC1.1**.

The Subject Lands are moderately sloped with slopes generally ranging between 2% and 10%. Existing elevations range between 342.5m near the southern edge of the Northgate lands where Beaver Creek exits the subject property and 360m on a knoll located in the northeast corner of the site just south of Conservation Drive and west of Beaver Creek Road.

2.2 Pre-Development Conditions

The Subject Lands are located within the Laurel Creek Watershed. Topographic conditions within the subject lands direct drainage to Laurel Creek, Beaver Creek (a tributary to Laurel Creek), and to the Laurel Creek Reservoir Tributary (LCRT) which drains directly to the Laurel Creek Reservoir. For the Laurel Creek Watershed Catchment delineation refer to NWSSS Figure 6.1 in **Appendix B**.

As shown on Figure 6.1, Catchment 309 (10.8ha) includes the western portion of the Subject Lands which drains to Laurel Creek to the southwest. Laurel Creek is the primary watercourse within the Laurel Creek watershed. Beaver Creek is a tributary to Laurel Creek and flows from north to south, confluence with Laurel Creek approximately 200m south of the subject lands. Laurel Creek flows to the Laurel Creek Reservoir.

Catchment 391(101.6ha) drains to Beaver Creek and is the central portion of the Beaver Creek Meadows District which includes the central portion of the Subject Lands as well as lands north of Conservation Drive outside of the plans of subdivision which also drain to Beaver Creek. Beaver Creek flows from north to south through the middle of the subject lands with a length of 6.1km and drains an area consisting of interim agricultural land, a church and open space. Beaver Creek joins Laurel Creek immediately to the south of the Subject Lands upstream of the Laurel Creek Reservoir.

Catchment 310 (70.1ha) is the eastern portion of the of the Beaver Creek Meadows District which includes the east portion of the Subject Lands as well as lands east and north outside of the plan of subdivision. These lands drain overland to the LCRT and directly to the Laurel Creek Reservoir. The Laurel Creek Reservoir is an engineered flood control for the City which is managed by the GRCA.

Currently the majority of existing homes and facilities within the North Waterloo lands are serviced via onsite septic systems. There is an existing 375mm sanitary sewer terminus on Beaver Creek Road 720m south of the Beaver Creek Meadows District. There are existing 300mm diameter watermains on Beaver Creek Road and Conservation Drive, which operate in different pressure zones (but with similar hydraulic grade lines) which are required to be extended into the Beaver Creek Meadows District.

The EA proposes two new pump stations and sanitary and water upgrades on Conservation Drive and Beaver Creek Road as necessary infrastructure improvements for the proposed development of the Subject Lands and the balance of the Beaver Creek Meadows District.

2.3 Geotechnical and Hydrogeological Information

In 2010, Stantec carried out a hydrogeological investigation for the NWSSS. The fieldwork for this investigation included the following, on the subject lands; 6 boreholes to depths ranging from 3.66m to 39.68m completed as 50mm monitoring wells (MW08-13), 4 Drive-Points (DP3-5 and 7), 3 Guelph-Permeameter tests (GP2-4) and 7 Test-Pits (TP3-4 and 6-10).

Based on the results of Stantec's detailed hydrogeological investigation (NWSSS - page 178, 2013), the subsurface stratigraphy is generally described as;

> *"surficial deposits of sandy silt, clayey silt to silty clay material for the western portion of the subject lands. These deposits were noted extending from ground surface to depths of 1.8m to 11.5m below ground surface."*

> *"surficial deposits of fine to medium grained sand for the eastern portion of the subject lands. These deposits were noted extending from ground surface to depths of 3.5m to 6.1m below ground surface."*

MTE was retained to complete a Hydrogeology Study for the Subject Lands. Refer to *Hydrogeology Study (July 17, 2020), prepared by MTE Consultants Inc.*

MTE carried out hydrogeological work in 2014 and 2019 to supplement Stantec's hydrogeological investigation. MTE's work involved additional fieldwork comprising of 14 monitoring wells in 2014 and two additional monitoring wells in 2019 distributed over the Subject Lands. Refer to the enclosed **MTE drawing No. 39502-104-EC1.1** for the monitoring well locations.

The field data shows the depth to groundwater level ranging from 0.2m to 6.2m below ground surface. The greatest depth to groundwater occurs near the topographic peak in the northeast corner of the Subject Lands at MW101-14 (MTE). The shallowest depth occurs adjacent to the Provincially Significant Wetland (PSW), east of Beaver Creek, in the south central portion of the Subject Lands at MW10-10 (Stantec). The area in the vicinity of MW10-10 was identified as having groundwater seeps by MTE staff and the project team for the NWSSS.

Refer to **Appendix C** for MTE and NWSSS borehole and test-pit logs.

CONSERVATION DRIVE

BEAVER CREEK ROAD

Beaver Creek Floodline

Laurel Creek Floodline

Laurel Creek

LEGEND

- PROPERTY BOUNDARY
- EXISTING CONTOURS (326)
- EXISTING EMBANKMENT (TOP) / (BOTTOM)
- EXISTING DRIPLINE

FIGURE 2.1

Date: JUL.05/17
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

EXISTING CONDITIONS PLAN

MTE
Engineers | Scientists | Surveyors

Project No.: 39502-104

July 5, 2017 — 8:45 a.m. — Plotted By: mbrown

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3.0 Proposed Development

The Consolidated Draft Plan of Subdivision for this residential development are comprised of the following:

- Single detached residential dwellings;
- Multiple residential/mixed use;
- Stormwater management facilities;
- Sanitary pumping station facilities;
- Park and open space network;
- Walkways, emergency access and service corridor blocks;
- Municipal rights-of-ways with widths of 20.0m and 18.0m; and
- Road widenings.

Please refer to **Appendix A** - **MHBC – Draft Plan Consolidation, dated July 14, 2020**.

4.0 Proposed Grading

4.1 Grading Considerations

The following list of grading constraints which influenced and/or governed the grading design of the Northgate and Erbsville Kartway Subdivisions:

- Match proposed centerline road elevations of Conservation Drive and Beaver Creek Road established in Stantec (EA 2015);
- Ensure compatibility with the proposed realignment and grading of Conservation Drive and Beaver Creek Road (final profile of Beaver Creek Road is currently being negotiated by all parties);
- Match existing and proposed boundary grades around the perimeter of the property while respecting existing natural heritage features (established buffers);
- Minimize grading within recommended buffers associated with natural heritage features;
- Ensure adequate cover is provided over municipal services;
- Ensure major storm event overland flow routes are directed towards the existing road rights-of-way where applicable, or towards the proposed stormwater management facilities;
- Comply with municipal standards for minimum and maximum road grades;
- Ensure adequate separation between composite high groundwater and proposed underside of house footings;
- Optimize earthworks to minimize the importation of material;
- Respect the Regional and 100year flood limits;
- Enhance groundwater inputs (recharge), and
- Maintain surface water balance to wetland features.

4.2 Roadworks and Lot Grading

As shown on the Consolidated Draft Plan, the proposed development is serviced by the external collector roads and internal local roads.

The Active Transportation Master Plan (MHBC) and the Traffic Study (Paradigm) recommends proposed traffic calming measures at several locations, as shown in **Appendix F** and as described below:

- Location A - A pedestrian refuge island on Street Seven near Conservation Drive
- Location B - A raised median island with pedestrian crossing, lane-narrowing and speed cushions on Street Three adjacent to Block 3 Walkway.
- Location C - A raised median island with pedestrian crossing, lane-narrowing and speed cushions on Street One south of Conservation Drive,
- Location D - A roundabout with pedestrian crossings at the intersection of Street One and Street Two, and
- Location E - A raised median island with pedestrian crossing, lane-narrowing and speed cushions on Street Two next to Walkway Block 9,

Following draft plan approval detailed design of traffic control measures will be completed and reviewed for final approval and prior to construction. In addition to the traffic calming measures, the turning radius analysis have been included in the in **Appendix F**.

Future Grand River Transit (GRT) routing is planned along Conservation Drive. Concrete landing pads will be provided at locations selected at detailed design stage in coordination with the Region. Street Three, a portion of Street Four and Street Seven are designated as potential bus routes in the District Plan. These streets will be designed with geometrics and pavement structure to accommodate GRT buses. Bus stops will be located in consultation with GRT at the detailed design stage.

Proposed roadways will be constructed to full urban cross sections including asphalt pavement, concrete curb and gutters, concrete sidewalks, roadway illumination and boulevard landscaping all in accordance with the City of Waterloo Engineering and Development Standards.

Right-of-way widths for the development and adjacent roads are shown in **Table 4.1**.

Table 4.1 – Proposed Road Classifications

Road	Classification	Right-Of-Way Width
Conservation Drive	Major Collector	26.0m (ultimate)
Beaver Creek Road	Minor Collector	20.0m
Streets One, Two (w/MUT), Three, Four, Seven and Eight	Local	20.0m
Streets Two (no MUT), Five and Six	Local	18.0m

The centerline road grades are designed ranging from 0.5% (design minimum) to 5.0% (design maximum). The preliminary overall lot grading was developed utilizing the proposed road layout, preliminary centerline road grades and individual lot design to address the constraints and considerations listed in Section 4.1 above.

Preliminary individual lot grading was developed to minimize grading within buffers and to respect the trail network and connections proposed for this development. Lot grades range from 2.0% (design minimum) to 6.0% (design maximum) with a combination of traditional back to front drainage, split drainage, and walk-out type lots. Preliminary finished grades are designed to optimize earthworks and minimize the importation of material necessary for construction. The preliminary overall proposed grading design is illustrated by preliminary finished grade contours as shown on the **Figure 4.1** and enclosed **MTE Drawing No. 39502-104 AG1.1**.

The composite high groundwater condition was modeled based on the recommendations of the Hydrogeological Study (July 6, 2020) prepared by MTE. The preliminary lot grading, house grades and underside of footing elevations were designed to maintain the minimum vertical separation of 0.6m above proposed composite high groundwater elevations. The groundwater separation is illustrated on enclosed **MTE Drawing No. 39502-104 QU8.1**.

Generally, the majority of services will be situated above the existing groundwater level with the exception being the sanitary sewer from Stage 8 to the proposed Conservation Drive sanitary pumping station. Isolation collars will be implemented for the installation of the deep sanitary sewer below the average groundwater level.

A geotechnical investigation for the proposed development will be completed prior to final design. The preliminary proposed pavement structure is summarized in **Table 4.2** which represents the City of Waterloo minimum standard. The final pavement structure design will be determined based on geotechnical study completed at final design and prior to any construction.

Table 4.2 – Preliminary Proposed Pavement Structures

Pavement Structure	Local Roads (mm)	Collector Roads (mm)	Bus Routes (mm)
Asphaltic Concrete-Surface	40	40	40
Asphaltic Concrete-Binder	50	50	100
Granular ‘A’ Base	150	150	150
Granular ‘B’ Sub-Base	300	500	500

4.3 Wetland & Woodland Buffers

As part of the NWSSS report, a comprehensive analysis was undertaken to determine recommended wetland buffers, development setbacks and limits of grading. These buffers and setbacks identified the development limits and are identified as follows:

- 30m from a Provincially Significant Wetland (PSW) with a minor adjustment in the vicinity of Block 13, Stage 4 of the Northgate Subdivision;
- 30m from Beaver Creek and Laurel Creek;
- 15m from a Non-Provincially Significant Wetland;
- 10m from Upland Woodlands, and
- 5m from Hedgerows

NRSI has completed an Environmental Impact Study for the development. Extensive grading within the buffers and development setbacks is generally not permitted. Certain fixed factors such as composite high groundwater, trail locations and other engineering design considerations (road profile/elevation and existing steep slopes) have influenced the overall grading resulting in some minor grading with the buffers in two areas:

- Along the westerly rear lot line of blocks fronting Street Two south of Street One of the Northgate Subdivision (transitional slopes intruding approximately 5m into the outer portion of the 10m dripline buffer).
- Along the rear lot line of blocks 12, 13,14 and 23 fronting Street Three and Street Six of the Northgate Subdivision (transitional slopes intruding approximately 5m into the outer portion of the 30m wetland buffer)

CONSERVATION DRIVE

(351.58) (354.19) (348.15) (356.60) (357.02)

(353.12) (H.P.)
(353.00)

STREET FOUR
(352.33)
(351.87)

(352.07) (H.P.)

STREET FIVE
(351.50)

(352.60)

(351.80) (351.50) STREET THREE (350.65)

(349.29) (L.P.)

STREET SIX

STREET EIGHT

STREET SEVEN

SWMF FACILITY 5914

SWMF 5915

STREET ONE
(354.46)

(353.42)

(352.23) (L.P.)
(352.33)

STREET TWO
(352.49)

BEAVER CREEK ROAD

(349.07)
(349.36)

(350.70) (L.P.)

SWMF 5917
(350.83) (L.P.)

(351.20) (L.P.)
(351.83) (H.P.)

(353.43) (H.P.)

(352.63) (L.P.)

(353.03) (H.P.)

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
Stage 7
Stage 8

Beaver Creek
Floodline
Floodline
Laurel Creek
Floodline
Laurel Creek

N

LEGEND

	SUBJECT LANDS
	10m DRIPLINE BUFFER
	30m WETLAND BUFFER
	DRAINAGE SPLIT
(350.69)	CL ROAD GRADE
(H.P.)	HIGH POINT
(L.P.)	LOW POINT
	OVERLAND FLOW ROUTE (MAJOR STORM)

FIGURE 4.1

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

PRELIMINARY ROAD GRADING PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 1:00 p.m. — Plotted By: AHenderson

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4.4 Community and Multi-Use Trails

An Active Transportation Master Plan has been prepared by MHBC and identifies the community trails, trail accesses and multi-use trails as follows:

- Off-road trail along the west buffer of Laurel Creek from Conservation Drive to the future pedestrian and cyclist bridge at the southwest corner of the Subject Lands;
- On-street multi-use trail on Street Three from Conservation Drive to the Beaver Creek Multi Use Trail via the Walkway Block 22 of Stage 4;
- Access to the Laurel Creek Trail Future Park in Block 1 of Stage 5;
- On-street multi-use trail across the Condominium lands of Stage 5;
- Off-road trail in the east and west buffer of Beaver Creek from the Walkway Block 22 of Stage 4 to the south edge of the Subject Lands, this section will include a pedestrian and cyclist bridge between SWMF 5914 and 5915;
- On-street multi-use trail on Street One from Conservation Drive to Beaver Creek Road;
- Access to the Beaver Creek Trail via the walkway Block 8 of Stage 1; and
- On-street multi-use trail on Street Two from Beaver Creek Drive to the Beaver Creek Trail via the walkway Block 9 of Stage 1.

Community trails are proposed within the buffers associated with Beaver Creek and related natural heritage features. Proposed trails will be located outside of the natural features and their buffers or will be located within the outer 5m of the buffer where appropriate. The final grading design associated with these trails will be coordinated with City of Waterloo Parks Department. The preliminary trail network and connections are shown on the enclosed **MTE Drawing No. 39502-104 AG1.1**.

4.5 Linkages / Wildlife Passages

Ecological linkages are intended to maintain or enhance connectivity within and between large natural areas, and to restore or create new linkages between natural areas where existing connectivity is degraded. The NWSS identified a series of existing ecological linkages within the North Waterloo lands. The main linkage within the study area is along Beaver Creek Road between ESPA 80 (refer to **Appendix B** NWSSS Figure 5.3: Surface Water Features and Environmentally Sensitive Areas) and the lands to the north**.**

To ensure the ecological linkages, two box culverts and exclusion walls are proposed on the private road within Stage 8 to accommodate wildlife crossing between the wetlands, as described in the following section.

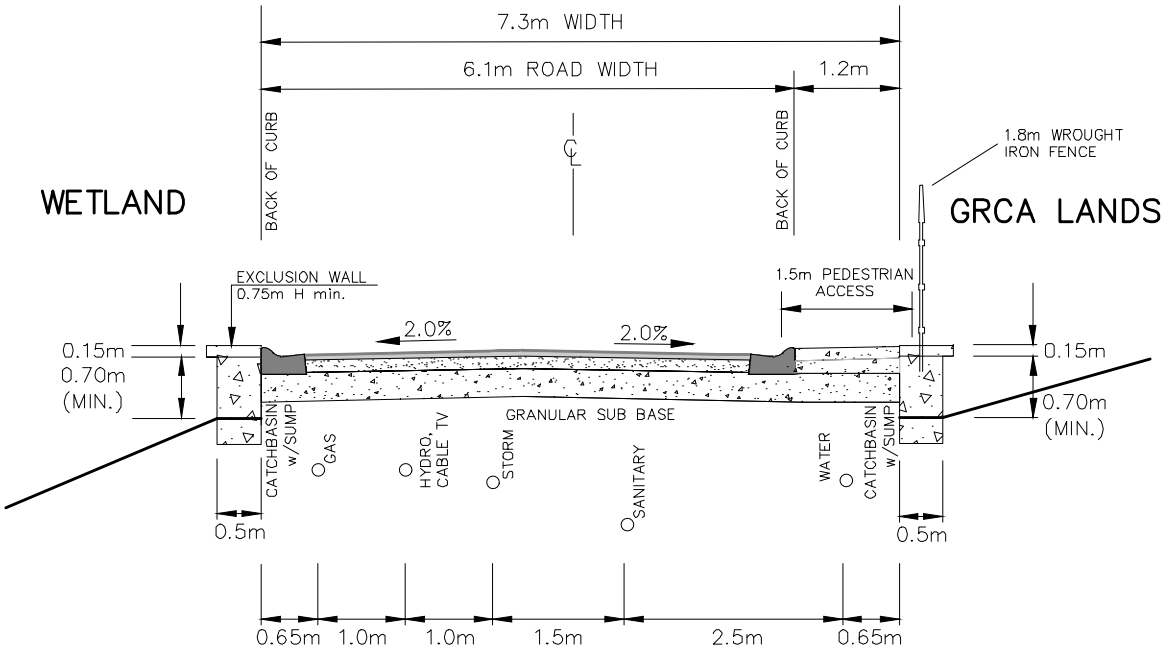
4.6 Private Road Within Stage 8

Stage 8 is comprised of a southern agricultural area and farming access. The proposed cross section for the private road is shown on **Figure 4.2**. The private road follows the alignment of the existing farm access to the southern agricultural area. The private road is designed to:

- Ensure acceptable impacts on natural features;
- Accommodate emergency vehicle access;
- Provide wildlife movement between the wetlands;
- Ensure a drainage connection between the wetlands;
- Guide wildlife movement away from the private road and direct movement to the proposed eco-passages through the use of exclusion walls;
- Match-existing grades as close as possible to minimize grading within buffer areas; and
- Provide enhanced buffers along the private road.

All the elements of this design, proposed exclusion walls and concrete box culverts are included on the attached drawing **Private Road Cross Sections MTE Drawing No. 39502-104 XS1.1**

39502-104-EXCLUSION WALL.DWG



7.3m PRIVATE ROAD CROSS-SECTION

Figure 4.2 **Scale: N.T.S.**

NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS

PRIVATE ROAD PROPOSED CROSS-SECTION

MTE

Engineers, Scientists, Surveyors

February 14, 2020 — 7:12 a.m. — Plotted By: ktaylor

5.0 Municipal Servicing

5.1 Sanitary Servicing

Sanitary sewage from the proposed development, and surrounding areas, has been planned and designed to ultimately outlet to the existing 375mm diameter sanitary trunk on Beaver Creek Road, 720m south of the southeast corner of the Subject Lands.

As discussed in the EA for upgrading Conservation Drive and Beaver Creek Road, two sanitary pumping stations (SPS) are required to service the Beaver Creek Meadows District and other lands in the vicinity. Refer to Stantec Figure 4-4 in **Appendix B** and Table 4-5 for drainage areas totaling 165.6ha, generating a flow of 176.1L/s. The development lands for Subject Lands are illustrated as Areas 7-10 totaling 31.3ha.

Preferred Alterative 2 locates the proposed Conservation Drive SPS on the Subject Lands just south and west of Conservation Drive and Beaver Creek Road intersection, and the proposed Beaver Creek SPS in the southeast corner of the Subject Lands as shown on Stantec Figure 4-6 in **Appendix B**. The SPS blocks (Conservation Drive and the Beaver Creek Road) are shown on the enclosed Draft Plan as Block 25, Stage 4 and Block 12 Stage 1, respectively. The Conservation Drive SPS (Block 25, Stage 4) is proposed to have a capacity of 100L/s with twin 200mm Ø forcemains ultimately outletting to the Beaver Creek SPS (Block 12, Stage 1). The Beaver Creek SPS is proposed to have a capacity of 180 L/s with twin 250mm Ø forcemains outletting to the gravity sewer on Beaver Creek Road which conveys the sanitary outfalls ultimately to the Waterloo Wastewater Treatment Plant.

The subdivision lands on the west side of Beaver Creek will flow by gravity to the proposed Conservation Drive SPS. The Conservation Drive SPS forcemains will pump sewage under Beaver Creek and east along Conservation Drive to a proposed gravity sewer just west of the Conservation Drive and Beaver Creek Road intersection. The gravity sewer down Beaver Creek Road receives drainage from other external lands conveying effluent to the Beaver Creek SPS via the Beaver Creek Road sanitary sewer.

The subdivision lands located between Beaver Creek and Beaver Creek Road will flow by gravity internally to the proposed Beaver Creek SPS. The entire 165.6ha sanitary drainage area will then be pumped to the existing 375mm diameter gravity sanitary trunk sewer terminus which is 720m south of the Beaver Creek Meadows District on Beaver Creek Road.

The proposed Draft Plan Consolidation for the Northgate and Erbsville Kartway Subdivision (July 14, 2020) proposes a range of 658 to 1016 units, comprised of single detached residential (150 to 226 units), multiple-residential/mixed use (410-683 units), and Vacant Land Condominium (75) units.

The conceptual sanitary servicing design is presented on **Figure 5.1.** The figure illustrates a schematic of the sanitary sewer including proposed finished road grades and depth of sewers at key points in the sewer network. The depth of the sewer ranges from approximately 3.0m to 9.0m deep, with the deepest point located on Street Six just before the connection to the Conservation Drive SPS. Areas where the proposed sanitary sewer is deeper than 5m a dual sewer system (local and deep) have been illustrated. Preliminary Sanitary Sewer Design Sheet has been prepared with pipe diameters and slopes for the preliminary proposed conditions. Refer to **Appendix D** for sanitary design calculations.

The sanitary connection to the Conservation Drive SPS can be routed through the access road associated with the multiple block (Block 21, Stage4), which would be subject to an easement or through the park. These two options are presented in the **Appendix D**.

CONSERVATION DRIVE

(351.58) (354.19) (348.15) (356.60) (357.02)

STREET SEVEN

STREET FOUR

STREET THREE

STREET FIVE

STREET EIGHT

STREET SIX

STREET ONE

STREET TWO

BEAVER CREEK ROAD

100YR PIPE

SPS

DUAL SEWER

Beaver Creek

Floodline

Laurel Creek

Floodline

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 8

F/G=351.38
SAN OBV.=348.58±
DEPTH=2.80m±

F/G=348.50
SAN OBV.=341.20±
DEPTH=7.30m±

F/G=350.53
SAN OBV.=341.48±
DEPTH=9.05m±

F/G=353.00
SAN OBV.=350.30±
DEPTH=2.70m±

F/G=355.60
SAN OBV.=348.77±
DEPTH=6.83m±
SAN OBV.=352.80±
DEPTH=2.80m±

F/G=351.53
SAN OBV.=348.10±
DEPTH=3.40m±

F/G=352.23
SAN OBV.=349.16±
DEPTH=3.05m±

F/G=351.80
SAN OBV.=347.00±
DEPTH=4.73m±

F/G=353.42
SAN OBV.=347.34±
DEPTH=6.08m±
SAN OBV.=350.62±
DEPTH=2.80m±

F/G=351.50
SAN OBV.=343.40±
DEPTH=8.10m±
SAN OBV.=348.13±
DEPTH=3.37m±

F/G=350.76
SAN OBV.=347.90±
DEPTH=2.86m±

F/G=352.55
SAN OBV.=346.13±
DEPTH=6.42m±
SAN OBV.=349.75±
DEPTH=2.80m±

F/G=353.37
SAN OBV.=345.70±
DEPTH=7.67m±
SAN OBV.=350.57±
DEPTH=2.80m±

F/G=349.74
SAN OBV.=345.50±
DEPTH=4.24m±

F/G=349.50
SAN OBV.=343.00±
DEPTH=6.50m±

F/G=353.05
SAN OBV.=350.25±
DEPTH=2.80m±

F/G=352.75
SAN OBV.=345.70±
DEPTH=7.95m±
SAN OBV.=350.57±
DEPTH=2.80m±

6	1.19	88	
4	1.17	29	
5	7.04	149	
7	5.91	507	
8	4.08	153	
3	2.01	26	
2	6.97	35	
1	4.16	14	

LEGEND

- SUBJECT LANDS
- 10m DRIPLINE BUFFER
- 30m WETLAND BUFFER
- SANITARY DRAINAGE AREA
- GRAVITY SEWER
- 1 / 4.16 / 14 — SANITARY DRAINAGE AREA No. / AREA (ha) / UNITS
- EXTERNAL FORCEMAIN
- F/G=346.00 SAN OBV.=343.80± DEPTH=2.20m± — C/L ROAD GRADE / LOCAL SANITARY OBVERT / SANITARY COVER
- MANHOLE
- FLOW ROUTE
- PROPOSED SANITARY PUMPING STATION

FIGURE 5.1

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

SANITARY SERVICING PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 1:07 p.m. — Plotted By: AHenderson

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5.2 Water Distribution

The proposed development is located within City of Waterloo's Pressure Zone 5 distribution system. The hydraulic grade line (HGL) of Zone 5 is approximately 404.4masl.

As discussed in the EA for Conservation Drive and Beaver Creek Road, upgrades are planned for the water distribution system to strengthen the supply and provide looping in the north-west area of Waterloo.

To provide Zone 5 watermain looping a 300mm watermain extension from the existing 300m diameter watermain on Erbsville Road at Regal Place would extend north on Erbsville Road and then east along Conservation Drive to Beaver Creek Road and then south on Beaver Creek Road with a new connection to the existing 300mm diameter watermain near the intersection of Beaver Creek Road and Laurelwood Drive. In addition, the existing 300mm diameter watermain on Conservation Drive at Roy Schmidt Road (Zone 4C) is to be connected to the new Zone 5 loop at the Conservation Drive/Beaver Creek Road intersection. Both these zones have the same hydraulic grade line and it is planned that these two pressure zones will be interconnected and operated as one consolidated zone.

Water supply for the proposed development will be provided by five connection points to the planned Zone 5 watermain loop improvements of the municipal water distribution system:

- Direct connection to a new 300mm diameter watermain extension along Conservation Drive (currently the 300mm diameter watermain terminates 60m east of Beaver Creek Road) at the following three locations:
    - the proposed intersection of Street One and Conservation Drive;
    - the proposed intersection of Street Three and Conservation Drive; and
    - the proposed intersection of Street Seven and Conservation Drive.
- Direct connection to a new 300mm diameter watermain extension along Beaver Creek Road (currently the 300mm diameter watermain terminates 650m north of Laurelwood Drive) at the following location:
    - the proposed intersection of Street One and Beaver Creek Road.
    - the proposed intersection of Street Two and Beaver Creek Road.

A water distribution analysis was completed for the proposed development to confirm that adequate pressure and flow demands can satisfactorily be met. Refer to **Figure 5.2** for the proposed watermain layout and **Appendix E** for the *Preliminary Water Distribution Analysis (July 2020)*, prepared by MTE Consultants Inc.

Based on the preliminary analysis the following conclusions can be made:

- The new 300mm diameter watermain system extension and looping on Conservation Drive and Beaver Creek Road will adequately service the proposed development.
- The proposed water distribution network will provide system pressures within the respective pressure guidelines.
- Under the proposed development conditions, the recommended *Fire Underwriters Survey (FUS)* fire flows are satisfied at the minimum Ministry of the Environment, Conservation, and Parks (MECP – previously known as MOE or MOECC) pressure requirement of 140 kPa.
- Pressure reducing valves are not required as maximum system pressures are all below the MECP guideline of 550 kPa.

CONSERVATION DRIVE

PROPOSED 300mmØ WTM EXTENSION

PROPOSED 300mmØ WTM EXTENSION

EX. 300mmØ WTM

200mmØ WTM

200mmØ WTM

STREET SEVEN

Stage 4

200mmØ WTM

STREET FOUR

Stage 1

STREET THREE

150mmØ WTM

STREET FIVE

Stage 4

STREET THREE

200mmØ WTM

200mmØ WTM

STREET EIGHT

STREET SIX

150mmØ WTM

Stage 5

Stage 3

Stage 3

STREET ONE

300mmØ WTM

Stage 2

PROPOSED 300mmØ WTM EXTENSION

BEAVER CREEK ROAD

WATERLOO PRESSURE ZONE 5

Beaver Creek

STREET TWO

200mmØ WTM

Stage 1

Stage 2

150mmØ WTM

150mmØ WTM

200mmØ WTM

PRIVATE VACANT LAND CONDOMINIUM

VLC "A"

VLC "B"

200mmØ WTM

Private Road

Stage 8

Stage 8

Stage 8

Laurel Creek

Laurel Creek

LEGEND

	SUBJECT LANDS
150mmØ WTM	PROPOSED 150mmø WTM
200mmØ WTM	PROPOSED 200mmø WTM
300mmØ WTM	PROPOSED 300mmø WTM
300mmØ WTM	PROPOSED 300mmø WTM EXTENSIONS BY OTHERS
150mmØ WTM	VLC "A" PRIVATE WATER SUPPLY
200mmØ WTM	VLC "B" PRIVATE WATER SUPPLY
300mmØ WTM	EXISTING 300mmø WTM

VLC = VACANT LAND CONDOMINIUM

FIGURE 5.2

Date: MAY.20/20
Scale: 1:1500

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

WATER DISTRIBUTION PLAN

MTE

Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 1:09 p.m. — Plotted By: AHenderson

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5.3 Storm Drainage

Storm drainage for the proposed development will be provided through a combination of minor (piped) and major (overland) drainage systems within municipal road rights-of-ways, multiple blocks and vacant land condominium road allowances. The proposed development area will drain via conventional storm sewers to proposed downstream SWM Facilities as shown on **Figure 5.3.**

Four distinct stormwater management facilities are proposed to handle storm drainage from the subject lands:

On the west Side of Beaver Creek:

- The largest facility (SWMF 5914) will occupy Block 26, Stage 4 southwest of Conservation Drive and Beaver Creek, handling most of the proposed development west of Beaver Creek (12.43ha). This area includes Stages 4 to 7 of the Northgate Subdivision Plan 30T-17401 and Stages 1 and 2 of the Kartway Plan 30T-17402. The facility will consist of a wetpond with forebay and discharge to a cooling trench.
- The front yards of the 14 lots and the private road loop in the Stage 8 Condo Block (1.07ha) will drain to a private facility (SWMF 5917). This facility will include oil-grit separator, a dry pond and communal infiltration gallery. The design will be finalized as a condition of condominium registration.
- The private road in Stage 8 (0.20ha) utilizes an OGS for water quality treatment and drains directly to the wetland.

On the east side of Beaver Creek,

- A small portion of Block 2, Stage 3 of the Northgate (0.89ha) will drain to a private facility (SWMF 5915). The facility will include oil-grit separator, a dry pond and an infiltration gallery. The design will be finalized through the site plan approval process and serviced as a condition of site plan approval.
- The balance of the Subject Lands, east of Beaver Creek (8.66ha), will drain to an off-site Communal SWM Facility (SWMF 5106), located on the east side of Beaver Creek Road. This facility will be a shared with lands currently proposed for development north of Conservation Drive, within Beaver Creek Meadows District Plan. This facility is in the final design stage. A series of Technical Memorandums were prepared by MTE and a preferred alternative has been selected which will include two wetpond cells with two forebays and cooling trenches (Alternative 4A in the Beaver Creek Meadows Communal Stormwater Management Study, by MTE, dated June 5, 2020). In the event the design or construction of the Communal SWMF is delayed a temporary/alternate SWMF can be designed and built to GRCA and MOEC guidelines. A Technical Memorandum included in the Preliminary SWM Report presents the preliminary design recommendations and criteria for a temporary/alternate facility.

The storm sewer system will be designed for the City of Waterloo 1:5 year storm event with overland flow routes generally following the proposed road allowances.

Major overland flow from the three on-site facilities noted above will be directed to Beaver Creek. Major overland flow from the off-site communal SWM facility will be to the LCRT via Beaver Creek Road storm sewer system.

CONSERVATION DRIVE

(351.58) (354.19) (348.15) (356.60) (357.02)

STREET SEVEN

STREET FOUR

STREET THREE

STREET FIVE

STREET EIGHT

STREET SIX

STREET ONE

STREET TWO

F/G=351.92
STM OBV.=350.42±
DEPTH=1.50m±

F/G=351.87
STM OBV.=349.07±
DEPTH=2.80m±

F/G=356.51
STM OBV.=355.00±
DEPTH=1.51m±

F/G=353.00
STM OBV.=350.22±
DEPTH=2.78m±

F/G=351.50
STM OBV.=348.86±
DEPTH=2.64m±

3915
0.89

SWMF
5915

3914
12.43

SWMF
FACILITY
5914

3102
8.66

F/G=353.28
STM OBV.=350.41±
DEPTH=3.00m±

F/G=352.23
STM OBV.=351.03±
DEPTH=1.20m±

F/G=351.80
STM OBV.=349.45±
DEPTH=2.35m±

100YR PIPE

BEAVER CREEK ROAD

F/G=349.29
STM OBV.=348.03±
DEPTH=1.20m±

F/G=351.50
STM OBV.=349.09±
DEPTH=2.40m±

3917
1.27

F/G=353.40
STM OBV.=351.82±
DEPTH=1.58m±

SWMF
5917

F/G=352.70
STM OBV.=349.21±
DEPTH=3.50m±

F/G=349.07
STM OBV.=347.51±
DEPTH=1.56m±

(349.36)

F/G=350.80
STM OBV.=348.61±
DEPTH=2.19m±

F/G=353.03
STM OBV.=351.53±
DEPTH=1.50m±

F/G=352.63
STM OBV.=350.81±
DEPTH=1.82m±

Beaver Creek

Floodline

Laurel Creek

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 8

LEGEND

- SUBJECT LANDS
- STORM DRAINAGE AREA
- 10m DRIPLINE BUFFER
- 30m WETLAND BUFFER
- MAJOR OVERLAND FLOW ROUTE

F/G=355.00
STM OBV.=353.20±
DEPTH=1.80m±
C/L ROAD GRADE
LOCAL STORM OBVERT
STORM COVER

- STORM MANHOLE

391x
1.000
- AREAS DRAINING TO SWM OR LID FACILITIES

FIGURE 5.3

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

STORM SERVICING PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 1:12 p.m. — Plotted By: AHenderson

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5.4 Stormwater Management

The proposed stormwater management infrastructure on the Subject Lands will include infiltration galleries on both the single and multi-residential blocks for clean roof run-off. Clean water infiltration volumes are further enhanced through the implementation of “amended top-soil” on many of the single-family lots.

Stormwater runoff for Block 2, Stage 3 (multiple-residential site plan development) and Block 2, Stage 8 (vacant land condominium) is treated to an enhanced level for water quality prior to being directed to End Of Pipe (EOP) infiltration facilities.

The proposed SWM facilities within the development are generally in the same location as shown in the NWSSS. The overall stormwater management scheme and analysis for the Subject Lands are presented in the Northgate and Erbsville Kartway Subdivisions Preliminary Stormwater Management Report MTE Consultants Inc. (July 17, 2020).

The following provides a general summary:

- The stormwater management strategy for the Subject Lands will provide the appropriate levels of quality, quantity, and water balance controls in keeping with the intent of the NWSSS, 2013.
- An Enhanced Level of water quality control will be provided in:
    - SWM Facility 5914 west of Beaver Creek utilizing a facility designed with a forebay and wetpond cell;
    - SWM Facility 5106 or Alternate SWMF utilizing a facility design with a forebay and wetpond cell;
    - SWM Facility 5915 utilizing an OGS and EOP infiltration gallery; and
    - SWM Facility 5917 utilizing an OGS and EOP infiltration gallery.
- For catchment 309 and 391; water quantity and erosion control will be provided utilizing extended detention to control all runoff from the Subject Lands, to the required unit flow rates published in the NWSSS.
- For catchment 310; water quantity and erosion control will be provided by directing peak flows to the by-pass channel mitigating impacts to the LCRT.
- Temperature mitigation, through enhanced groundwater recharge and baseflow enhancement, will be achieved through the implementation of infiltration, as outlined above. The implementation of a “cooling-trench” at the outlet of SWM Facility 5914 and 5106 provides temperature mitigation for these facilities. SWM Facilities 5915 and 5917 provide temperature mitigation through EOP infiltration galleries which infiltrate all runoff from the 25mm storm event.

6.0 Utility Servicing

The proposed development will connect to existing services to be extended along Conservation Drive and Beaver Creek Road. Waterloo North Hydro (electrical), Bell Canada (telephone), Union Gas (natural gas), and Rogers Cable (cable TV) are all expected to extend their services to the proposed development prior to building permit stage. 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. Overall site grading will provide for 'major' overland flow conveyance to the downstream SWM Facilities, provide adequate cover over municipal services and generally match proposed road and existing boundary grades with appropriate slopes. Minor grading will occur within the outer portion of the buffer for trails and two narrow 3:1 transition slopes as shown on **MTE Drawing No. 39502-104-AG1.1** enclosed.
2. Separation from the composite high groundwater and the basement finish floors has been provided throughout the development as shown on **MTE Drawing No. 39502-104-QU8.1** enclosed.
3. The proposed development can be adequately serviced with the planned construction of the Conservation Drive and Beaver Creek Road sanitary pumping stations, forcemains and sanitary sewers. It is expected that the construction of both pumping stations will be undertaken coincident with upgrading of both Conservation Drive and Beaver Creek Road prior to servicing of the subject lands.
4. Where sanitary sewers exceed 5m in depth dual sewers (deep and local) have been provided. Deep sanitary sewer constructed below the average groundwater elevations will be constructed with isolation collars.
5. Water supply for the proposed development will be provided by five connection points to the planned extension of the existing municipal water distribution system. It is expected that the 300mm watermain extensions will be undertaken coincident with upgrading of both Conservation Drive and Beaver Creek Road prior to servicing of the Subject Lands.
6. Stormwater management for the development can be accommodated in the SWM Facilities proposed as outlined in the *Preliminary Stormwater Management Report – MTE, July 17, 2020.*
7. Utility servicing will be undertaken at the appropriate time, to ensure services are available prior to occupancy.
8. Adequate services exist and are planned to accommodate the proposed development.

All of which is respectfully submitted;

MTE Consultants Inc.



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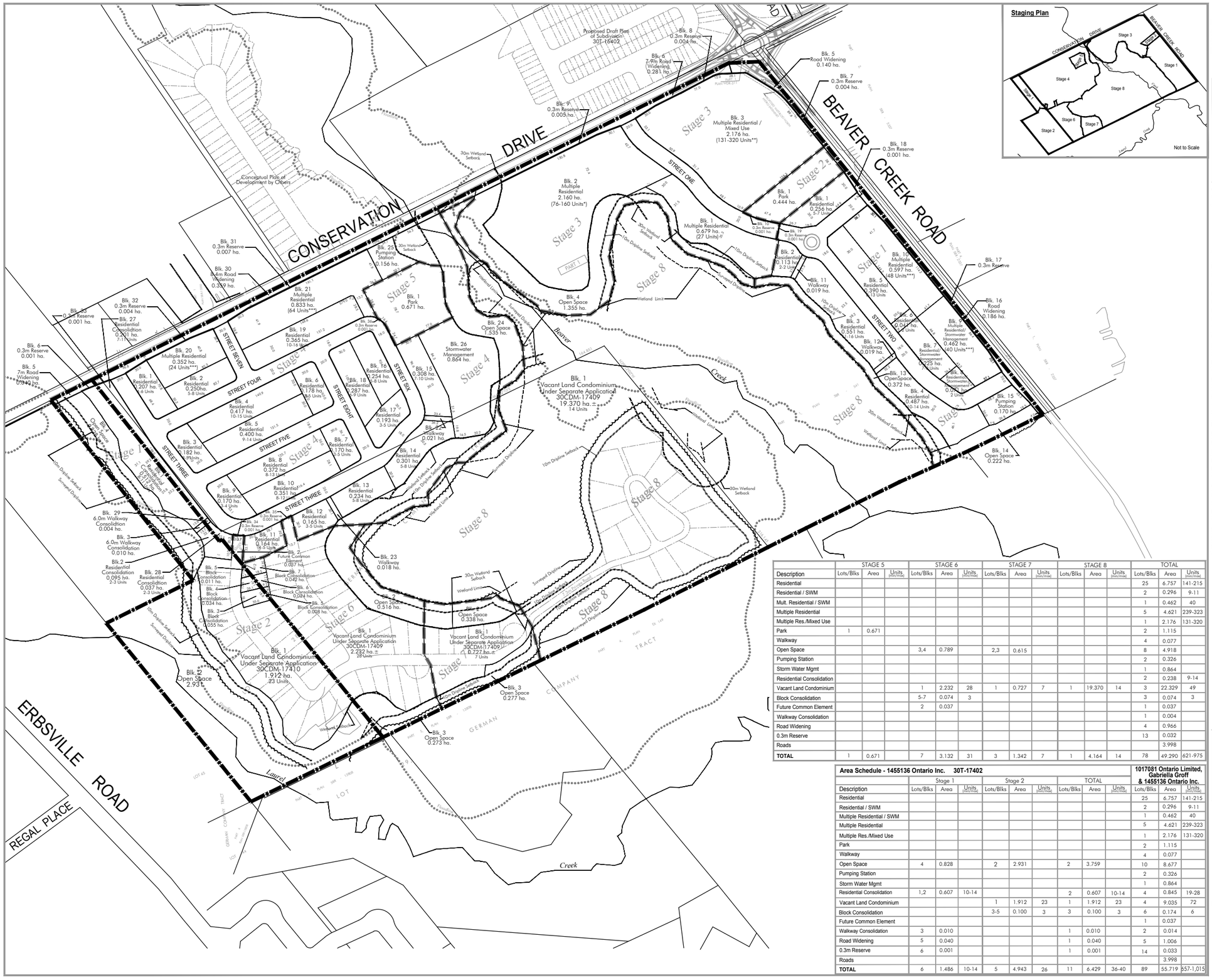
Appendix A
FSR

Draft Plan

Figure 6


CONSERVATION DRIVE
BEAVER CREEK ROAD
STREET ONE
STREET TWO
STREET THREE
STREET FOUR
STREET FIVE
STREET SIX
STREET SEVEN
STREET EIGHT
STREET NINE
Proposed Draft Plan of Subdivision 30T-15402
Conceptual Plan of Development by Others
Blk. 1 Vacant Land Condominium Under Separate Application 30CDM-17409 19.370 ha.± 14 Units
Blk. 1 Vacant Land Condominium Under Separate Application 30CDM-17410 1.912 ha. 23 Units
Blk. 1 Vacant Land Condominium Under Separate Application 30CDM-17409 0.727ha.± 7 Units
Blk. 1 Vacant Land Condominium Under Separate Application 30CDM-17409 2.232 ha.± 28 Units
Blk. 1 Multiple Residential 0.679 ha. (27 Units)
Blk. 1 Residential 0.256 ha. 2-7 Units
Blk. 2 Residential 0.113 ha. 2-2 Units
Blk. 1 Park 0.444 ha.
Blk. 1 Park 0.671 ha.
Blk. 2 Multiple Residential 2.160 ha. (76-160 Units*)
Blk. 3 Multiple Residential / Mixed Use 2.176 ha. (131-320 Units**)
Blk. 4 Open Space 1.355 ha.
Blk. 24 Open Space 1.535 ha.
Blk. 2 Open Space 0.516 ha.
Blk. 2 Open Space 0.338 ha.
Blk. 3 Open Space 0.277 ha.
Blk. 3 Open Space 0.273 ha.
Blk. 14 Open Space 0.222 ha.
Blk. 32 Open Space 2.931
Blk. 4 Open Space 0.222 ha.
Blk. 25 Pumping Station 0.156 ha.
Blk. 15 Pumping Station 0.170 ha.
Blk. 26 Stormwater Management 0.864 ha.
Blk. 7 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 8 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 9 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 10 Multiple Residential/ Stormwater Management 0.462 ha. (40 Units***)
Blk. 5 Residential 2.390 ha. 13 Units
Blk. 6 Residential 0.041 ha. 2 Units
Blk. 17 0.3m Reserve
Blk. 16 Road Widening 0.186 ha.
Blk. 15 Pumping Station 0.170 ha.
Blk. 5 Road Widening 0.140 ha.
Blk. 6 7.9m Road Widening 0.281 ha.
Blk. 7 0.3m Reserve 0.004 ha.
Blk. 8 0.3m Reserve 0.004 ha.
Blk. 9 0.3m Reserve 0.005 ha.
Blk. 18 0.3m Reserve 0.001 ha.
Blk. 19 0.3m Reserve 0.001 ha.
Blk. 31 0.3m Reserve 0.007 ha.
Blk. 30 0.4m Road Widening 0.002 ha.
Blk. 33 0.3m Reserve 0.001 ha.
Blk. 32 0.3m Reserve 0.004 ha.
Blk. 27 Residential Consolidation 0.201 ha. 7-11 Units
Blk. 6 0.3m Reserve 0.001 ha.
Blk. 5 7m Road Widening 0.044 ha.
Blk. 29 6.0m Walkway Consolidation 0.004 ha.
Blk. 3 6.0m Walkway Consolidation 0.010 ha.
Blk. 2 Residential Consolidation 0.095 ha. 2-3 Units
Blk. 28 Residential Consolidation 0.037 ha. 2-3 Units
Blk. 5 Block Consolidation 0.011 ha.
Blk. 4 Block Consolidation 0.034 ha.
Blk. 3 Block Consolidation 0.055 ha.
Blk. 7 Block Consolidation 0.042 ha.
Blk. 6 Block Consolidation 0.024 ha.
Blk. 8 Block Consolidation 0.008 ha.
Blk. 2 Future Common Element 0.037 ha.
Blk. 1 Residential 0.207 ha. 4-6 Units
Blk. 2 Residential 0.250ha. 5-8 Units
Blk. 4 Residential 0.417 ha. 10-15 Units
Blk. 5 Residential 0.400 ha. 9-14 Units
Blk. 3 Residential 0.182 ha. 3-5 Units
Blk. 8 Residential 0.372 ha. 8-13 Units
Blk. 9 Residential 0.170 ha. 3-4 Units
Blk. 10 Residential 0.351 ha. 8-12 Units
Blk. 11 Residential 0.164 ha. 3-5 Units
Blk. 12 Residential 0.165 ha. 3-5 Units
Blk. 13 Residential 0.234 ha. 5-8 Units
Blk. 14 Residential 0.301 ha. 5-8 Units
Blk. 16 Residential 0.254 ha. 5-8 Units
Blk. 17 Residential 0.193 ha. 3-5 Units
Blk. 18 Residential 0.287 ha. 5-9 Units
Blk. 19 Residential 0.365 ha. 10-16 Units
Blk. 20 Multiple Residential 0.352 ha. (24 Units***)
Blk. 21 Multiple Residential 0.833 ha. (64 Units***)
Blk. 22 Walkway 0.021 ha.
Blk. 23 Walkway 0.018 ha.
Blk. 11 Walkway 0.019 ha.
Blk. 12 Walkway 0.019 ha.
Blk. 4 Residential 0.487 ha. 9-14 Units
Blk. 3 Residential 0.551 ha. 7-16 Units
Blk. 13 OpenSpace 0.372 ha.
Blk. 10 Residential/ Stormwater Management 0.225 ha. 2 Units
Blk. 33 Residential 0.597 ha. (48 Units***)
Blk. 18 Residential 0.287 ha. 5-9 Units
Blk. 19 Residential 0.365 ha. 10-16 Units
Blk. 20 Multiple Residential 0.352 ha. (24 Units***)
Blk. 21 Multiple Residential 0.833 ha. (64 Units***)
Blk. 1 Residential 0.207 ha. 4-6 Units
Blk. 2 Residential 0.250ha. 5-8 Units
Blk. 4 Residential 0.417 ha. 10-15 Units
Blk. 5 Residential 0.400 ha. 9-14 Units
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Blk. 8 Residential 0.372 ha. 8-13 Units
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Blk. 33 Residential 0.597 ha. (48 Units***)
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Blk. 5 Residential 2.390 ha. 13 Units
Blk. 6 Residential 0.041 ha. 2 Units
Blk. 7 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 8 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 9 Residential/ Stormwater Management 0.225 ha. 2-7 Units
Blk. 17 0.3m Reserve
Blk. 16 Road Widening 0.186 ha.
Blk. 15 Pumping Station 0.170 ha.
Blk. 5 Road Widening 0.140 ha.
Blk. 6 7.9m Road Widening 0.281 ha.
Blk. 7 0.3m Reserve 0.004 ha.
Blk. 8 0.3m Reserve 0.004 ha.
Blk. 9 0.3m Reserve 0.005 ha.
Blk. 18 0.3m Reserve 0.001 ha.
Blk. 19 0.3m Reserve 0.001 ha.
Blk. 31 0.3m Reserve 0.007 ha.
Blk. 30 0.4m Road Widening 0.002 ha.
Blk. 33 0.3m Reserve 0.001 ha.
Blk. 32 0.3m Reserve 0.004 ha.
Blk. 27 Residential Consolidation 0.201 ha. 7-11 Units
Blk. 6 0.3m Reserve 0.001 ha.
Blk. 5 7m Road Widening 0.044 ha.
Blk. 29 6.0m Walkway Consolidation 0.004 ha.
Blk. 3 6.0m Walkway Consolidation 0.010 ha.
Blk. 2 Residential Consolidation 0.095 ha. 2-3 Units
Blk. 28 Residential Consolidation 0.037 ha. 2-3 Units
Blk. 5 Block Consolidation 0.011 ha.
Blk. 4 Block Consolidation 0.034 ha.
Blk. 3 Block Consolidation 0.055 ha.
Blk. 7 Block Consolidation 0.042 ha.
Blk. 6 Block Consolidation 0.024 ha.
Blk. 8 Block Consolidation 0.008 ha.
Blk. 2 Future Common Element 0.037 ha.

Appendix B
FSR

Reference Figures



Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

December 2015
165640041

Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

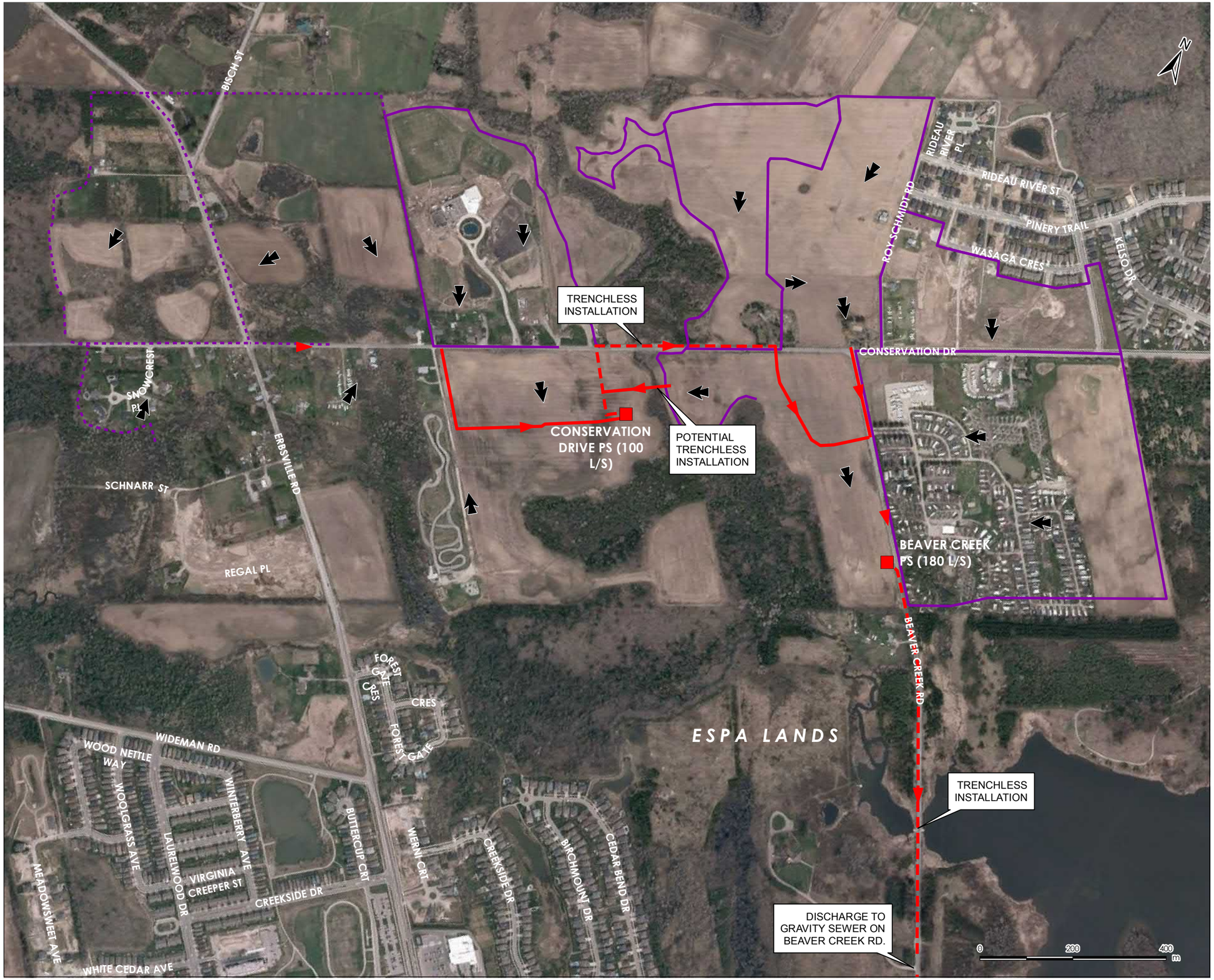
Figure No.

4-4

Title

Sanitary Flow Areas

V:\01656\active\165640041_cow_beaver_creek_ea\preliminary\analysis\gis\mxd\Report\165640041_ESR_Fig4-4_FlowAreas.mxd
Revised: 2015-12-14 By: kbuchanan



Stantec

Legend

- Sanitary Drainage Area
- Sanitary Drainage Area to be Refined as Development Proceeds
- Proposed Sanitary Pumping Station
- Proposed Gravity Sewer
- Proposed Forcemain
- Property Acquisition Required

Notes

1. Coordinate System: NAD83 UTM zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

December 2015
165640041

Client/Project

CITY OF WATERLOO
BEAVER CREEK ROAD & CONSERVATION DRIVE
UPGRADES AND EXTENSION OF MUNICIPAL SERVICES

Figure No.

4-6

Title

Sanitary Servicing Alternative 2

V:\01656\active\165640041_cow_beaver_creek_ea\preliminary\analysis\gis\mxd\Report\165640041_ESR_Fig4-6_Sanitary2.mxd
Revised: 2015-12-14 By: kbuchanan

NORTH WATERLOO SCOPED SUBWATERSHED STUDY

SURFACE WATER FEATURES AND ENVIRONMENTALLY SENSITIVE AREAS

FIGURE 5.3



- Monitoring Well (Stantec, 2010)
- Drive-Point Piezometer (Stantec, 2010)
- Guelph Permeameter (Stantec, 2010)
- Test Pit (Stantec, 2010)
- Abandoned Monitoring Well (Naylor, 2007)
- Monitoring Well (Stantec, 2005)
- Monitoring Well (CH2MHill, 1991)
- Monitoring Well (Terraqua, 1991)
- Piezometer Location
- Monitoring Well (Other)
- Test Hole
- Water Supply Well
- Well (Other)
- Abandoned Well
- Watercourse
- Primary Study Area
- Regulatory Floodplain (GRCA)
- Environmentally Sensitive Policy Area (ESPA)
- Laurel Creek Conservation Area

0 500 m

1:13000

NOTES

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Primary Study Area includes 2012 aerial photograph for lands within the City of Waterloo (source: City of Waterloo).
   Secondary Study Area includes 2010 aerial photograph for lands within the Township (source: First Base Solutions).
3. Floodplain and conservation area boundary © Grand River Conservation Authority, 2010.

NORTH

October 2013

Stantec

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE

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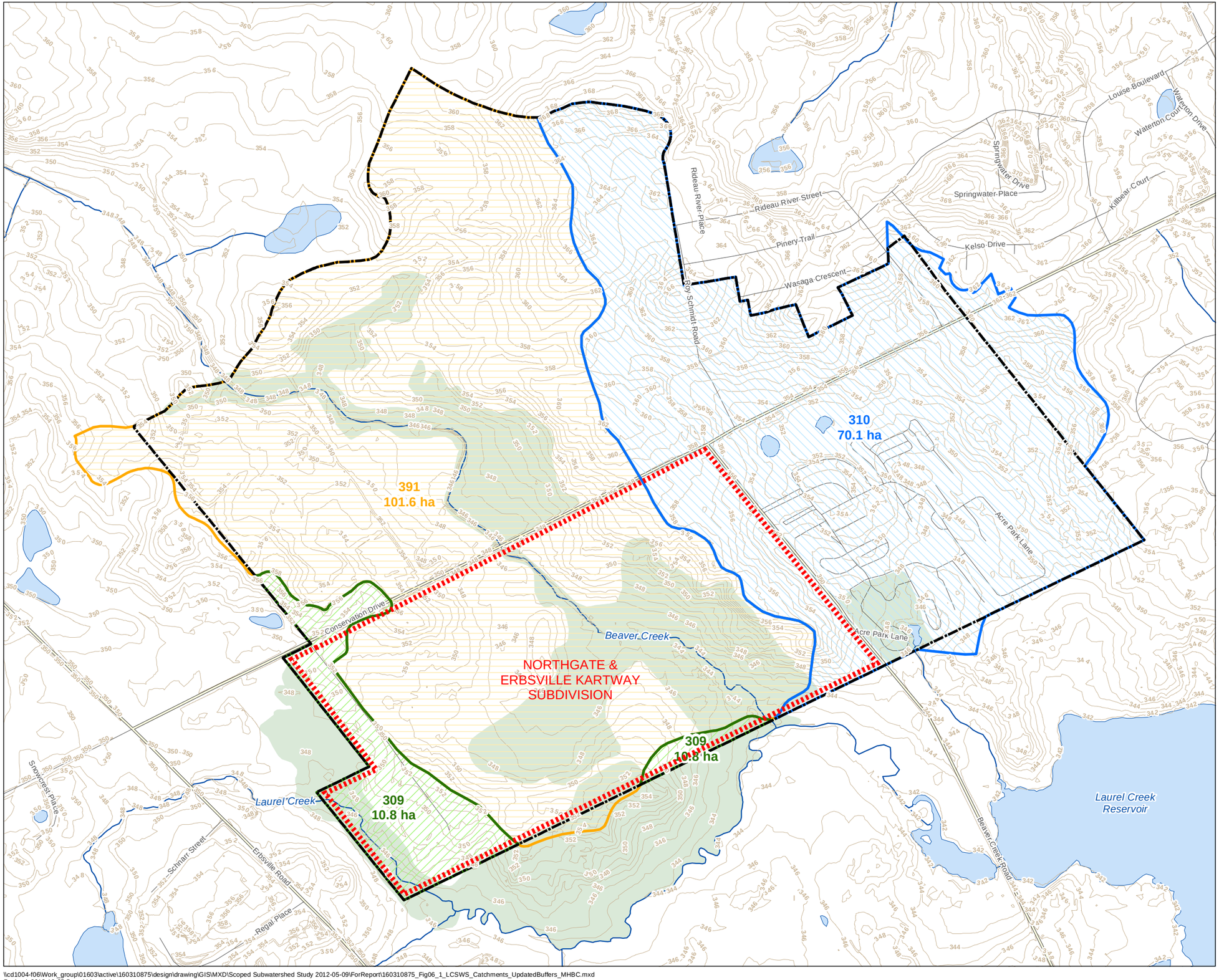
160330875

\\cd1004-f06\Work_group\01609\active\160310875_ Waterloo North\planning\drawing\Manifold\160340875_base.map [Fig5-03_SWFeatures Layout]
11/8/2013 10:13:04 AM By: ccoghlan Revised 2013-10-30 By: ccoghlan

NORTH WATERLOO SCOPED SUBWATERSHED STUDY

LCSWS CATCHMENTS

FIGURE 6.1



Primary Study Area
Highway
Major Road
Local Road
Topographic Contour (mAMSL)
Watercourse
Waterbody
Natural Heritage Features

Catchment Areas
309
310
391

0 50 100 200 300 400 m

1:7,500

NOTES

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
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NORTH

October 2013

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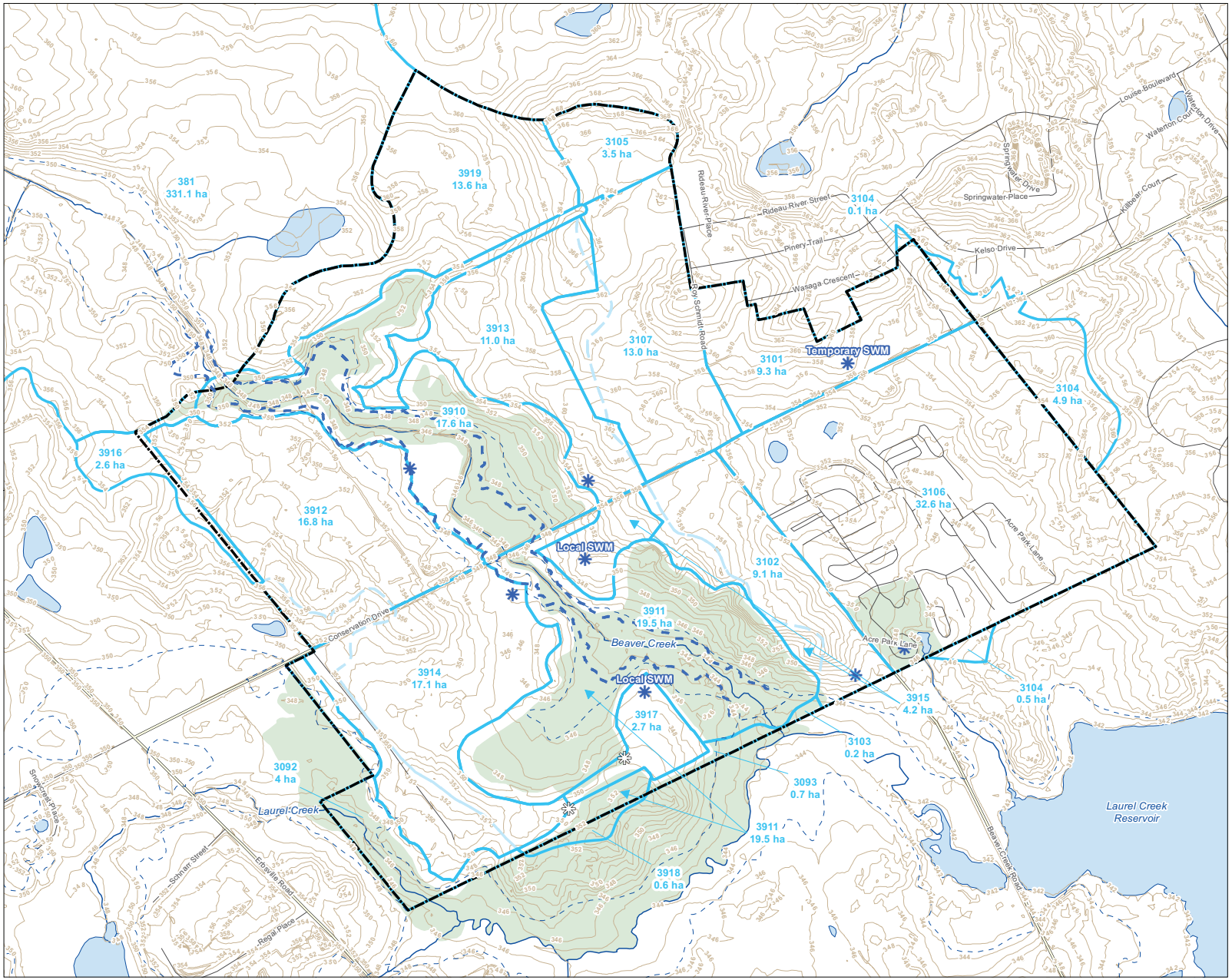
\\cd1004-f06\Work_group\01603\active\160310875\design\drawing\GIS\MXD\Scoped Subwatershed Study 2012-05-09\ForReport\160310875_Fig06_1_LCSWS_Catchments_UpdatedBuffers_MHBC.mxd
Revised: 2013-10-25 By: mkirkpatrick

NORTH WATERLOO SCOPED SUBWATERSHED STUDY

PROPOSED SUBCATCHMENTS

FIGURE 11.1



Primary Study Area
SWM Facility
Future Study Area
Highway
Major Road
Local Road
Topographic Contour (mAMSL)
Watercourse
Waterbody
Delineated Floodplain
GRCA Floodplain
Proposed Detailed Subcatchment
Existing Detailed Subcatchment
Natural Heritage Features

0 50 100 200 300 400 m

1:7,500

NOTES

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
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NORTH

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\\cd1004-f06\Work_group\01603\active\160310875\design\drawing\GIS\MXD\Scoped Subwatershed Study 2012-05-09\ForReport\160310875_Fig11_1_ProposedSubcatchments_MHBC.mxd
Revised: 2013-10-25 By: mkirkpatrick

Table 4-5: Determination of Assigned Sewage Pump Station Based on Projected Flows

Development Area ID	Development Area Size (ha)	Flow (L/s)	Assigned Sewage Pump Station
1	15.6	16.6	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
2	10.6	11.5	Beaver Creek PS (180 L/s)
3	13.0	13.9	
15	1.0	1.2	
5	9.8	10.7	
6	30	30.5	
7	8.7	9.6	
8	3.3	3.8	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
9	2.6	3.0	
10	16.7	17.7	
11	23.2	24.0	
12	15.7	16.7	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s) or Snowcrest Place PS (30 L/s)
13	8.3	9.1	
14	7.1	7.9	Beaver Creek PS (180 L/s) conveyed from Conservation Drive PS (100 L/s)
TOTAL	**165.6**	**176.1**	

Note 1: As per the clarification noted, Area 15 was added and the area previously referred to as Area 4 in the PCC presentation material was removed based on feedback received after PCC #3

Appendix C
FSR

MTE & NWSSS Boreholes and Test-Pits

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

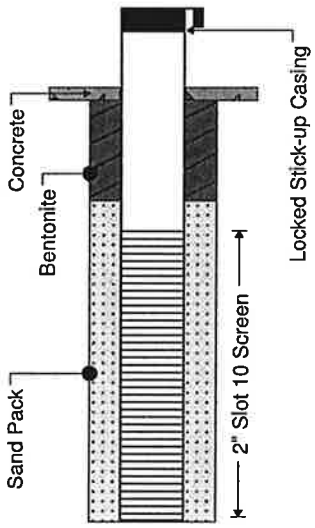
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW100-14

Job Number: 39502-104

Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.00	344.68	Ground Elevation							
0.00	343.92	**TOPSOIL** borwn, sandy silt, trace organics, damp							
0.76	343.16	**SILT** stiff, brown, clayey silt, little sand, trace gravel, moist		1	SS	3			
1.52	342.39	**SAND** compact, borwnish grey, medium sand, some gravel, little silt, saturated		2	SS	14			
2.29	341.58	compact, brown, fine sand		3	SS	13			
3.10	340.87	**CLAY** stiff, grey, silty clay, wet		4	SS	26			
3.81	340.11	**SAND** compact, brown, fine sand, brown, saturated		5	SS	22			
4.57	339.50	**CLAY TILL** very stiff, grey, clay till , some silt, wet		6	SS	21			
5.18		no clasts observed, some silt							
		Borehole Terminated at 5.18m							



January 9, 2015
Water Level 1.8 mbTOC (343.77 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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520 Bingemans Centre Drive
Kitchener, Ontario
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Logged By: TFC

Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW101-14

Job Number: 39502-104

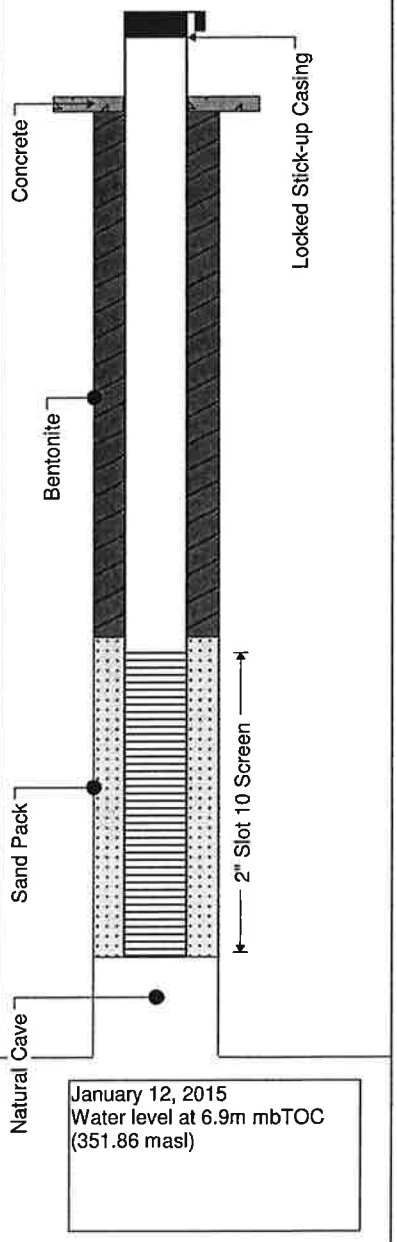
Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	357.85	Ground Elevation			
0.0	0.00	**TOPSOIL** light brown, silty sand, little organics, damp			
	357.09				
	0.76	**SAND** loose, brown, medium to coarse sand, trace gravel, moist	1	SS	6
	356.33				
2.0	1.52	compact, grey brown, medium to coarse sand, little gravel, moist	2	SS	11
			3	SS	8
	354.80				
	3.05	compact, grey brown, fine to medium sand, trace gravel, moist	4	SS	13
	354.04				
4.0	3.81	compact, grey borwn, fine to medium sand, moist	5	SS	22
	353.58				
	4.27	wet	6	SS	30
	352.52				
	5.33	compact, grey brown, fine to medium sand, trace gravel, wet	7	SS	21
	352.06				
6.0	5.79	saturated			
		compact, grey brown, fine sand	8	SS	18
	350.23				
	7.62	compact, brown, fine sand	9	SS	25
8.0					
	348.71				
	9.14	compact, grey brown, medium to coarse sand	10	SS	30
	348.10				
10.0	9.75	Borehole Terminated at 9.75			

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

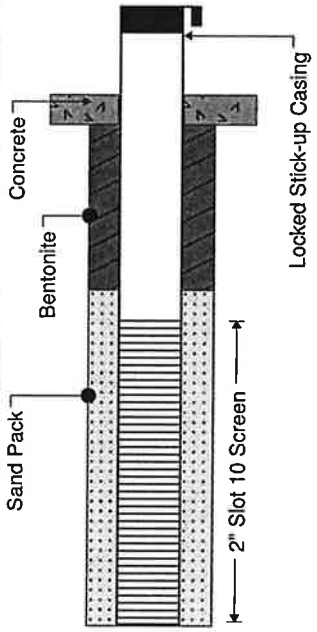
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW102-14

Job Number: 39502-104

Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	350.95	Ground Elevation							
0.0	350.95	**TOPSOIL** dark brown, silty sand, little organics, damp							
0.76	350.19	**SILT TILL** firm, brown, clayey silt till, some sand, trace gravel, moist		1	SS	6			
1.52	349.43	stiff, brown, oxidation staining, mottled tan brown, some fine sand moist		2	SS	17			
1.98	348.97	stiff, grey, clayey silt till, trace sand, grey, wet		3	SS	11			
3.05	347.90	**SILT** stiff, grey, clayey silt, saturated		4	SS	9			
				5	SS	13			
				6	SS	11			
5.94	345.01	Borehole Terminated at 5.94		7	SS	16			



January 12, 2015
Water level 1.8 mbTOC (349.9 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW103-14

Job Number: 39502-104

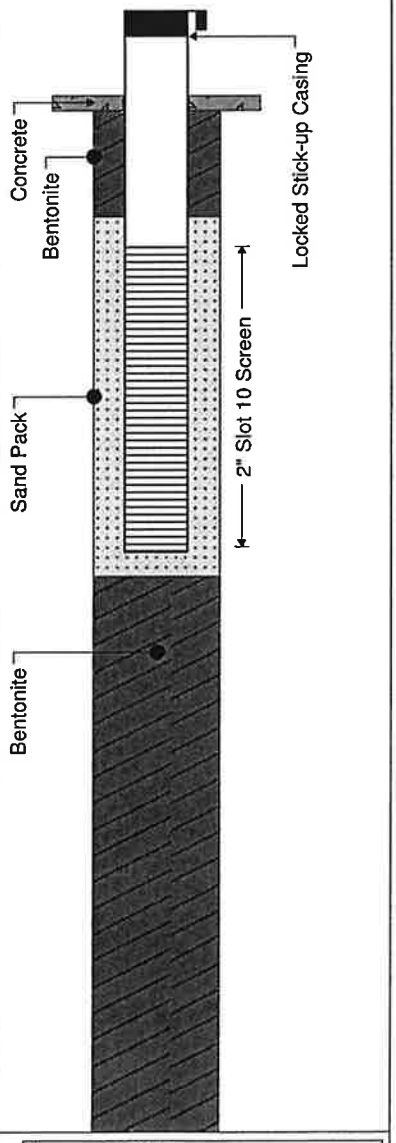
Drill Date: 12/11/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	345.78	Ground Elevation			
	0.00	**TOPSOIL** dark brown, silty sand, little organics, moist			
	345.02 0.76	**SAND** loose, brown, medium to course sand, few gravel, trace organics, wet	1	SS	8
	344.26 1.52		2	SS	26
2.0	343.80 1.98	compact, brown, medium sand, trace gravel, saturated			
		compact, greyish brown, medium to course sand, trace gravel	3	SS	16
	342.88 2.90	**CLAY TILL** very stiff, grey, clay till, some silt, trace fine sand, wet	4	SS	17
4.0		**SAND** compact, grey, medium sand, grey, saturated	5	SS	12
	341.21 4.57	**CLAY** very stiff, grey, clay till, some silt, trace fine sand, wet	6	SS	17
	340.45 5.33	**SILT** compact, grey, sandy silt, saturated	7	SS	10
6.0	339.68 6.10	**SILT** compact, brownish grey, clayey silt, some fine sand, saturated	8	SS	2
	338.16 7.62	**SAND** very loose, brownish grey, silty fine sand	9	SS	17
8.0		compact brownish grey, fine sand, some silt			
			10	SS	36
	335.87 9.91	**SAND** dense, brownish grey, silty fine sand	11	SS	33
10.0	335.26 10.52	Borehole Terminated at 10.52m			

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 8, 2015
Water level 1.3 mbTOC (345.3 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

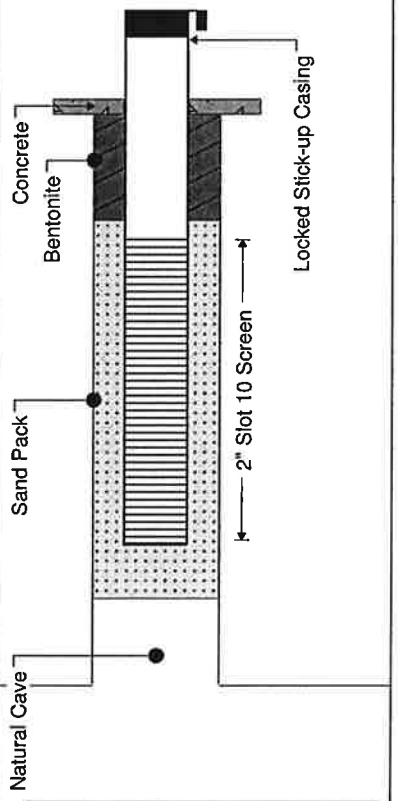
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW104-14

Job Number: 39502-104

Drill Date: 12/11/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	346.17	Ground Elevation							
0.00		**TOPSOIL** dark brown, silty sand, little organics, damp							
	345.41								
0.76		**SAND** loose, orange brown, fine sand, moist		1	SS	7			
	344.65								
1.52		compact, saturated		2	SS	14			
2.0				3	SS	10			
				4	SS	15			
	342.64								
3.53		compact, greyish brown, fine sand		5	SS	26			
4.0				6	SS	11			
				7	SS	4			
	340.23								
5.94		Borehole Terminated at 5.94							
6.0									
8.0									
10.0									



January 8, 2015
Water level 1.9 mbTOC (345.19 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105A-14

Job Number: 39502-104

Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	349.58	Ground Elevation							
0.0	0.00	**TOPSOIL** brown, silty sand, little organics, damp							
	348.82								
	0.76	**SILT** firm, brown, clayey silt, little sand, laminated grey silt layers, moist		1	SS	8			
2.0	348.28			2	SS	6			
	1.30								
	347.29	**SAND** loose, brown, silty fine sand,wet saturated		3	SS	7			
	2.29								
4.0	345.77			4	SS	20			
	3.81	**SAND** compact, dark brown, fine sand		5	SS	13			
				6	SS	23			
6.0				7	SS	19			
				8	SS	23			
	341.96								
	7.62	**SILT** dense, grey, clayey silt till		9	SS	18			
8.0				10	SS	26			
10.0				11	SS	20			

Concrete

Locked Stick-up Casing

Bentonite

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Sheet: 1 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

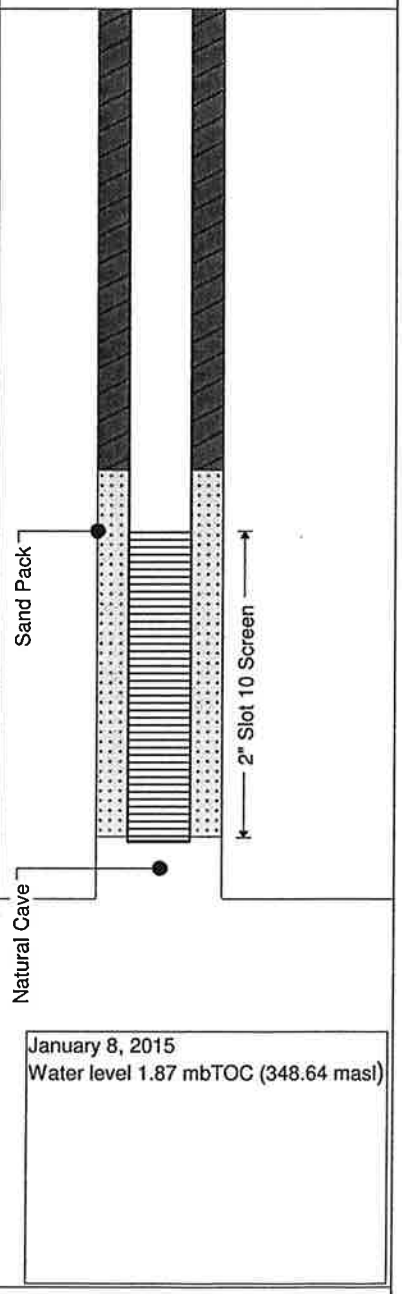
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105A-14

Job Number: 39502-104

Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
40.0	337.39								
	12.19	**SILT** compact, grey		12	SS	15			
42.0									
13.0									
44.0									
46.0				13	SS	14			
48.0									
15.0									
50.0				14	SS	14			
52.0									
54.0									
17.0									
56.0									
58.0									
60.0	331.29								
	18.29	**SAND** very loose, greyish brown, fine sand		15	SS	0*			
62.0									
19.0									
64.0									
66.0	329.16			16	SS	15			
	20.42	Borehole Terminate at 20.42m							
68.0									
21.0									
70.0									
72.0									
74.0									
23.0									
76.0									
78.0									



Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Sheet: 2 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105B-14

Job Number: 39502-104

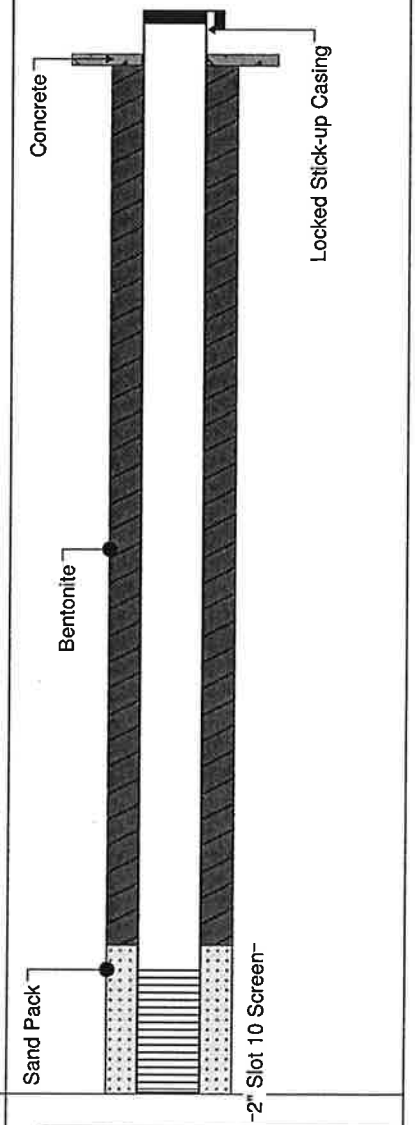
Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	349.66	Ground Elevation			
	0.00	**TOPSOIL** brown, silty sand, little organics, moist			
	348.90		1	SS	8
	0.76				
	348.36	**SILT** firm, brown, clayey silt, little sand, laminated grey silt layers, moist	2	SS	6
	1.30				
2.0	347.37		3	SS	7
	2.29	**SAND** loose, brown, silty fine sand, wet saturated	4	SS	20
	345.85				
4.0	3.81	**SAND** compact, dark brown, fine sand	5	SS	13
			6	SS	23
			7	SS	19
6.0			8	SS	23
	342.04				
8.0	7.62	**SILT TILL** dense, grey, clayey silt till	9	SS	18
			10	SS	26
10.0			11	SS	20
12.0	337.47				
	12.19	**SILT** compact, grey	12	SS	15
	336.86	Borehole Terminate at 12.8m			
	12.80				
14.0					

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 8, 2015
Water level 1.87 mbTOC (348.33 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Logged By: TFC

Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW106-14

Job Number: 39502-104

Drill Date: 12/10/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	350.79	Ground Elevation							
0.0	0.00	**TOPSOIL** light brown, silty sand, little organics, damp							
	350.03								
	0.76	**SILT** compact, tan, sandy silt, little fine sand, little clay, trace organic, moist		1	SS	10			
	349.27								
2.0	1.52			2	SS	9			
		wet		3	SS	27			
	347.74								
	3.05	**SILT TILL** dense, light brown, silt till, moist		4	SS	33			
	346.98								
4.0	3.81	**SILT** compact, grey, clayey silt till, moist		5	SS	22			
				6	SS	34			
	345.46								
	5.33	compact, grey, clayey silt		7	SS	40			
6.0	344.69								
	6.10	**SILT** compact, grey, silt		8	SS	28			
		saturated							
	343.17								
	7.62	compact, grey, some fine sand layers		9	SS	14			
8.0									
				10	SS	21			
10.0									
				11	SS	16			
12.0									
	337.99			12	SS	12			
	12.80								January 8, 2015 Water level 3.08 mbTOC (348.55 masl)
14.0									

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

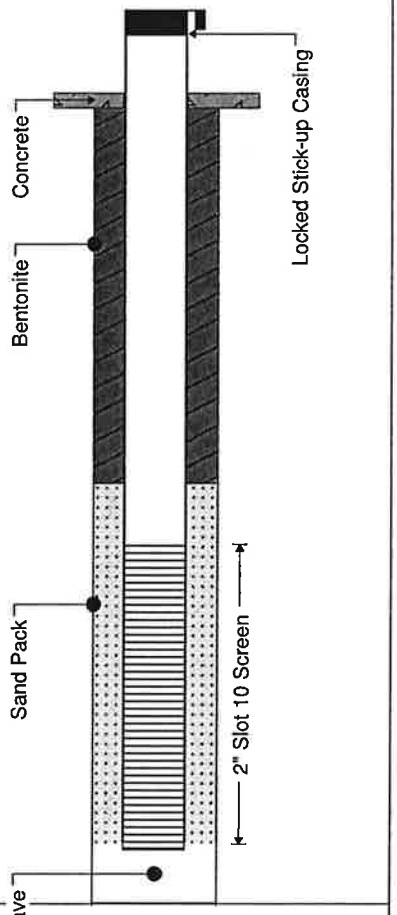
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW107-14

Job Number: 39502-104

Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
ft / m	350.58	Ground Elevation							
	0.00	**TOPSOIL** grey brown to dark brown, sandy silt, trace organics, damp							
	349.74								
	0.84	**SAND** loose, brown, silty fine sand, damp		1	SS	4			
2.0		**SAND** compact, tan, fine sand, damp		2	SS	12			
				3	SS	16			
	347.53								
	3.05	moist		4	SS	15			
	346.62								
4.0	3.96	compact, dark brown, fine sand, wet		5	SS	25			
	346.01								
	4.57	saturated		6	SS	27			
				7	SS	20			
6.0				8	SS	5			
	342.90								
	7.68	dense, brownish grey, fine sand		9	SS	48			
8.0	342.35								
	8.23	Borehole Terminated at 8.23m							
10.0									



January 7, 2015
Water level 5.18 mbTOC (346.26 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: Aardvark

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Logged By: TFC

Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW108-14

Job Number: 39502-104

Drill Date: 12/16/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	346.21	Ground Elevation							
0.00		**TOPSOIL** brown to dark brown, some clay, organics, damp							
0.76	345.45	**SILT** stiff, tan, clayey silt, trace course sand, trace organics, damp		1	SS	11			
1.52	344.69	compact, tan, clayey silt, some fine sand, trace course sand, moist		2	SS	14			
2.29	343.92	**SAND** compact, tan, fine sand, saturated		3	SS	17			
				4	SS	20			
3.81	342.40	dense, mottled tan brown with oxidation staining, fine sand		5	SS	40			
4.57	341.64	dense, brown, fine sand							
		compact, grey brown, fine sand		6	SS	14			
				7	SS	20			
6.10	340.11	compact, grey, fine sand		8	SS	15			
6.71	339.50	Borehole Terminated at 6.71m							

Concrete
Bentonite
Sand Pack
Natural Cave
Locked Stick-up Casing
2" Slot 10 Screen

January 8, 2015
Water level 1.85 mbTOC (345.08 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109A-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	349.77	Ground Elevation						
0.00		**TOPSOIL** loose, dark brown, fill, silty sand, little organics, damp	1	SS	8			
1.0			2	SS	15			
3.0		**SILT TILL** stiff, brown, clayey silt till, moist	3	SS	15			
5.0								
2.0		mottled brown, no clasts observed, moist	4	SS	9			
7.0								
9.0	346.72							
3.05		**CLAY** stiff, grey, little silt, moist	5	SS	10			
11.0								
4.0			6	SS	7			
13.0								
15.0			7	SS	9			
17.0	344.41							
5.36		**SAND** loose, brown, silty fine sand, wet	8	SS	8			
6.0	343.67							
6.10		**SAND** loose, brownish grey, fine to medium sand, saturated	9	SS	18			
21.0		compact, brown, fine sand						
23.0								
25.0			10	SS	16			
8.0								
27.0								
29.0			11	SS	5			
31.0								
10.0								
33.0								
35.0			12	SS	11			
37.0								
39.0								
12.0	337.58							
12.19		compact, brown, fine sand, little silt	13	SS	14			
41.0								
43.0								
45.0	336.05							
13.72		compact brownish grey, fine sand, little silt	14	SS	23			
14.0								
47.0								

Concrete

Locked Stick-up Casing

Bentonite

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

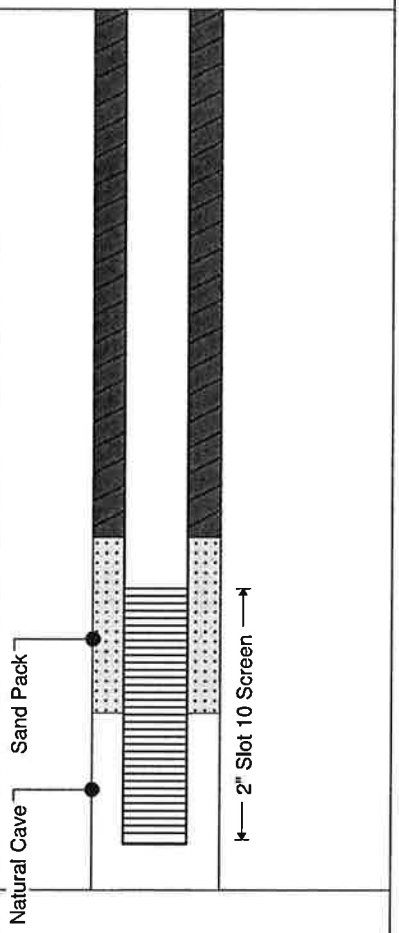
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109A-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
49.0									
51.0				15	SS	30			
53.0	16.0								
55.0	333.01								
	16.76	**CLAY** hard, brownish grey, silty clay, some fine sand,wet		16	SS	40			
57.0									
59.0	18.0								
	331.48								
	18.29	**SAND** dense, brown, fine sand, saturated		17	SS	37			
61.0									
63.0		**CLAY** hard, brownish grey, clay, wet							
65.0	20.0			18	SS	22			
67.0									
69.0									
	328.43								
	21.34	**SAND** dense, brownish grey, silty fine sand, saturated		19	SS	36			
71.0									
73.0	22.0								
75.0				20	SS	37			
77.0									
79.0	24.0								
81.0				21	SS	19			
	324.78								
	24.99	Borehole Terminated at 24.99m							
83.0									
85.0	26.0								
87.0									
89.0									
91.0	28.0								
93.0									
95.0									
97.0									



January 7, 2015
Water level 3.87 mbTOC (346.62 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 2 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

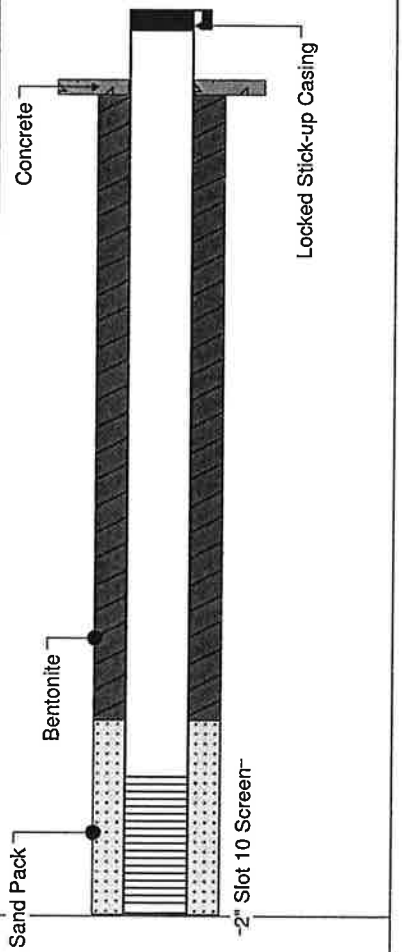
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109B-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	349.77	Ground Elevation							
0.00		**TOPSOIL** loose, dark brown, fill, silty sand, little organics, damp		1	SS	8			
2.0		**SILT TILL** stiff, brown, clayey silt till, moist; mottled brown, no clasts observed, moist		2	SS	15			
				3	SS	15			
				4	SS	9			
	346.72								
3.05		**CLAY** stiff, grey, little silt, moist		5	SS	10			
4.0				6	SS	7			
				7	SS	9			
	344.41								
5.36		**SAND** loose, brown, silty fine sand, wet		8	SS	8			
6.0	343.67								
6.10		**SAND** loose, brownish grey, fine to medium sand, saturated; compact, brown, fine sand		9	SS	18			
8.0				10	SS	16			
	340.63								
9.14		Borehole Terminated at 9.14m							
10.0									
12.0									



January 5, 2015
Water level 4.76 mbTOC (345.76 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

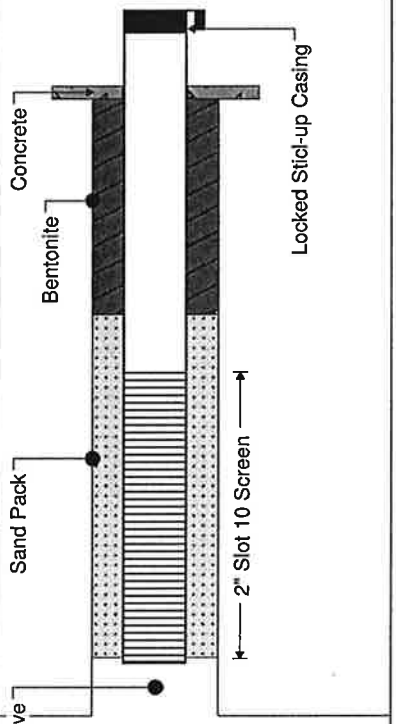
Location: 675 Conservation Dr. Waterloo, Ontario

Borehole Number: MW110-14

Job Number: 39502-104

Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	349.37	Ground Elevation							
0.0 – 0.76	349.37 – 348.61	**TOPSOIL** dark brown, silty sand, trace organics, moist							
0.76 – 1.52	348.61 – 347.85	**SAND** compact, grey, fine to medium sand,some silt, some gravel, wet		1	SS	19			
1.52 – 2.44	347.85 – 346.93	compact, brownish grey, fine sand, some silt, wet		2	SS	16			
2.44 – 6.71	346.93 – 342.66	saturated		3	SS	13			
				4	SS	8			
				5	SS	9			
				6	SS	14			
				7	SS	0*			
				8	SS	1			
6.71	342.66	Borehole Terminated at 6.71m							



January 7, 2015
Water level 2.10 mbTOC (348.08 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: 675 Conservation Dr. Waterloo, Ontario

Borehole Number: MW111-14

Job Number: 39502-104

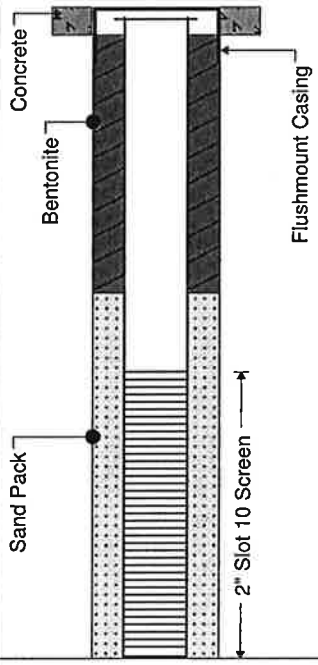
Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	349.43	Ground Elevation			
0.0	0.00	**TOPSOIL** tan brown, silty sand, trace organics, moist			
	348.67				
0.76	0.76	**SILT** firm, mottled borwn, clayey silt till, moist	1	SS	6
1.5			2	SS	9
2.0	347.14				
	2.29	**SAND** compact, brown, silty fine sand, saturated	3	SS	21
3.0		**CLAY** very stiff, brown, clay, little silt, little sand, wet	4	SS	19
4.0		**SAND** compact, grey, fine sand, saturated	5	SS	26
	344.86				
	4.57	**CLAY** very stiff, brown, clay, little silt, little sand, wet	6	SS	43
6.0	343.33	**SILT** hard, grey, clayey silt, little sand, wet	7	SS	34
	6.10		8	SS	17
	342.50				
	6.93	**CLAY** very stiff, grey, clay, some silt, wet			
8.0		Borehole Terminated at 6.93m			
10.0					
12.0					

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 7, 2015
Water level 0.75 mbTOC (348.56 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Monitoring Well: MW8-10

Project:	North Waterloo Subwatershed Study	**Field investigator:**	R.Dong/L.Veale
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 08	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	05-Mar-2010 / 08-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS					WELL DETAILS
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro-Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 350.44 m AMSL TOC Elev: 351.28 m AMSL Easting: 532289 Northing: 4814537 Stick-up: 0.82 m GS Elev: 350.38 m AMSL TOC Elev: 351.28 m AMSL Easting: 532271 Northing: 4814538 Stick-up: 0.90 m
			Ground Surface	350.44							
0	0		TOPSOIL some organic material, dark brown, stiff, dry	0.00 349.60			1	SS	2-2-2-3 (4)	12" 50%	Cement
			SILT little fine sand, trace clay, light brown	0.84 348.91			2	SS	5-7-9-2 (16)	9" 38%	Holeplug
5			becoming wet at 1.37 m BGS	1.52							
	2		SILT light brown, homogeneous, stiff, wet				3	SS	3-5-7-12 (12)	24" 100%	52 mm Schedule 40 PVC casing
							4	SS	9-13-14-14 (27)	24" 100%	
10							5	PQ	n/a	29" 161%	Top of sand (2.74 m BGS)
	4		some clay beginning at 3.6 m BGS, becoming brownish grey, firm		ATB1	Upper Maryhill Till and Equivalents	6	PQ	n/a	54" 90%	Top of screen (3.05 m BGS) No.2 Silica Sand No.10 Slot PVC screen 50 mm diameter
15											
20	6						7	PQ	n/a	54" 90%	Bottom of screen (4.57 m BGS)
							8	PQ	n/a	54" 90%	
25	8			341.93							
			SAND fine grained, some silt, brown, homogeneous, wet	8.51			9	PQ	n/a	49" 82%	
30	10		trace silt beginning at 9.8 m BGS				10	PQ	n/a	55" 92%	
35											
40	12		little silt beginning at 12.5 m BGS, becoming greyish brown, soft				11	PQ	n/a	51" 85%	52 mm Schedule 80 PVC casing
							12	PQ	n/a	55" 92%	
45	14						13	PQ	n/a	55" 92%	
50											
55	16		layer of fine sand, trace silt, stiff at 16.2 to 17.1 m BGS				14	PQ	n/a	28" 47%	
60	18						15	PQ	n/a	55" 92%	Bentonite Grout
			some silt beginning at 18.9 m BGS				16	PQ	n/a	58" 97%	
65	20										
70							17	PQ	n/a	56" 93%	
	22		trace silt beginning at 21.6 m BGS				18	PQ	n/a	37" 62%	
75				328.03 22.40							
			fine grained, little medium grained sand, grey brown, wet		AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents	19	PQ	n/a	38" 63%	
80	24		seam of grey brown, fine sand with little silt 0.2 m thick at 24.5 m BGS								
			medium sand content between 24.7 to 26.2 m BGS				20	PQ	n/a	44" 73%	
85	26										
							21	PQ	n/a	60" 100%	
90			seam of medium sand 0.2 m thick at 27.7 m BGS								

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

Stantec

STANTEC BOREHOLE AND WELL - CLUST 11X17 160340875 - DPS.GPJ EDGE DATA TEMPLATE.GDT 2/4/11 MJFRASER

Monitoring Well: MW8-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	R.Dong/L.Veale
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 08	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	05-Mar-2010 / 08-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 350.44 m AMSL TOC Elev: 351.26 m AMSL Easting: 532269 Northing: 4814537 Stick-up: 0.82 m
95			little silt from 28.0 to 28.7 m BGS fine grained, little medium grained sand, grey brown, wet				22	PQ	n/a	60" 100%	
100	30						23	PQ	n/a	14" 23%	
105	32						24	PQ	n/a	50" 83%	Bentonite Grout
110	34		seam of fine sand 5 cm thick at 33.8 m BGS				25	PQ	n/a	25" 42%	
115	36						26	PQ	n/a	3" 5%	Holeplug
120			seam of homogeneous fine sand between 36.9 and 37.4 m BGS, and				27	PQ	n/a	3" 5%	Top of sand (35.97 m BGS) Top of screen (36.58 m BGS)
125	38		37.8 and 38.1 m BGS, and				28	PQ	n/a	60" 100%	No.2 Silica Sand
			38.8 and 38.8 m BGS	311.42							No.10 Slot PVC screen 50 mm diameter
			trace gravel beginning at 39.0 m BGS	39.01			29	PQ	n/a	41" 82%	
130	40		SAND AND COBBLE large cobble at 39 m BGS, at 39.5 m and 39.7 m BGS	310.76	AFB3	Lower Moraine Stratified Sediments					Bottom of screen (39.68)
			End of Borehole	39.68							
135	42										
140											
145	44										
150	46										
155											
160	48										
165	50										
170	52										
175											
180	54										
185	56										

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL - CLIENT 11X17 - MOD0875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MAFRASER

Monitoring Well: MW9-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	J.Koch
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 09	**Drilling method:**	Track Mount, CME75, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	02-Mar-2010 / 04-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 345.71 m AMSL TOC Elev: 346.50 m AMSL Easting: 532634 Northing: 4814717 Stick-up: 0.79 m
			Ground Surface	345.71							
0	0		TOPSOIL some clay and silt, dark brown	0.00 344.95			1	SS	n/a	6" 25%	Cement
			CLAY some silt, trace gravel, brown, firm	0.76 344.19			2	SS	2-5-7-9 (12)	14" 58%	Holeplug
5	2		brownish grey, homogeneous, firm, wet	1.52	ATB1	Upper Maryhill Port Stanley Till and Equivalents	3	SS	4-5-7-9 (12)	15" 63%	52 mm Schedule 40 PVC casing
							4	SS	2-3-4-6 (7)	15" 63%	Top of sand (2.61 m BGS)
10							5	PQ	n/a	25" 96%	Top of screen (3.05 m BGS)
	4			341.90							No.2 Silica Sand
			SANDY SILT some clay, brownish grey, firm, wet	3.81 340.93			6	PQ	n/a	52.5" 88%	No.10 Slot PVC screen 50 mm diameter
15			SAND medium grained, silty to some silt, brownish grey, soft, wet	4.76 340.02							Bottom of screen (4.57 m BGS)
20	6		SILT sandy to some sand, greyish brown, very stiff, wet	5.69			7	PQ	n/a	44" 73%	
			seam of fine sand, little silt between 6.6 and 9.5 m BGS				8	PQ	n/a	59" 98%	
25	8		little clay between 8.1 and 9.5 m BGS				9	PQ	n/a	58" 96%	
30			stratified layers of clayey silt, little to some sand, firm to soft and silt, little clay, very hard between 9.5 and 11.3 m BGS								52 mm Schedule 80 PVC casing
	10		becoming soft at 11.3 m BGS				10	PQ	n/a	58" 95%	
35											
40	12				AFB1 / AFB2	Upper / Mide Moraine Stratified Sediments and Equivalents	11	PQ	n/a	59" 100%	
			laminated sediments at 13.4 m BGS				12	PQ	n/a	57" 95%	Bentonite Grout
45	14		little fine sand beginning at 14.2 m BGS, soft to firm								
50							13	PQ	n/a	51" 85%	
	16						14	PQ	n/a	58" 97%	
55			laminated sediments at 17.1 m BGS								
60	18		trace fine sand beginning at 18.8 m BGS				15	PQ	n/a	54" 88%	
65	20		cobble, 11 cm diameter, at 19.8 m BGS	325.82 19.89			16	PQ	n/a	43" 73%	
			SAND AND GRAVEL coarse grained gravel, some fine gravel, some cobbles, rounded particles		AFB3	Lower Moraine Stratified Sediments	17	PQ	n/a	n/a	
70				324.09							
	22		SILT TILL some fine sand, some coarse gravel, trace fine gravel, grey, very hard, moist	21.82			18	PQ	n/a	60" 101%	
75											Holeplug
	24				ATC1	Upper/ Main Catfish Creek Till	19	PQ	n/a	45" 61%	Top of sand (23.98 m BGS)
80											Top of screen (24.48 m BGS)
85	26						20	PQ	n/a	54" 90%	No.2 Silica Sand
											No.10 Slot PVC screen 50 mm diameter
90	28		End of Borehole	318.20 27.51							Bottom of screen (27.51)

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL - CLIENT 11X17 - 160340875 - DPS.GPJ EGAS DATA TEMPLATE.GDT 3/1/11 MJFRASER

Monitoring Well: MW10-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	19-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.25 m AMSL
Number:	160340875	**Top of casing elevation:**	347.05 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	532654
Contractor:	Pro Core Drilling	**Northing:**	4814388

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.80 m
0	0		Ground Surface	346.25								
			TOPSOIL some clay, organics, dark brown	0.00 345.94								Concrete
			SAND fine to medium grained, light brown with oxidation staining throughout	0.30			1	SS	2-4-5-8 (9)	16" 67%		Holeplug
							2	SS	10-8-6-6 (14)	0" 0%		52 mm Schedule 40 PVC casing
5				344.57								Top of sand (0.9 m BGS)
			SILTY CLAY light brown	1.68 344.42	AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents	3	SS	3-5-5-5 (10)	18" 75%		Top of screen (1.5 m BGS)
	2		SAND fine grained, some medium sand and silt, light brown, loose to compact, wet	1.83								No.2 Silica Sand
			becoming finer with depth				4	SS	2-3-4-5 (7)	8" 33%		No.10 Slot PVC screen 50 mm diameter
10							5	SS	6-8-10-8 (18)	16" 67%		Bottom of screen (3.1 m BGS)
				342.59								
			End of Borehole	3.66								
	4											
15												
20	6											
25												
	8											

Screen Interval: 1.52 - 3.05 m BGS
Sand Pack Interval: 0.91 - 3.05 m BGS
Well Seal Interval: 0.30 - 0.91 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Monitoring Well: MW11-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	05-Mar-2010 / 08-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	355.07 m AMSL
Number:	160340875	**Top of casing elevation:**	355.96 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	533047
Contractor:	Pro Core Drilling	**Northing:**	4814655

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.69 m
0	0		Ground Surface	355.07								
			SAND fine to medium grained, trace silt and organics, light brown	0.00 354.76								Concrete
			SAND fine to medium grained, light brown, some oxidation staining, loose	0.30			1	SS	1-3-3-5 (6)	11" 46%		
			some coarse sand and gravel at 0.8 to 1.4 m BGS				2	SS	4-6-7-6 (13)	6" 25%		52 mm Schedule 40 PVC casing
5							3	SS	4-7-12-14 (19)	14" 58%		
	2		SILTY SAND fine grained sand, light brown, compact, moist	353.09 1.98 352.93								Holeplug
			SAND fine grained, some medium sand, light brown, loose to compact, moist	2.13			4	SS	5-10-12-12 (22)	15" 63%		
10					AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents	5	SS	2-10-16-18 (26)	15" 63%		
			fine to coarse grained sand, trace gravel, light brown, loose, wet	351.41 3.66								Top of sand (3.7 m BGS)
	4											Top of screen (4.3 m BGS)
15							6	SS	7-11-12-12 (23)	20" 83%		No.2 Silica Sand
												No.10 Slot PVC screen 50 mm diameter
	6			348.97								Bottom of screen (5.8 m BGS)
20			SILTY CLAY grey	6.10			7	SS	2-4-5-5 (9)	24" 100%		Natural Cave
				348.36								
			End of Borehole	6.71								
25												
	8											

Screen Interval: 4.27 - 5.79 m BGS
Sand Pack Interval: 3.66 - 5.79 m BGS
Well Seal Interval: 0.30 - 3.66 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Monitoring Well: MW12-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	R Dong
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 12	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	09-Mar-2010 / 11-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 348.63 m AMSL TOC Elev: 349.52 m AMSL Easting: 532584 Northing: 4814125 Stick-up: 0.89 m
			Ground Surface	348.63							
0	0		TOPSOIL brown, decaying wood, moist	0.00			1	SS	2-3-4-4 (7)	12" 50%	Cement
				347.26			2	SS	3-4-4-4 (8)	10" 42%	Holeplug
5	2		CLAYEY SILT trace fine sand, light and dark brown mottled, soft, moist	1.37			3	SS	6-1-7-4 (8)	8" 33%	
			SILTY CLAY light brown and brown mottled, very stiff, moist	340.34 2.29			4	SS	6-6-8-14 (14)	17" 71%	52 mm Schedule 40 PVC casing
10			SILT little clay, trace coarse and fine gravel, trace well graded sand, brown, very soft, moist to wet	346.17 2.46			5	SS	n/a	14" 74%	Holeplug
				345.25							
15	4		SILTY CLAY little fine sand, trace cobbles, light brown, firm, moist to wet	3.38			6	PQ	n/a	24" 40%	Top of sand (4.57 m BGS)
			becoming stiff, brown at 4.9m BGS								Top of screen (5.18 m BGS)
			seam of wet, brown, fine sand, 0.23 m thick at 5.3 m BGS								No.2 Silica Sand
20	6		becoming brown grey at 5.9 m BGS		ATB1	Upper Maryhill Port Stanley Till and Equivalents	7	PQ	n/a	48" 79%	No.10 Slot PVC screen 50 mm diameter
			trace gravel beginning at 7.0 m BGS								Bottom of screen (6.71m BGS)
			trace coarse and medium sand beginning at 7.5 m BGS lensed trace soft clay pockets (1-2 mm in diameter), red and grey starting at 7.5 m BGS				8	PQ	n/a	50" 83%	
25	8		lensed trace to little silt pockets								52 mm Schedule 80 PVC casing
			laminated 2 mm thick of soft grey clay at 9.4 m BGS				9	PQ	n/a	61" 100%	
30	10										
			seam of wet silt and very fine sand, 0.05 m thick at 10.4 m BGS seam of little fine and coarse gravel, little well graded sand, 0.2 m thick at 10.5 m BGS seam of silt and very fine sand 0.05 thick between 10.7 and 11.0 m BGS				10	PQ	n/a	49" 83%	
35			seam of fine sand 2 mm thick at 11.4 m BGS	337.10							
			SILT AND SAND fine grained, brown grey, homogeneous, wet	11.53 336.64			11	PQ	n/a	52" 93%	
40	12		SAND fine grained, brown grey, homogeneous, wet	11.99							Bentonite Grout
			seam of silt, 0.01 m thick at 12.9 m BGS				12	PQ	n/a	46" 102%	
45			seam of silt, 0.01 m thick at 13.3 m BGS								
	14		seam of silt, 0.01 m thick at 14.4 m BGS				13	PQ	n/a	42" 70%	
50											
	16		seam of browny grey silty clay with lensed grey clay 0.05 m thick at 15.8 m BGS some medium sand between 16.1 and 16.5 m BGS		AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents	14	PQ	n/a	43" 63%	
55							15	PQ	n/a	42" 89%	
60	18		pocket of very fine sand, 0.03 m diameter at 18.5 m BGS some medium sand between 18.3 and 18.7 m BGS seam of firm silty clay 0.03 m thick at 18.7 m BGS								
			seam of coarse gravel 0.05 m thick at 19.3 m BGS				16	PQ	n/a	34" 59%	
65	20		seam of sand, stiff, 0.1 m thick at 20.0 m BGS								
			seam of some silt 0.04 m thick at 20.8 m BGS seam of some silt 0.13 m thick at 20.9 m BGS stratified clayey silt 0.03 m thick at 21.1 m BGS	327.50 21.13 327.09			17	PQ	n/a	48" 89%	
70			SAND AND SILT stratified fine sand with little silt, 2 cm thick and coarse sand with fine gravel 0.2 cm thick browny grey, wet	21.54							Holeplug
	22		SAND AND GRAVEL well graded, brown and grey, wet				18	PQ	n/a	36" 74%	Top of sand (21.95 m BGS)
75											Top of screen (22.56 m BGS)
					AFB3	Lower Moraine Stratified Sediments					
80	24										No.2 Silica Sand
				323.48							No.10 Slot PVC screen 50 mm diameter
			SANDY SILT TILL little medium sand coarse sand, trace to little fine and coarse gravel, grey brown, brown very hard, moist	25.15	ATC1	Upper/Main Catfish Creek Till	19	PQ	n/a	44" 69%	
85	26			322.37							Bottom of screen (25.60 m BGS)
			End of Borehole	26.26							
90	28										

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL - CLUST 1 (V3) - MOSSKRR - DPS.GPJ - EQUIS DATA TEMPLATE.GDT - 2/3/11 - MURHAISER

Monitoring Well: MW13-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	19-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	345.34 m AMSL
Number:	160340875	**Top of casing elevation:**	346.15 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	533060
Contractor:	Pro Core Drilling	**Northing:**	4814339

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.81 m
0	0		Ground Surface	345.34								
			TOPSOIL clay, organic material, dark brown	0.00			1	SS	1-2-4-6 (6)	7" 29%		Concrete
				344.42								Holeplug
			SILTY CLAY light brown	0.91			2	SS	1-2-4-4 (6)	24" 100%		
5			becoming coarser with depth		ATB1	Upper Maryhill Port Stanley Till and Equivalents						52 mm Schedule 40 PVC casing
	2		becoming clayey silt, some sandy silt				3	SS	2-3-6-8 (9)	14" 58%		
				343.05								
			SANDY SILT fine grained sand, light brown, moist	2.29			4	SS	6-6-6-7 (12)	2" 8%		Top of sand (2.4 m BGS)
10				342.14								Top of screen (3.1 m BGS)
			SILTY SAND fine grained, light brown, wet	3.20			5	SS	0-3-3-7 (6)	16" 67%		No.2 Silica Sand
	4				AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents						No.10 Slot PVC screen 50 mm diameter
15			some medium sand, trace silt beginning at 4.6 m BGS				6	SS	1-2-2-3 (4)	24" 100%		Bottom of screen (4.6 m BGS)
				340.16								
			End of Borehole	5.18								
20	6											
25	8											

Screen Interval: 3.05 - 4.57 m BGS
Sand Pack Interval: 2.44 - 4.57 m BGS
Well Seal Interval: 0.30 - 2.44 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Test Pit: TP3-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	350.20 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532454
Contractor:	Pro Core Drilling	**Northing:**	4814491

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	350.20					
			TOPSOIL silt, organics, dark brown, moist	0.00					
				349.90					
			SANDY SILT fine grained, light brown, loose, moist	0.30	ATB1	Upper Maryhill Port Stanley Till and Equivalents			
2	1								
4									
6	2								
8									
10	3								
12			End of Test Pit	346.54 3.66					
	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP4-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.80 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532628
Contractor:	Pro Core Drilling	**Northing:**	4814574

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	346.80					
			TOPSOIL clayey silt with organics, dark brown, moist	0.00					
				346.40					
			SAND medium grained, some fine and coarse sand, light brown, loose, moist	0.40					
2					AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
	1		becoming wet at 1.0 m BGS	345.79					
			SAND some fine gravel, light brown, loose, well graded, wet	1.01					
4									
			standing water encountered at 1.8 m BGS	345.03					
6			End of Test Pit	1.77					
	2								
8									
10	3								
12									
	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

Drawn By/Checked By: OR/LV

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP6-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	11-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	350.60 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532803
Contractor:	Pro Core Drilling	**Northing:**	4814702

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	350.60					
			TOPSOIL organics, dark brown, moist	0.00					
				350.20					
			CLAYEY SILT light brown, soft, moist	0.40					
2	1		wet layer at 1.1 m BGS		ATB1	Upper Maryhill Port Stanley Till and Equivalents			
4									
6	2								
				348.31					
8			SILT some clay, grey, soft, moist to wet	2.29					
				347.70					
10	3		CLAY grey, soft to firm, moist to wet	2.90					
				347.49					
			End of Test Pit	3.11					
12	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP7-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	352.80 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532458
Contractor:	Pro Core Drilling	**Northing:**	4814292

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	352.80					
			TOPSOIL clayey sand, organics, brown	0.00 352.50					
			SAND fine grained, brown, loose, moist	0.30	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
2									
	1								
4									
6									
	2								
8									
10									
	3								
12									
	4		End of Test Pit	348.84 3.96					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP8-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.30 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532890
Contractor:	Pro Core Drilling	**Northing:**	4814475

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	346.30					
			CLAYEY SILT some organics, brown, moist	0.00	ATB1	Upper Maryhill Port Stanley Till and Equivalents			
				345.08					
			SILT some clay, light brown, soft to firm, moist	1.22					
				344.47					
			SAND fine grained, little silt, light brown, loose	1.83	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
			becoming wet at 2.3 m BGS						
			standing water encountered at 3.35 m BGS	342.95					
			End of Test Pit	3.35					

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

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STANTEC BOREHOLE AND WELL 160330975 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP9-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	11-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	356.60 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	533098
Contractor:	Pro Core Drilling	**Northing:**	4814768

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	356.60					
			TOPSOIL FROST fine grained with organics, dark brown, moist	0.00 356.30					
			SAND fine to medium grained, medium to light brown, loose, moist	0.30	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
2	1								
4									
6	2								
8									
10	3								
12									
	4		End of Test Pit	352.66 3.94					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP10-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	355.20 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	533243
Contractor:	Pro Core Drilling	**Northing:**	4814589

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	355.20					
			TOPSOIL fine to medium grained sand with organics, dark brown, moist	0.00 354.90					
			SAND fine to medium grained, some coarse sand, trace gravel, trace cobbles (rounded), trace boulders, light brown, loose, moist	0.30					
2	1		gravel seam approx 0.15 m thick at 0.9 m BGS						
4									
6	2				AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
8									
10	3			351.33					
12	4		End of Test Pit	3.87					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

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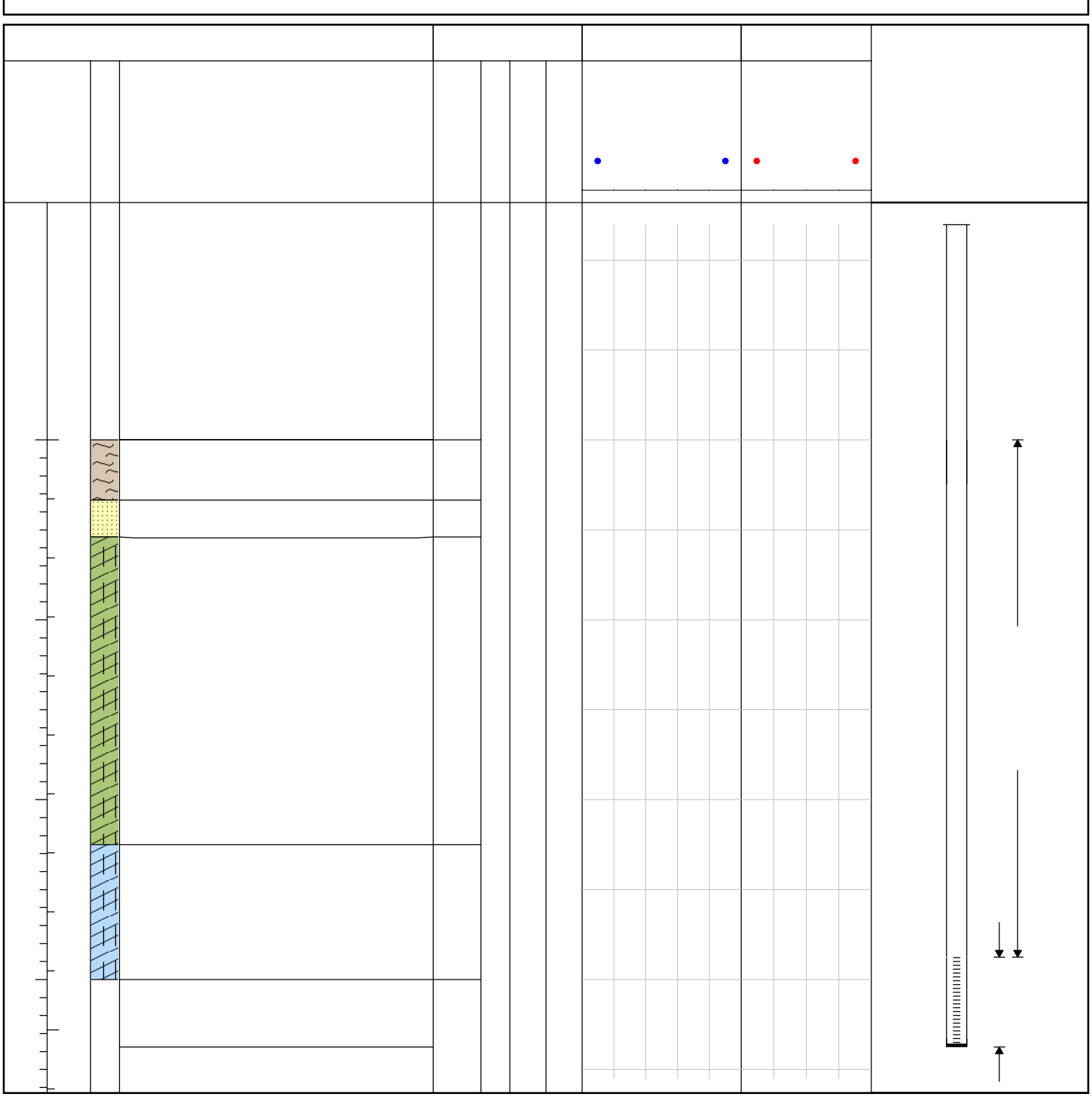
Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER



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Appendix D
FSR

Design Calculations

NORTHGATE and ERBSVILLE KARTWAY SUBDIVISIONS

CITY OF WATERLOO, Ontario

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 39502-104
Date: July 6, 2020
Design By: epb
Checked By: XXX
File: Q:\39502\104\Prelim Sanitary\39502-104 Sanitary Sewer Design Sheet Waterloo (SSMS) Rev4 -epb.xls

Drainage Area Plan No: Figure 7.0

Design Parameters

Average Daily Flow
Residential 0.00318 L/s/c
275.0 L/c/day
Commercial 1.5 L/s/ha
Industrial 0.5 L/s/ha
Inst. / School 2.5 L/s/ha

Mannings "*n*" 0.0130
Min. Velocity 0.6 m/sec
Max. Velocity 3.0 m/sec
Residential Harmon Peaking Factor (F)
Residential Areas Infiltration 0.15 L/s/ha

LOCATION				RESIDENTIAL AREAS and POPULATION						SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN					
										HECTARES AND FLOW OF EACH ZONING																	
										2.50 *L/s/ha*			1.50 *L/s/ha*			0.50 *L/s/ha*											
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	MAX UNITS	DENSITY	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS-C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
				each	*ppu*	*1000s*	*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*
To CONSERVATION DRIVE SPS																											
Stage 8	1			14	3.30	0.046	0.046	4.321517	0.6355	0.00	0.000	0.0000	0.00	0.000	0.0000	0.00	0.000	0.0000	0.0000	4.16	4.160	0.6240	1.2595	0.0	0.50	250	42.0285	0.857
Stage 6 + 7	2			35	3.30	0.116	0.162	4.180286	2.1515		0.000	0.0000		0.000	0.0000		0.000	0.0000	0.0000	6.97	11.130	1.6695	3.8210	0.0	0.50	250	42.0285	0.857
Stage 2 (30T-17402)	3			26	3.30	0.086	0.086	4.261186	1.1637	0.00	0.000	0.0000	0.00	0.000	0.0000	0.00	0.000	0.0000	0.0000	2.01	2.010	0.3015	1.4652	0.0	0.60	200	25.3927	0.809
Stage 1 (30T-17402) + part of Stage 4	4			29	3.30	0.096	0.096	4.248747	1.2942	0.00	0.000	0.0000	0.00	0.000	0.0000	0.00	0.000	0.0000	0.0000	1.17	1.170	0.1755	1.4697	0.0	0.60	200	25.3927	0.809
Stage 4	5			149	3.30	0.492	0.835	3.84916	10.2287		0.000	0.0000		0.000	0.0000		0.000	0.0000	0.0000	7.04	21.350	3.2025	13.4312	0.0	0.60	200	25.3927	0.809
Stage 4 (Multi-Res)	6			88	2.18	0.192	1.03	3.792582	12.3941		0.000	0.0000		0.000	0.0000		0.000	0.0000	0.0000	1.19	22.540	3.3810	15.7751	0.0	0.50	250	42.0285	0.857
To BEAVER CREEK ROAD SPS																											
Stage 3 (Multi-Res)	7			507	2.18	1.105	1.105	3.771556	13.2680	0.00	0.00	0.0000	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	5.91	5.91	0.8865	14.1545	0.0	0.60	200	25.3927	0.809
Stage 1 (Multi-Res)	8			88	2.18	0.192	1.297	3.724317	15.3758	0.00	0.00	0.0000	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	1.06	1.06	0.1589	15.5347	0.0	0.60	200	25.3927	0.809
Stage 1 (SF)	8			65	3.30	0.215	1.512	3.677135	17.6915		0.00	0.0000		0.00	0.0000		0.00	0.0000	0.0000	3.02	4.08	0.6119	18.3034	0.0	0.60	200	25.3927	0.809
																					73.41						
				1001	Max. units																						

NORTHGATE and ERBSVILLE KARTWAY SUBDIVISIONS

CITY OF WATERLOO, Ontario

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 39502-104
Date: July 6, 2020
Design By: EPB
Checked By: Val
File: Q:\39502\104\Prelim Storm\39502-104 Storm Sewer Design Sheet Waterloo(SSMS)_Rev5-Final.xlsx

Drainage Area Plan No: Figure 6.0

PRELIMINARY

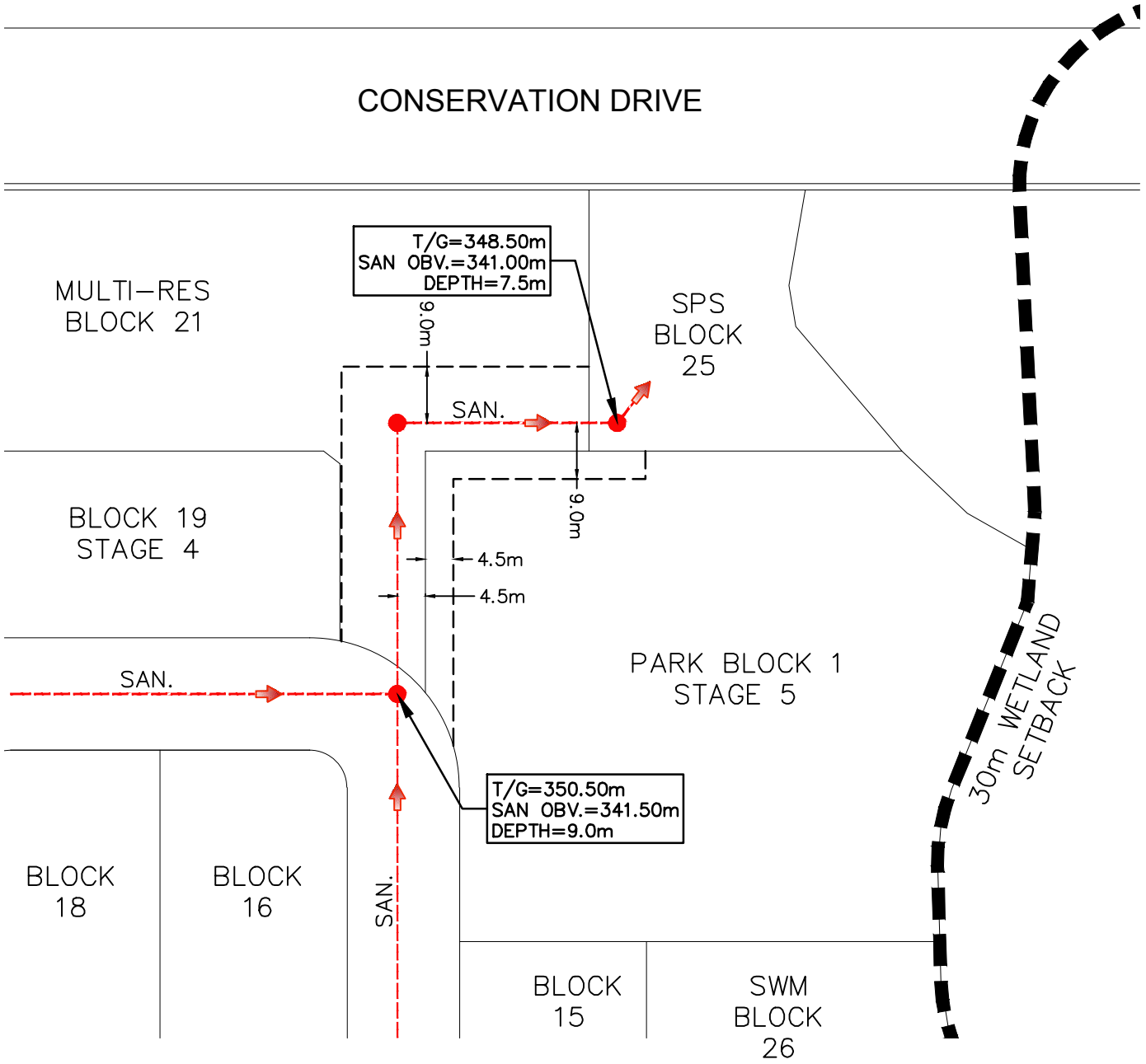
Design Parameters

5 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = a/(tc+b)^c
a = 1755
b = 12.3
c = 0.895

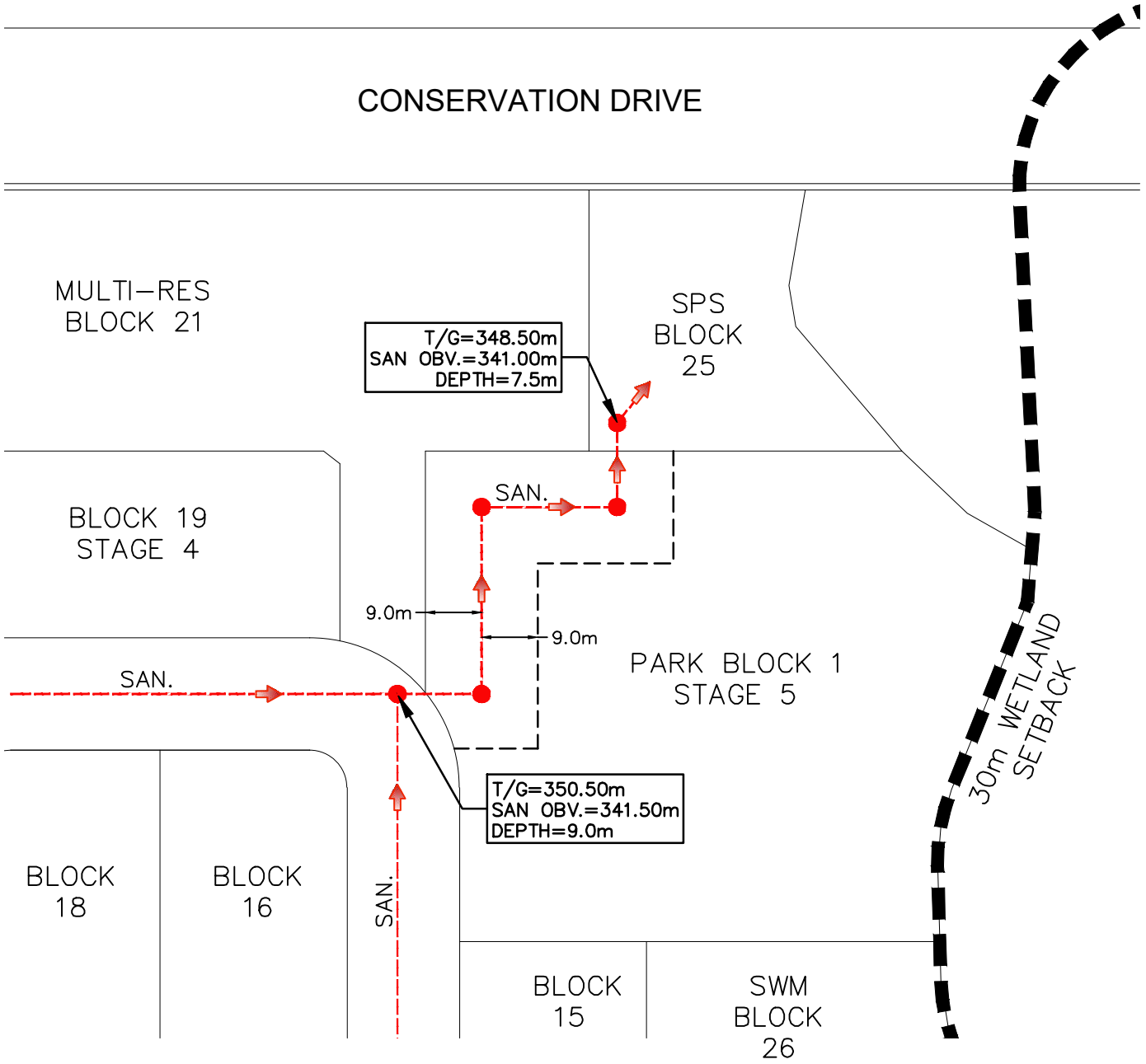
Manning's "n" 0.013
Min. Velocity 0.600 m/s
Max. Velocity 6.000 m/s

LOCATION				STORMWATER FLOW 5 YEAR STORM								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/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*%*
WEST Side of Beaver Creek																	
Condo (Stage 7)	1			0.500	0.650	0.3250	0.3250	10.0000	1.9423	108.82431	98.0	375	145.0	0.50	123.97713	1.1225	79.02
Condo (Stage 7)	2			0.970	0.650	0.6305	0.9555	11.9423	2.2086	101.00201	267.3	525	210.0	0.50	304.09995	1.4048	87.91
Condo (Stage 2)	3			1.320	0.650	0.8580	0.8580	10.0000	2.5368	108.82431	258.6	525	240.0	0.50	304.09995	1.4048	85.05
Street Three	4			0.390	0.650	0.2535	0.2535	10.0000	1.1295	108.82431	76.4	375	80.0	0.50	123.97713	1.1225	61.64
Street Three	5			0.420	0.650	0.2730	1.3845	12.2158	0.4454	99.99491	383.5	525	60.0	1.00	430.06227	1.9867	89.17
Street Three	6			0.600	0.750	0.4500	2.7900	13.2731	1.0278	96.29345	744.2	750	125.0	0.50	787.20572	1.7819	94.53
Street Three	7			0.300	0.650	0.1950	0.1950	10.0000	1.2260	108.82431	58.8	300	80.0	0.50	68.37776	0.9673	85.97
Street Five	8			1.430	0.650	0.9295	1.1245	11.2260	2.0803	103.74486	323.2	600	210.0	0.50	434.17173	1.5356	74.43
Street Three	9			0.440	0.650	0.2860	0.2860	10.0000	1.0308	108.82431	86.2	375	75.0	0.50	123.97713	1.1225	69.54
Street Four	10			0.690	0.650	0.4485	0.7345	11.0308	1.4260	104.51956	212.7	525	130.0	0.50	304.09995	1.4048	69.93
Street Seven	11			0.480	0.750	0.3600	0.3600	10.0000	0.9877	108.82431	108.5	375	75.0	0.50	123.97713	1.1225	87.53
Street Four	12			0.480	0.650	0.3120	1.4065	11.9604	0.8450	100.93475	393.2	675	90.0	0.50	594.38558	1.6610	66.16
Street Eight	13			0.510	0.650	0.3315	1.7380	12.8055	0.7237	97.89430	471.3	675	80.0	0.50	594.38558	1.6610	79.29
Street Eight	14			0.400	0.650	0.2600	3.1225	13.4385	0.5843	95.74048	828.1	900	75.0	0.50	1280.08329	2.0122	64.69
Street Six	15			0.400	0.650	0.2600	6.1725	14.1545	0.5017	93.42233	1597.3	1050	75.0	0.50	1930.91431	2.2299	82.72
Street Six	16			1.160	0.750	0.8700	0.8700	10.0000	1.3184	108.82431	262.3	525	125.0	0.50	304.09995	1.4048	86.24
Street Six	17		pond	0.650	0.650	0.4225	7.4650	14.1854	0.3279	93.32482	1929.8	1050	50.0	0.50	1930.91431	2.2299	99.94
Totals				*11.140*		*7.465*											
EAST Side of Beaver Creek																	
Street One	1			4.540	0.750	3.4050	3.4050	10.0000	1.2929	108.82431	1026.4	675	270.0	1.70	1095.99286	3.0627	93.65
Street One	2			0.420	0.650	0.2730	0.2730	10.0000	0.9718	108.82431	82.3	375	70.0	0.50	123.97713	1.1225	66.38
Street Two	3			1.440	0.650	0.9360	4.6140	11.2929	0.9652	103.48200	1322.6	900	160.0	0.75	1567.77545	2.4644	84.36
Street Two	4			1.980	0.650	1.2870	5.9010	12.2581	0.8798	99.84116	1632.0	900	170.0	1.00	1810.31115	2.8456	90.15
Street Two	5				0.650	0.0000	5.9010	13.1379	0.0787	96.75079	1581.5	900	20.0	2.00	2560.16658	4.0243	61.77
Totals				*8.380*		*5.9010*											



CONNECTION OPTION 'A'

SCALE 1:1000



CONNECTION OPTION 'B'

SCALE 1:1000

Appendix E
FSR

Preliminary Water Distribution Analysis

Northgate and Erbsville Kartway Subdivisions Beaver Creek Meadows District, Waterloo

Preliminary

Water Distribution Analysis

Project Location:

East of Erbsville Road
West of Beaver Creek Road
South of Conservation Drive
City of Waterloo

Prepared for:

1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate)
1455136 Ontario Inc. (Erbsville Kartway)
c/o Mr. Paul Grespan
675 Riverbend Drive
Kitchener, ON N2K 3S3

Prepared by:

MTE Consultants
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

July 5, 2017
Revised: July 17, 2020

MTE File No.: 39502-104

Engineers, Scientists, Surveyors.

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Appendix A Pressure Information (Region of Waterloo)
Appendix B Usage Rates / Water Demands & Design Values
Appendix C WaterCAD Output Files

1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate) and 1455136 Ontario Inc. (Erbsville Kartway), to prepare a Preliminary Water Distribution Analysis in support of Plans of Subdivision, Plan of Condominium (Vacant Land Condominium), and Zoning By-law amendment applications. The Northgate and Erbsville Kartway properties are collectively referred to herein as the 'Subject Lands'. For the purpose of this report, the two Draft Plans will be reviewed as one cohesive development.

The Subject Lands are comprised of 2 parcels with a total area of 55.72ha, of which approximately 49.29ha are Northgate lands and approximately 6.43ha are Erbsville Kartway lands, within the City of Waterloo. Note that the Northgate property (49.29ha) consists of 34.08ha of land located within the proposed subdivision and 15.21ha of open space lands along Beaver Creek, identified as "additional lands" that are outside the boundaries of the subdivision.

The Subject Lands are located within the Beaver Creek Meadows District Plan (BCMDP). The Subject Lands are generally bounded by Conservation Drive to the north, Beaver Creek Road to the east, Laurel Creek and associated conservation lands to the south, and Laurel Creek and agricultural lands to the west. Further west is Erbsville Road. The Subject Lands are bisected by Beaver Creek and hence can be broken down into two separate areas: the east side (east of Beaver Creek) and the west side (west of Beaver Creek). The location of the proposed development is presented in **Figure 1.1**.

The Subject Lands are proposed to be developed primarily as a residential community. The Draft Plans of Subdivision for the proposed developments has been prepared by MHBC Planning (dated July 14, 2020) and forms the basis for the proposed watermain servicing design presented in this report.

The purpose of this Preliminary Water Distribution Analysis is to confirm that adequate pressure and water supply is available to support the proposed development, through connections to the existing and future City of Waterloo water distribution network. This preliminary analysis is also used to determine the pipe sizes for the proposed internal water distribution network and whether the pressures within the development under various demand scenarios, including fire flow, are within the guidelines set out by the Ministry of the Environment, Conservation and Parks (MECP – previously known as MOE or MOECC), the Region of Waterloo, and the City of Waterloo.

This report supersedes the July 5, 2017 report to address changes to the Draft Plans of Subdivision.

1.2 Background Information

The Draft Plans are comprised of single family residential blocks, multiple residential blocks, a potential mixed-use block, stormwater management block, sanitary pumping station blocks, park blocks, open space blocks, walkways and municipal right-of-ways, and two separate (layered) private condominium developments. The two separate (layered) vacant land condominium developments will proceed under separate applications.

The Subject Lands are located within Waterloo Pressure Zone 5. Based on modelling results received from the Region, the current hydraulic grade line (HGL) of Zone 5 is approximately 404.4m, with a serviceability range of approximately 348.4m to 368.4m. It is our understanding that as part of the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment, prepared by Stantec Consulting Ltd.

dated December 14, 2015 the existing 300mm diameter watermain on Erbsville Road near Regal Place will be extended north and then east on Conservation Drive and south on Beaver Creek Road and will connect to the existing 300mm diameter watermain north of Laurelwood Drive creating a loop within the north end of Zone 5. In addition, we understand that the existing 300mm diameter watermain on Conservation Drive near Roy Schmidt Road is to be connected to this new Zone 5 loop at the intersection with Beaver Creek Road and as a result merging Pressure Zones 5 and 4c into one consolidated pressure zone. It is expected that these future watermain extensions will be undertaken coincident with upgrading both Conservation Drive and Beaver Creek Road prior to servicing of the Subject Lands. We also understand that as part of the BCMDP, there are currently other development applications filed and as such more accurate HGL information will be used as it becomes more readily available at a future date.

The current HGL information has specified that any centerline of road elevation below 348.4m may require individual pressure reducing valves (PRVs) on service connections, as specified in section B.2.4.7 of the *Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) (RMOW, 2020)*. The proposed ground contours of the site range from approximately 349.9m to 356.8m. Therefore, it is not anticipated that any service connections will require PRVs.

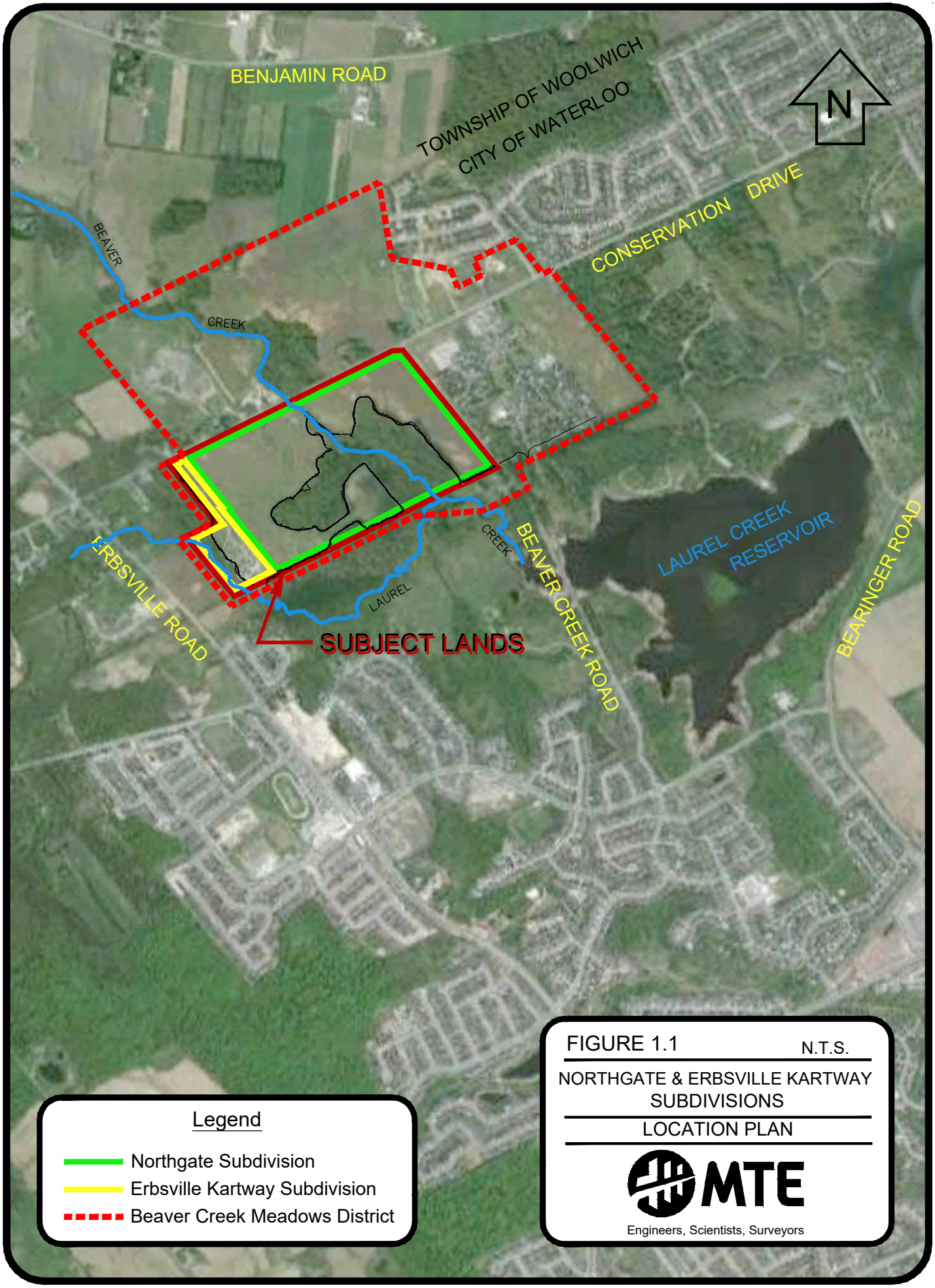
2.0 Analysis Methodology

2.1 Model Development

The Bentley water distribution system analysis program (WaterCAD CONNECT Edition) was utilized for the analysis of the local water distribution system for this study. The model utilizes demands for the fully-developed proposed subdivision. The Region of Waterloo maintains a macro scale water distribution model developed for trunk supply and distribution of water. The macro scale pressure and flow information from the Region's model is used in MTE's micro scale model to ensure the system operates within the allowable pressure ranges. The WaterCAD model includes the proposed road fabric and watermain connectivity to size the internal watermains, accounting for looping and head losses in the local system. The Region's modeling information was based on the proposed Zone 5 loop and did not include the merging with Zone 4c. This future connection will further improve the system.

2.1.1 Model Scenarios

One servicing scenario was modeled for the proposed Northgate and Erbsville Kartway development. The private condominium developments will each have private water supplies and will be included under separate applications, however, this scenario shows the conceptual watermain servicing for these condominium developments for information only. Each condominium development will have only one connection to the municipal water distribution system and will also be equipped with a backflow valve.



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May 20, 2020 — 3:50 p.m. — Plotted By: RBrezo

2.1.2 Network Connections

Both the west and east areas of the proposed development will connect directly to the proposed Regional watermain extensions on Conservation Drive and Beaver Creek Road. There will be a total of five connection points for the entire proposed development: two for the west side and three for the east side. The connections to the municipal water distribution system are as follows:

West of Beaver Creek

- Connection to the proposed 300mm diameter watermain extension on Conservation Drive at the intersection with Street Three.
- Connection to the proposed 300mm diameter watermain extension on Conservation Drive at the intersection with Street Seven.

East of Beaver Creek

- Connection to the proposed 300mm diameter watermain extension on Conservation Drive at the intersection with the north branch of Street One.
- Connection to the proposed 300mm diameter watermain extension on Beaver Creek Road at the intersection with the south branch of Street One.
- Connection to the proposed 300mm diameter watermain extension on Beaver Creek Road at the intersection with Street Two.

The nearest existing Region of Waterloo Water Distribution Model nodes are JCT_78138 and JCT_78134. Node JCT_78138 is located at the intersection of Conservation Drive and Street Three at an elevation of approximately 352m. Node JCT_78134 is located at the intersection of Beaver Creek Road and Street One at an elevation of approximately 352m. Node JCT_78138 was used to supply water for the west side of the proposed development and node JCT_78134 was used to supply the east side. Refer to **Figure 2.1** for more details regarding the layout of the water distribution network, location of the nodes, network connections, and water demand contributing areas. **Figure 2.1** also shows the conceptual private water supply layout for both condominium developments.

JCT_78138
J-25
PROPOSED 300mmØ WTM EXTENSION
CONSERVATION DRIVE
PROPOSED 300mmØ WTM EXTENSION
J-24
EX. 300mmØ WTM
JCT_78135
J-18
STREET ONE
PROPOSED 300mmØ WTM EXTENSION
200mmØ WTM
200mmØ WTM
STREET SEVEN
Stage 4
J-3
200mmØ WTM
J-1
STREET FOUR
J-2
Stage 5
Stage 3
Stage 3
J-19
300mmØ WTM
STREET EIGHT
STREET SIX
J-9
J-4
150mmØ WTM
J-5
STREET THREE
Floodline
J-6
STREET FIVE
Stage 4
Stage 2
J-20
200mmØ WTM
J-21
JCT_78134
J-10
J-15
J-7
150mmØ WTM
BCK FLOW
J-8
WATERLOO PRESSURE ZONE 5
Creek
Floodline
Floodline
BEAVER CREEK ROAD
200mmØ WTM
STREET TWO
J-22
Stage 1
J-12
J-11
PRIVATE VACANT LAND CONDOMINIUM
Stage 2
Stage 2
Laurel Creek
Floodline
VLC "A"
VLC "B"
PRIVATE 200mmØ WTM
J-13
J-14
J-16
J-17
Stage 8
Stage 8
JCT_78133
J-23
Laurel Creek

LEGEND

	SUBJECT LANDS
J-3	DEMAND JUNCTION
JCT_78138	REGION OF WATERLOO SUPPLY NODE
BCK FLOW	BACKFLOW PREVENTER VALVE
	JUNCTION CONTRIBUTING AREA
	VACANT LAND CONDOMINIUM JUNCTION CONTRIBUTING AREA
J-3	VACANT LAND CONDOMINIUM DEMAND JUNCTION
150mmØ WTM	PROPOSED 150mmø WTM
200mmØ WTM	PROPOSED 200mmø WTM
300mmØ WTM	PROPOSED 300mmø WTM EXTENSIONS (BY OTHERS)
150mmØ WTM	VLC "A" PRIVATE WATER SUPPLY
200mmØ WTM	VLC "B" PRIVATE WATER SUPPLY
300mmØ WTM	EXISTING 300mmø WTM

FIGURE 2.1

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

CONCEPTUAL WATER DISTRIBUTION NETWORK

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 1:39 p.m. — Plotted By: AHenderson

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2.2 Design Criteria

The network for the analysis was developed by assigning physical parameters to each node and pipe. The model was run under five demand scenarios: Average Day, Maximum Day, Minimum Hour, Peak Hour, and Maximum Day + Fire Flow. Each scenario was checked against guidelines for pressure and fire flow availability. The model parameters, design criteria, and guidelines are outlined in the following sections.

2.2.1 System Pressure

The system pressure information used for this analysis is based on the Region's water distribution model results provided by the Region (Mr. Kevin Dolishny) on March 24, 2017 for nodes JCT_78138 and JCT_78134. These results were confirmed by the Region to still be appropriate on May 20, 2020. The system pressures were determined for the Average Day, Maximum Day, Peak Hour, Minimum Hour, and Maximum Day + Fire Flow scenarios. **Table 2.1** provides a summary of the system pressures used in the analysis at each Regional node. **Appendix A** contains the system pressure data correspondence with the Region.

Table 2.1 – Regional System Pressures

Demand Scenario	Node 78134		Node 78138	
	Available Flow (L/s)	Residual Pressure (m)	Available Flow (L/s)	Residual Pressure (m)
Initial (Estimated)	0.00	404.00	0.00	404.00
Minimum Hour	1.16	404.59	1.10	404.56
Average Day	3.03	404.44	2.88	404.40
Maximum Day	4.32	403.39	4.10	403.39
Peak Hour	7.62	401.72	7.23	401.72
Max Day + 50L/s	54.28	401.00	54.06	400.80
Max Day + 100L/s	104.28	395.00	104.06	394.50
Max Day + 150L/s	154.28	386.30	154.06	385.40
Max Day + 200L/s	204.28	375.10	204.06	373.60
Max Day + 215L/s	219.28	371.20	-	-
Max Day + 219L/s	-	-	223.06	368.40

2.2.2 System Demands

The system demands for the subdivision were determined using the proposed population, based on land zoning, and specific water usage rates for the City of Kitchener from the *Tri-City Water Distribution Master Plan (AECOM, May 2009)* and *Region of Waterloo 2019 Water and Wastewater Monitoring Report (RMOW, 2019)*. Residential demands were derived for representative areas contributing to each node in the model, multiplied by the respective persons per unit designation from the *Region of Waterloo 2019 Water and Wastewater Monitoring Report* (refer to Note 2 in Appendix B), multiplied by 227.7L/p/d per the *Tri-City Water Distribution Master Plan* and then converted to L/s. Based on the Region's maximum unit densities, the estimated population of the subdivision is approximately 2,254. The unit densities, average usage rates, and demand calculations for each node are provided in **Appendix B**.

2.2.3 Peaking Factors

The peaking factors are based on the population of the development (2,001-3,000) as outlined in Chapter 3 of the *Design Guidelines for Drinking-Water Systems (MOE, 2008)*. However, the Maximum Day peaking factor is taken from the Region's Tri-City Water Distribution Master Plan as provided in the Recommendations. **Table 2.2** summarizes the peaking factors used in the analysis based on the population calculated in **Appendix B**.

Table 2.2 – Peaking Factors

Demand Scenario	Factor
Average Day	1.00
Maximum Day	1.44
Peak Hour	3.38
Minimum Hour	0.45

2.2.4 Pressure Requirements

As outlined in Section B.2.4 of the *DGSSMS*, the pressure guidelines used for all demand scenarios are shown in Table 2.3. The maximum static pressure in the watermain system should not exceed 700kPa under any scenario.

Table 2.3 – DGSSMS Pressure Guidelines

Demand Scenario	Pressure Guidelines (kPa)	
	Minimum	Maximum
Average Day	350	550
Maximum Day	350	550
Peak Hour	275	700
Minimum Hour	275	700
Max Day + Fire	140	700

2.2.5 Fire Flow Requirements

Various guidelines and references exist for calculating the required water supply for firefighting purposes. In Ontario, 2 standards/guidelines are most often referenced. They are:

1. Ontario Building Code (OBC) – Provincial codes and guidelines published by the Ministry of Municipal Affairs and Housing for the Province of Ontario.
2. The Fire Underwriters Survey (FUS) – an insurance industry guideline.

Many municipalities in Ontario use both the OBC and the FUS fire flow requirements for assessing firefighting water supply requirements. Ideally, fire flow demands for new developments are calculated based on the FUS criteria, however it is not reasonable to expect that the existing municipal watermain infrastructure always has the operational capacity to supply water at the rates prescribed in the FUS guidelines. As a result, at no time shall the available fire flow be less than that required by the Ontario Building Code.

The fire flow demand for the development was determined from the *Water Supply for Public Fire Protection, A Guide to Recommended Practice (1999), Fire Underwriter's Survey (FUS)*. Based on the FUS manual, the conceptual required fire flow is as follows:

- High-density, multiple residential/mixed-use – 11,000 L/min (183 L/s)
- Medium-density, contiguous multi-block Townhomes - 8,000 L/min (133 L/s)
- Medium-density, single family homes < 3m separation - 6,000 L/min (100 L/s)

Conceptual fire flow demand calculations for Blocks 20 and 21 are provided in **Appendix B** using only conceptual plans for these blocks. At this time, the site plans for all blocks have not been finalized and therefore the calculations for fire flow demand for these and remaining blocks will be completed as more current information is made available.

2.2.6 Friction Factors

Section B.2.3.1 of the *DGSSMS* recommends the following Hazen-Williams "C" values be used to estimate frictional losses through the system, regardless of size. The friction factors, as specified in Section B.2.3.1, include an allowance for age.

Table 2.4 – Hazen-Williams C-Factors

Material (mm)	C-Factor
PVC	150
DI	130
CPP	140
HDPE	140
Unknown	130

2.2.7 Velocity Requirements

Section B.2.3.4 of the *DGSSMS* recommends that velocities throughout the distribution system not exceed a maximum of 5.0 m/s under all flow conditions.

2.2.8 Minor Losses

Minor losses are caused by appurtenances and fittings along the length of pipe in the system. For this preliminary analysis, a conservative K value of 1.0 was used for all pipes.

3.0 Results

The model was run to analyze the pipe sizes according to the aforementioned design criteria, under the various demand scenarios. **Appendix C** provides the proposed network and a series of tables summarizing the output results of the WaterCAD analysis. **Table 3.1** demonstrates that the water distribution system will adequately service the development, while providing adequate flows within the *DGSSMS* recommended pressures for the Average Day, Maximum Day, Peak Hour, and Minimum Hour, and the recommended *FUS* fire flows at the minimum MECP pressure of 140kPa.

Table 3.1 – Modelling Results for Proposed Development

Node	Elev. (m)	Pressure (kPa)				Maximum Day + Fire Flow				
		Average Day	Maximum Day	Minimum Hour	Peak Hour	Fire Flow Required (L/s)	Available Fire Flow (L/s)	Residual Pressure (kPa)	Velocity of Max Pipe (m/s)	Pipe with Max. Velocity
J-1	352.60	500.3	500.2	500.5	499.0	100.00	202.80	140.0	3.79	P-2
J-2	351.65	509.6	509.5	509.8	508.3	183.00	204.10	143.2	3.53	P-3
J-3	351.05	515.5	515.3	515.6	514.1	183.00	191.77	140.0	3.83	P-5
J-4	352.20	504.2	504.1	504.4	502.9	100.00	189.34	140.0	3.96	P-6
J-5	350.98	516.2	516.0	516.3	514.8	100.00	160.96	140.0	4.59	P-8
J-6	350.46	521.3	521.1	521.4	519.9	100.00	188.88	140.0	3.36	P-5
J-7	350.69	519.0	518.8	519.2	517.6	100.00	177.29	152.2	3.10	P-6
J-8	350.29	522.9	522.8	523.1	521.5	100.00	184.78	144.6	3.14	P-2
J-9	350.13	524.5	524.3	524.6	523.1	100.00	154.22	140.0	4.63	P-16
J-11	*351.31*	*512.9*	*512.8*	*513.1*	*511.5*	*100.00*	*133.64*	*156.7*	*7.59*	*P-17*
J-12	*351.89*	*507.3*	*507.1*	*507.4*	*505.8*	*100.00*	*117.70*	*140.0*	*6.69*	*P-17*
J-13	*353.02*	*496.2*	*496.0*	*496.4*	*494.8*	*100.00*	*106.69*	*140.0*	*6.07*	*P-17*
J-14	*352.65*	*499.8*	*499.7*	*500.0*	*498.4*	*100.00*	*109.19*	*140.0*	*6.21*	*P-17*
J-16	*353.09*	*495.5*	*495.4*	*495.7*	*494.1*	*100.00*	*122.55*	*140.0*	*3.91*	*P-22*
J-17	*350.83*	*517.6*	*517.5*	*517.8*	*516.2*	*100.00*	*102.18*	*140.0*	*3.26*	*P-22*
J-18	355.71	470.1	469.9	470.3	468.2	183.00	205.06	145.6	1.60	P-27
J-19	354.20	484.9	484.7	485.1	483.0	183.00	207.93	157.8	1.80	P-27
J-20	353.85	488.3	488.1	488.5	486.4	133.00	207.41	160.9	1.97	P-27
J-21	353.35	493.2	493.0	493.4	491.3	183.00	209.31	168.9	1.99	P-28
J-22	352.78	498.8	498.6	499.0	496.9	100.00	198.63	140.0	3.67	P-29
J-23	351.70	509.4	509.1	509.6	507.5	183.00	204.17	140.0	4.05	P-31

**Rows highlighted in grey represent the private water supply for the condominium developments and are shown for information only.*

The pipe velocity did not exceed the *DGSSMS* recommended 5.0m/s in any of the municipal pipes. This velocity was only exceeded in the pipes within the private condominium developments under the fire flow condition. These pipe sizes were not increased for the sole purpose of reducing the maximum velocity experienced under the rare fire flow condition, as this may create an environment for stagnant water conditions to arise when demands are lower (ie. Average Day).

4.0 Conclusions and Recommendations

Based on the preliminary water distribution analysis, the following conclusions and recommendations are provided:

1. Connections to the proposed City of Waterloo watermains will adequately service the proposed water distribution network for the proposed Northgate and Erbsville Kartway Subdivision. It is expected that the future 300mm diameter watermain extensions will be undertaken coincident with upgrading of both Conservation Drive and Beaver Creek Road prior to servicing of the Subject Lands.
2. The proposed water distribution network will provide system pressures within the respective pressure guidelines and will not require pressure reducing valves.
3. Water model results indicate that the proposed water distribution system will adequately provide the recommended *FUS* fire flows at the minimum MECP pressure of 140kPa.
4. Pipe velocities were less than the *DGSSMS* recommended 5.0m/s for all municipal pipes within the subdivision under fire flow conditions. The pipe sizes within the private condominium development, experiencing pipe velocities greater than 5.0m/s, were not increased for the sole purpose of reducing the maximum velocity experienced under the rare fire flow condition, as this may create an environment for stagnant water conditions to arise under normal daily demands.

It is recommended that a final water distribution analysis report be prepared during the final design of the proposed Northgate and Erbsville Kartway Subdivision.

All of which is respectfully submitted;

MTE Consultants Inc.



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Appendix A
Water Distribution

Pressure Information (Region of Waterloo)

From: Kevin Dolishny <KDolishny@regionofwaterloo.ca>
Sent: Wednesday, May 20, 2020 9:48 AM
To: Michael Felinczak <MFelinczak@mte85.com>
Cc: John Holowackyj <JHolowackyj@regionofwaterloo.ca>; Valentina Lazic <vlazic@mte85.com>
Subject: Re: 39502-104: Northgate & Erbsville Kartway Subdivision (30T-17401) - Water Distribution Analysis

Hi Michael,

The 2017 results are still appropriate to use. The results included the construction of all of the surrounding 300mm watermain on Beaver Creek Dr, Conservation Dr, and Erbsville Rd already so they reflect future conditions. All of those watermain are required to support the proposed subdivision. The change in elevation should be inconsequential. The hydraulic grade line should be used anyway, and the pressures calculated based on the HGL and the elevations.

Kevin Dolishny, P. Eng. | Senior Engineer
Water Services | Region of Waterloo
519-575-4757x3862 | mobile 226-751-4551
kdolishny@regionofwaterloo.ca

From: Michael Felinczak <MFelinczak@mte85.com>
Date: Wednesday, May 20, 2020 at 9:21 AM
To: Kevin Dolishny <KDolishny@regionofwaterloo.ca>
Cc: John Holowackyj <JHolowackyj@regionofwaterloo.ca>, Valentina Lazic <vlazic@mte85.com>
Subject: 39502-104: Northgate & Erbsville Kartway Subdivision (30T-17401) - Water Distribution Analysis

Good morning Kevin,

We are currently undergoing some revisions to our water distribution analysis of the Northgate & Erbsville Kartway Subdivision in Waterloo, which was originally created in 2017. The Draft Plan slightly changed, mostly wetland buffers and some roads were moved slightly with no significant impact to the demands. You had originally provided the results of the Regional analysis to us (Gavin Vermeer) on March 24th 2017, which I have attached. This analysis included the following Regional nodes:

ROW Node JCT_78134 – Beaver Creek Road and Proposed Street One
ROW Node JCT_78138 – Conservation Drive and Proposed Street Three

I don't imagine that much has changed in the area since 2017 to create an impact to the surrounding distribution system. But would you be able to comment whether or not you believe a new Regional analysis would be necessary? I have attached a figure of our internal subdivision nodes and pipes as well as a spreadsheet outlining the demands at each node, if needed.

Also, as you may be aware, the City is in the process of planning the reconstruction of Conservation Drive and Beaver Creek Road and as such, the road grades are still in the process of being finalized. Can you comment on whether this will have an impact on the Regional node elevations?

Please let me know if you need any clarification.
Kind Regards,
Michael

Michael Felinczak, E.I.T. | Designer
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COVID-19 Update: We remain operational and are currently available by email and phone, however, our offices are closed. Staff that are required to visit job sites or perform field work are required to follow MTE health and safety policies and procedures, as well as additional COVID-19 protocols, which can be viewed here.

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Region of Waterloo

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ENVIRONMENTAL SERVICES
Water Services

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Date: March 24, 2017
File #: E18-10/WA

Gavin Vemeer, P. Eng.,
Design Engineer
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9
t. 519.743.6500x1279
e. GVemeer@mte85.com

Dear: Gavin

Re: Northgate Subdivision Conservation Dr, Waterloo

Please find the results of the modeling simulations for boundary conditions requested on February 17, 2017. The results included a figure showing the locations of the nodes from the Region's model. Additional infrastructure was added for this modelling request to reflect the proposed 300 mm dia watermains to be constructed in the near future. This added infrastructure represents a pressure zone Wat 5 loop in the northern section of the existing pressure zone boundary. All supply of water for this modelling request is from the existing pressure zone 5 with no merging of the adjoining pressure zone Wat 4c. All elevations for the new nodes are based on the existing contours (2014).

New nodes created:

Node (model)	**Node (consultant id)**	**Pressure Zone**	**Elevation** (mASL)
JCT_78134	J-26	Wat 5	352.0
JCT_78138	J-1	Wat 5	352.0
JCT_78139		Wat 5	349.5
JCT_78137	J-2	Wat 5	352.0
JCT_78136	J-18	Wat 5	358.5
JCT_78135		Wat 5	357.0
JCT_78138	J-25	Wat 5	348.0

Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows for node JCT_78134 located at the intersection of Beaver Creek Rd and Proposed Street One and for node JCT_78138 located at the intersection of Conservation Dr and proposed Street Two, Waterloo. The diurnal 24 hour demand distribution accounts for the minimum hour and peak hour peaking factors. The minimum hourly demand on the average day represents the minimum hour, and the maximum hourly demand on the maximum day represents the peak hour.

Demands as applied to nodes in the Northgate Subdivision:

Node	Pressure Zone	Elevation (mASL)	Residential Demand (L/s)		Fire Flow Results	
			Average Day	Maximum Day	Design Flow (L/s)	Design Pressure (m)
JCT_78134	Wat 5	352.0	2.97	4.28	215.0	19.2
JCT_78138	Wat 5	352.0	2.82	4.06	219.0	16.4

A fire flow analysis shows the maximum flow available at a node with an associated design pressure during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

Under existing conditions connectivity to Pressure Zone Wat 4c will improve the fire flow results with the connection to the Lakeshore Pumping Station.

Growth in the proposed Beaver Creek District Plan includes a proposed phasing plan (see Map 6 in the attachments). The initial phase will include a development of a commercial site east of this application. The development of this commercial site could change some of the proposed timing as recommended below. Additional modelling will be required.

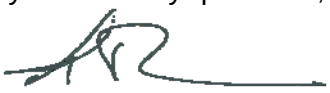
In the Stantec report, Consolidation of Waterloo North Pressure Zones – Staging and Implementation Plan dated October 4 2106.

Section 4.3 recommended the following:

- Northfield PS out of Service (All Watermain upgrades are to be completed prior to the decommissioning of Northfield PS).
- Proposed pump replacement at Lakeshore PS for WB16 **and/or** WB18 (domestic duty pump) with a pump rated for approximately 50 L/s at a TDH of 24 m. The pump replacement should be completed prior to the decommissioning of the Northfield PS.
- Note: A minimum of one pump is to be replaced. A second pump can be replaced depending on preferred level of redundancy and timing for scheduled pump replacement based on asset age.

No timing for the replacement of the pumps has been determined at the Lakeshore Pumping Station.

If you have any questions, please contact me.



Kevin Dolishny P.Eng.
Senior Project Engineer, Servicing and Development Planning
t. 519.575.4757 x 3862
e-mail: kdolishny@regionofwaterloo.ca

WAT 4 Infowater

JCT_78134 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	1.72	404.61	52.61
01:00 hrs	1.28	404.64	52.64
02:00 hrs	1.48	404.60	52.60
03:00 hrs	1.60	404.58	52.58
04:00 hrs	1.43	404.58	52.58
05:00 hrs	1.16	404.59	52.59
06:00 hrs	1.84	404.49	52.49
07:00 hrs	3.95	404.31	52.31
08:00 hrs	4.81	404.16	52.16
09:00 hrs	3.95	404.30	52.30
10:00 hrs	3.86	404.32	52.32
11:00 hrs	3.68	404.36	52.36
12:00 hrs	3.47	404.41	52.41
13:00 hrs	3.30	404.46	52.46
14:00 hrs	3.06	404.51	52.51
15:00 hrs	2.85	404.46	52.46
16:00 hrs	3.03	404.44	52.44
17:00 hrs	3.21	404.42	52.42
18:00 hrs	3.71	404.32	52.32
19:00 hrs	4.04	404.23	52.23
20:00 hrs	4.07	404.19	52.19
21:00 hrs	3.80	404.21	52.21
22:00 hrs	3.36	404.37	52.37
23:00 hrs	2.67	404.49	52.49
Average Day HGL:		404.42	
Minimum Hour:		404.64	

JCT_78134 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	2.01	404.31	52.31
01:00 hrs	1.24	404.41	52.41
02:00 hrs	1.58	404.40	52.40
03:00 hrs	1.88	404.31	52.31
04:00 hrs	1.80	404.28	52.28
05:00 hrs	1.50	404.29	52.29
06:00 hrs	2.78	403.85	51.85
07:00 hrs	5.78	402.55	50.55
08:00 hrs	6.76	402.32	50.32
09:00 hrs	4.84	403.07	51.07
10:00 hrs	3.77	403.53	51.53
11:00 hrs	3.51	403.71	51.71
12:00 hrs	3.08	403.92	51.92
13:00 hrs	3.94	403.50	51.50
14:00 hrs	5.18	403.12	51.12
15:00 hrs	4.32	403.39	51.39
16:00 hrs	5.78	402.84	50.84
17:00 hrs	6.08	402.68	50.68
18:00 hrs	7.10	402.12	50.12
19:00 hrs	7.62	401.72	49.72
20:00 hrs	7.53	401.63	49.63
21:00 hrs	6.76	402.33	50.33
22:00 hrs	4.58	403.52	51.52
23:00 hrs	3.21	403.88	51.88
Maximum Day HGL:		403.32	
Peak Hour:		401.63	

Available Flow (L/s)	Residual Pressure (m)
0.0	52.0
10.0	51.7
20.0	51.2
30.0	50.6
40.0	49.8
50.0	49.0
60.0	48.0
70.0	46.9
80.0	45.7
90.0	44.4
100.0	43.0
110.0	41.4
120.0	39.8
130.0	38.1
140.0	36.2
150.0	34.3
160.0	32.2
170.0	30.1
180.0	27.9
190.0	25.5
200.0	23.1
210.0	20.5
215.0	19.2

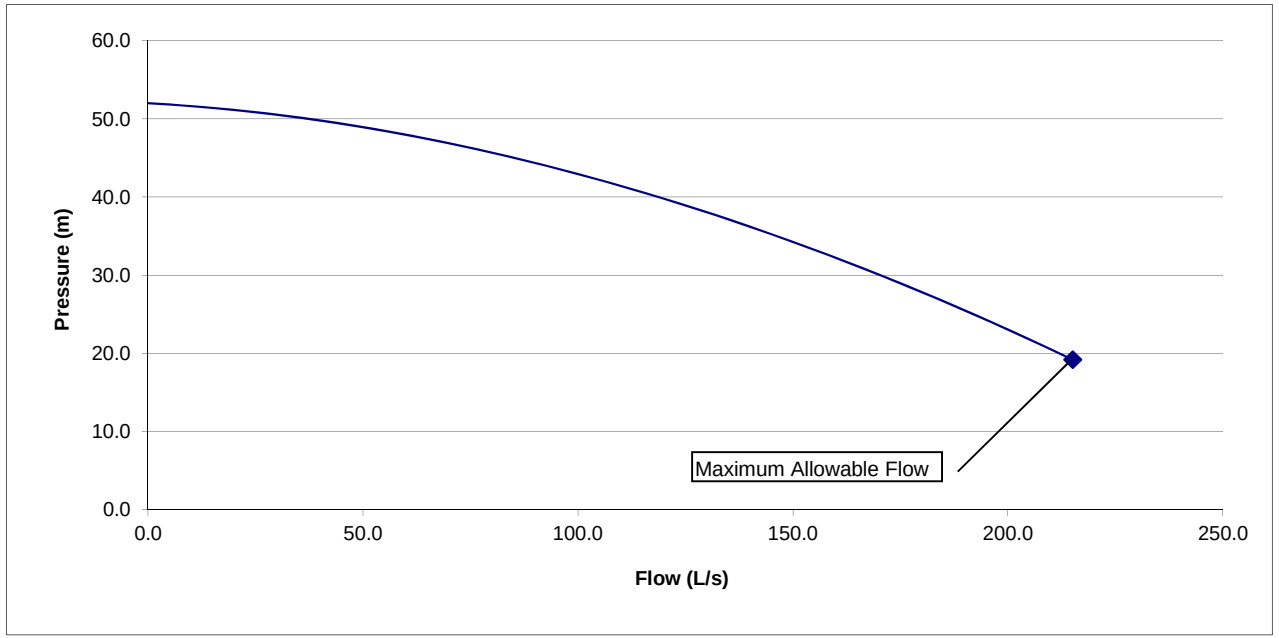
Fire Flow Analysis

Fire Flow Node:	JCT_78134
Design Flow (L/s):	215.0
Design Pressure (m):	19.2

Design Flow: *The final adjusted flow at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.*

Design Pressure: *The lowest allowable pressure at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.*

Critical Node ID: *The constraining node within the pressure zone that drops to the minimum design pressure of (14m (140 kPa)) during the design flow.*



WAT 5 Infowater

JCT_78138 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	1.64	404.58	52.58
01:00 hrs	1.21	404.62	52.62
02:00 hrs	1.41	404.58	52.58
03:00 hrs	1.52	404.55	52.55
04:00 hrs	1.35	404.55	52.55
05:00 hrs	1.10	404.56	52.56
06:00 hrs	1.75	404.46	52.46
07:00 hrs	3.75	404.26	52.26
08:00 hrs	4.57	404.10	52.10
09:00 hrs	3.75	404.25	52.25
10:00 hrs	3.67	404.28	52.28
11:00 hrs	3.50	404.32	52.32
12:00 hrs	3.30	404.37	52.37
13:00 hrs	3.13	404.42	52.42
14:00 hrs	2.90	404.48	52.48
15:00 hrs	2.71	404.42	52.42
16:00 hrs	2.88	404.40	52.40
17:00 hrs	3.05	404.39	52.39
18:00 hrs	3.52	404.27	52.27
19:00 hrs	3.84	404.18	52.18
20:00 hrs	3.86	404.14	52.14
21:00 hrs	3.61	404.16	52.16
22:00 hrs	3.19	404.33	52.33
23:00 hrs	2.54	404.45	52.45
Average Day HGL:		404.38	
Minimum Hour:		404.62	

JCT_78138 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	1.91	404.31	52.31
01:00 hrs	1.18	404.41	52.41
02:00 hrs	1.50	404.40	52.40
03:00 hrs	1.79	404.31	52.31
04:00 hrs	1.71	404.28	52.28
05:00 hrs	1.42	404.29	52.29
06:00 hrs	2.64	403.84	51.84
07:00 hrs	5.48	402.54	50.54
08:00 hrs	6.41	402.32	50.32
09:00 hrs	4.59	403.07	51.07
10:00 hrs	3.57	403.53	51.53
11:00 hrs	3.33	403.71	51.71
12:00 hrs	2.92	403.92	51.92
13:00 hrs	3.74	403.49	51.49
14:00 hrs	4.91	403.12	51.12
15:00 hrs	4.10	403.39	51.39
16:00 hrs	5.48	402.84	50.84
17:00 hrs	5.77	402.67	50.67
18:00 hrs	6.74	402.11	50.11
19:00 hrs	7.23	401.72	49.72
20:00 hrs	7.15	401.62	49.62
21:00 hrs	6.41	402.33	50.33
22:00 hrs	4.34	403.52	51.52
23:00 hrs	3.04	403.88	51.88
Maximum Day HGL:		403.32	
Peak Hour:		401.62	

Available Flow (L/s)	Residual Pressure (m)
0.0	52.0
10.0	51.7
20.0	51.1
30.0	50.5
40.0	49.7
50.0	48.8
60.0	47.8
70.0	46.7
80.0	45.4
90.0	44.0
100.0	42.5
110.0	40.9
120.0	39.2
130.0	37.4
140.0	35.4
150.0	33.4
160.0	31.2
170.0	29.0
180.0	26.6
190.0	24.1
200.0	21.6
210.0	18.9
219.0	16.4

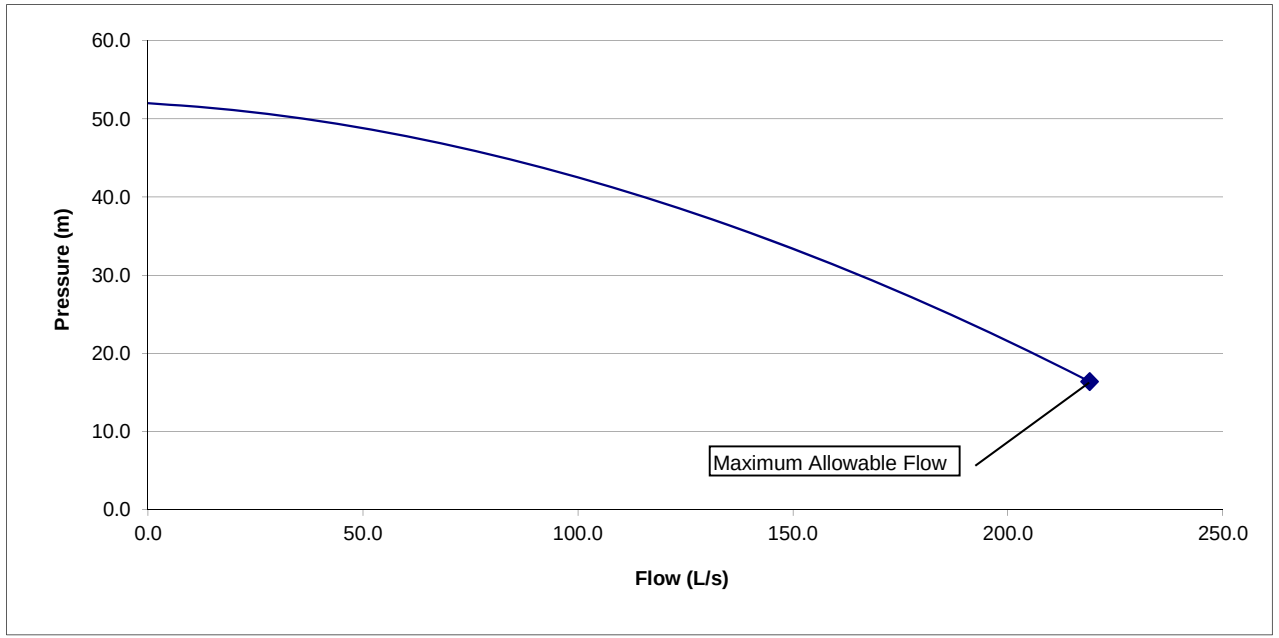
Fire Flow Analysis

Fire Flow Node:	JCT_78138
Design Flow (L/s):	219.0
Design Pressure (m):	16.4

Design Flow: *The final adjusted flow at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.*

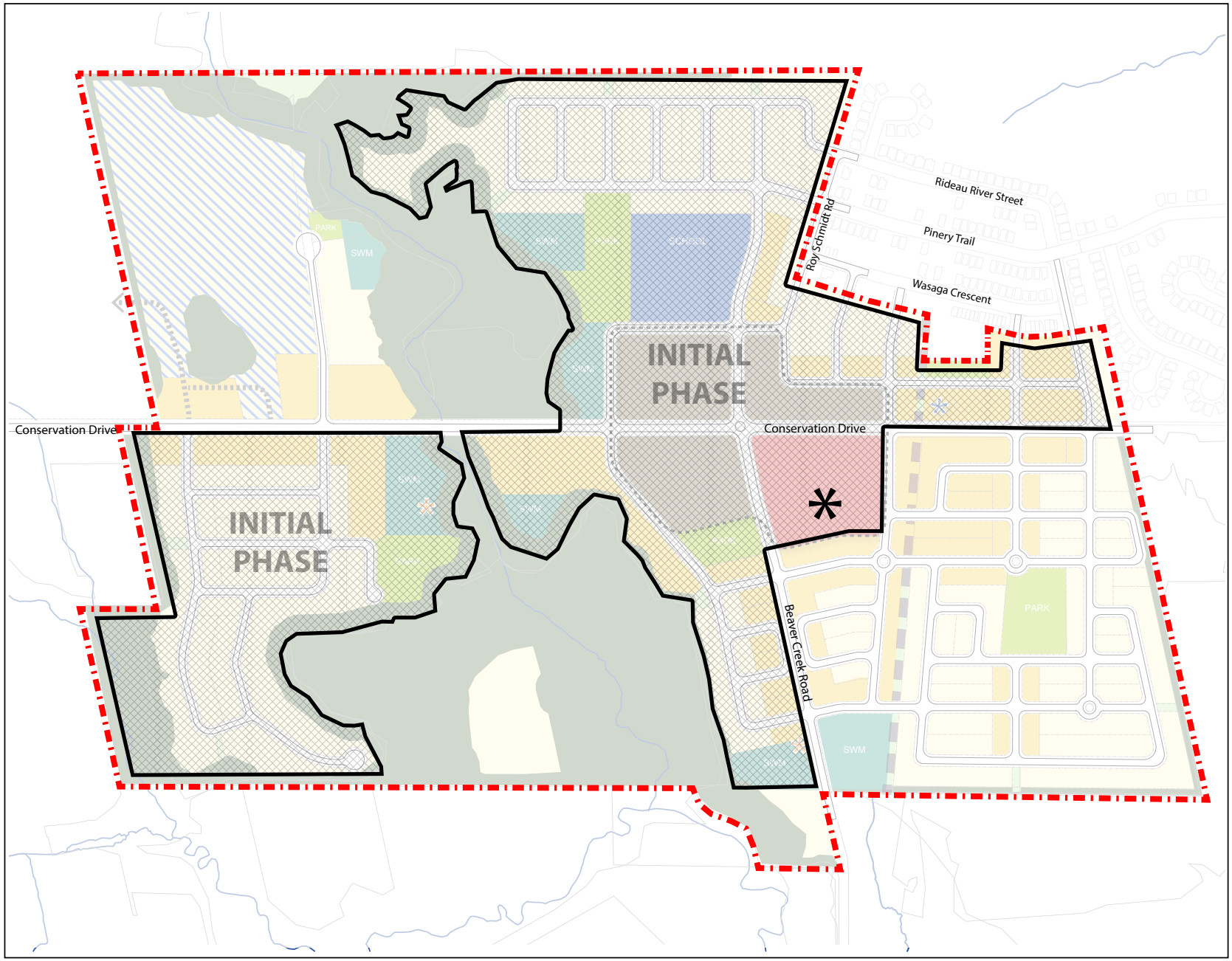
Design Pressure: *The lowest allowable pressure at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.*

Critical Node ID: *The constraining node within the pressure zone that drops to the minimum design pressure of (14m (140 kPa)) during the design flow.*



BEAVER CREEK MEADOWS DISTRICT PLAN

MAP 6
PHASING
COMMUNITY STRUCTURE

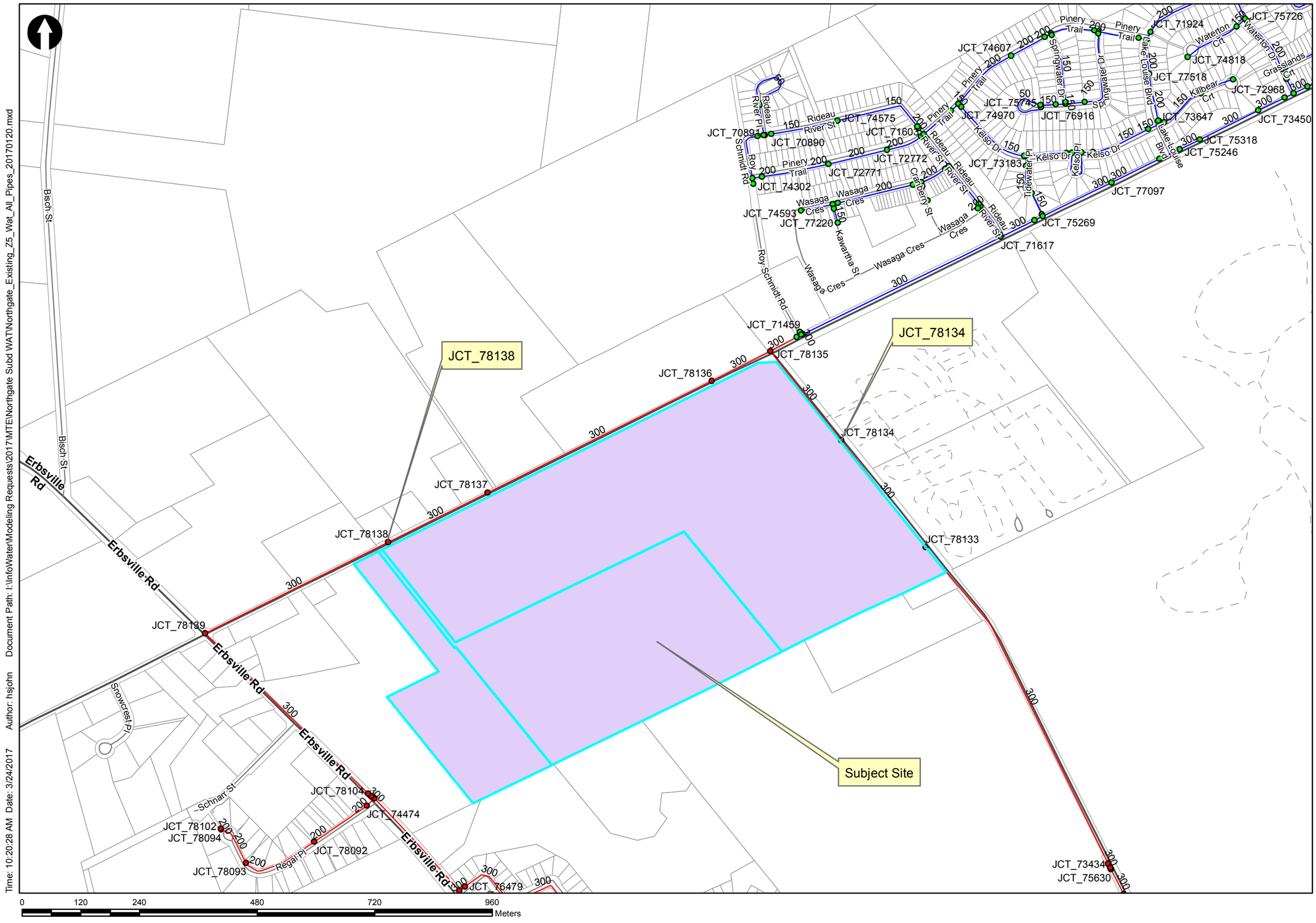


LEGEND

- District Plan Boundary
- Initial Phase
- * Development of the commercial site, whether fully or partially, subject to market demand

0 50 100 200 300 metres

Last Updated: January 19, 2016



Time: 10:20:28 AM Date: 3/24/2017 Author: hsjohn Document Path: I:\InfoWater\Modeling Requests\2017\MTE\Northgate Subd WAT\Northgate_Existing_Z5_Wat_All_Pipes_20170120.mxd

Region of Waterloo

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Legend

Junction
TYPE
- Active
- Domain

Tank
TYPE
- Active
- Domain

Reservoir
TYPE
- Active
- Domain

Pump
TYPE
- Active
- Domain

Valve
TYPE
- Active
- Domain

Pipe
TYPE
- Active
- Domain
- Highway
- Regional
- Local
- Private
- Proposed
- Ownership Parcels
- Subject Property

Northgate Subd Waterloo

Appendix B
Water Distribution

Usage Rates/Water Demands & Design Values

Northgate and Erbsville Kartway Subdivisions

City of Waterloo
Project No: 39502-104
Date: May 15, 2020
By: GDV/MXF

CONCEPTUAL FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

			(1)		(2)		(3)		(4)		**Final Adjusted**		
Building	Area "A" (m^2)	C	Fire Flow "F" (l/min)	(l/s)	Occupancy %	Adjusted Fire Flow (L/min)	Sprinkler %	Adjustment (L/min)	Exposure %	Adjustment (L/min)	**Fire Flow (L/min)**	**Rounded(L/min)**	**(L/s)**
Block 20 (24-Units)	2,288	1.0	11,000	183.3	-15	9,350	0	0	15	1,403	10,753	11,000	**183**
Block 21 (16-units)	1,556	1.0	9,000	150.0	-15	7,650	0	0	45	3,443	11,093	11,000	**183**

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

40% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(4) Exposure

0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS
CITY OF WATERLOO - PRESSURE ZONE 5
Pump Curve Design Sheet

Project No.: 39502-104
Date: 23-Dec-19
Design By: MXF
File: Q:\39502\104\Preliminary Water Distribution\39502-104 Region Pressures & Pump Curves.xlsx
Note: System pressure information is from correspondence to Gavin Vemeer from Kevin Dolishny at the Region of Waterloo on March 24, 2017.

Node 78134 Beaver Creek Road at Proposed Street One
Elevation = *352.00* m

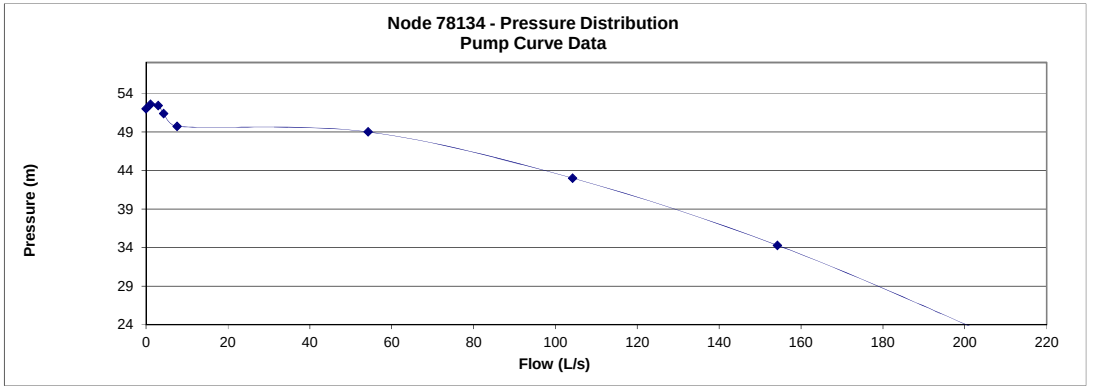
Average Day				
Time	Flow (L/s)	Head (m)	Residual Pressure (m)	
00:00 hrs	1.72	404.61	52.61	
01:00 hrs	1.28	404.64	52.64	
02:00 hrs	1.48	404.60	52.60	
03:00 hrs	1.60	404.58	52.58	
04:00 hrs	1.43	404.58	52.58	
05:00 hrs	**1.16**	**404.59**	**52.59**	**Min Hr**
06:00 hrs	1.84	404.49	52.49	
07:00 hrs	3.95	404.31	52.31	
08:00 hrs	4.81	404.16	52.16	
09:00 hrs	3.95	404.30	52.30	
10:00 hrs	3.86	404.32	52.32	
11:00 hrs	3.68	404.36	52.36	
12:00 hrs	3.47	404.41	52.41	
13:00 hrs	3.30	404.46	52.46	
14:00 hrs	3.06	404.51	52.51	
15:00 hrs	2.85	404.46	52.46	
16:00 hrs	**3.03**	**404.44**	**52.44**	**Avg Day**
17:00 hrs	3.21	404.42	52.42	
18:00 hrs	3.71	404.32	52.32	
19:00 hrs	4.04	404.23	52.23	
20:00 hrs	4.07	404.19	52.19	
21:00 hrs	3.80	404.21	52.21	
22:00 hrs	3.36	404.37	52.37	
23:00 hrs	2.67	404.49	52.49	
Average =	**2.97**	404.42	52.42	
Minimum =	**1.16**	404.64	52.64	

Maximum Day				
Time	Flow (L/s)	Head (m)	Residual Pressure (m)	
00:00 hrs	2.01	404.31	52.31	
01:00 hrs	1.24	404.41	52.41	
02:00 hrs	1.58	404.40	52.40	
03:00 hrs	1.88	404.31	52.31	
04:00 hrs	1.80	404.28	52.28	
05:00 hrs	1.50	404.29	52.29	
06:00 hrs	2.78	403.85	51.85	
07:00 hrs	5.78	402.55	50.55	
08:00 hrs	6.76	402.32	50.32	
09:00 hrs	4.84	403.07	51.07	
10:00 hrs	3.77	403.53	51.53	
11:00 hrs	3.51	403.71	51.71	
12:00 hrs	3.08	403.92	51.92	
13:00 hrs	3.94	403.50	51.50	
14:00 hrs	5.18	403.12	51.12	
15:00 hrs	**4.32**	**403.39**	**51.39**	**Max Day**
16:00 hrs	5.78	402.84	50.84	
17:00 hrs	6.08	402.68	50.68	
18:00 hrs	7.10	402.12	50.12	
19:00 hrs	**7.62**	**401.72**	**49.72**	**Peak Hr**
20:00 hrs	7.53	401.63	49.63	
21:00 hrs	6.76	402.33	50.33	
22:00 hrs	4.58	403.52	51.52	
23:00 hrs	3.21	403.88	51.88	
Max Day =	**4.28**	403.32	51.32	
Peak Hour =	**7.62**	401.63	49.63	

Fire Flow Analysis		
Available Flow (L/s)	Head (m)	Residual Pressure (m)
0.0	404.00	52.00
10.0	403.70	51.70
20.0	403.20	51.20
30.0	402.60	50.60
40.0	401.80	49.80
50.0	401.00	49.00
60.0	400.00	48.00
70.0	398.90	46.90
80.0	397.70	45.70
90.0	396.40	44.40
100.0	395.00	43.00
110.0	393.40	41.40
120.0	391.80	39.80
130.0	390.10	38.10
140.0	388.20	36.20
150.0	386.30	34.30
160.0	384.20	32.20
170.0	382.10	30.10
180.0	379.90	27.90
190.0	377.50	25.50
200.0	375.10	23.10
210.0	372.50	20.50
215.0	371.20	19.20

Fire Flow Analysis Adjusted for Maximum Day Flows		
Available Flow (L/s)	Head (m)	Residual Pressure (m)
4.3	404.00	52.00
14.3	403.70	51.70
24.3	403.20	51.20
34.3	402.60	50.60
44.3	401.80	49.80
54.3	401.00	49.00
64.3	400.00	48.00
74.3	398.90	46.90
84.3	397.70	45.70
94.3	396.40	44.40
104.3	395.00	43.00
114.3	393.40	41.40
124.3	391.80	39.80
134.3	390.10	38.10
144.3	388.20	36.20
154.3	386.30	34.30
164.3	384.20	32.20
174.3	382.10	30.10
184.3	379.90	27.90
194.3	377.50	25.50
204.3	375.10	23.10
214.3	372.50	20.50
219.3	371.20	19.20

Node 78134 - Pump Curve Pressure Distribution			
Demand Scenario	Discharge (L/s)	HGL (m)	Head (m)
0 (Est.)	0.00	404.00	52.00
Minimum Hour	1.16	404.59	52.59
Average Day	3.03	404.44	52.44
Maximum Day	4.32	403.39	51.39
Peak Hour	7.62	401.72	49.72
Max Day + 50 L/s Fire Flow	54.28	401.00	49.00
Max Day + 100 L/s Fire Flow	104.28	395.00	43.00
Max Day + 150 L/s Fire Flow	154.28	386.30	34.30
Max Day + 200 L/s Fire Flow	204.28	375.10	23.10
Max Day + 215 L/s Fire Flow	219.28	371.20	19.20



NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS
CITY OF WATERLOO - PRESSURE ZONE 5
Pump Curve Design Sheet

Project No.: 39502-104
Date: 23-Dec-19
Design By: MXF
File: Q:\39502\104\Preliminary Water Distribution\39502-104 Region Pressures & Pump Curves.xlsx
Note: System pressure information is from correspondence to Gavin Vemeer from Kevin Dolishny at the Region of Waterloo on March 24, 2017.

Node 78138 Conservation Drive at Proposed Street Three
Elevation = *352.00* m

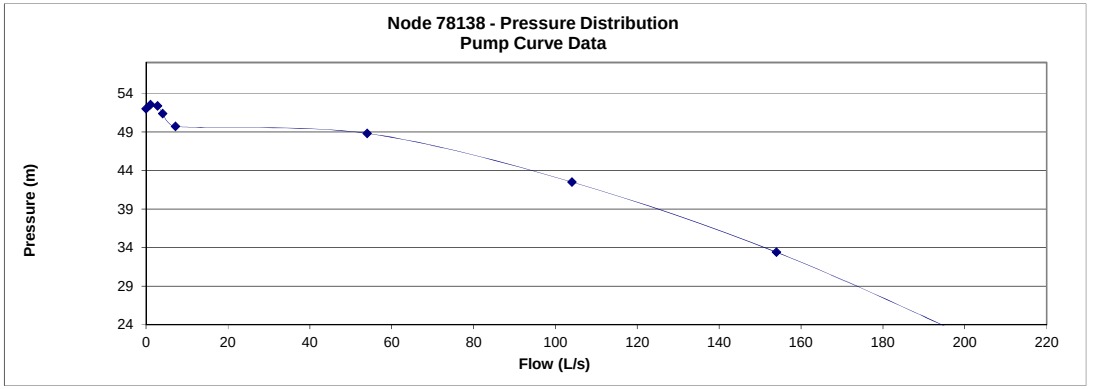
Average Day				
Time	Flow (L/s)	Head (m)	Residual Pressure (m)	
00:00 hrs	1.64	404.58	52.58	
01:00 hrs	1.21	404.62	52.62	
02:00 hrs	1.41	404.58	52.58	
03:00 hrs	1.52	404.55	52.55	
04:00 hrs	1.35	404.55	52.55	
05:00 hrs	**1.10**	**404.56**	**52.56**	**Min Hr**
06:00 hrs	1.75	404.46	52.46	
07:00 hrs	3.75	404.26	52.26	
08:00 hrs	4.57	404.10	52.10	
09:00 hrs	3.75	404.25	52.25	
10:00 hrs	3.67	404.28	52.28	
11:00 hrs	3.50	404.32	52.32	
12:00 hrs	3.30	404.37	52.37	
13:00 hrs	3.13	404.42	52.42	
14:00 hrs	2.90	404.48	52.48	
15:00 hrs	2.71	404.42	52.42	
16:00 hrs	**2.88**	**404.40**	**52.40**	**Avg Day**
17:00 hrs	3.05	404.39	52.39	
18:00 hrs	3.52	404.27	52.27	
19:00 hrs	3.84	404.18	52.18	
20:00 hrs	3.86	404.14	52.14	
21:00 hrs	3.61	404.16	52.16	
22:00 hrs	3.19	404.33	52.33	
23:00 hrs	2.54	404.45	52.45	
Average =	**2.82**	404.38	52.38	
Minimum =	**1.10**	404.62	52.62	

Maximum Day				
Time	Flow (L/s)	Head (m)	Residual Pressure (m)	
00:00 hrs	1.91	404.31	52.31	
01:00 hrs	1.18	404.41	52.41	
02:00 hrs	1.50	404.40	52.40	
03:00 hrs	1.79	404.31	52.31	
04:00 hrs	1.71	404.28	52.28	
05:00 hrs	1.42	404.29	52.29	
06:00 hrs	2.64	403.84	51.84	
07:00 hrs	5.48	402.54	50.54	
08:00 hrs	6.41	402.32	50.32	
09:00 hrs	4.59	403.07	51.07	
10:00 hrs	3.57	403.53	51.53	
11:00 hrs	3.33	403.71	51.71	
12:00 hrs	2.92	403.92	51.92	
13:00 hrs	3.74	403.49	51.49	
14:00 hrs	4.91	403.12	51.12	
15:00 hrs	**4.10**	**403.39**	**51.39**	**Max Day**
16:00 hrs	5.48	402.84	50.84	
17:00 hrs	5.77	402.67	50.67	
18:00 hrs	6.74	402.11	50.11	
19:00 hrs	**7.23**	**401.72**	**49.72**	**Peak Hr**
20:00 hrs	7.15	401.62	49.62	
21:00 hrs	6.41	402.33	50.33	
22:00 hrs	4.34	403.52	51.52	
23:00 hrs	3.04	403.88	51.88	
Max Day =	**4.06**	403.32	51.32	
Peak Hour =	**7.23**	401.62	49.62	

Fire Flow Analysis		
Available Flow (L/s)	Head (m)	Residual Pressure (m)
0.0	404.00	52.00
10.0	403.70	51.70
20.0	403.10	51.10
30.0	402.50	50.50
40.0	401.70	49.70
50.0	400.80	48.80
60.0	399.80	47.80
70.0	398.70	46.70
80.0	397.40	45.40
90.0	396.00	44.00
100.0	394.50	42.50
110.0	392.90	40.90
120.0	391.20	39.20
130.0	389.40	37.40
140.0	387.40	35.40
150.0	385.40	33.40
160.0	383.20	31.20
170.0	381.00	29.00
180.0	378.60	26.60
190.0	376.10	24.10
200.0	373.60	21.60
210.0	370.90	18.90
219.0	368.40	16.40

Fire Flow Analysis Adjusted for Maximum Day Flows		
Available Flow (L/s)	Head (m)	Residual Pressure (m)
4.1	404.00	52.00
14.1	403.70	51.70
24.1	403.10	51.10
34.1	402.50	50.50
44.1	401.70	49.70
54.1	400.80	48.80
64.1	399.80	47.80
74.1	398.70	46.70
84.1	397.40	45.40
94.1	396.00	44.00
104.1	394.50	42.50
114.1	392.90	40.90
124.1	391.20	39.20
134.1	389.40	37.40
144.1	387.40	35.40
154.1	385.40	33.40
164.1	383.20	31.20
174.1	381.00	29.00
184.1	378.60	26.60
194.1	376.10	24.10
204.1	373.60	21.60
214.1	370.90	18.90
223.1	368.40	16.40

Node 78138 - Pump Curve Pressure Distribution			
Demand Scenario	Discharge (L/s)	HGL (m)	Head (m)
0 (Est.)	0.00	404.00	52.00
Minimum Hour	1.10	404.56	52.56
Average Day	2.88	404.40	52.40
Maximum Day	4.10	403.39	51.39
Peak Hour	7.23	401.72	49.72
Max Day + 50 L/s Fire Flow	54.06	400.80	48.80
Max Day + 100 L/s Fire Flow	104.06	394.50	42.50
Max Day + 150 L/s Fire Flow	154.06	385.40	33.40
Max Day + 200 L/s Fire Flow	204.06	373.60	21.60
Max Day + 219 L/s Fire Flow	223.06	368.40	16.40



Northgate and Erbsville Kartway Subdivisions

City of Waterloo
Project No: 39502-104
Date: May 19, 2020
By: MXF
File: Q:\39502\104\Preliminary Water Distribution\39502-104 Water Demands.xlsx

Node ID	Residential									Final Demands[4] (l/s)					Road Elevation (m)
	Single Detached and Semi-detached			Townhomes			Apartment (or equivalent level of density)			Average Day	Maximum Day	Minimum Hour	Peak Hour	Max Day + Fire Flow[5]	
	# Units[1]	# Persons[2]	Demand[3] (l/s)	# Units[1]	# Persons[2]	Demand[3] (l/s)	# Units[1]	# Persons[2]	Demand[3] (l/s)	Q_{avg}	$Q_{max.day}$	$Q_{min.hr}$	Q_{peak}	$Q_{max.day+fire}$	
J-1	22	72	0.188		0	0.000		0	0.000	0.188	0.271	0.085	0.637	100.27	353.00
J-2	23	75	0.197		0	0.000	24	42	0.112	0.309	0.445	0.139	1.044	183.78	352.33
J-3	16	52	0.137		0	0.000	64	113	0.299	0.436	0.627	0.196	1.472	183.96	351.87
J-4	12	39	0.103		0	0.000		0	0.000	0.103	0.148	0.046	0.347	100.15	352.60
J-5	27	88	0.231		0	0.000		0	0.000	0.231	0.333	0.104	0.782	100.33	351.89
J-6	19	62	0.163		0	0.000		0	0.000	0.163	0.234	0.073	0.550	100.23	351.50
J-7	20	65	0.171		0	0.000		0	0.000	0.171	0.247	0.077	0.579	100.25	350.65
J-8	19	62	0.163		0	0.000		0	0.000	0.163	0.234	0.073	0.550	100.23	350.65
J-9	18	59	0.154		0	0.000		0	0.000	0.154	0.222	0.069	0.521	100.22	349.92
J-10		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	351.50
J-11	*15*	*49*	*0.128*		*0*	*0.000*		*0*	*0.000*	*0.128*	*0.185*	*0.058*	*0.434*	*100.19*	*351.31*
J-12	*16*	*52*	*0.137*		*0*	*0.000*		*0*	*0.000*	*0.137*	*0.197*	*0.062*	*0.463*	*100.20*	*351.89*
J-13	*10*	*33*	*0.086*		*0*	*0.000*		*0*	*0.000*	*0.086*	*0.123*	*0.039*	*0.290*	*100.12*	*353.02*
J-14	*13*	*42*	*0.111*		*0*	*0.000*		*0*	*0.000*	*0.111*	*0.160*	*0.050*	*0.376*	*100.16*	*352.65*
J-15		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	351.40
J-16	*7*	*23*	*0.060*		*0*	*0.000*		*0*	*0.000*	*0.060*	*0.086*	*0.027*	*0.203*	*100.09*	*353.09*
J-17	*14*	*46*	*0.120*		*0*	*0.000*		*0*	*0.000*	*0.120*	*0.173*	*0.054*	*0.405*	*100.17*	*350.83*
J-18		0	0.000		0	0.000	160	283	0.746	0.746	1.075	0.336	2.523	184.41	355.71
J-19		0	0.000		0	0.000	320	566	1.493	1.493	2.149	0.672	5.045	185.48	354.20
J-20		0	0.000	27	66	0.174		0	0.000	0.174	0.250	0.078	0.587	133.58	353.85
J-21	9	29	0.077		0	0.000	44	78	0.205	0.282	0.407	0.127	0.954	183.74	353.35
J-22	40	130	0.343		0	0.000		0	0.000	0.343	0.493	0.154	1.158	100.49	352.78
J-23	16	52	0.137		0	0.000	44	78	0.205	0.342	0.493	0.154	1.157	183.83	351.70
J-24		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	356.63
J-25		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	354.22
JCT_78133		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	349.29
JCT_78134		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	352.00
JCT_78135		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	357.00
JCT_78138		0	0.000		0	0.000		0	0.000	0.000	0.000	0.000	0.000	0.00	352.00
Sub-total	**316**	**1027**	**2.707**	**27**	**66**	**0.174**	**656**	**1161**	**3.060**	**5.940**	**8.554**	**2.673**	**20.078**		

Total Units =	**999**
Total Population =	**2254**

Table Notes:

1. Unit Count based on MHBC document: Draft Plan of Subdivision (April 9, 2020)

2. Population Density	
Structure Type	**PPU**
Single, detached	3.25
Semi-detached	3.25
Townhouse	2.44
Apartment	1.77
Multiple Unit Types	2.11
Unspecified Unit Type	3.05

Reference: Region of Waterloo 2019 Water and Wastewater Monitoring Report (Region of Waterloo, May 2019)

3. Water Demand	
Residential (Medium Density)	227.7 l/d/person 0.00264 l/s/person
Multiple Residential (High Density)	227.7 l/d/person 0.00264 l/s/person

Reference: Water Demand per person from the Tri-City Distribution System Study (AECOM, May 2009)

4. Peaking Factors	
Average Day	1.00
Maximum Day*	1.44
Minimum Hour	0.45
Peak Hour	3.38

Reference: Design Guidelines for Drinking-Water System. MOE, 2008. Table 3-1: Peaking Factors (population 2001 to 3000)
*Max Day Peak Factor taken from Tri-City Distribution System Study (AECOM, May 2009)

5. Fire Flow	
Single Family <3m separation	6,000 l/min 100 l/s
High-density / Townhomes (contiguous)	8,000 l/min 133 l/s
Multi-residential/Mixed-Use (High-density)	11,000 l/min 183 l/s

Reference: *Water Supply for Public Fire Protection, A Guide to Recommended Practice (1999), Fire Underwriter's Survey (FUS)* .

Appendix C
Water Distribution

WaterCAD Output Files

Northgate & Erbsville Kartway Subdivisions

Active Scenario: Avg Day

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	352.60	0.188	403.72	500.3
J-2	351.65	0.309	403.72	509.6
J-3	351.05	0.436	403.72	515.5
J-4	352.20	0.103	403.72	504.2
J-5	350.98	0.231	403.72	516.2
J-6	350.46	0.163	403.72	521.3
J-7	350.69	0.171	403.72	519.0
J-8	350.29	0.163	403.72	522.9
J-9	350.13	0.154	403.72	524.5
J-11	351.31	0.128	403.72	512.9
J-12	351.89	0.137	403.72	507.3
J-13	353.02	0.086	403.72	496.2
J-14	352.65	0.111	403.72	499.8
J-16	353.09	0.060	403.72	495.5
J-17	350.83	0.120	403.72	517.6
J-18	355.71	0.746	403.75	470.1
J-19	354.20	1.493	403.75	484.9
J-20	353.85	0.174	403.75	488.3
J-21	353.35	0.282	403.75	493.2
J-22	352.78	0.343	403.75	498.8
J-23	351.70	0.342	403.75	509.4

Northgate & Erbsville Kartway Subdivisions

Active Scenario: Max Day + Fire

Label	Elevation (m)	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Velocity of Maximum Pipe (m/s)	Pipe w/ Maximum Velocity
J-1	352.60	4	True	100.000	100.271	202.798	140.0	141.1	3.79	P-2
J-2	351.65	5	True	183.000	183.445	204.103	143.2	140.0	3.53	P-3
J-3	351.05	3	True	183.000	183.627	191.766	140.0	145.2	3.83	P-5
J-4	352.20	4	True	100.000	100.148	189.338	140.0	141.7	3.96	P-6
J-5	350.98	4	True	100.000	100.333	160.958	140.0	228.7	4.59	P-8
J-6	350.46	4	True	100.000	100.234	188.879	140.0	142.0	3.36	P-5
J-7	350.69	6	True	100.000	100.247	177.292	152.2	140.0	3.10	P-6
J-8	350.29	6	True	100.000	100.234	184.775	144.6	140.0	3.14	P-2
J-9	350.13	4	True	100.000	100.222	154.218	140.0	246.2	4.63	P-16
J-11	351.31	5	True	100.000	100.185	133.636	156.7	140.0	7.59	P-17
J-12	351.89	3	True	100.000	100.197	117.698	140.0	165.1	6.69	P-17
J-13	353.02	3	True	100.000	100.123	106.693	140.0	180.4	6.07	P-17
J-14	352.65	3	True	100.000	100.160	109.186	140.0	161.0	6.21	P-17
J-16	353.09	3	True	100.000	100.086	122.546	140.0	162.1	3.91	P-22
J-17	350.83	3	True	100.000	100.173	102.181	140.0	238.6	3.26	P-22
J-18	355.71	5	True	183.000	184.075	205.059	145.6	140.0	1.60	P-27
J-19	354.20	5	True	183.000	185.149	207.928	157.8	140.0	1.80	P-27
J-20	353.85	6	True	133.000	133.250	207.408	160.9	140.0	1.97	P-27
J-21	353.35	4	True	183.000	183.407	209.314	168.9	140.0	1.99	P-28
J-22	352.78	4	True	100.000	100.493	198.626	140.0	168.4	3.67	P-29
J-23	351.70	3	True	183.000	183.493	204.172	140.0	155.5	4.05	P-31

Northgate & Erbsville Kartway Subdivisions

Active Scenario: Max Day

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	352.60	0.271	403.71	500.2
J-2	351.65	0.445	403.71	509.5
J-3	351.05	0.627	403.71	515.3
J-4	352.20	0.148	403.71	504.1
J-5	350.98	0.333	403.70	516.0
J-6	350.46	0.234	403.70	521.1
J-7	350.69	0.247	403.70	518.8
J-8	350.29	0.234	403.70	522.8
J-9	350.13	0.222	403.70	524.3
J-11	351.31	0.185	403.70	512.8
J-12	351.89	0.197	403.70	507.1
J-13	353.02	0.123	403.70	496.0
J-14	352.65	0.160	403.70	499.7
J-16	353.09	0.086	403.70	495.4
J-17	350.83	0.173	403.70	517.5
J-18	355.71	1.075	403.72	469.9
J-19	354.20	2.149	403.72	484.7
J-20	353.85	0.250	403.72	488.1
J-21	353.35	0.407	403.72	493.0
J-22	352.78	0.493	403.72	498.6
J-23	351.70	0.493	403.72	509.1

Northgate & Erbsville Kartway Subdivisions

Active Scenario: Min Hour

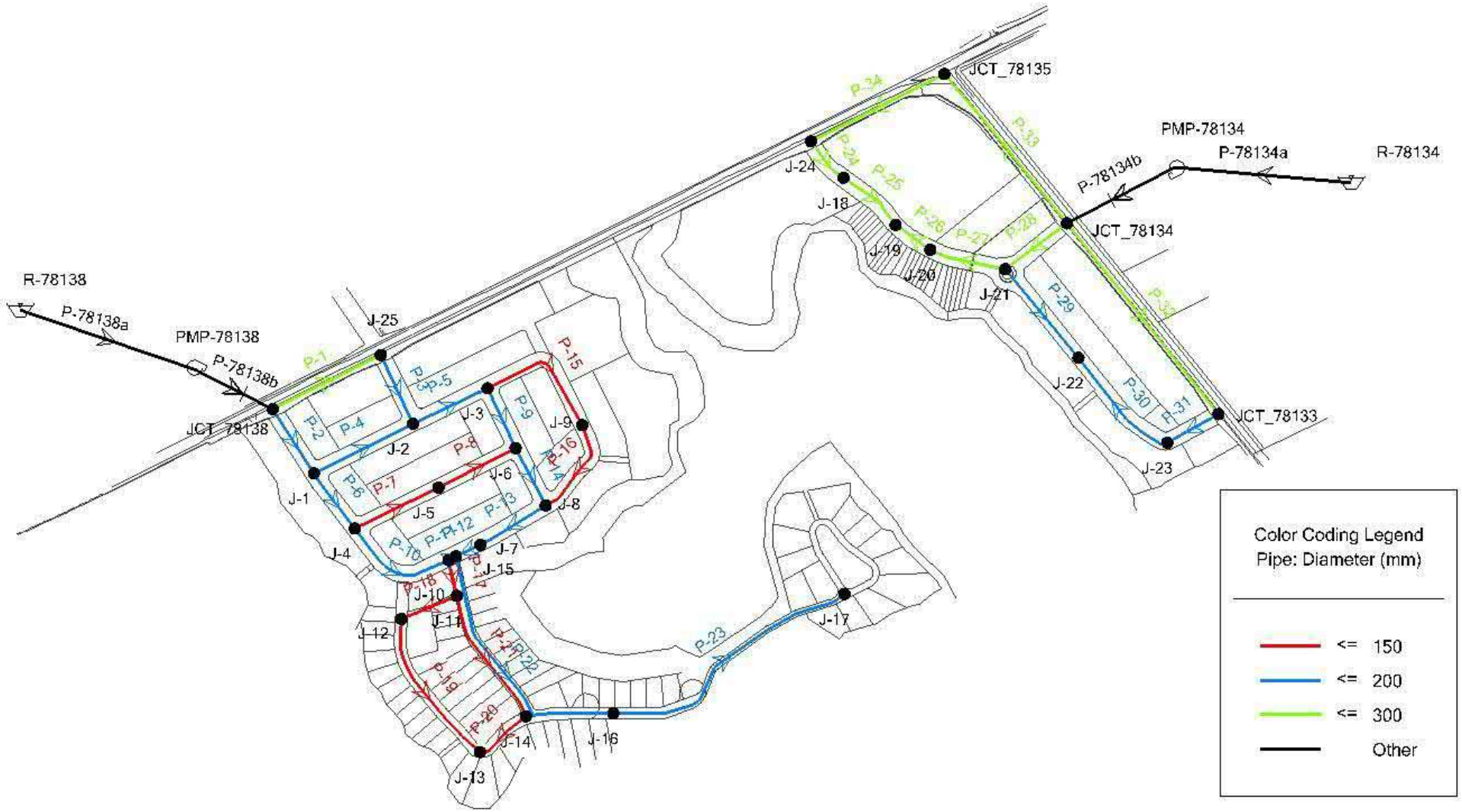
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	352.60	0.085	403.74	500.5
J-2	351.65	0.139	403.74	509.8
J-3	351.05	0.196	403.74	515.6
J-4	352.20	0.046	403.74	504.4
J-5	350.98	0.104	403.74	516.3
J-6	350.46	0.073	403.74	521.4
J-7	350.69	0.077	403.74	519.2
J-8	350.29	0.073	403.74	523.1
J-9	350.13	0.069	403.74	524.6
J-11	351.31	0.058	403.74	513.1
J-12	351.89	0.062	403.74	507.4
J-13	353.02	0.039	403.74	496.4
J-14	352.65	0.050	403.74	500.0
J-16	353.09	0.027	403.74	495.7
J-17	350.83	0.054	403.74	517.8
J-18	355.71	0.336	403.77	470.3
J-19	354.20	0.672	403.77	485.1
J-20	353.85	0.078	403.77	488.5
J-21	353.35	0.127	403.77	493.4
J-22	352.78	0.154	403.77	499.0
J-23	351.70	0.154	403.77	509.6

Northgate & Erbsville Kartway Subdivisions

Active Scenario: Peak Hour

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	352.60	0.637	403.59	499.0
J-2	351.65	1.044	403.59	508.3
J-3	351.05	1.472	403.58	514.1
J-4	352.20	0.347	403.58	502.9
J-5	350.98	0.782	403.58	514.8
J-6	350.46	0.550	403.58	519.9
J-7	350.69	0.579	403.58	517.6
J-8	350.29	0.550	403.58	521.5
J-9	350.13	0.521	403.58	523.1
J-11	351.31	0.434	403.58	511.5
J-12	351.89	0.463	403.58	505.8
J-13	353.02	0.290	403.58	494.8
J-14	352.65	0.376	403.58	498.4
J-16	353.09	0.203	403.58	494.1
J-17	350.83	0.405	403.58	516.2
J-18	355.71	2.523	403.55	468.2
J-19	354.20	5.045	403.55	483.0
J-20	353.85	0.587	403.55	486.4
J-21	353.35	0.954	403.55	491.3
J-22	352.78	1.158	403.55	496.9
J-23	351.70	1.157	403.55	507.5

Water Distribution Network



Appendix F
FSR

Traffic Calming Measures and Turning Radius Analysis

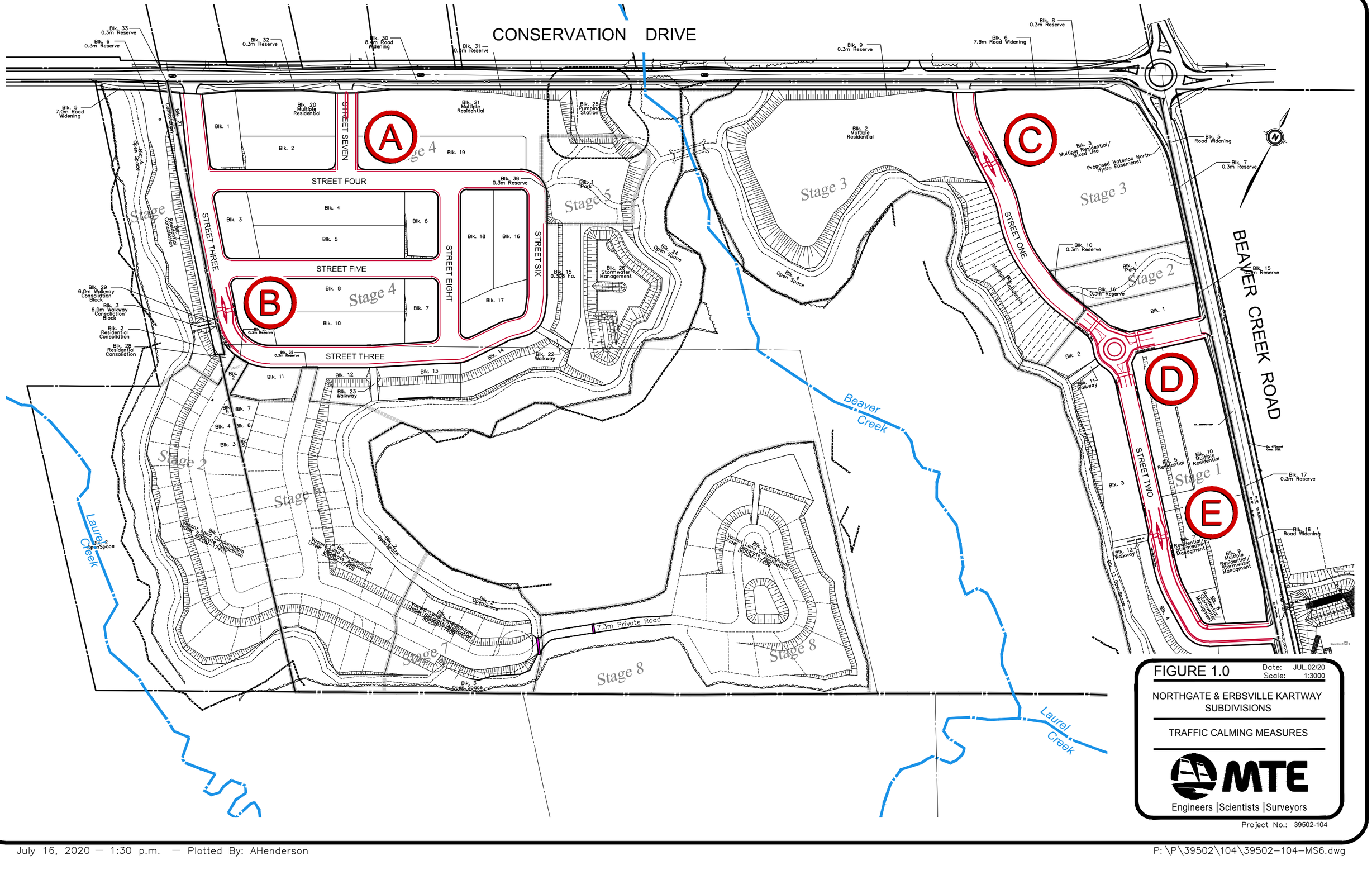


FIGURE 1.0

Date: JUL.02/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES

MTE

Engineers | Scientists | Surveyors

Project No.: 39502-104

July 16, 2020 — 1:30 p.m. — Plotted By: AHenderson

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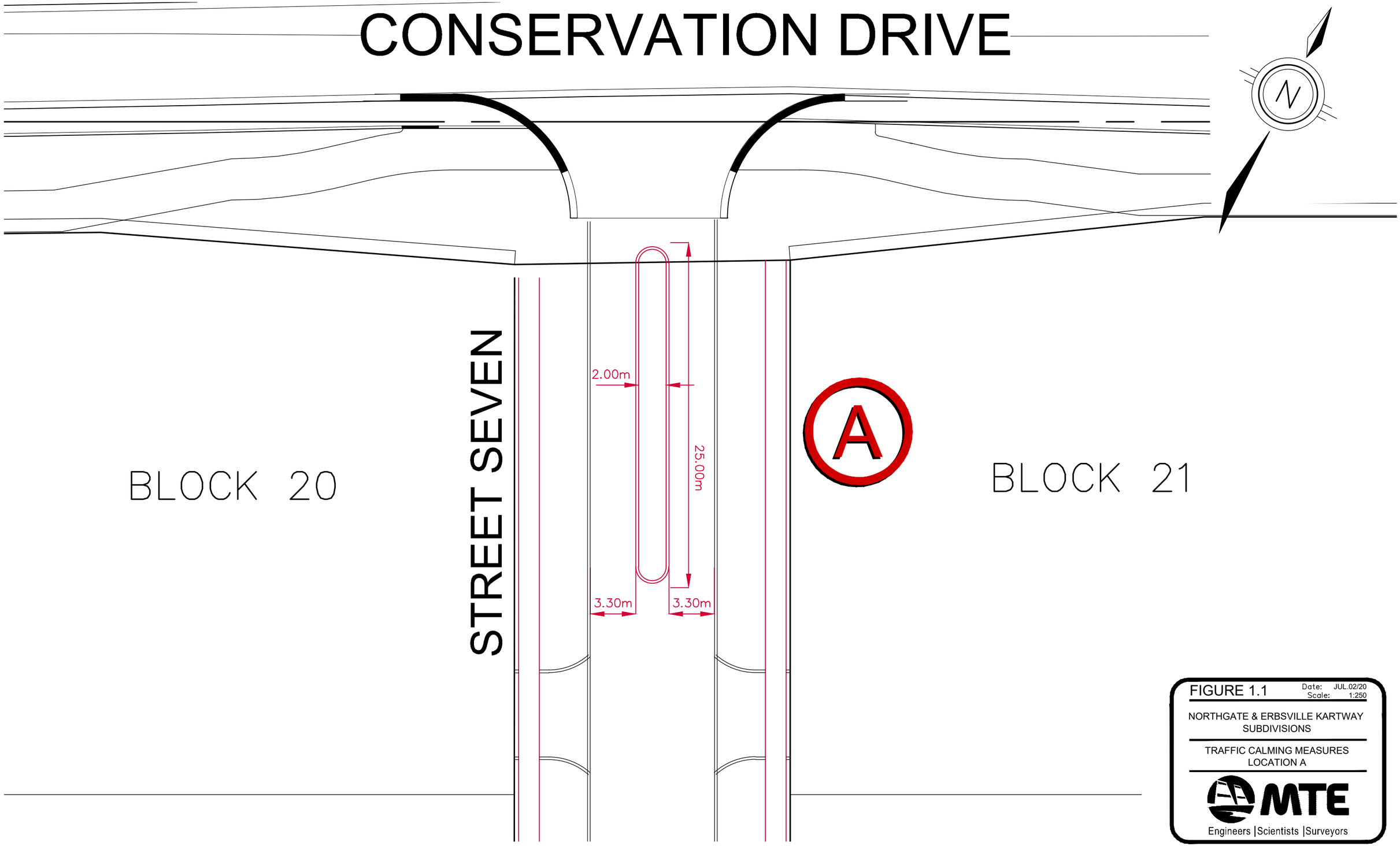
CONSERVATION DRIVE



BLOCK 20

BLOCK 21

FIGURE 1.1

Date: JUL.02/20
Scale: 1:250

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES LOCATION A

MTE
Engineers | Scientists | Surveyors

Project No.: 39502-104

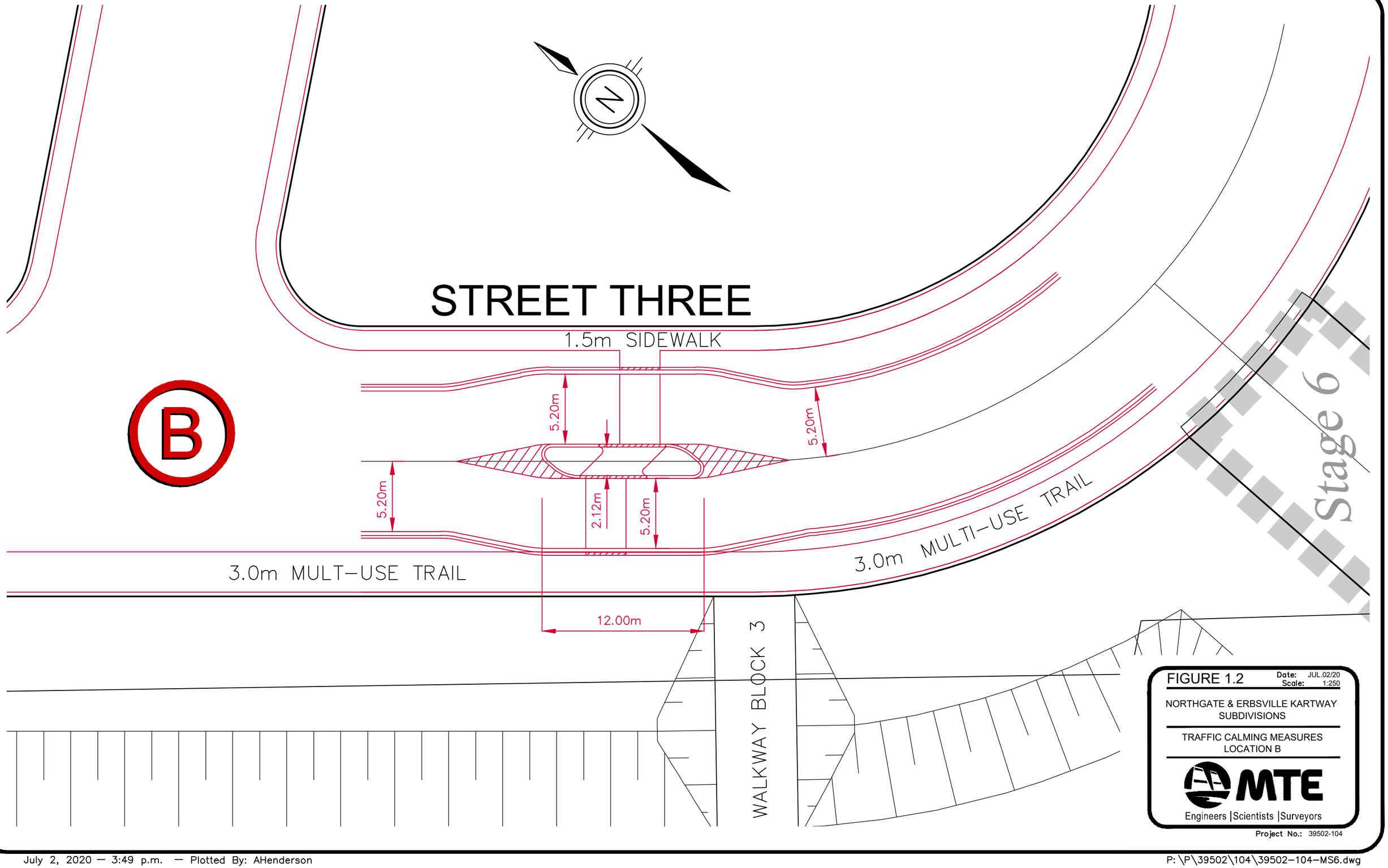


FIGURE 1.2

Date: JUL.02/20
Scale: 1:250

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES LOCATION B

MTE
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Project No.: 39502-104

July 2, 2020 — 3:49 p.m. — Plotted By: AHenderson

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STREET ONE

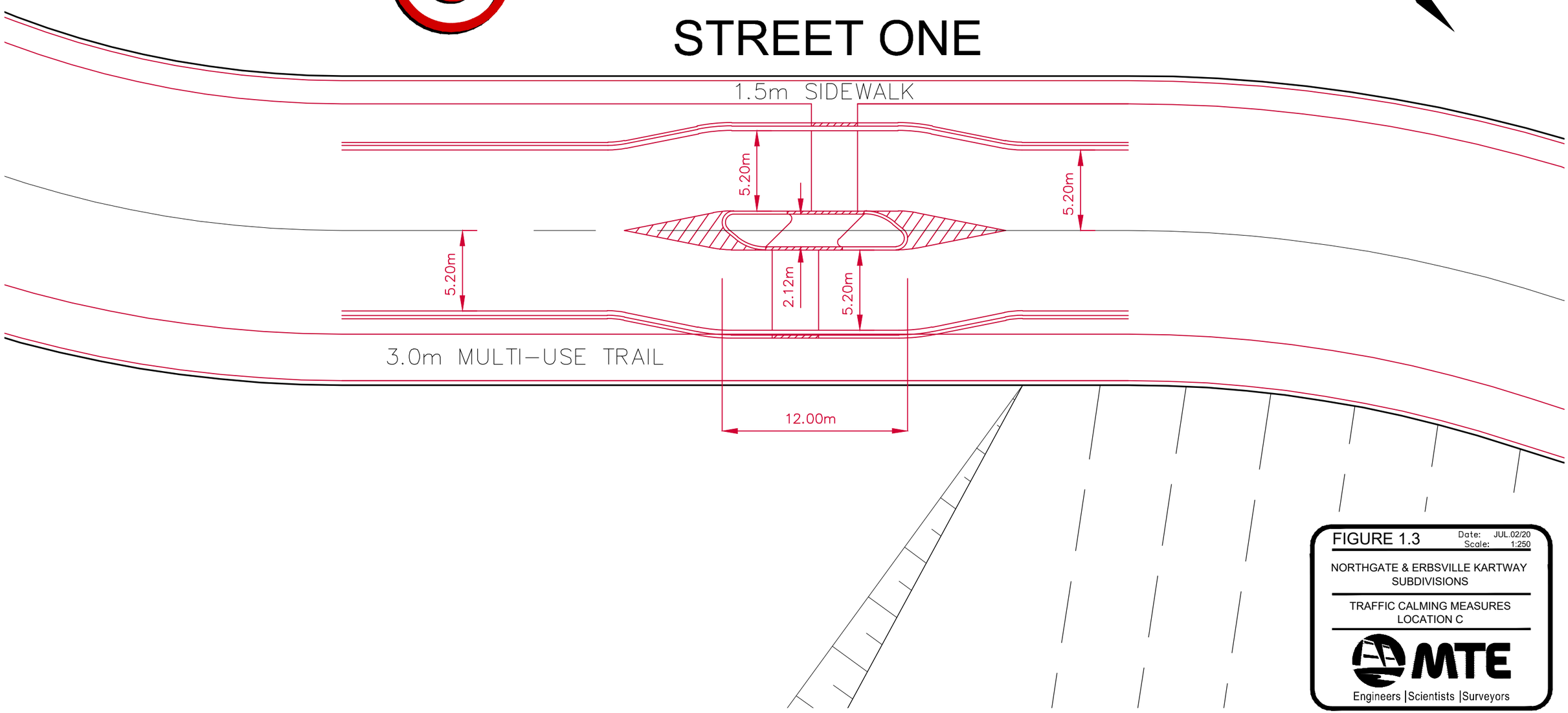

FIGURE 1.3 Date: JUL.02/20 Scale: 1:250

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES LOCATION C

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Project No.: 39502-104

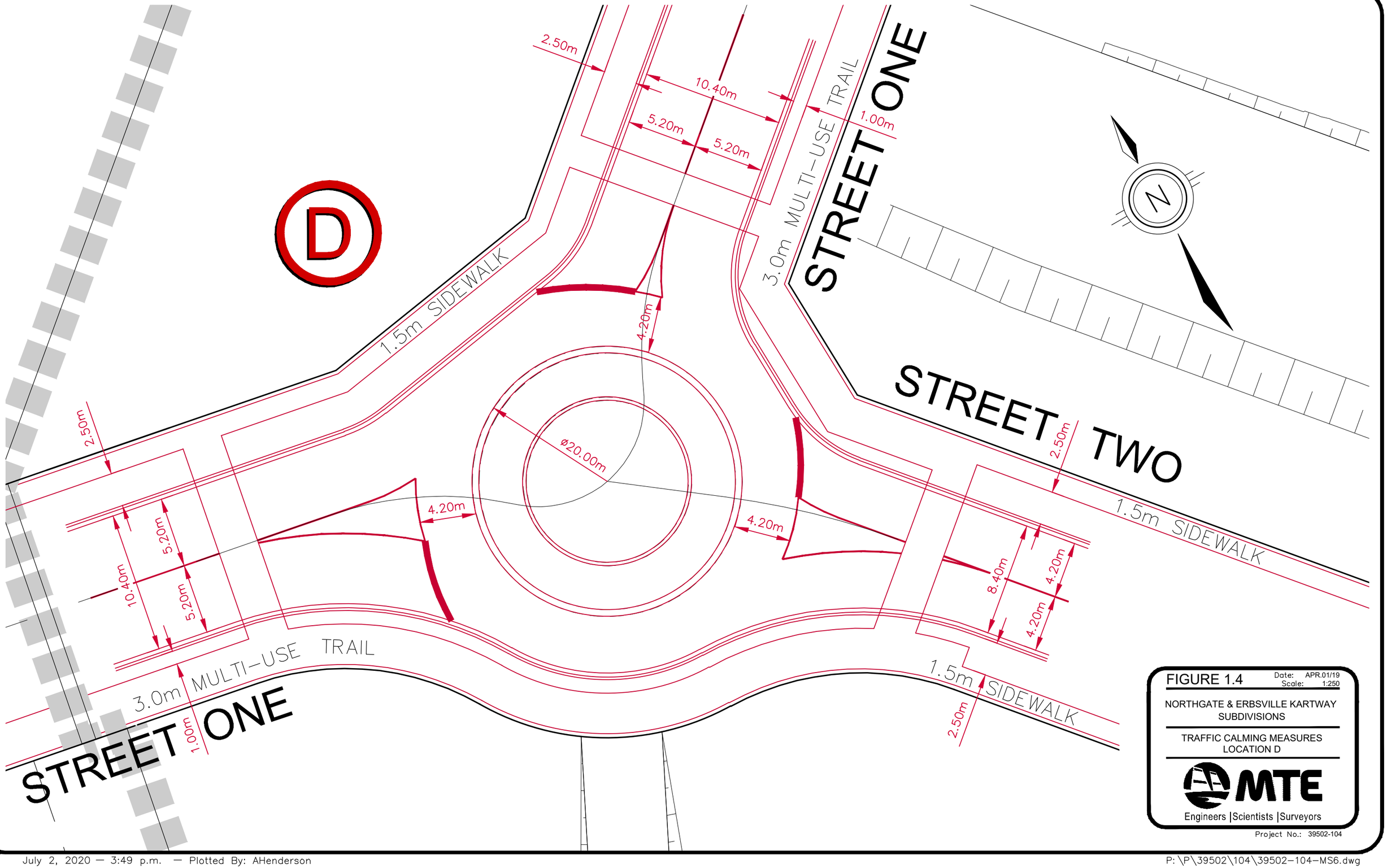

FIGURE 1.4

Date: APR.01/19
Scale: 1:250

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES LOCATION D

MTE

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July 2, 2020 — 3:49 p.m. — Plotted By: AHenderson

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E

STREET TWO

1.5m SIDEWALK

4.20m

4.20m

4.20m

2.12m

4.20m

1.5m SIDEWALK

3.0m MULTI-USE TRAIL

12.00m

WALKWAY BLOCK 12

FIGURE 1.5

Date: JUL.02/20
Scale: 1:250

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TRAFFIC CALMING MEASURES
LOCATION E

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July 16, 2020 — 1:29 p.m. — Plotted By: AHenderson

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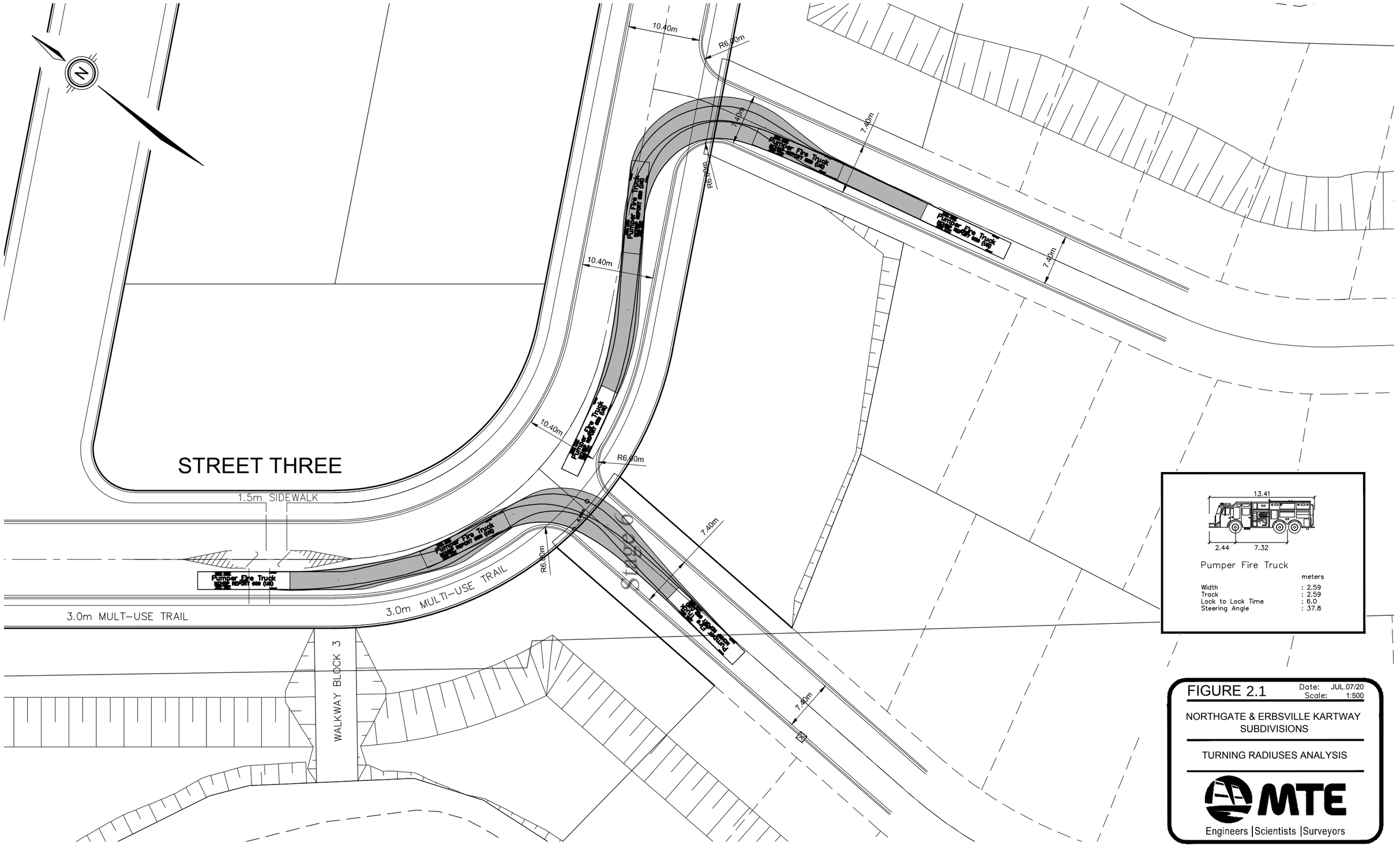

FIGURE 2.1

Date: JUL.07/20
Scale: 1:500

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TURNING RADIUSES ANALYSIS

MTE
Engineers | Scientists | Surveyors

Project No.: 39502-104

July 7, 2020 — 3:36 p.m. — Plotted By: ANechita

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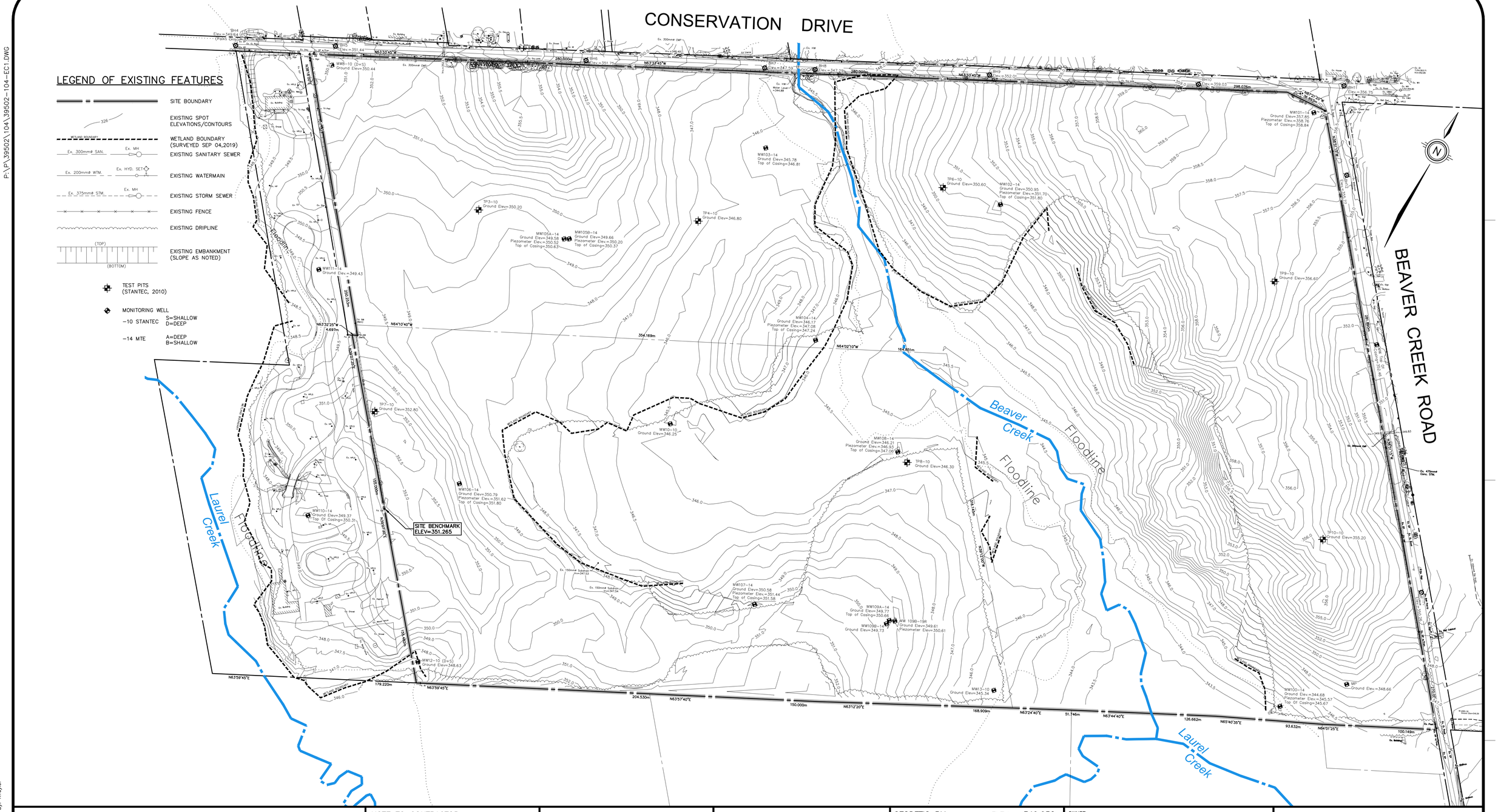
39502-104-EC1.1

MTE FILE No: P:_P\39502\104\39502-104-EC1.DWG

EXISTING CONDITIONS PLAN

July 2, 2020 – 2:48 p.m. – Plotted By: KTaylor



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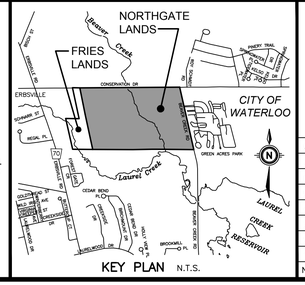

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	FOR REVIEW	VAL	MAY.29/20

GEODETIC BM ELEV. = 349.950m

TABLET SET ON N.E. END OF E. CURB OF CONCRETE BOX CULVERT ON REGIONAL RD. 16 IN ERBSVILLE, 4.9m E. OF CONTRELINE OF REGIONAL RD. 16 32m N.E. OF THE N.E. CORNER OF WHITE FRAME HOUSE, 161m S. OF THE INTERSECTION OF REGIONAL RD. 14 AND 16.

SITE BENCHMARK ELEV. = 351.265m

TOP OF SIB (SEE PLAN FOR LOCATION)

OWNER

1017081 ONTARIO LIMITED & GABRIELLA ELIZABETH GROFF/1455136 ONTARIO INC

1455136 ONTARIO INC. KITCHENER

PROJECT

NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS

CONSERVATION DRIVE WATERLOO

DRAWING

EXISTING CONDITIONS PLAN

MTE

Engineers, Scientists, Surveyors

519-743-6500

Project Manager V.LAZIC	Project No. 39502-104
Design By	Checked By
Drawn By KAT	Checked By MSB
Surveyed By MTE	Drawing No. EC1.1
Date Aug.14/14	
Scale 1:1500	Sheet of

39502-104-AG1.1

MTE FILE No:

FINISHED GRADE CONTOURS PLAN

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CREEKSIDE CHURCH

CONSERVATION DRIVE

BEAVER CREEK ROAD

PROPOSED ROAD GRADES ALONG CONSERVATION DRIVE AND BEAVER CREEK ROAD BASED ON STANTEC DESIGN FROM SEP. 2018.

PROPOSED ROAD GRADES ALONG CONSERVATION DRIVE AND BEAVER CREEK ROAD BASED ON STANTEC DESIGN FROM SEP. 2018.

LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- 10m DRIPLINE BUFFER
- 30m WETLAND BUFFER
- WETLAND BOUNDARY (SURVEYED SEP 04,2019)
- STAGE LIMIT
- EXISTING CONTOURS
- FINSIHED GRADE CONTOURS
- (351.98) PROPOSED SPOT ELEVATIONS
- 2.5% PROPOSED DIRECTION OF DRAINAGE

STREET ONE
STREET TWO
STREET THREE
STREET FOUR
STREET FIVE
STREET SIX
STREET SEVEN
STREET EIGHT

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
Stage 6
Stage 7
Stage 8

PROPOSED 30m LONG 1.0m HIGH RETAINING

3:1 EMBANKMENT INTO BUFFER

PROP 8.5x1.5x0.9m BOX CULVERT (0.3m EMBEDMENT)

PROP 15x1.8x1.2m BOX CULVERT (0.3m EMBEDMENT)

Beaver Creek

Laurel Creek

NOTE TO CONTRACTOR :

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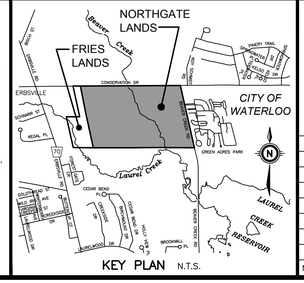

KEY PLAN N.T.S.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	FOR REVIEW	VAL	MAY.28/20

GEODETIC BM ELEV. = 349.950m
TABLET SET ON N.E. END OF E. CURB OF CONCRETE BOX CULVERT ON REGIONAL RD. 16 IN ERBSVILLE, 4.9m E. OF CONTRELINE OF REGIONAL RD. 16 32m N.E. OF THE N.E. CORNER OF WHITE FRAME HOUSE, 161m S. OF THE INTERSECTION OF REGIONAL RD. 14 AND 16.

SITE BENCHMARK ELEV. = 351.265m
TOP OF SIB (SEE PLAN FOR LOCATION)

OWNER
1017081 ONTARIO LIMITED & GABRIELLA ELIZABETH GROFF/1455136 ONTARIO INC
1455136 ONTARIO INC. KITCHENER

PROJECT
NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS
CONSERVATION DRIVE WATERLOO

DRAWING
FINISHED GRADE CONTOURS PLAN

MTE
Engineers, Scientists, Surveyors
519-743-6500

Project Manager V.LAZIC	Project No. 39502-104
Design By	Checked By
Drawn By KAT	Checked By MSB
Surveyed By MTE	Drawing No. AG1.1
Date May.15/20	
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July 16, 2020 — 1:22 p.m. — Plotted By: Attenderson

MTE FILE No: 39502-104-QU8.1

PRELIMINARY GROUNDWATER SEPARATION PLAN

P:\P\39502\104\39502-104-QU8.DWG

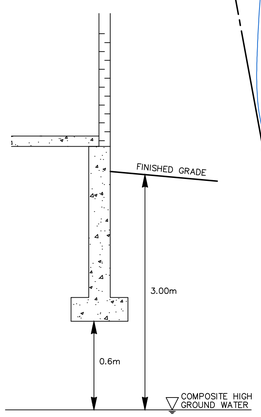
CONSERVATION DRIVE

BEAVER CREEK ROAD

LEGEND

- PROPERTY BOUNDARY
- STAGING LIMIT
- 526 EXISTING CONTOURS
- 526 PROPOSED CONTOURS
- 526 INTERPRETED COMPOSITE HIGH GROUNDWATER LEVEL CONTOURS
- −0.28 LESS THAN 3.00m * SEE DETAIL 'A' BELOW.
- +0.27 GREATER THAN 3.00m

TICKS ARE READ AS SEPARATION BETWEEN 0.6m BELOW UNDERSIDE (U/S) OF FOOTING AND EXISTING HIGH GROUNDWATER.



DETAIL 'A'
N.T.S.

NOTES:

1. THIS ANALYSIS IS VALID ON; REAR TO FRONT DRAINING, SPLIT DRAINING AND FRONT HALF OF WALKOUT LOT TYPES.
2. NOT APPLICABLE ON; STREETS, PARK BLOCKS, SWM BLOCKS AND REAR HALF OF WALKOUT LOTS.

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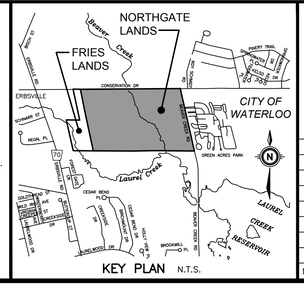

KEY PLAN N.T.S.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	FOR REVIEW	VAL	MAY.29/20

GEODETIC BM ELEV. = 349.950m
TABLET SET ON N.E. END OF E. CURB OF CONCRETE BOX CULVERT ON REGIONAL RD. 16 IN ERBSVILLE, 4.9m E. OF CONTRELINE OF REGIONAL RD. 16 32m N.E. OF THE N.E. CORNER OF WHITE FRAME HOUSE, 161m S. OF THE INTERSECTION OF REGIONAL RD. 14 AND 16.

SITE BENCHMARK ELEV. = 351.265m
TOP OF SIB (SEE PLAN FOR LOCATION)

OWNER
1017081 ONTARIO LIMITED & GABRIELLA ELIZABETH GROFF/1455136 ONTARIO INC
1455136 ONTARIO INC. KITCHENER

PROJECT
NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS
CONSERVATION DRIVE WATERLOO

DRAWING
PRELIMINARY GROUNDWATER SEPARATION PLAN

MTE
Engineers, Scientists, Surveyors
519-743-6500

Project Manager: V.LAZIC	Project No.: 39502-104
Design By:	Checked By:
Drawn By: KAT	Checked By: MSB
Surveyed By: MTE	Drawing No.: QU8.1
Date: Jun.25/20	
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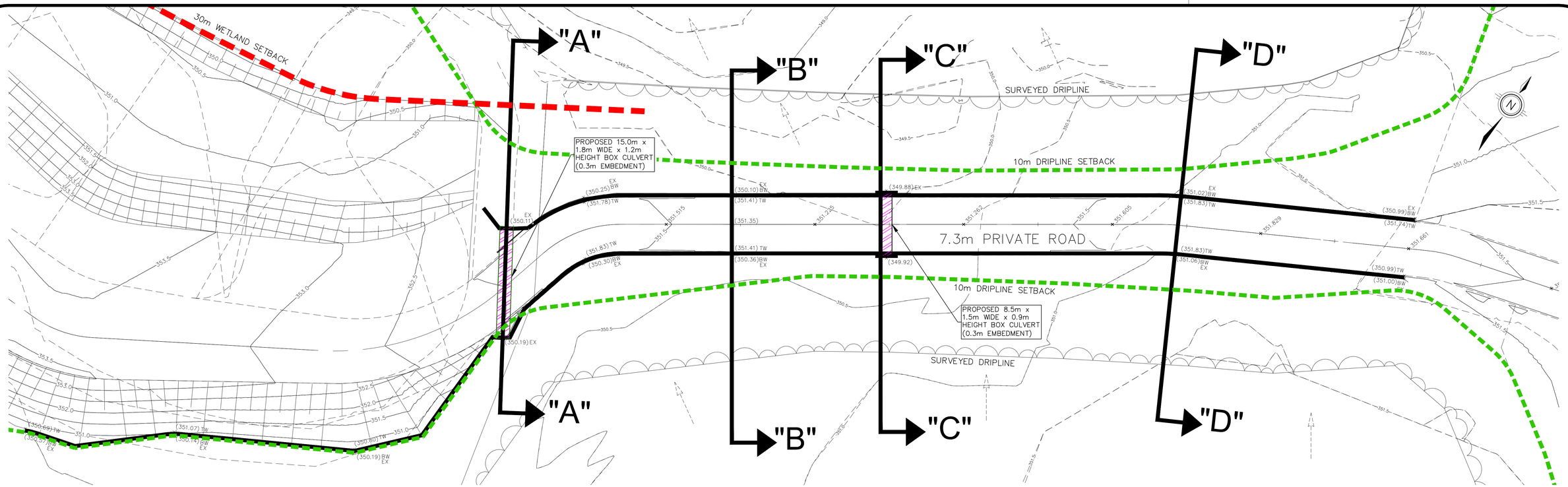
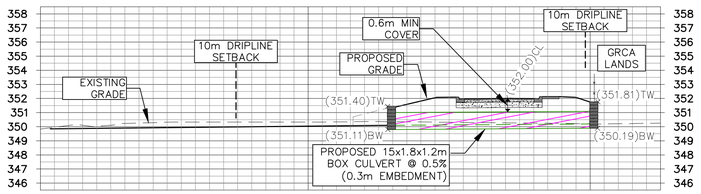


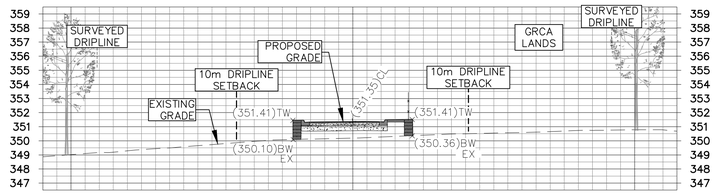


BOX CULVERT

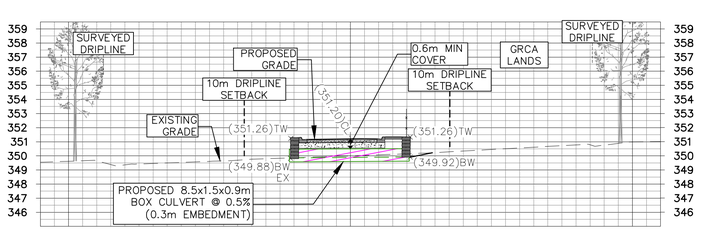
$OR = \frac{W*H}{L} = \frac{1.8*0.9}{15} = 0.1$

0.3m EMBEDMENT

SECTION A-A



SECTION B-B

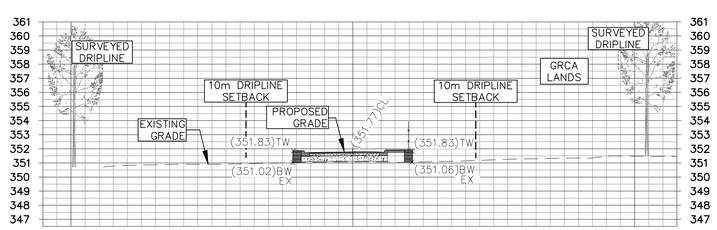


BOX CULVERT

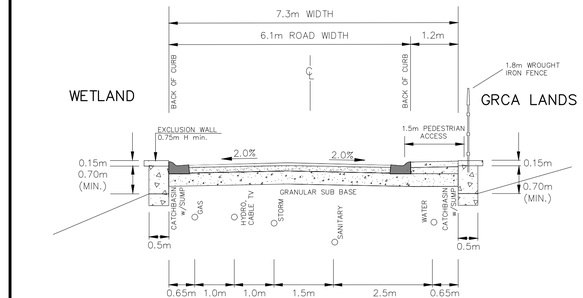
$OR = \frac{W*H}{L} = \frac{1.5*0.6}{8.5} = 0.1$

0.3m EMBEDMENT

SECTION C-C



SECTION D-D



7.3m PRIVATE ROAD CROSS-SECTION

XS1.1

Scale: H-1:200 V- 1:200

NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS

PRIVATE ROAD CROSS SECTIONS

MTE

Engineers, Scientists, Surveyors

Project No.: 39502-104

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MTE FILE PATH:
July 3, 2020 - 4:09:44 PM - Plotted By: Alexander Henderson