# Servicing Strategy Report

**556 and 576 Conservation Drive**
**City of Waterloo**

**July 2016**

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MERITECH

July 12, 2016

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169 Lexington Court, Unit B
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Attention: Mr. Ian Cook
Partner

Dear Mr. Cook,

**Re: Servicing Strategy Report**
**556 and 576 Conservation Drive**
**City of Waterloo**

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Enclosed please find our Servicing Strategy Report for the above-noted project, in support of Draft Plan Approval.

Our servicing report identifies constraints for environmental issues, sanitary sewerage, water supply, and storm drainage/stormwater management. Our report also considers grading constraints, transportation, and utility availability. Where necessary, reasonable assumptions based on normal industry practices have been used and are described as such.

It is our opinion that adequate services exist to support this project. Recommendations from our report shall be incorporated into the detailed design phase of the project, following approval of the draft plan.

Yours very truly,

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# Executive Summary

The proposed residential development is located on the north side of Conservation Drive at the northern terminus of Beaver Creek Road in Waterloo. It is bordered by residential, agricultural and recreational lands. The site will be developed for single-family, multi-family units with a school parcel, park block, open space and a stormwater management facility. The development is being processed through the Draft Plan of Subdivision process with the City of Waterloo and the Region of Waterloo.

Both the standard 18 meter and 20 meter standard municipal cross-sections are proposed, with sanitary and storm sewers, watermain, and other utilities. Sidewalk on both sides of all streets is proposed.

The development will have its sanitary outlet into proposed infrastructure in Conservation Drive and Beaver Creek Road and drain to a proposed Beaver Creek Sanitary Pumping Station north-west of the Laurel Creek Reservoir. Sanitary connections should be provided to each lot and connect to the proposed sewer. A 250mm sanitary sewer with 45L/s peak flow should be incorporated downstream for servicing the development. This flow is to be further refined depending on the school site sizing

The City has proposed to provide 300mm diameter watermains in Conservation Drive and Beaver Creek Road adjacent to the subject lands in the future. These future mains will provide additional flows to the proposed subdivision. The proposed watermain is a combination of 150mm, 200mm, and 300mm watermain. This provides adequate flow and pressure for firefighting supply.

Waterloo North Hydro and Bell Canada have confirmed services in the vicinity. It is expected that Rogers also has service, but have not responded to requests. Union Gas will need to extend mains to service the development and will be coordinated through the detailed design stage.

The storm drainage is divided into east and west catchments. The west catchment discharges to the on-site stormwater management facility and is attenuated for quantity control and quality control. The east side discharges off site for quality enhancement downstream without quantity controls.

A 1050mm storm sewer with peak flow of 1.8m³/sec is to be incorporated in the Beaver Creek Road storm sewer sizing. Storm connections should be provided to each lot for sump pumps and connect to the internal storm sewer discharging into the SWM facility which either discharges to Beaver Creek and the proposed storm sewer in Conservation Drive.

Further refinement of the design in collaboration with the School Board is required to confirm servicing requirements to the school site. The final design should incorporate the conclusions and recommendations stemming from this report.

Approval agencies should review and approve this document as a suitable approach to a preliminary design configuration and Draft Plan approval.

## Disclaimer

This Servicing Strategy Report was prepared by Meritech Engineering for 2115881 Ontario Limited. The comments, recommendations and materials presented in this report reflect our best judgement in light of the information available at the time of preparation. Except for approval and commenting municipalities and agencies in their review and approval of this project, any use which a third party makes of this report, or any reliance upon, or decisions as a result of, are the responsibility of such third parties. Meritech Engineering accepts no responsibility for damages suffered by any third party, other than an approval or commenting municipality or agency, as a result of decisions made or actions taken based on this report.

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# Introduction

The proposed subdivision is located on Conservation Drive in Waterloo, Ontario as shown in Figure 1. The site is bordered by existing residential lands to the east, agricultural lands to the north, Beaver Creek to the west, agricultural lands to the south on the west side of Beaver Creek Road, and the Green Acre Park campground to the south-east.

The site is an irregularly shaped parcel. It is currently used as agricultural lands, and two homes are located on the site. The drainage is split; with roughly half of the site going west to Beaver Creek and the remainder draining to the south-east corner of the site where it drains towards Green Acre Park and eventually to the Laurel Creek Reservoir.

The development shown on the Draft Plan of Subdivision in Appendix A is composed of a mix of low density residential, medium density townhomes, a block reserved for a school, a stormwater management block, a park, and open space.

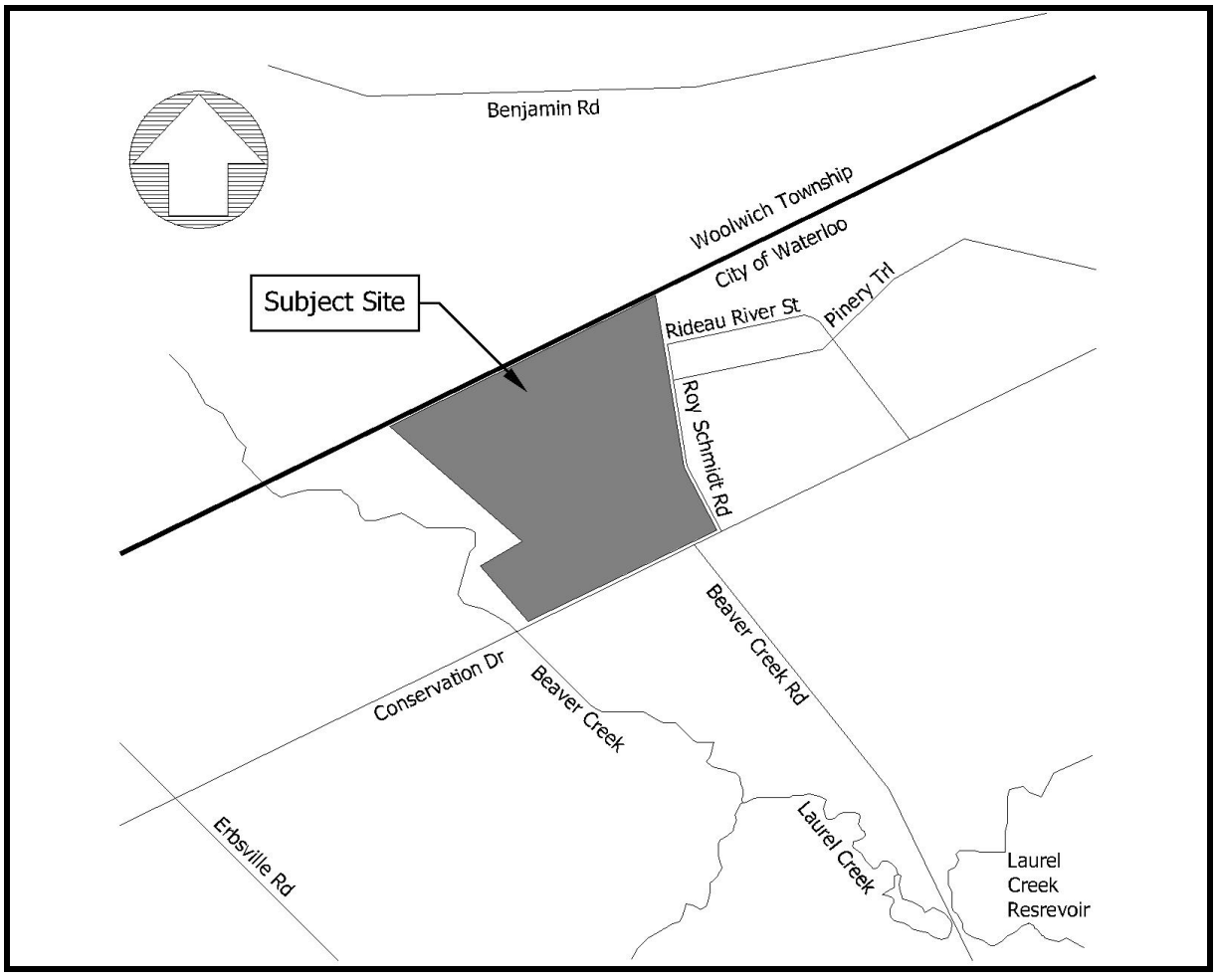



**Figure 1: Subdivision Location**

# Approach

The following flowchart explains a typical submission and approval process. The section highlighted in grey indicates the status of this circulation:

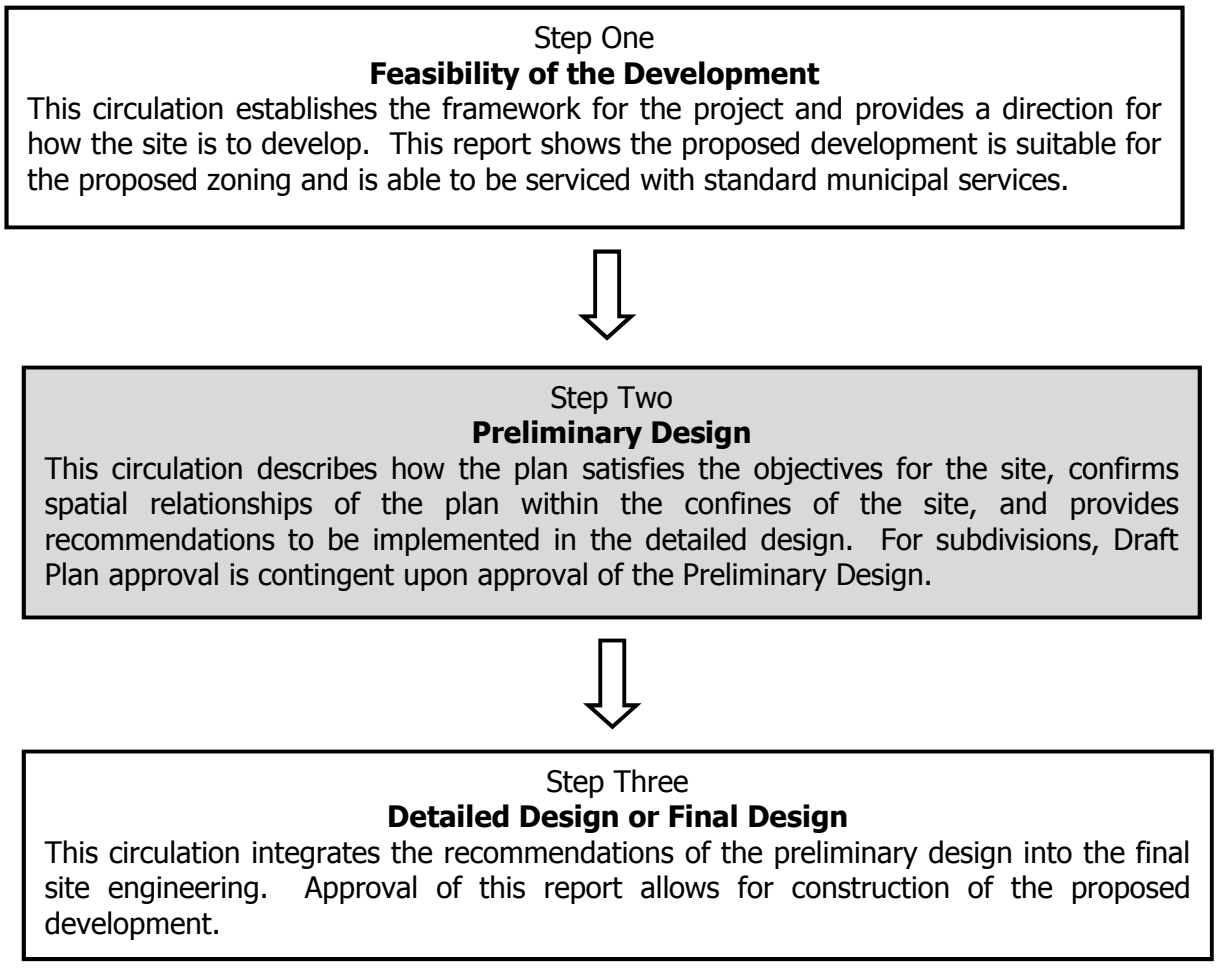



**Figure 2: Approach Flowchart**

# Policy Framework

This chapter outlines the framework upon which the plan is built upon. Previous studies, municipal and provincial standards, as well as any field investigations undertaken to support the project, are examples of information described in this chapter. This background information is then used to build an appropriate plan for the site. The next chapter, Objectives and Targets, describes the site-specific requirements noted from the following sources:

## Planning Documents

*City of Waterloo Official Plan,* October 2014
The subject lands are designated Low Density Residential with a future node shown at the intersection of Conservation Drive and Beaver Creek Road.

*City of Waterloo Zoning By-law,* August 23, 2012
The subject lands are zoned Agricultural.

*City of Waterloo Transportation Master Plan,* IBI Group, April 2011
Conservation Drive is a "Major Collector"; Pinery Trail and Beaver Creek Road are "Minor Collector". Neither Conservation Drive nor Beaver Creek Road are included on exhibit 10.1 – "Recommended Road Network Capacity Enhancements" for the next 20+ years.

*Beaver Creek Meadows District Plan,* January 8, 2015
The Beaver Creek Meadows District Plan was approved by council on January 25, 2016. It provides detail regarding the design and development of the community. The site is shown as a mix of low density residential, medium density residential, and an elementary school site and is anticipated to be part of the initial phase of development of the community district.

## Watershed Plans

*Laurel Creek Watershed Study,* 1992
This document analyses various elements of the watershed, notably the hydrology and the response to the creek during various rainfall events and recommendations to mitigate flooding. The subject site is within catchments 301 and 310.

*North Waterloo Scoped Subwatershed Study,* 2013
This document, hereafter referred to as the "NWSSS", provides technical information to assist in the development of a District Plan, the completion of Class Environmental Assessment processes, and the design of subdivisions.

## Stormwater Management Studies

Meritech Engineering is preparing a Preliminary Stormwater Management Report to accompany the Draft Plan application.

## MOE Guidelines

*Stormwater Management Planning and Design Manual,* Ministry of the Environment, 2003
This manual provides guidelines on the planning and design of stormwater management facilities in Ontario.

## Regional Guidelines

*Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services Guidelines (DGSSMS)*
The design portion of this annually-updated document (Part B) should be considered as guidelines that provides the municipalities' design preferences under normal circumstances. These guidelines are read together with Municipal guidelines and standards in place.

## Municipal Guidelines

*City of Waterloo Development Engineering Manual,* 2013
This manual provides design guidelines for servicing and grading of subdivisions. It also includes a list of coefficients to be used in modelling of synthetic design storms.

*Aesthetic Principles for Storm Water Management, City of Waterloo,* 1996
In accordance with accepted practice throughout the Region of Waterloo, this document describes the preferred features to be incorporated into stormwater management facilities in order to achieve aesthetic and functional objectives.

## Conservation Authority Guidelines

*Greater Golden Horseshoe Area Conservation Authority Erosion & Siltation Control Guideline for Urban Construction, December 2006*
This document describes the methodology for determining the erosion potential of a site and the measures that should be undertaken to mitigate construction disturbance.

## Environmental Studies

*Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Service Class Environmental Assessment,* Stantec Consulting Ltd., December 14, 2015
The EA is ongoing and will address upgrades to Beaver Creek Road and Conservation Drive. Water, storm, sanitary and transportation upgrades are planned adjacent to the subject lands.

NRSI is preparing an Environmental Study to accompany the application. Recommendations from this report guide the site servicing, grading, and stormwater management.

## Geotechnical Studies

A geotechnical investigation was prepared by LVM (March 20, 2015).

## Hydrogeological Studies

Hydrogeological investigations and monitoring of the site have been carried out within the NWSSS and this report referenced from that document.

## Transportation Studies

Salvini Consulting prepared an "Intersectoin Operational Assessment" and the Conservation Drive, and Beaver Creek Class EA document guide the design of Conservation Drive.

## Noise Studies

Meritech Engineering is preparing a Preliminary Noise Assessment to accompany the Draft Plan application. This will guide grading and placement of noise attenuation features.

## Pre-Consultation

Pre-Submission Comments from the Grand River Conservation Authority dated September 14, 2015 have been included in Appendix E of the Preliminary Stormwater Management Report. Key items from these comments are included in the following chapter 'Objectives and Criteria'.

## Reconnaissance

Meritech staff visited the site on November 17, 2015 in order to verify existing drainage patterns of the site and adjacent properties, to confirm existing infrastructure surrounding the site, and to make note of all aboveground features on neighbouring properties. See Figure 3 for existing conditions photographs.



Looking South from NE corner



Looking East across site



Looking North along Roy Schmidt



Looking SE across site



Looking South across East side of site



Looking West along North PL

**Figure 3: Existing Condition Photographs**

# Objectives and Criteria

This section outlines the objectives and criteria for the wide variety of issues considered in this report; the following Discussion section will demonstrate how the objectives presented have been achieved and how the criteria are met.

## Sanitary Servicing

The primary objective with respect to sanitary servicing is that a sanitary sewer system servicing the site can be constructed as per MOE, Region of Waterloo (SSMS), and City of Waterloo standards.

The development will outlet into proposed infrastructure in Conservation Drive and Beaver Creek Road and drain to a proposed Beaver Creek Sanitary Pumping Station just north-west of the Laurel Creek Reservoir. These works are ongoing as part of the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment. Flow rates from the subject site will be provided to ensure capacity in the proposed infrastructure.

## Water Servicing

There are two objectives regarding water servicing: provide domestic water supply as per Provincial, Regional, and City requirements, and ensure that an adequate fire-fighting water supply is available as per Ontario Building Code and other Regional requirements (FUS).

An existing 300mm diameter watermain stub exists in Conservation Drive just east of Beaver Creek Road and an existing 200mm diameter watermain is looped through Pinery Trail and Rideau River Drive. It is proposed in the *Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment* to provide 300mm diameter watermain in Conservation Drive and Beaver Creek Road adjacent to the subject lands in the future.

The water supply on site will be modeled with the assumption that the future watermain extension on Beaver Creek Road is not yet complete. The modelling will be completed using an extension of the 300mm diameter watermain in Conservation Drive into the site and looped to a connection to the 200mm diameter watermain in Pinery Trail. These mains will provide sufficient flows for the proposed Draft Plan.

The Region of Waterloo has provided pressure information for proposed junctions JCT_MTC_01 and JCT_MTC_03 located on the proposed loop through the site from Conservation Drive to Pinery Trail. This information is used later in this report to demonstrate that the water distribution system and proposed internal water system is able to provide fire protection as per OBC and FUS guidelines, as will be described in the following chapter.

## Storm Servicing

The primary objective with respect to storm servicing is that a storm sewer system servicing the site can be constructed as per MOE, Region of Waterloo (SSMS), and City of Waterloo standards.

The development will be discretized and have two primary outlets, as per the North Waterloo Scoped Subwatershed Study (NWSSS). The west side of the site will outlet to a proposed stormwater management block included in the subject site. The east side of the site will outlet to proposed infrastructure south of the intersection of Conservation Drive and Beaver Creek Road, and it will be necessary to provide peak flow rates to ensure the proposed infrastructure is designed with sufficient capacity. On-site stormwater management features should be reviewed in conjunction with the storm servicing.

## Stormwater Management

Stormwater techniques have evolved considerably. Peak flow control is not necessarily the only component of a complete stormwater management solution. In accordance with Section 5.2.1 of the MOE manual, modern techniques include a 'treatment-train' approach of lot-level controls, water balance and infiltration, and water quality enhancement.

In accordance with the NWSSS the following objectives where established for areas within the study area:

- Maintain, and where possible, enhance the hydrologic inputs to Beaver Creek and wetland communities to minimize the influence of development
- Maintain and protect hydrologic functions
- Ensure no impairment of water quality leaving Beaver Creek, Laurel Creek, and Laurel reservoir
- Ensure no significant increase in erosion potential occurs in Beaver Creek or at discharge points from the development area

The specific stormwater management criteria to this subdivision are as follows:

- Utilize the treatment train approach
- Maintain peak flows towards Beaver Creek at or below existing levels for all storms up to and including the Regional storm event
- Provide enhanced water quality control towards Beaver Creek including extended detention storage
- Implement thermal mitigation measures for stormwater discharge to Beaver Creek
- Provide quality control for flows towards the east (Laurel Creek Reservoir as opposed to Beaver Creek)

## Grading and Drainage

Grading of the development site may be determined by a number of factors including:

- Dividing the site drainage between the outlets (Beaver Creek & south of Conservation Road)
- Directing overland flows to the stormwater management facility

- The location of the stormwater management facility and the elevation of its outlet
- Matching existing elevations at proposed intersections
- Matching elevations along neighboring properties
- Providing sufficient cover on watermain and sewers
- Conforming to a typical road cross-section and typical lot grading requirements
- Minimizing earthmoving costs

## Transportation

The road network proposed on the Draft Plan should meet the standards of the Municipality.

## Utilities

The following utility companies are required to confirm their ability to service the development and have been circulated.

- Canada Post
- Waterloo North Hydro
- Bell Canada
- Rogers Cable
- Union Gas

# Discussion

## Subdivision Design

A mixture of uses are proposed for the development (refer to the proposed Draft Plan in Appendix A), which currently is comprised of single detached lots, street townhouses, back-to-back townhouses, future development blocks, and a school site. Besides the requirement for municipal right of ways, the current plan also includes a park and two parkettes, walkway blocks, a trail block, open space, and a stormwater management block.

Both the standard 18 meter and 20 meter standard municipal cross-sections are proposed, with sanitary and storm sewers, watermain, and other utilities in standard locations as required by the City. Sidewalk on both sides of all streets is proposed.

Phasing/staging of the development – in terms of construction activities and subdivision registration – will be developed through the Draft Plan process.

The front setbacks for all types of lots (singles, townhouses, and back-to-back townhouses) are proposed to be reduced to 3.0m with a porch encroachment of 1.0m (i.e. the porch would be 2.0m from streetline), consideration of this reduction and the current right of way standard incorporating an easement should be reviewed through the detailed design phase . For the size of the lots shown on the proposed Draft Plan, the reduced setback yields lots with an approximate maximum imperviousness of almost 60%, slightly more than the 55% assumed in the NWSSS.

# Sanitary Servicing

The development will outlet into proposed infrastructure in Conservation Drive and Beaver Creek Road and drain to a proposed Beaver Creek Sanitary Pumping Station north-west of the Laurel Creek Reservoir. These works are ongoing as part of the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment. 23 single lots are proposed to be directed to the neighboring development to the east (Rideau River Street and Roy Schmicht Road.

Based on the unit counts provided by the Draft Plan, post development peak flows were used by applying peaking factors to the average day demands shown in Table 1. The flows were calculated based on areas shown on the proposed Draft Plan and combined to provide a total site peak flow discharge. A conservative Harmon peaking factor of 4 is used at this preliminary stage.

As shown below, the proposed school site of 2.88ha yields a design flow of 7.2L/s using a demand of 2.5 (L/s)/ha. In order to verify this design flow is adequate, the MOE's estimate (Design Guidelines for Sewage Works and Design Guidelines for Drinking-Water Systems, both 2008) of 70-140 L/d per student over eight hours multiplied by an estimated student population of more than 500 results in an non-peaked design flow of 3.5-11L/s, and the peaking factor is assumed to be 2.

| Unit Type | Flow | Area (ha) | Units | Peak Flow (L/s) |
|---|---|---|---|---|
| Institutional | 2.5 (L/s)/ha | 2.88 | - | ~7 to ~20 |
| Residential | 350 (L/cap)/day | | | |
| *Singles* | | 8.62 | 258 x 3.3ppu | 13.8 |
| *Towns* | | 3.36 | 220 x 2.18ppu | 7.8 |
| Infiltration | 0.15 (L/s)/ha | 14.86 | - | 2.2 |
| | | | | Total: 30 - 45 |

**Table 1: Sanitary Flows**

The proposed development of will generate peak flows of approximately 30L/s – 50L/s. This peak flow rate is about 60% - 100% of the capacity of the 250mm diameter sewer leaving the site.

Additional design information on the proposed school will be used in the detailed design phase to determine an appropriate peaking factor and thus the design flow from the facility, as the school site could contribute up to about half of the total flows from the development.

For current purposes this analysis confirms the maximum size sanitary sewer is 250mm, and recommends that the detailed design of Beaver Creek Road sanitary sewer, allow for maximum peak flow from this development of 45L/s.

# Water Servicing

## Existing Infrastructure

As shown on the Region's modeling report in Appendix D an existing 300mmø watermain stub exists in Conservation Drive just east of Beaver Creek Road and an existing 200mmø watermain is looped through Pinery Trail and Rideau River Street. It is proposed in the *Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment* to provide 300mm diameter watermains in Conservation Drive and Beaver Creek Road adjacent to the subject lands in the future. These future mains will provide additional flows to the proposed subdivision; the intent of this modeling is to demonstrate that the subdivision can be developed prior to their completion.

## Proposed Development

A number of modeling locations have been selected as the most likely 'worst-case' events. Each will be modeled to demonstrate the ability of the water distribution network to provide an adequate firefighting supply. These locations are:

A) Single detached home furthest away from the watermain connections to the subdivision
B) Single detached home at the highest point of the site
C) School central to the site
D) Back-to-back townhouse block of units at the southwest corner of the subdivision

Modeling inputs for each of these locations are shown in Table 2. All buildings are assumed to be constructed with standard wooden frames with concrete foundations. With the exception of the school, the buildings are not proposed to be fitted with sprinklers.

| **Modeling Locations** Description | **Assumed Building Size** | **Total Building Footprint** | **Approx. Centreline Elevation** | **Storeys** |
|---|---|---|---|---|
| **A** furthest single | 11m x 18.3m (35' x 60') | 201.3m² | 358.5 | 2+basement |
| **B** highest single | | | 364.1 | 2+basement |
| **C** school | 4650m² (50,000ft²) | 4650m² | 361.0 | 1 |
| **D** 14-unit townhouse block | 6.5m x 10.5m ea (21' x 35' ea) | 955.5m² | 359.0 | 3+basement |

**Table 2: Water Modeling Locations**

The proposed watermain is a combination of 150mm, 200mm, and 300mm watermain. The Site Servicing Plan is included in Appendix B to show the proposed watermains for the development.

## Analysis Results

Modeling of the existing water distribution system was provided by the Region of Waterloo and is included in Appendix D. Surface elevations were used in the EPANET modeling as specified in the Regional Municipality of Waterloo Design Guidelines (DGSSMS). Demand was estimated by unit counts, with population per unit factors from the City's development manual; refer to base Water Demand Calculations in Appendix C. For the school, the average day demand is taken to be 3.7L/s based on a demand of 210(L/d)/student over 8 hours (MOE) with an assumed population of 500.

Table 3 shows the results of the modeling for each of the modeling locations run. For additional details, refer to EPANET output in Appendix C.

At this stage of design, only the most conservative modeling scenario was run, the "maximum day plus fire" scenario using the Fire Underwriters Study (FUS) methodology. Other scenarios such as the minimum hour, base demand, and peak hour have much smaller demands and can be completed at a future design stage to confirm suitable operating pressures during normal conditions, etc. Similarly, the Building Code (OBC) calculations result in lower firefighting demands than the FUS method.

The fire flow values for any commercial and school sites are to be confirmed when information becomes available.

| Location | Fire Demand (L/s) | Reservoir Used | Reservoir Head masl | Min. Pressure m |
|---|---|---|---|---|
| A | 90 | JCT_MTC_01 | 396.00 | 28.55 |
| B | 90 | JCT_MTC_01 | 396.00 | 19.91 |
| C | 200-250 * | JCT_MTC_02 | - | - |
| D | 255 **<br>116 ** | JCT_MTC_02 | -<br>387.90 | -<br>15.87 |

*Estimated, reference the Tri-City Water Distribution Master Plan, 2009, and the Cambridge West MESP's *Surface Water Resources and Municipal Servicing Study*, 2013

**If no fire walls

*** Assuming fire walls such that four units form the largest continuous area

**Table 3: Water Modeling Inputs/Results (*Max Day Plus Fire*)**

It was determined that during the maximum day plus fire scenarios the proposed watermain in the subdivision is sufficient to convey the firefighting flows to the single detached homes as per FUS requirements and maintain the minimum 140 kPa or 14.25 m (DGSSMS) pressure.

The school and the townhomes should they not have multiple fire walls, will both require the future 300mm diameter watermain from Beaver Creek Road to be constructed in order to achieve the required firefighting flows. Confirmation of watermain sizes internal to the subdivision shall be completed within the detailed design phase and refined for approval prior to registration.

## Storm Servicing

The development will have multiple outlets. The west side of the site will outlet to the proposed stormwater management block included in the subject site, and from there towards Beaver Creek. The east side of the site will outlet to proposed infrastructure at the intersection of Conservation Drive and Beaver Creek Road; it will be necessary to ensure that the proposed external infrastructure is designed with sufficient capacity. The minor flow conveyance will be through the storm sewer system and the major storm conveyance will be along the roads.

Stormwater management features should be reviewed in conjunction with the storm servicing design. Runoff coefficients were obtained from the *City of Waterloo Development Engineering Manual*. The subdivision's outflow at the intersection of Conservation Drive and Beaver Creek Road is approximately 1.8m³/s, which is able to be conveyed by a 1050mm diameter storm sewer.

As per the Stormwater Management Report, it may be necessary to install a Clean Water Conveyance system through some portions of the site in order to provide a water balance for infiltration. This system can be generally viewed as similar to the Etobicoke System presented in the MOECC's SWM Design Guidelines and would incorporate water from catchbasins being cleaned in oil/grit separators to an infiltrating pipe below the conveyance pipe or a third pipe system where roof leaders and sump pump connections are collected separately from road drainage and infiltrated through a perforated pipe within the municipal right of way.

## Stormwater Management

A constructed wetland is proposed to provide control to runoff from the west side, the location of which is influenced by existing topography. As a result, the stormwater management block is proposed at the west side of the site adjacent to Beaver Creek. The forebay and constructed wetland are adequately sized to store the volume of water required to attenuate storms from the 2-year up to the regional storm event to the levels indicated in the subwatershed study and to provide an "Enhanced" level of treatment in accordance with MOE Guidelines. The pond outlet will be composed of a reverse slope outlet pipe with a 75mm diameter orifice, and an overflow weir for large events.

The constructed wetland will discharge to Beaver Creek and includes the following:

- A central location, with easy access, for sediment removal
- Extended detention water quality treatment
- Flood control up to the Regional storm event, matching flows provided in the subwatershed study
- A "baseflow" component (extended detention drawdown)
- An aesthetically pleasing facility designed to blend into surrounding lands
- Easily maintainable and accessible inlets and outlets

### Water Quantity

The stormwater management facility meets the water quantity targets by attenuating peak flows leaving the site for the requisite storm events. The Stormwater Management Report describes this in more detail.

### Water Quality

The site was designed to meet the MOE Enhanced level of water quality control by implementing a sediment forebay and extended detention along with pre-treatment through grassed swales.

### Water Balance, Infiltration, and Groundwater

A water balance will be provided through the use of a combination of lot level soak away pits; roof water to soak away pits; clean water third pipe system; end-of-pipe infiltrating facility; and common infiltration trenches. Refer to the Preliminary Stormwater Management Report for details.

## Grading and Drainage

The primary consideration for establishing the road grades is to provide for major storm routes to convey the surface flow to the stormwater management facility serving the designated drainage area. The road surface profile provides these routes and all grades are within the minimum and maximum allowable grades. The road centre line gradient and rates of pavement cross slope will provide rapid surface drainage. The roadways will be constructed in accordance with the City's standards.

Due to the topographic nature of the site, consideration is given to designing the site for suitable houses consisting of a mix of deck units and of standard house types. The limit of grading will typically be to the established lot property lines. The intent of the proposed lot grading design is to discharge surface water away from the building envelope. The front drainage of all the lots will be discharged to the road to be captured in the storm sewer and directed to the stormwater management facilities.

## Transportation

The roundabout and grading of Conservation Drive is being carried out by Stantec Consulting and the results of their design should be incorporated into the detailed design of the subdivision. It is recommended that the preliminary grading and servicing plan be shared with Stantec in order to confirm grades as presented with work for both designs.

## Utilities

The following utility companies have responded with their ability to service the development:

- Waterloo North Hydro
  - The area is serviced by overhead conductors, no concerns were identified.
- Bell Canada
  - Existing lines adjacent to the site are not of sufficient size to service the development; therefore, services will need to be extended from the intersection of Conservation Drive and Waterton Drive.
- Rogers Cable
  - No comment.
- Union Gas
  - There is not an existing line to service the site. A line should be brought through to the area for development of all properties and will be further investigated through the detailed design phase.

# Conclusions

Sanitary sewerage is south along Beaver Creek Road, to a pumping station currently being sited/detailed by others as part of the EA process.

Provision of a 150mm-300mm diameter watermain through the subdivision provides adequate flow and pressure as per MOE and Region guidelines for firefighting supply; development of the school block and townhouses may be contingent on the future extension of watermain up Beaver Creek Road.

The subdivision's outflow at the intersection of Conservation Drive and Beaver Creek Road is approximately 1.8m³/s, which is able to be conveyed by a 1050mm diameter storm sewer.

The stormwater management plan consists of a flow split between Beaver Creek to the west and an off-site facility south of Conservation Drive. The subdivision's facility includes a forebay and constructed wetland to attenuate various storm events and provide water quality control. A water balance is provided through the use of multiple lot-level, conveyance, and end-of-pipe measures.

# Recommendations

The final design should incorporate the conclusions and recommendations stemming from this report.

Sanitary connections should be provided to each lot and connect to the proposed sewer.

A 250mm sanitary sewer with 45L/s peak flow should be incorporated downstream for servicing the development. This flow is to be further refined depending on the school site sizing

A 1050mm storm sewer with peak flow of 1.8m³/sec is to be incorporated in the Beaver Creek Road storm sewer sizing.

Storm connections should be provided to each lot for sump pumps and connect to the internal storm sewer discharging into the SWM facility which either discharges to Beaver Creek and the proposed storm sewer in Conservation Drive.

Post-development peak flows should be attenuated to target peak flow rates for the northwest part of the subdivision.

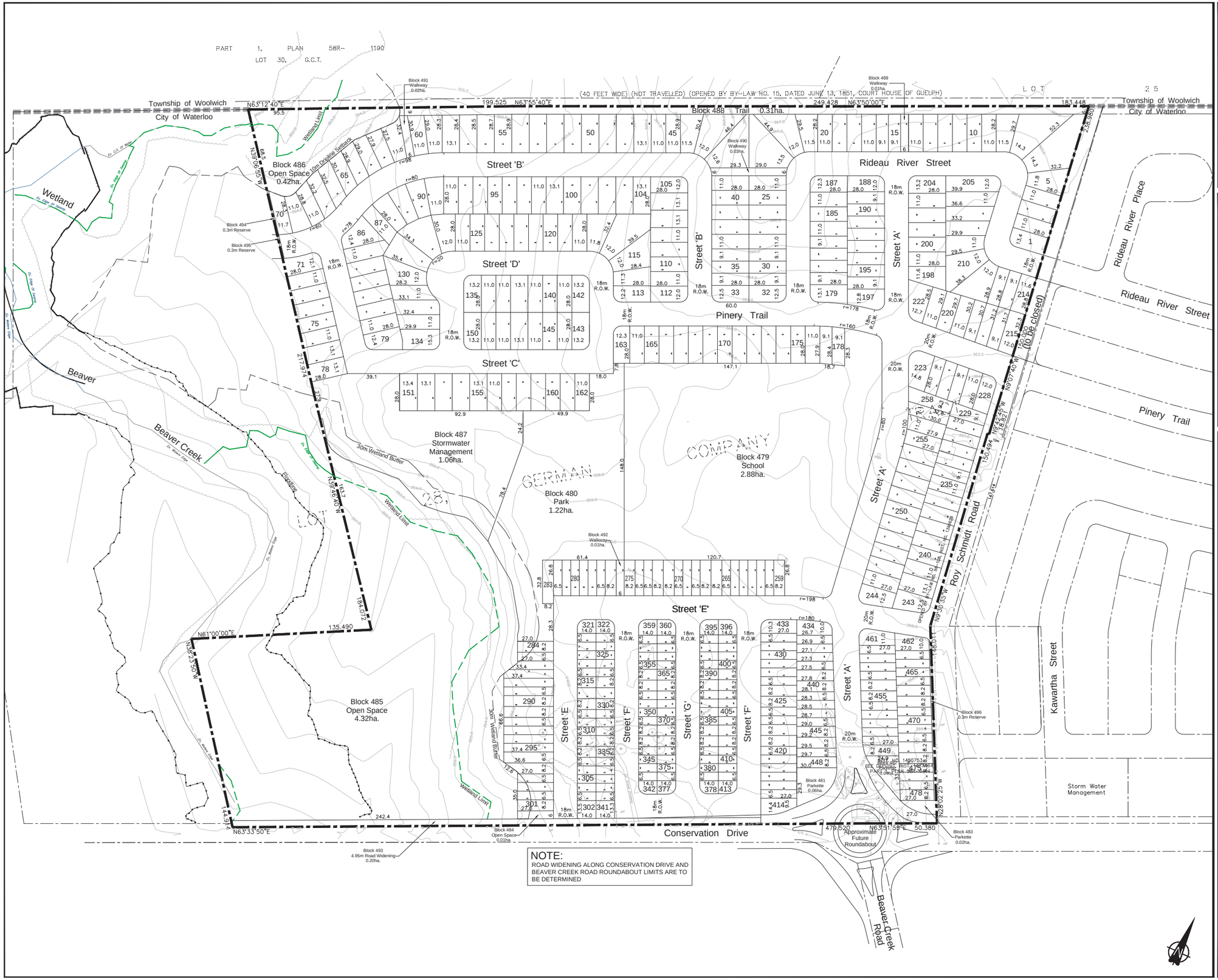
A detailed water distribution design should be prepared, and future conditions modeling should be provided by the Region to demonstrate that the proposed school site has adequate firefighting flows.

Approval agencies should review and approve this document as a suitable approach to a preliminary design configuration and Draft Plan approval.

# References

Ministry of the Environment, Stormwater Management Planning & Design Manual
March 2003

# Appendix A: Draft Plan


PART 1, PLAN 58R-- 1190
LOT 30, G.C.T.
Township of Woolwich
City of Waterloo
N63°12'40"E 95.5
199.525 N63°55'40"E
(40 FEET WIDE) (NOT TRAVELLED) (OPENED BY BY-LAW NO. 15, DATED JUNE 13, 1851, COURT HOUSE OF GUELPH)
249.428 N63°50'00"E
183.448
L O T 2 5
Township of Woolwich
City of Waterloo
Block 491 Walkway 0.02ha.
Block 489 Walkway 0.01ha.
Block 488 Trail 0.31ha.
Block 490 Walkway 0.03ha.
Wetland Limit
10m Dripline Setback
Block 486 Open Space 0.42ha.
Block 494 0.3m Reserve
Block 495 0.3m Reserve
Wetland
Beaver
Beaver Creek
Floodplain
30m Wetland Buffer
Block 487 Stormwater Management 1.06ha.
Block 479 School 2.88ha.
Block 480 Park 1.22ha.
Block 485 Open Space 4.32ha.
Block 492 Walkway 0.01ha.
Block 493 4.95m Road Widening 0.20ha.
Block 484 Open Space 0.01ha.
Block 481 Parkette 0.06ha.
Block 496 0.3m Reserve
Block 483 Parkette 0.02ha.
Street 'A'
Street 'B'
Street 'C'
Street 'D'
Street 'E'
Street 'F'
Street 'G'
Rideau River Street
Rideau River Place
Pinery Trail
Roy Schmidt Road
Kawartha Street
Beaver Creek Road
Conservation Drive
Storm Water Management
Approximate Future Roundabout
N61°00'00"E 135.490
N38°23'50"W 184.072
N63°33'50"E 242.4
N39°06'55"W 68.5
N63°16'40"W 165.7
N63°51'55"E 50.380
N63°51'55"E 479.520
N26°07'40"W 145.811
N26°07'40"W 150.434
N26°07'40"W 145.011
N26°07'40"W 148.621
N26°07'40"W 140.194
N26°07'40"W 145.811

# Appendix B: Design Drawings

Ex. CA. Of Creek

Ex. Edge of Swamp

Infiltration gallery

Street 'B'

Street 'D'

Street 'C'

Max 6.0m high retaining wall

Beaver Creek

Ex. Hedge row

SWM Pond

Infiltration gallery

Park

Infiltration gallery

Infiltration gallery

Ex. Edge of Swamp

Ex. Edge of Swamp

Match existing elevations along entire northern limit

Rideau River Street

Street 'B'

Street 'A'

Pinery Trail

Infiltration gallery

School

Street 'A'

Rideau River Place

Rideau River Street (to be closed)

Pinery Trail

Roy Schmidt Road

Street 'E'

Street 'F'

Street 'G'

Street 'F'

Street 'A'

Kawartha Street

Conservation Drive

POLE

Ex Gutter


MERITECH
Engineering
1315 Bishop Street North, Suite 201 Cambridge
T 519.621.1140 F 519.621.7724 www.meritech.ca


DRAWING: Conceptual Grading Plan
556 & 576 Conservation Drive

| | | | |
|---|---|---|---|
| DRAWN BY: | JEL | CHECKED BY: | CHT |
| FILE NAME: | 1279-Figure | DATE: | Jul. 2016 |

SCALE: 1:1000

1279-SG

Rear yards over/through wall to infiltration gallery under trail, sized for 2-yr volume. (See detail below)

Rear yards over/through wall to infiltration gallery, sized for 2-yr volume.

Ex. Post & Wire Fence

Ex. CA. Of Creek

Ex. Edge Of Swamp

Ex. Edge Of Swamp

Ex. Edge Of Swamp

Ex. Edge Of Swamp

Ex. Edge Of Swamp

Street 'B'

Rideau River Street

150mmø Wmn, Streets B, C & D

150mmø Wmn, Street A (Pinery Trail to Rideau River Street) & Rideau River Street

Street 'D'

Street 'B'

Street 'A'

Rideau River Place

Rideau River Street

Pinery Trail

300mmø Wmn

(to be closed)

200mmø Wmn Pinery Trail (Street B to Street A)

Street 'C'

825mmø Stm into SWM Pond

Beaver Creek

Ex. Hedge Row

Ex. Hedge Row

Ex. Hedge Row

# Appendix C: Calculations

MERITECH engineering

Project: Conservatior
File: 1279
Completed by: SBW
Date: 5/19/2016
Checked by: CHT
Date: 5/20/2016

## Water Demand Calculations

**City of Waterloo**

| Node | Elevation (m) | Node Type | # of Units | Pop. Density (ppl/unit) | Pop. | Demand (l/cap/day) | Demand (l/sec) |
|---|---|---|---|---|---|---|---|
| 1 | 354.60 | towns | 14 | 2.440 | 35 | 225 | 0.091 |
| 2 | 358.70 | towns | 18 | 2.440 | 44 | 225 | 0.115 |
| | | singles | 10 | 3.250 | 33 | 225 | 0.086 |
| | | total | | | | 225 | 0.201 |
| 3 | 358.20 | towns | 19 | 2.440 | 47 | 225 | 0.122 |
| | | singles | 6 | 3.250 | 20 | 225 | 0.052 |
| | | total | | | | 225 | 0.174 |
| 4 | 357.30 | towns | 9 | 2.440 | 22 | 225 | 0.057 |
| 5 | 358.20 | towns | 25 | 2.440 | 61 | 225 | 0.159 |
| 6 | 358.60 | towns | 20 | 2.440 | 49 | 225 | 0.128 |
| 7 | 358.00 | towns | 25 | 2.440 | 61 | 225 | 0.159 |
| 8 | 358.80 | towns | 18 | 2.440 | 44 | 225 | 0.115 |
| 9 | 358.20 | towns | 24 | 2.440 | 59 | 225 | 0.154 |
| 10 | 358.90 | towns | 20 | 2.440 | 49 | 225 | 0.128 |
| 11 | 358.10 | towns | 22 | 2.440 | 54 | 225 | 0.141 |
| 12 | 355.80 | towns | 22 | 2.440 | 54 | 225 | 0.141 |
| 13 | 361.10 | school | 1 | 500.000 | 500 | 210 | 3.646 |
| | | singles | 9 | 3.250 | 30 | 225 | 0.078 |
| | | total | | | | 225 | 3.724 |
| 14 | 363.30 | singles | 28 | 3.250 | 91 | 225 | 0.237 |
| 15 | 362.70 | singles | 17 | 3.250 | 56 | 225 | 0.146 |
| 16 | 363.40 | singles | 17 | 3.250 | 56 | 225 | 0.146 |
| 17 | 363.80 | singles | 20 | 3.250 | 65 | 225 | 0.169 |
| 18 | 363.70 | singles | 13 | 3.250 | 43 | 225 | 0.112 |
| 19 | 362.70 | singles | 17 | 3.250 | 56 | 225 | 0.146 |
| 20 | 362.30 | singles | 17 | 3.250 | 56 | 225 | 0.146 |
| 21 | 362.90 | singles | 16 | 3.250 | 52 | 225 | 0.135 |
| 22 | 360.30 | singles | 17 | 3.250 | 56 | 225 | 0.146 |
| 23 | 358.90 | singles | 16 | 3.250 | 52 | 225 | 0.135 |
| 24 | 358.40 | singles | 6 | 3.250 | 20 | 225 | 0.052 |
| 25 | 357.90 | singles | 15 | 3.250 | 49 | 225 | 0.128 |
| 26 | 358.10 | singles | 20 | 3.250 | 65 | 225 | 0.169 |
| 27 | 358.90 | singles | 21 | 3.250 | 69 | 225 | 0.180 |
| 28 | 360.30 | singles | 11 | 3.250 | 36 | 225 | 0.094 |
| | | | | | | | |
| | | Totals | 513 | - | 1984 | - | 7.510 |

Page 1 5/21/2016 9:56:13 AM

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
*************************************************************************
```

Input File: 1279.D - JCT3.Node12.NET

Conservation Drive - Max Day plus Fire (115L/s) @ Node 12

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---|---|---|---|---|
| 1 | 1 | 2 | 148 | 150 |
| 2 | 2 | 29 | 50 | 150 |
| 3 | 3 | 4 | 174 | 150 |
| 4 | 3 | 5 | 79 | 200 |
| 5 | 5 | 6 | 144 | 150 |
| 6 | 6 | 8 | 47 | 150 |
| 9 | 5 | 7 | 46 | 200 |
| 10 | 7 | 9 | 45 | 200 |
| 11 | 9 | 11 | 49 | 200 |
| 12 | 8 | 7 | 148 | 150 |
| 13 | 8 | 10 | 49 | 150 |
| 14 | 10 | 9 | 144 | 150 |
| 15 | 11 | 12 | 147 | 200 |
| 16 | 3 | 13 | 136 | 150 |
| 17 | 13 | 15 | 87 | 150 |
| 18 | 2 | 14 | 207 | 150 |
| 20 | 17 | 18 | 72 | 150 |
| 21 | 18 | 19 | 92 | 150 |
| 22 | 15 | 19 | 63 | 150 |
| 23 | 19 | 20 | 86 | 200 |
| 24 | 20 | 28 | 74 | 150 |
| 25 | 20 | 21 | 96 | 150 |
| 26 | 21 | 22 | 97 | 150 |
| 27 | 22 | 23 | 108 | 150 |
| 28 | 23 | 24 | 78 | 150 |
| 29 | 24 | 25 | 92 | 150 |
| 30 | 25 | 26 | 68 | 150 |
| 31 | 26 | 27 | 64 | 150 |
| 34 | 15 | 17 | 111 | 150 |
| 35 | 17 | 16 | 137 | 150 |
| 36 | 16 | 14 | 110 | 150 |
| 37 | 15 | 14 | 109 | 150 |
| 7 | 27 | 28 | 119 | 150 |
| 8 | 26 | 28 | 133 | 150 |
| 19 | 3 | 29 | 10 | 200 |

Page 2 Conservation Drive - Max Day plus Fire (115L/s) @ Node 12

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality | |
|---|---|---|---|---|---|
| 1 | 0.13 | 387.82 | 33.22 | 0.00 | |
| 2 | 0.17 | 387.82 | 29.12 | 0.00 | |
| 3 | 0.25 | 387.42 | 29.22 | 0.00 | |
| 4 | 0.08 | 387.42 | 30.12 | 0.00 | |
| 5 | 0.23 | 383.69 | 25.49 | 0.00 | |
| 6 | 0.18 | 382.55 | 23.95 | 0.00 | |
| 7 | 0.23 | 382.19 | 24.19 | 0.00 | |
| 8 | 0.17 | 382.19 | 23.39 | 0.00 | |
| 9 | 0.22 | 380.73 | 22.53 | 0.00 | |
| 10 | 0.18 | 381.81 | 22.91 | 0.00 | |
| 11 | 0.20 | 378.46 | 20.36 | 0.00 | |
| 12 | 115.20 | 371.67 | 15.87 | 0.00 | |
| 13 | 5.36 | 387.42 | 26.32 | 0.00 | |
| 14 | 0.34 | 387.53 | 24.23 | 0.00 | |
| 15 | 0.21 | 387.47 | 24.77 | 0.00 | |
| 16 | 0.21 | 387.51 | 24.11 | 0.00 | |
| 17 | 0.24 | 387.48 | 387.30 | 0.00 | |
| 18 | 0.16 | 387.48 | 23.78 | 0.00 | |
| 19 | 0.21 | 387.47 | 24.77 | 0.00 | |
| 20 | 0.21 | 387.47 | 25.17 | 0.00 | |
| 21 | 0.19 | 387.47 | 24.57 | 0.00 | |
| 22 | 0.21 | 387.47 | 27.17 | 0.00 | |
| 23 | 0.19 | 387.47 | 28.57 | 0.00 | |
| 24 | 0.07 | 387.47 | 29.07 | 0.00 | |
| 25 | 0.18 | 387.47 | 29.57 | 0.00 | |
| 26 | 0.24 | 387.47 | 29.37 | 0.00 | |
| 27 | 0.26 | 387.47 | 28.57 | 0.00 | |
| 28 | 0.14 | 387.47 | 27.17 | 0.00 | |
| 29 | -125.69 | 387.90 | 0.00 | 0.00 | Reservoir |

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---|---|---|---|---|
| 1 | -0.13 | 0.01 | 0.00 | Open |
| 2 | -8.52 | 0.48 | 1.51 | Open |
| 3 | 0.08 | 0.00 | 0.00 | Open |
| 4 | 116.62 | 3.71 | 47.23 | Open |
| 5 | 20.83 | 1.18 | 7.90 | Open |
| 6 | 20.65 | 1.17 | 7.77 | Open |
| 9 | 95.56 | 3.04 | 32.66 | Open |
| 10 | 95.30 | 3.03 | 32.50 | Open |
| 11 | 115.40 | 3.67 | 46.33 | Open |
| 12 | -0.03 | 0.00 | 0.00 | Open |
| 13 | 20.51 | 1.16 | 7.67 | Open |
| 14 | 20.33 | 1.15 | 7.55 | Open |

Page 3 Conservation Drive - Max Day plus Fire (115L/s) @ Node 12
Link Results: (continued)

| Link ID | Flow LPS | VelocityUnit m/s | Headloss m/km | Status |
|---|---|---|---|---|
| 15 | 115.20 | 3.67 | 46.17 | Open |
| 16 | 0.22 | 0.01 | 0.00 | Open |
| 17 | -5.14 | 0.29 | 0.59 | Open |
| 18 | 8.23 | 0.47 | 1.41 | Open |
| 20 | 1.28 | 0.07 | 0.05 | Open |
| 21 | 1.12 | 0.06 | 0.04 | Open |
| 22 | 0.80 | 0.05 | 0.02 | Open |
| 23 | 1.71 | 0.05 | 0.02 | Open |
| 24 | 0.84 | 0.05 | 0.02 | Open |
| 25 | 0.66 | 0.04 | 0.01 | Open |
| 26 | 0.46 | 0.03 | 0.01 | Open |
| 27 | 0.25 | 0.01 | 0.00 | Open |
| 28 | 0.06 | 0.00 | 0.00 | Open |
| 29 | -0.02 | 0.00 | 0.00 | Open |
| 30 | -0.20 | 0.01 | 0.00 | Open |
| 31 | -0.10 | 0.01 | 0.00 | Open |
| 34 | -1.32 | 0.07 | 0.05 | Open |
| 35 | -2.85 | 0.16 | 0.20 | Open |
| 36 | -3.06 | 0.17 | 0.23 | Open |
| 37 | -4.83 | 0.27 | 0.53 | Open |
| 7 | -0.36 | 0.02 | 0.00 | Open |
| 8 | -0.35 | 0.02 | 0.00 | Open |
| 19 | -117.17 | 3.73 | 47.65 | Open |

```
******************************************************************************
*                            E P A N E T                                     *
*                     Hydraulic and Water Quality                            *
*                     Analysis for Pipe Networks                             *
*                          Version 2.0                                       *
******************************************************************************
```

Input File: 1279.A - JCT1.Node17.NET

Conservation Drive - Max Day plus Fire (90L/s) @ Node 12

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---|---|---|---|---|
| 1 | 1 | 2 | 148 | 150 |
| 2 | 2 | 3 | 60 | 150 |
| 3 | 3 | 4 | 174 | 150 |
| 4 | 3 | 5 | 79 | 150 |
| 5 | 5 | 6 | 144 | 150 |
| 6 | 6 | 8 | 47 | 150 |
| 9 | 5 | 7 | 46 | 150 |
| 10 | 7 | 9 | 45 | 150 |
| 11 | 9 | 11 | 49 | 150 |
| 12 | 8 | 7 | 148 | 150 |
| 13 | 8 | 10 | 49 | 150 |
| 14 | 10 | 9 | 144 | 150 |
| 15 | 11 | 12 | 147 | 150 |
| 16 | 3 | 13 | 136 | 150 |
| 17 | 13 | 29 | 80 | 150 |
| 18 | 2 | 14 | 207 | 150 |
| 20 | 17 | 18 | 72 | 150 |
| 21 | 18 | 19 | 92 | 150 |
| 22 | 15 | 19 | 63 | 150 |
| 23 | 19 | 20 | 86 | 200 |
| 24 | 20 | 28 | 74 | 150 |
| 25 | 20 | 21 | 96 | 150 |
| 26 | 21 | 22 | 97 | 150 |
| 27 | 22 | 23 | 108 | 150 |
| 28 | 23 | 24 | 78 | 150 |
| 29 | 24 | 25 | 92 | 150 |
| 30 | 25 | 26 | 68 | 150 |
| 31 | 26 | 27 | 64 | 150 |
| 34 | 15 | 17 | 111 | 150 |
| 35 | 17 | 16 | 137 | 150 |
| 36 | 16 | 14 | 110 | 150 |
| 37 | 15 | 14 | 109 | 150 |
| 7 | 27 | 28 | 119 | 150 |
| 8 | 26 | 28 | 133 | 150 |
| 19 | 15 | 29 | 7 | 150 |

Page 2 Conservation Drive - Max Day plus Fire (90L/s) @ Node 24

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality | |
|---|---|---|---|---|---|
| 1 | 0.13 | 395.14 | 40.54 | 0.00 | |
| 2 | 0.17 | 395.14 | 36.44 | 0.00 | |
| 3 | 0.25 | 395.25 | 37.05 | 0.00 | |
| 4 | 0.08 | 395.25 | 37.95 | 0.00 | |
| 5 | 0.23 | 395.24 | 37.04 | 0.00 | |
| 6 | 0.18 | 395.24 | 36.64 | 0.00 | |
| 7 | 0.23 | 395.24 | 37.24 | 0.00 | |
| 8 | 0.17 | 395.24 | 36.44 | 0.00 | |
| 9 | 0.22 | 395.24 | 37.04 | 0.00 | |
| 10 | 0.18 | 395.24 | 36.34 | 0.00 | |
| 11 | 0.20 | 395.24 | 37.14 | 0.00 | |
| 12 | 0.20 | 395.24 | 39.44 | 0.00 | |
| 13 | 5.36 | 395.59 | 34.49 | 0.00 | |
| 14 | 0.34 | 394.80 | 31.50 | 0.00 | |
| 15 | 0.21 | 395.27 | 32.57 | 0.00 | |
| 16 | 0.21 | 393.70 | 30.30 | 0.00 | |
| 17 | 89.81 | 392.35 | 28.55 | 0.00 | |
| 18 | 0.16 | 393.24 | 29.54 | 0.00 | |
| 19 | 0.21 | 394.38 | 31.68 | 0.00 | |
| 20 | 0.21 | 394.38 | 32.08 | 0.00 | |
| 21 | 0.19 | 394.38 | 31.48 | 0.00 | |
| 22 | 0.21 | 394.38 | 34.08 | 0.00 | |
| 23 | 0.19 | 394.38 | 35.48 | 0.00 | |
| 24 | 0.07 | 394.38 | 35.98 | 0.00 | |
| 25 | 0.18 | 394.38 | 36.48 | 0.00 | |
| 26 | 0.24 | 394.38 | 36.28 | 0.00 | |
| 27 | 0.26 | 394.38 | 35.48 | 0.00 | |
| 28 | 0.14 | 394.38 | 34.08 | 0.00 | |
| 29 | -100.26 | 396.00 | 0.00 | 0.00 | Reservoir |

Link Results:

| Link ID | Flow LPS | VelocityUnit m/s | Headloss m/km | Status |
|---|---|---|---|---|
| 1 | -0.13 | 0.01 | 0.00 | Open |
| 2 | -9.24 | 0.52 | 1.75 | Open |
| 3 | 0.08 | 0.00 | 0.00 | Open |
| 4 | 1.62 | 0.09 | 0.07 | Open |
| 5 | 0.49 | 0.03 | 0.01 | Open |
| 6 | 0.30 | 0.02 | 0.00 | Open |
| 9 | 0.90 | 0.05 | 0.02 | Open |
| 10 | 0.51 | 0.03 | 0.01 | Open |
| 11 | 0.41 | 0.02 | 0.01 | Open |
| 12 | -0.16 | 0.01 | 0.00 | Open |
| 13 | 0.30 | 0.02 | 0.00 | Open |
| 14 | 0.12 | 0.01 | 0.00 | Open |

Page 3 Conservation Drive - Max Day plus Fire (90L/s) @ Node 24
Link Results: (continued)

| Link ID | Flow LPS | VelocityUnit m/s | Headloss m/km | Status |
|---|---|---|---|---|
| 15 | 0.20 | 0.01 | 0.00 | Open |
| 16 | -11.19 | 0.63 | 2.50 | Open |
| 17 | -16.55 | 0.94 | 5.16 | Open |
| 18 | 8.94 | 0.51 | 1.65 | Open |
| 20 | -26.46 | 1.50 | 12.30 | Open |
| 21 | -26.62 | 1.51 | 12.43 | Open |
| 22 | 28.54 | 1.61 | 14.14 | Open |
| 23 | 1.71 | 0.05 | 0.02 | Open |
| 24 | 0.84 | 0.05 | 0.02 | Open |
| 25 | 0.66 | 0.04 | 0.01 | Open |
| 26 | 0.46 | 0.03 | 0.01 | Open |
| 27 | 0.25 | 0.01 | 0.00 | Open |
| 28 | 0.06 | 0.00 | 0.00 | Open |
| 29 | -0.02 | 0.00 | 0.00 | Open |
| 30 | -0.20 | 0.01 | 0.00 | Open |
| 31 | -0.10 | 0.01 | 0.00 | Open |
| 34 | 39.90 | 2.26 | 26.31 | Open |
| 35 | -23.46 | 1.33 | 9.84 | Open |
| 36 | -23.67 | 1.34 | 10.00 | Open |
| 37 | 15.07 | 0.85 | 4.33 | Open |
| 7 | -0.36 | 0.02 | 0.00 | Open |
| 8 | -0.35 | 0.02 | 0.00 | Open |
| 19 | -83.71 | 4.74 | 103.79 | Open |

```
******************************************************************
*                          E P A N E T                           *
*                   Hydraulic and Water Quality                  *
*                   Analysis for Pipe Networks                   *
*                         Version 2.0                            *
******************************************************************
```

Input File: 1279.B - JCT1.Node24.net

Conservation Drive - Max Day plus Fire (90L/s) @ Node 24

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---|---|---|---|---|
| 1 | 1 | 2 | 148 | 150 |
| 2 | 2 | 3 | 60 | 150 |
| 3 | 3 | 4 | 174 | 150 |
| 4 | 3 | 5 | 79 | 150 |
| 5 | 5 | 6 | 144 | 150 |
| 6 | 6 | 8 | 47 | 150 |
| 9 | 5 | 7 | 46 | 150 |
| 10 | 7 | 9 | 45 | 150 |
| 11 | 9 | 11 | 49 | 150 |
| 12 | 8 | 7 | 148 | 150 |
| 13 | 8 | 10 | 49 | 150 |
| 14 | 10 | 9 | 144 | 150 |
| 15 | 11 | 12 | 147 | 150 |
| 16 | 3 | 13 | 136 | 150 |
| 17 | 13 | 29 | 80 | 150 |
| 18 | 2 | 14 | 207 | 150 |
| 20 | 17 | 18 | 72 | 150 |
| 21 | 18 | 19 | 92 | 150 |
| 22 | 15 | 19 | 63 | 150 |
| 23 | 19 | 20 | 86 | 200 |
| 24 | 20 | 28 | 74 | 150 |
| 25 | 20 | 21 | 96 | 150 |
| 26 | 21 | 22 | 97 | 150 |
| 27 | 22 | 23 | 108 | 150 |
| 28 | 23 | 24 | 78 | 150 |
| 29 | 24 | 25 | 92 | 150 |
| 30 | 25 | 26 | 68 | 150 |
| 31 | 26 | 27 | 64 | 150 |
| 34 | 15 | 17 | 111 | 150 |
| 35 | 17 | 16 | 137 | 150 |
| 36 | 16 | 14 | 110 | 150 |
| 37 | 15 | 14 | 109 | 150 |
| 7 | 27 | 28 | 119 | 150 |
| 8 | 26 | 28 | 133 | 150 |
| 19 | 15 | 29 | 7 | 150 |

Page 2 Conservation Drive - Max Day plus Fire (90L/s) @ Node 24

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality | |
|---|---|---|---|---|---|
| 1 | 0.13 | 395.37 | 40.77 | 0.00 | |
| 2 | 0.17 | 395.37 | 36.67 | 0.00 | |
| 3 | 0.25 | 395.44 | 37.24 | 0.00 | |
| 4 | 0.08 | 395.44 | 38.14 | 0.00 | |
| 5 | 0.23 | 395.43 | 37.23 | 0.00 | |
| 6 | 0.18 | 395.43 | 36.83 | 0.00 | |
| 7 | 0.23 | 395.43 | 37.43 | 0.00 | |
| 8 | 0.17 | 395.43 | 36.63 | 0.00 | |
| 9 | 0.22 | 395.43 | 37.23 | 0.00 | |
| 10 | 0.18 | 395.43 | 36.53 | 0.00 | |
| 11 | 0.20 | 395.43 | 37.33 | 0.00 | |
| 12 | 0.20 | 395.43 | 39.63 | 0.00 | |
| 13 | 5.36 | 395.67 | 34.57 | 0.00 | |
| 14 | 0.34 | 395.16 | 31.86 | 0.00 | |
| 15 | 0.21 | 395.23 | 32.53 | 0.00 | |
| 16 | 0.21 | 394.83 | 31.43 | 0.00 | |
| 17 | 0.24 | 394.44 | 30.64 | 0.00 | |
| 18 | 0.16 | 393.21 | 29.51 | 0.00 | |
| 19 | 0.21 | 391.65 | 28.95 | 0.00 | |
| 20 | 0.21 | 389.05 | 26.75 | 0.00 | |
| 21 | 0.19 | 386.29 | 23.39 | 0.00 | |
| 22 | 0.21 | 383.53 | 23.23 | 0.00 | |
| 23 | 0.19 | 380.49 | 21.59 | 0.00 | |
| 24 | 90.07 | 378.31 | 19.91 | 0.00 | |
| 25 | 0.18 | 381.83 | 23.93 | 0.00 | |
| 26 | 0.24 | 384.45 | 26.35 | 0.00 | |
| 27 | 0.26 | 385.03 | 26.13 | 0.00 | |
| 28 | 0.14 | 386.13 | 25.83 | 0.00 | |
| 29 | -100.69 | 396.00 | 0.00 | 0.00 | Reservoir |

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---|---|---|---|---|
| 1 | -0.13 | 0.01 | 0.00 | Open |
| 2 | -7.25 | 0.41 | 1.12 | Open |
| 3 | 0.08 | 0.00 | 0.00 | Open |
| 4 | 1.62 | 0.09 | 0.07 | Open |
| 5 | 0.49 | 0.03 | 0.01 | Open |
| 6 | 0.30 | 0.02 | 0.00 | Open |
| 9 | 0.90 | 0.05 | 0.02 | Open |
| 10 | 0.51 | 0.03 | 0.01 | Open |
| 11 | 0.41 | 0.02 | 0.01 | Open |
| 12 | -0.16 | 0.01 | 0.00 | Open |
| 13 | 0.30 | 0.02 | 0.00 | Open |
| 14 | 0.12 | 0.01 | 0.00 | Open |

Page 3 Conservation Drive - Max Day plus Fire (90L/s) @ Node 24
Link Results: (continued)

| Link ID | Flow LPS | VelocityUnit m/s | Headloss m/km | Status |
|---|---|---|---|---|
| 15 | 0.20 | 0.01 | 0.00 | Open |
| 16 | -9.20 | 0.52 | 1.74 | Open |
| 17 | -14.56 | 0.82 | 4.07 | Open |
| 18 | 6.95 | 0.39 | 1.03 | Open |
| 20 | 31.59 | 1.79 | 17.08 | Open |
| 21 | 31.43 | 1.78 | 16.92 | Open |
| 22 | 60.48 | 3.42 | 56.86 | Open |
| 23 | 91.71 | 2.92 | 30.27 | Open |
| 24 | 49.67 | 2.81 | 39.48 | Open |
| 25 | 41.83 | 2.37 | 28.71 | Open |
| 26 | 41.63 | 2.36 | 28.47 | Open |
| 27 | 41.42 | 2.34 | 28.20 | Open |
| 28 | 41.23 | 2.33 | 27.96 | Open |
| 29 | -48.85 | 2.76 | 38.28 | Open |
| 30 | -49.03 | 2.77 | 38.54 | Open |
| 31 | -22.43 | 1.27 | 9.05 | Open |
| 34 | 19.78 | 1.12 | 7.17 | Open |
| 35 | -12.06 | 0.68 | 2.87 | Open |
| 36 | -12.27 | 0.69 | 2.96 | Open |
| 37 | 5.66 | 0.32 | 0.71 | Open |
| 7 | -22.69 | 1.28 | 9.25 | Open |
| 8 | -26.85 | 1.52 | 12.63 | Open |
| 19 | -86.13 | 4.87 | 109.42 | Open |

# Appendix D: Agency Correspondence

Region of Waterloo

TRANSPORTATION AND
ENVIRONMENTAL SERVICES
Water Services

150 Frederick Street
Kitchener ON Canada N2G 4J3
Telephone: (519) 575-4426
Fax: (519) 575-4452
www.region.waterloo.on.ca

Date: November 12, 2015
File #: E18-10/WA.10

Chris Togeretz, P.Eng.
Engineering Designer
Meritech Engineering
1315 Bishop Street North, Suite 202
Cambridge ON N1R 6Z2
Telephone: (519) 623-1140 x214
Facsimile: (519) 623-7334
mailto:christophert@meritech.ca

**Dear: Chris**

**Re: 556 and 576 Conservation Dr, Waterloo**

Please find the results of the modeling simulations for boundary conditions first requested on June 3, 2015 and then updated on August 18, 2015, including a figure showing the locations of the nodes from the Region's model.

Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands for nodes:

- JCT_MTC_01 located at the intersection of Pinery Trail and Street A
- JCT_MTC_03 located at the intersection of Street H and Street A.
- Names of streets as noted above are from the GSP Group drawing dated July 29 2015 for the presubmission application.

Please note that this modeling is representative of existing conditions at the site and includes two new additional watermains to close the loop within the proposed subdivision.

- 300 mm dia watermain connection from existing node JCT_05154 to JCT_MTC-01
- 200 mm dia watermain connection from existing node JCT_04161 to JCT_MTC-01

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:

| Node | Pressure Zone | Elevation | Ave Day Demands (L/s) | | Max Day Demands (L/s) | |
|---|---|---|---|---|---|---|
| | | | Res | Inst | Res | Inst |
| JCT_MTC_01 | Wat 4c | 362.0 mASL | 3.30 | 0.00 | 4.80 | 0.00 |
| JCT_MTC_03 | Wat 4c | 362.0 mASL | 0.00 | 3.70 | 0.00 | 5.50 |

A fire flow analysis shows the maximum flow available at JCT_MTC_01 is 152.9 L/s with a design pressure of 17.4 m during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

A fire flow analysis shows the maximum flow available at JCT_MTC_03 is 148.5 L/s with a design pressure of 17.2 m during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

Please be advised the Region has a study in progress titled **Staging and Implementation Plan for Consolidating Pressure Zones in North-Central Waterloo**. This study will incorporate pressure zone Wat 4b and Wat 4c within Pressure Zone Wat 5 and modifications to portions of pressure zone Wat 4. The consolidation of the pressure zones will provide an opportunity to reduce operation and maintenance costs while maintaining the existing level of service and provide more opportunities for better looping and supply of service within the newly expanded pressure zone Wat 5. The study will provide the staging of the capital projects to decommission the existing pumping stations and to construct the new linear infrastructure to form the new pressure Zone Wat 5. It is anticipate the study will be completed by the end of 2015.

The HGL for pressure zone Wat 4c is 405 mASL the HGL for pressure zone Wat 5 is 404.9 mASL.

The existing ground elevations range from 346 mASL to 366 mASL. Any development with a finished road elevation below 348.8 mASL will require individual pressure reducing devices on each water service in accordance with Section B.2.4.7 of the Design Guidelines and Supplemental Specifications for Municipal Services for January 2015.

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

cc. John Holowackyj, Region of Waterloo (email)
Shilling Yip, Region of Waterloo (email)

Pressure Zone Wat 4c

**JCT_MTC_01 Average Day 24 Hour Simulation**

| Time | Demand (L/s) | Head (m) | Pressure (m) |
|---|---|---|---|
| 00:00 hrs | 3.47 | 404.95 | 42.95 |
| 01:00 hrs | 1.98 | 404.98 | 42.98 |
| 02:00 hrs | 1.82 | 404.98 | 42.98 |
| 03:00 hrs | 1.82 | 404.98 | 42.98 |
| 04:00 hrs | 1.82 | 404.98 | 42.98 |
| 05:00 hrs | 2.31 | 404.97 | 42.97 |
| 06:00 hrs | 2.97 | 404.96 | 42.96 |
| 07:00 hrs | 3.96 | 404.90 | 42.90 |
| 08:00 hrs | 4.29 | 404.84 | 42.84 |
| 09:00 hrs | 4.95 | 404.82 | 42.82 |
| 10:00 hrs | 5.02 | 404.81 | 42.81 |
| 11:00 hrs | 4.13 | 404.85 | 42.85 |
| 12:00 hrs | 2.48 | 404.91 | 42.91 |
| 13:00 hrs | 2.15 | 404.92 | 42.92 |
| 14:00 hrs | 1.88 | 404.93 | 42.93 |
| 15:00 hrs | 1.78 | 404.93 | 42.93 |
| 16:00 hrs | 1.78 | 404.93 | 42.93 |
| 17:00 hrs | 1.78 | 404.93 | 42.93 |
| 18:00 hrs | 1.78 | 404.93 | 42.93 |
| 19:00 hrs | 3.30 | 404.88 | 42.88 |
| 20:00 hrs | 6.44 | 404.74 | 42.74 |
| 21:00 hrs | 6.60 | 404.74 | 42.74 |
| 22:00 hrs | 5.94 | 404.77 | 42.77 |
| 23:00 hrs | 4.79 | 404.87 | 42.87 |

| | |
|---|---|
| **Average Day HGL:** | 404.90 |
| **Minimum Hour:** | 404.98 |

**JCT_MTC_01 Maximum Day 24 Hour Simulation**

| Time | Demand (L/s) | Head (m) | Pressure (m) |
|---|---|---|---|
| 00:00 hrs | 5.04 | 404.90 | 42.90 |
| 01:00 hrs | 2.88 | 404.96 | 42.96 |
| 02:00 hrs | 2.64 | 404.96 | 42.96 |
| 03:00 hrs | 2.64 | 404.96 | 42.96 |
| 04:00 hrs | 2.64 | 404.96 | 42.96 |
| 05:00 hrs | 3.36 | 404.95 | 42.95 |
| 06:00 hrs | 4.32 | 404.92 | 42.92 |
| 07:00 hrs | 5.76 | 404.80 | 42.80 |
| 08:00 hrs | 6.24 | 404.68 | 42.68 |
| 09:00 hrs | 7.20 | 404.63 | 42.63 |
| 10:00 hrs | 7.30 | 404.62 | 42.62 |
| 11:00 hrs | 6.00 | 404.70 | 42.70 |
| 12:00 hrs | 3.60 | 404.82 | 42.82 |
| 13:00 hrs | 3.12 | 404.84 | 42.84 |
| 14:00 hrs | 2.74 | 404.85 | 42.85 |
| 15:00 hrs | 2.59 | 404.86 | 42.86 |
| 16:00 hrs | 2.59 | 404.86 | 42.86 |
| 17:00 hrs | 2.59 | 404.86 | 42.86 |
| 18:00 hrs | 2.59 | 404.86 | 42.86 |
| 19:00 hrs | 4.80 | 404.76 | 42.76 |
| 20:00 hrs | 9.36 | 404.48 | 42.48 |
| 21:00 hrs | 9.60 | 404.46 | 42.46 |
| 22:00 hrs | 8.64 | 404.53 | 42.53 |
| 23:00 hrs | 6.96 | 404.74 | 42.74 |

| | |
|---|---|
| **Maximum Day HGL:** | 404.79 |
| **Peak Hour:** | 404.46 |

| Available Flow (L/s) | Residual Pressure (m) |
|---|---|
| 0.0 | 42.9 |
| 10.0 | 42.6 |
| 20.0 | 42.2 |
| 30.0 | 41.7 |
| 40.0 | 41.1 |
| 50.0 | 40.3 |
| 60.0 | 39.4 |
| 70.0 | 38.4 |
| 80.0 | 37.3 |
| 90.0 | 36.0 |
| 100.0 | 34.0 |
| 110.0 | 30.9 |
| 120.0 | 27.6 |
| 130.0 | 24.2 |
| 140.0 | 20.5 |
| 148.5 | 17.2 |

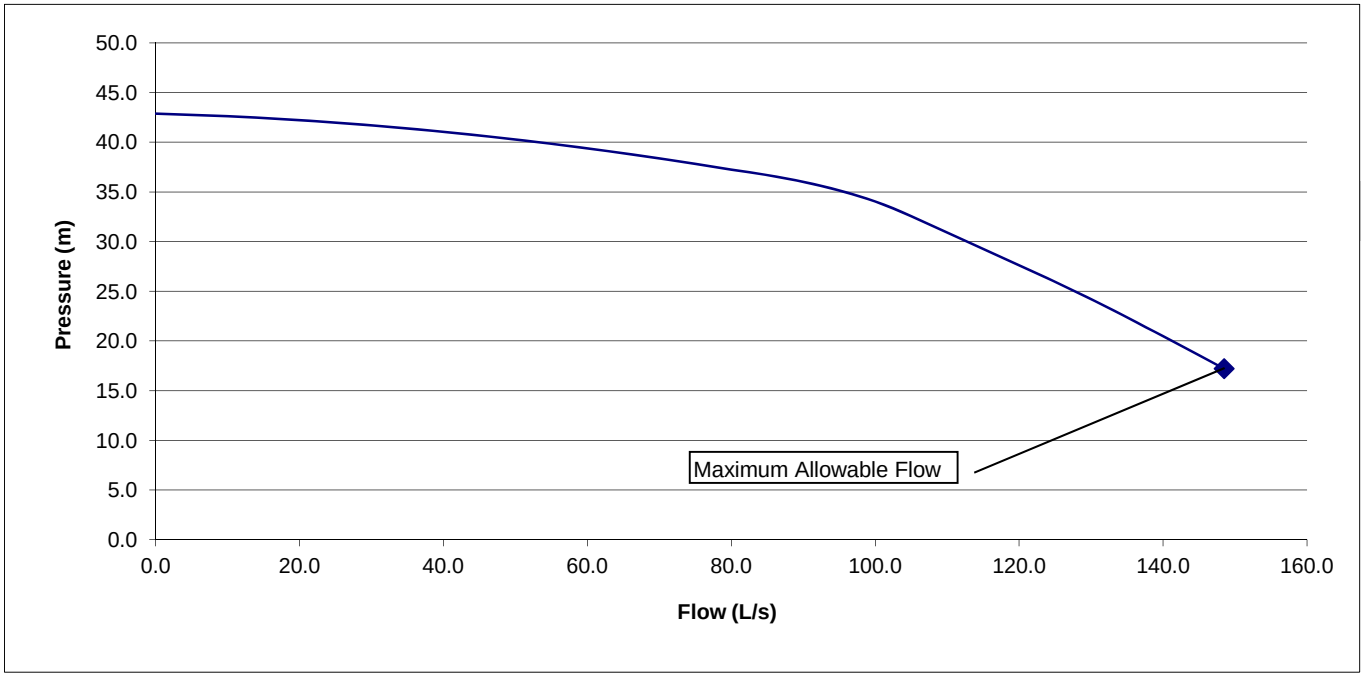
**Fire Flow Analysis**

| | |
|---|---|
| **Fire Flow Node:** | JCT_MTC_01 |
| **Design Flow (L/s):** | 148.5 |
| **Design Pressure (m):** | 17.2 |

*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.*



Pressure Zone Wat 4c

**JCT_MTC_03 Average Day 24 Hour Simulation**

| Time | Demand (L/s) | Head (m) | Pressure (m) |
|---|---|---|---|
| 00:00 hrs | 0.74 | 404.95 | 42.95 |
| 01:00 hrs | 0.74 | 404.98 | 42.98 |
| 02:00 hrs | 0.74 | 404.98 | 42.98 |
| 03:00 hrs | 0.74 | 404.98 | 42.98 |
| 04:00 hrs | 0.74 | 404.98 | 42.98 |
| 05:00 hrs | 0.74 | 404.97 | 42.97 |
| 06:00 hrs | 0.74 | 404.96 | 42.96 |
| 07:00 hrs | 2.96 | 404.90 | 42.90 |
| 08:00 hrs | 5.18 | 404.84 | 42.84 |
| 09:00 hrs | 5.18 | 404.82 | 42.82 |
| 10:00 hrs | 5.18 | 404.81 | 42.81 |
| 11:00 hrs | 5.18 | 404.85 | 42.85 |
| 12:00 hrs | 5.18 | 404.91 | 42.91 |
| 13:00 hrs | 5.18 | 404.92 | 42.92 |
| 14:00 hrs | 5.18 | 404.93 | 42.93 |
| 15:00 hrs | 5.18 | 404.93 | 42.93 |
| 16:00 hrs | 5.18 | 404.93 | 42.93 |
| 17:00 hrs | 5.18 | 404.93 | 42.93 |
| 18:00 hrs | 5.18 | 404.93 | 42.93 |
| 19:00 hrs | 5.18 | 404.88 | 42.88 |
| 20:00 hrs | 5.18 | 404.75 | 42.75 |
| 21:00 hrs | 5.18 | 404.74 | 42.74 |
| 22:00 hrs | 5.18 | 404.77 | 42.77 |
| 23:00 hrs | 2.96 | 404.87 | 42.87 |

| | |
|---|---|
| **Average Day HGL:** | 404.90 |
| **Minimum Hour:** | 404.98 |

**JCT_MTC_03 Maximum Day 24 Hour Simulation**

| Time | Demand (L/s) | Head (m) | Pressure (m) |
|---|---|---|---|
| 00:00 hrs | 1.10 | 404.90 | 42.90 |
| 01:00 hrs | 1.10 | 404.96 | 42.96 |
| 02:00 hrs | 1.10 | 404.96 | 42.96 |
| 03:00 hrs | 1.10 | 404.96 | 42.96 |
| 04:00 hrs | 1.10 | 404.96 | 42.96 |
| 05:00 hrs | 1.10 | 404.95 | 42.95 |
| 06:00 hrs | 1.10 | 404.92 | 42.92 |
| 07:00 hrs | 4.40 | 404.80 | 42.80 |
| 08:00 hrs | 7.70 | 404.68 | 42.68 |
| 09:00 hrs | 7.70 | 404.63 | 42.63 |
| 10:00 hrs | 7.70 | 404.62 | 42.62 |
| 11:00 hrs | 7.70 | 404.70 | 42.70 |
| 12:00 hrs | 7.70 | 404.82 | 42.82 |
| 13:00 hrs | 7.70 | 404.84 | 42.84 |
| 14:00 hrs | 7.70 | 404.85 | 42.85 |
| 15:00 hrs | 7.70 | 404.86 | 42.86 |
| 16:00 hrs | 7.70 | 404.86 | 42.86 |
| 17:00 hrs | 7.70 | 404.86 | 42.86 |
| 18:00 hrs | 7.70 | 404.86 | 42.86 |
| 19:00 hrs | 7.70 | 404.76 | 42.76 |
| 20:00 hrs | 7.70 | 404.48 | 42.48 |
| 21:00 hrs | 7.70 | 404.47 | 42.47 |
| 22:00 hrs | 7.70 | 404.53 | 42.53 |
| 23:00 hrs | 4.40 | 404.74 | 42.74 |

| | |
|---|---|
| **Maximum Day HGL:** | 404.79 |
| **Peak Hour:** | 404.47 |

| Available Flow (L/s) | Residual Pressure (m) |
|---|---|
| 0.0 | 43.0 |
| 10.0 | 42.8 |
| 20.0 | 42.4 |
| 30.0 | 42.0 |
| 40.0 | 41.4 |
| 50.0 | 40.6 |
| 60.0 | 39.8 |
| 70.0 | 38.9 |
| 80.0 | 37.8 |
| 90.0 | 36.7 |
| 100.0 | 35.3 |
| 110.0 | 32.4 |
| 120.0 | 29.2 |
| 130.0 | 25.9 |
| 140.0 | 22.3 |
| 150.0 | 18.5 |
| 152.9 | 17.4 |

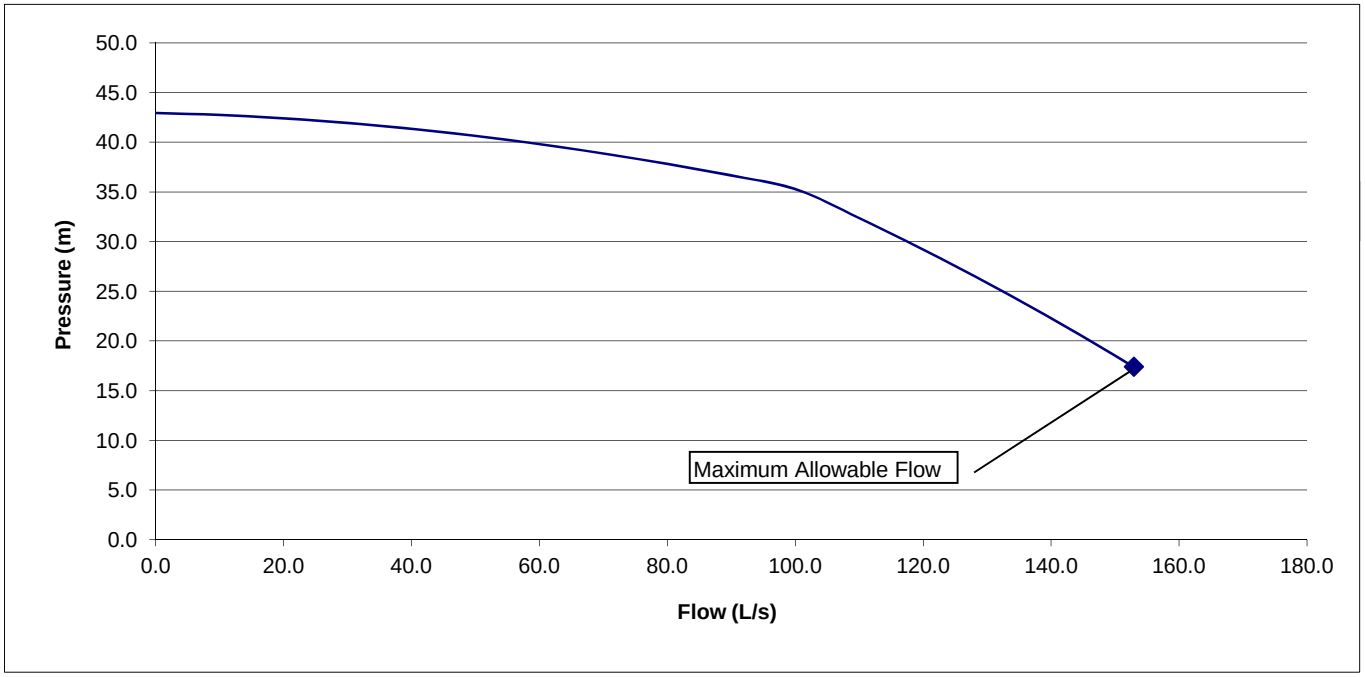
**Fire Flow Analysis**

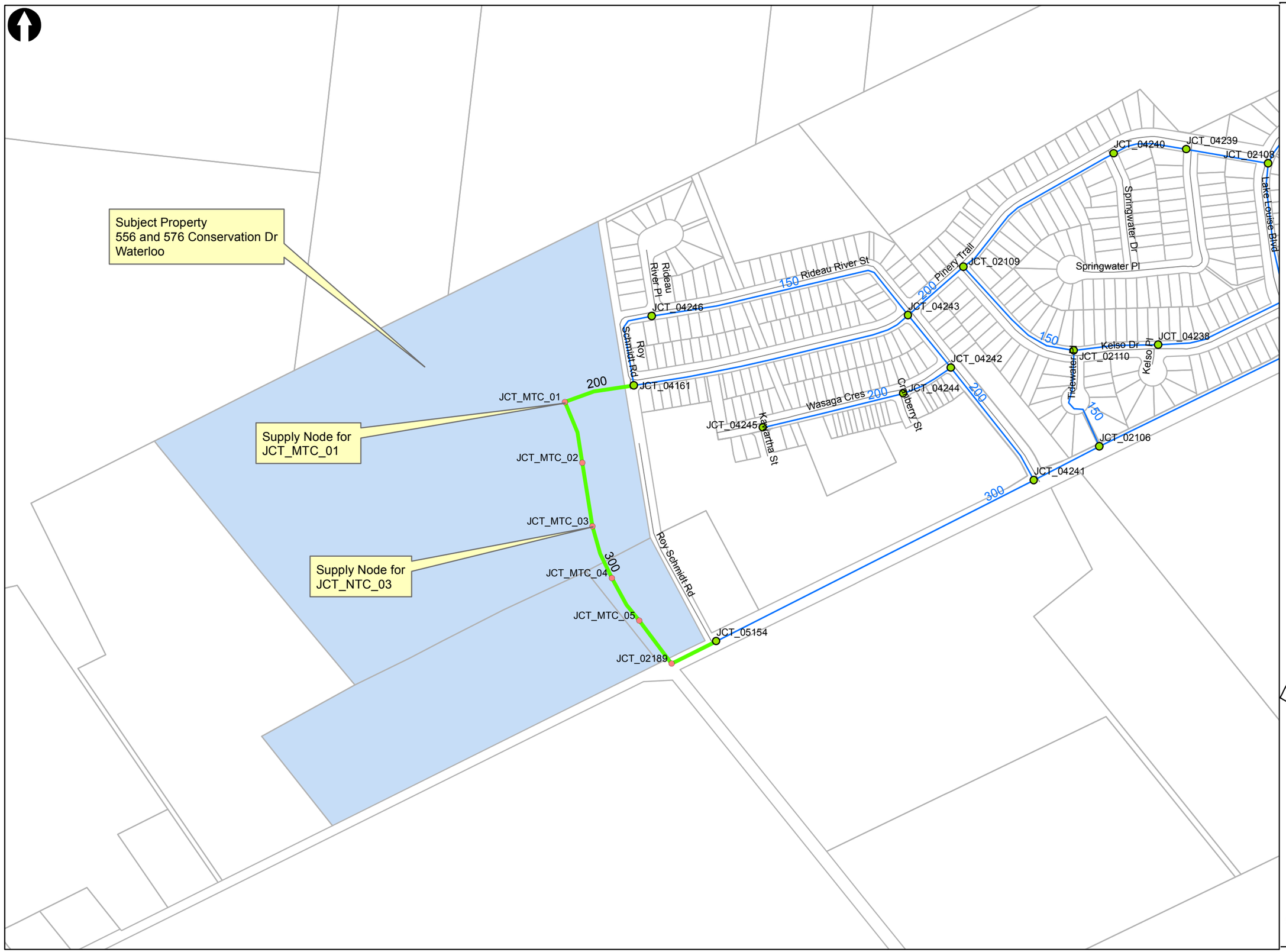
| | |
|---|---|
| **Fire Flow Node:** | JCT_MTC_03 |
| **Design Flow (L/s):** | 152.9 |
| **Design Pressure (m):** | 17.4 |

*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.*






Region of Waterloo

TRANSPORTATION AND ENVIRONMENTAL SERVICES

Water Services

150 Frederick Street
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Telephone: (519) 575-4426
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## Legend

**Pipes**

**Ownership & Diameter**

- Local/Dual/Private < 450 mm
- Regional < 450 mm
- Local/Dual/Private >= 450 mm
- Regional >= 450 mm
- Nodes Added
- Pipes Added
- Highway
- Major Road
- Minor Road
- Private Road
- Subject Site




**Modeling Request For**
**556 and 576 Conservation Dr**
**Waterloo**

0 20 40 80 120 160 200m

# *Appendix E: Geotechnical Data*

(excerpts only)

# Appendix F: Historical Drawings