

Wastewater Servicing

WW-2 Alternative Servicing Strategies Development Report

Project # TP168050; Client Name: City of Guelph

Prepared for:

City of Guelph

1 Carden Street, Guelph, ON N1H 3A1

3/6/2019

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3/6/2019

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ISSUE	DATE	ORIG	REVIEW	DESCRIPTION
V2 Draft	March 2019	EAP	AA	Updated to consider June 25 2018 Concept Plan
Initial Draft	August 2018	EAP	RS	Initial Draft for Client Review



1.0 Introduction

The scope of this report involves the following:

-) Preparation of Wastewater Servicing Concepts;
-) Development of sewer-sheds for wastewater servicing configuration;
-) Identify the Capital Projects required to implement services for each alternative; and,
-) Provide an evaluation of the alternatives in terms of Cost Benefit.

The options to be evaluated for the Clair Maltby Secondary Plan (CMSP) lands include systems that are connected to the City's collection system via three potential external receiving branches described in *Wastewater Servicing – Clair Maltby WW-1 Existing Conditions Design Criteria & Level of Service Objectives Report - Issued September 2018 and updated in March 2018 (WW-1 Report)*.

The wastewater servicing evaluation is in support of the evolving planning framework driven by the Clair Maltby Secondary Planning Process. This process has seen the development of a number of land use plans including as follows:

-) Charrette identifying Alternative Community Structures;
-) Development of an Initial Preferred Community Structure – February 2018
-) Development of an Updated Community Structure July 2018
-) Further Refinement to be completed after the issuance of the initial report

Concepts in this report represent the latest community structure provided in July 2018. The technical analysis, costing of alternatives were originally developed based on the previous community structure. In the March 2019 update, the presentation of the report has been modified to match the July 2018 Preferred Community Structure, while the analysis relies on the sewer layouts. Note that the costing of alternatives is based on the exercise initially done for the February 2018 Preferred Community Structure.

2.0 Wastewater Servicing Alternatives

2.1 Development of Wastewater Collection System Alternatives

Servicing of the lands is described in terms of internal and external services. The delineation of the internal services is first established with three Options. Internal services refer to the services required on the Clair Maltby Secondary Plan Area lands to provide sewers available to future lots along the road right-of-way. External Servicing refers to the upgrades required in the three branches of the receiving system evaluated in the WW-1 Report.

Alternative internal gravity sewer designs (Options 1, 2, & 3) were developed through the following steps:

1. Delineation of sewers along all the roads as per the Clair Maltby Preferred Concept Plan (as shown in WW-1).
2. Preliminary Road Grades developed through the Stormwater services evaluation.
3. Conceptual gravity sewers developed based on road profiles.
4. Sewersheds delineated based on topography and road profiles.
5. Sewers laid out with minimum slopes as per criteria described in the WW-1.

Alternative 4 (on-site servicing) is included and discussed separately.

2.2 Constraints and Loading Analysis

2.2.1 Internal Sewershed Delineation

Based on the topography, and the road profiles in the Preferred Community Structure (July 2018), conceptual sewers and associated sewersheds are provided in **Figure 2-1**. The plans include sewer services along every proposed internal and existing road.

A sewer system is shown extending to the Clair Gordon Connection Point at Farley Drive and Goodwin Avenue. These sewersheds are used as the basis for developing the internal servicing options described below.

The CMSP topography and receiving sewersheds dictates that there are generally three sewer servicing zones, North, South East and South West. In order to service the entirety of the secondary plan lands, outlets need to be identified for each of the three zones. The extent of the zones can vary as the high ground in the centre of the lands can be directed to either of the lands. As such an overlap is shown in high ground that could be serviced by the North or South West Zone.

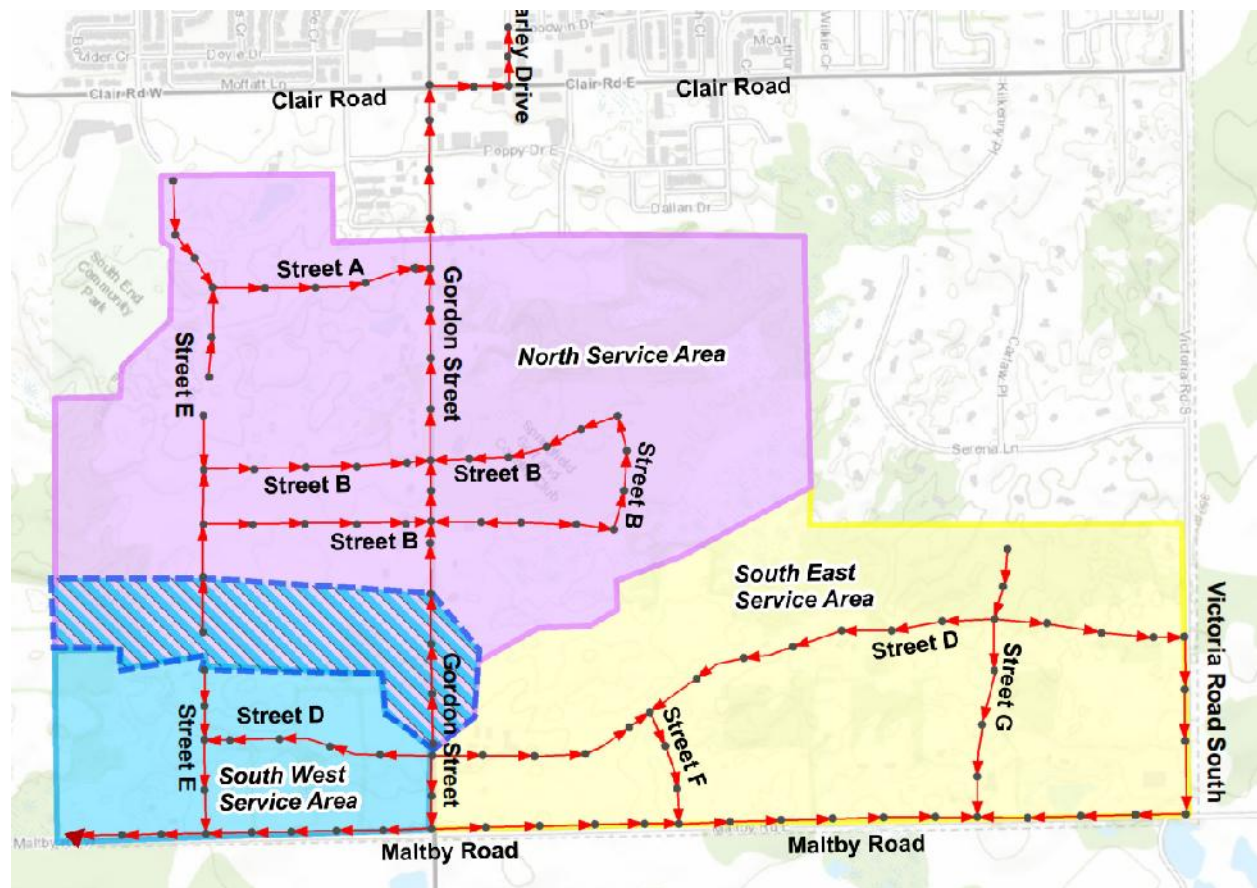


Figure 2-1 Initial Concept – Internal Gravity Sewers and Sewersheds

2.2.2 Wastewater Demand Generation

Based on the planning information described in the WW-1 Report, the Clair Maltby Secondary Plan lands demand is determined based on servicing a population of 21,668 people on a net developable land of 245.9 ha. It is expected that the land use plan will be refined, and population distribution will change accordingly.

For the purpose of evaluating the wastewater alternatives, this study assigns the sewer demand based on the population & net developable land being evenly distributed throughout the Clair Maltby Secondary Lands. This can be refined in the next stage (WW-3 Staging and Implementation Plan).

2.3 Alternative Servicing Solutions

Wastewater servicing alternative Solutions were generated to review possibilities associated with the following questions:

- J **Option Question #1:** What is the extent of the lands can be serviced with a gravity connection to the City's system without introducing new pumping stations only?
- J **Option Question #2:** What is the most economically suitable configuration that connects to the City's system (with or without pumping stations)?

The Alternatives are organized based on the possibilities afforded by the three outlets as described in the WW-1 report, i.e. Hanlon Southgate Outlet, Clair Gordon, Outlet and the Victoria Road Outlet. Given the limitations of the Hanlon-Southgate outlet, connections to this outlet are not evaluated in detail.

Probable cost estimates are provided based on 2018 dollars for similar work in Southern Ontario. Consistent unit costs were applied to all alternatives and the estimates provided allow for a comparison of the relative cost of one alternative solution to the next. Note that the cost of implementation is volatile and can vary considerably from the estimates provided.

Note that the cost estimates are based on the same alternatives configured according to the February 2018 Community Structure Plan which was subsequently updated.

2.3.1 Alternative Solution #1 – New Gravity Service Only

Alternative Solution #1 is developed to address the question of how much land can be serviced with no new pumping stations (Option Question #1 ref section 2.3) and is shown conceptually in **Figure 2-2**. Alternative Solution #1 services a limited portion of the subject lands.

It evaluates the limits of what can be serviced via gravity sewers connecting to the receiving system without any new pumping stations.

Alternative Solution #1 maximizes the extent of the North Service Area allowing for approximately 71% of the CMSP lands to be developed.

Key Considerations for this option include:

- J **Deep Trunk Sewers:** Sewers along Gordon Street and Clair Road have depths ranging from 10-13 m required to maximize the extent of the sewersheds.
- J **Receiving System:** This solution is suitable for conception to the Clair Gordon System only and requires capacity upgrades in the downstream as described in the WW-1 report.

The internal layout involves approximately 2070 meters of new sewers in existing roads (Gordon Street, Clair Road etc.), 6000 meters of new sewers in new roads (Street A, Street B etc.), and associated manholes.

The estimated capital cost for implementing this solution is \$12.0 M as given in the **Table 2-1**.

Table 2-1 Estimated Cost - Alternative Solution #1 – New Gravity Service Only

Internal Sewers + Connection to Farley & Goodwin Drive	\$9.3 M
Upgrade Clair-Gordon bottleneck Section 1 approximately 700m (450 mm upgraded to 600 mm)	\$0.9 M
Upgrade Clair-Gordon bottleneck Section 2 approximately 1300m (600 mm upgraded to 675 mm)	\$1.8 M
Total Cost Option #1	\$12.0 M

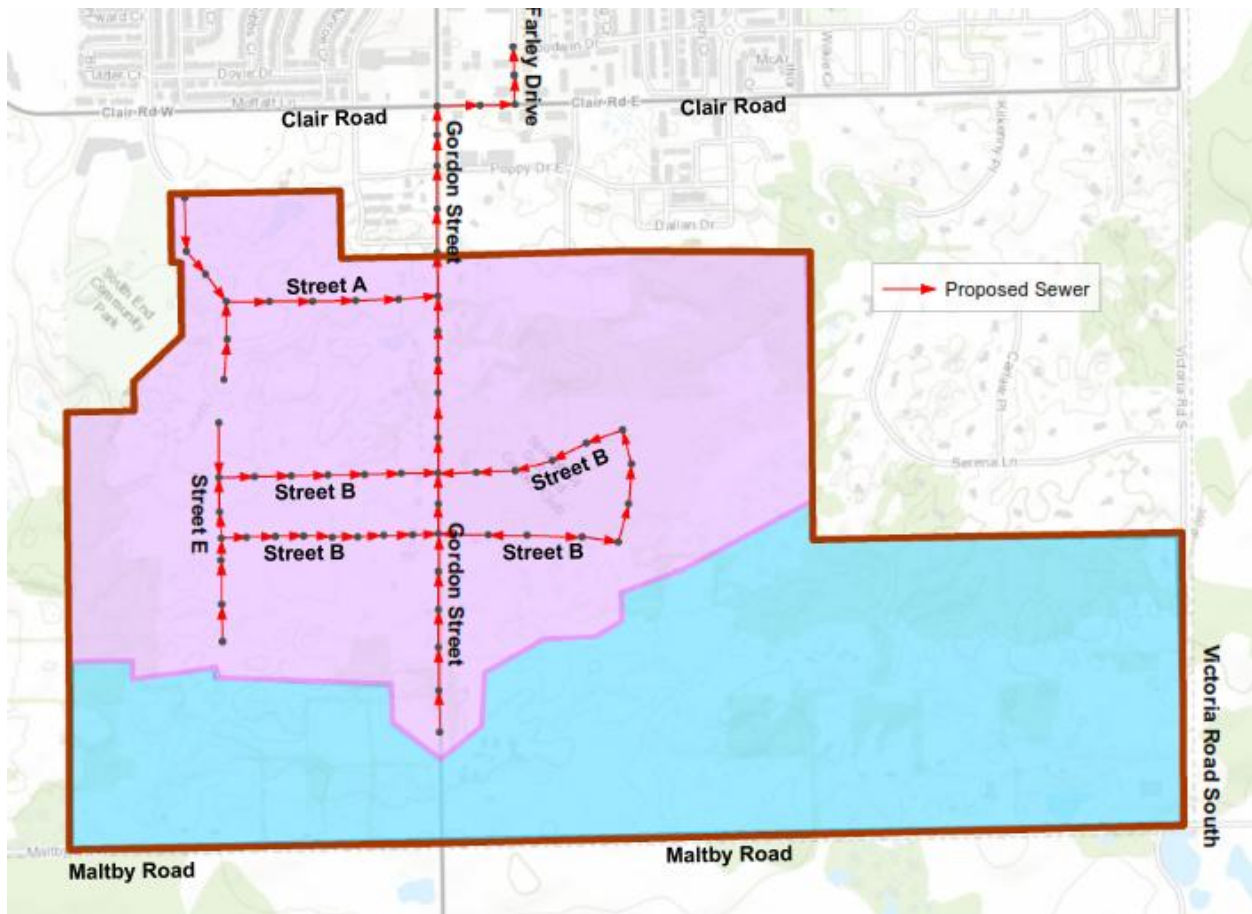


Figure 2-2 Alternative Solution #1 - New Gravity Service Only

2.3.2 Wastewater Servicing Alternative #2 – Full Lands Developed with minimum number of pumping stations

Alternative Solution #2 expands on Alternative #1 by identifying the additional pumping that would be required to service 100 % of the CMSP lands.

As with Alternative Solution #1, deep trunk sewers are required along Street F, Gordon Street, and Clair Road with depths ranging from 10-13 m.

The internal layout has approximately 5200 meters of new sewers in existing roads (Gordon Street, Maltby Road, etc.), 9,100 meters of new sewers in new roads (Street A, Street B etc.), and associated manholes.



Alternative #2 has two sewage pumping stations (SPSs) in the South West low point, and in the South East low point which allows the servicing of the South East and South West Zones. These pumping stations are labeled as the Gordon-Maltby SPS in the South West, and the Victoria-Maltby SPS in the South East.

Alternative Solution #2 has three sub-options which differ by how the system is configured to connect to the City's receiving system in regards to the limiting capacities of the Victoria Road and Clair Gordon Receiving Systems. The three sub-options are as follows:

Alternative Solution # 2(a) 100% of flow directed to Clair-Gordon System: This alternative connects to the Clair Gordon System at Farley Drive and requires external upgrades to the entire bottleneck that was identified in the WW-1 Report. It is shown in **Figure 2-3**.

The estimated capital cost for implementing this solution is \$18.7 M as given in the **Table 2-2**.

Table 2-2 Estimated Cost - Alternative Solution # 2(a) - 100% of flow directed to Clair-Gordon System

Internal Sewers + Connection to Farley & Goodwin Drive	\$12.0 M
Upgrade Clair-Gordon bottleneck Section 1 Approximately 700 m (450 mm upgraded to 600 mm)	\$0.9 M
Upgrade Clair-Gordon bottleneck Section 2 Approximately 1300 m (600 mm upgraded to 675 mm)	\$1.8 M
Gordon-Maltby SPS & Forcemain	\$1.7 M
Victoria-Maltby SPS & Forcemain	\$2.3 M
Total Cost Option #2(a)	\$18.7 M

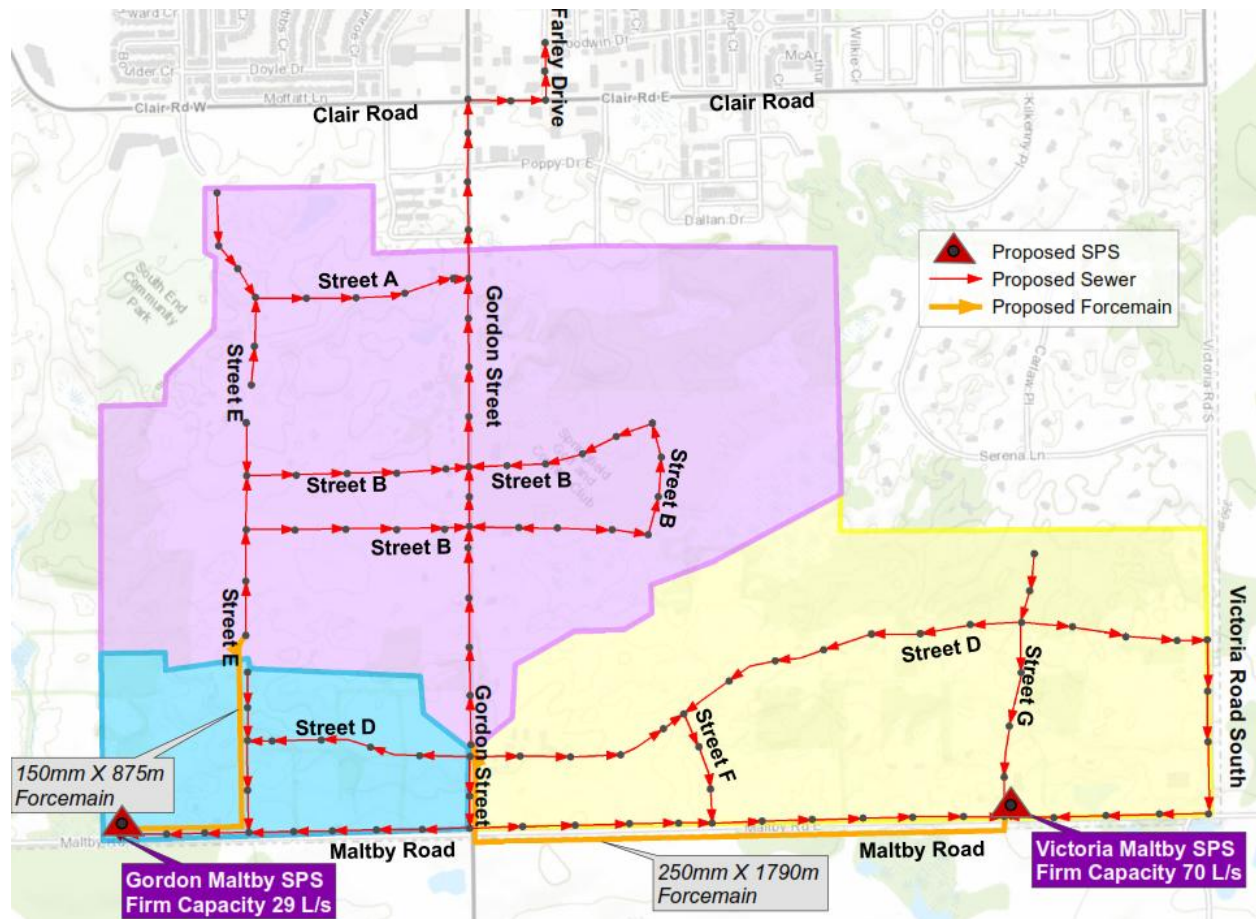


Figure 2-3 Alternative Solution #2(a) - Minimum Pumping Stations 100% to Clair Gordon

Alternative Solution # 2(b) 60% of flow directed to Clair-Gordon System: This alternative connects to the Clair Gordon System at Farley Drive and requires external upgrades to a portion of the bottleneck that was identified in the WW-1 Report. The Victoria-Maltby Sewage Pumping Station – will be directed to the Victoria Road System via a 6.5 km forcemain. It is shown in **Figure 2-4**.

The estimated capital cost for implementing this solution is \$21.5 M as given in the **Table 2-3**.

Table 2-3 Estimated Cost - Alternative Solution #2(b) - 60% of flow directed to Clair-Gordon System

Internal Sewers + Connection to Farley & Goodwin Drive	\$12.0 M
Upgrade Clair-Gordon bottleneck Section 1 Approximately 700 m (450 mm upgraded to 600 mm)	\$0.9 M
Upgrade Clair-Gordon bottleneck Section 2 Approximately 1300 m (600 mm upgraded to 675 mm)	\$1.8 M
Gordon-Maltby SPS & Forcemain	\$1.7 M
Victoria-Maltby SPS & Forcemain	\$5.1 M
Total Cost Option #2(b)	\$21.5 M

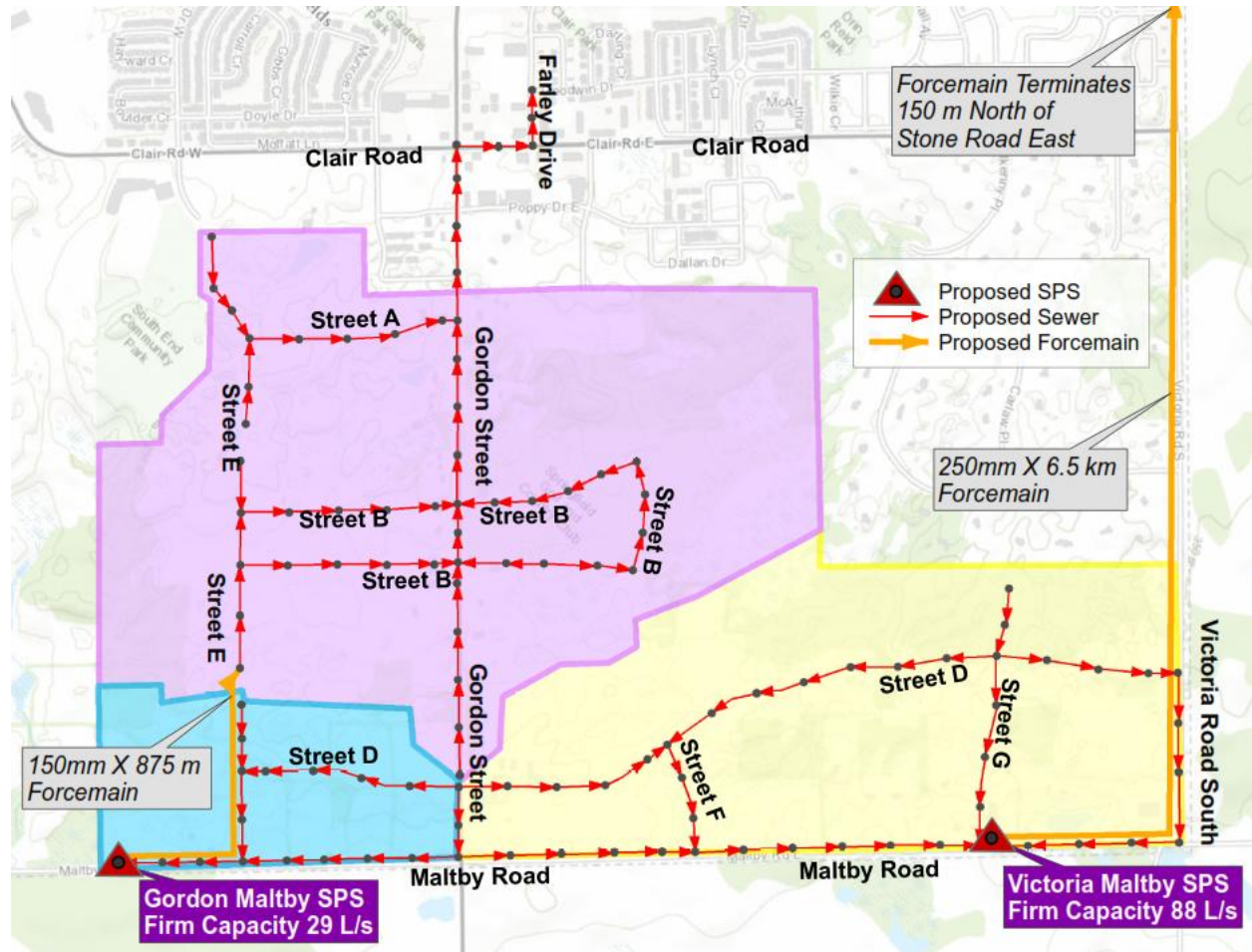


Figure 2-4 Alternative Solution #2(b) - Minimum Pumping Stations 60% to Clair Gordon

Alternative Solution # 2(c) 40% of flow directed to Clair-Gordon System: This alternative connects to the Clair Gordon System at Farley Drive. Alternative Solution #2c minimizes the extent of the North Service Area allowing such that only 40% of the CMSP lands are directed by gravity into the Clair Gordon System. This allows for the system to connect at Farley drive without needing any external upgrades. The Victoria-Maltby Sewage Pumping Station – will be directed to the Victoria Road System via a 6.5 km forcemain. It is shown in **Figure 2-5**.

The estimated capital cost for implementing this solution is \$21.0 M as given in the **Table 2-4**.

Table 2-4 Estimated Cost - Alternative Solution #2(c) - 40% of flow directed to Clair-Gordon System

Internal Sewers + Connection to Farley & Goodwin Drive	\$12.0 M
Upgrade Clair-Gordon bottleneck Section 1 Approximately 700 m (450 mm upgraded to 600 mm)	\$0.9 M
Gordon-Maltby SPS & Forcemain	\$2.1 M
Victoria-Maltby SPS & Forcemain	\$6.0 M
Total Cost Option #2(c)	\$21.0 M

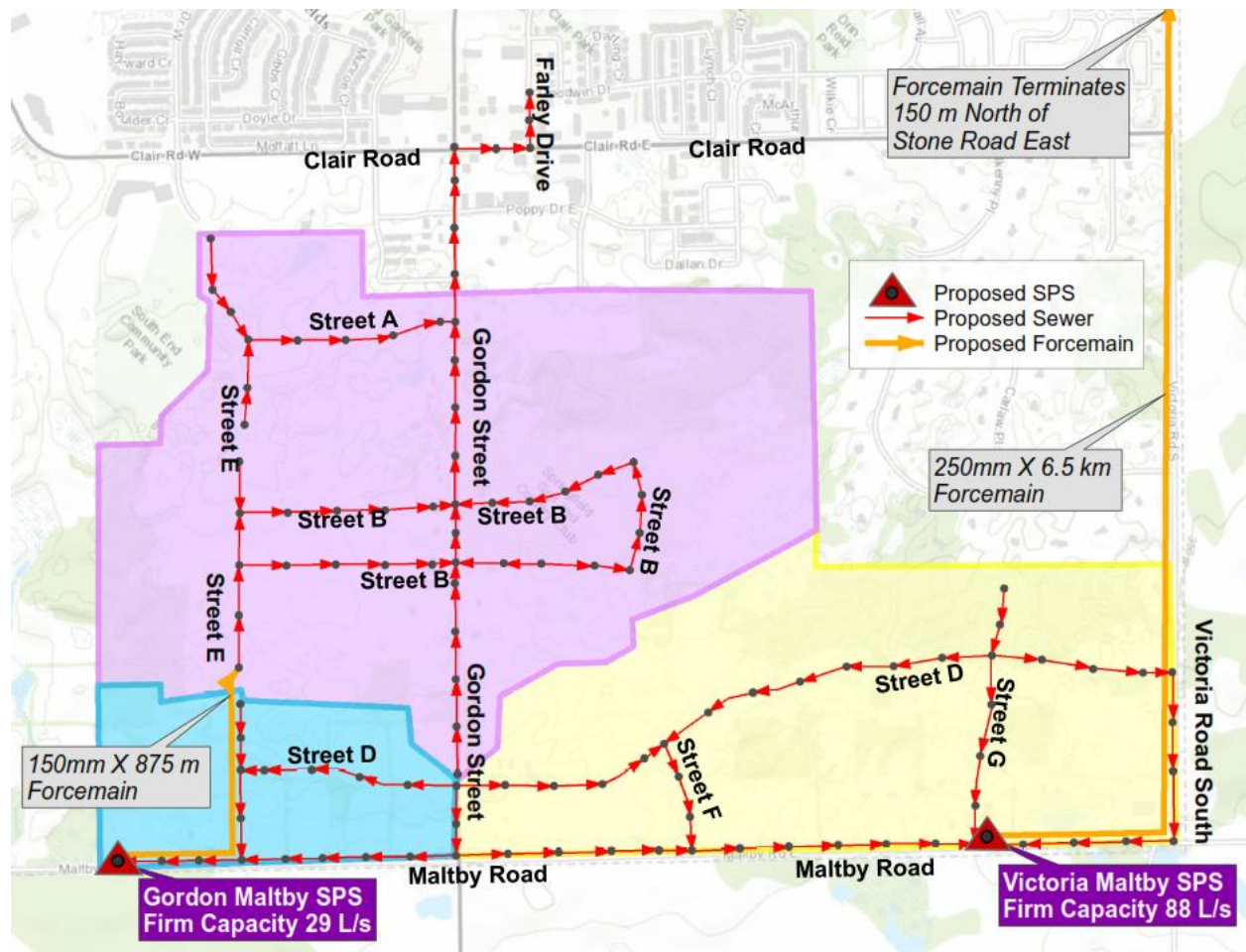


Figure 2-5 Alternative Solution #2(c) - Minimum Pumping Stations - 40% to Clair Gordon

2.3.3 Wastewater Servicing Alternative #3 – Full Lands Developed with shallow gravity sewers

Alternative Solution #3 expands on Alternative #2 by adding a third pumping station in the central low spot to service the North Zone.

Alternative Solution #3 eliminates the deep sewers along Street F, Gordon Street, and Clair Road.

The internal layout has approximately 5,200 meters of new sewers in existing roads (Gordon Street, Maltby Road, etc.), 9100 meters of new sewers in new roads (Street A, Street B etc.), and associated manholes. Sub Option # 3(a) has less total length of sewers as the section on Clair Road and Farley drive is eliminated.

Alternative #3 has three sewage pumping stations (SPSs) including the two described for Alternative #2 and an additional SPS in the Central area known as the Central SPS.

Alternative Solution #3 has three sub-options which differ by how the system is configured to connect to the City's receiving system in regards to the limiting capacities of the Victoria Road and Clair Gordon Receiving Systems. The three sub-options are as follows:

Alternative Solution # 3(a) 100% of flow directed to Clair-Gordon System: This alternative connects to the Clair Gordon System at Farley Drive via the Central SPS and forcemain. It requires external upgrades to the entire bottleneck that was identified in the WW-1 Report. It is shown in **Figure 2-6**.

The estimated capital cost for implementing this solution is \$19.7 M as given in the **Table 2-5**.

Table 2-5 Estimated Cost - Alternative Solution #3(a) - 100% of flow directed to Clair-Gordon System

Internal Sewers + Connection to Farley & Goodwin Drive	\$9.5 M
Upgrade Clair-Gordon bottleneck Section 1 Approximately 700 m (450 mm upgraded to 600 mm)	\$0.9 M
Upgrade Clair-Gordon bottleneck Section 2 Approximately 1300 m (600 mm upgraded to 675 mm)	\$1.8 M
Central SPS- 219 L/s + 900 m Forcemain (Static Head 15 m)	\$3.5 M
Gordon-Maltby SPS & Forcemain	\$1.7 M
Victoria-Maltby SPS & Forcemain	\$2.3 M
Total Cost Option #3(a)	\$19.7 M

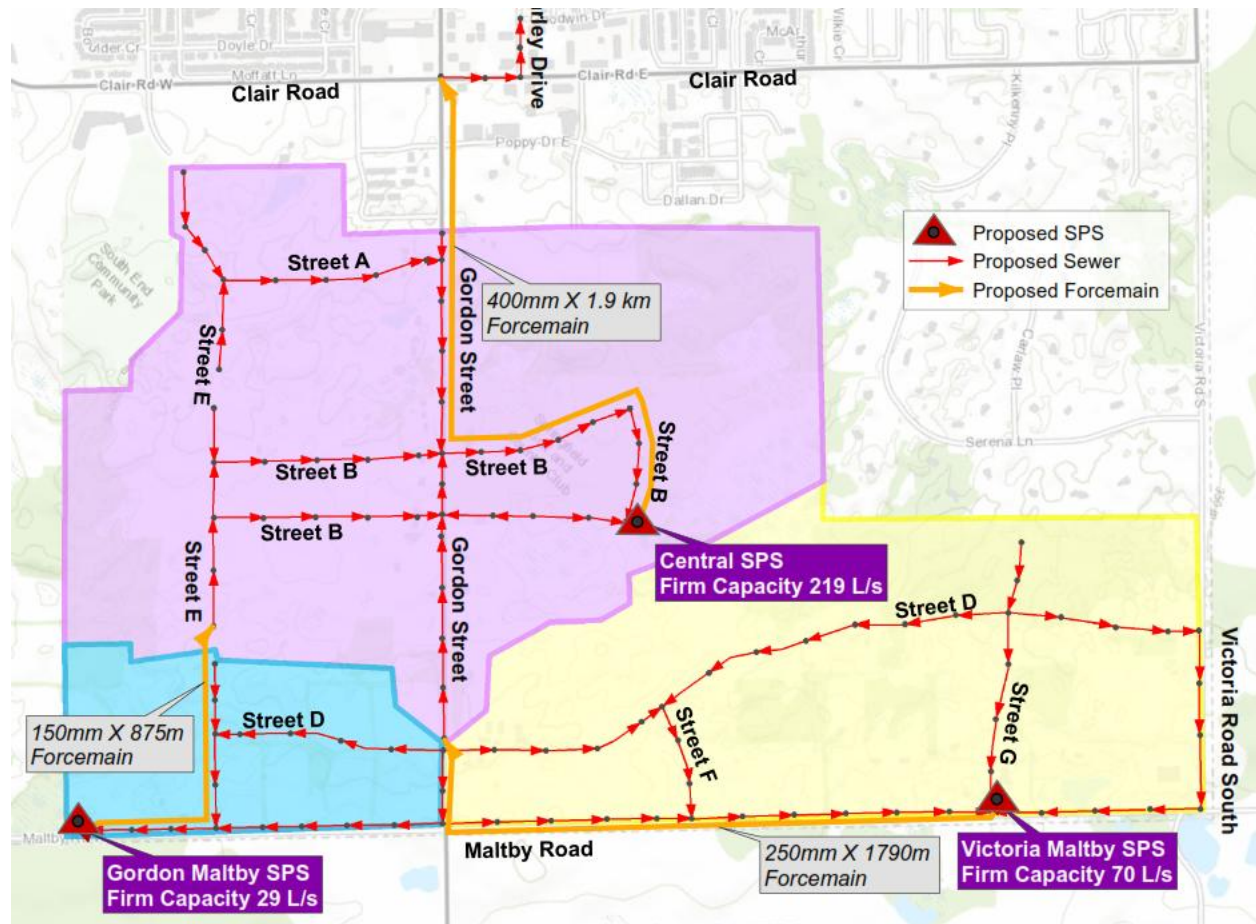


Figure 2-6 Alternative Solution #3(a) - Shallow Gravity Sewers 100% to Clair Gordon

Alternative Solution # 3(b) 40% of flow directed to Clair-Gordon System: This alternative connects to the Clair Gordon System at Farley Drive via the Central SPS and forcemain. Alternative Solution #2c minimizes the extent of the North Service Area allowing such that only 40% of the CMSP lands are directed by gravity into the Clair Gordon System. This allows for the system to connect at Farley drive without needing any external upgrades. The Victoria Maltby Sewage Pumping Station – will be directed to the Victoria Road System via a 6.5 km forcemain. It is shown in **Figure 2-7**.

The estimated capital cost for implementing this solution is \$22.7 M as given in the **Table 2-6**.

Table 2-6 Estimated Cost - Alternative Solution #3(b) - 40% of flow directed to Clair-Gordon System

Internal Sewers + Connection to Farley & Goodwin Drive	\$9.5 M
Upgrade Clair-Gordon bottleneck Section 1 Approximately 700 m (450 mm upgraded to 600 mm)	\$0.9 M
Upgrade Clair-Gordon bottleneck Section 2 Approximately 1300 m (600 mm upgraded to 675 mm)	\$1.8 M
Central SPS & Forcemain	\$2.4 M
Gordon-Maltby SPS & Forcemain	\$2.1 M
Victoria-Maltby SPS & Forcemain	\$6.0 M
Total Cost Option #3(b)	\$22.7 M

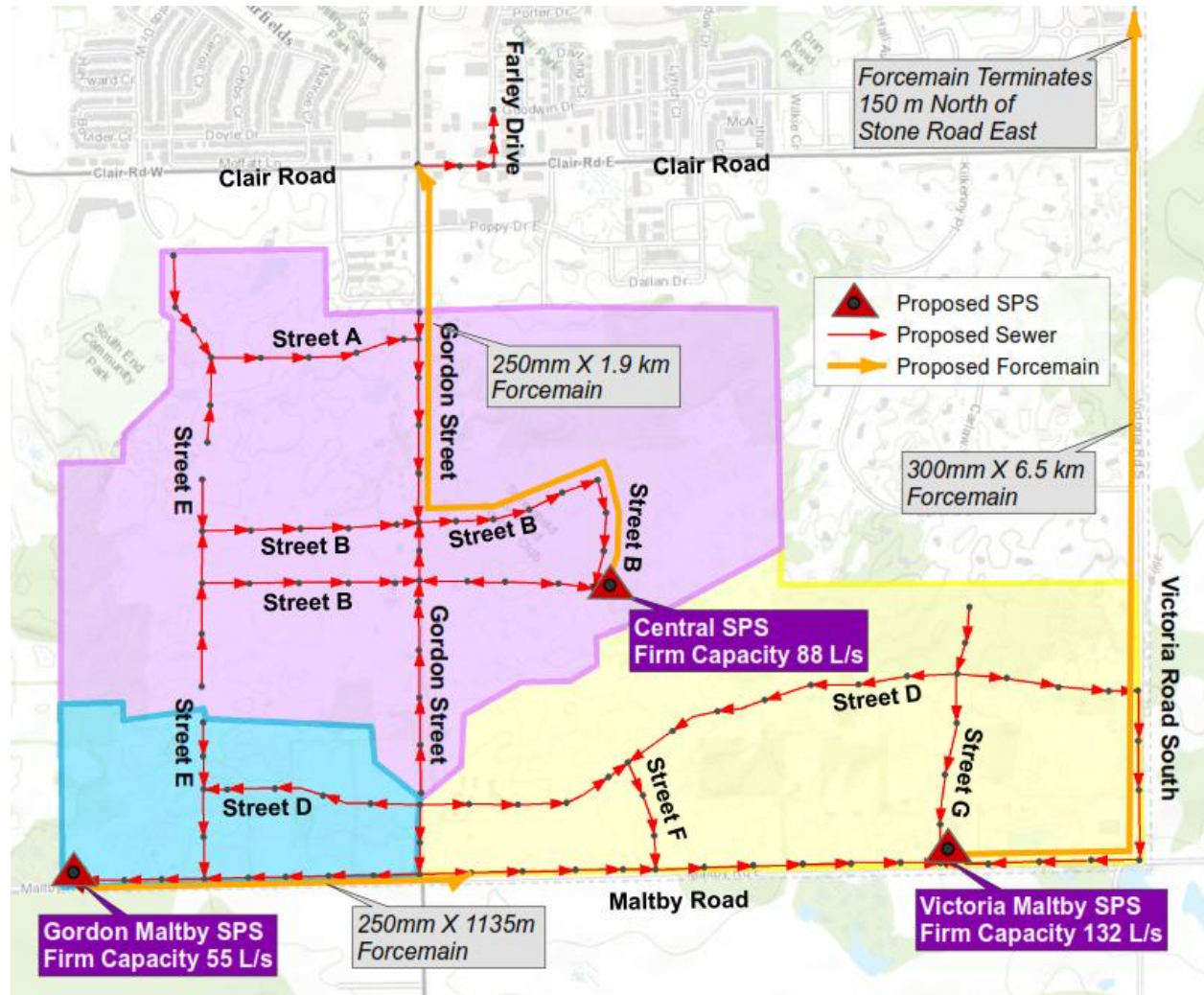


Figure 2-7 Alternative Solution #3(b) - Shallow Gravity Sewers 40% to Clair Gordon

Alternative Solution # 3(c) 100 % of flow directed to Victoria Road System: This alternative eliminates the connection to the Clair Gordon System. Alternative Solution #2c minimizes the extent of the North Service Area allowing such that only 40% of the CMSP lands are directed by gravity into the Clair Gordon System. This allows for the system to connect at Farley drive without needing any external upgrades. The Victoria Maltby Sewage Pumping Station – will be directed to the Victoria Road System via a 6.5 km forcemain. It is shown in **Figure 2-8**.

The estimated capital cost for implementing this solution is \$19.0 M as given in the **Table 2-7**.

Table 2-7 Estimated Cost - Alternative Solution #3(c) - 100% of flow directed to Victoria Road System

Internal Sewers	\$8.6 M
Central SPS & Forcemain	\$2.3 M
Gordon-Maltby SPS & Forcemain (static Head 10 m)	\$2.0 M
Victoria-Maltby SPS & Forcemain (Static Head + 12 m)	\$6.2 M
Total Cost Option #3(c)	\$19.0 M

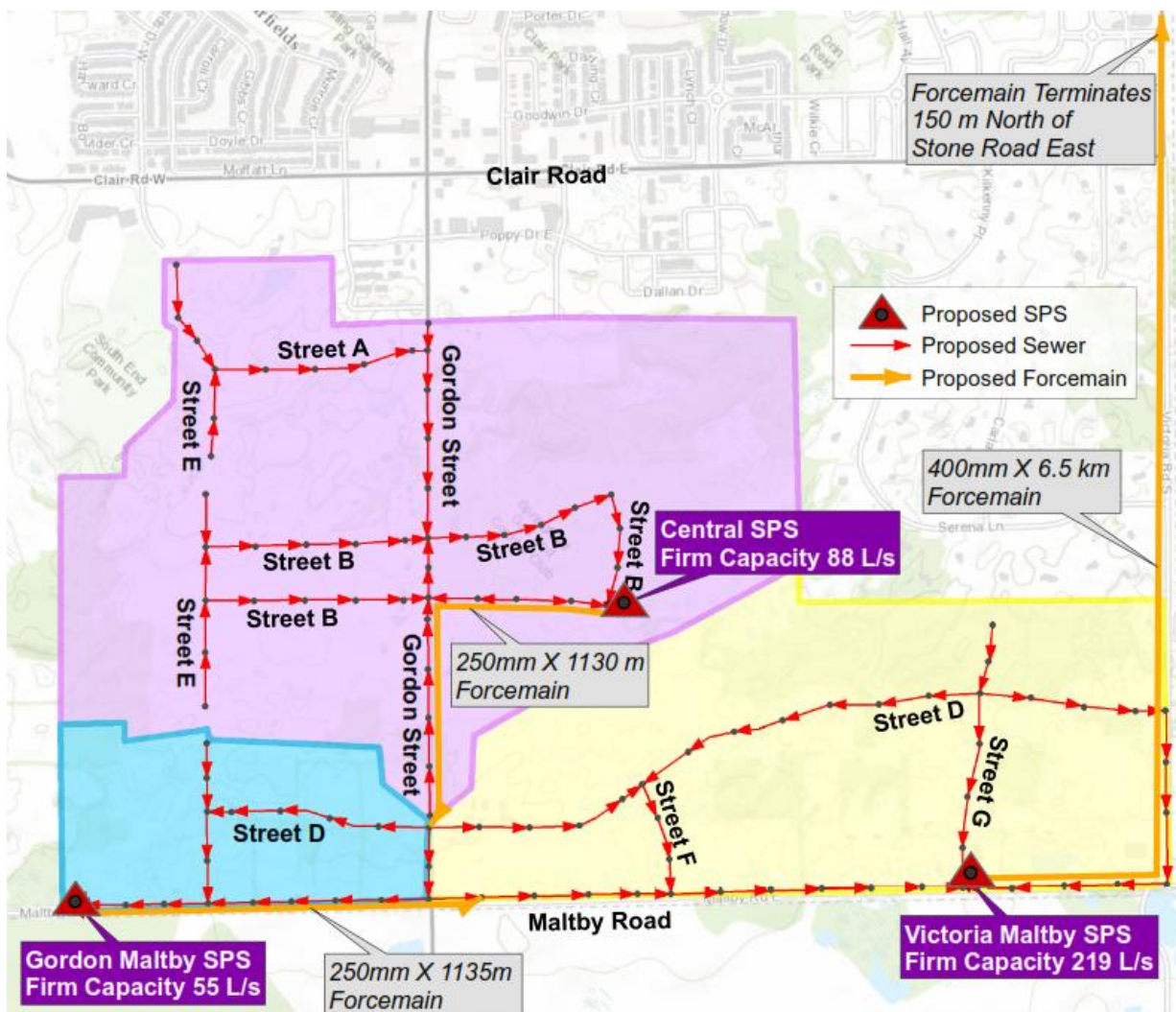


Figure 2-8 Alternative Solution #3(c) - Shallow Gravity Sewers 100% to Victoria Road System



3.0 Conclusions and Next Steps

The three alternative solutions have been prepared and can be refined with the development of the Clair Maltby Secondary Plan Lands.

The alternative solutions as described in this report will be evaluated in consultation with the City of Guelph and Stakeholders as part of the Master Servicing Plan.

A preferred strategy will be developed, and a staging and implementation plan will be developed and described in the final **WW-3 Evaluation & Selection of Preferred Strategy Report**.



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