Wastewater Servicing – Clair Maltby

WW-1 Existing Conditions Design Criteria & Level of Service Objectives 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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Prepared by:

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

1.0 Introduction

The scope of this report involves the following:

- Review of the City of Guelph's Wastewater Master Planning in regards to the servicing of the Clair Maltby Secondary Plan (CMSP);
- Confirmation of Planning requirements for the CMSP lands, i.e. Projected residential and employment populations and road layout concept for the purpose of planning a wastewater collection and treatment system;
- Confirmation of the design criteria to be applied for determining the capacity and the demand loads in the wastewater collection system;
- Confirmation of Demand Projections for the Proposed Lands;
- Confirmation of downstream collection system capacity up to the wastewater treatment plant(s);

2.0 Planning Context

2.1 Study Area

The CMSP lands are situated in the Southern part of the City of Guelph and the lands are bounded by Victoria Road S to the North-East, Clair Road E to the North-West, Southgate Drive to the South-West, and Maltby Road W to the South-East and the location is given in **Figure 2-1**. The land ranges in elevation from approximately 331 to 359 metres above sea level (masl). The subject lands have a total area of 491 ha.

2.2 Proposed Land Use

As part of the CMSP planning process, a preferred land use plan was developed through an intensive stakeholder engagement process with a technical advisory composed of City Staff, planners, citizens and landowners.

The proposed land use layout used for this study is given in **Figure 2-1.** This figure was originally provided in February 2018, and an updated plan was provided in September 2018.

In order to facilitate the planning this study separates the CMSP lands into two distinct areas, the main CMSP area and the Rolling Hills area. The Rolling Hills area is the 71 ha portion in the North East.

The planned population and net developable area used for wastewater generation is 21,688 and 245.9 ha based on information provided in February 2018.

Planning Input is provided in **Appendix B**.

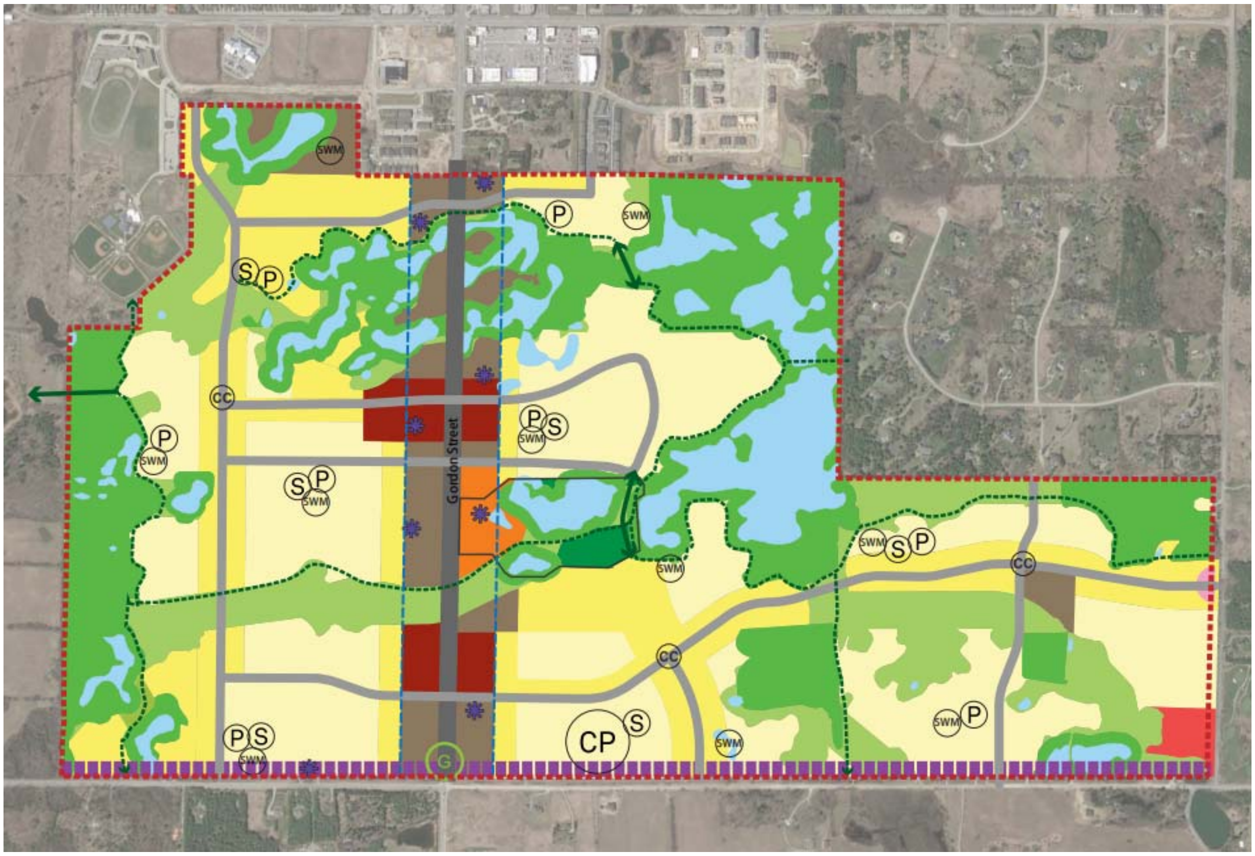


Figure 2-1. Preferred Land Use for Clair Maltby

3.0 Wastewater Design Criteria

3.1 Background Information

Design criteria is established based on a review of background information provided by the City of Guelph as follows:

- Development Engineering Manual Version 1.0 – City of Guelph Engineering and Capital Infrastructure Services
- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS 2017)
- Hydraulic Modeling Update for the 2013 Guelph DC Study (Final)
- MECP 2008 Sewage Works Design Guidelines
- City of Guelph Planning Model (InfoSWMM / InfoSEWER)

3.2 Design Flow Generation

The sewer demands in this planning process are described as “existing demand”, “baseline demand” and “Planned flows for the Clair Maltby Lands”.

Existing Demand represent what is estimated in the 2012 Scenario (2012_WExisting) of the model received from the City of Guelph.

Baseline Demand **-**represent the demands that are forecast for the various horizon years in the model supplied by the City of Guelph

Planned Demand – Clair Maltby – represents the demands that are estimated based on the population forecasts provided for the Clair Maltby Secondary Plan lands.

Design flows for all categories have domestic flow component and an extraneous flow component. The total flow is the sum of both components. The two components are estimated as follows:

Domestic Flow

Existing and baseline demand is estimated based on the flows provided in the City of Guelph model, it includes a population based average flow that is input into the model according to a diurnal pattern as provided in the planning model.

Planned Demand is added to the Baseline Future flows at an average day demand of 300 L/person-day with the applied diurnal pattern added at the entry manhole (node).

Extraneous Flow

Inflow and Infiltration for existing Areas as estimated in the baseline model by the City of Guelph. Inflow and infiltration for new areas assumed at a factor of 0.28 L/s-ha.

3.3 Sewer Hydraulics

Design Slopes for new sanitary sewers

New sewers in the Clair Maltby Lands, are designed conceptually with a minimum full-pipe flow velocity of 0.8 m/s. This exceeds the City's minimum of 0.6 m/s and provides flexibility to ensure that other criteria, such as higher slopes for pipes running at 1/3 of the depth, can be met and that changes can be accommodated in the detailed design stage.

The minimum design slope is a function of the full pipe velocity and the pipe size.

Sewer Capacity Evaluation

The City of Guelph has adopted a no-surcharge approach in regards to sewer capacity evaluation. The capacity is thus defined as the full flowing capacity of the pipe with hydraulic grade line at the pipe obvert. Upgrades to the sewer system are triggered when demand exceeds capacity.

Other conventional approaches to this problem include the hydraulic grade line risk evaluation. With this approach, sewers can be loaded beyond the full pipe-capacity and function at a higher flow rate under partially pressurized conditions, in which case the flooding risk of nearby buildings & infrastructure is evaluated with respect to the hydraulic grade line.

3.4 Pumping Station Design Capacity

If a pumping station is required, multiple pumps are designed to meet a firm capacity. The firm capacity is defined as the system flow rate with all pumps except one out-of-service. If the pumps do not have equal capacity the highest capacity pump is assumed out of service for the purpose of determining firm capacity.

The use of firm capacity introduces a safety/redundancy factor as the system flow rate can exceed the firm capacity when all pumps are running.

4.0 Receiving Sewer System

4.1 Receiving Branches

The receiving system accessible to the Clair Maltby Lands can be described in terms of the following three (3) branches:

1. Clair Gordon Branch
2. Southgate-Hanlon Branch
3. Victoria Road Branch

The City's wastewater model is used as the basis for understanding the available capacity in each of the systems. For planning purposes, the flow capacity is converted to show the equivalent population and serviceable land area. The available capacity shown represents the amount, over and above the 2031 baseline demand, that can be added to the receiving system without surcharging.

A comprehensive Wastewater Model Review is included in **Appendix A** of this report.

The available capacity in the 3 connection points is given as:

- Clair Gordon Connection Point = (8,667 population and 98.4 ha/27.54 L/s II)
- Southgate-Hanlon Connection Point = (2,167 population and 24.6 ha/6.9 L/s II)
- Victoria Road Connection Point = undefined capacity for baseline 2031 conditions

4.1.1 Clair-Gordon Connection Branch

The Clair-Gordon Branch is a collection system located on the Farley Drive and Goodwin Drive intersection. The collection system is shown in **Figure 4.1**

1. Local sewers along Farley Drive 450 mm to 600 mm from the access point approximately 700 meters downstream at Dawn Ave and Clairfields Rd W. The access point can accommodate 40% and the 600 mm pipe segment can accommodate 60% of the Clair Maltby demands without causing surcharging downstream.
2. Local sewers 600 mm to 675 mm from the access point approximately 1960 meters downstream at Trunk Sewer near Kirby Court. This point can accommodate 100% of the Clair Maltby demands without causing surcharging downstream.

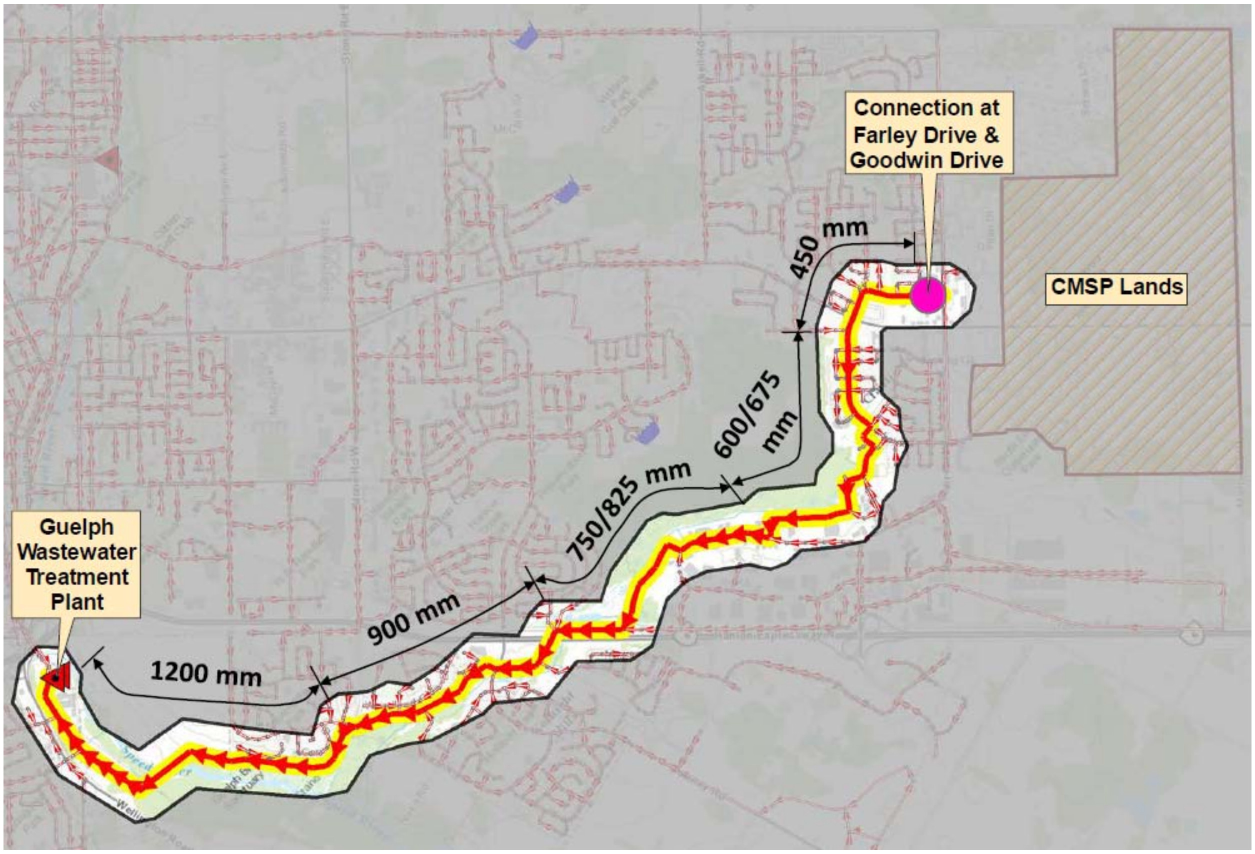


Figure 4.1. Clair Gordon Branch

System Upgrades:

The Clair Gordon Branch has a bottleneck through a 2.0 km section as shown in **Figure 4.2**.

1. Analysis confirms that sending 100% of Clair Maltby demands to Goodwin Drive and Farley Drive would require an upsize of the existing sewer down to the Trunk Sewer at Kirby Court.
   The 700 m x 450 mm section requires upgrading 600 mm pipe and the 1.3 km x 600 mm pipe requires upgrading to a 675 mm pipe at a total estimated cost of $2,700,000.
2. Another option is to phase development to connect to either 2 or 3 connection points.
   With 2 connection points, 40% of developable lands would be sent to Point A and 60% of developable lands would be sent to Point C. With 3 connection points, 40% of developable lands would be sent to Point A, an additional 20% to Point B and the remaining 40% to Point C.
3. The third option to overcome the capacity limitation is by twinning the bottleneck and the fourth option is by-passing new flows around the bottleneck.

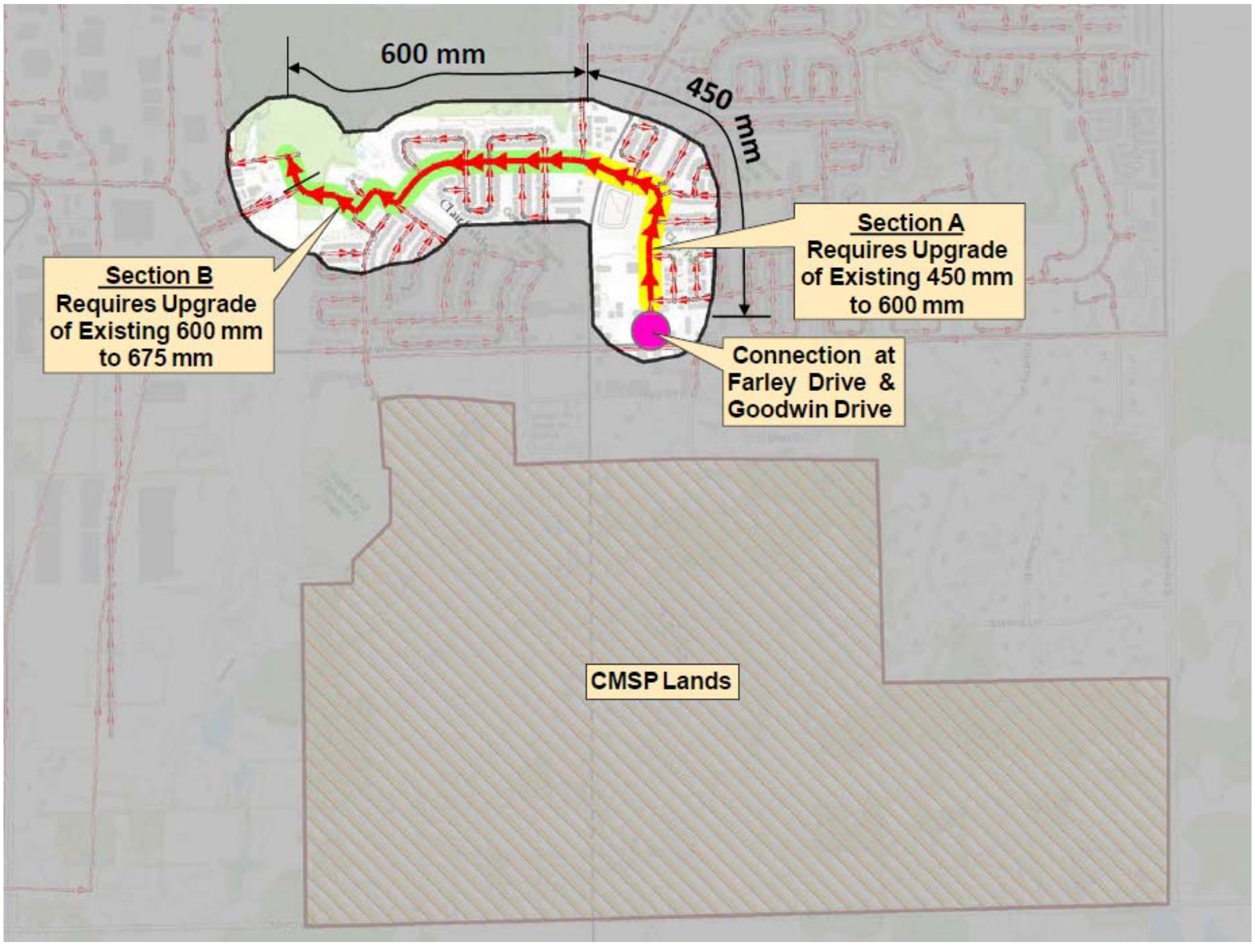


Figure 4.2. Clair Gordon Bottleneck Section

4.1.2 Victoria Road Connection

The Victoria Road Branch is a collection system located South-East of Victoria Road South and Arkell Road. The collection system discharges to the York Trunk through the following segments as shown in **Figure 4.3.**

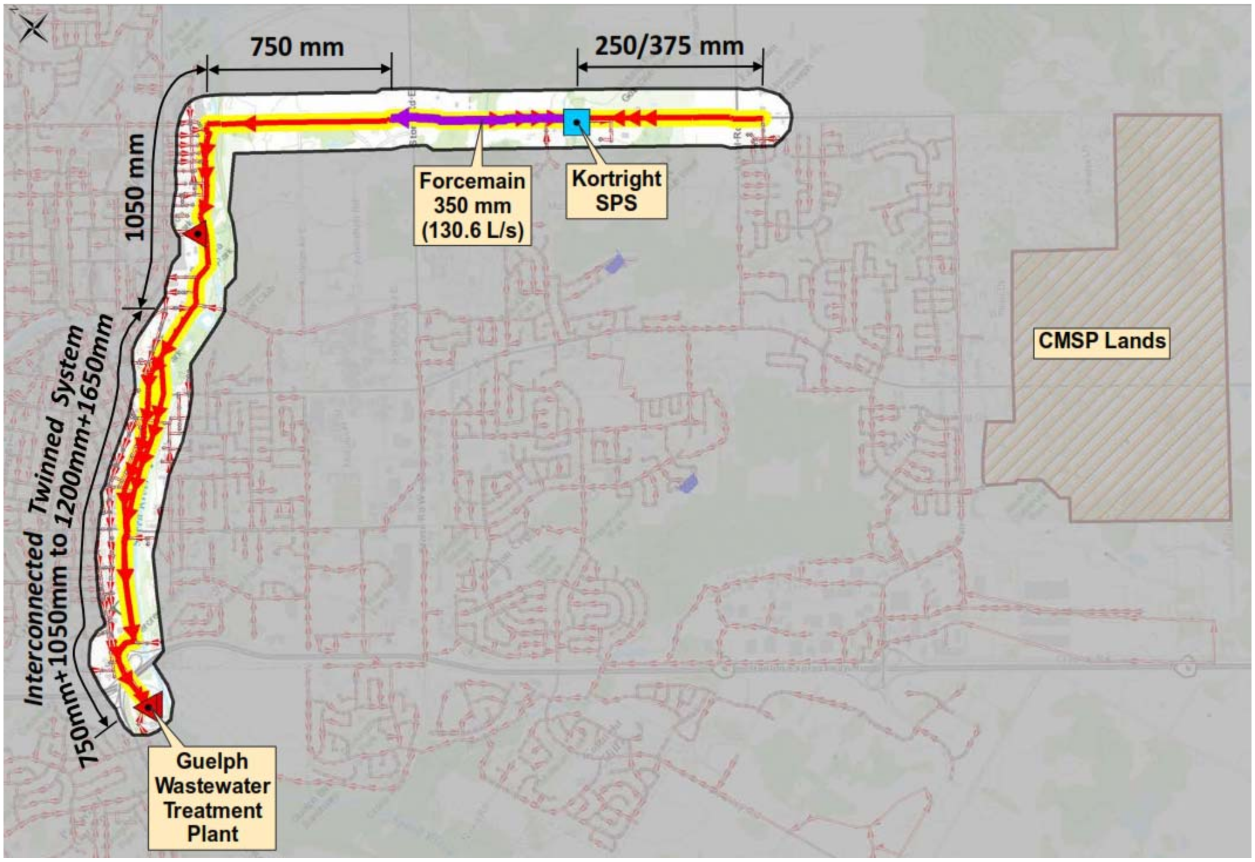


Figure 4.3. Victoria Road Collection System

1. Local sewers along Victoria Road 200 mm to 375 mm from the access point approximately 450 m to the North of Maltby Road to the Kortright East Sewage Pumping Station. This 375 mm pipe segment can accept 40% of the Clair Maltby demands without causing surcharging downstream.
2. The Kortright East Pumping Station and Forcemain has a firm capacity of 130.6 L/s of which is 100% dedicated to existing land uses and baseline growth to 2031. There is insufficient capacity in the Kortright East Pumping station and forcemain to accommodate any significant additional demand beyond the 2031 baseline demand.
3. A 750 mm sewer at Victoria Road and Stone Road. This portion of the system is accessible at approximately 6.2 km to the North of Maltby Road. This point can accommodate 100% of the Clair Maltby demands.

4.1.3 South-Gate Hanlon Connection

The South-Gate Hanlon Branch is a collection system located South-East of Southgate Drive and Clair Road W. The collection system discharges to the same Trunk as the Clair-Gordon collection system. The collection system is shown in **Figure 4.4**

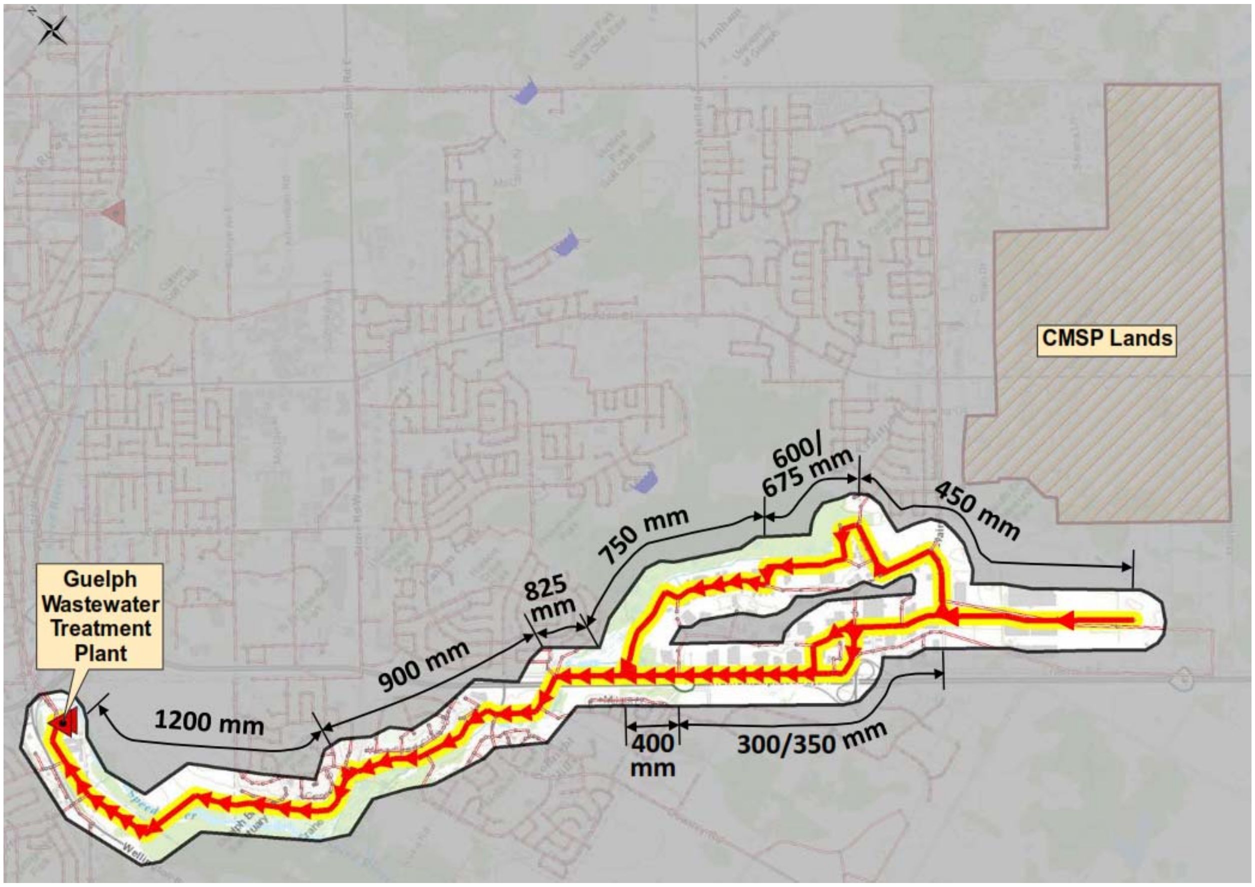


Figure 4.4. Southgate - Hanlon

Local sewers along Southgate Drive 450 mm to 300 mm from the access point approximately 1358 m to the North of Maltby Road to the Kortright East Sewage Pumping Station. This 450 mm pipe segment can accept 10% of the Clair Maltby demands without causing surcharging downstream.

This analysis is based on the future baseline flows connecting to the system without any upgrades. The City's Master Plan provides for upgrades that will increase capacity in the system. The Victoria Road Connection Point capacity will have an increase in capacity in the next five (5) years – as a result of ongoing upgrades downstream of the connection point.

5.0 Conclusion

The receiving sewer system was designed and implemented based on a previous Urban boundary limit which is exceeded by the Clair Maltby Lands.

Planning Alternatives for the Clair Maltby Lands can proceed based on the following possible outlets:

1. Clair Gordon Branch – connecting at Farley Drive and Goodwin Drive – this currently can receive 40% of the proposed demand from the CMSP lands and can be upgraded to 100% by addressing the bottleneck issues
2. Victoria Road System – connecting at the 750 mm sewer to the North of Stone Road on Victoria Road – Currently can receive 100% of the proposed demand from the CMSP lands.

It is not recommended that the Southgate Hanlon outlet be pursued for this development.

APPENDIX A

TECHNICAL NOTE: CLAIR MALTBY WASTEWATER MODELLING

Technical note:
Clair Maltby Wastewater Modelling

1. Introduction

Wood Environment & Infrastructure Solutions Canada (Wood Canada) is to develop a Water and Wastewater Servicing Plan for the Clair Maltby Master Environmental Servicing Plan and Secondary Plan for the City of Guelph, Ontario. This will provide a long-term strategy for the servicing of the Clair Maltby Secondary Plan. The Servicing Plan will support the long-term growth scenarios envisioned by the City.

As part of this, Wood Canada have requested modelling support associated with the sanitary system from Wood Environment & Infrastructure Solutions UK (Wood UK) to enable the assessment of existing and future sanitary system capacity and the impact on the future sanitary system from the Clair Maltby Lands.

The basis of all modelling undertaken is the existing Guelph InfoSWMM sanitary model which has been converted to an InfoWorks ICM model.

The scope of this report involves the following:

- Review of Existing InfoSWMM Model;
- Model Conversion to InfoWorks ICM & comparison with InfoSWMM outputs for confidence;
- Baseline constraint analysis for current and future time horizons to identify existing capacity constraints;
- Modelling of the Clair Maltby Lands to three potential connection points;
- Constraint analysis to identify capacity issues introduced by the inclusion of the Clair Maltby Lands; and,
- Development phasing analysis to identify the percentage of the Clair Maltby Lands that can connect to the existing sanitary sewer system without causing capacity constraints and the need for sewer upgrades.

1.1 Model Background

In 2013, AECOM utilised an existing wastewater model, which was calibrated as part of the "2008 W/WW Master Plan" in 2008, to carry out extensive model upgrades. This incorporated the following:

- New sewers;
- Inspection manholes;
- Pipe invert elevations; and
- Ground elevations.

The work undertaken by AECOM is detailed in “Hydraulic Modeling Update for the 2013 Guelph DC Study (Final)” report. The updated AECOM 2013 model reflects the City of Guelph's current sanitary system. It is noted that although the current 2013 model was calibrated in 2008; with updates implemented for the 2013 study, the model is considered to be acceptable for master planning purposes by the City of Guelph.

The Wastewater model database which has been used for this study was named "2013-11-21-Guelph_Sanitary_Model-60298422". This was provided by the City of Guelph in InfoSWMM (Innovyze) format.

1.2 Existing InfoSWMM Model

The "2013-11-21- Guelph_Sanitary_Model-60298422" InfoSWMM model was converted by AMECFW Canada to EPA SWMM5 text files for import into InfoWorks ICM (Innovyze). Each scenario in the InfoSWMM model was then converted as a separate SWMM5 text file. The baseline model for this analysis (representing 2013) is based on the InfoSWMM scenario "2012_WEXSTING". This model is deemed to be correct for use as the "Baseline Model" and is an accurate representation of the City's current sewer system. Wood do not provide any warranty for the model.

2. InfoWorks ICM Model

This section details the conversion of the InfoSWMM model to InfoWorks ICM, the model review and connectivity check undertaken, and the setting up of the baseline 2013 and 2031 model scenarios.

Table 2.1 highlights the files provided by Wood Canada which have been used to produce the InfoWorks ICM model scenarios for use in the baseline constraint analysis:

Table 2.1 Baseline ICM Model and Ancillary Files

	File Name	Comments
SWMM5 Network File	2012_WExisting.inp	SWMM 5 .inp file imported into a blank InfoWorks ICM model network named "Guelph Wastewater Model".
Subcatchments	N/A	Due to differences in application of flows to model nodes in InfoSWMM and InfoWorks ICM, dummy subcatchments were created in ICM to allow application of dry weather and II flows. The subcatchments were sized based on a dummy area of 0.1ha where no RDII flows were applied, or the corresponding RDII Sewershed Area (hc).
2012 Dry Weather Flows	2012_WEXISTING.xlsx	DWF's were imported to relevant InfoWorks ICM Sanitary Subcatchments. Baseflow allocations were applied as ICM "Baseflow". Allocations for SOUHTH, SOUTH, Fut_Res, Fut_ICI, Fut_II, RES, ICI and ROCKWOOD were combined per junction/subcatchment and applied as ICM "Additional Foul Flow". Relevant Time Pattern ID was applied to each subcatchment as a corresponding "Wastewater Profile" (See Time Patterns below)
2031 Dry Weather Flows	2031_175K_EXPIPE_2013UPD.xlsx	Applied as 2012 DWFs above.
Rainfall Derived Inflows and Infiltration (RDII)	Node RDII - 2012 WExisting.xlsx	RDII flows imported to relevant InfoWorks ICM Subcatchments as contributing areas (Sewershed Area (hc)) and associated RDII Hydrograph profiles.
Time Patterns	Time Patters for 2012 WExisting.xlsx	Time Patterns applied to a InfoWorks ICM "WasteWater" ancillary file named "2012_WEXISTING Waste water". Time Patter ID 1 from the InfoSWMM model was applied as a Weekday profile and Time Pattern ID 2 as a weekend profile. The following ICM Wastewater profiles were created:

File Name	Comments
	1: FM_1 2: FM_2 3: FM_3 4: FM_4 5: FM_5 6: FM_6 7: FM_7 8: FM_8 9: FM_B 10: PEAK2 11: PEAK2.8

2.1 Connectivity and Model Review

The following steps were completed as part of the model review and connectivity check:

- Imported existing InfoSWMM model "2012_Wexisting.inp" to InfoWorks ICM v8.5.7.
- InfoWorks ICM Model Network named "Guelph Wastewater Model".
- Connectivity in ICM model was reviewed and compared with InfoSWMM and found to be comparable.
- The model was "flagged" in ICM to identify data which has come from the original InfoSWMM model. The data flag used for this was "SWMM - Value imported from InfoSWMM model".
- The imported InfoSWMM model was subject to an engineering validation in InfoWorks ICM. Several errors were noted which were resolved. A number of "warnings" also identified locations in the model where pipes had "invert levels above ground level" or "soffit above ground level". No changes were made to the model with regards to these warnings, apart from where these caused an instability in the InfoWorks ICM model. Details of changes made to the ICM model to gain successful model validation and resolve model instabilities can be found in the document "Guelph_Wastewater_Model_Validation_Log.pdf", located in **Appendix A**. Any changes to the model to obtain engineering validation have been flagged "WOOD - Value adjusted by Wood Environmental & Infrastructure Solutions".

2.2 InfoWorks ICM 2012 Baseline Model

- Dummy subcatchments were created in the InfoWorks ICM model to allow application of DWF's and RDII. These were set to 0.1ha in size for junctions with DWF only, or to the relevant "Sewershed area" for nodes with RDII. The subcatchments were also set to apply inflows to associated junctions in the model.
- DWF & RDII were applied to relevant subcatchments based on files provided from the InfoSWMM model (see table 2.1).
- Time patterns were set up within an InfoWorks ICM Wastewater file and associated time patterns applied to relevant subcatchments (see table 2.1).
- "Base" scenario within the model network represents the 2013 wastewater network and flows.

- The resulting ICM flow/depths from key locations from 1 in 25-year design storm were reviewed with InfoSWMM outputs to ensure that results were comparable. Flows were found to be generally within ±10% at all locations throughout the catchment, apart from in locations with level errors in the InfoSWMM model which had been rectified in ICM.

2.3 InfoWorks ICM 2031 Baseline Model

- Additional Dummy subcatchments were created in the InfoWorks ICM model to allow application of future 2031 DWF's and RDII. These were set to 0.1ha in size for junctions with DWF only, or to the relevant "Sewershed area" for nodes with RDII. The subcatchments were also set to apply inflows to associated junctions in the model.
- 2031 DWF & RDII were applied to relevant subcatchments based on files provided from the InfoSWMM model (see table 2.1).
- Time patterns were set up within an InfoWorks ICM Wastewater file and associated time patterns applied to relevant subcatchments (see table 2.1).
- Future infrastructure associated with two planned projects included in the Master Plan framework of the City of Guelph have been added to the 2031 model after confirmation from the City of Guelph that these are partially constructed and will be completed by 2020. The infrastructure projects are "WW-I-1 Twinning and replacement of existing York Trunk from east of Hanlon to Victoria" & "WW-I-1A Add parallel pipe on Wellington St W" as detailed in Appendix H of "Hydraulic Modeling Update for the 2013 Guelph DC Study (Final)" report. Details of the new infrastructure were taken from InfoSWMM network "2031_175k_EXPIPE_2013UPD" and can be seen highlighted in green in Figure 2.1 below.
- "2031 Network 2031 Flows" scenario within the model network represents the 2031 wastewater network and flows.

Figure 2.1 2031 Additional Assets Associated with Infrastructure Projects WW-I-1 & WW-I-1A

3. Baseline Constraints Analysis

3.1 Introduction

There are 3 potential connection points for flows from the proposed Clair Maltby Lands to discharge to the existing sewer system. The connection points and associated downstream network (highlighted green) are detailed in figures 3.2 to 3.4 below:

Figure 3.1 Clair Maltby Lands Connection Point – Clair Gordon

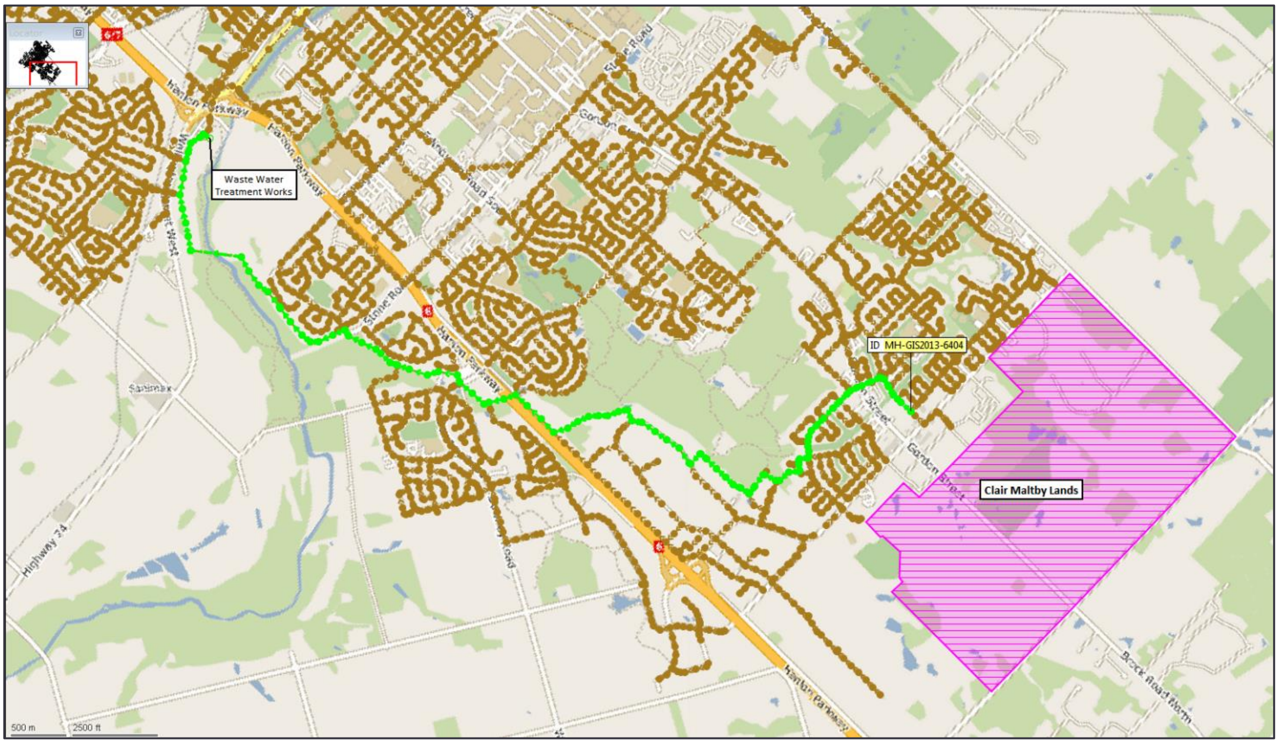


Figure 3.2 Clair Maltby Lands Connection Point – Southgate-Hanlon

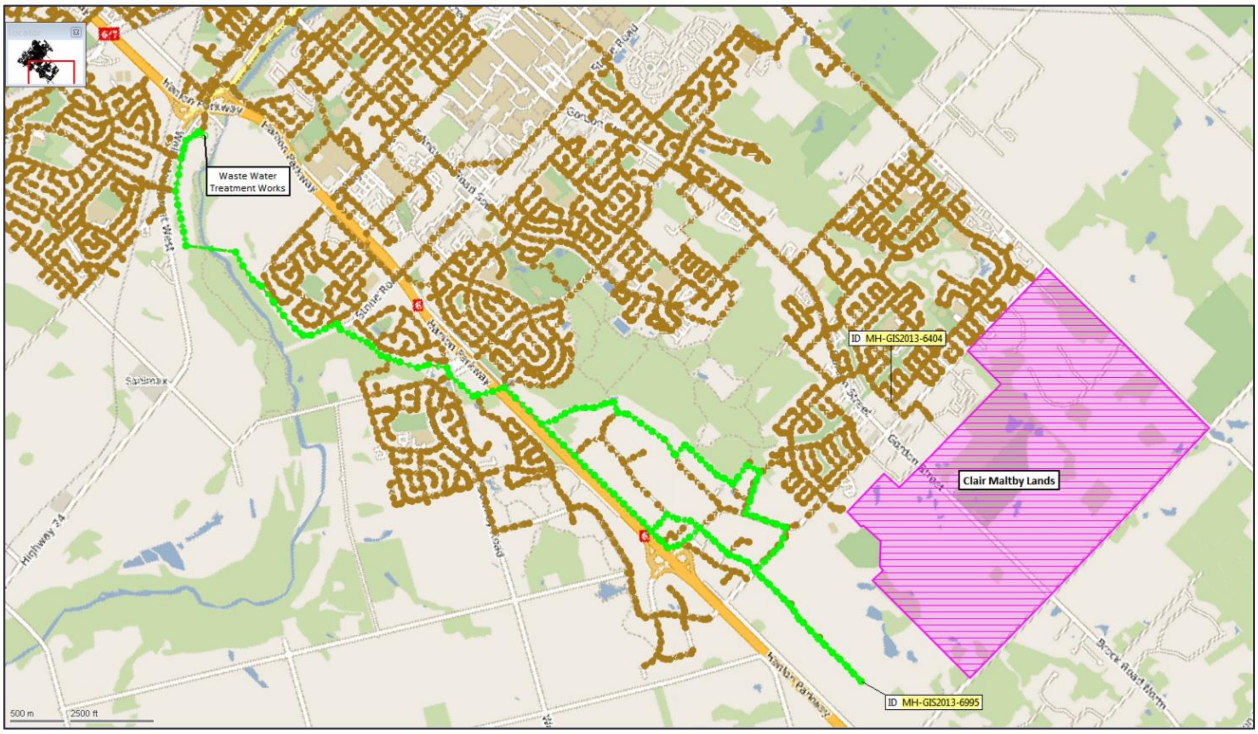
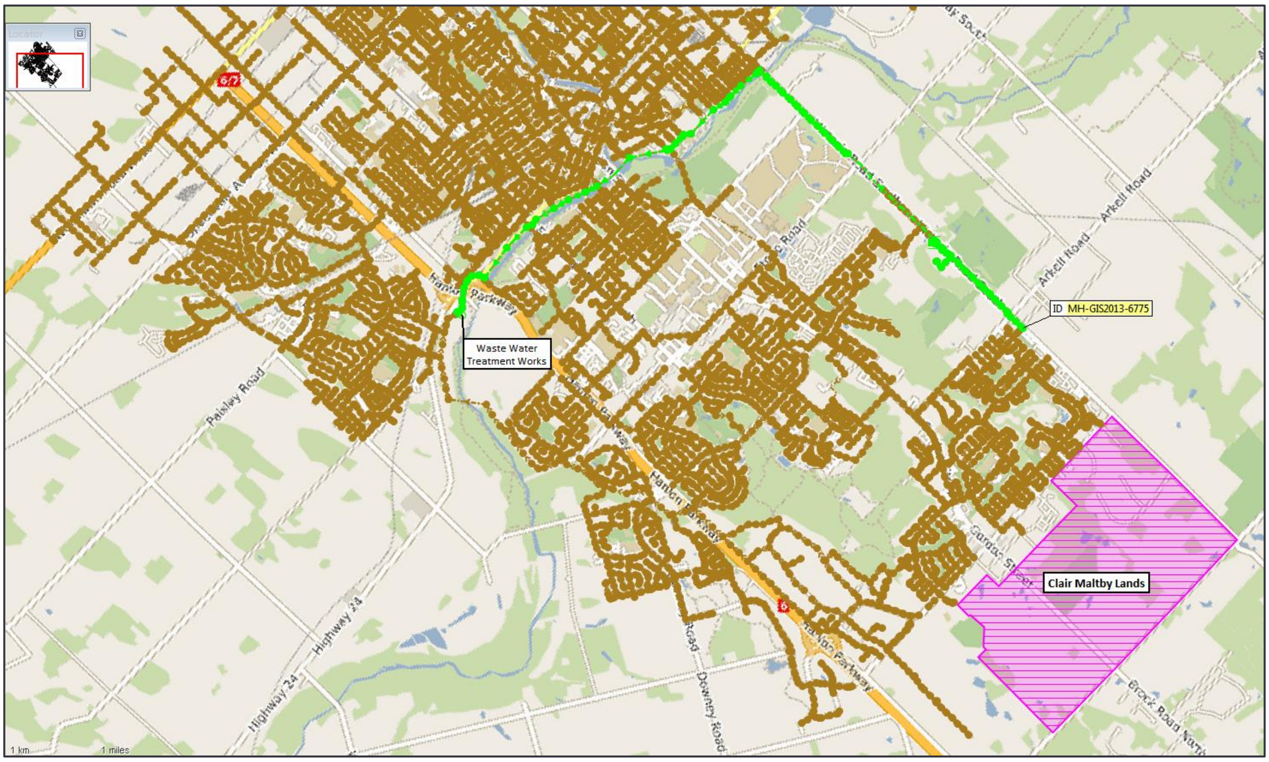


Figure 3.3 Clair Maltby Lands Connection Point – Victoria Road



Model simulations were carried out with a 1 in 25yr design storm to gain an understanding of existing capacity constraints within the sewer network downstream of the potential connection points of the Clair Maltby Lands. This exercise was carried out for two flow time horizons, 2012 & 2031, on the corresponding baseline model scenarios. For the baseline constraints analysis, no flows from the Clair Maltby Lands are included in the model.

A constraint is defined as a surcharged pipe with a "Max Surcharge State" of >=1.0 from the ICM simulation results as described in figure 3.5:

Figure 3.4 Surcharge State Definition

Max surcharge state	Indicates whether the flow rate in the system exceeded the capacity of the drainage network to the extent that levels rose within manholes at any time during the simulation. Maximum surcharge state can be one of the following values:

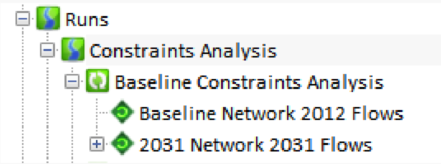
Value	Description
<1	Not surcharged Where the ratio of water depth (max_depth) to pipe height (conduit_height) is 0 or less than 1
1	Surcharged by depth
2	Surcharged by flow

See **Surcharge Rate** for more details.

Table 3.1 below details the simulation parameters and input files used for this analysis:

Table 3.1 Baseline Constraints Analysis – Model Simulation Parameters

	Details	Comments
ICM Model Scenario	Base 2031 Network 2031 Flows	Base scenario represents 2012 network and flows (see section 2.2) Represents 2031 network with 2031 flows (see section 2.3)
Rainfall	M25 Design storm (25YRCHICDES)	25-year return period design storm taken directly from InfoSWMM model.

WasteWater	2012_WEXISTING Waste water	See "Time Patterns" in table 2.1 above.
Simulation Start Date/Time	01/05/2007 @ 00:00	As per InfoSWMM simulations
Simulation Finish Date/Time	03/05/2007 @ 23:45	As per InfoSWMM simulations
Simulation Timestep	20 seconds	As per InfoSWMM simulations
Results Timestep	900 seconds	As per InfoSWMM simulations
Simulation Name	Baseline Constraints Analysis	

Model results from the baseline constraints analysis are presented below and have also been provided for the entire catchment in ArcGIS shape file format in **Appendix B & C**.

3.2 2012 Baseline Scenario Constraints

From the corresponding model simulation, Tables 3.2 to 3.4 identifies the existing downstream constraints from each of the potential three connection points of the Clair Maltby Lands with 2012 flows applied to the baseline sewerage network. The model results for all pipes from the connection points downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix B** alongside model longsections and plans showing the location of identified constraints.

Table 3.2 2012 Baseline Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.3 2012 Baseline Constraints – Southgate-Hanlon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.4 2012 Baseline Constraints – Victoria Road Connection Point

Asset ID	Max Surcharge State	Comments
SED0001845	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 781.68l/s against PFC of 605l/s.
SED0001897	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 859.02l/s against PFC of 476l/s.
SED0001999	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 784.79l/s against PFC of 617l/s.
SED0002949	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 860.17l/s against PFC of 694l/s.
SED0002950	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 861.48l/s against PFC of 565l/s.
SED0005877	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 866.96l/s against PFC of 769l/s.
SED01960-2	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 778.13l/s against PFC of 593l/s.
SED0004477	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 426.69l/s against PFC of 330l/s.
SED0004259	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 277.36l/s against PFC of 197l/s.
SED0004292	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 271.87l/s against PFC of 118l/s.
SED0004392	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 518.47l/s against PFC of 338l/s.
SED0004412	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 428.16l/s against PFC of 227l/s.
SED0004413	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.91l/s against PFC of 401l/s.
SED0004414	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.92l/s against PFC of 218l/s.
SED0004426	2	Trunk sewer along North bank of the Speed River. Pipe is under capacity, max flow 427.85l/s against PFC of 216l/s.
CN-GIS2013-7436	1	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.
CN-GIS2013-7416	1	Pipes have capacity but are surcharge by depth due to downstream trunk sewer incapacity (see above pipes).
SED0001960	1	
SED0004285	1	
SED0004312	1	
SED0004415	1	
SED0004420	1	

3.3 2031 Baseline Scenario Constraints

From the corresponding model simulations, Tables 3.5 to 3.7 identifies the downstream constraints from each of the 3 potential connection points of the Clair Maltby Lands with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection points downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix C** alongside model longsections and plans showing the location of identified constraints.

Table 3.5 2031 Baseline Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.6 2031 Baseline Constraints – Southgate-Hanlon Connection Point

Asset ID	Max Surcharge State	Comments
SIP0000017	1.0	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	
SIP0000019	1.0	

Table 3.7 2031 Baseline Constraints – Victoria Road Connection Point

Asset ID	Max Surcharge State	Comments
CN-GIS2013-7436	1	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.

3.4 Baseline Constraint Analysis Conclusions

The baseline constraints analysis has identified that in general the existing sewer system has capacity for both 2012 and 2031 flows with few pipes in the downstream network from the potential connection points showing a capacity constraint.

The Clair Gordon and Southgate-Hanlon connection points have no downstream capacity constraints identified by the analysis apart from the triple inverted syphon pipes under the Speed River which are designed to be surcharged.

The Victoria Road connection point has a number of existing downstream capacity constraints for the baseline 2012 scenario (see table 3.4). The model simulation has identified under capacity and surcharging in the main trunk sewer running along the North bank of the Speed River to the WwTW. However, the inclusion of infrastructure projects WW-I-1 & WW-I-1A in the 2031 baseline scenario (see section 2.3 above) resolves the identified constraints (see table 3.7). Upgrade of the existing Kortright East Sewage Pumping Station (model node PS-KRSPS-1) may however be required if flows were to be connected to Victoria Road.

4. Clair Maltby Lands Constraints Analysis

4.1 Introduction

Model simulations were carried out to gain an understanding of capacity constraints within the sewer network downstream of the 3 potential connection points with the Clair Maltby Lands and associated flows included. This exercise was carried out using the 2031-time horizon network and flows.

A constraint is defined as a surcharged pipe with a "Max Surcharge State" of >=1.0 from the ICM simulation results as described in Figure 3.4 above.

4.2 Clair Maltby Lands – Model Input

The model was updated by adding an additional subcatchment to represent the Clair Maltby Lands and the associated population and II flows. This has applied to the three connection points using three separate modelled scenarios.

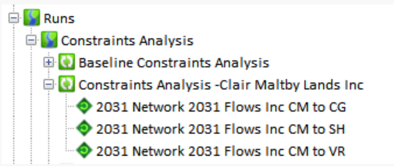
Details of the modelled subcatchment can be found in Table 4.1. All population and flow figures were provided by Wood Canada.

Table 4.1 Clair Maltby Lands - Modelled Subcatchment Details

	Clair Gordon Connection Point	Southgate-Hanlon Connection Point	Victoria Road Connection Point	Comments
Subcatchment ID	Clair Maltby Lands	Clair Maltby Lands	Clair Maltby Lands	
System Type	Sanitary	Sanitary	Sanitary	
Drains to Node ID	MH-GIS2013-6404	MH-GIS2013-6995	MH-GIS2013-6775	Most appropriate existing connection manhole for each scenario.
Total Area (ha)	538.105	538.105	538.105	
Developable Area (ha)	245.9	245.9	245.9	
Wastewater Profile	PEAK2	PEAK2	PEAK2	Uses consumption rate of 300l/h/d with an associated diurnal profile with a maximum multiplier of 2xDWF
Population	21,668	21,668	21,668	
Baseflow II (l/s)	68.852	68.852	68.852	Infiltration & Inflow has been applied as a constant baseflow based on the total developable lands area of 245.9ha @ 0.28l/s/ha
RDII	N/A	N/A	N/A	No RDII has been applied to the Clair Maltby Lands subcatchment.

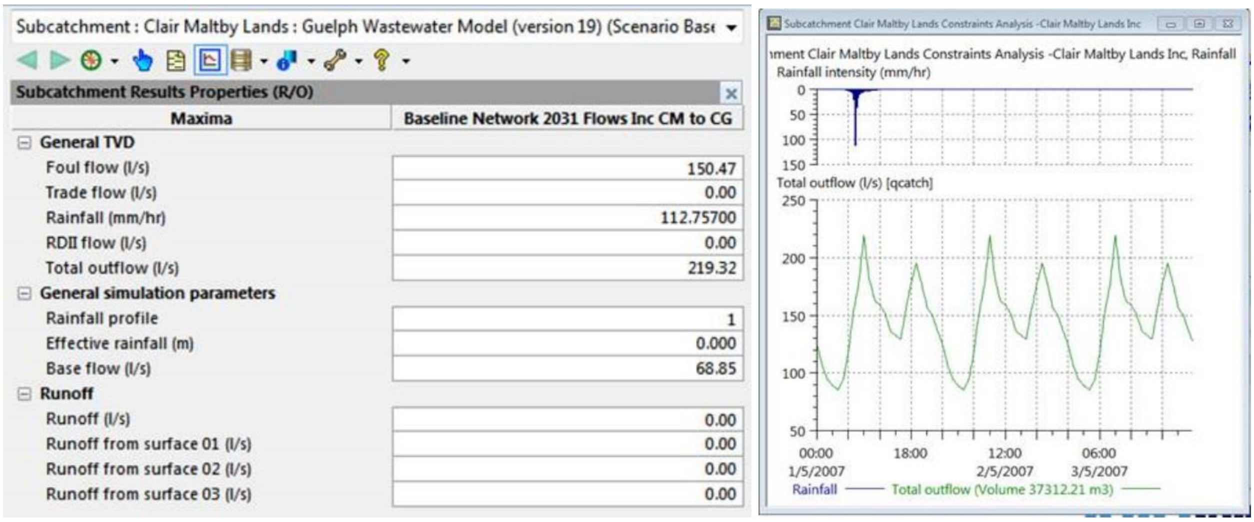
Table 4.2 below details the simulation parameters and input files used for the Clair Maltby Lands constraints analysis:

Table 4.2 Clair Maltby Lands Constraints Analysis – Model Simulation Parameters

	Details	Comments
ICM Model Scenario	- 2031 Network 2031 Flows Inc CM to CG - 2031 Network 2031 Flows Inc CM to SH - 2031 Network 2031 Flows Inc CM to VR	Three model scenarios representing different connection points for Clair Maltby Lands flows.
Rainfall	M25 Design storm (25YRCHICDES)	25-year return period design storm taken directly from InfoSWMM model.
WasteWater	Clair Maltby Lands Waste Water	As "2012_WEXISTING Waste water" wastewater file put with 300l/h/d consumption rate added to profile 10 "PEAK2" so Clair Maltby Lands could be modelled as a population rather than a flow rate.
Simulation Start Date/Time	01/05/2007 @ 00:00	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Finish Date/Time	03/05/2007 @ 23:45	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Timestep	20 seconds	As per InfoSWMM & Baseline Constraints Analysis simulations
Results Timestep	900 seconds	As per InfoSWMM & Baseline Constraints Analysis simulations
Simulation Name	Constraints Analysis -Clair Maltby Lands Inc	

When running the model with the above simulation parameters and inputs associated with the Clair Maltby Lands, the model subcatchment representing the development generates a peak total flow rate of circa 220l/s. Figure 4.1 below gives more detailed breakdown of flow rates predicted by the model:

Figure 4.1 Clair Maltby Lands – Predicted Model Flows



4.3 Clair Maltby Lands Constraints – Clair Gordon Connection Point

From the corresponding model simulation, Figure 4.2 and Table 4.3 identifies the downstream constraints from the modelled Clair Gordon connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix D** alongside model longsections and plans showing the location of identified constraints.

Figure 4.2 Clair Maltby Lands Constraints – Clair Gordon Connection Point

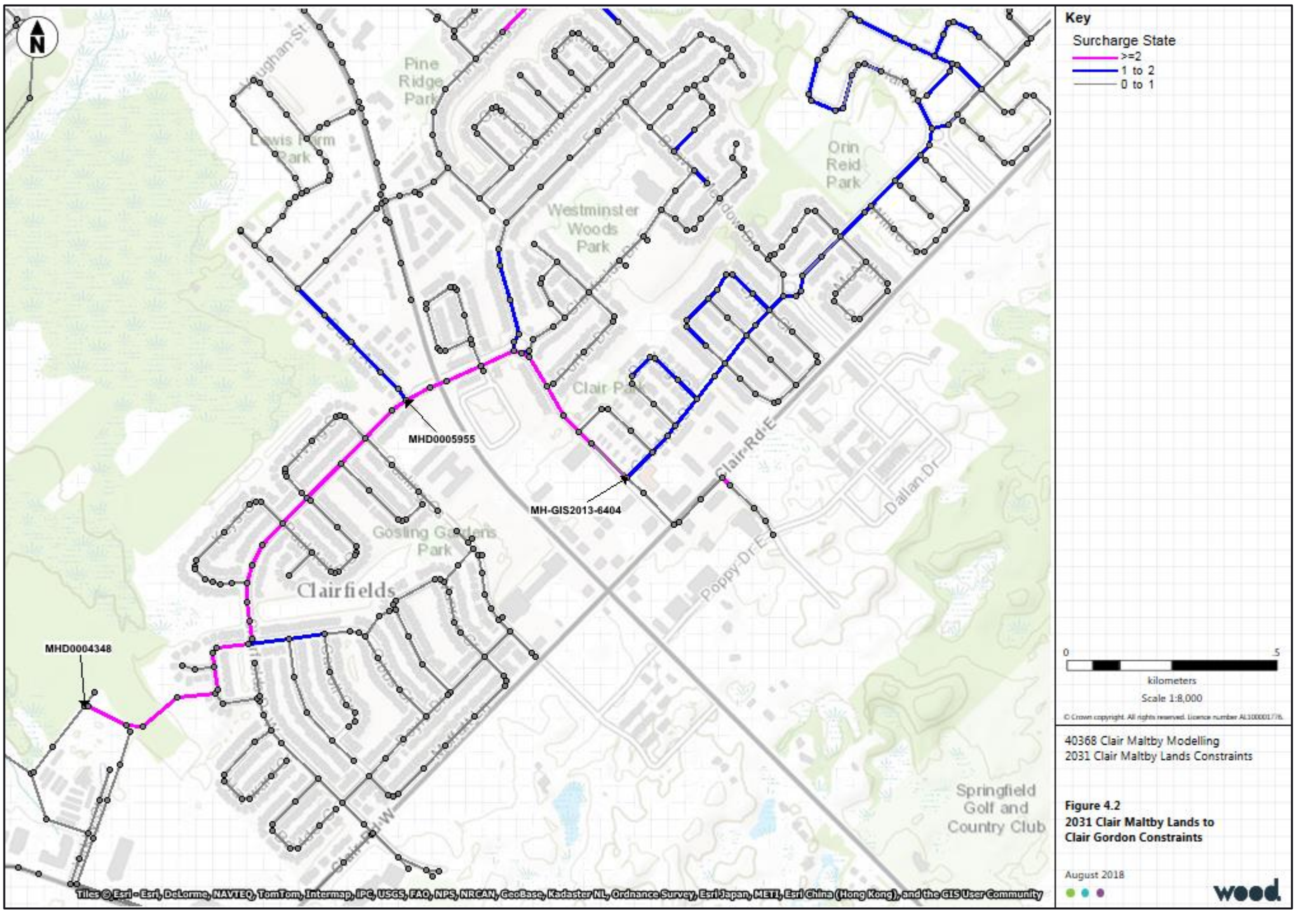


Table 4.3 Clair Maltby Lands Constraints – Clair Gordon Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7027	2.0	254.87	116	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7028	2.0	254.29	173	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7029	2.0	253.98	139	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005977	2.0	344.02	290	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0005979	2.0	343.96	275	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005980	2.0	355.98	300	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005981	2.0	356.07	297	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005982	2.0	356.17	296	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005984	2.0	356.68	325	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005985	2.0	356.72	322	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005986	2.0	389.98	305	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005990	2.0	390.32	310	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005991	2.0	390.46	207	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005992	2.0	392.25	323	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005993	2.0	392.28	330	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006515	2.0	335.76	300	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006516	2.0	343.66	327	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006517	2.0	343.81	314	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006518	2.0	331.48	323	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006519	2.0	333.51	309	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006520	2.0	335.31	315	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006521	2.0	327.45	305	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006522	2.0	327.83	303	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0006523	2.0	330.34	304	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006532	2.0	264.92	144	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006533	2.0	266.96	128	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006534	2.0	266.98	150	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006535	2.0	267.09	117	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006553	2.0	260.54	218	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006554	2.0	255.03	133	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006555	2.0	255.04	150	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006556	2.0	254.94	114	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006621	2.0	335.56	300	Sewer downstream of development connection point. Pipe is now under capacity.
SIP0000017	1.0	271.83	1309	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	64.61	114	
SIP0000019	1.0	585.82	1850	

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Clair Gordon connection point has resulted in several downstream constraints. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6404, a section of sewer between the connection point and MH MHD0004348, approximately 1,950m downstream, becomes under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). The capacity restraint caused by the additional flows also results in backing up and surcharge to the upstream system (see dark blue pipes on figure 4.2). Downstream of MH MHD0004348 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows.

Although the additional flows from the Clair Maltby Lands produce significant surcharge in the existing sewer system, no flooding is predicted by the model in the vicinity of the Claire Gordon or at any point downstream to the treatment works, i.e. top water levels do not exceed ground level.

4.4 Clair Maltby Lands Constraint – Southgate-Hanlon Connection Point

From the corresponding model simulation, Figure 4.3 and Table 4.4 identifies the downstream constraints from the modelled Southgate-Hanlon connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix E** alongside model longsections and plans showing the location of identified constraints.

Figure 4.3 Clair Maltby Lands Constraints– Southgate-Hanlon Connection Point

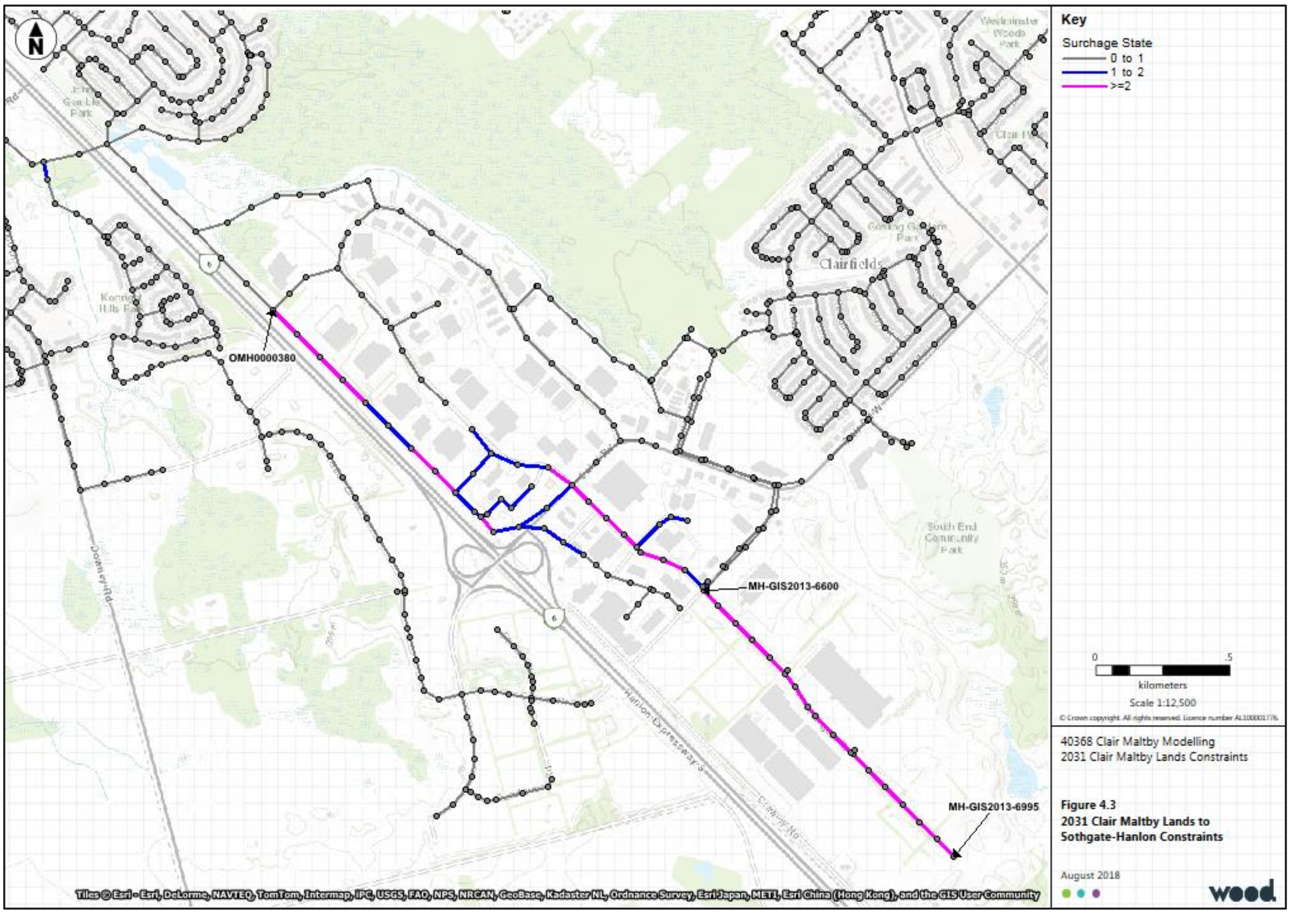


Table 4.4 Clair Maltby Lands Constraints– Clair Gordon Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7275	2.0	246.39	188	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7027	2.0	244.55	170	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7028	2.0	243.19	174	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7029	2.0	241.81	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005977	2.0	240.77	165	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005979	2.0	238.63	178	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005980	2.0	237.97	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005981	2.0	237.06	186	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005982	2.0	236.18	172	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005984	2.0	235.26	181	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005985	2.0	232.89	163	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005986	2.0	233.12	162	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005990	2.0	232.92	155	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005991	2.0	232.11	180	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005992	2.0	231.3	168	Sewer downstream of development connection point. Pipe is now under capacity.
SED0005993	2.0	230.74	169	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006515	2.0	230.43	171	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006516	2.0	54.41	37	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006517	2.0	121.78	83	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006518	2.0	122.22	84	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006519	2.0	123.67	123	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006520	2.0	124.11	112	Sewer downstream of development connection point. Pipe is now under capacity.

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0006521	2.0	125.66	110	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006522	2.0	70	67	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006523	2.0	96.91	71	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006532	2.0	98.58	60	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006533	2.0	99.79	89	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006534	2.0	94.39	71	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006535	2.0	94.54	61	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006553	2.0	94.57	84	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006554	2.0	95.85	57	Sewer downstream of development connection point. Pipe is now under capacity.
SED0006555	2.0	126.11	113	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7274	1.0	93.96	318	Pipes have capacity but are surcharge by depth due to downstream sewer incapacity (see above pipes).
CN-GIS2013-7495	1.0	70.16	104	
SED0004677	1.0	55	82	
SED0004679	1.0	55.36	83	
SED0004683	1.0	56.47	95	
SED0004684	1.0	56.84	98	
SED0004702	1.0	56.44	88	
SED0004704	1.0	57.29	80	
SED0004727	1.0	122.71	132	
SED0004728	1.0	123.18	124	
SED0004732	1.0	69.87	93	
SED0004734	1.0	70.29	84	

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
SED0004742	1.0	94.25	171	
SIP0000017	1.0	277.65	1309	Pipes have capacity but are surcharged by depth. These are triple inverted Siphon pipes under the Speed River so are designed to be surcharged.
SIP0000018	1.0	64.62	114	
SIP0000019	1.0	597.91	1850	

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Southgate-Hanlon connection point has resulted in several downstream constraints. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6995, sections of sewer between the connection point and MH OMH0000380, approximately 3,500m downstream, become under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). Downstream of MH OMH0000380 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows.

Although the additional flows from the Clair Maltby Lands produce significant surcharge in the existing sewer system, no flooding is predicted by the model in the vicinity of the Southgate-Hanlon or at any point downstream to the treatment works, i.e. top water levels do not exceed ground level.

4.5 Clair Maltby Lands Constraint – Victoria Road Connection Point

From the corresponding model simulation, Figure 4.4 and Table 4.5 identifies the downstream constraints from the modelled Victoria Road connection point with 2031 flows applied to the 2031 sewerage network. The model results for all pipes from the connection point downstream to the Wastewater Treatment Works (WwTW) can be found in **Appendix F** alongside model longsections and plans showing the location of identified constraints.

Figure 4.4 Clair Maltby Lands Constraints– Victoria Road Connection Point

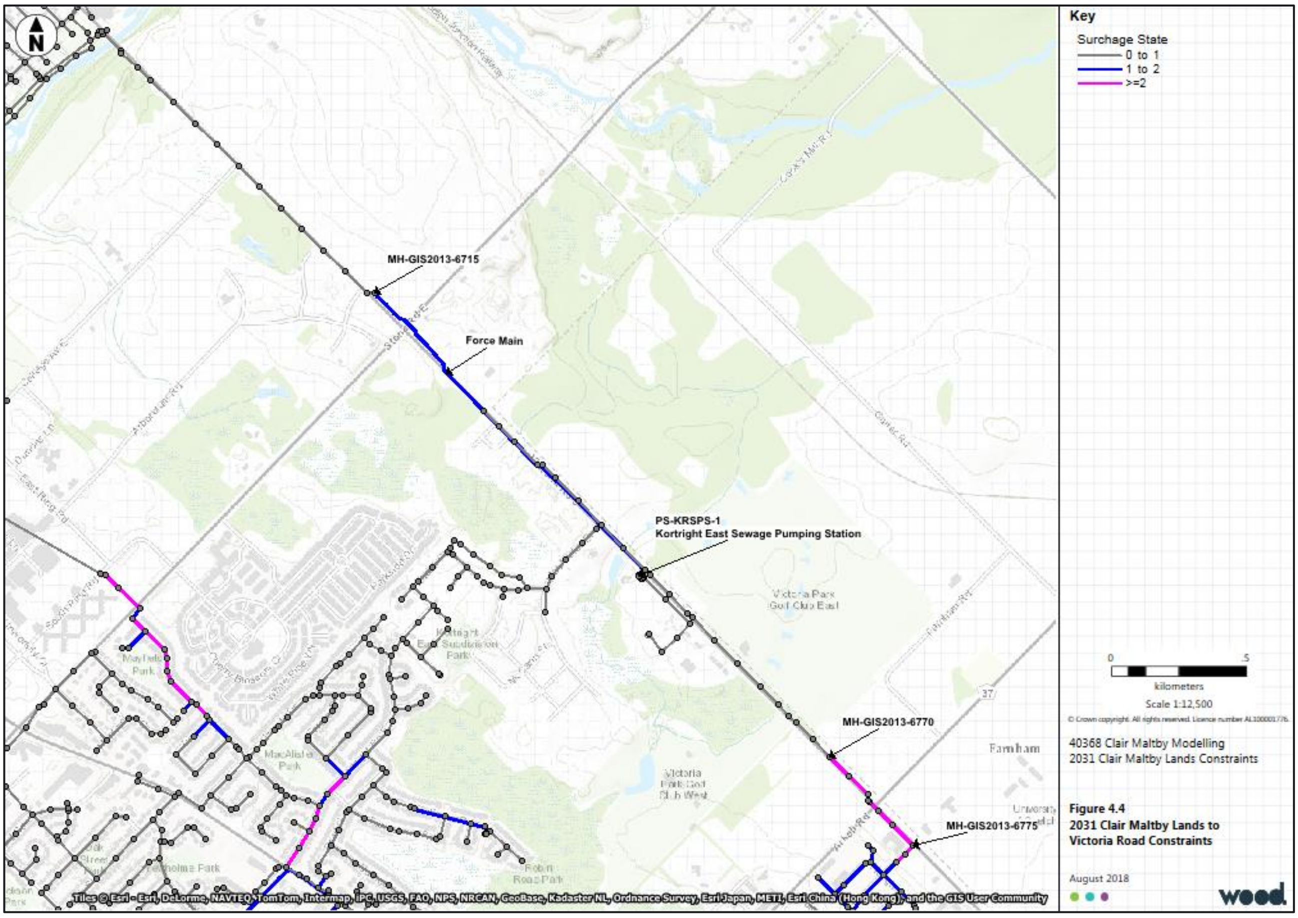


Table 4.5 Clair Maltby Lands Constraints– Victoria Road Connection Point

Asset ID	Max Surcharge State	Max Flow (l/s)	Pipe Full Capacity (l/s)	Comments
CN-GIS2013-7459	2.0	76.68	67	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7461	2.0	73.33	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7462	2.0	76.68	27	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7463	2.0	76.68	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7464	2.0	73.19	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7465	2.0	73.21	32	Sewer downstream of development connection point. Pipe is now under capacity.

CN-GIS2013-7466	2.0	73.26	32	Sewer downstream of development connection point. Pipe is now under capacity.
CN-GIS2013-7436	1.0	196.39	161	Pipe has capacity but is surcharged by depth. This is the Force Main for Kortright East Sewage Pumping Station so is designed to be surcharged.

From the above figure and table, the addition of the flows from the Clair Maltby Lands to the proposed Victoria Road connection point has resulted in downstream constraints close to the connection point itself. With the Clair Maltby Lands flows applied to MH MH-GIS2013-6775 the section of sewer between the connection point and MH MH-GIS2013-6770, approximately 450m downstream, becomes significantly under capacity resulting in surcharge to the system (top water level above pipe soffit/overt). Downstream of MH MH-GIS2013-6770 no further surcharge is predicted by the model and the existing sewers have sufficient capacity to accommodate the additional flows. However, the additional flows from the Clair Maltby Lands to MH MH-GIS2013-6775 are likely to have an impact on the capacity and operation of Kortright East Sewage Pumping Station (model node PS-KRSPS-1) which may need to be investigated further if this connection point is taken forward.

In addition to surcharge, top water levels are also exceeding ground level at points on the network in the vicinity of the Victoria Road connection point. The model predicts significant new flooding in a number of locations as a direct impact of the inclusion of the developments flows to MH MH-GIS2013-6775. Figure 4.5 and Table 4.6 below highlight the locations of the sewer flooding predicted by the model:

Figure 4.5 Clair Maltby Lands Constraints Analysis 2031 Flows – Victoria Road Flooding

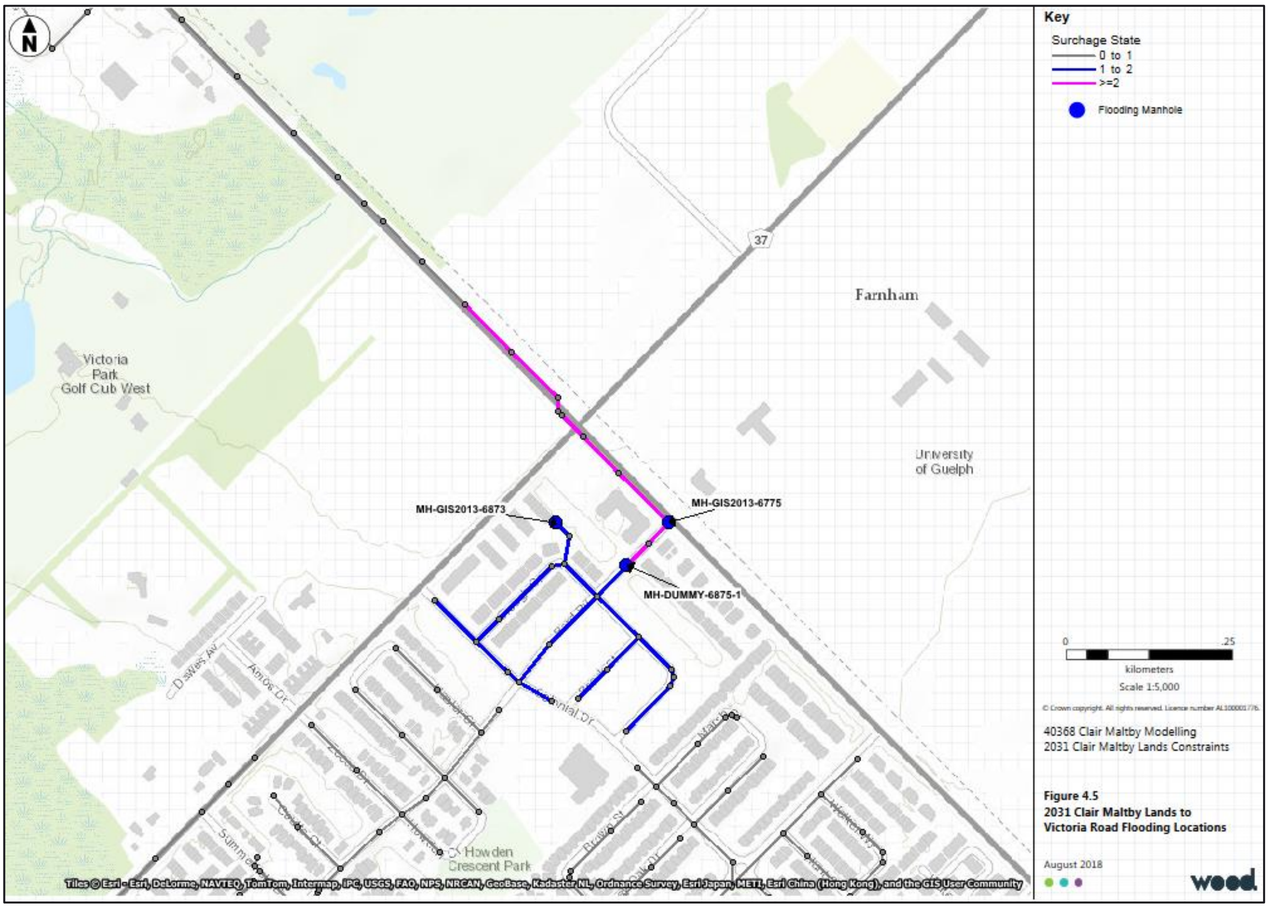


Table 4.6 Clair Maltby Lands Constraints Analysis 2031 Flows – Victoria Road Flooding

Manhole ID	2031 Network 2031 Flows Flood/Lost Volume (m^3)	2031 Network 2031 Flows – Clair Maltby to Victoria Road Flood/Lost Volume (m^3)
MH-DUMMY-6875-1	0	9076.5
MH-GIS2013-6775	0	7936.8
MH-GIS2013-6873	0	2351.3

5. Development Phasing

The constraints analysis for all three potential connection points for the entire Clair Maltby Lands resulted in the identification of significant capacity constraints in the downstream system. Further model analysis was therefore undertaken to identify the percentage of the lands (population and II flows) that could be connected to each point without causing downstream surcharge. This therefore provides an indication of the amount of the lands that can be developed without the need to upgrade the existing sewer system. Alternative connection points for the remaining phases of development, as well as a connection point for the full development, have also been identified.

5.1 Development Phasing - Clair Gordon Connection Point

Model analysis showed that 40% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 8,667 and II of 27.54l/s.

Further analysis showed that if an alternative connection point at MH MHD0005955 is utilised, the system can accommodate 60% of the Clair Maltby Lands. This equates to 13,000 population and 44.75l/s II. There is no predicted downstream surcharge due to an increase in pipe size at this point from 450mm to 600mm diameter.

Alternatively, 100% of the developable lands could be connected to MH MHD0004348 as the system downstream of this point is able to accommodate all of the development flows. There are no predicted constraints in the system downstream to the treatment works.

Figure 4.2 above identifies the three potential connection points on the Clair Gordon system.

5.2 Development Phasing – Southgate-Hanlon Connection Point

Model analysis showed that only 10% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 2,167 and II of 6.88l/s.

Further analysis showed that 100% of the developable lands could be connected to an alternative location, MH OMH0000380, where the downstream system is able to accommodate the development flows.

Figure 4.3 above identifies the two potential connection points on the Southgate-Hanlon system.

5.3 Development Phasing – Victoria Road Connection Point

Model analysis showed that only 10% of the Clair Maltby Lands can be accommodated without any detrimental effect on the downstream system. This equates to a population of 2,167 and II of 6.88l/s.

Further analysis showed that is an alternative connection point at MH MH-GIS2013-6770 is used, the model predicts that 40% of the Clair Maltby Lands can be accommodated. This is due to the increase in pipe diameter from 250mm to 375mm resulting in an increased pipe full capacity at this point. The 40% equates to a population of 8,867 and a II flow of 27.54l/s.

Alternatively, 100% of the developable lands could be connected to MH MH-GIS2013-6715 which is situated at the discharge location of the Kortright East Sewage Pumping Station Force Main. The model predicts no detriment to the system. In addition, this would remove the need to upgrade the pumping station to accommodate the additional flows from the Clair Maltby Lands.

Figure 4.4 above identifies the three potential connection points on the Victoria Road system.

Author	**Reviewer**
....	....
Alistair Dalton	**Iris Isaksen**

Appendix A
Model Validation log

Refer to digital folder "Appendix A - Model Validation log"

Appendix B
Constraints Analysis 2012 Network 2012 Flows

Refer to digital folder "Appendix B - Constraints Analysis 2012 Network 2012 Flows"

Appendix C
Constraints Analysis 2031 Network 2031 Flows

Refer to digital folder "Appendix C - Constraints Analysis 2031 Network 2031 Flows"

Appendix D
Constraints Analysis Clair Gordon Connection Point

Refer to digital folder “Appendix D - Constraints Analysis Clair Gordon Connection Point”

Appendix E
Constraints Analysis Southgate-Hanlon Connection Point

Refer to digital folder "Appendix E - Constraints Analysis Southgate-Hanlon Connection Point"

Appendix F
Constraints Analysis Victoria Road Connection Point

Refer to digital folder “Appendix F - Constraints Analysis Victoria Road Connection Point”

Appendix G
Clair Maltby InfoWorks ICM Model

Refer to digital folder “Appendix G - InfoWorks ICM Model”

APPENDIX B
PLANNING INPUT

Clair-Maltby Population and Employment Feb 8 2018

Land Use	Gross Area (Ha)
Study Area	**538.17**

Gross to Net	
Non-Developable Lands	
Rolling Hills Residential	71.11
Cultural Heritage Landscape	4.91
NHS	216.25
Total	**292.27**

Land Use	Gross Area (Ha)	Net Area	Units per Net Hectare		Units (Res)		PPU	Jobs per hectare	Pop		Jobs		Pop + Jobs (Total)	
			Min	Max	Min	Max			Min	Max	Min	Max	Min	Max
Built-Up Area														
Medium Density Residential	8.42	6.82	40	100	273	682	2.45		668	1671			668	1671
Existing Roads		0.34												
Local Roads	15%	1.26												
Mixed Use	1.53	1.26												
Existing Roads		0.12												
Local Roads	10%	0.15												
Commercial	25%	1.70						72			123	123	123	123
Residential	75%	0.95	40	100	38	95	1.68		64	159			64	159

Land Use	Gross Area (Ha)	Net Area	Units per Net Hectare		Units (Res)		PPU	Jobs per hectare	Pop		Jobs		Pop + Jobs (Total)	
			Min	Max	Min	Max			Min	Max	Min	Max	Min	Max
Greenfield Area														
Urban-Rural Transition	10.07	6.73	20	40	135	269	3.33		448	897			448	897
Local Roads	20%	2.01												
Collector Roads		0.42												
SWM	9%	0.91												
Low Density Residential	131.65	56.25	20	40	1,125	2,250	3.33		3,746	7,492			3,746	7492
Local Roads	20%	26.33												
Collector Roads		11.22												
Neighbourhood Parks		8.00												
Community Park		10.00												
Elementary Schools		8.00												
SWM	9%	11.85												
Medium Density Residential	43.08	24.89	40	100	995	2,489	2.45		2,439	6,097			2,439	6097
Local Roads	15%	6.46												
Collector Roads		7.85												
SWM	9%	3.88												
High Density Residential	23.84	14.59	100	200	1,459	2,917	1.68		2,451	4,901			2,451	4901
Local Roads	10%	2.38												
Existing Roads		3.87												
Collector Roads		0.85												
SWM	9%	2.15												
Mixed Use	6.91	3.47												
Local Roads	10%	0.69												
Existing Roads		0.99												
Collector Roads		1.14												
SWM	9%	0.62												
Commercial	25%	0.87						72			62	62	62	62
Residential	75%	2.60	100	200	260	520	1.68		437	874			437	874
Employment	20.40	15.87						36			571	571	571	571
Local Roads	10%	2.04												
Collector Roads		0.66												
SWM	9%	1.84												
Undercount (3.5%)									359	773			359	773
Total Developable Lands	**245.90**								**9,880**	**21,034**	**634**	**634**	**10,065**	**21,668**
acres	**607.38**													

Total Non-Developable & Developable	**538.17**
Area check	538.17

Notes:
The Gross areas (in red) represent the total gross area of the land use.
Net area is the gross area of the land use, subtract the hard/soft servicing.

Proposed Collector Roads	26m	City email 1/3/2018
Community park	10ha	City email 1/3/2018
Neighbourhood Park	1ha	City email 1/3/2018
Elementary School	2ha	City email 1/3/2018
Trail Outside NHS	5m	City email 1/3/2018
Densities	as per table	City emails 1/3/2018, 2/8/2018
SWM	9%	Schekenberger email Jan 10, 2018
Undercount	3.50%	Jamie Cook email Jan 25, 2018
PPUs	as per table	Jamie Cook email Jan 25, 2018