Preliminary Servicing Report

556 and 576 Conservation Drive
City of Waterloo

Revised September 2022

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September 6, 2022

GSP Group
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Attention: Ms. Kristen Barisdale MCIP RPP
Associate, Senior Planner

Dear Ms. Barisdale,

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

Please find our revised Preliminary Servicing 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,

MERITECH ENGINEERING



Stefan Van Hartingsveldt, C.E.T.
Project Lead



Chris H. Togeretz, P.Eng.
Manager, Design Services

STV/cht
Enclosures (2)

cc Ian Cook, 2115881 Ontario Limited
Brad Trussler, Mattamy Development Corporation

Executive Summary

The proposed 29-hectare 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 and multi-family units with a school parcel, park block, open spaces, 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.

Modified 18-meter and 20-meter municipal cross-sections are proposed, with sanitary and storm sewers, a third pipe "clean water collector", watermain, and other utilities. The sanitary sewer is proposed to be moved off the centreline of the road and a clean water collector pipe has been added to the typical cross-sections. Sidewalk is proposed on both sides of all streets.

Sanitary sewers for the development will discharge into the proposed infrastructure in Conservation Drive and Beaver Creek Road, and then to the proposed Beaver Creek Sanitary Pumping Station north of the Laurel Creek Reservoir. A 250mm sanitary sewer will be required downstream of the development to accommodate the calculated peak flow of 33 L/s. Sanitary connections shall be provided to each lot and connect to the proposed sewer. The "Brohman" lands to the northwest have been accounted for using a gravity connection installed as low as required. This requirement necessitated a routing of the sanitary through the proposed park.

The City has proposed to provide 300mm diameter watermains in Conservation Drive and Beaver Creek Road adjacent to the subject lands. These 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 in accordance with the Ontario Building Code and FUS.

Storm drainage is divided into east and west catchments in accordance with the North Waterloo Scoped Subwatershed Study. 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 without quantity controls.

For the subject lands, a 1050mm diameter storm sewer with a peak flow of 1.9 m^3/sec is to be incorporated in the Beaver Creek Road storm sewer sizing. Storm connections shall be provided to each lot for sump pumps and roof leaders and connect to the third-pipe "clean water connector" sewer which infiltrates these clean flows within the road right of ways.

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

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 (now Enbridge) will need to extend mains to service the development and will be coordinated through the detailed design phase and reconstruction of Beaver Creek Road and Conservation Drive.

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

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For Further Information

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Table of Contents

Introduction 3
Approach 4
Policy Framework 5
Planning Documents 5
Watershed Plans 5
Stormwater Management Studies 5
MOE Guidelines 6
Regional Guidelines and Studies 6
Municipal Guidelines 6
Conservation Authority Guidelines 7
Environmental Studies 7
Geotechnical Studies 7
Hydrogeological Studies 7
Transportation Studies 7
Noise Studies 8
Pre-Consultation 8
Reconnaissance 8
Review Comments 8
Objectives and Criteria 10
Sanitary Servicing 10
Water Servicing 10
Storm Servicing 11
Stormwater Management 11
Grading and Drainage 12
Transportation 12
Utilities 12
Discussion 13
Subdivision Design 13
Sanitary Servicing 13
Water Servicing 14
Existing Infrastructure 14
Proposed Development 15
Analysis Results 16
Storm Servicing 19
Stormwater Management 20
Water Quantity 20
Water Quality 20
Water Balance, Infiltration, and Groundwater 20
Grading and Drainage 20
Transportation 21
Utilities 22
Conclusions 24
Recommendations 25

List of Figures

Figure 1: Subdivision Location 3
Figure 2: Approach Flowchart 4
Figure 3: Existing Condition Photographs 9
Figure 4: Watermain Layout Schematic 17
Figure 5: Active Transportation Schematic 23

List of Tables

Table 1: Sanitary Flows 14
Table 2: Water Modeling Locations 15
Table 3: FUS Water Modeling Inputs/Results (*Max Day Plus Fire*) 18
Table 4: Non-Fire Scenario Pressures (kPa) 19
Table 5: Standard Road Cross-section Information 22

Appendices

Appendix A: Draft Plan
Appendix B: Design Drawings
Appendix C: Calculations
Appendix D: Truck Turning Movements for Trails
Appendix E: Agency Correspondence
Appendix F: "Quick-Start" Servicing and Stormwater Management Option Letter

Introduction

The proposed 29 hectare 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 were previously located on the site (now since demolished). 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, as 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.

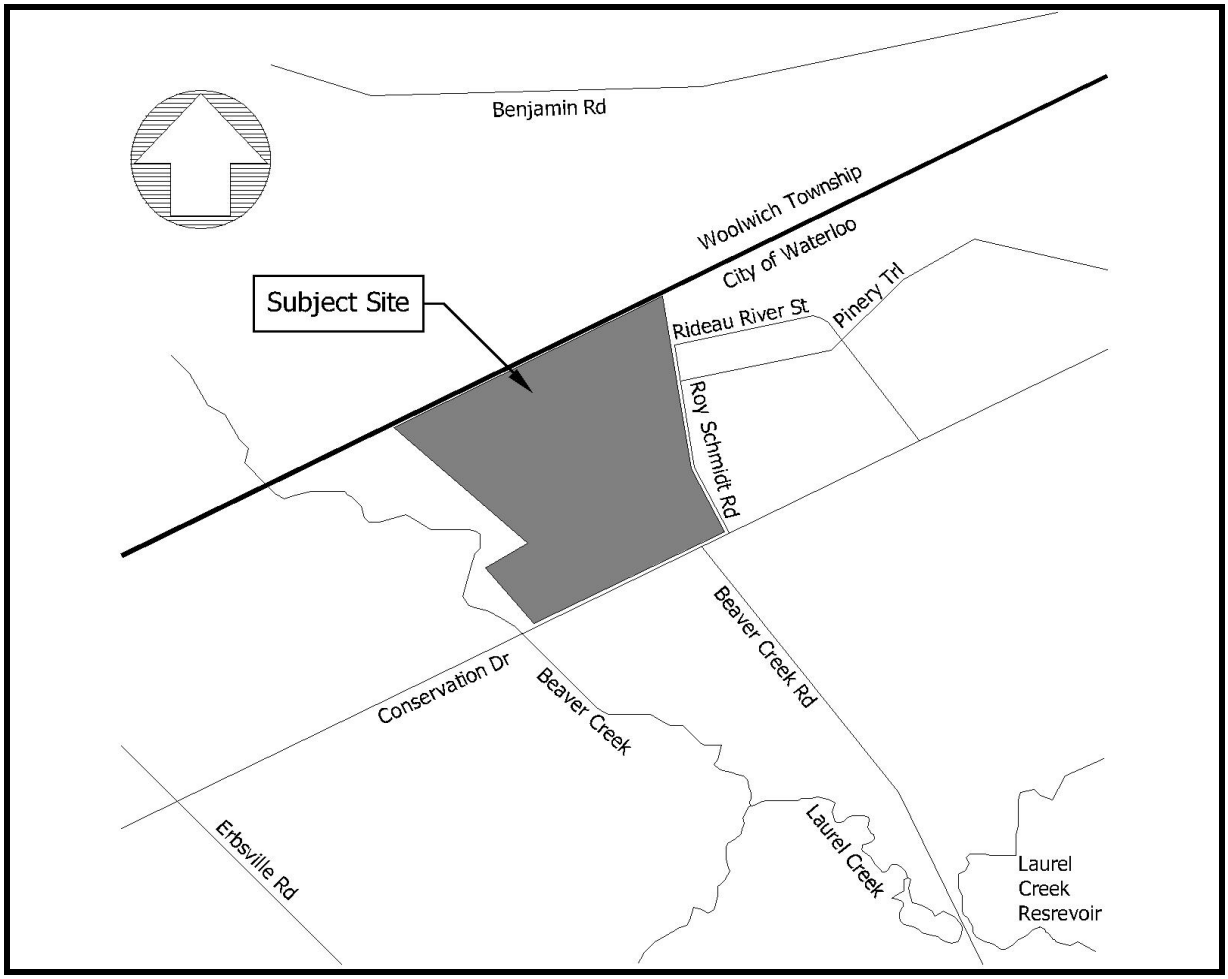


Figure 1: Subdivision Location

Approach

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

Step One
Feasibility of the Development
This circulation establishes the framework for the project and provides a direction for how the site is to develop. This report shows the proposed development is suitable for the proposed zoning and is able to be serviced with standard municipal services.

⇩

Step Two
Preliminary Design
This circulation describes how the plan satisfies the objectives for the site, confirms spatial relationships of the plan within the confines of the site, and provides recommendations to be implemented in the detailed design. For subdivisions, Draft Plan approval is contingent upon approval of the Preliminary Design.

⇩

Step Three
Detailed Design or Final Design
This circulation integrates the recommendations of the preliminary design into the final site engineering. Approval of this report allows for construction of the proposed development.

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 2012
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, September 2018
The subject lands are currently 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, 1993
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 submitted a Preliminary Stormwater Management Report in July 2016 to accompany the first Draft Plan application. The report presents the proposed stormwater

management approach for the western half of the subject site. The report has since been updated (herein) and is being re-submitted as part of the complete submission package.

The "Developer Group" representing the active developers in the Beaver Creek Meadows District Plan Area (BCM-DPA) have commissioned a stormwater management study for the area, including the east half of the subject site.

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.

Draft Low Impact Development (LID) Stormwater Management Guidance V. 1, 2022
This manual provides guidance on the planning of stormwater management LID technologies in Ontario. Although it is currently in a draft, it has been reviewed and referenced in order to provide a forward-looking design.

Regional Guidelines and Studies

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) provides the local municipalities' design preferences under normal circumstances. These guidelines are read together with other applicable Municipal guidelines and standards.

Waterloo Pressure Zones 4 and 5 Consolidation, ongoing
This study is intended to refine the recommendations of the Class EA study for Beaver Creek Road and Conservation Drive (see below) in conjunction with the City of Waterloo's Water Distribution Master Plan (2017).

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.

Stormwater Management Master Plan (SWM-MP) Municipal Class Environmental Assessment, City of Waterloo, 2019
This manual provides design guidelines for stormwater management within the City of Waterloo.

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 2019
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
This Class EA study assessed options for core infrastructure associated with upgrades to Beaver Creek Road and Conservation Drive. Preferred options were presented for aater supply, storm and sanitary system, and transportation upgrades for the Beaver Creek Meadows District Plan Area.

As part of the project team for the subject lands, Natural Resource Solutions Inc. (NRSI) have prepared a Scoped 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 in 2015. The results of this investigation helped in the formulation of a suitable servicing and grading approach for the subject lands.

Hydrogeological Studies

Hydrogeological investigations and monitoring of the site were carried out within the NWSSS, and this report makes reference to those findings and recommendations.

An additional hydrogeological study was prepared by Stantec in December 2021 to support the current application. Further site investigation was undertaken and recommendations were made to direct the stormwater management approach summarized in this report.

Transportation Studies

The Conservation Drive and Beaver Creek Class EA document guides the general framework for the reconstruction of Conservation Drive and Beaver Creek Road. The study provided recommendations for both vehicular transportation along with active transportation networks.

In support of the 2016 Draft Plan application, Salvini Consulting prepared an "Intersection Operations Assessment Study"; the general approach that was presented in this study has been maintained through the various minor incremental changes to the Draft Plan. Most recently, additional information regarding the planned active transportation elements of the

Draft Plan and the transportation planning considerations for development of the planned school block have been provided.

Noise Studies

Meritech Engineering has prepared a Preliminary Noise Assessment under separate cover to accompany the Draft Plan application. This report guides grading and placement of noise attenuation features due to noise arising from traffic on Conservation Drive.

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.

Review Comments

Comments have been received from the following sources in response to our Third Functional Engineering Submission dated August 2020. Relevant components related to our responses have been incorporated into the revised reports.

- City of Waterloo comments dated January 19, 2021 and February 3, 2021
- Grand River Conservation Authority (GRCA) comments dated July 8, 2021



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 subsequent Discussion section will demonstrate how the objectives presented in this section 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 MECP, Region of Waterloo (SSMS), and City of Waterloo standards.

The development will outlet into proposed infrastructure in Conservation Drive and Beaver Creek Road and then to the proposed Beaver Creek Sanitary Pumping Station just north of the Laurel Creek Reservoir. These works are ongoing as part of the implementation phase 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. In the *Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment,* it is proposed to provide a 300mm diameter watermain in Conservation Drive and Beaver Creek Road adjacent to the subject lands, sometime in the future.

In the absence of any final recommendations from the Region of Waterloo regarding consolidated pressure zones in this part of the City of Waterloo, for the current purposes the water supply on site has been modeled on the assumption that the future watermain extension on Beaver Creek Road is not yet complete. The modelling has been 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.

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, in zone WAT 4C. They also provided the information for proposed junction JCT_39019, located at the corner of Conservation Drive and Beaver Creek Road, which includes future watermains looped through Beaver Creek Road, Conservation Drive and Erbsville Road, in zone WAT 5. This information is used later in this report to analyse the water distribution system and show that proposed internal water system is able to provide fire protection as per OBC and FUS guidelines. A future model, which will include

a connection between the two zones, will be developed when boundary pressure/flow information is available from the Region of Waterloo.

Storm Servicing

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

The development has been discretized and has two primary outlets, as per the North Waterloo Scoped Subwatershed Study (NWSSS). The west side of the site outlets to a proposed stormwater management block included within the subject site. The east side of the site outlets to proposed infrastructure south of the intersection of Conservation Drive and Beaver Creek Road. The receiving storm sewer on Beaver Creek Road shall be sized to convey peak flow rates generated from the subject site.

On-site stormwater management features are to be reviewed in conjunction with the storm servicing. Clean roof runoff from the majority of the subdivision will be directed into a proposed clean water collector (CWC) "third-pipe" system. This clean runoff will be infiltrated. Overflows are to be provided into the storm sewer system.

Stormwater Management

Stormwater techniques have evolved considerably in the past decades, in that peak flow control is not the only component of a complete stormwater management solution. In accordance with Section 5.2.1 of the MOE manual and the NWSSS, 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 were 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

It should be noted that the subject site is divided into two main catchments of the NWSSS. The western half discharges to Beaver Creek while the eastern half discharges to the south, towards the Laurel Creek Reservoir. The focus of stormwater management in this report is the western half of the site; the eastern half of the site is being accommodated for in an off-site facility. Notwithstanding, some of the lot level control applies to both halves, and includes:

- 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 from the east half of the site (discharging to Laurel Creek Reservoir as opposed to Beaver Creek)

Grading and Drainage

Grading of the development site has been determined by a number of factors including:

- Dividing the site drainage between the storm sewer outlets (Beaver Creek to the west; and Conservation Drive to the south)
- Directing overland flows to the respective stormwater management facility
- The location of the stormwater management facility and the elevation of its outlet
- Matching existing or proposed 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 is to meet the principles of the Beaver Creek Meadows District Plan and the standards of the City of Waterloo as "complete streets".

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
- Enbridge (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 rights of way, the current plan also includes a park, open space, and a stormwater management block.

Modified 18-meter and 20-meter standard municipal cross-sections are proposed, with sanitary, storm, and CWC sewers; watermain; and other utilities in standard locations as required by the City. The four proposed road cross-sections can be seen in Appendix B. The sanitary sewer is proposed to be moved off the centreline and a clean water collector (CWC) pipe added to the section through the majority of the site. Sidewalk is proposed on both sides of all streets and a multi-use trail is proposed along the west side of Street A up to Pinery Trail. Bike lanes are proposed on Street A and Pinery Trail.

Staging of the development, as shown on the Draft Plan, considers the logical extension of services and road connections. Should construction of external infrastructure be unexpectedly delayed, a "quick start" option to commence development of part of the subdivision is proposed, as described in the letter included as Appendix F.

Sanitary Servicing

The preferred option for sanitary servicing, as established by the Beaver Creek Road and Conservation Drive Upgrades and Extension of Municipal Services Class Environmental Assessment, is to provide a single sewer outlet into proposed infrastructure in Conservation Drive and Beaver Creek Road that will flow to the proposed Beaver Creek Sanitary Pumping Station north of the Laurel Creek Reservoir.

A small portion of the site at the north-east corner is intended to connect to an existing sewer on Rideau River Street, based on topography and proposed grading. The "quick-start" option in Appendix F expands on this.

The Brohman lands to the north-west have been included in the sanitary design as these external lands are intended to drain through the subject site.

Based on the unit counts provided in the Draft Plan, peak flows have been estimated 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 peak flow. Population densities are provided in the City of Waterloo Development Manual. A conservative Harmon peaking factor of 4 is used at this preliminary phase.

As shown below, the proposed 3.21 ha school site yields a design flow of 0.80 L/s using a demand of 0.25 (L/s)/ha as per the DGSSMS. 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 a non-peaked design flow of 1.2 L/s – 2.4 L/s, and the peaking factor is assumed to be 2.0.

Unit Type	Flow	Area (ha)	Units	Peak Flow (L/s)
Institutional	0.25 (L/s)/ha	3.21	-	~1.6 to ~4.8
Residential	275 (L/cap)/day			
Singles		7.98	260 x 3.3ppu	10.5
Towns/Multi Blocks		4.38	349 x 2.18ppu	9.4
Brohman		2.03	35 x 3.3ppu	1.6
Infiltration	0.25 (L/s)/ha	± 23	-	5.8
				Total: 28 – 33

Table 1: Sanitary Flows

The proposed development of will generate peak flows of approximately 28 L/s – 33 L/s. This peak flow rate is about 70% - 75% 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 20% of the total flows from the development. For current purposes this analysis confirms the maximum size sanitary sewer for the site is 250mm, and recommends that the detailed design of Beaver Creek Road sanitary sewer allow for a maximum peak flow from this development of 33 L/s.

Water Servicing

Existing Infrastructure

As shown on the Region's modeling report in Appendix E, 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 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 ultimate looping described in the EA.

Proposed Development

As shown on the Draft Plan in Appendix A, development will be staged. The availability of a sufficient firefighting water supply will determine which parts of the development can proceed. The anticipated sequence of watermain connections is as follows:

- (If the "quick start" approach is used): looping only from Activa lands to the east
- Next, adding another loop from the quick start option to the existing stub on Conservation Drive
- Third, together with Stage 1 of the Beaver Creek Road project, adding a loop to the interim condition, south along Beaver Creek Road to Laurelwood Drive
- Finally, adding another loop to Stage 1 to connect Conservation Drive to Erbsville Road

Only the second and third sequence is currently modeled and discussed in the following section, in keeping with the boundary conditions modeling provided by the Region. In Table 3 below they are referred to as connections "only to Activa" and "full buildout".

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. Street townhouse block of units at the southwest corner of the subdivision
e. Street townhouse block of units on the east side of Street A, north of Street F

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	**Node**	**Assumed Building Size**	**Total Building Footprint**	**Approx. Centreline Elevation**	**Storeys**
A furthest single	19	11.3m x 18m (37' x 59')	203.4m²	357.1	2+basement
B highest single	13			364.9	2+basement
C school	5	4650m² (50,000ft²)	4650m²	358.2	1
D 6-unit townhouse block	7	6.5m x 15.5m ea (21' x 51' ea)	604.5m²	357.4	2+basement
E 6-unit townhouse block	8			360.50	2+basement

Table 2: Water Modeling Locations

The proposed watermain is a combination of 150mm, 200mm, and 300mm watermain. Both Figure 4 (Watermain Layout Schematic) and the Preliminary Servicing Plan included in Appendix B show the proposed watermains for the development.

Analysis Results

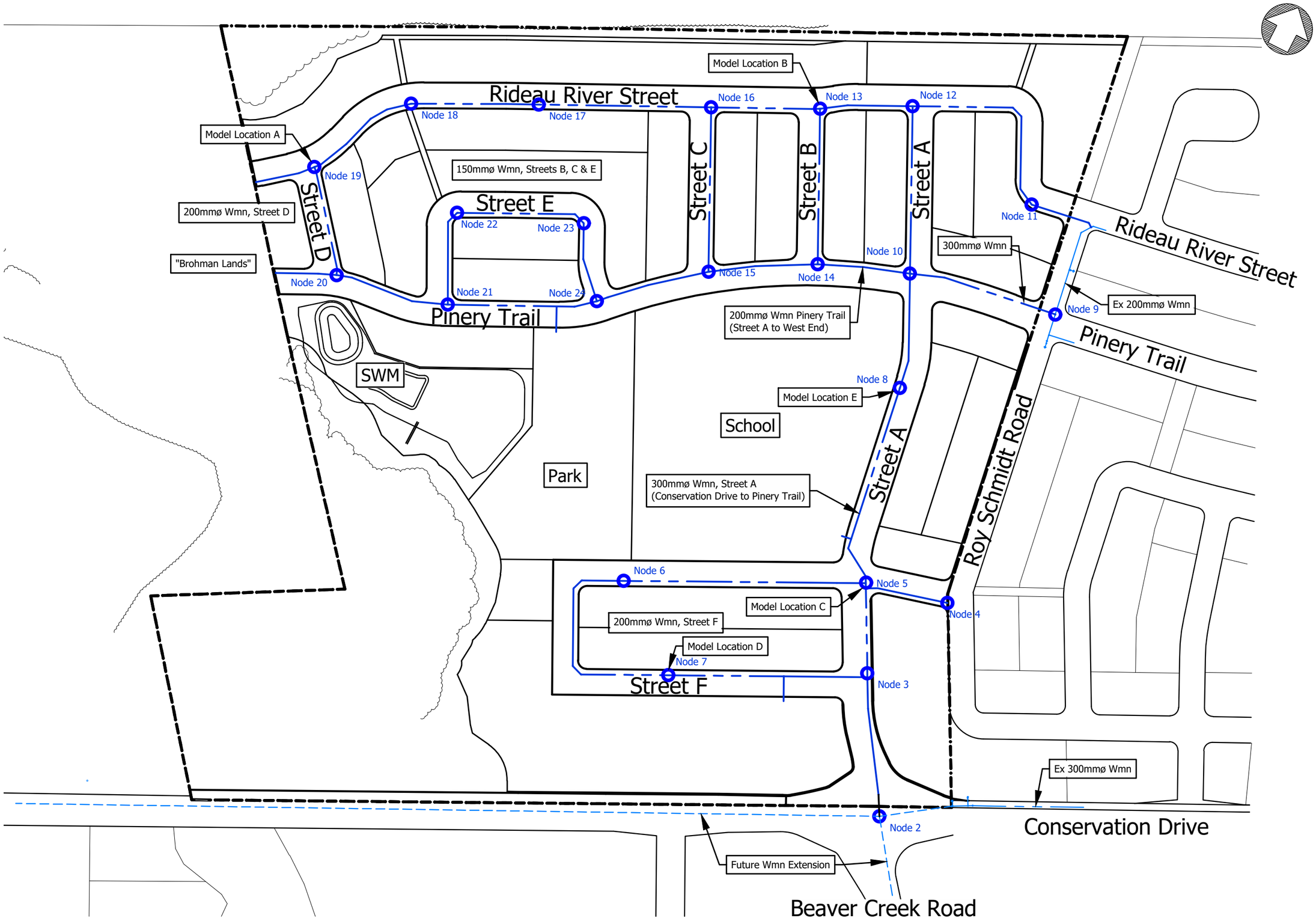
Modeling of the existing water distribution system was provided by the Region of Waterloo and is included in Appendix E. Surface elevations were used in the EPANET modeling as specified in the Regional Municipality of Waterloo Design Guidelines (DGSSMS). Demand was estimated by unit counts, with population 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 3.7 L/s based on a demand of 210 (L/d)/student over 8 hours (MOECP) 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 phase 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 phase 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 higher-density and school sites are to be confirmed when information becomes available during the Site Plan Approval phase.

Should construction of external infrastructure be unexpectedly delayed, a "quick start" option to commence development of part of the subdivision is proposed, as described in the letter included as Appendix F.



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DRAWING: Watermain Layout Schematic
556 & 576 Conservation Drive

DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279.Figures	DATE:	Aug 2022
SCALE:	1:2500		Figure 4

Location	Estimated Fire Demand (L/s)	Assumed Fire Demand (L/s)	Reservoir Used	Watermain Construction Connectivity	Min. Pressure @ Assumed Fire Demand (kPa)	Max. Fireflow Available
A.1	88	100	JCT_MTC_01	Only to Activa (east)	162	106
A.2	88	100	JCT_39019	Full Buildout	225	124
B.1	88	100	JCT_MTC_01	Only to Activa (east)	147	102
B.2	88	100	JCT_39019	Full Buildout	210	124
C	200-250 *	-	JCT_39019	Full Buildout	140 @ 157 L/s	157
D	97	133	JCT_39019	Full Buildout w/ Firewall	189	156
E	97	133	JCT_MTC_01	Only to Activa (east) w/ Firewall	189 @ 97 L/s	111

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

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

"Full buildout" in Table 3 above refers to the modeling provided by the Region of Waterloo (see Appendix E) and is expected to result in lower pressures and/or firefighting flows than the ultimate state of the watermain distribution system will be able to provide.

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 and street townhomes as per FUS requirements and maintain the minimum 140 kPa pressure (DGSSMS).

It is noted that the *Max Day* demand is 8.25 L/s (see "Water Demand Calculations" sheet in Appendix C) multiplied by the Max Day factor of 1.34 to give a factored demand of 11 L/s. Thus, the flow rates in the modeling attached in Appendix C consistently are 11 L/s greater than the fireflow rates being modeled.

Table 3 shows that the townhouses on Street A – modeling location E – will be required to be constructed with firewalls, should they be constructed prior to full buildout.

The school – included in Stage 3 – will likely require the future 300mm diameter watermain from Beaver Creek Road to be constructed in order to achieve the required firefighting flows shown in Table 3. Final modeling for the school site will need to be completed during the Site Plan process to confirm if there are restrictions on building size, materials, fire walls, or the need for fire suppression (i.e. sprinkler system) for the school. Confirmation of watermain sizes internal to the subdivision shall be completed within the detailed design phase for Stage 1 and refined for approval prior to construction or registration. The water distribution system should provide the required fireflow shown in Table 3. Development of

the school block is not anticipated to be immediate; it is our understanding that construction of a school would happen perhaps several years after Registration of the first Stage. Full implementation of the EA is expected to be complete by then, meaning that a larger fireflow will be available than currently provided as shown in Table 3.

Water pressures during the Max Day and Peak Hour scenarios have been checked and summarized in Table 4. As friction loss is negligible in low flow scenarios due to the proximity of the supply nodes provided by the Region, pressures can be determined by the elevation difference between the HGL and highest/lowest nodes in the subdivision. This shows that the pressures sit between the required levels of 350 kPa – 550 kPa in the Max Day scenario and 275 kPa – 700 kPa in the Peak Hour scenario (DGSSMS section B.2.4.3).

Node	**Elev** (m)	**Max Day HGL** (m)	**Pressure at Node 13** (364.8m)	**Pressure at Node 20** (356.6m)	**Peak Hour HGL** (m)	**Pressure at Node 13** (364.8m)	**Pressure at Node 20** (356.6m)
JCT_MTC_01	362.9	404.60	390	471	404.27	387	467
JCT_MTC_03	358.2	404.59	390	471	404.25	387	467
JCT_39019	356.6	402.45	369	450	401.00	355	435

Table 4: Non-Fire Scenario Pressures (kPa)

Storm Servicing

Runoff coefficients were obtained from the *City of Waterloo Development Engineering Manual*.

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. This catchment area includes the drainage from some of the Brohman lands. 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. In both cases, minor flow conveyance will be through the storm sewer system and the major storm conveyance will be along the roads. The subdivision's outflow at the intersection of Conservation Drive and Beaver Creek Road is approximately 1.9m³/s, which is able to be conveyed by a 1050mm diameter storm sewer.

As further described in the updated Preliminary Stormwater Management Report, a clean water collector (CWC) system will be provided throughout the subdivision in order to provide infiltration to achieve a water balance for the site. This system can be generally viewed as a third pipe system whereby roof leaders and sump pump connections are collected separately from road drainage and infiltrate through a perforated pipe within the municipal right of way.

Stormwater Management

A constructed wetland/infiltrating basin is proposed to provide control from the west half of the site, 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/infiltrating basin 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 the 2003 MOE Guidelines. The pond outlet will be composed of a reverse slope outlet pipe with an orifice-controlled outlet pipe, twin overflow culverts, and an overflow weir for the Regional event.

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

- A central location, with easy access, for sediment removal
- Flood control up to the Regional storm event, matching flows provided in the subwatershed study
- An aesthetically pleasing facility designed to blend into surrounding lands and trails
- Easily maintainable and accessible inlets and outlets

Should construction of the external communal SWM facility be unexpectedly delayed, a "quick start" option to commence development of part of the subdivision is proposed, as described in the letter included as Appendix F.

Water Quantity

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

Water Quality

The site was designed to meet the Enhanced level of water quality control by implementing a sediment forebay 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, conveyance, and end-of-pipe techniques: roof water to soak away pits; a clean water collector third pipe system, an 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 road grades is to provide for major storm routes to convey the surface flow to the stormwater management facilities serving the subdivision. The road surface profile provides these routes and all grades are within the minimum and

maximum allowable grades. The road centreline 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 has been given to designing the site for a mix 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.

The geotechnical report provides a recommendation that basement floor slabs be installed about the groundwater levels (section 5.5.2). Based on previous projects within the City of Waterloo, it is believed that through the detailed design phase it will be necessary to demonstrate 0.5m separation to the seasonally high groundwater table from the underside of footings.

Depending on the style of unit, the elevation of the underside of footing is typically in the range of ±1.7m to ±2m below streetline elevations. A careful review of the Preliminary Grading Plan against Figure 12 of the Hydrogeological Assessment (seasonally high groundwater contours) shows that no part of the subdivision is expected to be at risk of not being able to have standard depth basements with more than adequate separation to groundwater.

Transportation

The roundabout and grading of Conservation Drive is being carried out by Stantec Consulting and the results of their design will 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 will work for both designs.

City comments identified the desire for confirmation that a truck performing tree, trail, or other maintenance would be able to turn the corners of the trail system at the north limits of the subdivision. Comments noted that it "…is anticipated that that stub portion would not need to be built as trail yet (or ever depending on the layout of the trail network on the adjacent property). A sign should be installed at this location (with wording and construction to be approved by Engineering Services) that indicates the trail does not continue west."

Included as Appendix D are two figures showing that a standard pickup truck is easily able to navigate the trail's bends. The Draft Plan shows that the hammerhead proposed at the northwest corner, behind Block 4, has been accounted for in the lot fabric.

There are a number of typical road cross-sections in the subdivision, dependent on whether or not multi-use trails and bike lanes are present on a particular street. Table 5 shows the proposed details for each type of road; please reference Table 9.4 of the City's Transportation Master Plan regarding the City's standard requirements for Minor Collector roads.

Street	Right of Way width (m)	1.5m bike lanes	3.0m multi-use trail	1.8m sidewalk	Lane widths (m)	Boulevard widths (m)
Local Streets	18	No	No	Both sides	3.7	2.7
Pinery (Roy Schmidt to Street A)	20	Yes	No	Both sides	3.0	2.6
Pinery (Street A to west limit)	18	Yes	No	Both sides	3.0	1.6
Street A (Conservation to Pinery)	20	Yes	West side	East side	3.5	1.5

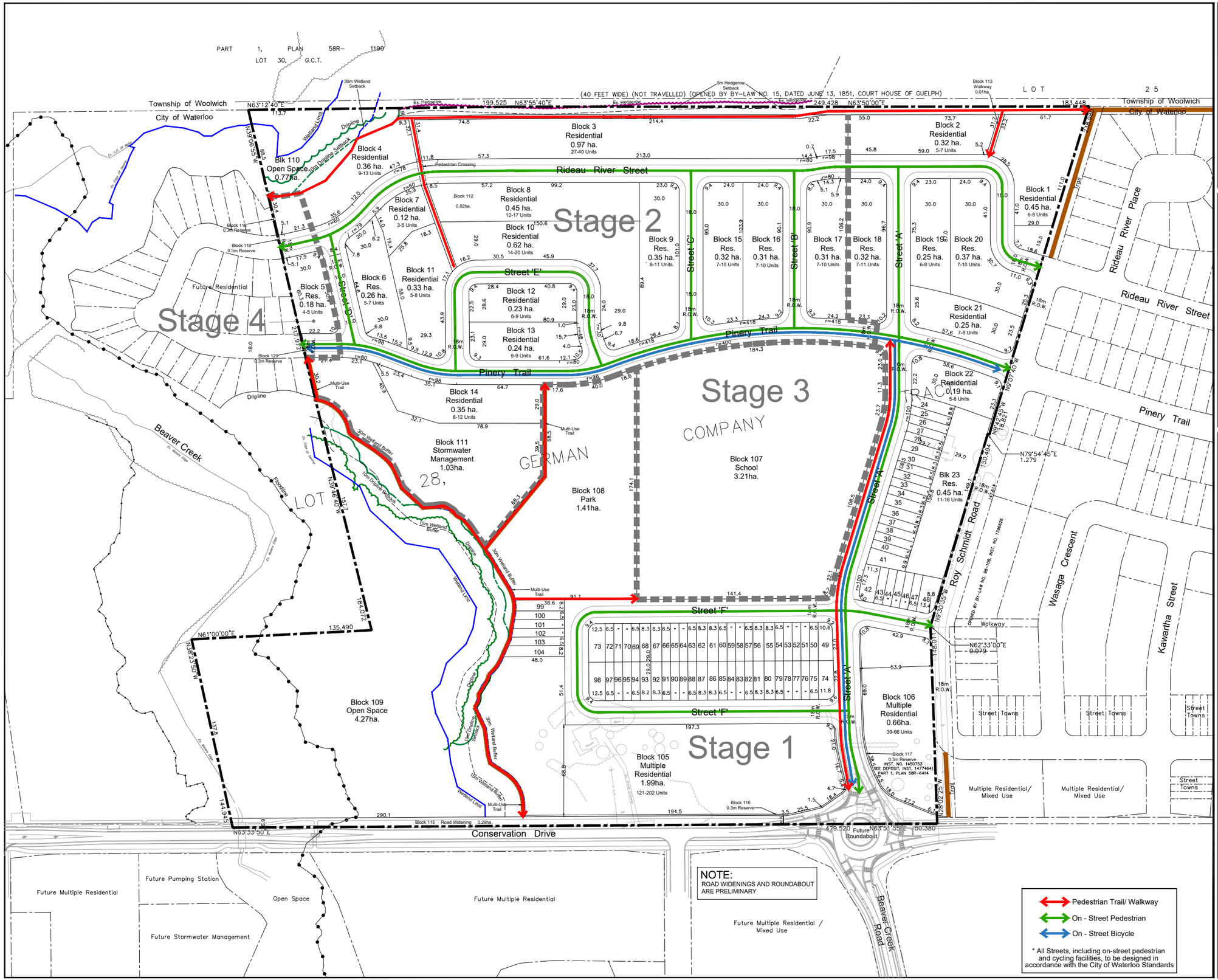
Table 5: Standard Road Cross-section Information

Figure 5 on the following page shows the locations of each of these typical road cross-sections, and the four proposed cross-sections are included in Appendix B.

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.
- Enbridge (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.


PART 1, PLAN 58R-1190
LOT 30, G.C.T.
Township of Woolwich
City of Waterloo
(40 FEET WIDE) (NOT TRAVELLED) (OPENED BY BY-LAW NO. 15, DATED JUNE 13, 1851, COURT HOUSE OF GUELPH)
LOT 25
Township of Woolwich
City of Waterloo
N63°12'40"E 199.525
N63°55'40"E 249.428
N63°50'00"E 183.448
Rideau River Street
Rideau River Place
Rideau River Street
Pinery Trail
Pinery Trail
Pinery Trail
Conservation Drive
Beaver Creek Road
Roy Schmidt Road
Wasaga Crescent
Kawartha Street
Street 'A'
Street 'B'
Street 'C'
Street 'D'
Street 'E'
Street 'F'
Street 'F'
Street 'W'
Stage 1
Stage 2
Stage 3
Stage 4
Block 1 Residential 0.45 ha. 6-8 Units
Block 2 Residential 0.32 ha. 5-7 Units
Block 3 Residential 0.97 ha. 27-40 Units
Block 4 Residential 0.36 ha. 9-13 Units
Block 5 Res. 0.18 ha. 4-5 Units
Block 6 Res. 0.26 ha. 5-7 Units
Block 7 Residential 0.12 ha. 3-5 Units
Block 8 Residential 0.45 ha. 12-17 Units
Block 9 Res. 0.35 ha. 8-11 Units
Block 10 Residential 0.62 ha. 14-20 Units
Block 11 Residential 0.33 ha. 5-8 Units
Block 12 Residential 0.23 ha. 6-9 Units
Block 13 Residential 0.24 ha. 6-9 Units
Block 14 Residential 0.35 ha. 8-12 Units
Block 15 Res. 0.32 ha. 7-10 Units
Block 16 Res. 0.31 ha. 7-10 Units
Block 17 Res. 0.31 ha. 7-10 Units
Block 18 Res. 0.32 ha. 7-11 Units
Block 19 Res. 0.25 ha. 6-8 Units
Block 20 Res. 0.37 ha. 7-10 Units
Block 21 Residential 0.25 ha. 7-8 Units
Block 22 Residential 0.19 ha. 5-6 Units
Blk 23 Res. 0.45 ha. 11-16 Units
Block 105 Multiple Residential 1.99ha. 121-202 Units
Block 106 Multiple Residential 0.66ha. 39-66 Units
Block 107 School 3.21ha.
Block 108 Park 1.41ha.
Block 109 Open Space 4.27ha.
Block 110 Open Space 0.77ha.
Block 111 Stormwater Management 1.03ha.
Block 112 0.02ha.
Block 113 Walkway 0.01ha.
Block 114 0.3m Reserve
Block 115 Road Widening 0.29ha.
Block 116 0.3m Reserve
Block 117 0.3m Reserve INST. NO. 1450753 (SEE DEPOSIT, INST. 1477464) PART 1, PLAN 58R-6414
Block 118 0.3m Reserve
Block 119 0.3m Reserve
Block 120 0.3m Reserve
Future Residential
Future Multiple Residential
Future Pumping Station
Open Space
Future Stormwater Management
Future Multiple Residential
Future Multiple Residential / Mixed Use
Multiple Residential/ Mixed Use
Multiple Residential/ Mixed Use
Street Towns
Street Towns
Street Towns
Street Towns
Future Roundabout
Walkway
Beaver Creek
Wetland Limit
Dripline
30m Wetland Setback
15m Wetland Buffer
30m Wetland Buffer
5m Hedgerow Setback
Multi-Use Trail
Pedestrian Crossing
Ex. Hedgerow
Ex. Top of Bank
Ex. Water Table
Ex. CA or Apron
Ex. Culvert
Ex. Utility Pole
Ex. Overhead Wires
Ex. Catch Basin
Ex. Storm Manhole
Ex. Sanitary Manhole
Ex. Gas Valve
Ex. Hydrant
Ex. Water Valve
Ex. Water Meter
Ex. Bell Pedestal
Ex. Hydro Pedestal
Ex. Hydro Transformer
Ex. Bell Manhole
Ex. Hydro Manhole
Ex. Light Standard
Ex. Traffic Light
Ex. Traffic Control Box
Ex. Mail Box
Ex. Sign
Ex. Tree
Ex. Deciduous Tree
Ex. Coniferous Tree
Ex. Shrub
Ex. Fence
Ex. Wood Fence
Ex. Chain Link Fence
Ex. Wire Fence
Ex. Concrete Curb
Ex. Asphalt
Ex. Gravel
Ex. Concrete
Ex. Building
Ex. Shed
Ex. Garage
Ex. Deck
Ex. Pool
Ex. Patio
Ex. Retaining Wall
Ex. Stairs
Ex. Ramp
Ex. Bench
Ex. Picnic Table
Ex. Fire Hydrant
Ex. Fire Department Connection
Ex. Fire Extinguisher
Ex. Fire Alarm
Ex. Fire Sprinkler
Ex. Fire Hose
Ex. Fire Truck
Ex. Fire Station

Conclusions

Sanitary sewerage is towards the south, along Beaver Creek Road to a pumping station currently being sited/detailed by others.

Provision of 150mm-300mm diameter watermains through the subdivision provides adequate flow and pressure as per MECP and Region guidelines for firefighting supply. Development of the school block may be contingent on the timing of construction of the future extension of watermain up Beaver Creek Road. There may be restrictions on building size, materials, fire walls, or the need for fire suppression (i.e. sprinkler system) for the school.

The storm sewer outflow at the intersection of Conservation Drive and Beaver Creek Road is approximately 1.9m³/s, which would require a 1050mm diameter storm sewer for this site alone.

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 stormwater management facility includes a forebay and constructed wetland/infiltrating basin 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.

Should construction of external infrastructure be unexpectedly delayed, a "quick start" option to commence development of part of the subdivision is proposed.

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 an allowance for a peak flow of 33 L/s should be incorporated downstream for servicing this development. This flow is to be further refined during detailed design depending on the school site sizing.

A 1050mm storm sewer with peak flow of 1.9 m^3/sec is to be incorporated in the Beaver Creek Road storm sewer sizing, for servicing this site.

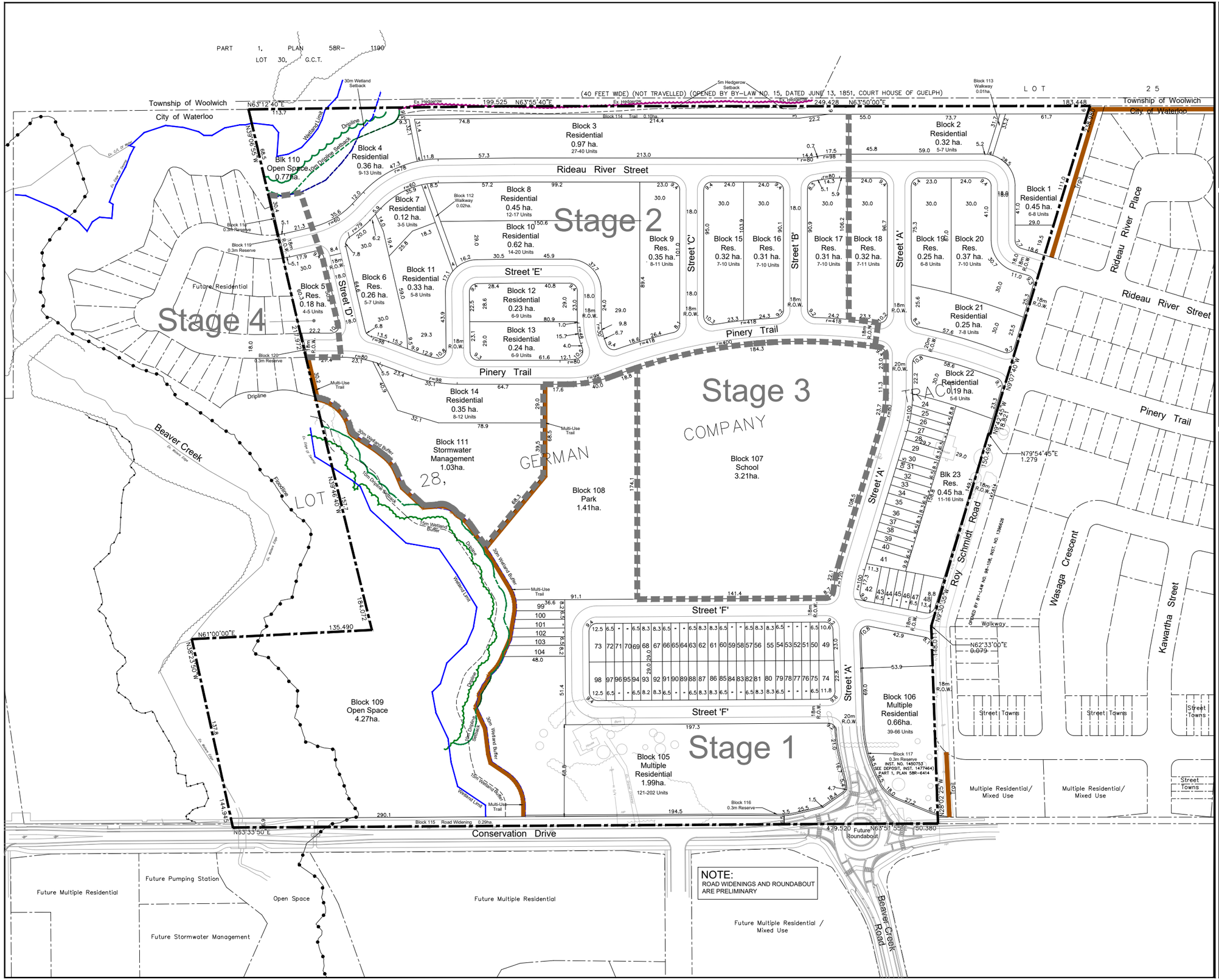
Storm connections should be provided to each lot for sump pumps and connect to the internal clean water collector (CWC) sewer, along with roof leader discharge.

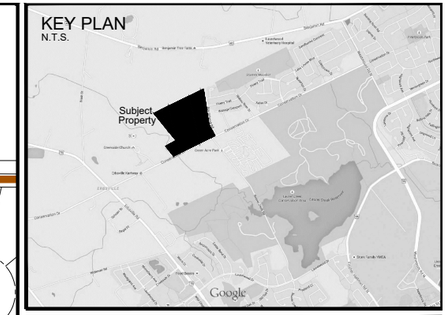
Post-development peak flows shall be attenuated to target peak flow rates for the northwest part of the subdivision.

A detailed water distribution design shall be prepared during detailed design, and future conditions modeling should be provided by the Region to demonstrate that the proposed school site has FUS-level firefighting flows. Water modeling for multi-unit blocks shall be prepared at the time of site plan submissions.

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

Appendix A: Draft Plan





DRAFT PLAN OF SUBDIVISION

Part of Lot 28
German Company Tract
City of Waterloo
Regional Municipality of Waterloo

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLKS.	UNITS	AREA (ha.)
Residential (single detached)	1-23	182-260	7.98
Street Townhouses	24-104	81	1.73
Multiple Residential	105,106	160-268	2.65
School	107		3.21
Park	108		1.41
Open Space	109,110		5.04
Stormwater Management	111		1.03
Walkway	112,113		0.04
Trail	114		0.09
Road Widening	115		0.29
0.3m Reserve	116,120		0.00
Roads			5.16
Total		423-609	28.63

UNIT BREAKDOWN

Min. Potential Singles	182
13.1m internal lot	*152*
13.75m corner lot	*30*
Max. Potential Singles	260
9.0m internal lot	*230*
12.5m corner lot	*30*
Street Townhouses	81

NOTE: Wetland boundary provided by NRSI August 2021

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and l ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
i) Well-drained sandy loam on lacustrine deposits
k) All sanitary and storm sewers as required

OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE REGIONAL MUNICIPALITY OF WATERLOO.

2119881 ONTARIO LIMITED — August 17, 2016 DATE

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

RAYMOND J SIBTHORP, O.L.S. — August 18, 2016 DATE
MacDonald Tamblyn Lord Surveying Limited

GSP group
PLANNING I URBAN DESIGN I LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS
April 30, 2020
June 25, 2020
March 10, 2020
March 15, 2020
March 19, 2020
August 19, 2021
December 15, 2021

Date: July 29, 2015 | Drawn By: S.L./ML | Dwg. File Name: dp09009zo.dwg
Scale: 1:1250 metric | Project No.: 09009.40

Appendix B: Design Drawings

Rideau River Street

Pinery Trail

Rideau River Place

Street A

Street B

Street C

Street D

Street E

Street F

SWM Pond

Park

School

Roy Schmidt Road

Wasaga Crescent

2.5m Asphalt Trail

3.0m Asphalt Walkway

Infiltration gallery

Area to be developed in the future when grading allows.

Match existing elevations along entire northern limit

Bollards/gates to be confirmed in detailed design

Proposed Conservation Drive layout

Ex. Edge of Swamp

Ex. Edge of Water

Ex. Water Edge

15m Wetland Buffer

Wetland Limit

Ditch

4.0m Maintenance Road Access

1.0m Asphalt Walkway

1 & 1/2 Storey Storm Building

All lots are back-to-front or split drainage unless shown otherwise:

W/O = "walkout" type lot
SS = "sunshine" or "lookout" type lot

MERITECH
Civil Land Dev
1315 Bishop Street North, Suite 202 Cambridge
T 519.623.1140 F 519.623.7334 www.meritechcivil.ca

Preliminary Grading Plan
556 & 576 Conservation Drive

DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279.Figure	DATE:	Aug 2022

SCALE: 1 : 1000

1279-SG

Split point of sanitary and 3rd pipe.

Rear yards to infiltration gallery, sized for 2-yr volume.

~Inv @ Intersection
Wat=362.70
San=361.60
CWC=362.00

~Inv @ Intersection
Stm=360.50
Wat=361.30
San=359.50
CWC=360.00

Rear yards to infiltration gallery, sized for 2-yr volume.

Rideau River Street

~Inv @ Intersection
Stm=360.95
Wat=360.75
San=360.00
CWC=360.50

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

~Inv @ Intersection
Stm=354.95
Wat=354.95
San=354.15
CWC=354.45

150mmø Wmn, Streets B, C & E

Street E

Street C

Street B

150mmø Wmn

Street A

Rideau River Place

Rideau River Street

200mmø Wmn

Street D

~Inv @ Intersection
Stm=354.30
Wat=354.45
San=353.60
CWC=354.00

~Inv @ Intersection
Stm=356.55
Wat=356.45
San=355.50
CWC=356.00

Pinery Trail

~Inv @ Intersection
Stm=360.05
Wat=359.85
San=359.00
CWC=359.50

~Inv @ Intersection
Stm=359.60
Wat=360.60
San=358.75
CWC=359.10

300mmø Wmn

Ex 200mmø Wmn

Pinery Trail

900mmø Stm into SWM Pond

~Inv @ Intersection
Stm=355.00
Wat=355.05
San=353.10
CWC=354.50

~Inv @ Intersection
Stm=355.60
Wat=355.65
San=352.70
CWC=355.00

~Inv @ Intersection
Stm=358.25
Wat=358.15
San=357.20
CWC=357.70

200mmø Wmn Pinery Trail (Street A to West End)

Split point of sanitary and 3rd pipe.

Wetland

Infiltrating Dry Pond

Diversion pipe for winter months.

300mmø Wmn, Street A (Conservation Drive to Pinery Trail)

Street A

3rd pipe (CWC) system for roof leaders.

Level spreader

15m Wetland Buffer

30m Wetland Buffer

10m Drainage Setback

200mmø San, Remainder of Subdivision

School roof area to infiltration. Exact location to be determined.

~Inv @ Intersection
Wat=355.65
San=351.45
CWC=356.00

~Inv @ Intersection
Stm=354.90
Wat=355.80
San=350.40
CWC=354.40

Roy Schmidt Road

Wasaga Crescent

Kawartha Street

Street F

Overflow to storm sewer from CWC system

200mmø Wmn, Street F

250mmø San, Street A (Conservation Drive to North end of Street F)

Rear yards to infiltration gallery, sized for 2-yr volume.

Street A

~Inv @ Intersection
Stm=354.45
Wat=354.85
San=350.00
CWC=354.00

Overflow to storm sewer from CWC system

600mmø Stm to External SWM Facility
Required Inv=353.35

1050mmø Stm to External SWM Facility
Required Inv=352.90

250mmø San to External SPS
Required Inv=349.44

Connection of watermain by others

Conservation Drive

Ex Gutter

Ex Gutter

MERITECH
Engineering
310 Hespeler Road, Unit 1, Cambridge, ON N1R 6J9
T 519.623.1240 F 519.623.2324 www.meritechcorp.com

Preliminary Servicing Plan
556 & 576 Conservation Drive

DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279 Figures	DATE:	Aug 2022
SCALE:	1: 1000		
DRAWING:	1279-SS		

Rideau River Street

Street 'C'

Street 'B'

Street 'A'

Street 'D'

Street 'E'

Pinery Trail

Infiltration gallery

Infiltration gallery in trail block

Match existing elevations along entire northern limit

Rideau River Place

Rideau River Street

Single row silt fence, as per OPSD 219.130.

Pinery Trail

Constructed Wetland/Infiltrating Basin

SWM Pond to act as Temp Silt Pond during grading operations.

School

Park

Double row silt fence, as per OPSD 219.130.

Topsoil not to be stockpiled on the park block

Street 'A'

Roy Schmidt Road

Wasaga Crescent

Kawartha Street

Street 'F'

Street 'F'

Street 'A'

Infiltration gallery

Conservation Drive

Ex. Edge of Swamp

Ex. Edge of Swamp

Ex. Wetland Edge

Water Edge

Ex. Top of Creek

Ex. Top of Bank

Ex. Hedgerow

Ex. Post & Wire Fence

Ex. Ditch

Ex. Culvert

Ex. Gutter

Ex. Gutter

Existing or proposed ground

Proposed ground

Flow direction

0.15m Min
0.5m Max

1
2

1
2

1

0.5m

Control Swale Detail

Not to Scale

Existing asphalt area

Catchbasin frame & grate

Provide erosion control filter cloth (silt sack) between catchbasin/manhole moduloc and frame. Alternatively, attach erosion control filter cloth firmly to the underside of the catchbasin lid to ensure adequate filtering of sediments.

OPSD Precast catchbasin or
OPSD Precast manhole

Catchbasin Protection in Paved Area

Not to Scale

Temp Silt Pond

Double Silt Fence

Single Silt Fence

1.0m high snow fence c/w T-bar post @ 2.0m o/c

Filter fabric

Top of berm

15mmø clear stone filter, 150mm thick

Hickenbottom c/w orifice

0.5m

Rock fill
150mmø min.

Overflow

Water level

0.3m freeboard

0.3m overboard

5.0m min.

Final lot grade

Total Basin Volume

Active Storage Volume

Pre-grade

Undisturbed ground or compacted backfill

Rip-rap, 300mm deep

Dead Storage Volume

Outlet piped to grade or storm sewer

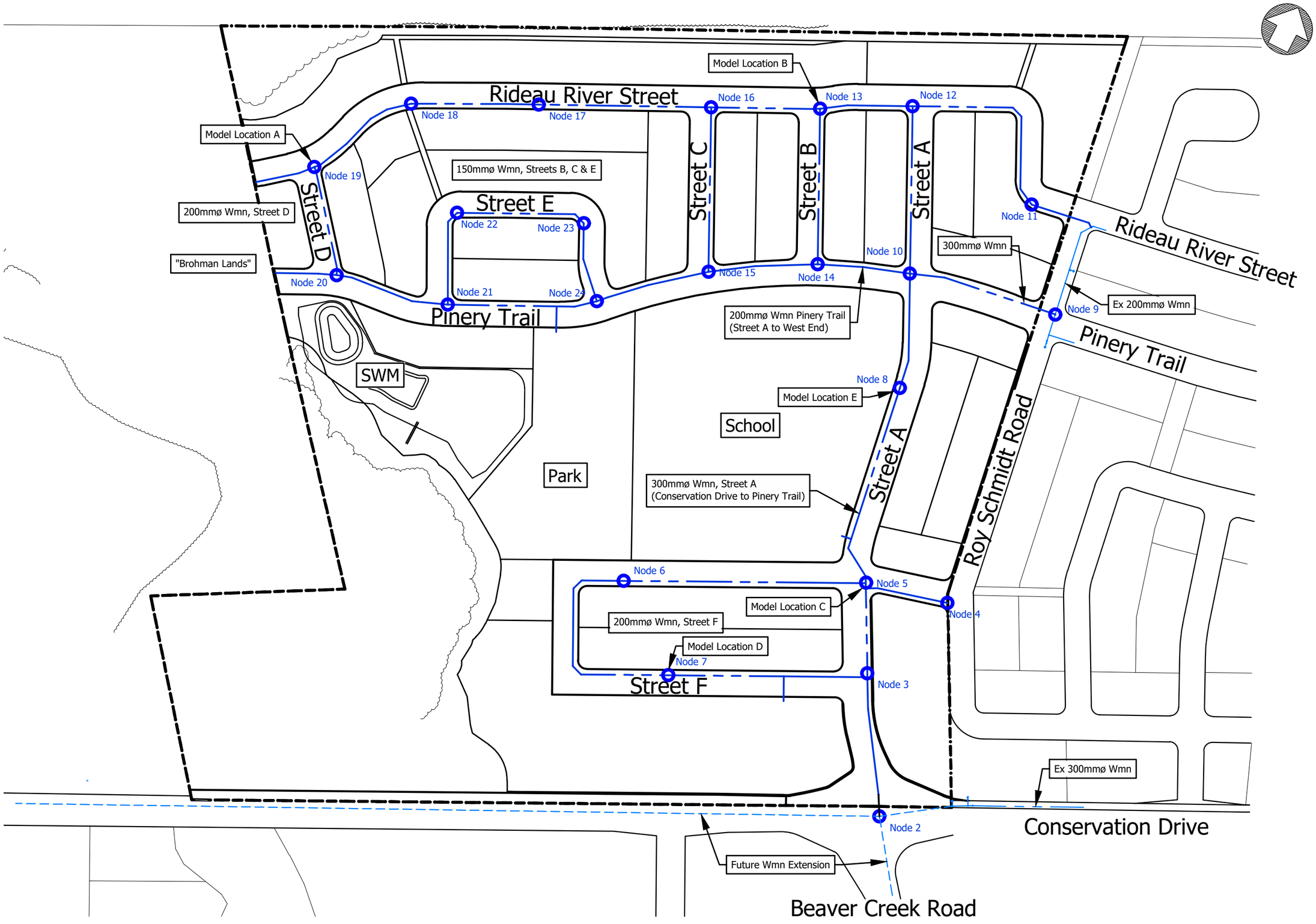
Sediment Control Pond Outlet Detail

Not to Scale

MERITECH
Engineering
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T 519.623.1240 F 519.623.7334 www.meritechca

Preliminary Erosion & Sediment Control Plan
556 & 576 Conservation Drive

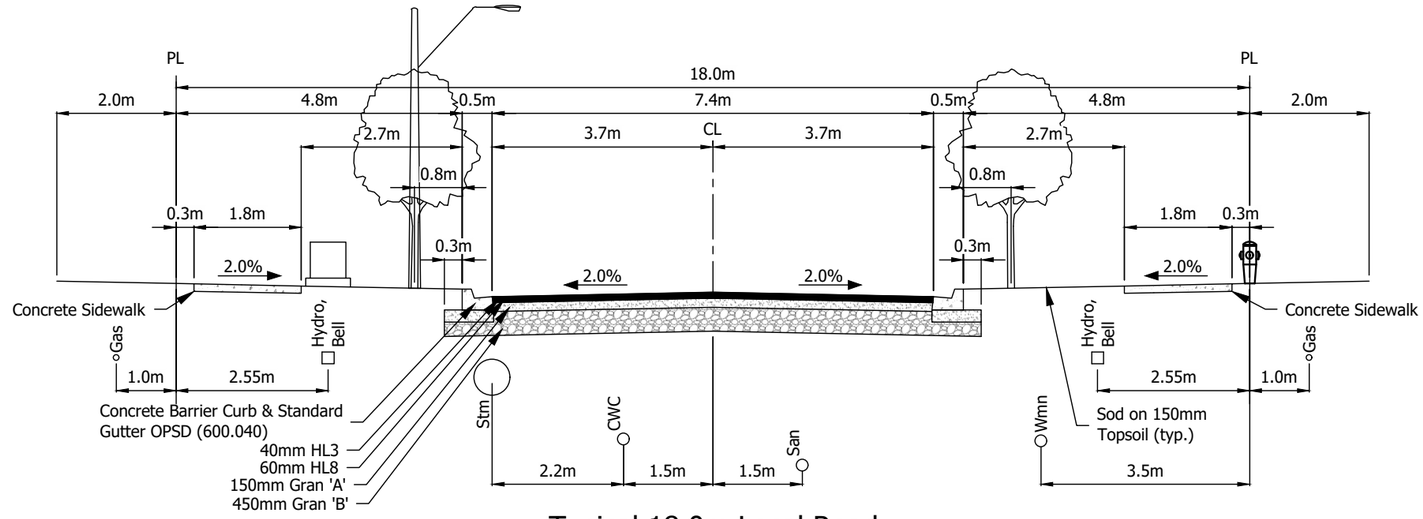
DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279 Figures	DATE:	Aug 2022
		SCALE:	1: 1000
			1279-ESC



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1315 Bishop Street North, Suite 202 Cambridge
T 519.623.1140 F 519.623.7334 www.meritech.ca

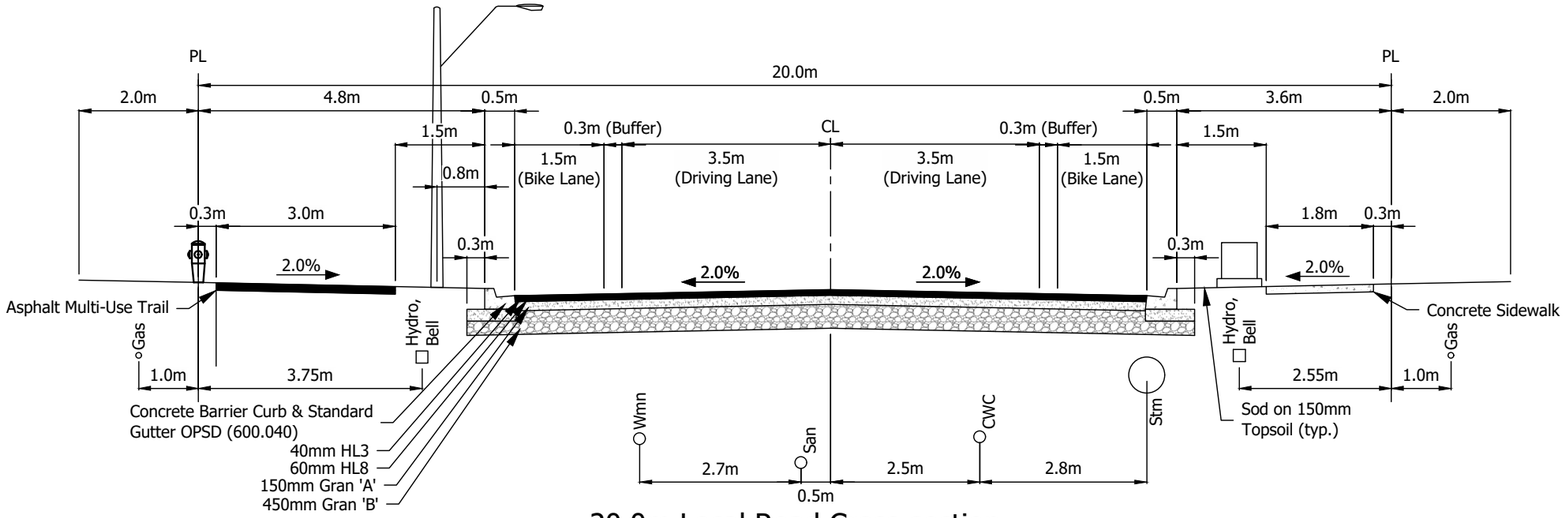
DRAWING: Watermain Layout Schematic
556 & 576 Conservation Drive

DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279.Figures	DATE:	Aug 2022
SCALE:	1:2500		Figure 4



Typical 18.0m Local Road
Cross-section

Not to Scale



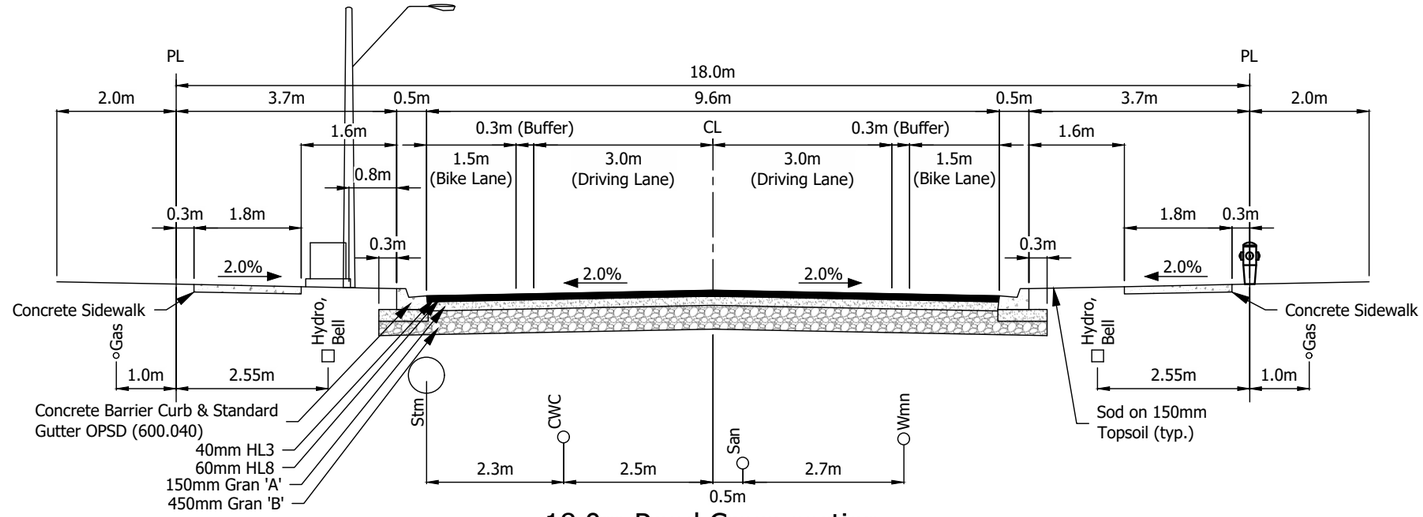
20.0m Local Road Cross-section
Street A (Conservation Drive to Pinery Trail)

Not to Scale

MERITECH engineering
1315 Bishop Street North, Suite 202 Cambridge
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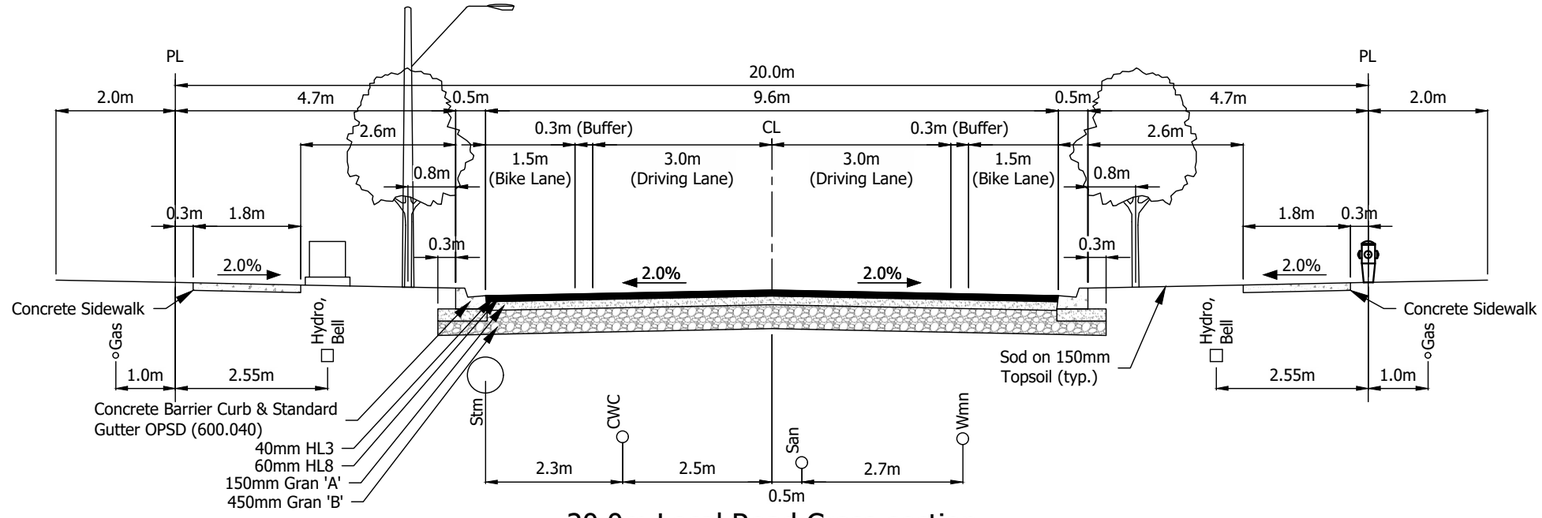
DRAWING: Proposed Street Sections - 1
556 & 576 Conservation Drive

DRAWN BY:	STV	CHECKED BY:	CHT
FILE NAME:	1279.Figures	DATE:	Sept 2, 2022
		SCALE:	NTS
			Cross-Sections 1



18.0m Road Cross-section
Pinery Trail (Street A to West Limit)

Not to Scale



20.0m Local Road Cross-section
Pinery Trail (Roy Schmidt to Street A)

Not to Scale

MERITECH engineering
1315 Bishop Street North, Suite 202 Cambridge
T 519.623.1140 F 519.623.7334 www.meritech.ca

DRAWING: Proposed Street Sections - 2
556 & 576 Conservation Drive

DRAWN BY:	STV	SCALE:	NTS
CHECKED BY:	CHT		Cross-Sections 2
FILE NAME:	1279.Figures	DATE:	Sept 2, 2022

Appendix C: Calculations

MERITECH engineering

Project: Conservation
File: 1279
Completed by: STV
Date: 2017-10-20 rev: 2020-06-04
Checked by: CHT
Date: 2018-01-09

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)
2	356.50						
3	357.15	towns	66	2.440	162	225	0.422
4	358.25	singles	8	3.250	26	225	0.068
5	358.20	school	1	500.000	500	210	3.646
		towns	4	2.440	10	225	0.026
		total				225	3.672
6	358.10	towns	30	2.440	74	225	0.193
7	357.40	towns	231	2.440	564	225	1.469
8	360.50	towns	18	2.440	44	225	0.115
9	363.20	singles	14	3.250	46	225	0.120
10	362.90	singles	19	3.250	62	225	0.161
11	363.50	singles	18	3.250	59	225	0.154
12	363.50	singles	21	3.250	69	225	0.180
13	364.80	singles	18	3.250	59	225	0.154
14	362.00	singles	18	3.250	59	225	0.154
15	360.30	singles	16	3.250	52	225	0.135
16	362.90	singles	23	3.250	75	225	0.195
17	359.00	singles	21	3.250	69	225	0.180
18	357.60	singles	18	3.250	59	225	0.154
19	357.10	singles	14	3.250	46	225	0.120
20	356.60	singles	8	3.250	26	225	0.068
21	357.20	singles	18	3.250	59	225	0.154
22	357.50	singles	19	3.250	62	225	0.161
23	358.20	singles	17	3.250	56	225	0.146
24	358.60	singles	9	3.250	30	225	0.078
		Totals	629	-	2268	-	8.250

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Conservation Dr
File: 1279
Calculated by: STV
Date: 24-Oct-17
Checked by: checkedby
Date: 1-Jan-00

Singles

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C =** Coefficient related to the type of construction.
A = Floor area (m²)

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

A)	**Building structure 'C'**	**=**	1.0
B)	**A (m²)**	**=**	203.40
C)	**# Floors (excl. basement)**		2
D)	**F (L/min)**	**=**	4437
	Rounded	**=**	**4000**

E) Type of occupancy/contents

(●) Non-Combustible ( ) Free Burning
( ) Limited Combustible ( ) Rapid Burning
( ) Combustible

Fire hazard adjustment	-	-25%
Adjustment	**=**	**-1000**
F_{adj} (L/min)		**3000**

F) % reduction based on sprinkler system effectiveness = 0.00%
Reduction - **0**

G)

	Distance to nearest building (m)	% addition
N	30.0	10%
E	2.4	25%
S	13.0	15%
W	2.4	25%

% addition based on building separation = 75%
Addition + **2250**

H) Total Fire Flow = 5250 L/min
= **88** **L/sec**

Note: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following value may be used.
(for other residential buildings, the regular method should be used)

Exposure Distances: 0.00 m
Type of Construction (W/M): W

Total Fire Flow (L/min) = 8000 = 133 L/sec

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Conservation Dr
File: 1279
Calculated by: STV
Date: 24-Oct-17
Checked by: checkedby
Date: 1-Jan-00

12-Unit Back-to-Back Townhouse Block

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C =** Coefficient related to the type of construction.
A = Floor area (m²)

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

A)	**Building structure 'C'**	**=**	1.0
B)	**A (m²)**	**=**	286.00
C)	**# Floors (excl. basement)**		3
D)	**F (L/min)**	**=**	6444
	Rounded	**=**	**6000**

E) Type of occupancy/contents

(●) Non-Combustible ( ) Free Burning
( ) Limited Combustible ( ) Rapid Burning
( ) Combustible

Fire hazard adjustment	-	25%
Adjustment	**=**	**-1500**
F_{adj} (L/min)		**4500**

F) % reduction based on sprinkler system effectiveness = 0.00%
Reduction - **0**

G)

	Distance to nearest building (m)	% addition
N	24.0	10%
E	2.4	25%
S	24.0	10%
W	Fire wall	10%

% addition based on building separation = 55%
Addition + **2475**

H) Total Fire Flow = 6975 L/min
= **116** **L/sec**

Note: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following value may be used.
(for other residential buildings, the regular method should be used)

Exposure Distances: 0.00 m
Type of Construction (W/M): W

Total Fire Flow (L/min) = 8000 = 133 L/sec

MERITECH

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Conservation Dr
File: 1279
Calculated by: STV
Date: 24-Oct-17
Checked by: checkedby
Date: 1-Jan-00

Street Towns

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C =** Coefficient related to the type of construction.
A = Floor area (m²)

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

A)	**Building structure 'C'**	**=**	1.0
B)	**A (m²)**	**=**	302.25
C)	**# Floors (excl. basement)**		2
D)	**F (L/min)**	**=**	5409
	Rounded	**=**	**5000**

E) Type of occupancy/contents

(●) Non-Combustible ( ) Free Burning
( ) Limited Combustible ( ) Rapid Burning
( ) Combustible

Fire hazard adjustment	-	25%
Adjustment	**=**	**-1250**
F_{adj} (L/min)		**3750**

F) % reduction based on sprinkler system effectiveness = 0.00%
Reduction - **0**

G)

	Distance to nearest building (m)	% addition
N	14.0	15%
E	3.0	25%
S	28.0	10%
W	Fire Wall	10%

% addition based on building separation = 60%
Addition + **2250**

H) Total Fire Flow = 6000 L/min
= **100** **L/sec**

Note: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following value may be used.
(for other residential buildings, the regular method should be used)

Exposure Distances: 0.00 m
Type of Construction (W/M): W

Total Fire Flow (L/min) = 8000 = 133 L/sec

MERITECH

Fire Flow Calculations

1999 Fire Underwriters Survey (FUS) Method

Project: Conservation Dr
File: 1279
Calculated by: STV
Date: 21-Sep-21
Checked by: checkedby
Date: 1-Jan-00

Street A - Street Towns

Buildings require a sufficient amount of water, based on the FUS, for fire fighting purposes.
The required fire flow (L/minute) is expressed by the equation:

where **C =** Coefficient related to the type of construction.
A = Floor area (m²)

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

A)	**Building structure 'C'**	**=**	1.0
B)	**A (m²)**	**=**	302.25
C)	**# Floors (excl. basement)**		2
D)	**F (L/min)**	**=**	5409
	Rounded	**=**	**5000**

E) Type of occupancy/contents

(●) Non-Combustible ( ) Free Burning
( ) Limited Combustible ( ) Rapid Burning
( ) Combustible

Fire hazard adjustment	**-**	-25%
Adjustment	**=**	**-1250**
F_{adj} (L/min)		**3750**

F) % reduction based on sprinkler system effectiveness	**=**	0.00%
Reduction	**-**	**0**

G)

	Distance to nearest building (m)	% addition
N	3.0	25%
E	15.0	15%
S	Fire Wall	10%
W	34.0	5%

% addition based on building separation	**=**		55%
Addition	**+**	**2063**	

H)	**Total Fire Flow**	**=**	5813 L/min
		=	**97 L/sec**

Note: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following value may be used.
(for other residential buildings, the regular method should be used)

Exposure Distances:	0.00	m
Type of Construction (W/M):	W	

Total Fire Flow (L/min) = 8000 = 133 L/sec

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.2                                 *
*************************************************************************
```

Input File: 1279.A.1 - JCT1.Node19.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
11	5	8	105	300	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	11	25	75	150	
6	9	25	70	200	
7	1	10	5	300	
9	1	8	110	300	
12	26	1	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	383.02	26.52	0.00	
4	0.09	383.02	24.77	0.00	
5	4.92	383.02	24.82	0.00	
3	0.57	383.02	25.87	0.00	
6	0.26	383.02	24.92	0.00	
7	1.97	383.02	25.62	0.00	
8	0.15	383.02	22.52	0.00	
9	0.16	382.99	19.79	0.00	
10	0.22	383.00	20.10	0.00	
11	0.21	382.72	19.22	0.00	
12	0.24	382.37	18.87	0.00	
13	0.21	381.37	16.57	0.00	
14	0.21	381.39	19.39	0.00	
15	0.18	380.01	19.71	0.00	
16	0.26	380.00	17.10	0.00	
17	0.24	377.97	18.97	0.00	
18	0.21	376.15	18.55	0.00	
19	100.16	374.63	17.53	0.00	
20	0.09	376.09	19.49	0.00	
21	0.21	377.56	20.36	0.00	
22	0.22	377.91	20.41	0.00	
23	0.20	378.51	20.31	0.00	
24	0.10	378.77	20.17	0.00	
25	0.00	382.94	20.54	0.00	
1	0.00	383.03	20.23	0.00	
26	-111.06	362.90	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	-0.72	0.02	0.00	Open	
10	-1.25	0.04	0.01	Open	
11	-7.80	0.11	0.04	Open	
14	12.52	0.18	0.11	Open	
15	16.80	0.95	5.30	Open	
16	-12.16	0.69	2.91	Open	
17	28.71	1.62	14.31	Open	
18	-3.09	0.17	0.23	Open	
19	73.56	2.34	20.12	Open	
20	70.27	2.24	18.48	Open	
21	1.58	0.09	0.07	Open	
22	32.92	1.86	18.43	Open	
23	32.68	1.85	18.18	Open	
24	32.47	1.84	17.97	Open	
25	-67.69	2.15	17.25	Open	
26	-67.78	2.16	17.29	Open	
27	-16.15	0.91	4.93	Open	
28	-16.37	0.93	5.05	Open	
29	68.50	2.18	17.63	Open	
30	-16.57	0.94	5.17	Open	
31	51.83	1.65	10.52	Open	
32	-31.60	1.79	17.08	Open	
1	1.82	0.03	0.00	Open	
3	0.00	0.00	0.00	Open	
4	0.98	0.03	0.01	Open	
5	-12.36	0.70	3.00	Open	
6	12.36	0.39	0.74	Open	
7	103.10	1.46	5.22	Open	
9	7.96	0.11	0.05	Open	
12	111.06	0.00	-20.13	Open	Pump

Page 1 8/29/2022 10:33:39 AM

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*************************************************************
*                          E P A N E T                      *
*                  Hydraulic and Water Quality              *
*                  Analysis for Pipe Networks               *
*                        Version 2.2                        *
*************************************************************
```

Input File: 1279.A.2 - JCT39019.Node19.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	8	10	115	300	
9	11	25	75	150	
11	25	9	70	200	
6	5	8	105	300	
7	1	2	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	391.41	34.91	0.00	
4	0.09	390.51	32.26	0.00	
5	4.92	390.51	32.31	0.00	
3	0.57	390.84	33.69	0.00	
6	0.26	390.61	32.51	0.00	
7	1.97	390.72	33.32	0.00	
8	0.15	389.96	29.46	0.00	
9	0.16	389.36	26.16	0.00	
10	0.22	389.36	26.46	0.00	
11	0.21	389.08	25.58	0.00	
12	0.24	388.73	25.23	0.00	
13	0.21	387.73	22.93	0.00	
14	0.21	387.76	25.76	0.00	
15	0.18	386.37	26.07	0.00	
16	0.26	386.36	23.46	0.00	
17	0.24	384.33	25.33	0.00	
18	0.21	382.52	24.92	0.00	
19	100.16	380.99	23.89	0.00	
20	0.09	382.45	25.85	0.00	
21	0.21	383.92	26.72	0.00	
22	0.22	384.27	26.77	0.00	
23	0.20	384.88	26.68	0.00	
24	0.10	385.13	26.53	0.00	
25	0.00	389.30	26.90	0.00	
1	-111.06	356.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	11.48	0.37	0.64	Open	
10	-13.45	0.43	0.86	Open	
14	12.52	0.18	0.11	Open	
15	16.80	0.95	5.30	Open	
16	-12.16	0.69	2.91	Open	
17	28.71	1.62	14.31	Open	
18	-3.09	0.17	0.23	Open	
19	73.56	2.34	20.12	Open	
20	70.27	2.24	18.48	Open	
21	1.58	0.09	0.07	Open	
22	32.92	1.86	18.43	Open	
23	32.68	1.85	18.18	Open	
24	32.47	1.84	17.97	Open	
25	-67.69	2.15	17.25	Open	
26	-67.78	2.16	17.29	Open	
27	-16.15	0.91	4.93	Open	
28	-16.37	0.93	5.05	Open	
29	68.50	2.18	17.63	Open	
30	-16.57	0.94	5.17	Open	
31	51.83	1.65	10.52	Open	
32	-31.60	1.79	17.08	Open	
1	-97.05	1.37	4.66	Open	
3	-111.06	1.57	5.99	Open	
4	-11.22	0.36	0.62	Open	
5	103.10	1.46	5.22	Open	
9	-12.36	0.70	3.00	Open	
11	-12.36	0.39	0.74	Open	
6	103.26	1.46	5.23	Open	
7	111.06	0.00	-34.81	Open	Pump

Page 1 8/29/2022 10:33:14 AM

```
*************************************************************
*                          E P A N E T                      *
*                  Hydraulic and Water Quality              *
*                  Analysis for Pipe Networks               *
*                        Version 2.2                        *
*************************************************************
```

Input File: 1279.B.1 - JCT1.Node13.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
11	5	8	105	300	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	11	25	75	150	
6	9	25	70	200	
7	1	10	5	300	
9	1	8	110	300	
12	26	1	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	383.02	26.52	0.00	
4	0.09	383.02	24.77	0.00	
5	4.92	383.02	24.82	0.00	
3	0.57	383.02	25.87	0.00	
6	0.26	383.02	24.92	0.00	
7	1.97	383.02	25.62	0.00	
8	0.15	383.02	22.52	0.00	
9	0.16	382.98	19.78	0.00	
10	0.22	383.00	20.10	0.00	
11	0.21	382.45	18.95	0.00	
12	0.24	381.77	18.27	0.00	
13	100.21	379.81	15.01	0.00	
14	0.21	381.86	19.86	0.00	
15	0.18	381.59	21.29	0.00	
16	0.26	380.86	17.96	0.00	
17	0.24	381.06	22.06	0.00	
18	0.21	381.25	23.65	0.00	
19	0.16	381.42	24.32	0.00	
20	0.09	381.47	24.87	0.00	
21	0.21	381.51	24.31	0.00	
22	0.22	381.52	24.02	0.00	
23	0.20	381.54	23.34	0.00	
24	0.10	381.55	22.95	0.00	
25	0.00	382.88	20.48	0.00	
1	0.00	383.03	20.23	0.00	
26	-111.06	362.90	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	-0.72	0.02	0.00	Open	
10	-1.25	0.04	0.01	Open	
11	-7.80	0.11	0.04	Open	
14	17.80	0.25	0.20	Open	
15	24.03	1.36	10.29	Open	
16	-17.43	0.99	5.68	Open	
17	41.23	2.33	27.96	Open	
18	-31.62	1.79	17.10	Open	
19	61.05	1.94	14.25	Open	
20	29.22	0.93	3.64	Open	
21	18.13	1.03	6.11	Open	
22	-9.49	0.54	1.84	Open	
23	-9.73	0.55	1.93	Open	
24	-9.94	0.56	2.01	Open	
25	-10.10	0.32	0.51	Open	
26	-10.19	0.32	0.52	Open	
27	-2.34	0.13	0.14	Open	
28	-2.56	0.14	0.16	Open	
29	10.91	0.35	0.59	Open	
30	-2.75	0.16	0.19	Open	
31	8.05	0.26	0.33	Open	
32	27.36	1.55	13.08	Open	
1	1.82	0.03	0.00	Open	
3	0.00	0.00	0.00	Open	
4	0.98	0.03	0.01	Open	
5	-17.64	1.00	5.80	Open	
6	17.64	0.56	1.43	Open	
7	103.10	1.46	5.22	Open	
9	7.96	0.11	0.05	Open	
12	111.06	0.00	-20.13	Open	Pump

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.2                                 *
*************************************************************************

Input File: 1279.B.2 - JCT39019.Node13.net
```

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	8	10	115	300	
9	11	25	75	150	
11	25	9	70	200	
6	5	8	105	300	
7	1	2	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	391.41	34.91	0.00	
4	0.09	390.51	32.26	0.00	
5	4.92	390.51	32.31	0.00	
3	0.57	390.84	33.69	0.00	
6	0.26	390.61	32.51	0.00	
7	1.97	390.72	33.32	0.00	
8	0.15	389.96	29.46	0.00	
9	0.16	389.35	26.15	0.00	
10	0.22	389.36	26.46	0.00	
11	0.21	388.81	25.31	0.00	
12	0.24	388.13	24.63	0.00	
13	100.21	386.17	21.37	0.00	
14	0.21	388.23	26.23	0.00	
15	0.18	387.95	27.65	0.00	
16	0.26	387.22	24.32	0.00	
17	0.24	387.42	28.42	0.00	
18	0.21	387.61	30.01	0.00	
19	0.16	387.79	30.69	0.00	
20	0.09	387.83	31.23	0.00	
21	0.21	387.87	30.67	0.00	
22	0.22	387.88	30.38	0.00	
23	0.20	387.90	29.70	0.00	
24	0.10	387.91	29.31	0.00	
25	0.00	389.25	26.85	0.00	
1	-111.06	356.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	11.48	0.37	0.64	Open	
10	-13.45	0.43	0.86	Open	
14	17.80	0.25	0.20	Open	
15	24.03	1.36	10.29	Open	
16	-17.43	0.99	5.68	Open	
17	41.23	2.33	27.96	Open	
18	-31.62	1.79	17.10	Open	
19	61.05	1.94	14.25	Open	
20	29.22	0.93	3.64	Open	
21	18.13	1.03	6.11	Open	
22	-9.49	0.54	1.84	Open	
23	-9.73	0.55	1.93	Open	
24	-9.94	0.56	2.01	Open	
25	-10.10	0.32	0.51	Open	
26	-10.19	0.32	0.52	Open	
27	-2.34	0.13	0.14	Open	
28	-2.56	0.14	0.16	Open	
29	10.91	0.35	0.59	Open	
30	-2.75	0.16	0.19	Open	
31	8.05	0.26	0.33	Open	
32	27.36	1.55	13.08	Open	
1	-97.05	1.37	4.66	Open	
3	-111.06	1.57	5.99	Open	
4	-11.22	0.36	0.62	Open	
5	103.10	1.46	5.22	Open	
9	-17.64	1.00	5.80	Open	
11	-17.64	0.56	1.43	Open	
6	103.26	1.46	5.23	Open	
7	111.06	0.00	-34.81	Open	Pump

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.2                                 *
*************************************************************************
```

Input File: 1279.C - JCT39019.Node5.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	8	10	115	300	
9	11	25	75	150	
11	25	9	70	200	
6	5	8	105	300	
7	1	2	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	380.91	24.41	0.00	
4	0.09	379.07	20.82	0.00	
5	157.32	379.07	20.87	0.00	
3	0.57	379.74	22.59	0.00	
6	0.26	379.27	21.17	0.00	
7	1.97	379.51	22.11	0.00	
8	0.15	379.07	18.57	0.00	
9	0.16	379.06	15.86	0.00	
10	0.22	379.07	16.17	0.00	
11	0.21	379.06	15.56	0.00	
12	0.24	379.06	15.56	0.00	
13	0.21	379.06	14.26	0.00	
14	0.21	379.06	17.06	0.00	
15	0.18	379.06	18.76	0.00	
16	0.26	379.06	16.16	0.00	
17	0.24	379.06	20.06	0.00	
18	0.21	379.06	21.46	0.00	
19	0.16	379.06	21.96	0.00	
20	0.09	379.06	22.46	0.00	
21	0.21	379.06	21.86	0.00	
22	0.22	379.06	21.56	0.00	
23	0.20	379.06	20.86	0.00	
24	0.10	379.06	20.46	0.00	
25	0.00	379.06	16.66	0.00	
1	-163.45	356.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	17.26	0.55	1.37	Open	
10	-19.23	0.61	1.68	Open	
14	0.64	0.01	0.00	Open	
15	0.52	0.03	0.01	Open	
16	-0.28	0.02	0.00	Open	
17	0.56	0.03	0.01	Open	
18	-0.20	0.01	0.00	Open	
19	1.72	0.05	0.02	Open	
20	1.31	0.04	0.01	Open	
21	0.13	0.01	0.00	Open	
22	0.42	0.02	0.01	Open	
23	0.18	0.01	0.00	Open	
24	-0.02	0.00	0.00	Open	
25	-0.18	0.01	0.00	Open	
26	-0.28	0.01	0.00	Open	
27	0.07	0.00	0.00	Open	
28	-0.15	0.01	0.00	Open	
29	1.00	0.03	0.01	Open	
30	-0.34	0.02	0.00	Open	
31	0.55	0.02	0.00	Open	
32	-0.55	0.03	0.01	Open	
1	-143.66	2.03	9.64	Open	
3	-163.45	2.31	12.25	Open	
4	-17.00	0.54	1.34	Open	
5	3.10	0.04	0.01	Open	
9	-0.48	0.03	0.01	Open	
11	-0.48	0.02	0.00	Open	
6	3.25	0.05	0.01	Open	
7	163.45	0.00	-24.31	Open	Pump

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                           Version 2.2                                 *
*************************************************************************
```

Input File: 1279.D (133LPS) - JCT39019.Node7.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	8	10	115	300	
9	11	25	75	150	
11	25	9	70	200	
6	5	8	105	300	
7	1	2	#N/A	#N/A	Pump

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	385.15	28.65	0.00	
4	0.09	384.09	25.84	0.00	
5	4.92	384.09	25.89	0.00	
3	0.57	384.23	27.08	0.00	
6	0.26	382.46	24.36	0.00	
7	134.97	380.68	23.28	0.00	
8	0.15	384.09	23.59	0.00	
9	0.16	384.09	20.89	0.00	
10	0.22	384.09	21.19	0.00	
11	0.21	384.09	20.59	0.00	
12	0.24	384.09	20.59	0.00	
13	0.21	384.09	19.29	0.00	
14	0.21	384.09	22.09	0.00	
15	0.18	384.09	23.79	0.00	
16	0.26	384.09	21.19	0.00	
17	0.24	384.09	25.09	0.00	
18	0.21	384.09	26.49	0.00	
19	0.16	384.09	26.99	0.00	
20	0.09	384.09	27.49	0.00	
21	0.21	384.09	26.89	0.00	
22	0.22	384.09	26.59	0.00	
23	0.20	384.09	25.89	0.00	
24	0.10	384.09	25.49	0.00	
25	0.00	384.09	21.69	0.00	
1	-144.06	356.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	-51.65	1.64	10.45	Open	
10	-83.31	2.65	25.34	Open	
14	0.64	0.01	0.00	Open	
15	0.52	0.03	0.01	Open	
16	-0.28	0.02	0.00	Open	
17	0.56	0.03	0.01	Open	
18	-0.20	0.01	0.00	Open	
19	1.72	0.05	0.02	Open	
20	1.31	0.04	0.01	Open	
21	0.13	0.01	0.00	Open	
22	0.42	0.02	0.01	Open	
23	0.18	0.01	0.00	Open	
24	-0.02	0.00	0.00	Open	
25	-0.18	0.01	0.00	Open	
26	-0.28	0.01	0.00	Open	
27	0.07	0.00	0.00	Open	
28	-0.15	0.01	0.00	Open	
29	1.00	0.03	0.01	Open	
30	-0.34	0.02	0.00	Open	
31	0.55	0.02	0.00	Open	
32	-0.55	0.03	0.01	Open	
1	-60.18	0.85	1.92	Open	
3	-144.06	2.04	9.69	Open	
4	51.91	1.65	10.55	Open	
5	3.10	0.04	0.01	Open	
9	-0.48	0.03	0.01	Open	
11	-0.48	0.02	0.00	Open	
6	3.25	0.05	0.01	Open	
7	144.06	0.00	-28.55	Open	Pump

Page 1 8/29/2022 10:38:50 AM

```
******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.2                             *
******************************************************************
```

Input File: 1279.E - JCT1.Node8.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
2	4	5	75	150	
8	7	6	170	200	
10	7	3	140	200	
11	5	8	105	300	
14	10	9	90	300	
15	10	12	120	150	
16	12	11	120	150	
17	12	13	70	150	
18	13	14	120	150	
19	10	14	80	200	
20	14	15	75	200	
21	15	16	120	150	
22	16	17	110	150	
23	17	18	100	150	
24	18	19	85	150	
25	19	20	85	200	
26	20	21	85	200	
27	21	22	70	150	
28	22	23	120	150	
29	15	24	70	200	
30	23	24	50	150	
31	24	21	115	200	
32	16	13	80	150	
1	5	3	70	300	
3	3	2	95	300	
4	5	6	155	200	
5	11	25	75	150	
6	9	25	70	200	
7	1	10	5	300	
9	1	8	110	300	
12	26	1	#N/A	#N/A	Pump

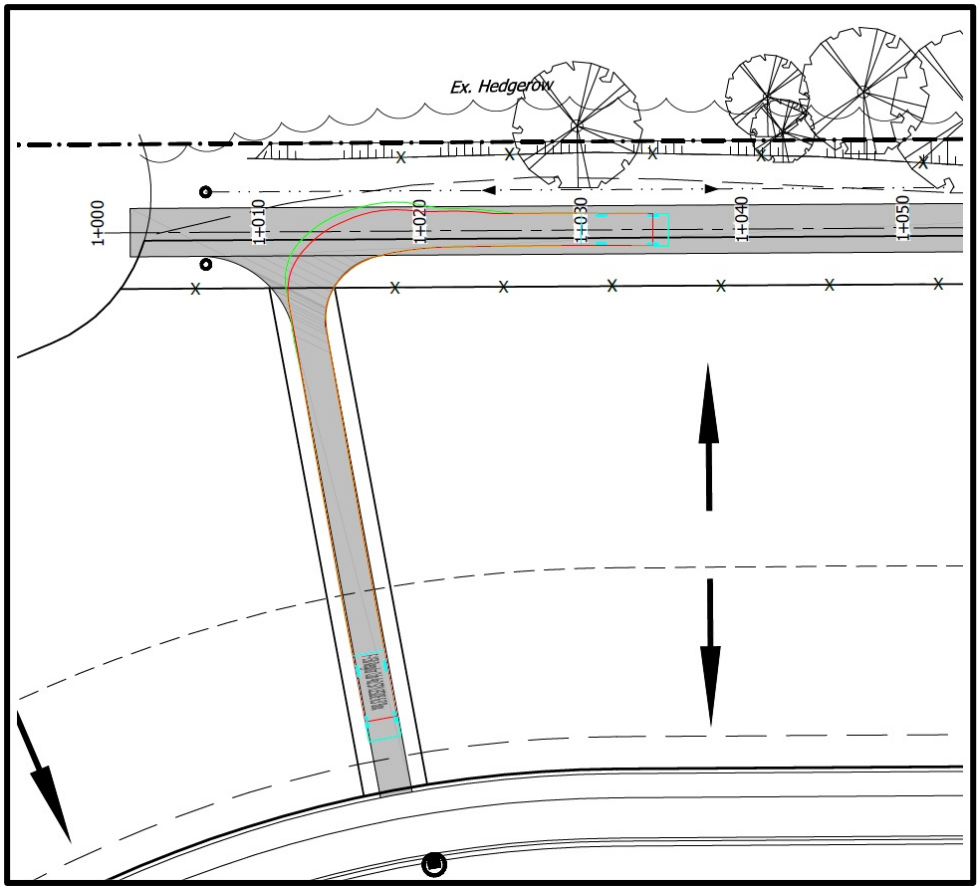
Node Results:

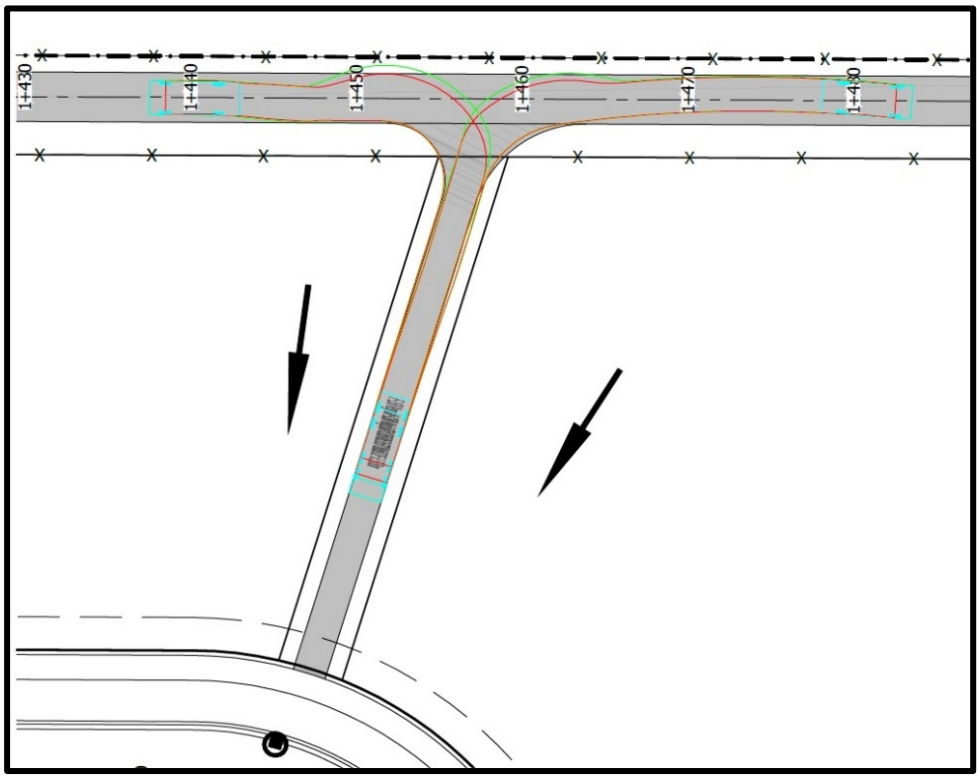
Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	383.44	26.94	0.00	
4	0.09	383.44	25.19	0.00	
5	4.92	383.44	25.24	0.00	
3	0.57	383.44	26.29	0.00	
6	0.26	383.44	25.34	0.00	
7	1.97	383.44	26.04	0.00	
8	97.15	383.45	22.95	0.00	
9	0.16	384.04	20.84	0.00	
10	0.22	384.04	21.14	0.00	
11	0.21	384.04	20.54	0.00	
12	0.24	384.04	20.54	0.00	
13	0.21	384.04	19.24	0.00	
14	0.21	384.04	22.04	0.00	
15	0.18	384.04	23.74	0.00	
16	0.26	384.04	21.14	0.00	
17	0.24	384.04	25.04	0.00	
18	0.21	384.04	26.44	0.00	
19	0.16	384.04	26.94	0.00	
20	0.09	384.04	27.44	0.00	
21	0.21	384.04	26.84	0.00	
22	0.22	384.04	26.54	0.00	
23	0.20	384.04	25.84	0.00	
24	0.10	384.04	25.44	0.00	
25	0.00	384.04	21.64	0.00	
1	0.00	384.04	21.24	0.00	
26	-108.06	362.90	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
2	-0.09	0.01	0.00	Open	
8	-0.72	0.02	0.00	Open	
10	-1.25	0.04	0.01	Open	
11	-7.80	0.11	0.04	Open	
14	0.64	0.01	0.00	Open	
15	0.52	0.03	0.01	Open	
16	-0.28	0.02	0.00	Open	
17	0.56	0.03	0.01	Open	
18	-0.20	0.01	0.00	Open	
19	1.72	0.05	0.02	Open	
20	1.31	0.04	0.01	Open	
21	0.13	0.01	0.00	Open	
22	0.42	0.02	0.01	Open	
23	0.18	0.01	0.00	Open	
24	-0.02	0.00	0.00	Open	
25	-0.18	0.01	0.00	Open	
26	-0.28	0.01	0.00	Open	
27	0.07	0.00	0.00	Open	
28	-0.14	0.01	0.00	Open	
29	1.00	0.03	0.01	Open	
30	-0.34	0.02	0.00	Open	
31	0.55	0.02	0.00	Open	
32	-0.56	0.03	0.01	Open	
1	1.82	0.03	0.00	Open	
3	0.00	0.00	0.00	Open	
4	0.98	0.03	0.01	Open	
5	-0.48	0.03	0.01	Open	
6	0.48	0.02	0.00	Open	
7	3.10	0.04	0.01	Open	
9	104.96	1.48	5.39	Open	
12	108.06	0.00	-21.14	Open	Pump

Appendix D: Truck Turning Movements for Trails


Ex. Hedgerow
1+000
1+010
1+020
1+030
1+040
1+050


1+430
1+440
1+450
1+460
1+470
1+480

Appendix E: Agency Correspondence

Grand River Conservation Authority
Resource Management Division
Kaitlyn Smith, Resource Planner

400 Clyde Road, P.O. Box 729
Cambridge, Ontario N1R 5W6
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Fax: (519) 621-4945
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PLAN REVIEW REPORT:	**Region of Waterloo** **Shiling Yip**

DATE:	**YOUR FILE:**	**GRCA FILE:**
September 14, 2015	Conservation Dr. at Beaver Creek Rd.	Presub 556, 560 & 576 Conservation Drive

RE: **Presubmission Draft Plan of Subdivision & Zone Change Application**
556, 560 and 576 Conservation Drive, City of Waterloo
2115881 Ontario Limited

GRCA COMMENT*:
A portion of the subject properties are regulated by the Grand River Conservation Authority (GRCA) under Ontario Regulation 150/06. GRCA request an opportunity to review the formal applications to ensure conformance with the relevant policies of the Provincial Policy Statement, the North Waterloo Scoped Subwatershed Study, and Ontario Regulation 150/06. Please see below for our detailed review requirements.

1. **Nature of the Application:**
   It is our understanding that the applicant is proposing to develop the vacant properties with a mix of low rise residential uses, including associated school, park, open space, and stormwater management blocks.

2. **GRCA Resource Issues:**
   Information currently available at this office indicates that the subject properties contain the following natural heritage and hazard features of interest to the GRCA:

   - Sunfish Lake – Laurel Creek Provincially Significant Wetland Complex and associated 120 metre allowance
   - Beaver Creek and associated 15 metre allowance
   - One Zone floodplain and associated 5 metre allowance

   Due to the presence of these resource features, a portion of the subject properties is regulated by the GRCA under Ontario Regulation 150/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation).

3. **Review of Application under the *Planning Act*:**
   For review of the Draft Plan of Subdivision and Zone Change applications, GRCA staff will require submission of the following materials:

   - Scoped Environmental Impact Study (EIS)
   - Stormwater Management (SWM) & Servicing Report
   - Hydrogeological Assessment
   - Pre-construction Monitoring Report (2 years)
   - Preliminary Grading and Erosion and Sediment Control Plans

   We note that the North Waterloo Scoped Subwatershed Study (NWSSS) recommends a 30 metre buffer for all Provincially Significant Wetlands in the subwatershed. The preliminary plan has incorporated this buffer, which also provides sufficient development setback from the creek and floodplain. GRCA staff support the Open Space zoning; however, a portion of the buffer (Block 35) is shown as Park. This is not the intent of the 30 metre buffer; therefore, GRCA staff request that this be revised to Open Space.

We also note that Stormwater Management Blocks 38 and 39 encroach into the wetland buffer. In accordance with the NWSSS, the Scoped EIS and SWM Report will need to demonstrate that there are no feasible locations outside of the buffer and that adverse impacts to the natural features can be avoided and/or mitigated appropriately. Please be advised that buffer encroachment shall only be permitted for *a portion* of stormwater management, not entire facilities.

Trail locations should also be shown on the Draft Plan of Subdivision and addressed in the supporting documentation (with attention paid to the requirements of the NWSSS).

4. **Review of Application under Ontario Regulation 150/06:**
Development proposed with GRCA regulated areas requires prior issuance of a GRCA permit pursuant to Ontario Regulation 150/06. GRCA staff will review the Draft Plan of Subdivision and Zone Change applications for conformance with Ontario Regulation 150/06 and advise of any specific permit requirements through that process.

5. **Plan Review Fees:**
The GRCA applies Plan Review Fees for *Planning Act* applications located within GRCA areas of interest. Given that the Draft Plan of Subdivision and Zone Change applications will be submitted concurrently, only the subdivision fee will be applied.

According to the 2015 Plan Review Fee Schedule, the fee for a Draft Plan of Subdivision application is $2,050 (base fee) plus $1,070 per net hectare (to a maximum of $25,000). Upon submission of the application, the GRCA will invoice for 70% of the total fee. The remaining 30% will be due prior to GRCA providing conditions for Draft Plan Approval. Additional fees are applied for providing clearance of Draft Plan Approval conditions for registration of the plan.

Please be advised that a separate fee is applied for a GRCA permit application. A 'minor' fee of $380 is typically applied in cases where GRCA staff have already reviewed the related Draft Plan of Subdivision.

We trust this information is of assistance. If you have any questions, or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Kaitlyn Smith
Resource Planner
Grand River Conservation Authority

cc: Kristen Barisdale – GSP Group (email)
Trevor Hawkins – City of Waterloo (email)
Robyn McMullen – City of Waterloo (email)

These comments are respectfully submitted as advice and reflect resource concerns within the scope and mandate of the Grand River Conservation Authority

Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 www.grandriver.ca

July 8, 2021

Shilling Yip
Principal Planner
Planning, Development & Legislative Services
Regional Municipality of Waterloo
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Natalie Hardacre
Manager, Planning Approvals
Integrated Planning & Public Works
City of Waterloo
100 Regina Street South
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Re: Draft Plan of Subdivision 30T-16402
Zone Change Application Z-16-14
556, 560 and 576 Conservation Drive, City of Waterloo
2115881 Ontario Limited

The Grand River Conservation Authority (GRCA) has reviewed the following in support of the Draft Plan of Subdivision application:

- Planning Justification Report (GSP, July 2016)
- Hydrogeological Report (Stantec, August 2020)
- Geotechnical Report (LVM, March 2015)
- Environmental Impact Study (NRSI, September 2020)
- Servicing Strategy Report (Meritech, August 2020)
- Preliminary Stormwater Management Report (Meritech, August 2020)
- Draft Plan (GSP, revised June 25, 2020)
- Grading Plan (Meritech, July 2020)

At this time, GRCA staff are not in a position to recommend approval of the above-noted applications at this time. Please refer to our comments below:

Stormwater Management

1. The Beaver Creek Meadows Communal Stormwater Management (SWM) Facility is proposed to service post-development subcatchment 3107 for this subdivision. The GRCA has been providing comments to MTE regarding this facility, and all contributing developments must demonstrate meeting and

exceeding their respective infiltration targets. The high-level calculations provided are insufficient to confirm that the proposed post-development infiltration volumes are achievable.

a. For draft plan approval, please provide a monthly water balance that clearly demonstrates that this subdivision's infiltration target is met with an appropriate factor of safety.
b. Please provide the monthly water balance for each catchment (east and west) in the pre-development, post-development and post-development with mitigation conditions.
c. Please include the post-development infiltration volumes for the east and west catchments separately, to confirm that the infiltration rates specified for the communal SWM facility and the North Waterloo Scoped Subwatershed Study (NWSSS) are being met, respectively.

2. In a letter to the Beaver Creek Meadows Developers Group dated December 11, 2020, the City of Waterloo advised that it "does not support private subsurface engineered [low impact development] approaches for lands not held in municipal ownership within the Beaver Creek District Plan area that would count towards overall sub-catchment and catchment SWM infiltration goals," with some exceptions noted. The GRCA supports the City's position and will analyze proposed infiltration in the same manner.

   It is proposed that a portion of the post-development infiltration deficit is mitigated through lot level controls. While we are supportive of additional infiltration measures, we will be unable to support a water balance relying on lot-level infiltration on private property, and we request that proposed infiltration mitigation calculations do not include amended topsoil and disconnected downspouts. Supporting information and details regarding infiltration facilities that will count towards meeting the infiltration targets should be provided, including seasonally high groundwater levels.

Natural Heritage

3. Wetland boundaries on this site were last verified by the GRCA in 2015. Given the amount of buffer encroachment proposed within the vicinity of the on-site SWM facility, we request that this section of the wetland be delineated and, if necessary, resurveyed.

4. With respect to areas of minor buffer encroachment, detailed grading and landscaping plans are required at detailed design to demonstrate how buffer functions within these areas will be maintained or enhanced. All plans must clearly illustrate a 15-metre minimum grading setback from all wetland areas.

5. The environmental impact study (EIS) suggests that measures will be implemented in order to meet or exceed the post-development infiltration target recommended by the NWSSS. However, further detail was lacking in the EIS. It

appears the modelling information presented in the SWM report was not interpreted. The additional infiltration and water balance details (as requested in comment 1) should be reviewed as part of the EIS.

6. We note that the hydrogeology assessment is undergoing updates. We request that a final assessment report be submitted to the GRCA at the detailed design stage.

Advisory Comments

7. A treed section of the 30-metre wetland buffer will be directly impacted by grading for the on-site SWM facility, and while the limit of grading respects the 15-metre setback from the surveyed wetland limit, it may impact the contiguous woodland. The woodland was last surveyed in 2016. Given the presence of several regionally significant species within the woodland, we recommend that this section of the woodland be reviewed by the Region and resurveyed if necessary.

8. We recommend that no vegetation be removed during the active bat season and the breeding bird season.

9. According to Meritech, “as the surface receiver of the SWM facility is also Beaver Creek, a winter bypass is potentially unneeded.” Given the past evidence of trout spawning along Laurel Creek (per NWSSS) and the potential for salmonids to inhabit the lower reaches of Beaver Creek, a winter bypass is recommended. We understand that a bypass will be proposed in upcoming revisions to the SWM facility. Please provide additional details regarding its proposed location / outlet and operation.

10. Continued surface water quality monitoring along Beaver Creek and at the stormwater outfall is recommended in order to assess overall conditions, to verify whether or not mitigation measures are adequate, and determine if surface discharge from the SWM facility is a source of adverse water quality impacts to the creek.

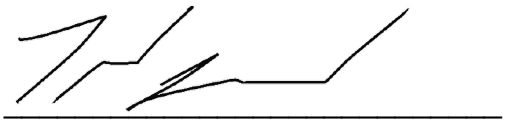
Fees

11. We wish to acknowledge receipt of a cheque in the amount of $17,500.00. Subdivision fees for applications filed prior to 2018 were capped at $25,000.00, so this covers the required 70% of the required total review fees. Prior to issuance of conditions of draft plan approval, we will require the remaining fees of $7,500.00. Additional fees will be required for clearance, and a separate fee will be required for any GRCA permits.

Please provide a comment-response matrix with all subsequent submissions outlining how all GRCA comments have been addressed.

We trust this information is of assistance. If you have any questions, or require additional information, please contact me at 519-621-2763 ext. 2292 or theywood@grandriver.ca.

Sincerely,



Trevor Heywood
Resource Planner
Grand River Conservation Authority

c.c. Kristen Barisdale, GSP Group
Jane Gurney, Region of Waterloo
Robyn McMullen, City of Waterloo

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: July 19, 2021
File #: E18-10/KI

Chris Togeretz, P. Eng.
Meritech Engineering
1315 Bishop St N, Suite 202
Cambridge, ON N1R 6Z2
t. 519.623.1140 ext 214
e. christophert@meritech.ca

Dear: Chris

Re: 556-576 Conservation Dr, Waterloo

Please find the results of the modeling simulations for boundary conditions requested on April 13, 2021. The results include a figure showing the locations of the nodes from the Region's model. The diurnal 24-hour demand distribution accounts for the minimum hour and peak hour peaking factors. The maximum pressure on the average day represents the minimum hour, and the minimum pressure on the maximum day represents the peak hour.

Two scenarios were modeled for this request and are summarized in Table 1 below.

Table 1 – Scenario Descriptions

Scenario	Description
Scenario 1	No Beaver Creek Meadows infrastructure included. Servicing for subject site provided by existing infrastructure on Conservation Dr and Roy Schmidt Rd with internal site looping.
Scenario 2	Watermains on Beaver Creek Rd, Conservation Dr, and Erbsville Rd are included, providing WAT 5 looping but no interconnection with WAT 4C. No other WAT 5 watermains included.

For Scenario 2, only the following proposed watermains were included in the analysis:

- Erbsville Rd (Regal Pl to Conservation Dr) 300mm PVC
- Conservation Dr (Erbsville Rd to Beaver Creek Rd) 300mm PVC
- Beaver Creek Rd (Laurel Creek Nature Centre to Conservation Dr) 300mm PVC

The other proposed watermains from the Waterloo Zone 4B, 4C, and 5 consolidations study were not included, specifically the watermains on:

- Bearinger Rd (Laurelwood Dr to Westmount)
- Columbia St. (Westmount Rd to Hagey Blvd)
- Erbsville Rd (Blue Beech Blvd to Werni Ct) and
- Erbsbville Rd (Erbsville Crt to White Elm Blvd)

Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows for various nodes under various scenarios.

Table 2 – Modeling Results

Scenario	Node	Elevation (mASL)	Demand				Fire Flow Results	
			Ave Day (L/s)		Max Day (L/s)		Design Flow (L/s)	Design Pressure (m)
			res	emp	res	emp		
1	JCT_MTC_01	362.9	2.3	1.9	3.5	2.8	126.8	14.0
	JCT_MTC_03	358.2	2.3	1.9	3.5	2.8	122.5	14.0
2	JCT_39019	356.6	4.6	3.7	6.9	5.5	204.7	14.0

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.

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 4C Infowater Location : Street A and Pinery Trail
Scenario 1

JCT_MTC_0 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	3.05	404.90	42.00
01:00 hrs	2.62	404.93	42.03
02:00 hrs	2.44	404.93	42.03
03:00 hrs	2.39	404.93	42.03
04:00 hrs	2.21	404.94	42.04
05:00 hrs	2.14	404.95	42.05
06:00 hrs	2.79	404.91	42.01
07:00 hrs	4.17	404.80	41.90
08:00 hrs	5.13	404.70	41.80
09:00 hrs	5.39	404.70	41.80
10:00 hrs	5.41	404.70	41.80
11:00 hrs	5.55	404.69	41.79
12:00 hrs	5.47	404.70	41.80
13:00 hrs	5.25	404.72	41.82
14:00 hrs	5.05	404.74	41.84
15:00 hrs	4.78	404.77	41.87
16:00 hrs	4.77	404.77	41.87
17:00 hrs	4.78	404.76	41.86
18:00 hrs	4.87	404.75	41.85
19:00 hrs	4.87	404.74	41.84
20:00 hrs	4.63	404.76	41.86
21:00 hrs	4.33	404.79	41.89
22:00 hrs	4.04	404.82	41.92
23:00 hrs	3.55	404.86	41.96

Average Day HGL: 404.80
Minimum Hour: 404.95

JCT_MTC_0 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	4.26	404.83	41.93
01:00 hrs	3.53	404.88	41.98
02:00 hrs	3.06	404.90	42.00
03:00 hrs	3.25	404.89	41.99
04:00 hrs	3.37	404.88	41.98
05:00 hrs	3.27	404.89	41.99
06:00 hrs	5.49	404.72	41.82
07:00 hrs	7.98	404.40	41.50
08:00 hrs	8.75	404.27	41.37
09:00 hrs	8.71	404.33	41.43
10:00 hrs	8.01	404.44	41.54
11:00 hrs	7.86	404.46	41.56
12:00 hrs	7.82	404.48	41.58
13:00 hrs	7.16	404.53	41.63
14:00 hrs	6.10	404.62	41.72
15:00 hrs	6.40	404.61	41.71
16:00 hrs	6.31	404.58	41.68
17:00 hrs	6.16	404.59	41.69
18:00 hrs	6.83	404.50	41.60
19:00 hrs	7.49	404.41	41.51
20:00 hrs	7.69	404.39	41.49
21:00 hrs	7.27	404.46	41.56
22:00 hrs	6.41	404.60	41.70
23:00 hrs	5.53	404.71	41.81

Maximum Day HGL: 404.60
Peak Hour: 404.27

WAT 4C Infowater Location : Street A and Pinery Trail

JCT_MTC_01	Residual Pressure (m)
0.0	42.0
10.0	41.4
20.0	40.6
30.0	39.5
40.0	38.1
50.0	36.4
60.0	34.4
70.0	32.2
80.0	29.6
90.0	26.9
100.0	23.8
110.0	20.5
120.0	17.0
126.8	14.0

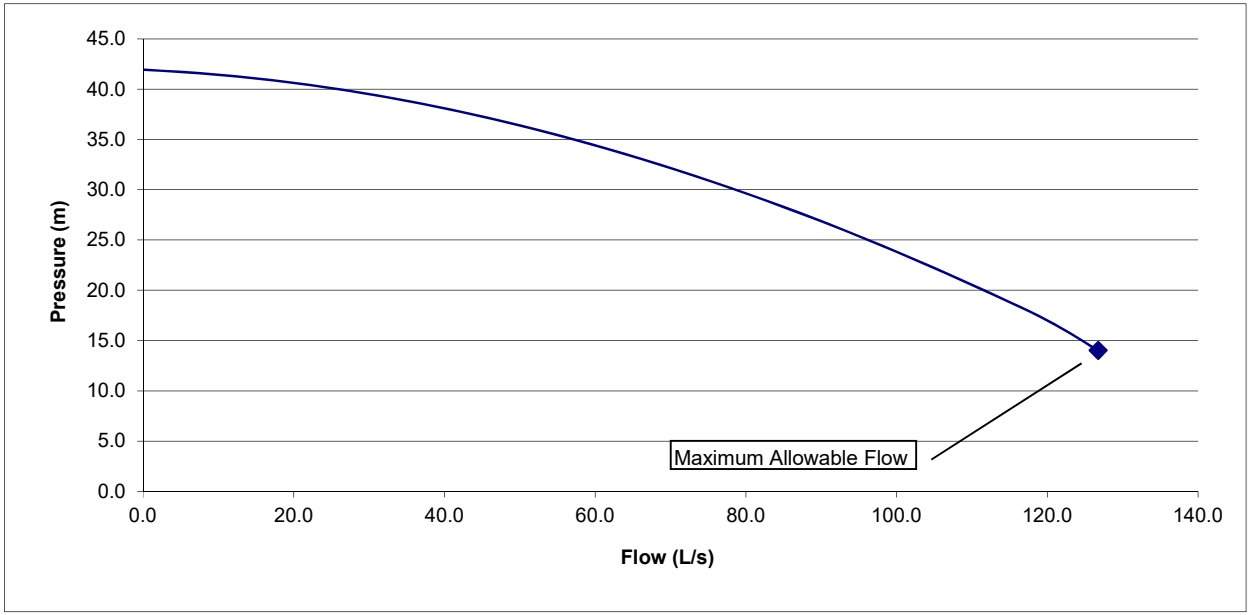
Fire Flow Analysis

Fire Flow Node:	JCT_MTC_01
Design Flow (L/s):	126.8
Design Pressure (m)	14.0

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

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

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



WAT 4C Infowater Location : Street A middle
Scenario 1

JCT_MTC_0 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	3.05	404.90	46.70
01:00 hrs	2.62	404.92	46.72
02:00 hrs	2.44	404.93	46.73
03:00 hrs	2.39	404.93	46.73
04:00 hrs	2.21	404.94	46.74
05:00 hrs	2.14	404.95	46.75
06:00 hrs	2.79	404.91	46.71
07:00 hrs	4.17	404.79	46.59
08:00 hrs	5.13	404.69	46.49
09:00 hrs	5.39	404.69	46.49
10:00 hrs	5.41	404.69	46.49
11:00 hrs	5.55	404.68	46.48
12:00 hrs	5.47	404.69	46.49
13:00 hrs	5.25	404.71	46.51
14:00 hrs	5.05	404.74	46.54
15:00 hrs	4.78	404.76	46.56
16:00 hrs	4.77	404.76	46.56
17:00 hrs	4.78	404.76	46.56
18:00 hrs	4.87	404.74	46.54
19:00 hrs	4.87	404.73	46.53
20:00 hrs	4.63	404.75	46.55
21:00 hrs	4.33	404.78	46.58
22:00 hrs	4.04	404.81	46.61
23:00 hrs	3.55	404.86	46.66

Average Day HGL: 404.80
Minimum Hour: 404.95

JCT_MTC_0 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	4.26	404.82	46.62
01:00 hrs	3.53	404.88	46.68
02:00 hrs	3.06	404.90	46.70
03:00 hrs	3.25	404.89	46.69
04:00 hrs	3.37	404.88	46.68
05:00 hrs	3.27	404.89	46.69
06:00 hrs	5.49	404.71	46.51
07:00 hrs	7.98	404.38	46.18
08:00 hrs	8.75	404.25	46.05
09:00 hrs	8.71	404.31	46.11
10:00 hrs	8.01	404.42	46.22
11:00 hrs	7.86	404.45	46.25
12:00 hrs	7.82	404.46	46.26
13:00 hrs	7.16	404.52	46.32
14:00 hrs	6.10	404.61	46.41
15:00 hrs	6.40	404.59	46.39
16:00 hrs	6.31	404.57	46.37
17:00 hrs	6.16	404.58	46.38
18:00 hrs	6.83	404.49	46.29
19:00 hrs	7.49	404.40	46.20
20:00 hrs	7.69	404.37	46.17
21:00 hrs	7.27	404.44	46.24
22:00 hrs	6.41	404.59	46.39
23:00 hrs	5.53	404.70	46.50

Maximum Day HGL: 404.59
Peak Hour: 404.25

WAT 4C Infowater Location : Street A middle

JCT_MTC_03	Residual Pressure (m)
0.0	46.7
10.0	46.1
20.0	45.1
30.0	43.8
40.0	42.0
50.0	39.9
60.0	37.4
70.0	34.5
80.0	31.3
90.0	27.8
100.0	23.9
110.0	19.7
120.0	15.2
122.5	14.0

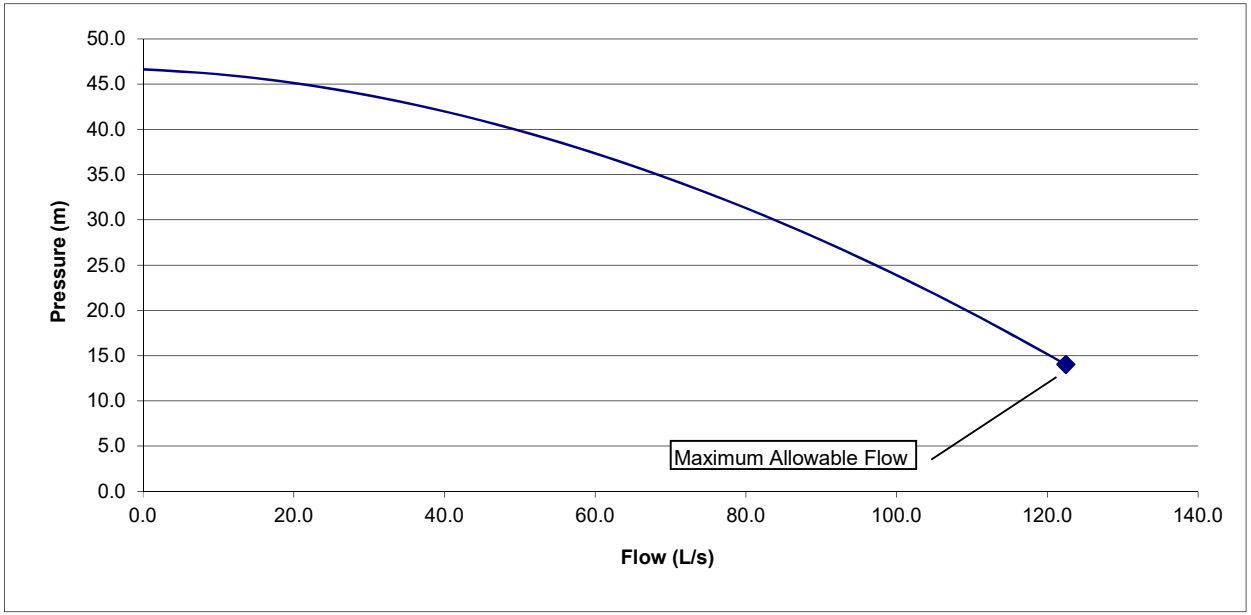
Fire Flow Analysis

Fire Flow Node:	JCT_MTC_03
Design Flow (L/s):	122.5
Design Pressure (m)	14.0

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

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

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 Location : Conservation and Beaver Creek
Scenario 2

JCT_39019 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	6.11	403.54	46.94
01:00 hrs	5.23	403.71	47.11
02:00 hrs	4.89	403.57	46.97
03:00 hrs	4.78	403.57	46.97
04:00 hrs	4.43	403.64	47.04
05:00 hrs	4.27	403.73	47.13
06:00 hrs	5.59	403.52	46.92
07:00 hrs	8.34	402.70	46.10
08:00 hrs	10.26	402.18	45.58
09:00 hrs	10.78	402.40	45.80
10:00 hrs	10.83	402.40	45.80
11:00 hrs	11.11	402.41	45.81
12:00 hrs	10.93	402.67	46.07
13:00 hrs	10.51	402.76	46.16
14:00 hrs	10.10	402.86	46.26
15:00 hrs	9.56	402.97	46.37
16:00 hrs	9.54	402.92	46.32
17:00 hrs	9.56	402.86	46.26
18:00 hrs	9.75	402.68	46.08
19:00 hrs	9.73	402.56	45.96
20:00 hrs	9.26	402.58	45.98
21:00 hrs	8.66	402.71	46.11
22:00 hrs	8.08	402.89	46.29
23:00 hrs	7.10	403.16	46.56

Average Day HGL: 402.96
Minimum Hour: 403.73

JCT_39019 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	8.52	403.19	46.59
01:00 hrs	7.06	403.46	46.86
02:00 hrs	6.13	403.47	46.87
03:00 hrs	6.50	403.42	46.82
04:00 hrs	6.75	403.44	46.84
05:00 hrs	6.54	403.54	46.94
06:00 hrs	10.97	402.97	46.37
07:00 hrs	15.97	401.59	44.99
08:00 hrs	17.50	401.00	44.40
09:00 hrs	17.42	401.66	45.06
10:00 hrs	16.03	402.12	45.52
11:00 hrs	15.72	402.21	45.61
12:00 hrs	15.64	402.34	45.74
13:00 hrs	14.32	402.22	45.62
14:00 hrs	12.20	402.05	45.45
15:00 hrs	12.80	403.12	46.52
16:00 hrs	12.61	401.81	45.21
17:00 hrs	12.33	401.74	45.14
18:00 hrs	13.65	401.24	44.64
19:00 hrs	14.98	402.04	45.44
20:00 hrs	15.39	402.01	45.41
21:00 hrs	14.53	402.33	45.73
22:00 hrs	12.83	403.05	46.45
23:00 hrs	11.06	402.72	46.12

Maximum Day HGL: 402.45
Peak Hour: 401.00

WAT 5 Infowater Location : Conservation and Beaver Creek

JCT_39019	Residual Pressure (m)
0.0	46.4
10.0	46.0
20.0	45.5
30.0	44.8
40.0	44.0
50.0	43.1
60.0	42.0
70.0	40.8
80.0	39.5
90.0	38.1
100.0	36.6
110.0	35.0
120.0	33.2
130.0	31.3
140.0	29.4
150.0	27.3
160.0	25.1
170.0	22.8
180.0	20.4
190.0	17.9
200.0	15.3

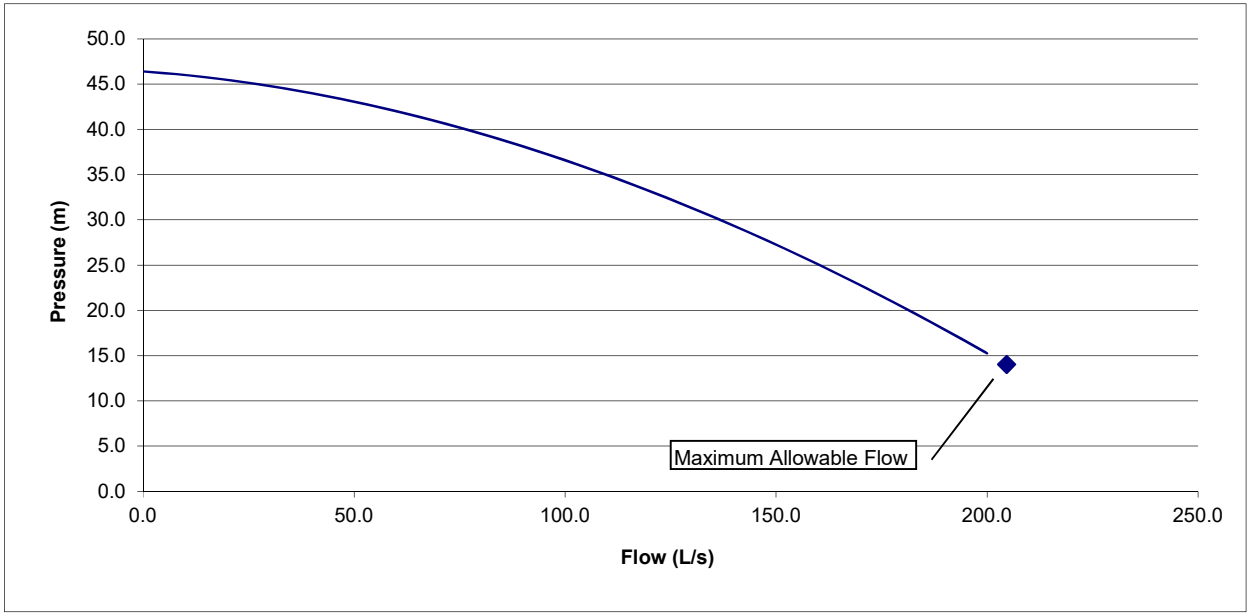
Fire Flow Analysis

Fire Flow Node:	JCT_39019
Design Flow (L/s):	204.7
Design Pressure (m)	14.0

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

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

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



Township of Woolwich

City of Waterloo

JCT_MTC_01

JCT_MTC_03

556-576 Conservation Dr

Rideau River Pl

Rideau River St

Pinery Trail

Kelso Dr

Wasaga Cres

Cranberry St

Kawartha St

Roy Schmidt Rd

Conservation Dr

Beaver Creek Rd

0 75 150 300 450 600 Meters

Time: 3:19 PM Date: 7/19/2021 Author: dolkevin Document Path: I:\InfoWater\Modeling Requests\2021\Meritech\556-576 Conservation Dr WATAll_Pipes_20210114_pro_Conservation.aprx

Region of Waterloo

TRANSPORTATION AND ENVIRONMENTAL SERVICES

Water Services

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Kitchener ON Canada N2G 4J3
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Fax: (519) 575-4452
www.regionofwaterloo.ca

Legend

Junction
Type
- Active
- Domain

Tank
Type
- Active
- Domain

Reservoir
Type
- Active
- Domain

Pump
Type
- Active
- Domain

Valve
Type
- Active
- Domain

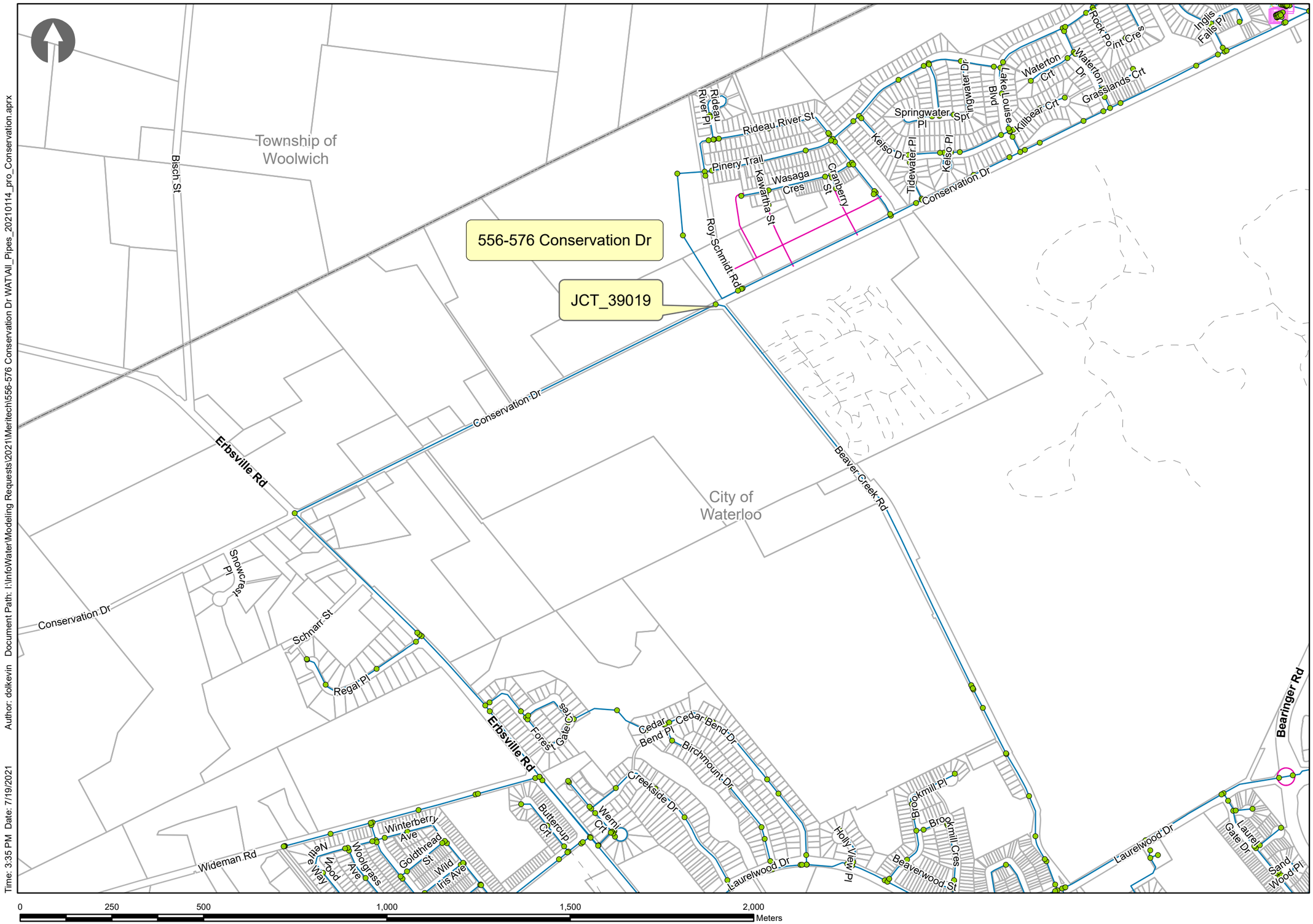
Pipe
Type
- Active
- Domain

Roads

Roads
- Highway
- Arterial/Collector
- Local
- Private
- Proposed Roads

Non modelling data Layer
- Regional Municipal Boundaries
- Assessment Parcels (MPAC)

556-576 Conservation Dr
Scenario 1



Time: 3:35 PM Date: 7/19/2021 Author: dolkevin Document Path: I:\InfoWater\Modeling Requests\2021\Meritech\556-576 Conservation Dr WATVAll_Pipes_20210114_pro_Conservation.aprx

Region of Waterloo

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Water Services

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Telephone: (519) 575-4426
Fax: (519) 575-4452
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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
- Roads
  - Roads
    - Highway
    - Arterial/Collector
    - Local
    - Private
    - Proposed Roads
- Non modelling data Layer
  - Regional Municipal Boundaries
  - Assessment Parcels (MPAC)

556-576 Conservation Dr
Scenario 2

Appendix F: "Quick-Start" Servicing and Stormwater Management Option Letter

September 6, 2022

GSP Group
72 Victoria Street South, Suite 201
Kitchener, ON N2G 2A9

Attention: Ms. Kristen Barisdale, MCIP RPP
Associate, Senior Planner

Dear Ms. Barisdale,

Re: "Quick-Start" Servicing and Stormwater Management Option
556 and 576 Conservation Drive
City of Waterloo

This "quick-start" servicing option is being presented in order to provide an opportunity to begin construction of a small portion of the project without relying on external factors. Construction of the majority of the subdivision is currently reliant on the reconstruction of Beaver Creek Road and Conservation Drive, with the addition of road upgrades, watermain, sanitary and storm sewers as well as the off-site SWM facility and a pumping station to the south on Beaver Creek Road.

However, with the extension of Rideau River Street and Pinery Trail into the site, a "crescent" street will be formed along Street A. This provides sufficient municipal services and emergency access to the area. A sketch showing the proposed limits of the "quick-start" phase is attached.

Sanitary

An existing sanitary trunk sewer is located in Rideau River Street, in the existing subdivision to the east, with an invert elevation of 357.46m (refer to drawing 5-2198 attached). The sewer would be extended into the site and be able to provide an outlet for Blocks 1, 2, 18-22, and part of Blocks 3 and 17. A total of approximately 45-65 single detached lots would be able to be serviced.

Water

An existing 200mm diameter watermain loops from Rideau River Street through Roy Schmidt Road to Pinery Trail in the existing subdivision to the east. The water modeling letter we received from the Region has a junction located at the intersection of Street A and Pinery Trail, within the subject site. As we would be further looping the watermain through Street A to Rideau River Street, the flows available will be similar to what is shown in the Region's model.

Design flows of up to 120 L/s are available with a residual pressure of 17.0m. This is more than sufficient to provide adequate protection of the single detached homes according to FUS requirements.

Storm & Stormwater Management

The design, construction, and operation of a temporary SWM facility to service the site's east drainage area is a viable option should the construction of the external communal SWM facility be delayed.

Storm runoff for the "quick-start" area would be collected by the local storm sewer and conveyed south towards the south-east corner of the site. A temporary stormwater management facility would be constructed in this location to control and attenuate the flows. As described below, an appropriately sized SWM facility can be constructed on Block 106 to serve the entire portion of the site that drains to the south. Soils in this location have a very high infiltration rate.

Under ultimate conditions, the external SWM facility will receive *partially-controlled* flows from Catchments 502 and 503, as well as the uncontrolled flows from external Catchment 601 per Figure 7 of the SWM report. In an interim condition scenario, the temporary SWM facility would receive the *uncontrolled* flows from fully developed Catchments 502 and 503 and the uncontrolled flows from external Catchment 601. This conservative approach ensures that the temporary SWM facility is adequately sized for any combination of imperviousness conditions between pre-development and ultimate post-development stages.

The temporary SWM facility would be located within Block 106 of the current plan as shown in the figure attached and comprises a sediment forebay and a dry main cell with an infiltration basin at the bottom. The temporary SWM facility would meet all the SWM design objectives applicable to the external facility until the time when the external communal SWM facility becomes operational. The temporary SWM facility can be designed to receive and control minor flows, to convey major flows, and to minimize adjustments to the (by then existing) stormwater infrastructure upon decommissioning.

Quality Control

The main stormwater quality control feature of the temporary SWM facility is a sediment forebay sized to treat a 2-year storm event in accordance with MECP criteria. The applicable design calculations are attached.

Additional considerations in the sediment forebay design include the Aesthetic Design Principles for Storm Water Management Facilities in the Region of Waterloo and sound engineering practices.

Quantity Control

The temporary SWM facility includes a dry cell that will provide sufficient storage to contain minor flows. Since the soils in this area are suitable for infiltration, the dry cell will operate as an infiltration basin (e.g. no outlet pipe) to minimize future disturbances to the stormwater

infrastructure within the road right of way. An emergency weir will provide an outlet to the ultimate conditions overland route as established in the SWM report.

Performance of the Temporary SWM Facility

The pond configuration and overflow weir combine to satisfy the post to pre peak flow control objectives.

Pond volumes were calculated using the "average end area" method based on the areas for each contour. The resulting stage-storage characteristics of both the forebay and dry pond are summarized in Table 1. The forebay is sized for the 5-year flow pipe capacity entering the forebay. Major flows will be directed to a low point in the road coincident with the maintenance road and will flow directly into the dry pond to prevent re-suspension of sediment within the forebay.

The outlet structure consists of a concrete weir that allow outflow in larger storm events. The first 2.3m of ponding depth will be contained within the pond and infiltrated. In accordance with available hydrogeological and geotechnical data, the seasonally high groundwater table is at an elevation of approximately 354.2; the bottom of the pond has been set 1.0 metres higher.

Elev.	Depth	Description	Discharge	Volumes			
			Total	Area	Incr. Vol.	Dead Stor.	Live Stor.
(m)	(m)		(m^3/s)	(m^2)	(m^3)	(m^3)	(m^3)
	Dry Cell						
355.2	0.0	Bottom	0	1,062	-		0
355.4	0.2		0	1,189	225		225
355.6	0.4		0	1,319	251		476
355.8	0.6		0	1,450	277		753
356.0	0.8		0	1,584	303		1,056
356.2	1.0		0	1,721	330		1,387
356.4	1.2		0	2,935	466		1,852
356.6	1.4		0	3,234	617		2,469
356.8	1.6		0	3,534	677		3,146
357.0	1.8		0	3,837	737		3,883
357.2	2.0		0	4,141	798		4,681
357.4	2.2		0	4,339	848		5,529
357.5	2.3	Concrete Weir	0	4,440	439		5,968
357.6	2.4		0.25	4,542	449		6,417
357.8	2.6	Freeboard	1.32	4,735	929		7,346
	Forebay						
354.7	-1.5	Bottom		201	0	0	
355.0	-1.2			288	73	73	
355.3	-0.9			384	101	174	
355.6	-0.6			490	131	305	
355.9	-0.3			604	164	469	
356.2	0.0	**Permanent Pool**		727	200	669	

Table 1: Stage Storage Discharge for Forebay and Infiltrating Dry Pond

Table 2 summarizes the overall performance of the Temporary SWM Facility, including storage volumes of the various storm events and peak discharge rates.

Description	Rainfall Parameters	Elevation (m)	Depth (m)	Maximum Storage Volume (m^3)	Discharge (m^3/s)
Pond Bottom		355.20	0.0	0	0
5-year ponding	Waterloo	356.94	1.74	3,670	0.000
Concrete weir		357.50	2.30	5,968	0.000
100-year ponding	Waterloo	357.65	2.45	6,651	0.514
Freeboard		357.80	2.60	7,346	1.317

Table 2: Pond Performance Summary

Table 3 presents the total peak flows towards Beaver Creek Road for the range of design storms. The pre-development peak flows are taken from the existing peak flow rates shown in Table 11.3 of the NWSSS. Flow rates from catchment 3101 were pro-rated so that only the flows from the subject site were used to determine the pre-development rates. This was combined with the catchment 3105 flows to calculate the pre-development rate.

Event/Condition	5-year (m^3/s)	100-year (m^3/s)
Pre-Development	0.166	0.561
Attenuated post-development (CoW ABCs)	0	0.514

Table 3: Comparison of Attenuated Peak Flows (Flows to Beaver Creek Road)

Closing

We trust the information contained in this letter demonstrates that a portion of the subdivision can be serviced prior to the construction of any works on Beaver Creek Road to the south.

Yours very truly,

MERITECH ENGINEERING

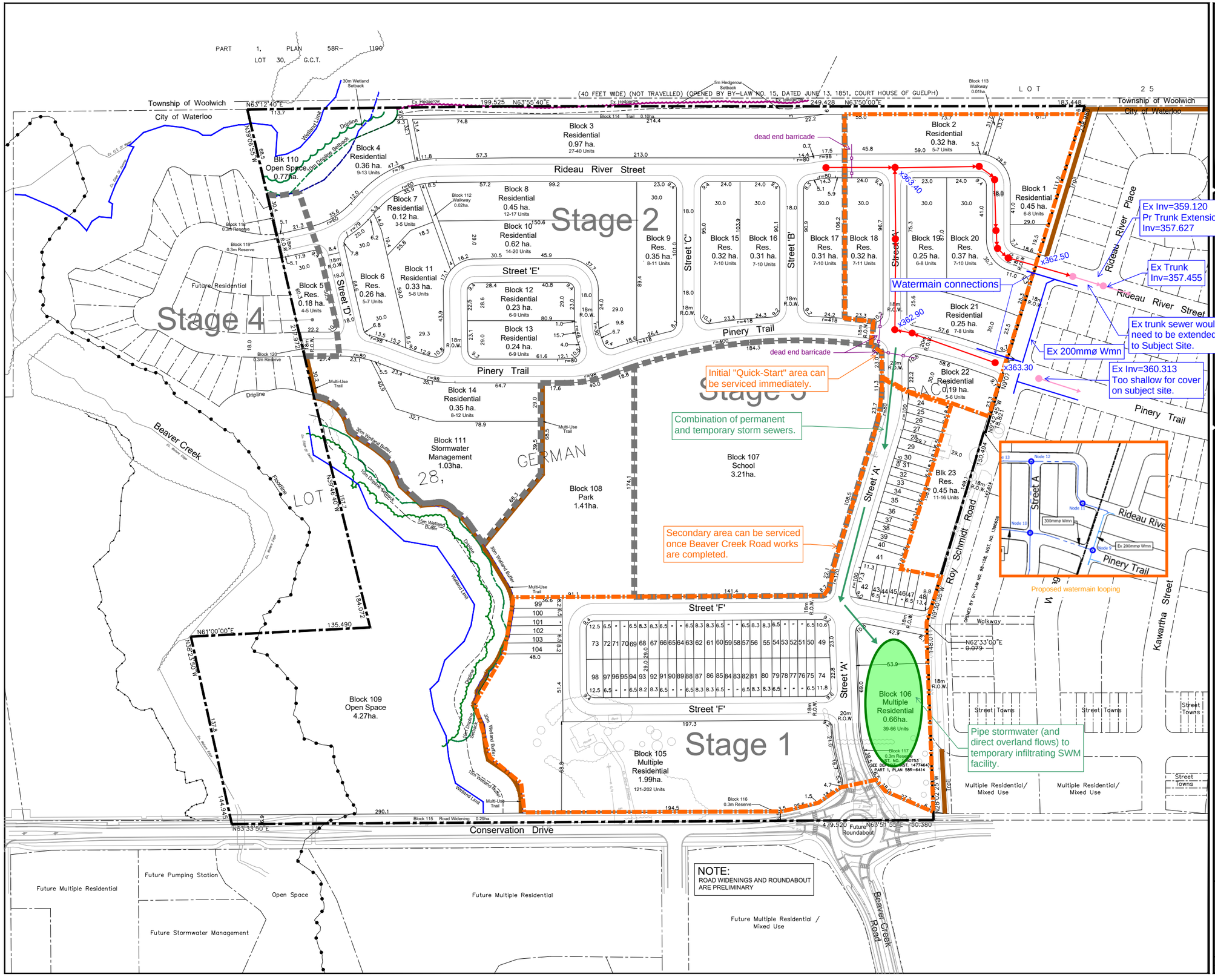


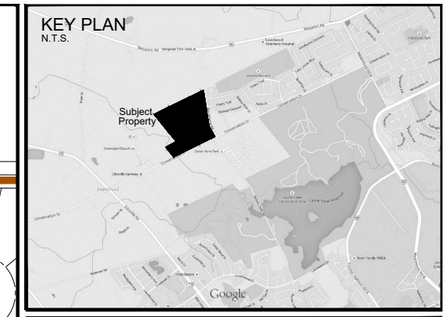
Stefan Van Hartingsveldt, C.E.T.
Project Lead

Chris H. Togeretz, P.Eng.
Manager, Design Services

STV/
Enclosures (Servicing "Quick-Start" Option Markup; Drawing 52198; Temporary Pond Concept; Forebay Sizing Calculations; MIDUSS modeling output files)

cc





DRAFT PLAN OF SUBDIVISION

Part of Lot 28
German Company Tract
City of Waterloo
Regional Municipality of Waterloo

Servicing "Quick-Start" Option Markup
Meritech Engineering
Aug 24, 2022

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLKS.	UNITS	AREA (ha.)
Residential (single detached)	1-23	182-260	7.98
Street Townhouses	24-104	81	1.73
Multiple Residential	105,106	160-268	2.65
School	107		3.21
Park	108		1.41
Open Space	109,110		5.04
Stormwater Management	111		1.03
Walkway	112,113		0.04
Trail	114		0.09
Road Widening	115		0.29
0.3m Reserve	116,120		0.00
Roads			5.16
Total		423-609	28.63

UNIT BREAKDOWN

Min. Potential Singles	182
13.1m internal lot	*152*
13.75m corner lot	*30*
Max. Potential Singles	260
9.0m internal lot	*230*
12.5m corner lot	*30*
Street Townhouses	81

NOTE: Wetland boundary provided by NRSI August 2021

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
i) Well-drained sandy loam on lacustrine deposits
k) All sanitary and storm sewers as required

OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE REGIONAL MUNICIPALITY OF WATERLOO.

2115681 ONTARIO LIMITED — August 17, 2016 DATE

SURVEYOR'S CERTIFICATE

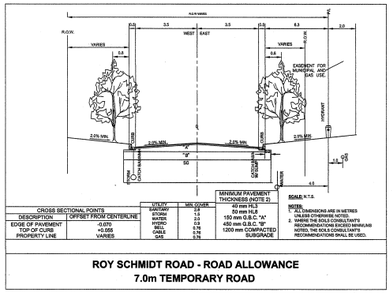
I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

RAYMOND J SIBTHORP, O.L.S. — August 18, 2016 DATE
MacDonald Tamblyn Lord Surveying Limited

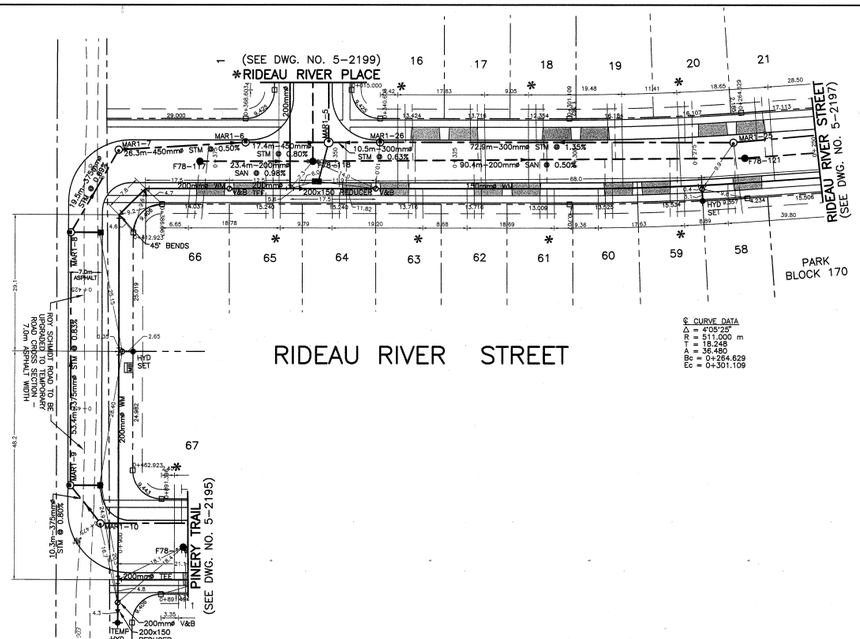
GSP group
PLANNING | URBAN DESIGN | LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS
April 30, 2020
June 25, 2020
March 10, 2020
March 15, 2020
March 19, 2020
August 19, 2021
December 15, 2021

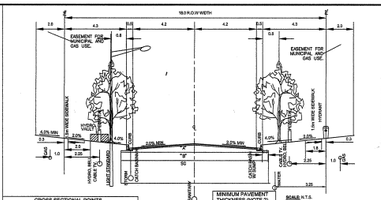
Date: July 29, 2015 | Drawn By: S.L./ML | Dwg. File Name: dp09009zo.dwg
Scale: 1:1250 metric | Project No.: 09009.40



ROY SCHMIDT ROAD - ROAD ALLOWANCE
7.0m TEMPORARY ROAD



STANDARD ROAD ALLOWANCE
18.0m R.O.W. -9m ROAD
W-202



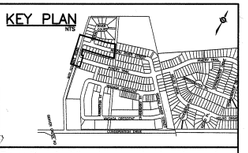
RIDEAU RIVER STREET
0+000 TO 0+392
NTS

LOT #	SAN. INV.	STM. INV.
16	359.60	361.10
17	359.75	361.25
18	359.76	361.26
19	360.03	361.53
20	359.93	361.42
21	360.04	361.54
58	360.19	361.68
59	360.12	361.62
60	359.95	361.45
61	359.89	361.39
62	359.81	361.31
63	359.41	360.91
64	359.38	360.88
65	359.40	360.90
66	359.45	360.95

LEGEND:

MH 17	STORM MANHOLE
CBMH 18	STORM CATCHBASIN MANHOLE
	STORM CATCHBASIN
	DOUBLE CATCHBASIN
MH 6A	SANITARY MANHOLE
HYD SET	FIRE HYDRANT c/w VALVE & BOX
V&B	WATERMAIN VALVE & BOX
200x150mmø TEE	WATERMAIN TEE
	STANDARD IRON BAR (SIB)
	SANITARY SERVICE LATERAL (100mmø)
	STORM SERVICE LATERAL (150mmø)
	WATERMAIN SERVICE LATERAL (25mmø)
*	DENOTES NON-STANDARD SERVICE LATERAL LOCATIONS

KEY PLAN
NTS



The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

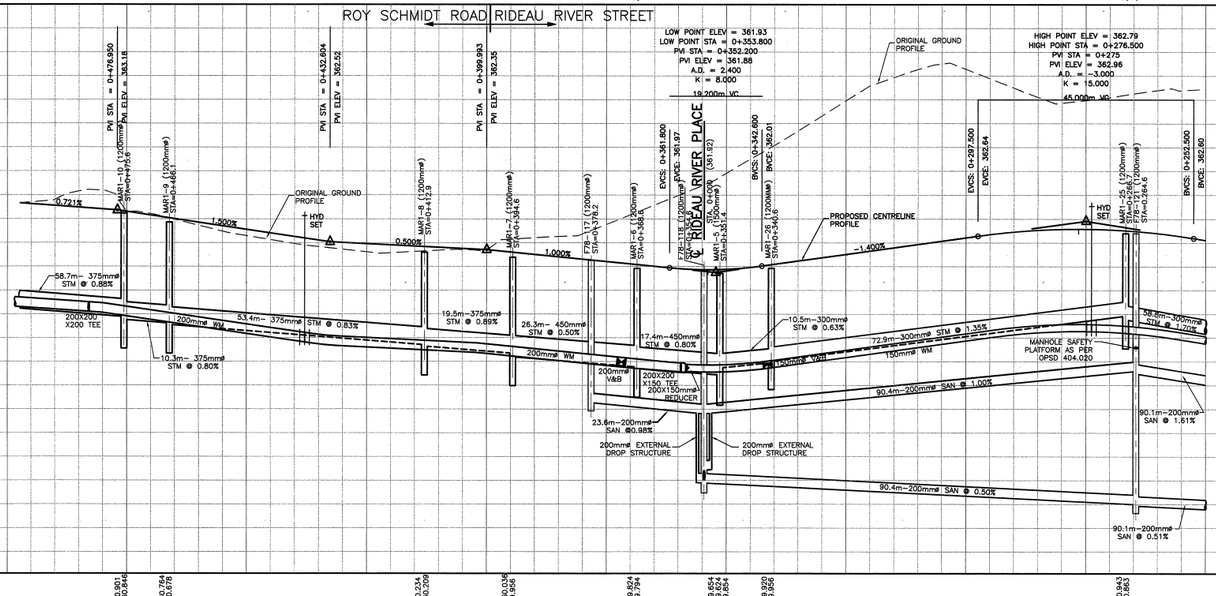
NOTES

1. BENCHMARKS:
   - CONCRETE MONUMENT No. 030-97-0009 LOCATED ON THE FRONT LOT CORNER OF LOT 78 AND BLOCK 178 ON WATERTON DRIVE. ELEVATION = 356.326m
   - CONCRETE MONUMENT No. 030-97-0010 LOCATED ON THE NORTHWEST CORNER OF THE INTERSECTION OF PINERY TRAIL AND LAKE LOUISE BLVD. ELEVATION = 359.268m
2. SANITARY SEWER
   - 200mmø PVC PIPE SDR 35
3. SANITARY SEWER MANHOLES
   - OPSD 701.010 (MH 3A-5A, 9A)
4. STORM SEWERS
   - 300 to 600 PVC ULTRARIB
   - >600mmø 65-D CONC. UNLESS OTHERWISE NOTED
5. STORM MANHOLES
   - OPSD 701.010 (MH/CBMH 4-10)
   - OPSD 701.011 (MH 11) C/W 600mm SUMP
6. CATCHBASINS
   - OPSD 705.010
   - CB FRAME AS PER CITY OF WATERLOO STD. DWG W-520 (FISH TYPE)
7. CATCHBASIN LEADS
   - 300mmø PVC SDR35 OR ULTRARIB, MIN. SLOPE 1.0%
8. WATERMAIN
   - CLASS 150 AWWA C-900 PVC PIPE
   - MINIMUM COVER 2.0m
   - MINIMUM VERTICAL CLEARANCE BETWEEN WATERMAIN AND OTHER SERVICES = 0.5m
9. PAVEMENT CONSTRUCTION
   40mm HL3
   50mm HL8
   150mm G.B.C. 'A'
   450mm G.B.C. 'B'
10. CURB RADII AT INTERSECTIONS ARE 9.0m, UNLESS OTHWERWISE NOTED.
11. ALL HYDRANTS
    - 2-65mm and 1-100mm (STORZ) NOZZLES
    - 150mm MECHANICAL JOINT INLET
12. ALL SERVICE LATERALS GREATER THAN 4.0m DEEP SHALL INCORPORATE A RISER (OPSD 1006.02) MODIFIED, SUCH THAT THE SERVICE LATERAL AT PROPERTY LINE IS NOT DEEPER THAN 3.5m
13. CONCRETE CURB & GUTTER
    - OPSD 600.040
14. ROAD CROSS-SECTION
    - STD. DWG. No. W-202 (18m ROW)
15. SEWER BEDDING SHALL CONFORM TO OPSD 802.010 'CLASS B' FOR PVC PIPE, AND 802.030 TO 802.032 'CLASS B' FOR CONC. PIPE, USING GRANULAR "A" AS BEDDING MATERIAL.

C/L ROADWAY CHAINAGE: 0+500 | 0+475 | 0+450 | 0+425 | 0+400 | 0+375 | 0+350 | 0+325 | 0+300 | 0+275 | 0+250

ELEVATION FIN. C/L: 363.14 | 362.96 | 362.79 | 362.48 | 362.35 | 362.25 | 362.14 | 361.96 | 361.93 | 361.86 | 361.96 | 362.25 | 362.70 | 362.74 | 362.70 | 362.76 | 362.74 | 362.99 | 362.86 | 362.58

ELEVATION FIN. CASTING: 363.14 | 362.96 | 362.36 | 362.25 | 362.14 | 361.96 | 361.93 | 361.86 | 361.96 | 362.70 | 362.74



STM. SEWER INVERT: E360.901 W360.946 | SE360.784 N360.678 | S360.034 NE360.209 | SW360.036 E359.956 | W359.824 E359.794 | W359.654 E359.504 | W359.654 E359.854 | W358.920 E359.820 | W360.843 E360.883

SAN. SEWER INVERT: E359.120 | W358.890 (DROP) W357.465 E357.455 | W357.654 E358.900 (LOCAL) | W358.843 (LOCAL) W357.000 E356.984 E359.758 (LOCAL)

Stantec

CERTIFIED ENGINEERING TECHNOLOGIST — JEROME J.C. GRUBB — № 050228

REGISTERED PROFESSIONAL ENGINEER — M. JONES — PROVINCE OF ONTARIO

J.L.G.	06.08.18	AS RECORDED - STAGE 1
J.L.G.	06.01.09	STREET NAMES
J.L.G.	05.12.16	CITY COMMENTS
INT.	YY.MM.DD	REVISION

CITY OF WATERLOO

SEAL

TITLE:
ACTIVA-CONSERVATION DRIVE SUBDIVISION
RIDEAU RIVER STREET
0+250 TO 0+392
ROY SCHMIDT ROAD
0+392 TO 0+500

DATE: AUGUST 2005	DESIGNED BY: KD/JLG
SCALE : 1:500	DRAWN BY: KD
	CHECKED BY: JLG
FILE NO. 30T-03401	DRAWING NO.
FIELD BK. PAGE DATE	5-2198

X:\p\1603\active\1603871\construction\drawing\w_revised\1603871-c-202-25_rideau south.dwg
2007-05-16 07:29:56 by Carpenter

Temporary Pond Concept
Meritech Engineering
STV
1:500

Temporary Pond Inlet

Temporary Storm Sewer

Overland Flow Route

Forebay

Street 'A'

5m Wide Outlet Weir
Inv=357.50

Infiltrating Dry Pond

Seasonally High
Groundwater=354.20

Grading split

MERITECH

Project Name: Conservation Drive
Project Number: 1279
Calc'd by: STV
Date: 4-Oct-21
Chk'd by: CHT
Date: 27-Jan-22

Sediment Forebay Sizing Calculations

(in accordance with MOE 2003)

Forebay Dimensions

				Calculated min.	Actual	
Average bottom width	7.9	m	Average top width	19.9	19.9	m
Maximum bottom width	8.5	m	Maximum top width	20.5	20.5	m
Average bottom length	25.5	m	Average top length	37.5	37.5	m
Average depth	1.50	m	Total Volume	669	m³	
Average sideslope	4	:1	Usable Volume	432	m³	

1) Forebay Settling Length

Dist = forebay length (m)
r = length to width ratio at average depth
= **2.3** (should be greater than 2:1)
Q_p = peak flow rate from facility during design quality storm
= **0.000** m³/s **2 year** storm event
V_s = settling velocity (dependent on particle size)
= **0.0003** m/s for 150 μm particle
Therefore, distance = **0.0** m vs. **37.5** m provided

2) Dispersion Length

Dist = length of dispersion (m)
Q = flowrate into forebay (lesser of actual pipe capacity or 10-year peak runoff rate)
= **1.740** m³/s Pipes sized for: **5-year** storm event
d = depth of the permanent pool above the maximum sediment depth
= **0.750** m
V_f = desired velocity in the forebay
= **0.50** m/s
Therefore, distance = **37.1** m vs. **37.5** m provided
Also, min. bottom width = Dist./8 = **4.6** m vs. **7.9** m provided

3) Check Velocity Across Full Width of Forebay Above Maximum Accumulated Sediment Depth

V_a = average velocity in the forebay (m/s)
Q_i = flowrate into forebay
= **1.740** m³/s **5-year** storm event
A_x = cross sectional area of forebay perpendicular to flow
= **13.1** m² above the maximum sediment depth
Therefore, velocity = V_a = **0.13** m/s should be < thai **0.15** m/s

4) Cleanout Interval

V_u = usable accumulation storage volume of forebay at a
max. depth, d_u = **0.75** m
= **237** m³
L_a = annual loading
for **51.0** % impervious
= **1.640** m³/ha/yr
A_c = **14.610** ha of contributing land
Therefore, interval = I = **9.9** yrs between cleanouts **5.0** years min. preferred

5) 10 year Accumulated Sediment Depth

A_c = contributing area
= **14.610** ha.
L_a = annual loading
= **1.640** m³/ha/yr
I = cleanout interval
= **10** years
V_r = required total storage volume
= **239.6** m³
Actual total storage volume
= **669.3** m³

```
"               MIDUSS Output ------------------------------------------------>"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                               February 7, 2010"
"           10  Units used:                                          ie METRIC"
"               Job folder:                  K:\PRJ - DOCS\1279\60-Design\SWM"
"               Output filename:               1279d5yr3hrJan122021(Temp).out"
"               Licensee name:                       Stefan Van Hartingsveldt"
"               Company                                  Meritech Engineering"
"               Date & Time last used:              2021-01-12 at 2:42:26 PM"
" 81          ADD COMMENT================================================="
"          2  Lines of comment"
"             SWM Analysis of 5-yr 3hr post-development storm event "
"             for 556 and 576 Conservation Drive, Waterloo"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     7200.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1755.000   Coefficient A"
"       12.347   Constant B"
"        0.895   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          136.512    mm/hr"
"             Total depth                 47.549    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 81          ADD COMMENT================================================="
"          4  Lines of comment"
"             Flows from 502 and 503 are to a proposed SWM facility "
"             south of Conservation Drive. Rooftop runoff from the "
"             school (502) up to 25mm rainfall depth to infiltration"
"             but conservatively ignored in this modeling."
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.000     0.000     0.000     0.000"
" 33          CATCHMENT 601"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         601   External Area North of Site"
"        0.000   % Impervious"
"        3.500   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        3.500   Pervious Area"
"       90.000   Pervious length"
"        3.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       61.000   Pervious SCS Curve No."
"        0.106   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       16.239   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.030     0.000     0.000     0.000 c.m/sec"
"              Catchment 601          Pervious   Impervious Total Area "
"              Surface Area           3.500      0.000      3.500      hectare"
"              Time of concentration  51.688     3.417      51.687     minutes"
"              Time to Centroid       162.878    90.804     162.877    minutes"
"              Rainfall depth         47.549     47.549     47.549     mm"
"              Rainfall volume        1664.22    0.00       1664.22    c.m"
"              Rainfall losses        42.489     6.017      42.489     mm"
"              Runoff depth           5.060      41.532     5.060      mm"
"              Runoff volume          177.11     0.00       177.11     c.m"
"              Runoff coefficient     0.106      0.000      0.106      "
"              Maximum flow           0.030      0.000      0.030      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.030     0.030     0.000     0.000"
" 33           CATCHMENT 502"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           502   Front half of school site"
"        50.000   % Impervious"
"         1.986   Total Area"
"        30.000   Flow length"
"         3.000   Overland Slope"
"         0.993   Pervious Area"
"        30.000   Pervious length"
"         3.000   Pervious slope"
"         0.993   Impervious Area"
"        30.000   Impervious length"
"         3.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.245   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.879   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.304     0.030     0.000     0.000 c.m/sec"
"              Catchment 502          Pervious   Impervious Total Area "
"              Surface Area           0.993      0.993      1.986      hectare"
"              Time of concentration  17.561     1.767      5.208      minutes"
"              Time to Centroid       119.503    88.287     95.087     minutes"
"              Rainfall depth         47.549     47.549     47.549     mm"
"              Rainfall volume        472.16     472.16     944.32     c.m"
"              Rainfall losses        35.905     5.740      20.823     mm"
"              Runoff depth           11.644     41.809     26.726     mm"
"              Runoff volume          115.62     415.16     530.79     c.m"
"              Runoff coefficient     0.245      0.879      0.562      "
"              Maximum flow           0.041      0.299      0.304      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.304     0.305     0.000     0.000"
" 33           CATCHMENT 503"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          503   East part of site incl townhouses"
"       70.000   % Impervious"
"        9.124   Total Area"
"       15.000   Flow length"
"        3.000   Overland Slope"
"        2.737   Pervious Area"
"       15.000   Pervious length"
"        3.000   Pervious slope"
"        6.387   Impervious Area"
"       15.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.245   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.870   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    2.033     0.305     0.000     0.000 c.m/sec"
"             Catchment 503          Pervious   Impervious Total Area "
"             Surface Area           2.737      6.387      9.124      hectare"
"             Time of concentration  11.586     1.166      2.287      minutes"
"             Time to Centroid       112.272    87.475     90.143     minutes"
"             Rainfall depth         47.549     47.549     47.549     mm"
"             Rainfall volume        1301.51    3036.86    4338.38    c.m"
"             Rainfall losses        35.905     6.164      15.087     mm"
"             Runoff depth           11.644     41.385     32.462     mm"
"             Runoff volume          318.71     2643.16    2961.88    c.m"
"             Runoff coefficient     0.245      0.870      0.683      "
"             Maximum flow           0.135      2.008      2.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.033     2.338     0.000     0.000"
" 54          POND DESIGN"
"        2.338   Current peak flow    c.m/sec"
"        0.654   Target outflow    c.m/sec"
"       3669.8   Hydrograph volume    c.m"
"          15.   Number of stages"
"      355.200   Minimum water level    metre"
"      357.800   Maximum water level    metre"
"      355.200   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                355.200     0.000     0.000"
"                355.400  1.01E-05   225.000"
"                355.600  1.01E-05   476.000"
"                355.800  1.01E-05   753.000"
"                356.000  1.01E-05  1056.000"
"                356.200  1.01E-05  1387.000"
"                356.400  1.01E-05  1852.000"
"                356.600  1.01E-05  2469.000"
"                356.800  1.01E-05  3146.000"
"                357.000  1.01E-05  3883.000"
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"                357.200  1.01E-05  4681.000"
"                357.400  1.01E-05  5529.000"
"                357.500  1.01E-05  5968.000"
"                357.600    0.2463  6417.000"
"                357.800     1.317  7346.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                357.500     0.900     5.000     1.000     1.000"
"              Peak outflow                  0.000    c.m/sec"
"              Maximum level               355.432    metre"
"              Maximum storage             264.882    c.m"
"              Centroidal lag               60.463   hours"
"                   2.033     2.338     0.000     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    503"
"             6   Combine "
"           503   Node #"
"                 SWM facility south of Conservation Dr"
"              Maximum flow                  0.000    c.m/sec"
"              Hydrograph volume             4.333    c.m"
"                      2.033     2.338     0.000     0.000"
" 38           START/RE-START TOTALS 503"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                     14.610    hectare"
"              Total Impervious area                     7.380    hectare"
"              Total % impervious                       50.512"
" 19           EXIT"
```

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"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                               February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:                  K:\PRJ - DOCS\1279\60-Design\SWM"
"                Output filename:             1279d100yr3hrJan122021(Temp).out"
"                Licensee name:                       Stefan Van Hartingsveldt"
"                Company                                  Meritech Engineering"
"                Date & Time last used:              2021-01-12 at 2:44:36 PM"
" 81           ADD COMMENT=================================================="
"           2  Lines of comment"
"              SWM Analysis of 100-yr 3hr post-development storm event "
"              for 556 and 576 Conservation Drive, Waterloo"
" 31           TIME PARAMETERS"
"         5.000   Time Step"
"       180.000   Max. Storm length"
"      7200.000   Max. Hydrograph"
" 32           STORM Chicago storm"
"             1   Chicago storm"
"      4692.000   Coefficient A"
"        17.437   Constant B"
"         0.956   Exponent C"
"         0.400   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
"              Maximum intensity          239.793    mm/hr"
"              Total depth                 89.960    mm"
"             6   100hyd   Hydrograph extension used in this file"
" 81           ADD COMMENT================================================="
"           4  Lines of comment"
"              Flows from 502 and 503 are to a proposed SWM facility "
"              south of Conservation Drive. Rooftop runoff from the "
"              school (502) up to 25mm rainfall depth to infiltration"
"              but conservatively ignored in this modeling."
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                       0.000     0.000     0.000     0.000"
" 33           CATCHMENT 601"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           601   External Area North of Site"
"         0.000   % Impervious"
"         3.500   Total Area"
"        90.000   Flow length"
"         2.000   Overland Slope"
"         3.500   Pervious Area"
"        90.000   Pervious length"
"         3.000   Pervious slope"
"         0.000   Impervious Area"
"        90.000   Impervious length"
"         3.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        61.000   Pervious SCS Curve No."
"         0.256   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        16.239   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
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"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.234     0.000     0.000     0.000 c.m/sec"
"              Catchment 601          Pervious   Impervious Total Area "
"              Surface Area           3.500      0.000      3.500      hectare"
"              Time of concentration  26.531     2.693      26.530     minutes"
"              Time to Centroid       128.060    87.835     128.060    minutes"
"              Rainfall depth         89.960     89.960     89.960     mm"
"              Rainfall volume        3148.60    0.00       3148.60    c.m"
"              Rainfall losses        66.957     7.220      66.957     mm"
"              Runoff depth           23.003     82.740     23.003     mm"
"              Runoff volume          805.10     0.00       805.11     c.m"
"              Runoff coefficient     0.256      0.000      0.256      "
"              Maximum flow           0.234      0.000      0.234      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.234     0.234     0.000     0.000"
" 33           CATCHMENT 502"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           502   Front half of school site"
"        50.000   % Impervious"
"         1.986   Total Area"
"        30.000   Flow length"
"         3.000   Overland Slope"
"         0.993   Pervious Area"
"        30.000   Pervious length"
"         3.000   Pervious slope"
"         0.993   Impervious Area"
"        30.000   Impervious length"
"         3.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.427   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.925   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.623     0.234     0.000     0.000 c.m/sec"
"              Catchment 502          Pervious   Impervious Total Area "
"              Surface Area           0.993      0.993      1.986      hectare"
"              Time of concentration  10.526     1.393      4.280      minutes"
"              Time to Centroid       106.545    85.939     92.452     minutes"
"              Rainfall depth         89.960     89.960     89.960     mm"
"              Rainfall volume        893.30     893.30     1786.61    c.m"
"              Rainfall losses        51.510     6.752      29.131     mm"
"              Runoff depth           38.450     83.208     60.829     mm"
"              Runoff volume          381.81     826.26     1208.06    c.m"
"              Runoff coefficient     0.427      0.925      0.676      "
"              Maximum flow           0.191      0.571      0.623      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.623     0.639     0.000     0.000"
" 33           CATCHMENT 503"
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"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          503   East part of site incl townhouses"
"       70.000   % Impervious"
"        9.124   Total Area"
"       15.000   Flow length"
"        3.000   Overland Slope"
"        2.737   Pervious Area"
"       15.000   Pervious length"
"        3.000   Pervious slope"
"        6.387   Impervious Area"
"       15.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.425   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.903   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    3.922     0.639     0.000     0.000 c.m/sec"
"             Catchment 503          Pervious   Impervious Total Area "
"             Surface Area           2.737      6.387      9.124      hectare"
"             Time of concentration  6.945      0.919      1.931      minutes"
"             Time to Centroid       102.209    85.375     88.202     minutes"
"             Rainfall depth         89.960     89.960     89.960     mm"
"             Rainfall volume        2462.39    5745.57    8207.95    c.m"
"             Rainfall losses        51.719     8.749      21.640     mm"
"             Runoff depth           38.241     81.211     68.320     mm"
"             Runoff volume          1046.74    5186.78    6233.53    c.m"
"             Runoff coefficient     0.425      0.903      0.759      "
"             Maximum flow           0.621      3.695      3.922      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    3.922     4.561     0.000     0.000"
" 54          POND DESIGN"
"        4.561   Current peak flow    c.m/sec"
"        0.654   Target outflow    c.m/sec"
"       8246.7   Hydrograph volume    c.m"
"          15.   Number of stages"
"      355.200   Minimum water level    metre"
"      357.800   Maximum water level    metre"
"      355.200   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                355.200     0.000     0.000"
"                355.400  1.01E-05   225.000"
"                355.600  1.01E-05   476.000"
"                355.800  1.01E-05   753.000"
"                356.000  1.01E-05  1056.000"
"                356.200  1.01E-05  1387.000"
"                356.400  1.01E-05  1852.000"
"                356.600  1.01E-05  2469.000"
"                356.800  1.01E-05  3146.000"
"                357.000  1.01E-05  3883.000"
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"                357.200  1.01E-05  4681.000"
"                357.400  1.01E-05  5529.000"
"                357.500  1.01E-05  5968.000"
"                357.600    0.2463  6417.000"
"                357.800     1.317  7346.000"
"           1.   WEIRS"
"                  Crest      Weir     Crest      Left     Right"
"              elevation coefficie   breadth sideslope sideslope"
"                357.500     0.900     5.000     1.000     1.000"
"              Peak outflow                  0.514    c.m/sec"
"              Maximum level               357.650    metre"
"              Maximum storage            6651.392    c.m"
"              Centroidal lag                2.753   hours"
"                   3.922     4.561     0.514     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    503"
"             6   Combine "
"           503   Node #"
"                 SWM facility south of Conservation Dr"
"              Maximum flow                  0.514    c.m/sec"
"              Hydrograph volume          2283.001    c.m"
"                      3.922     4.561     0.514     0.514"
" 38           START/RE-START TOTALS 503"
"              3   Runoff Totals on EXIT"
"              Total Catchment area                     14.610    hectare"
"              Total Impervious area                     7.380    hectare"
"              Total % impervious                       50.512"
" 19           EXIT"
```