APPENDIX A
Technical Memorandum: Wastewater Model Development and Results

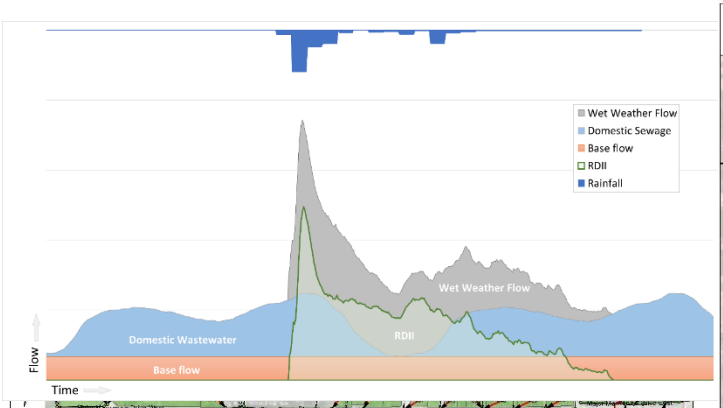
City of Richmond Hill

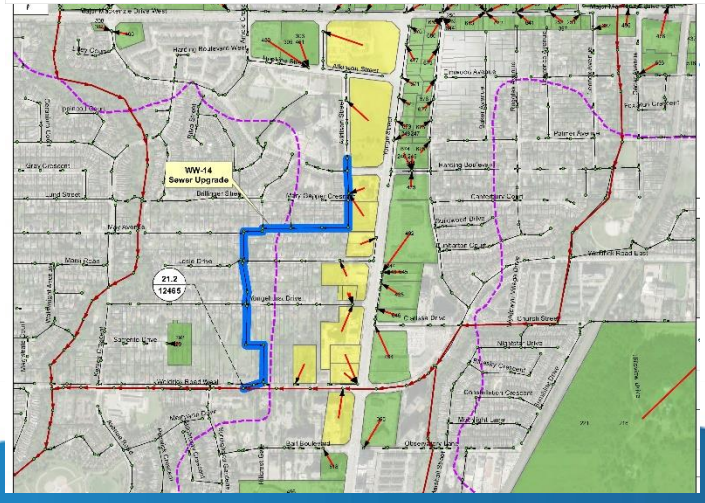
Civica Reference: RIC18-0004

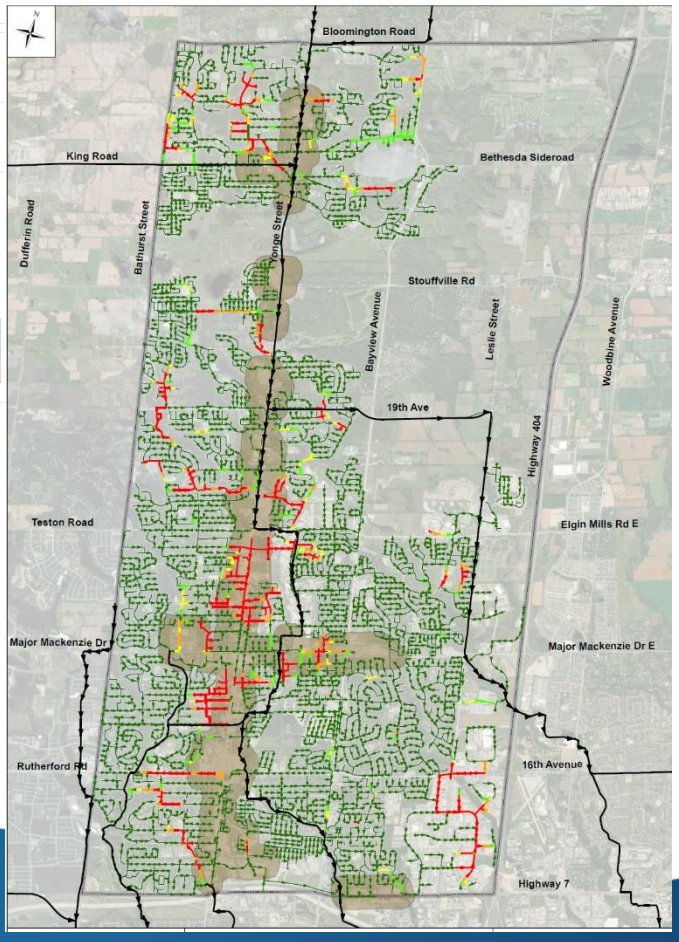
Urban MESP Update Study

Final Technical Memorandum: Wastewater Model Development and Results

October 31, 2023







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October 31, 2023 **CIVICA Ref: RIC18-0004**

City of Richmond Hill
225 East Beaver Creek Road
Richmond Hill, ON
L4B 3P4

Attention: Jeff Walters, P. Eng.
Manager, Development Engineering (Stormwater and Subdivisions)

RE: Technical Memorandum: Wastewater Model Development and Results Assessment

Dear Mr. Walters,

Please find enclosed the Wastewater Technical Memorandum for your review.

Do not hesitate to contact us for further clarification and/or comment.

Sincerely,

CIVICA INFRASTRUCTURE INC.

Alan Villalobos
Project Manager

cc: Edward Graham, Civica Infrastructure

Encl. Technical Memorandum: Wastewater Model Development and Results Assessment

Document History & QA/QC

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Revision History

Name	Date	Reason for Change	Version
Alan Villalobos	**2019-05-24**	**First Draft**	**Version 1**
Alan Villalobos	**2023-03-31**	**Updated Growth Projections**	**Version 2**
Alan Villalobos	**2023-09-13**	**Address City's and Region's comments**	**Version 3**
Alan Villalobos	**2023-10-06**	**Address City's and Region's comments**	**Draft Final**
Alan Villalobos	**2023-10-31**	**Address City's and Region's comments**	**Final**

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1.0 Introduction

1.1 Background Review

In 2010, Richmond Hill Council adopted a new Official Plan (OP) that sets out the long-term vision for growth and development in Richmond Hill. Given that Richmond Hill's settlement area is nearly built out, most of the future growth and development in the City will occur through intensification. Directing new growth to the centres and corridors as set out in the Plan represents a city-building approach to developing a complete community. The hierarchy of centres and corridors is intended to achieve the City's intensification target and accommodate growth based on a comprehensive land use planning framework to direct and manage population and employment growth to 2051.

In 2014, the City completed an Urban Master Environmental Servicing Plan (UMESP). The UMESP was undertaken to identify the infrastructure work needed to support the planned growth and intensification within centers and corridors identified in the City's Official Plan.

1.2 Objectives

The purpose of this Technical Memorandum is to evaluate the existing sanitary sewer system using a detailed hydrodynamic InfoWorks ICM model, with the following objectives:

- To define the performance of City's sanitary sewer system with respect to the magnitude and extent of surcharging/overloading in the wastewater collection system;
- To identify locations where surcharge potentially will cause basement flooding; and
- To aid in the development and evaluation of mitigation measures for basement flooding.

Existing deficiencies and limitations within the drainage system are identified. The results presented here will be used to define alternative improvement measures prior to developing the preferred alternative.

1.3 Study Area

The study area will include the network of centres and corridors which include the secondary plan areas for local centres, key development areas, and the Richmond Hill Centre urban growth centre, as well as the other remaining intensification areas identified within the Richmond Hill Official Plan. This MESP update study area extends beyond these urban structure elements, where necessary, to ensure that the analyses and infrastructure recommendations account for any interdependencies with adjacent areas.

Note that the study area is consistent with the 2014 UMESP. **Figure 1-1** shows the boundary of the study area.

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N

Bloomington Road

King Road

Bethesda Sideroad

Dufferin Road

Bathurst Street

Stouffville Rd

Bayview Avenue

Leslie Street

Woodbine Avenue

19th Ave

Yonge Street

Highway 404

Teston Road

Elgin Mills Rd E

Major Mackenzie Dr

Major Mackenzie Dr E

Rutherford Rd

16th Avenue

Highway 7

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Legend

- Study Areas
- Emerging Growth Centres
- Municipal Boundary

Figure 1-1:
Study Areas

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

2.0 Model Development

The sanitary system modelling conducted as part of the 2014 UMESP was done using InfoSewer. As the Region of York has been using InfoWorks as their standard modelling tool for sanitary systems, the existing InfoSewer model was converted to InfoWorks ICM. This should allow for more functionality if further modelling is required and would be consistent with the Regional model.

2.1 Existing Infrastructure

The City of Richmond Hill currently owns and operates approximately 9,292 sanitary sewers and 8,928 sanitary maintenance holes. The sewer diameters range from 125 mm to 2,700 mm. The City's wastewater collection system discharge to four Regional trunk sewers which flow in a southerly direction, including:

- The North Don Collector;
- The Central Collector;
- The Richmond Hill Collector (also referred to as the Yonge Street Collector); and,
- The 19th Avenue Collector (which flows east to the YDSS).

For the purpose of this study, the study area was limited to the local sanitary sewers. **Figure 2-1** illustrates the local and the Regional trunk systems.

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N

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Major Mackenzie Dr

Major Mackenzie Dr E

Rutherford Rd

16th Avenue

Highway 7

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Legend

- Existing Sanitary Manholes
- Existing Sanitary Conduits
- Study Boundary
- Emerging Growth Centres
- Municipal Boundary

Figure 2-1:
Wastewater Collection System

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

2.2 Data Gaps Infill and Rectification

The sewer network information was initially assembled using both the sewer network database provided by the City and the previous InfoSewer model; however, some assets had one or multiple gaps or issues. Therefore, appropriate assumptions were made to rectify/infill the data gaps. However, future verification is recommended for purposes other than hydraulic capacity. **Figure 2-2** shows the location of the pipes with inferred data. **Table 2-1** summarizes the assumptions made to infill data gaps. The detailed assumptions are also documented internally in the model input data.

Table 2-1: Summary of data gaps rectification in wastewater network

Structure Type	Parameter	Number of Records	Number of Missing or Zero Values	Percent Missing (%)	Infill Data Source / Assumptions
Sewers	Upstream Node ID	9,338	9,338	100%	Search for MH ID by coordinates
	Downstream Node ID	9,338	9,338	100%	Search for MH ID by coordinates
	Diameter	9,338	2	0%	Review of previous InfoSewer model and/or interpolate based on surrounding sewers
	Upstream Invert	9,338	9	0%	Review of previous InfoSewer model and/or interpolate based on surrounding sewers
	Downstream Invert	9,338	10	0%	Review of previous InfoSewer model and/or interpolate based on surrounding sewers
	Negative Slope	9,338	64	1%	Review of previous InfoSewer model and/or interpolate based on surrounding sewers
	Total	**65,366**	**18,761**	**29%**	
Manholes	Ground Elevation	9,362	9,362	100%	Review of previous InfoSewer model or obtain from DEM
	Bottom Elevation	9,362	9,362	100%	Interpolate from sewer invert elevation
	Node is not connected to a link	9,362	625	7%	Will be deleted
	Node missing	9,362	422	5%	Will define dummy nodes
	Outlet invert higher than inlet invert in the manhole	9,362	391	4%	Search TMIG InfoSewer model and York Region YDSS model
	Total	**46,810**	**20,162**	**43%**	

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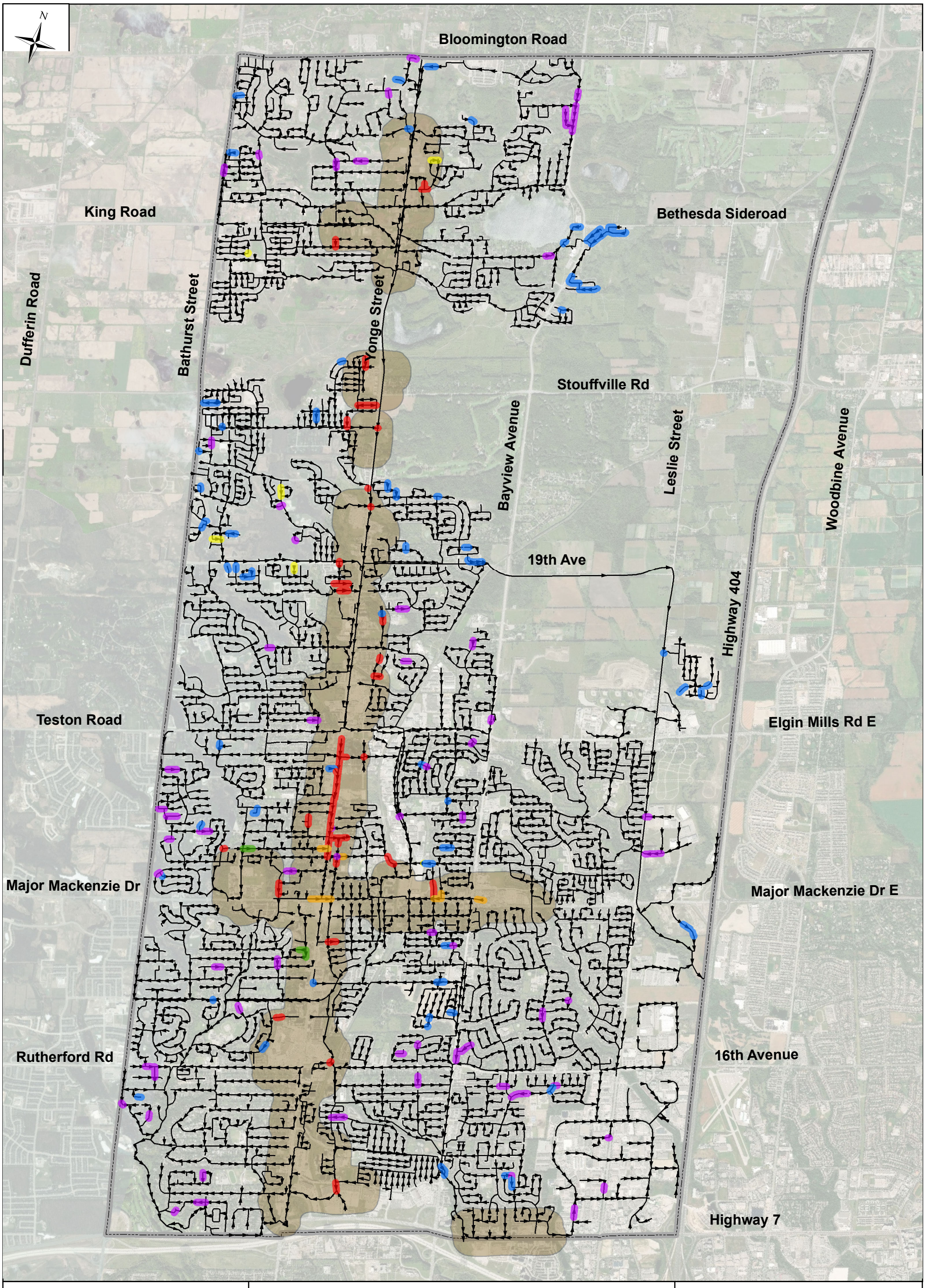

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Legend

Sewer Inferred Locations:

- Town As-built drawings
- Town drawings marked Not As-built
- TMIG InfoSewer Data
- Civica Survey
- York Region YDSS
- Data Assumed

- Existing Sanitary Conduits
- Study Areas
- Municipal Boundary

Figure 2-2:
Location of Sewers with Inferred Data

Drawn By: J.H. Date: May 22, 2019

0 500 1,000 2,000 Meters

2.3 Subcatchment Delineation

The subcatchments were discretized based on the lot fabric shapefile information, and population was assigned using the 2016 census data per Traffic Zone (TZ) and the Water Consumption (WC) data. A total of 7,536 subcatchments were delineated for the City's model. The 2016 annual water consumption data per individual address was used to distribute the population within each traffic zone. The method is to assume that population is proportional to the water consumption, as shown in **Figure 2-3**. The process to estimate the population included the following steps:

1. Sum the total annual water consumption in each traffic zone.
2. Calculate the population at water meter location as per the following equation:

$$Subcatchment\ Population = \frac{WC\ in\ Subcatchment}{Total\ WC\ in\ TZ} \times Total\ Residential\ Population\ in\ TZ$$

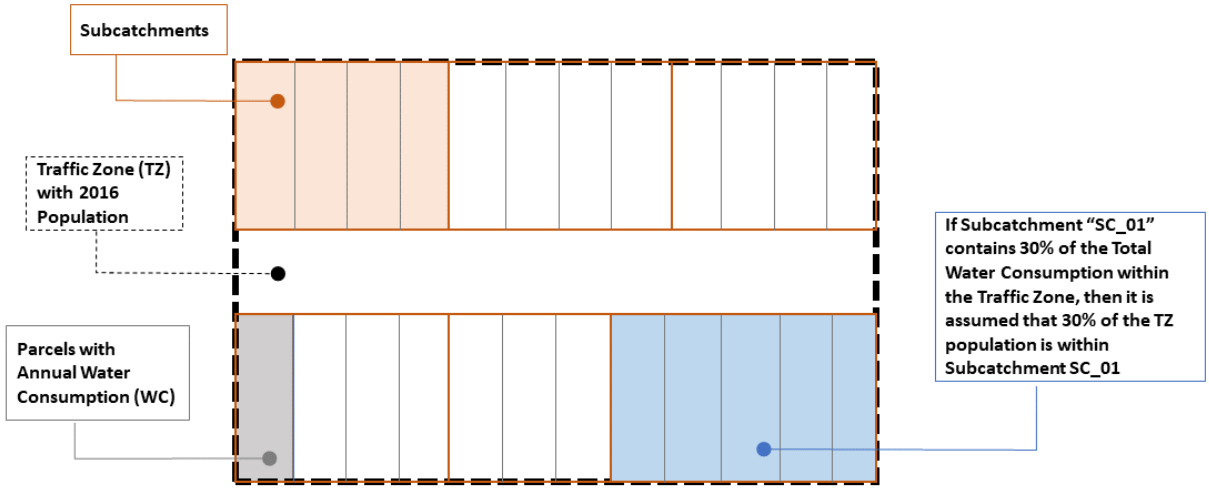

Figure 2-3: Concept of population estimates based on water consumption records

2.4 Boundary Conditions

There are no upstream boundary conditions for the City's hydraulic model. For downstream boundary conditions, the Regional trunk sewers were evaluated under the 25-year design storm and confirmed no surcharge conditions. Therefore, it can be concluded that there is no backflow affecting local sewers, and the downstream system can be modelled as free flow outfalls.

2.5 Wastewater Flow Generation

This section discusses the flow generation procedure within the model for the sanitary sewer system. In general, any sanitary sewer system conveys flow from the following sources:

- Domestic Sewage (Residential and ICI);
- Base flow (Ground Water Infiltration, GWI); and,
- Rainfall-Derived Inflow and Infiltration (RDII).

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The first two sources of flow generation are considered as dry-weather flow (DWF). The third source is the extraneous flow known as RDII or I/I. Extraneous flows are undesirable as they increase the load on the sanitary sewer and reduce the capacity on treatment facilities. The amount of extraneous flow captured and carried in the sanitary sewers depends not only on the supply of water from rain, snowmelt, or groundwater, which are comparatively easy to predict, but also on the sewer system conditions, which are very difficult to predict. The sewer system conditions reflect the physical conditions of the sewer system. Within the sewer system there may be several types of obstructions such as debris, cracks or even collapsed walls. The physical condition of the sewer system may cause greater I/I into the sewer and /or create blockages allowing for significant surcharging. **Figure 2-4** illustrate a typical sanitary flow hydrograph under WWF conditions.

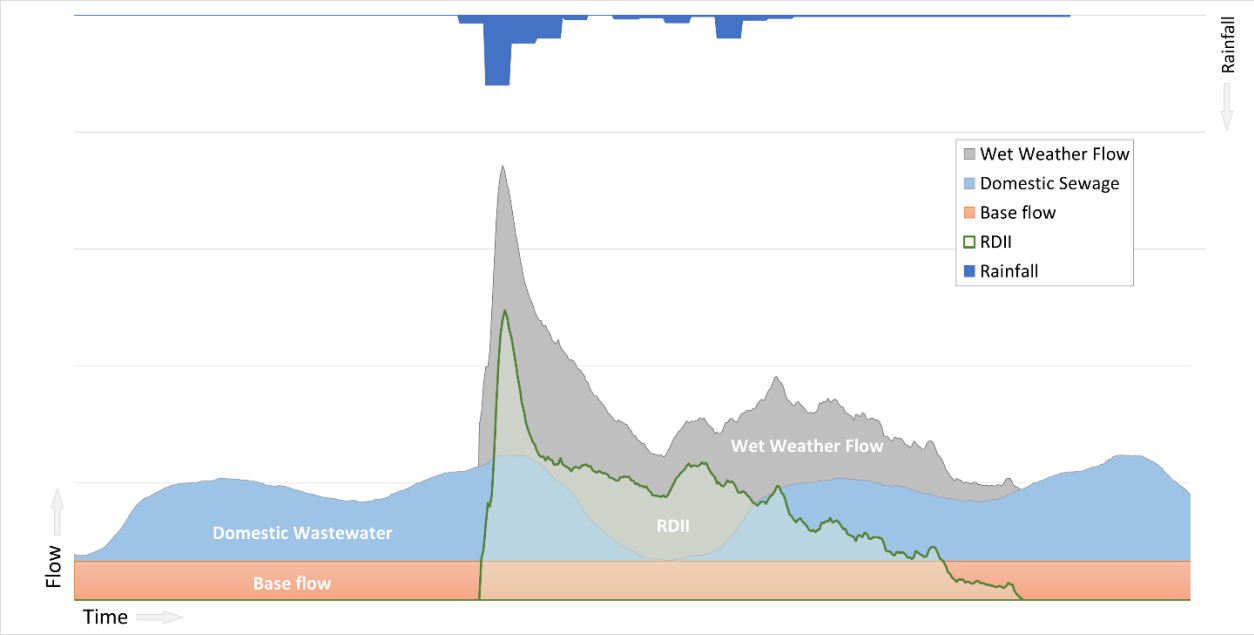

Figure 2-4: Sanitary wet-weather flow components

2.5.1 Base Flow

Baseflow represents the DWF infiltration of a sanitary system. This occurs as a result of defects in pipes, joints and manhole connections. Baseflow includes constant commercial discharges such as wash water, cooling water, laundromats, etc. For the purpose of this report, the baseflow or groundwater infiltration accounts for 85% of the minimum flow daily flow. Note that the baseflow is included as part of the average daily wastewater DWF profile.

2.5.2 Domestic Sewage

Wastewater generated from residential and employment lands is calculated based on measured flow, population data from the 2016 Census data and diurnal patterns extracted from the flow data. As mentioned above the estimated baseflow is included in the total wastewater DWF profiles.

2.5.3 Rainfall-Derived Inflow and Infiltration

Rainfall-Derived Inflow and Infiltration (I/I) represents any extraneous source of water entering the sanitary system as a result of a storm event. The amount of I/I is calculated separately in the model based

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on observed data. Since the amount of I/I varies between subcatchments primarily due to cross-connections, sewer infrastructure condition, soil conditions, and topography, the value is estimated by calibrating the model. The selected calibration method is the InfoWork's Groundwater Infiltration Module (GIM) which is described in **Section 3.2**.

3.0 Model Calibration

3.1 Rain and Flow Monitoring Assessment

Available historical rainfall and flow monitoring data was reviewed and analyzed to characterize dry weather flow (DWF) and wet weather flow (WWF) for use in the hydrodynamic model calibration. The flow monitoring data provides an indication of the performance of the wastewater network under various rain events.

Flow data from twenty-one (21) sanitary flow monitoring stations and three (3) rain gauges were selected for this study. **Figure 3-1** shows the location of these flow meter stations and rain gauges.

3.1.1 Dry Weather Flow

The measured flow parameters for each subcatchment are summarized in **Table 3-1**. These values were calculated using data from the 2016 flow monitoring period. The population is estimated based on the 2016 Census and Traffic Zone given by the City.

As measured, DWF Rate is defined as the per-capita daily water use plus GWI or baseflow. This value is entered as the "Per Capita Flow (Domestic)" parameter in the InfoWorks ICM model. As shown in **Table 3-1** the DWF rates (per-capita flow rates) range from 83 L/c/d to 400 L/c/d with an average of 254 L/c/d. For non-monitored areas, the York Region's design DWF rate of 265 l/c/d was used.

Table 3-1: DWF Parameters used in the model

Flow Monitoring Station	Area (ha)	Land Use (1)	Residential Population	ICI Population	Total Population	Daily DWF Volume (L)	DWF Rate (L/c/d)	Measured Peaking Factor
RH002_10	31.6	Res	954	38	992	320,475	323	1.64
RH003_10	134.3	Res	4,957	206	5,163	1,403,637	272	1.34
RH003_20	26.2	Res	933	232	1,165	327,971	282	1.33
RH004a_10	366.9	Res	11,920	1,620	13,540	3,737,550	276	1.31
RH008_10	69.2	Res	3,979	-	3,979	990,285	249	1.49
RH010_10	111.7	Res	6,148	391	6,539	1,025,462	157	1.83
RH012	83.5	Res	3,921	427	4,348	996,909	229	1.59
RH013_10	38.8	Res	2,198	302	2,500	679,759	272	1.61
RH014_10	213.8	Res	11,109	519	11,628	3,106,695	267	1.7
RH058	221.3	Res	11,739	1,569	13,308	2,310,197	174	1.42
RH056_m03	82.2	Res + ICI	1,922	1,684	3,606	298,930	83	1.51
RH017_10	99.7	Res + ICI	2,275	3,124	5,399	1,059,969	196	1.39
RH055_20	65.0	Res	1,922	116	2,038	814,968	400	1.21

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Flow Monitoring Station	Area (ha)	Land Use [1]	Residential Population	ICI Population	Total Population	Daily DWF Volume (L)	DWF Rate (L/c/d)	Measured Peaking Factor
RH029_10	157.4	Res + ICI	5,667	3,141	8,808	2,048,231	233	1.25
RH030_10	78.7	Res	3,328	777	4,105	1,284,364	313	1.34
RH033_10	27.1	Res	1,238	246	1,484	341,250	230	1.31
RH050_10	67.8	Res	1,499	359	1,858	731,657	394	1.17
RH040	88.3	Res + ICI	6,889	2,533	9,422	1,988,368	211	1.48
RH042_10	70.5	Res + ICI	1,594	460	2,054	646,910	315	1.26
RH048b	151.5	Res	5,993	1,306	7,299	1,671,329	229	1.55
Civica FM3	139.8	Res + ICI	5933	3744	9677	2,212,638	223	1.23

[1] Areas with 80% or more residential land use were assumed to be Residential (RES), areas with 80% or more ICI land use were assumed to be ICI, the rest were assumed to be mixed-used (Res + ICI)

3.1.2 Wet Weather Flow Analysis

The number and magnitude of significant storms is important for assessing the suitability of the data for model calibration. The greater the number and larger the magnitude of storms, the more reliable and accurate the model should be when used to predict system response during critical (design) storms. **Table 3-2** summarizes the most intense storms captured during the 4-months period, from May 1, 2016 to August 31, 2016, selected to calibrate the model.

Table 3-2: The 5 most intense storms captured during the 4-months monitoring period

Event	R YR RH 01 Peak Intensity 5 min (mm/hr)	R YR RH 10 Peak Intensity 5 min (mm/hr)	R YR RH 15 Peak Intensity 5 min (mm/hr)	Return Period
August 13, 2016	74.4	55.2	84.0	< 2-year
July 25, 2016	64.8	62.4	62.4	< 2-year
June 11, 2016	55.2	62.4	52.8	< 2-year
July 27, 2016	50.4	0	43.2	< 2-year
June 5, 2016	38.4	19.2	26.4	< 2-year

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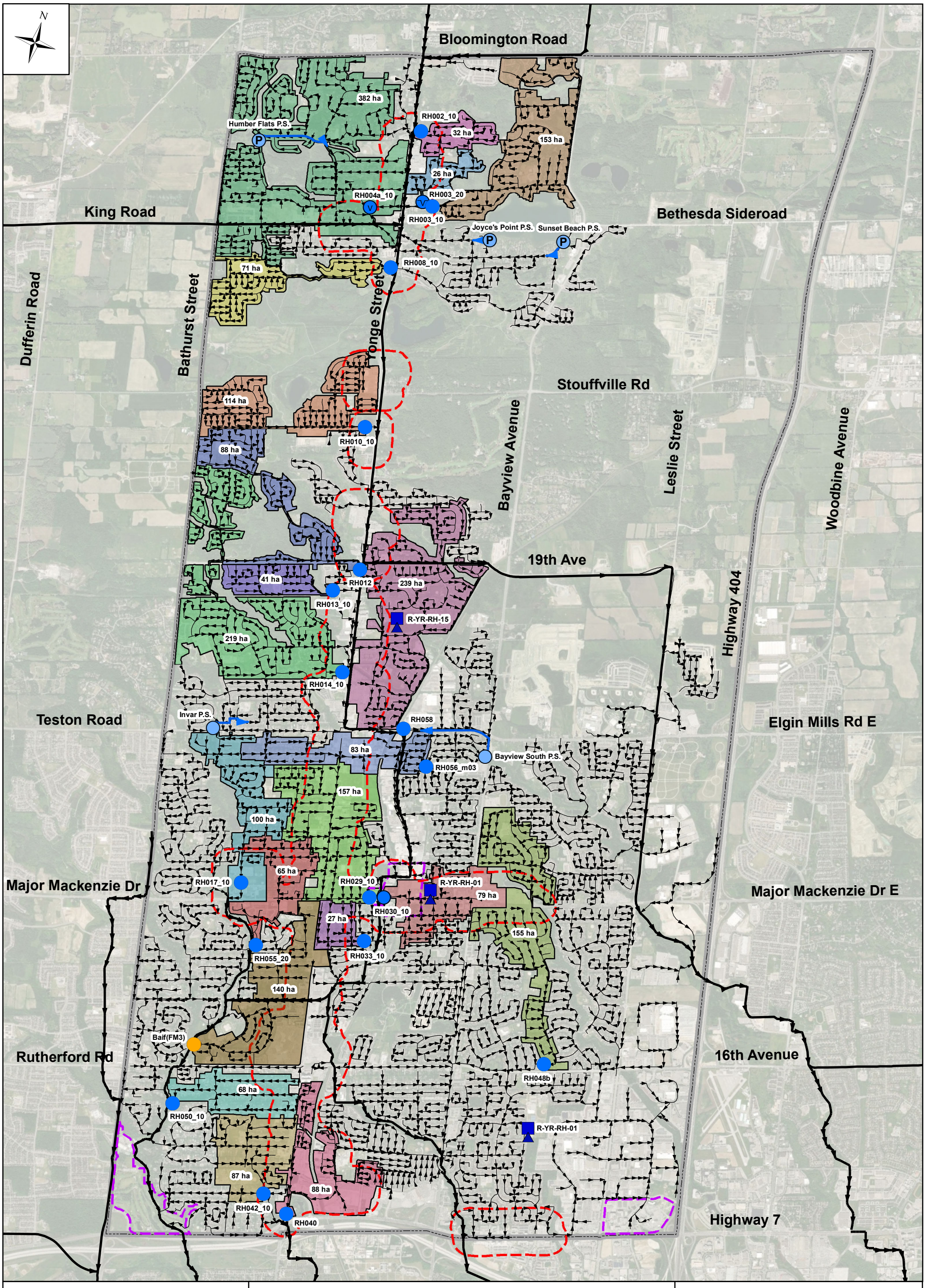

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Legend

- 2016 Flow Monitoring Locations (20)
- 2017 Flow Monitoring Location (1)
- 2016 Rain Gauges (3)
- Existing Pumping Stations (5)
- Forcemains
- Sanitary Sewers
- York Region Sanitary Trunk Sewers
- Drainage Area
- Study Areas
- Emerging Growth Centres
- Municipal Boundary

Figure 3-1: Drainage Areas and Flow Monitoring Locations (2016 & 2017)

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

3.2 Ground Water Infiltration Module

The Groundwater Infiltration Module (GIM) method was used to calibrate the model for wet weather responses. The advantage of the InfoWorks GIM is to provide a large, highly attenuated response to rainfall which typically originates from groundwater infiltration, or large pervious areas of the catchment, as well as to allow continuous simulation.

The GIM provides two additional options in which rainfall can enter the sewer. The first option, called soil storage reservoir, represents the process whereby rainfall can seep through the soil and enter the sewer through cracks in the pipes. The second infiltration mechanism, called groundwater store reservoir, represents the process when water table level rises due to rainwater percolation. When the water table level exceeds the pipe invert level, there is a further contribution to the sewer. **Figure 3-2** illustrates the concept of groundwater infiltration module in InfoWorks.

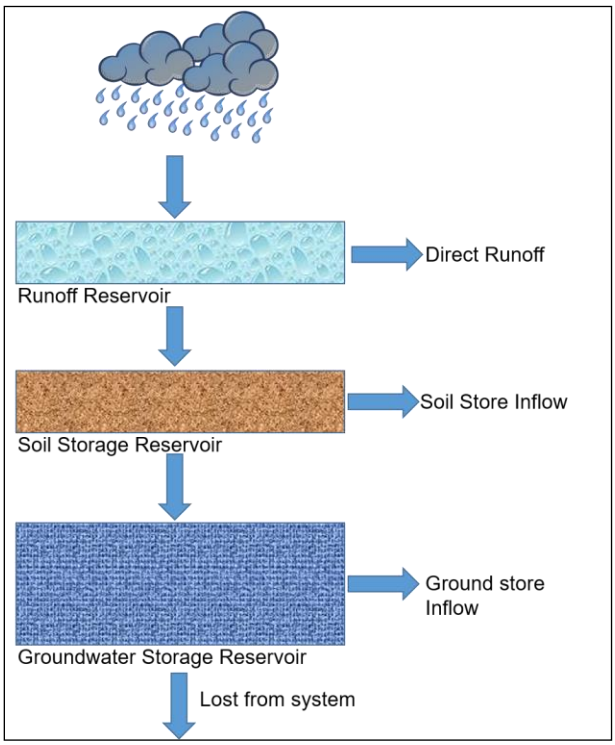

Figure 3-2: InfoWorks GIM conceptual representation

The following assumptions are made about the GIM:

- The reservoirs act independently. In other words, the groundwater level could be higher than the soil store level;
- The GIM takes no account of the flow depth in the pipe. There could therefore be I/I into a pipe that is surcharged; and,
- There is no interaction between ground water levels in subcatchments. The water table levels could be very different in adjacent catchments without any transfer of flow between them.

There is a total of ten (10) parameters used in GIM. Of these, the Porosity of Soil, Porosity of Ground and the Soil Depth should be fixed as they have a physical basis. The remaining seven (7) parameters are

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calibration coefficients and these should be adjusted to match the observed flows. The continuous simulation accounts for antecedent moisture conditions (AMC) which may have an impact on the I/I response. **Table 3-3** shows the parameters used in the InfoWorks GIM.

Primarily, the AMC has an impact on medium and slow I/I response, which is typically generated from pervious areas and infiltration through the soil and into cracks in the pipes. The Urban Catchment Wetness Index (UCWI), in the Rainfall-Sub event dialog, defines the antecedent moisture conditions.

When a long-term simulation is analyzed, the user will have to set an initial UCWI which will affect only the AMC of the first storm event. When evaluating a non-monitored storm event or when using a design storm, it is recommended to use the average UCWI predicted at the beginning of each storm during the long-term calibration.

Table 3-3: GIM parameters

Parameter	Description
Soil Depth	This is the depth of soil available to receive runoff. It is generally the cover depth to the pipes. A value is fixed and not usually varied.
Percolation Coefficient	A time coefficient determined by calibration from existing data. Increasing the Percolation Coefficient increases the duration of the infiltration flow.
Baseflow Coefficient	A time coefficient determined by calibration from existing data. Increasing both the Baseflow Coefficient and the difference between the Baseflow Threshold Level and the Infiltration Threshold Level, increases the time between groundwater infiltration events.
Infiltration Coefficient	A time coefficient determined by calibration from existing data. Increasing the Infiltration Coefficient increases the duration of groundwater infiltration.
Percolation Threshold	The percentage saturation level of the soil at which water starts to percolate downwards. Increasing the Percolation Threshold increases the lag between when the storm starts and when infiltration starts
Percolation Percentage Infiltrating	The percentage of percolation flow that infiltrates directly into the drainage network. Increasing Percolation Percentage Infiltrating increases the volume infiltrating.
Porosity of Soil	This is the percentage of air in the soil store. For a given volume of runoff, decreasing this value will increase the soil store depth and hence the percolation threshold will be reached sooner. Therefore, increasing this value reduces the initial losses in the soil store.
Porosity of Ground	This acts the same way as the porosity of soil. Decreasing this value will increase the rate of rise of the groundwater store. Therefore, the amount of inflow required to reach the baseflow and infiltration thresholds is reduced.
Baseflow Threshold Level	This is the groundwater store level at which there is a contribution from the groundwater store to the 'lost to groundwater'. Therefore, increasing this value will increase the contribution from the groundwater store to the sewer.
Infiltration Threshold Level	The level of the groundwater storage reservoir at which groundwater infiltration occurs. Increasing both the Baseflow Coefficient and the difference between the Baseflow Threshold Level and the Infiltration Threshold Level, increases the time between groundwater infiltration events.

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3.3 Calibration Results

Once the network was built and all the gaps were filled, the model was calibrated. The calibration process was undertaken when the validation was free of significant warnings, instabilities and errors. The calibration consisted of adjusting the InfoWorks GIM parameters to match as best as possible the simulated flows to the observed flows. When flow monitoring stations are installed in series (flow from the upstream flow meter contributes to a flow meter downstream), the calibration process starts first at the upstream subcatchments.

The WaPUG (Wastewater Planning Users Group) criterion was applied to assess the quality of the calibration. A subcatchment area was considered calibrated when the peak flow, volume and shape of the hydrograph met the following WaPUG criteria:

- Non-instantaneous peak flow matches within -15% to +25%;
- Depth matches within -10% to +20%
- Volume matches within -10% to +20%; and,
- The modelled hydrograph resembles the shape of the observed hydrograph for the duration of the event.

A 4-month period, from May 1, 2016 to August 31, 2016 was selected to calibrate the City's sanitary sewer. The GIM parameters used in the calibration are presented in **Table 3-4**. An initial UCWI of eighty (80) was used in the calibration. Note that this value only affects the first storm. The results show good agreement between the measured and modelled values for all stations, as shown in **Table 3-5**.

With the exception of station RH003_20 where the predicted peak flow for the August 14-19 event is 33% higher than the observed peak flow, the results shows that all the other simulated events were within the WaPUG criteria in terms of both peak flow and total volume. This confirms that the model is able to project the actual scenario within an acceptable deviation.

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Table 3-4: GIM Parameters used in the model calibration

Station / GIM ID	Parameters									
	Soil Depth (m)	Percolation Coefficient	Baseflow Coefficient	Infiltration Coefficient	Percolation Threshold	Percolation Percentage Infiltrating	Porosity of Soil	Porosity of Ground	Baseflow Threshold Level[(1)] (m)	Infiltration Threshold Level[(1)] (m)
RH002_10	4	0.1	0.01	0.2	35	4	40	40	-100	100
RH003_10	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH003_20	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH004a_10	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH008_10	4	0.1	0.01	0.2	35	4	40	40	-100	100
RH010_10	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH012	4	0.1	0.01	0.2	35	2	40	40	-100	100
RH013_10	4	0.1	0.01	0.2	35	6	40	40	-100	100
RH014_10	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH058	4	0.1	0.01	0.2	35	2	40	40	-100	100
RH056_m03	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH017_10	4	0.1	0.01	0.2	35	3	40	40	-100	100
RH055_20	4	0.1	0.01	0.2	35	6	40	40	-100	100
RH029_10	4	0.05	0.01	0.2	35	6	40	40	-100	100
RH030_10	4	0.05	0.01	0.2	35	3.1	40	40	-100	100
RH033_10	4	0.05	0.01	0.2	35	7.5	40	40	-100	100
RH050_10	4	0.1	0.01	0.2	35	8	40	40	-100	100
RH040	4	0.1	0.01	0.2	35	5	40	40	-100	100
RH042_10	4	0.1	0.01	0.2	35	7	40	40	-100	100
RH048b	4	0.1	0.01	0.2	35	4	40	40	-100	100
Civica FM3	4	0.1	0.01	0.2	35	3	40	40	-100	100

[(1)] Relative to chamber floor

Table 3-5: Model calibration results

Station	Event Date	Rainfall		Peak Flow (m3/s)			Volume (m3)		
		Volume	Peak Intensity (mm/hr)	Measured	Modelled	Difference (%)	Measured	Modelled	Difference (%)
RH002_10	Aug 14-19 2016	21.0	14.4	0.010	0.009	-10%	1,739	1,681	-3%
	July 24-30 2016	41.2	62.4	0.009	0.011	22%	1,962	2,098	7%
	May 10-20 2016	26.4	24.0	0.009	0.008	-11%	3,217	3,324	3%
RH003_10	Aug 14-19 2016	21.0	14.4	0.032	0.035	9%	7,742	7,329	-5%
	July 24-29 2016	30.8	62.4	0.024	0.029	21%	6,312	7,242	15%
	June 03-13 2016	30.2	52.8	0.029	0.026	-10%	15,419	14,717	-5%
RH003_20	Aug 14-19 2016	21.0	14.4	0.006	0.008	33%*	1,625	1,700	5%
	July 24-27 2016	18.8	62.4	0.005	0.006	20%	1,170	1,223	5%
	June 03-13 2016	30.2	52.8	0.007	0.006	-14%	3,518	3,418	-3%
RH004a_10	Aug 14-19 2016	21.0	14.4	0.080	0.100	25%	19,347	19,312	0%
	July 13-15 2016	14.2	21.6	0.064	0.064	0%	9,998	10,498	5%
	June 03-13 2016	30.2	52.8	0.079	0.073	-8%	41,593	38,059	-8%
RH008_10	June 03-13 2016	30.2	52.8	0.020	0.020	0%	9,838	10,375	5%
	May 12-18 2016	26.4	24.0	0.020	0.020	0%	7,023	7,227	3%
	July 01-26 2016	42.8	62.4	0.019	0.018	-5%	26,054	27,253	5%
RH010_10	Aug 15-19 2016	21.0	14.4	0.029	0.028	-3%	4,704	4,409	-6%
	June 03-13 2016	30.2	52.8	0.028	0.025	-11%	10,243	10,808	6%
	May 09-21 2016	26.4	24.0	0.027	0.026	-4%	12,664	12,639	0%
RH012	Aug 14-19 2016	21.0	14.4	0.020	0.023	15%	4,800	5,125	7%
	July 24-30 2016	41.2	62.4	0.023	0.026	13%	6,056	6,349	5%
	June 03-13 2016	30.2	52.8	0.021	0.020	-5%	10,247	10,360	1%
RH013_10	Aug 14-19 2016	21.0	14.4	0.018	0.016	-11%	3,573	3,454	-3%
	July 24-30 2016	41.2	62.4	0.018	0.021	17%	4,281	4,318	1%
	June 03-13 2016	30.2	52.8	0.014	0.014	0%	7,234	6,970	-4%
RH014_10	Aug 14-19 2016	21.0	14.4	0.073	0.069	-5%	17,209	15,999	-7%
	July 24-30 2016	41.2	62.4	0.081	0.082	1%	19,133	19,931	4%
	June 30 - July 04 2016	9.6	19.2	0.066	0.059	-11%	12,477	12,422	0%
RH058	May 11-21 2016	26.4	24.0	0.049	0.045	-8%	11,843	11,983	1%
	June 03-13 2016	30.2	52.8	0.044	0.045	2%	20,975	24,154	15%
	July 23-27 2016	31.0	62.4	0.043	0.050	16%	13,931	14,155	2%
RH056_m03	Aug 15-21 2016	15.8	14.4	0.016	0.014	-13%	2,228	2,009	-10%

Station	Event Date	Rainfall		Peak Flow (m3/s)			Volume (m3)		
		Volume	Peak Intensity (mm/hr)	Measured	Modelled	Difference (%)	Measured	Modelled	Difference (%)
	July 23-26 2016	23.0	64.8	0.016	0.015	-6%	1,424	1,446	2%
	July 27 - Aug 06 2016	19.0	50.4	0.014	0.013	-7%	3,864	3,923	2%
RH017_10	Aug 12-19 2016	53.0	74.4	0.047	0.059	26%	7,678	8,037	5%
	July 24-30 2016	37.2	64.8	0.029	0.028	-3%	7,434	6,838	-8%
	June 09-13 2016	12.2	55.2	0.020	0.019	-5%	3,608	3,723	3%
RH055_20	Aug 12-19 2016	53.0	74.4	0.039	0.046	18%	6,088	6,406	5%
	June 03-13 2016	33.4	55.2	0.016	0.016	0%	8,851	8,650	-2%
	May 16-31 2016	15.2	31.2	0.017	0.017	0%	16,343	14,960	-8%
RH029_10	Aug 12-19 2016	53.0	74.4	0.133	0.138	4%	14,726	15,855	8%
	July 24-30 2016	37.2	64.8	0.094	0.094	0%	13,134	13,481	3%
	June 03-13 2016	33.4	55.2	0.058	0.051	-12%	21,854	21,626	-1%
RH030_10	Aug 12-19 2016	53.0	74.4	0.061	0.057	-7%	9,331	9,499	2%
	July 22-31 2016	37.2	64.8	0.034	0.034	0%	11,830	11,849	0%
	June 03-13 2016	33.4	55.2	0.024	0.024	0%	13,499	13,294	-2%
RH033_10	Aug 12-19 2016	53.0	74.4	0.033	0.029	-12%	2,849	2,686	-6%
	July 24-30 2016	37.2	64.8	0.021	0.021	0%	2,088	2,271	9%
	June 03-13 2016	33.4	55.2	0.012	0.011	-8%	3,299	3,626	10%
RH050_10	Aug 12-19 2016	53.0	74.4	0.061	0.056	-8%	6,434	5,925	-8%
	July 10-20 2016	13.0	31.2	0.016	0.016	0%	7,865	7,663	-3%
	May 11-21 2016	22.8	31.2	0.016	0.018	13%	8,239	7,643	-7%
RH040	Aug 14-19 2016	15.8	16.8	0.039	0.037	-5%	10,220	10,044	-2%
	July 24-30 2016	24.8	62.4	0.040	0.035	-13%	12,317	12,403	1%
	June 03-13 2016	37.4	62.4	0.040	0.035	-13%	20,339	20,564	1%
RH042_10	Aug 12-19 2016	52.2	55.2	0.053	0.060	13%	5,107	5,057	-1%
	June 02-16 2016	37.4	62.4	0.027	0.025	-7%	9,970	9,254	-7%
	May 11-21 2016	23.0	40.8	0.017	0.016	-6%	7,953	6,336	-20%
RH048b	Aug 14-19 2016	15.8	16.8	0.037	0.036	-3%	8,526	8,717	2%
	July 24-30 2016	24.8	62.4	0.041	0.046	12%	10,458	11,037	6%
	June 03-13 2016	37.4	62.4	0.033	0.034	3%	17,141	17,842	4%
Civica FM3	July 12-17 2017	42.7	91.4	0.057	0.055	-4%	9,855	11,538	17%
	July 19-23 2017	23.9	67.1	0.054	0.067	24%	8,126	8,677	7%
	Aug 17-24 2017	38.6	103.6	0.05	0.061	22%	14,328	16,482	15%

*Predicted peak flow is not within the WaPUG criteria

3.4 Model Assumptions and Application

Based on the quality of the data available at the time the model was developed, and the assumptions made in consultation with the City of Richmond Hill, the wastewater hydraulic model provides the most realistic representation of the existing sewer network performance conditions. Nevertheless, it should be noted that there are some limitations with the use and application of the calibrated model for the study area. The model limitations include:

- The best possible information available at the time was used to create, calibrate and validate the model; however, assumptions had to be made to fill the data gaps;
- Flow monitoring was used to calibrate the model. For non-monitoring areas, the City's design criteria was used DWF and I/I rates;
- The model was calibrated using rainfall events with a return period less than 2-year;
- Thiessen polygons were assumed for rainfall distribution; and,
- The model is designed to predict municipal sewer surcharge, and not to detect temporary or permanent potential operational failures such as sewer blockages.

4.0 Assessment of Sanitary Sewer System Performance

The calibrated model was used to assess the sanitary system under extreme wet-weather conditions, specifically during the City's 1 in 25-year design storm (using the IDF curve pre-2021). The storm is a six-hour event with a time-to-peak ratio of 0.33 (Chicago-type storm), with a peak intensity of 172 mm/hr over 10-min intervals. **Figure 4-1** shows the hyetograph of the 25-year design storm used in this assessment. It should be noted that the initial UCWI used for the design storm was 6 mm, which is the average UCWI predicted by the model during wet weather events.

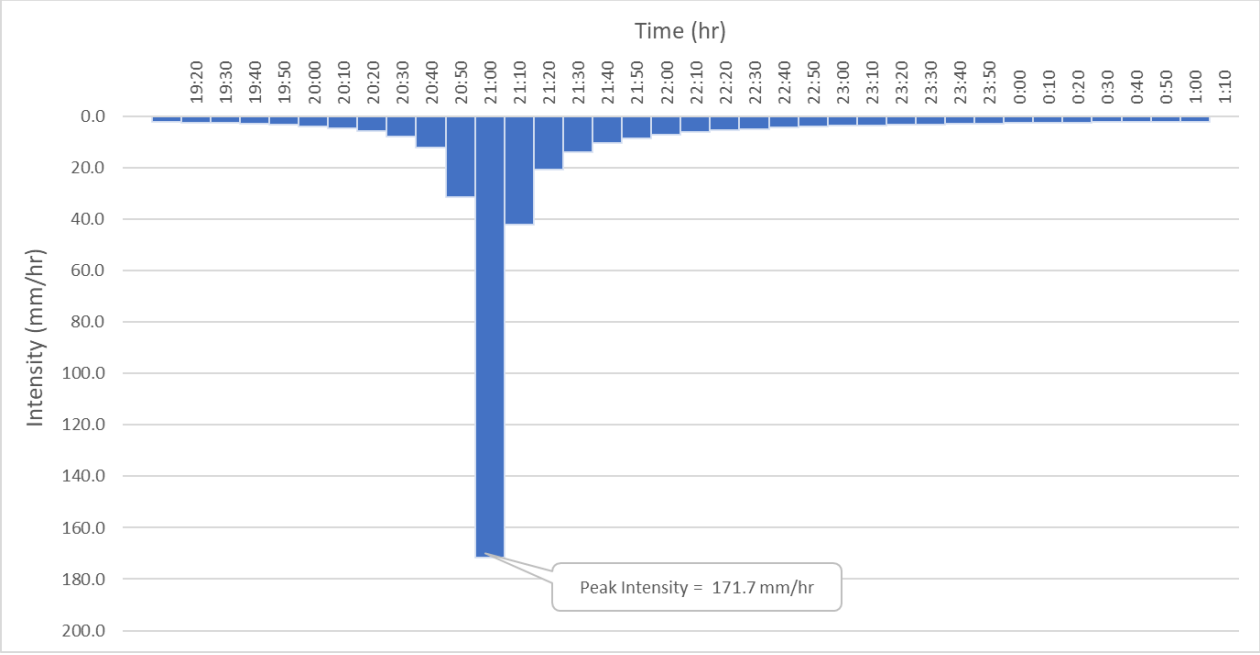

Figure 4-1: 1 in 25-year design storm hyetograph

In the model, the peak intensity (172 mm/hr) of the design storms was aligned to match the peak-measured DWF. This approach predicts the worst-case scenario in which the peak DWF and peak I/I occur at the same time, as shown in **Figure 4-2.**

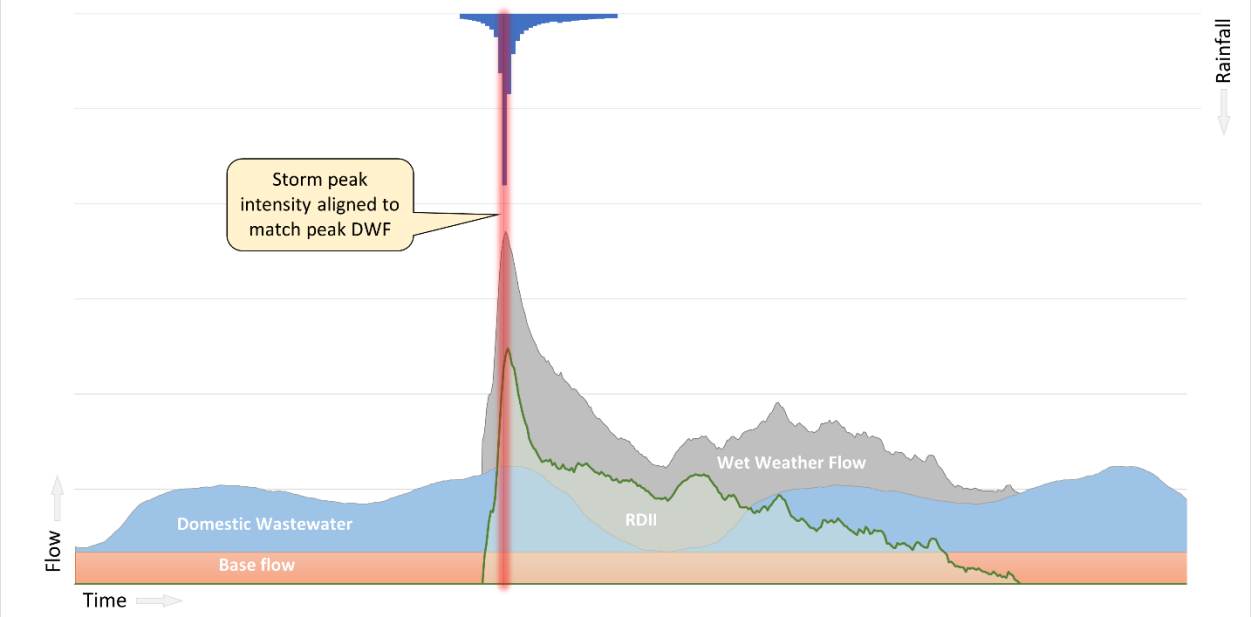

Figure 4-2: Concept of Worst-Case Scenario

As mentioned in **Section 3.1,** the DWF rate assigned for areas without flow monitoring data was 265 L/c/d, and the infiltration allowance was assumed to be 0.26 L/s/ha.

5.0 Existing Conditions

Under existing conditions, the existing sanitary sewer performance under the City's 25-year design storm is depicted in **Figure 5-1.** As shown, the sanitary sewer system is predicted to surcharge at multiple locations due to bottlenecks and backwater, caused by bottlenecks. A level of surcharge (water level above the obvert of the pipe) greater than 0.3 m can be seen along Naughton Drive, East of Yonge Street. Also, at multiple locations between Elgin Mills Road and Major Mackenzie Drive; and along Harding Boulevard, just south of Major Mackenzie Drive.

In consultation with the City, if surcharge is present during Existing Conditions, and is not caused by future growth within the Study Area, then remedial measures will not be evaluated as part of this study. Further studies are needed to evaluate proposed solutions and eliminate surcharge conditions in locations outside of the study area, and surcharge caused by existing developments (2016 population).

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N

Bloomington Road

King Road

Bethesda Sideroad

Dufferin Road

Bathurst Street

Yonge Street

Stouffville Rd

Bayview Avenue

Leslie Street

Woodbine Avenue

19th Ave

Highway 404

Teston Road

Elgin Mills Rd E

Major Mackenzie Dr

Major Mackenzie Dr E

Rutherford Rd

16th Avenue

Highway 7

Richmond Hill

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Legend

Manhole Water Depth (m)
(Water Level to Obvert)

- No Surcharge
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- > 0.6

- York Region Sanitary Trunk Sewers
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Figure 4-3:
Level of Surcharge Under Existing Conditions

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

6.0 Future Development Scenarios

This section summarizes the assessment of the sanitary sewer system considering the following incremental scenarios: 2041, 2051 and Ultimate build-out conditions.

Incremental development conditions assume that each successive scenario adds flows derived from population growth from the previous scenarios as per the expected development sequence. The York Region's per capita flow rate of 265 L/s/ha was applied for all future population.

The areas and populations added in each future scenario have been defined in consultation with the City and from the best available planning documents, e.g. Traffic Zone Projections and Development Applications. Initially, the future population was estimated and distributed using the Traffic Zone Projections. These estimations were further refined based on known development applications. This means that the estimated population from known development applications was subtracted from the projected Traffic Zone population. For example, if the projected 2041 population for a given TZ is 10,000 people, and in that TZ there are some development applications with an estimated population of 2,000 people, then, it is assumed that the final projected TZ population to be distributed within the study area is 8,000 people.

The estimated future population from known development applications and Traffic Zone Projections is shown in **Appendix I**. The wastewater connection points to the local sanitary sewer for each forecasted growth area is also shown in **Appendix I**.

A breakdown of the estimated future population for each growth scenario is presented in **Table 6-1.** The Official Plan (OP) land use intensification areas and three (3) Emerging Growth Centres (EGC) are shown in **Figure 6-1**.

OP Intensification Areas:

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre

Emerging Growth Centres:

- Newkirk GO Local Centre
- Bathurst and Highway 7 Centre
- East Beaver Creek and Highway 7 Centre

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Table 6-1: Population Breakdown Per Growth Scenario

Description	Growth Scenario		
	2016 2041	**2041 2051**	**2051 Ultimate Build out**
Residential population[1]	107,192	126,097	247,539
Employment population[2]	30,571	42,715	92,295
Other residential and employment population[3]			39,122
Total Population	**140,977**	**31,049**	**210,144**

Notes:

[1)] 2016 to 2041 growth includes residential population from active development applications (where population was greater than original 2021 forecast). In TZ where population decreased, the 2016 population was kept.

[2)] In TZ where employment decreased, the 2016 employment numbers were kept.

[3)] Includes additional population growth from Richmond Hill Centre Secondary Plan, OPAs for Oak Ridges Local Centre and the Village Core, beyond original 2021 forecast.

The sewer performance under each growth scenario is depicted in **Figure 6-2** to **Figure 6-4**. As expected, the level of surcharge increases from the 2041 to the Ultimate Build-out growth scenario.

The following sections summarize the evaluation of alternative solutions and the selection of preferred remedial measures to safely accommodate the ultimate Build-out population in the study area.

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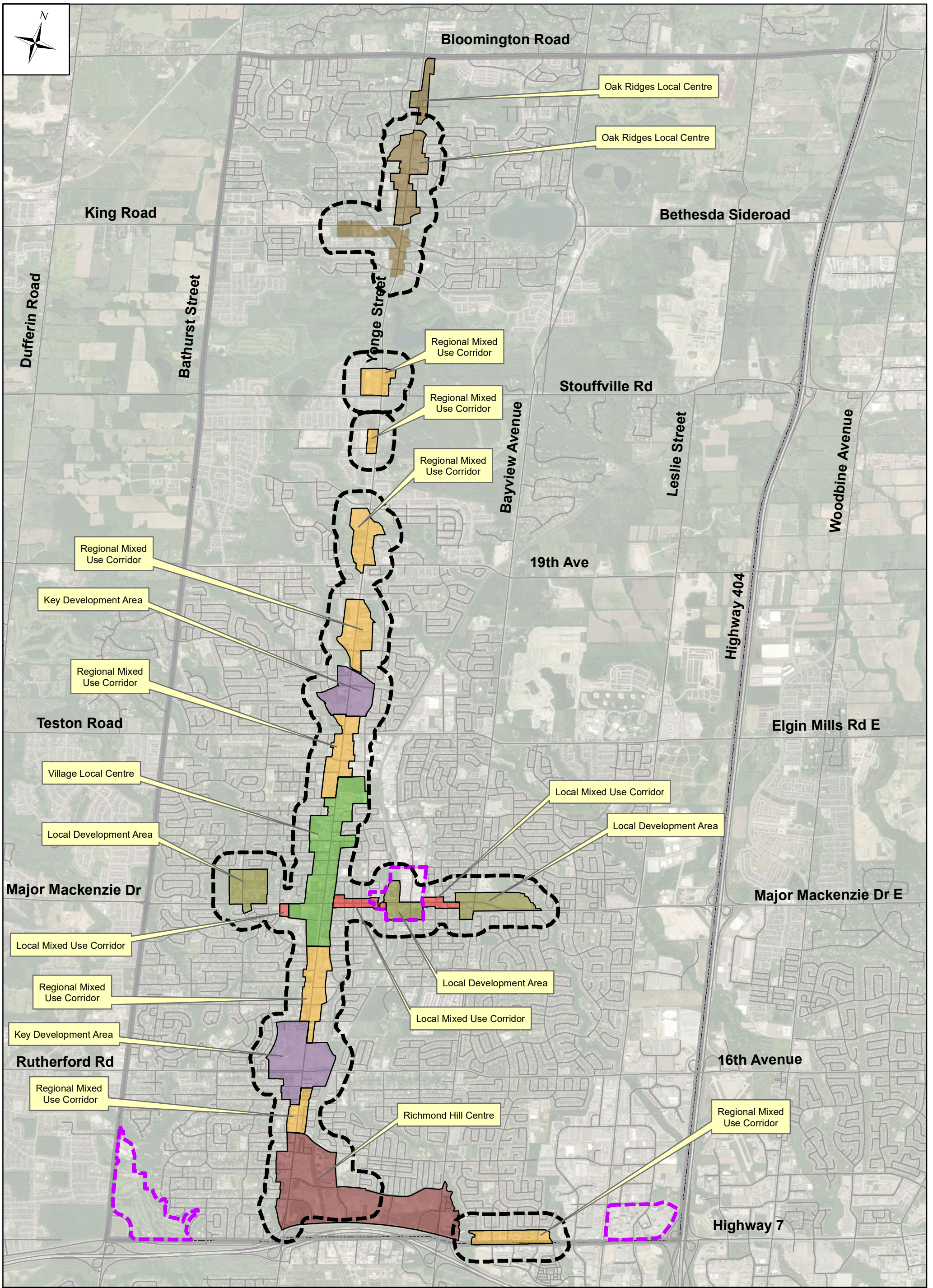

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Legend

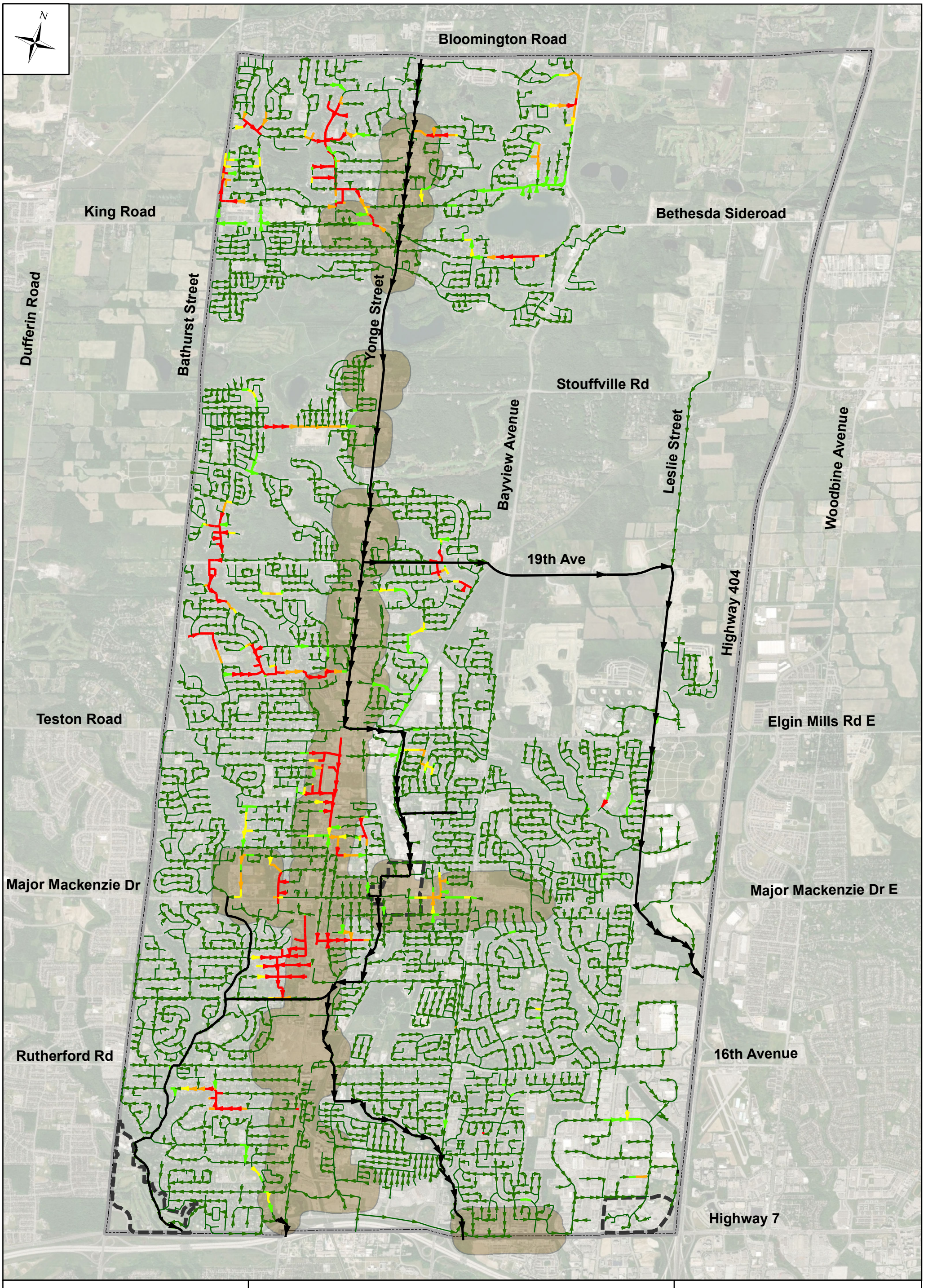
OP Areas

- Village Local Centre
- Key Development Areas
- Local Development Areas
- Local Mixed Use Corridor
- Oak Ridges Local Centre
- Regional Mixed Use Corridors
- Richmond Hill Centre
- Study Area
- Emerging Growth Centres
- Municipal Boundary

Figure 6-1: Future Growth Centres and OP Areas

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters



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Legend

Manhole Water Depth (m)
(Water Level to Obvert)

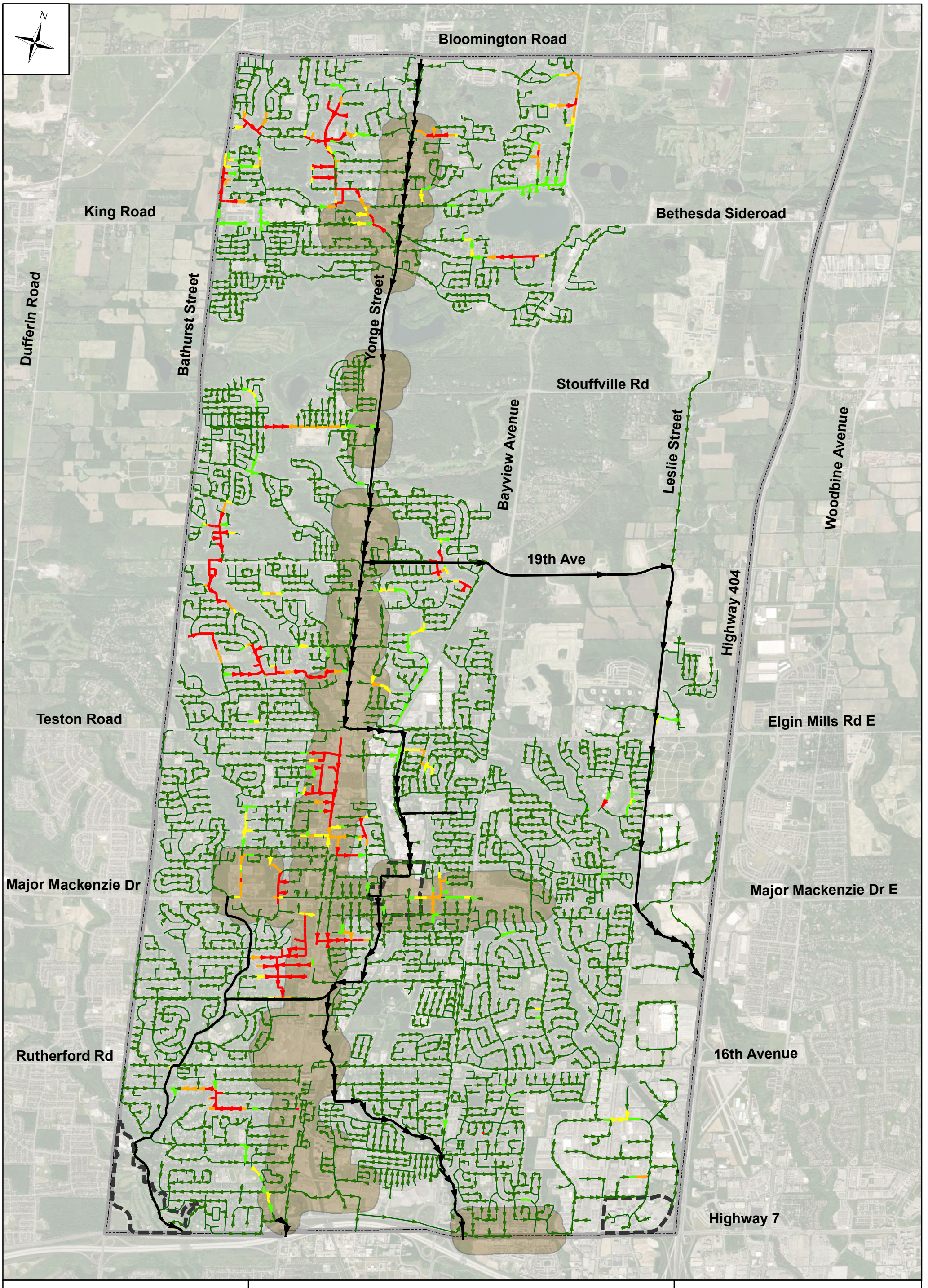
- No Surcharge
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- > 0.6

- York Region Sanitary Trunk Sewers
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Figure 6-2:
Level of Surcharge Under 2041 Conditions

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters



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Legend

Manhole Water Depth (m)
(Water Level to Obvert)

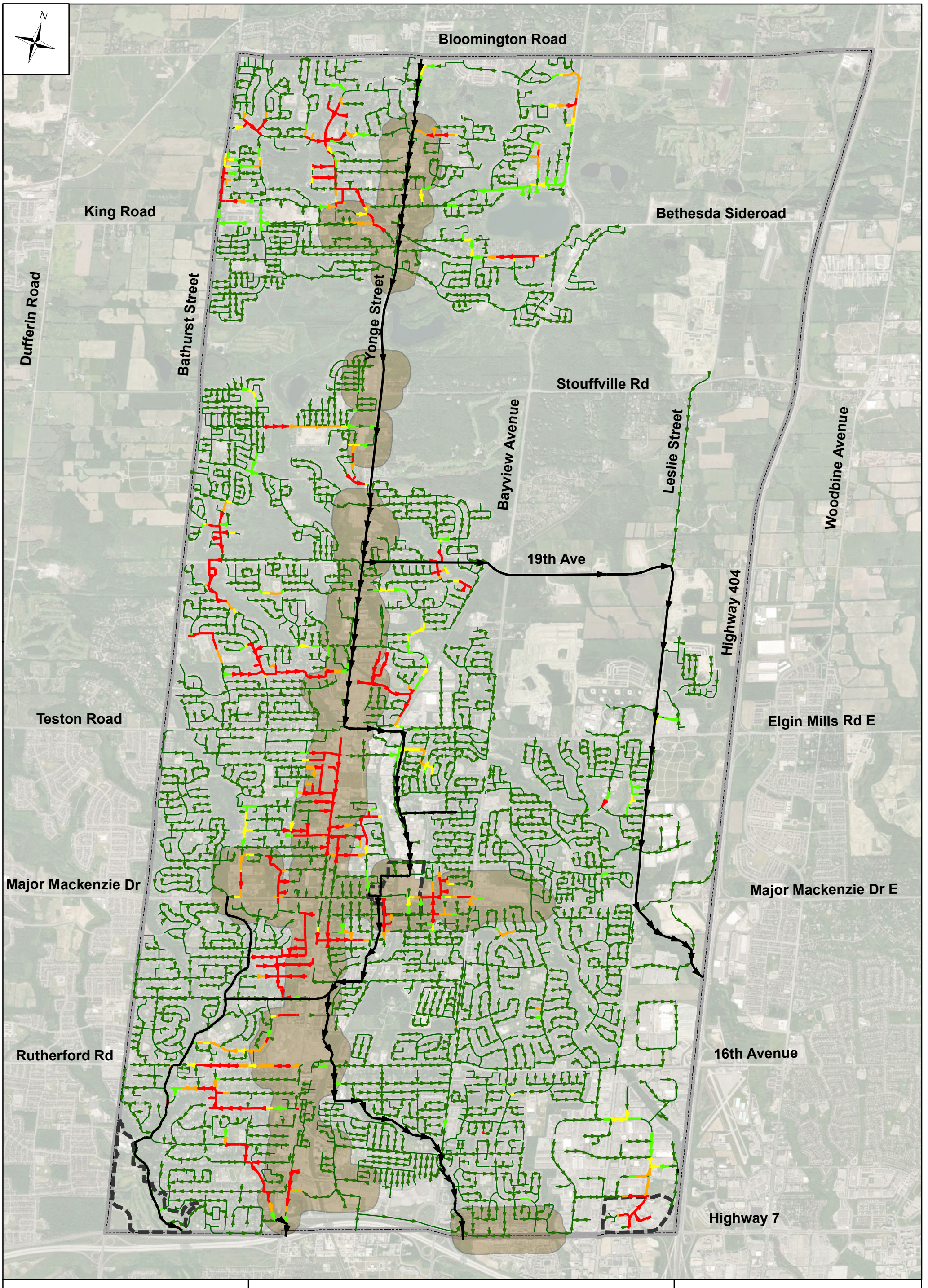
- No Surcharge
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- > 0.6

- York Region Sanitary Trunk Sewers
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Figure 6-3:
Level of Surcharge Under 2051 Conditions

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Legend

Manhole Water Depth (m)
(Water Level to Obvert)

- No Surcharge
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- > 0.6

- York Region Sanitary Trunk Sewers
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Figure 6-4:
Level of Surcharge Under Ultimate Build-Out

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

7.0 Evaluation of Alternatives

To minimize the risk of sewer surcharge triggered by the ultimate Build-out population, four (4) alternative solutions were evaluated, following the previous 2014 Master Plan. These alternative solutions are described in **Table 7-1** below.

Table 7-1: Evaluation of Wastewater Alternatives

Alternative	Description	Results of Evaluation
1. Do Nothing	A do-nothing scenario would allow Build-out of the urban structure in accordance with the Official Plan, without making improvements to the sanitary collection system.	This approach would result in a substandard level of service through some parts of the City, with the potential for sanitary sewer surcharging as build-out occurs. This could then trigger basement flooding, and possibly even surface flooding. This alternative does not satisfy the objectives associated with the problem statement for this project but provides an important baseline for comparison to other viable solutions.
2. Limit Community Growth	This alternative would require updating the Official Plan in order to limit the extent of intensification to only what could be accommodated within the existing sanitary sewers. In order to accommodate the provincially-mandated growth, the City would have to designate additional areas within the City for intensification, where sufficient reserve sanitary servicing capacity exists.	This alternative solution would ultimately negate some of the planning processes that have been undertaken to date, and therefore be unsatisfactory with respect to the objectives associated with the problem statement for this project.
3. Implement Water Conservation Procedures	This alternative solution would effectively increase the population that could be serviced through the existing collection system by decreasing the average per-capita flow rates across the City.	While many municipalities have successfully reduced the overall flow generation rate through implementing education and incentive-based water conservation procedures, the success of these programs in general – and within the specific areas where a flow reduction would be required in order to service the planned growth – is not guaranteed.
4. Enhance / Expand the Existing Collection System	This alternative would have the City plan for strategic enhancements to and/or expansion of the existing collection system in order to accommodate the planned populations at the prescribed level of service in accordance with the City's design criteria.	The future condition model was used to identify the extent of system upgrades needed to compensate for any observed shortfalls.

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As reported in the previous 2014 Master Plan, Alternatives 1 and 2 are not recommended within the context of the problem statement for this project. Alternative 3 is not recommended because the flow reduction that would be required to service the planned future growth is not guaranteed. Therefore, Alternative 4 is the preferred solution for this Study.

8.0 Preferred Solutions

Based on the evaluation of the four (4) Alternatives discussed in **Section 7.0,** Alternative 4 was selected as the preferred alternative solution. The mitigation measures proposed as part of Alternative 4 are listed and described in **Table 8-2.** The overall preferred remedial measures for the Study Area can be seen in **Figure 8-1** and the detailed maps for every proposed project are provided in **Appendix II**.

For the purposes of this report, all recommended pipe replacements refer to replacing an existing pipe with a larger sized pipe (i.e. upsizing/upgrading). Although, it has been assumed that most of the proposed solution will be located within the City's right-of-way, some of the crossings, new pipes, and new connections and will be affecting the Regional infrastructure. **Table 8-1** lists the solutions impacting the Region's infrastructure.

Table 8-1: Wastewater Solutions Affecting Regional Infranstructure

SAN Project ID	Location	Sewer Type	Regional Infrastructure
WW-01	King Rd	Replacement Pipes	Region's ROW
WW-02	Yonge St	New Pipes	Region's ROW Regional MH
WW-05	Yonge St	New Pipe	Cross Yonge St
WW-06	Yonge St	New Pipes	Region's ROW Cross Yonge St
WW-07	Beechy Dr	Replacement Pipe	New connection with Regional MH
WW-08	Yonge St	Replacement Pipes	Region's ROW
WW-12	Major Mackenzie Dr E	Replacement Pipes	Region's ROW
WW-14	Yonge St	New Pipe	Cross Yonge St
WW-17	Carrville Rd	Replacement Pipes	Region's ROW
WW-19	Yonge St	New Pipes	Region's ROW Cross Yonge St

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The locations of proposed City infrastructure shown in this report are conceptual only and the location of infrastructure within or adjacent to Regional road allowances will be subject to review by both the City and York Region through a detailed design approval process. The Region has advised that new City infrastructure shall generally be located within an easement along the frontage of private properties adjacent to a Regional road allowance.

8.1 Areas with Existing Deficiency or Outside of the Study Area

As mentioned in **Section 5.0**, sewers that are surcharging but were not triggered by future growth within the study area will not be evaluated for remedial measures during this study. Further studies are recommended to address existing capacity constraints throughout the City. These locations are highlighted in blue in **Figure 8-1**.

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WW-01:
Pipe Replacement of
205.8 m of 250 mm with 300 mm
264.4 m of 250 mm with 375 mm

WW-02:
New Pipe
558.6 m of 450 mm

WW-03:
New Pipe
144.7 m of 250 mm

WW-03:
Pipe Replacement of
167.7 m of 250 mm with 300 mm

WW-03:
Pipe Replacement of
63.8 m of 250 mm with 300 mm
137.5 m of 250 mm with 375 mm

WW-04:
New Pipe
121.0 m of 250 mm

WW-05:
New Pipe
48.6 m of 250 mm

WW-06:
New Pipe
114.8 m of 300 mm

WW-07:
Pipe Replacement of
10 m of 200 mm with 375 mm
514.3 m of 250 mm with 375 mm
208.7 m of 250 mm with 375 mm
58.2 m of 300 mm with 375 mm

WW-08:
Pipe Replacement of
108.8 m of 300 mm with 375 mm
255 m of 300 mm with 450 mm
214.5 m of 300 mm with 525 mm
15.2 m of 375 mm with 525 mm

WW-09:
Pipe Replacement of
266.3 m of 250 mm with 375 mm

WW-10:
Pipe Replacement of
5.5 m of 375 mm with 525 mm
114 m of 375 mm with 600 mm
224.7 m of 450 mm with 600 mm

WW-11:
Pipe Replacement of
86.3 m of 375 mm with 675 mm
271.3 m of 300 mm with 525 mm
5.3 m of 450 mm with 675 mm
131.4 m of 450 mm with 525 mm
335.6 m of 450 mm with 600 mm
17.4 m of 375 mm with 600 mm

WW-12:
Pipe Replacement of
233.2 m of 250 mm with 300 mm
83.8 m of 250 mm with 375 mm
96.9 m of 300 mm with 450 mm
300.4 of 375 mm with 525 mm
126.2 m of 375 mm with 450 mm

WW-13:
Pipe Replacement of
171.9 m of 250 mm with 375 mm

WW-13:
Pipe Replacement of
142.7 m of 300 mm with 450 mm
309 m of 350 mm with 450 mm
176.1 m of 375 mm with 525 mm

WW-13:
Pipe Replacement of
455.7 m of 525 mm with 600 mm

WW-13:
Pipe Replacement of
452.2 m of 525 mm with 600 mm

WW-14:
New Pipe 362.9 m of 375 mm
Pipe Replacement of
99 m of 200 mm with 375 mm

WW-15:
Pipe Replacement of
287.6 m of 200 mm with 300 mm

WW-16:
Pipe Replacement of
273.3 m of 250 mm with 375 mm
69.2 m of 300 mm with 375 mm

WW-17:
Pipe Replacement of
552.0 m of 300 mm with 375 mm

WW-17:
Pipe Replacement of
110.8 m of 300 mm with 375 mm

WW-17:
Pipe Replacement of
313.6 m of 300 mm with 375 mm

WW-18:
New Pipe
32.5 m of 300 mm

WW-18:
Pipe Replacement of
46.0 m of 250 mm with 300 mm

WW-19:
New Pipe
173.4 m of 250 mm

WW-19:
New Pipe
151.3 m of 300 mm

WW-19:
New Pipe
41.1 m of 300 mm

WW-19:
New Pipe
334.7 m of 450 mm
199.1 m of 525 mm
506.2 m of 675 mm

WW-20:
Pipe Replacement of
113.6 m of 250 mm with 300 mm
251.1 m of 300 mm with 450 mm

Bloomington Road
King Road
Bathurst Street
Yonge Street
Bethesda Sideroad
Stouffville Rd
Bayview Avenue
Leslie Street
Woodbine Avenue
19th Ave
Highway 404
Elgin Mills Rd E
Teston Road
Major Mackenzie Dr E
16th Avenue
Rutherford Rd
Highway 7

Legend

Recommended Solutions:

- Pipe Replacement
- New Pipe
- Sewer Installed through Viva Next BRT

Manhole Water Depth (m) (Water Level to Obvert)

- No Surcharge
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- > 0.6

- Sewer Surcharging During Existing Conditions
- York Region Sanitary Trunk Sewers
- Study Areas
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill

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RIC18-0004 -
Richmond Hill UMESP Update

Figure 8-1:
Recommended Wastewater Projects

Drawn By: J.H. Date: Oct 28, 2023

0 500 1,000 2,000 Meters

Table 8-2: Recommended Wastewater Projects

Project	2014 UMESP Project ID	Description	Location	From	To	Existing Diameter (mm)	Recommended Diameter (mm)	Length (m)
WW-1	n/a	Sewer Upgrade	King Road and Schomberg Road	on King Street	on Schomberg Road	250	300 and 375	470.2
WW-2	WW-17	New Pipe	Yonge Street	Muirhead Crescent	Jefferson Sideroad	NA	450	558.6
WW-3	WW-16	New Pipe & Sewer Upgrade	Yonge Street, Grange Drive and Townwood Drive	on Yonge Street	on Townwood Drive	250	250, 300 and 375	513.7
WW-4	n/a	New Pipe	Easement along Yonge Street	NA	NA	NA	250	121
WW-5	n/a	New Pipe	Yonge Street	NA	NA	NA	250	48.6
WW-6	WW-15	New Pipe	Yonge Street and easement	NA	NA	NA	300	114.8
WW-7	WW-13, WW-14	Sewer Upgrade	Industrial Road, Newkirk Road and Beechy Drive	Yonge Street / Industrial Road	Beechy Drive / Newkirk Road	300, 250 and 200	375	791.2
WW-8	WW-11	Sewer Upgrade	Yonge Street	Levendale Road	Dunlop Street	300 and 375	375, 450 and 525	593.5
WW-9	WW-12	Sewer Upgrade	Wright Street	Hall Street	Yonge Street	250	375	266.3
WW-10	WW-11	Sewer Upgrade	Dunlop Street and Church Street	Yonge Street	Centre Street East	375 and 450	525 and 600	344.2
WW-11	WW-11	Sewer Upgrade	Centre Street East and Pugsley Avenue	Church Street	Major Mackenzie Drive East	300, 375 and 450	525, 600 and 675	847.3

Project	2014 UMESP Project ID	Description	Location	From	To	Existing Diameter (mm)	Recommended Diameter (mm)	Length (m)
WW-12	n/a	Sewer Upgrade	Major Mackenzie Drive East and Easement	Bayview Avenue	Essex Avenue	250, 300 and 375	300, 375, 450 and 525	840.5
WW-13	WW-10	Sewer Upgrade	Addison Street and Easement, May Avenue Easements, Weldrick Road West and Springhead Gardens	Addison Street	Kitsilano Crescent	250, 300, 350, 375 and 525	375, 450, 525 and 600	1707.6
WW-14	WW-9	Sewer Upgrade, and New Pipe	Addison Street, Yonge Street Easement, City Park, Church Street South	Addison Street	Harding Boulevard	200	375	461.9
WW-15	n/a	Sewer Upgrade	Cedar Avenue	Elmwood Avenue	South of Palmer Avenue	200	300	287.6
WW-16	n/a	Sewer Upgrade	Baif Boulevard	Yonge Street	Springhead Gardens	250 and 300	375	342.5
WW-17	n/a	Sewer Upgrade	Carrville Road	Yonge Street	Duncombe Lane	300	375	976.4
WW-18	WW-04	Sewer Upgrade, and New Pipe	Dalemount Gate	Yonge Street	Ellesmere Street	250	300	78.5
WW-19	n/a	New Pipe	Yonge Street, High Tech Road, RHC Street, Easements and Red Maple Road	Yonge Street	Red Maple Road	NA	250, 300, 450, 525 and 675	1405.8
WW-20	n/a	Sewer Upgrade	York Boulevard, East Beaver Creek Road	York Boulevard	Norman Bethune Avenue	250 and 300	300 and 450	364.7

Notes:

1. Sewer Upgrades refer to replacing an existing pipe with a larger sized pipe.
2. All proposed works are assumed to be within the City's right-of-way.

8.2 Sequence of Implementation

The assessment of the interim scenarios (2041 and 2051), between the existing conditions and the Ultimate Build-out scenario, was used to establish the timing of recommended wastewater projects based on anticipated or estimated locations for development within the study area for each growth period. However, the actual triggers for individual projects would be development-driven, so the recommended timing of projects would need to be reviewed and adjusted periodically to account for the actual pace of growth. This is especially relevant to the preparation of applicable development charge bylaws. **Table 8-3** list the anticipated timing of the recommended wastewater projects.

Table 8-3: Anticipated Timing of Proposed Wastewater Solutions

Project ID	Growth Period		
	2041	2051	Ultimate Build out
WW-1	Partially	Partially	Fully
WW-2	Fully	Fully	Fully
WW-3	Partially	Partially	Fully
WW-4	Fully	Fully	Fully
WW-5	Fully	Fully	Fully
WW-6	Fully	Fully	Fully
WW-7	Fully	Fully	Fully
WW-8	Partially	Partially	Fully
WW-9	-	Partially	Fully
WW-10	Fully	Fully	Fully
WW-11	Partially	Partially	Fully
WW-12	Partially	Partially	Fully
WW-13	Partially	Partially	Fully
WW-14	Fully	Fully	Fully
WW-15	-	-	Fully
WW-16	-	-	Fully
WW-17	-	-	Fully
WW-18	Partially	Partially	Fully
WW-19	Fully	Fully	Fully
WW-20	-	-	Fully

8.3 Cost Estimates

AACE type Class 4 cost estimate has been employed to determine the preliminary cost estimates of the identified projects in the study area. Civica's 2020 unit price database was used as a baseline for the cost estimate analysis. The unit prices were adjusted to 2023 prices using Infrastructure Cost Indexes from Statistics Canada. A trend analysis using data from 2010 to 2019 was used to extrapolate the index values to 2023. Moreover, a 25% multiplier for project delivery allowance and 25% for Class 4 Contingency have been applied to the cost estimates.

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The project delivery allowance is a multiplier for preliminary design, tendering, construction services, insurance, mobilization & demobilization, traffic control, utility impacts/relocations, etc. The unit rates and costing estimates do not include any land costs.

The estimated cost of the recommended wastewater projects for the ultimate Build-out scenario is $41.1M and includes HST.

Table 8-4 lists the total cost per recommended project, a detailed breakdown of the cost estimates is presented in **Appendix III**.

Table 8-4: Estimated Cost of Recommended Wastewater Projects

Project ID	2041 Scenario Total Cost	Additional Cost to Service 2051 Population	2051 Scenario Total Cost	Additional Cost to Service Ultimate Build out Population	Ultimate Build out Total Cost
WW-1	$855,092	$0	$855,092	$810,031	**$1,665,123**
WW-2	$2,444,174	$0	$2,444,174	$0	**$2,444,174**
WW-3	$581,355	$0	$581,355	$1,145,080	**$1,726,435**
WW-4	$381,896	$0	$381,896	$0	**$381,896**
WW-5	$205,766	$0	$205,766	$0	**$205,766**
WW-6	$401,508	$0	$401,508	$0	**$401,508**
WW-7	$3,005,095	$0	$3,005,095	$0	**$3,005,095**
WW-8	$1,458,088	$0	$1,458,088	$554,944	**$2,013,032**
WW-9	$0	$595,442	$595,442	$310,133	**$905,575**
WW-10	$1,276,321	$0	$1,276,321	$0	**$1,276,321**
WW-11	$1,357,603	$238,247	$1,595,850	$1,393,934	**$2,989,784**
WW-12	$1,083,446	$0	$1,083,446	$1,679,548	**$2,762,994**
WW-13	$2,506,646	$288,988	$2,795,634	$3,742,290	**$6,537,924**
WW-14	$1,800,114	$0	$1,800,114	$0	**$1,800,114**
WW-15	$0	$0	$0	$841,679	**$841,679**
WW-16	$0	$0	$0	$1,164,700	**$1,164,700**
WW-17	$0	$0	$0	$3,320,329	**$3,320,329**
WW-18	$148,879	$0	$148,879	$158,796	**$307,675**
WW-19	$0	$0	$0	$5,997,674	**$5,997,674**
WW-20	$0	$0	$0	$1,315,721	**$1,315,721**
Total	**$17,505,983**	**$1,122,677**	**$18,628,660**	**$22,434,859**	**$41,063,519**

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9.0 Conclusions and Recommendations

9.1 Conclusions

Based on the analysis and assumptions presented in the report, the following conclusions can be drawn:

1. An InfoWorks model was calibrated using data from twenty (20) flow monitoring stations and three (3) rain gauges. For non-monitoring areas, the Region's design criteria was used, a per capita DWF of 265 l/d and an I/I rate of 0.26 L/s/ha.

2. The calibrated model was used to assess the sanitary sewer performance under the City's 25-year design storm. The system was evaluated under four scenarios: Existing Conditions, 2041, 2051 and Ultimate Build-out.

3. Alternative solutions were evaluated only for surcharged sewers triggered by future growth in the study area. Further studies will be needed to address existing capacity constrains and surcharged sewers outside of the study area.

4. A total of twenty (20) wastewater projects were identified to safely convey sanitary flows from future developments. The estimated cost for the recommended projects is $41.1M.

9.2 Recommendations

The model results show that all the future development flows inside of the study area can be accommodated safely with the implementation of the recommended remedial measures. Furthermore, the following risk management measures may be considered to further increase the system security against overloading.

a) Continuous flow monitoring to verify the future flow generation rates as compared to theoretical design rates. The same can be said for all future areas analyzed using theoretical flow generation rates.

b) All new developments within the study area, should provide enhanced construction, inspection, and monitoring standards. This will further reduce dry- and wet-weather flows below theoretical design rates.

c) Continuous operation and maintenance of sewers (through CCTV inspections) to maintain good hydraulic conditions.

d) Reduction of flow generation (dry and wet) in existing developed areas. This includes I/I source investigation and demonstrated rainfall-derived inflow and infiltration reductions in public and private properties.

e) Collect flow data in near real-time to verify that the servicing strategy is performing. The data should allow for adjustments in the strategy during the course of the servicing period.

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Municipal Water Resources

Appendix I

Future Developments Population and Connection Points

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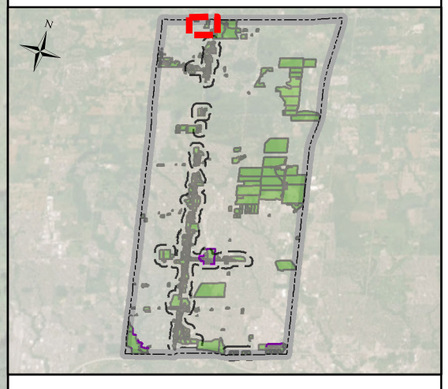
Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

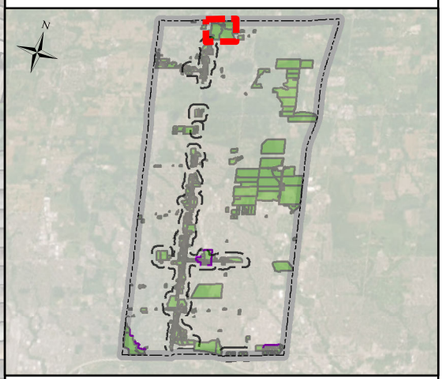
Future Growth and Connection (1) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- 2041 & 2051 Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



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RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (2)
(2041 & 2051)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Old Bloomington Road

Bloomington Road

Grovepark Street

Bombay Court

Coon's Road

Yonge Street

St Laurent Drive

Craigleith Crescent

Worthington Avenue

Long Point Drive

Snively Street

Glebeholme Boulevard

Gordon Avenue

745

1372

114

102

4252

905

471

1046

68

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population Ultimate Build-Out)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (2)
(Ultimate Build-Out)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (3) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Elm Grove Avenue

Carmela Avenue

Marzilli Gate

Maple Grove Avenue

Schomberg Road

Wendy Way

11

11

46

32

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

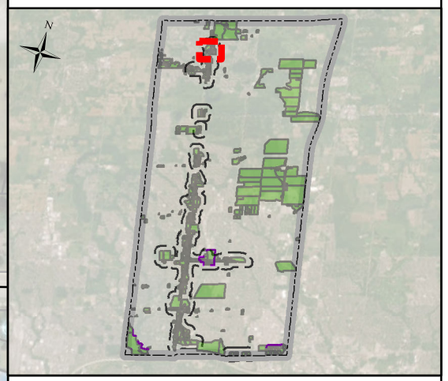
Future Growth and Connection (4) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



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RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (5) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (6) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

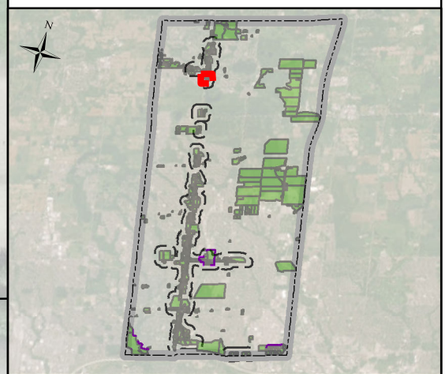
Future Growth and Connection (7) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (8) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Vitluk Drive
Parker Avenue
Penny Place
Schomberg Road
Poplar Drive
Aubrey Avenue
George Street
McCachen Street
Shaver Street
Hughes Street
King Road
Bostwick Crescent
Bond Crescent
Timber Valley Drive

90
142
106
21
76
16
244 / 766 / 1226
16 / 18 / 23
8 / 8 / 11
18
254
63
263
108 / 131 / 933
269
78 / 94 / 716
131 / 160 / 878
29
14
112
7

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (9) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

N

Verdi Road

Puccini Drive

Aida Place

Toscanini Road

King Road

Kings Hill Road

Chelton Drive

Longwood Avenue

Glade Drive

Growood Street

Grand Oak Drive

Bond Crescent

McCachen Street

Poplar Drive

Vitlor Drive

Lorwood Court

Blyth Street

Maple Grove Avenue

6

6

530

35

62

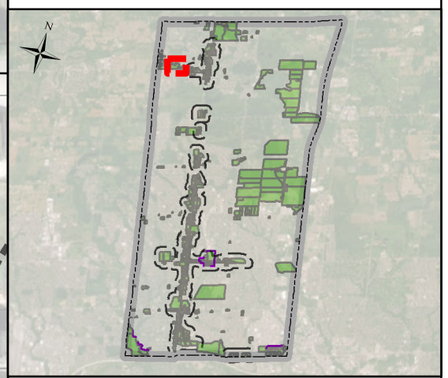
67

15

35

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



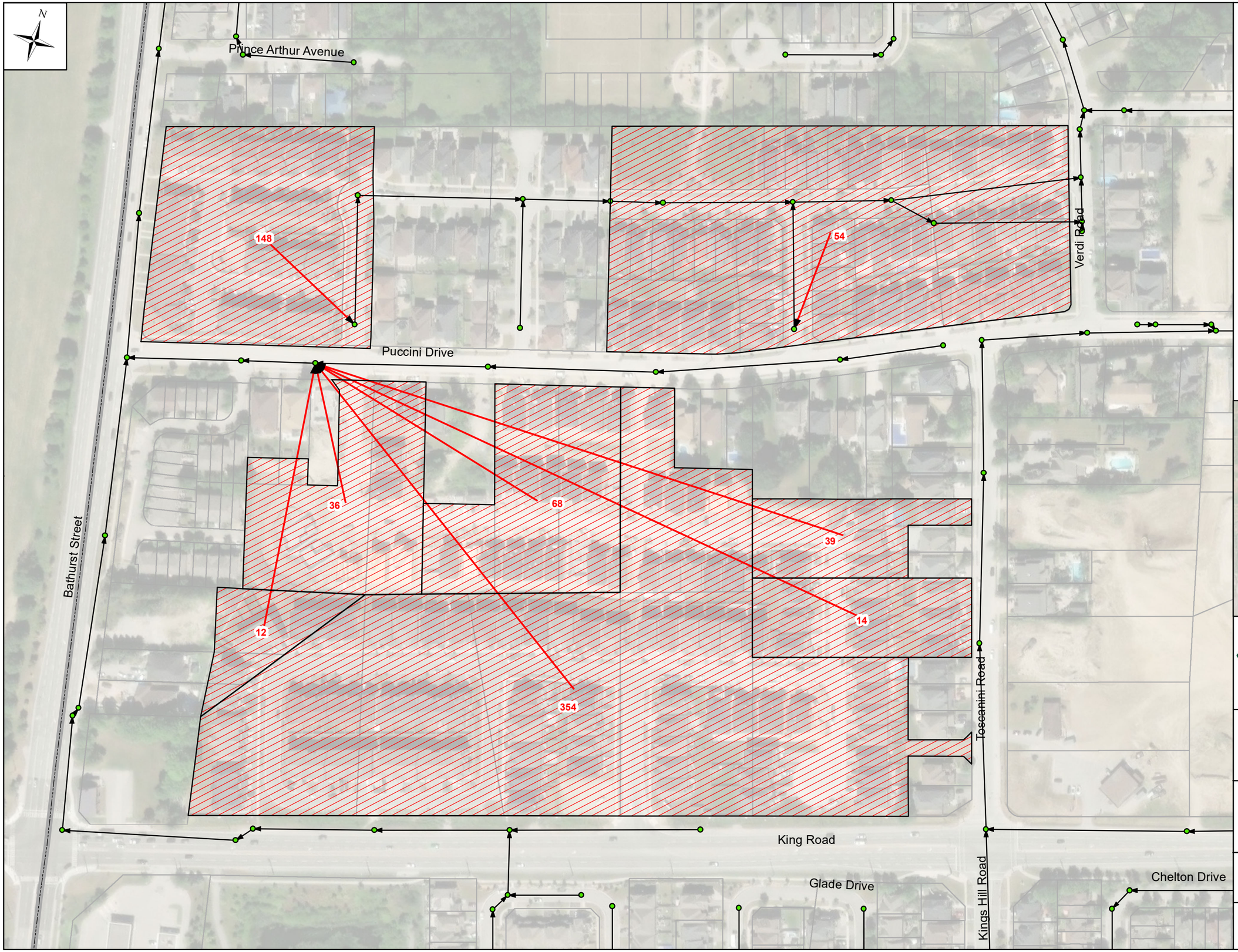
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (10) (2021 Data)

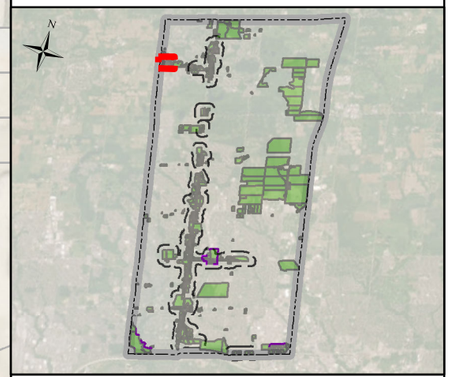
Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (11) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

N

Lowther Avenue

Madison Avenue

Laurier Avenue

Portage Avenue

Prince Arthur Avenue

Bathurst Street

15

9

7

2

15

2

13

7

7

13

13

6

18

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

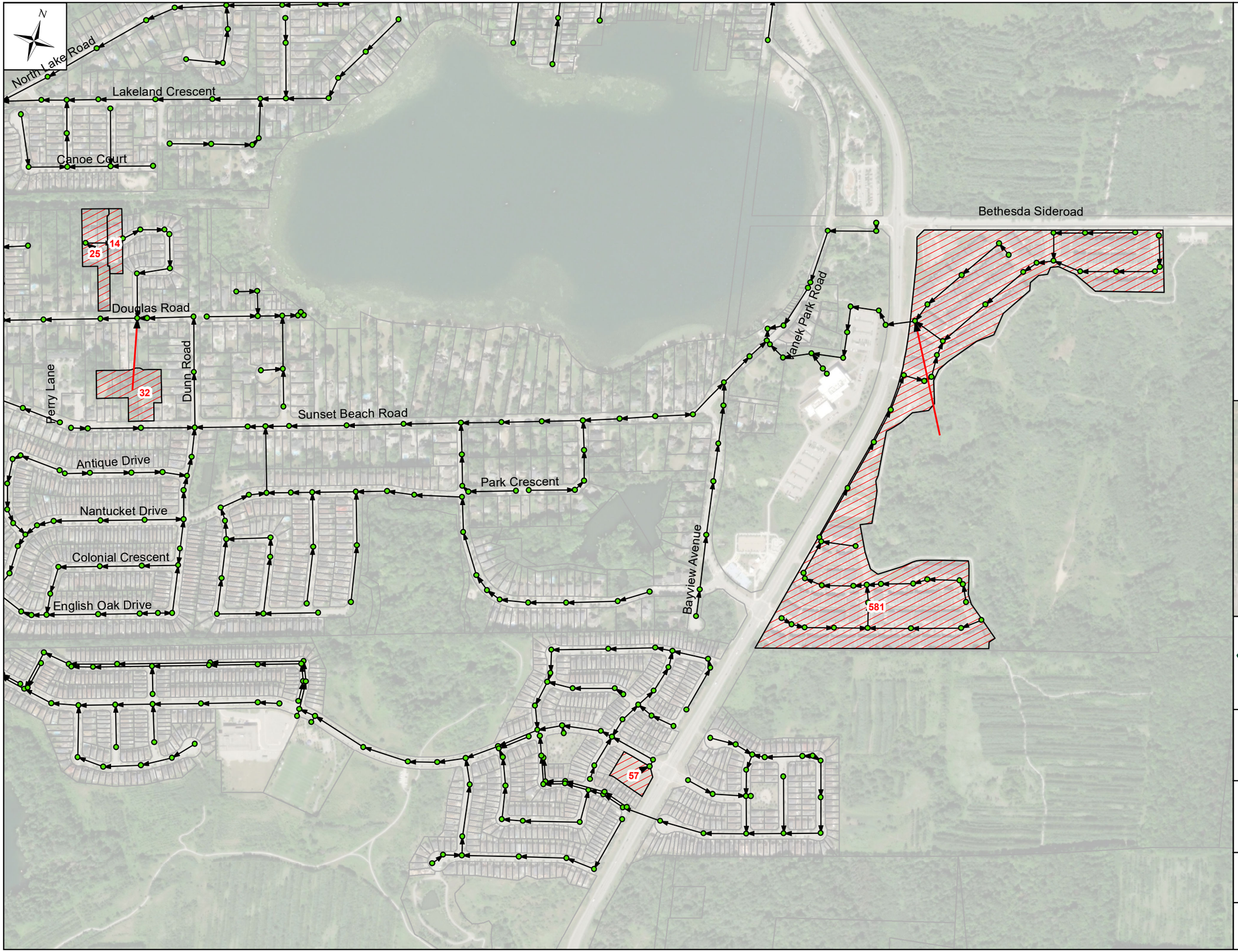
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (12) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

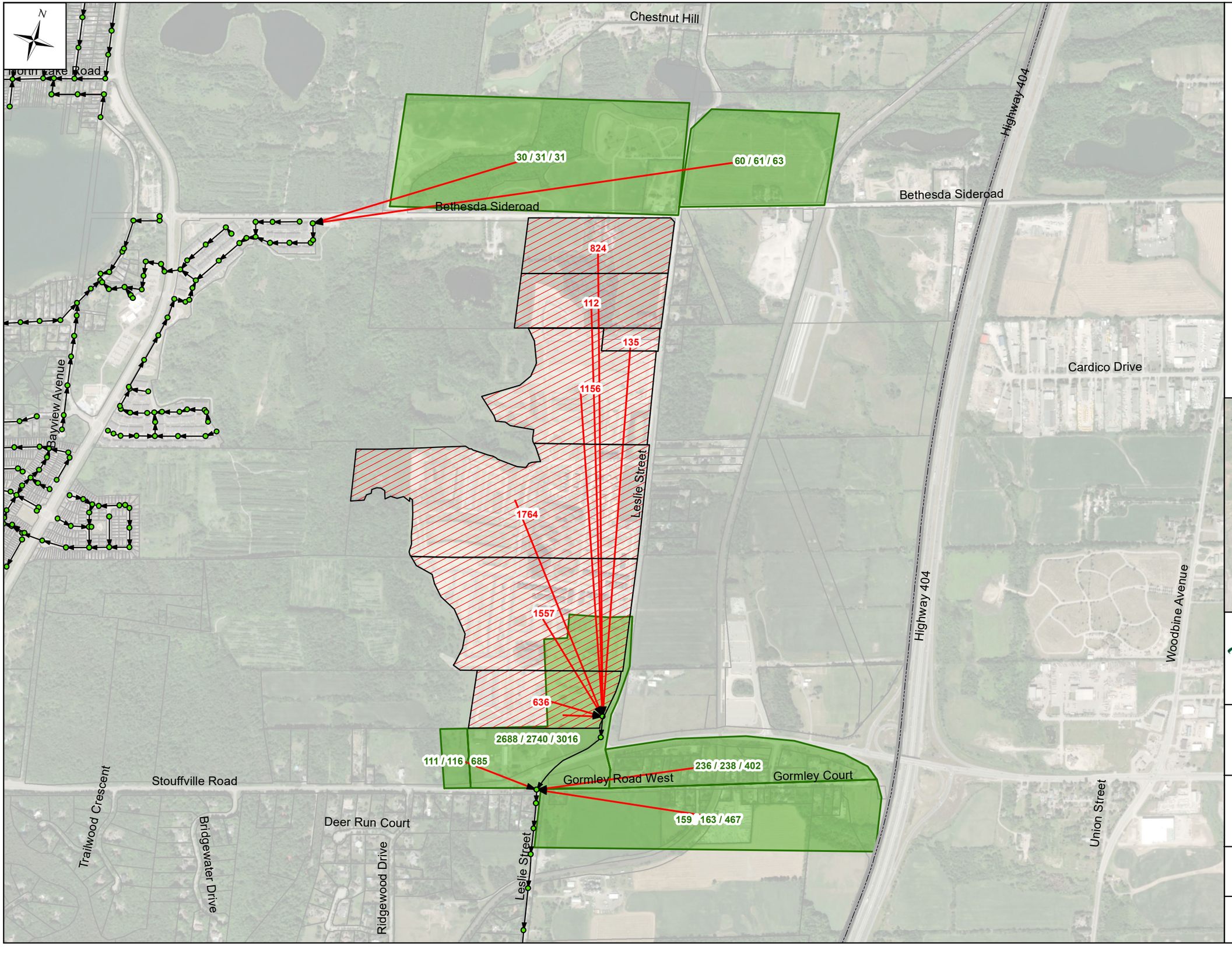
Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (13) (2021 Data)

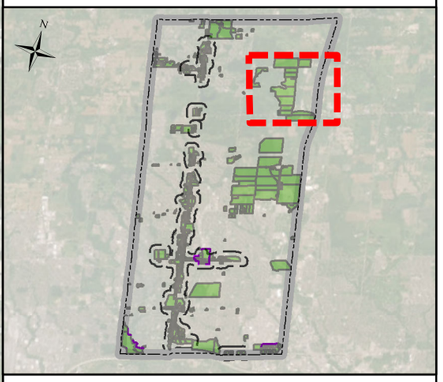
Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (14) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 125 250 500 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- Future Sanitary Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

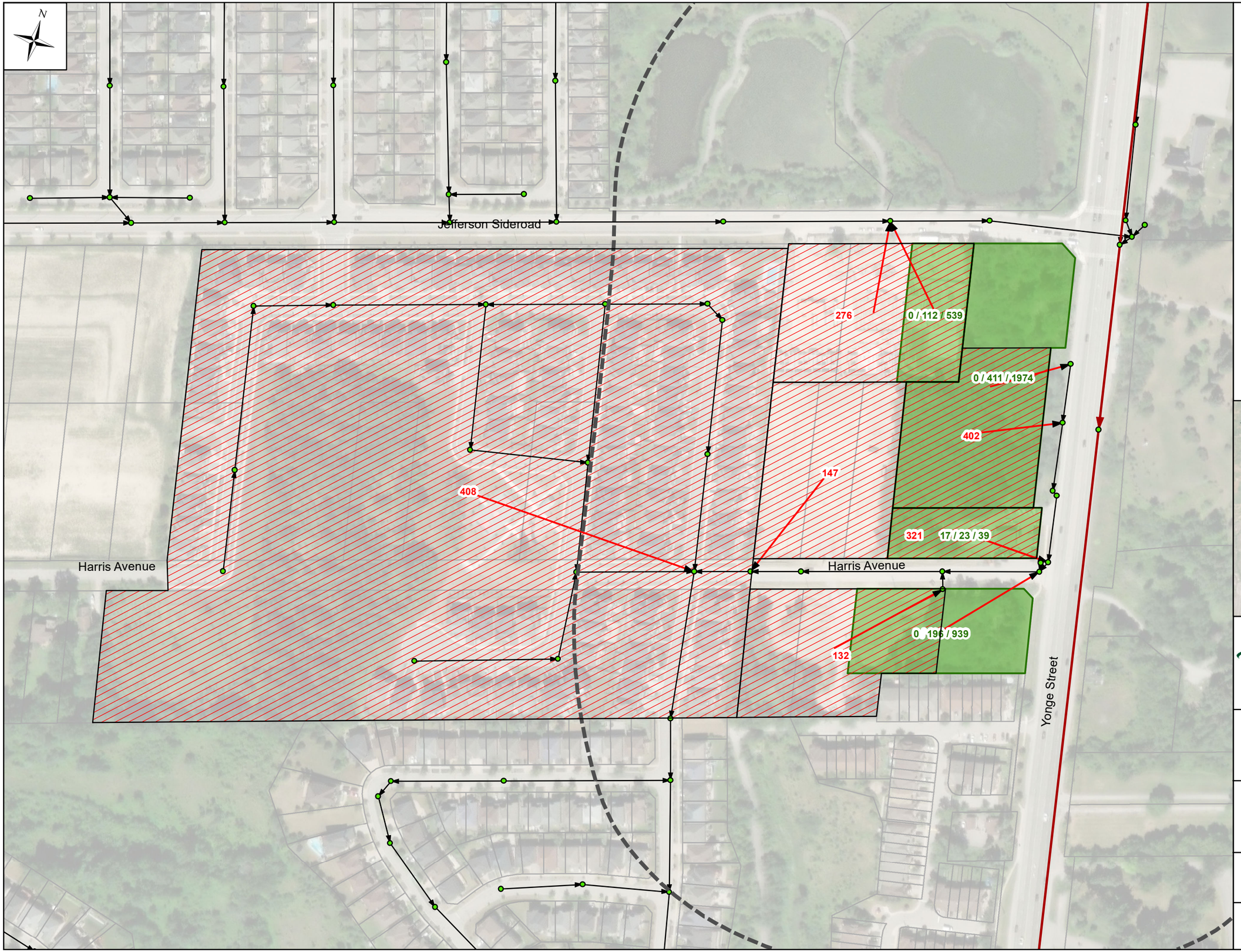
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (15) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (16) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Jefferson Sideroad

Beech Avenue

Harris Avenue

124

159

532

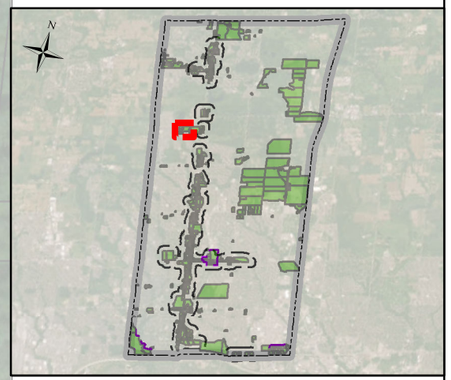
0

26

18

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



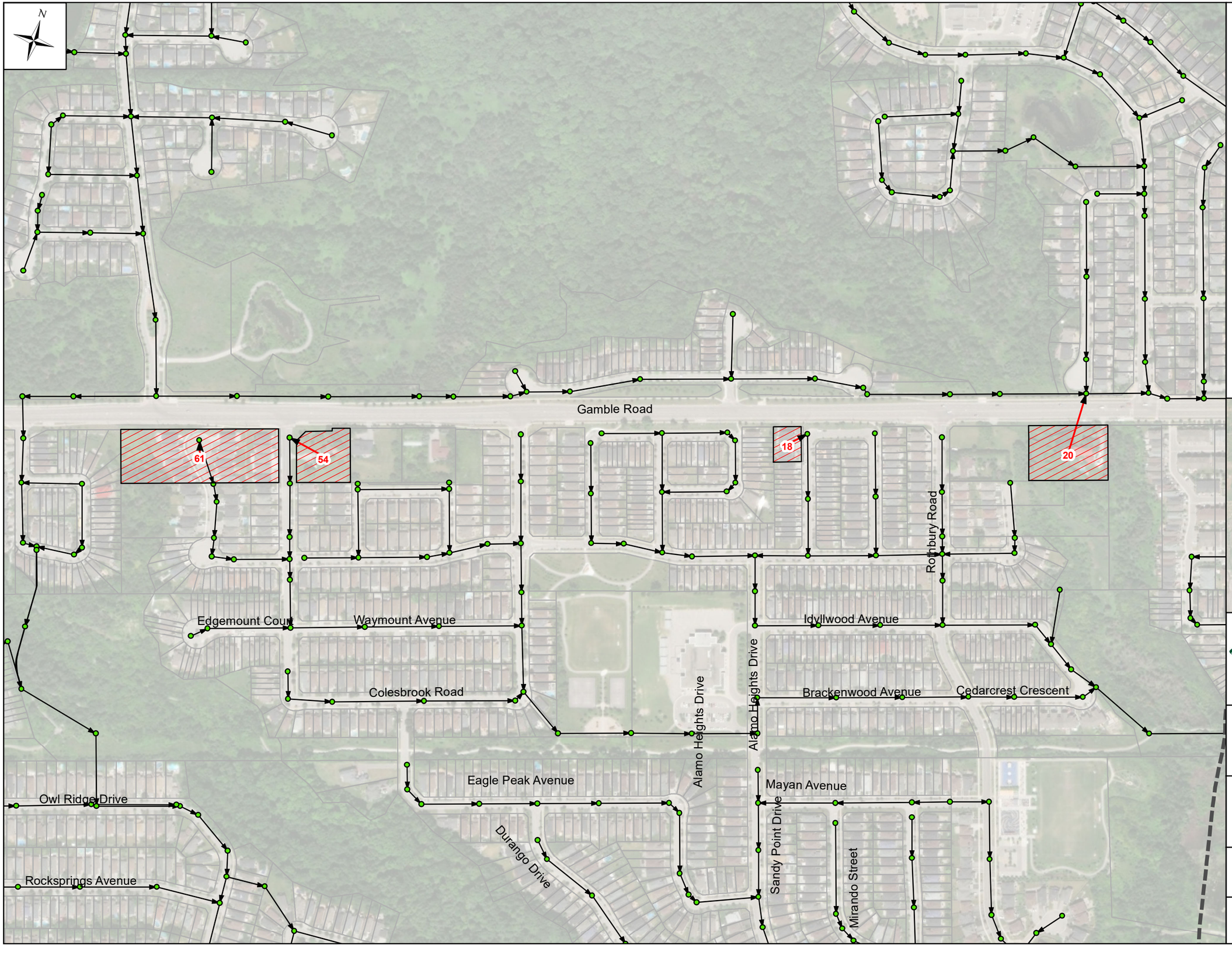
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (17) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (18) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

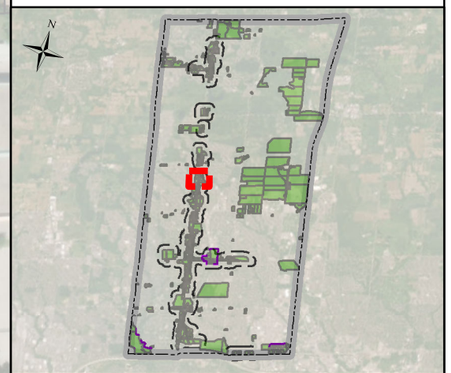
Future Growth and Connection (19) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (20) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

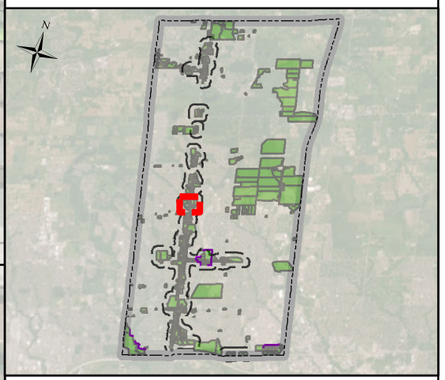
Future Growth and Connection (21) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



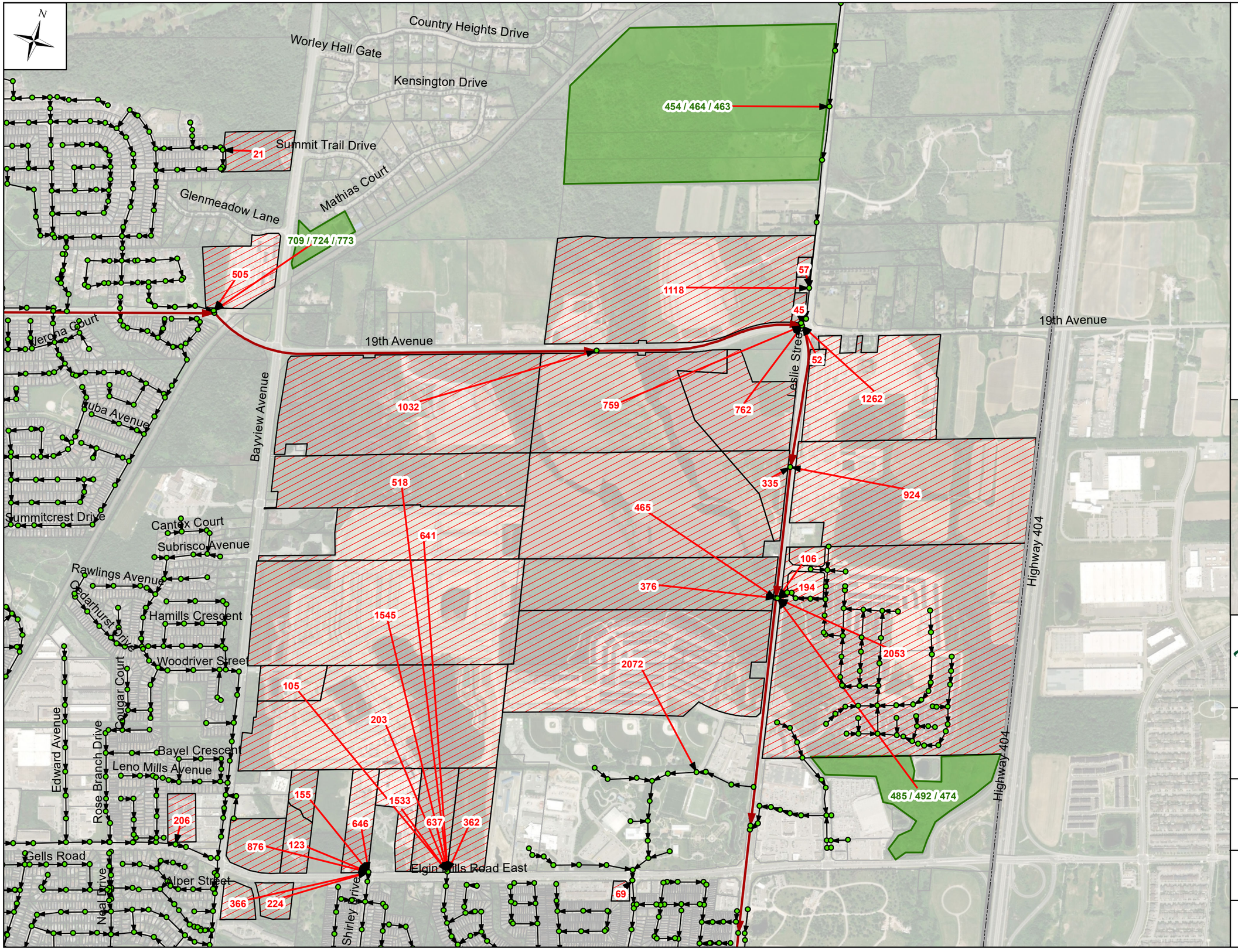
Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (22) (2021 Data)

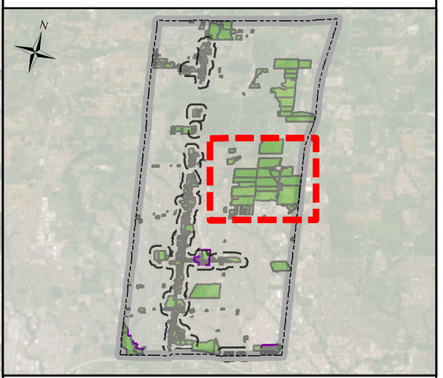
Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



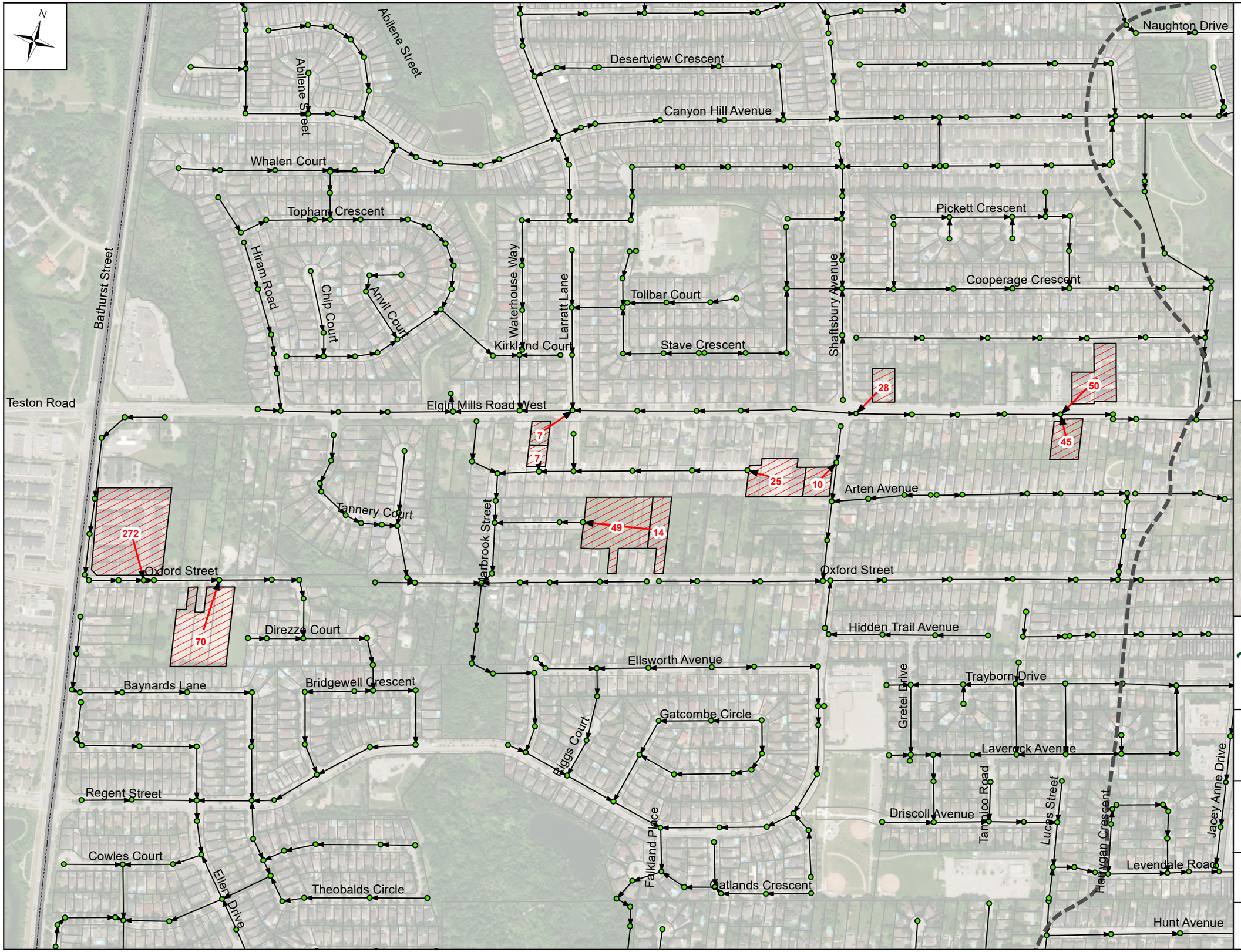
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (23) (2021 Data)

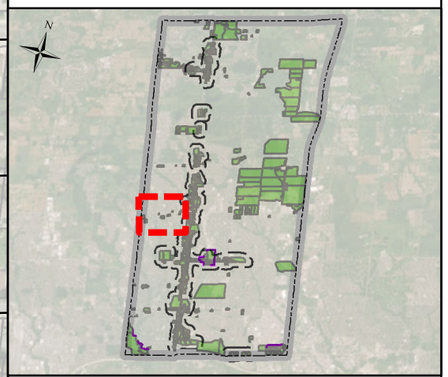
Drawn By: J.H. Date: Oct 28, 2023

0 125 250 500 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (24) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (25) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Trayborn Drive
Laverock Avenue
Jacey Anne Drive
Enford Road
Harrygan Crescent
Levendale Road
Yonge Street
Hunt Avenue
Benson Avenue
Stephenson Crescent

36 / 94 / 205
12 / 142 / 4717
15 / 39 / 86
11 / 29 / 64
1 / 2 / 52
39 / 74 / 410
6 / 14 / 32

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

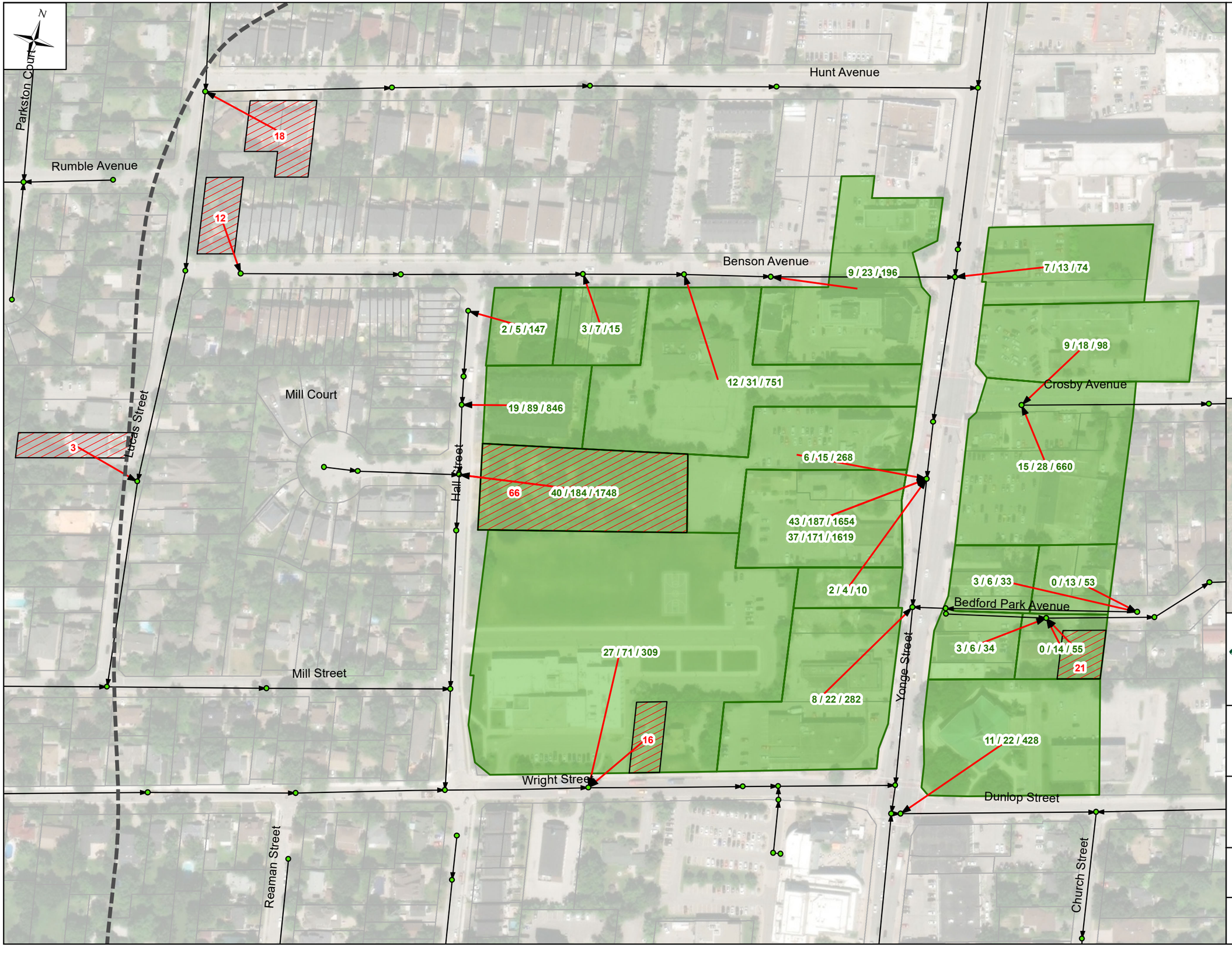
Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (26) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

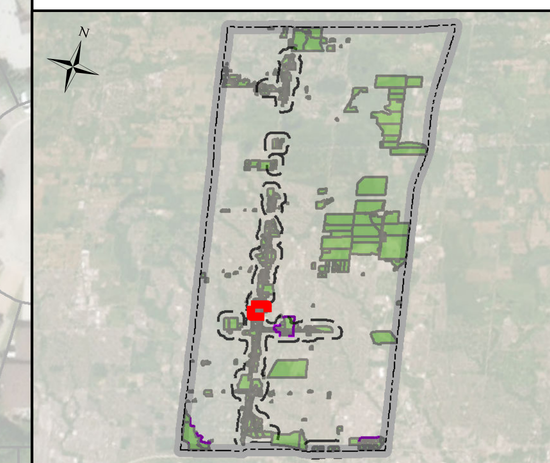
Future Growth and Connection (27) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041)
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (28) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

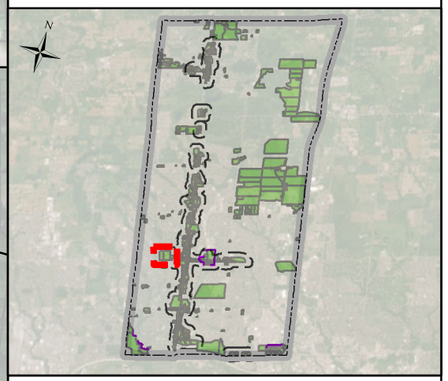
Future Growth and Connection (29) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041)
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



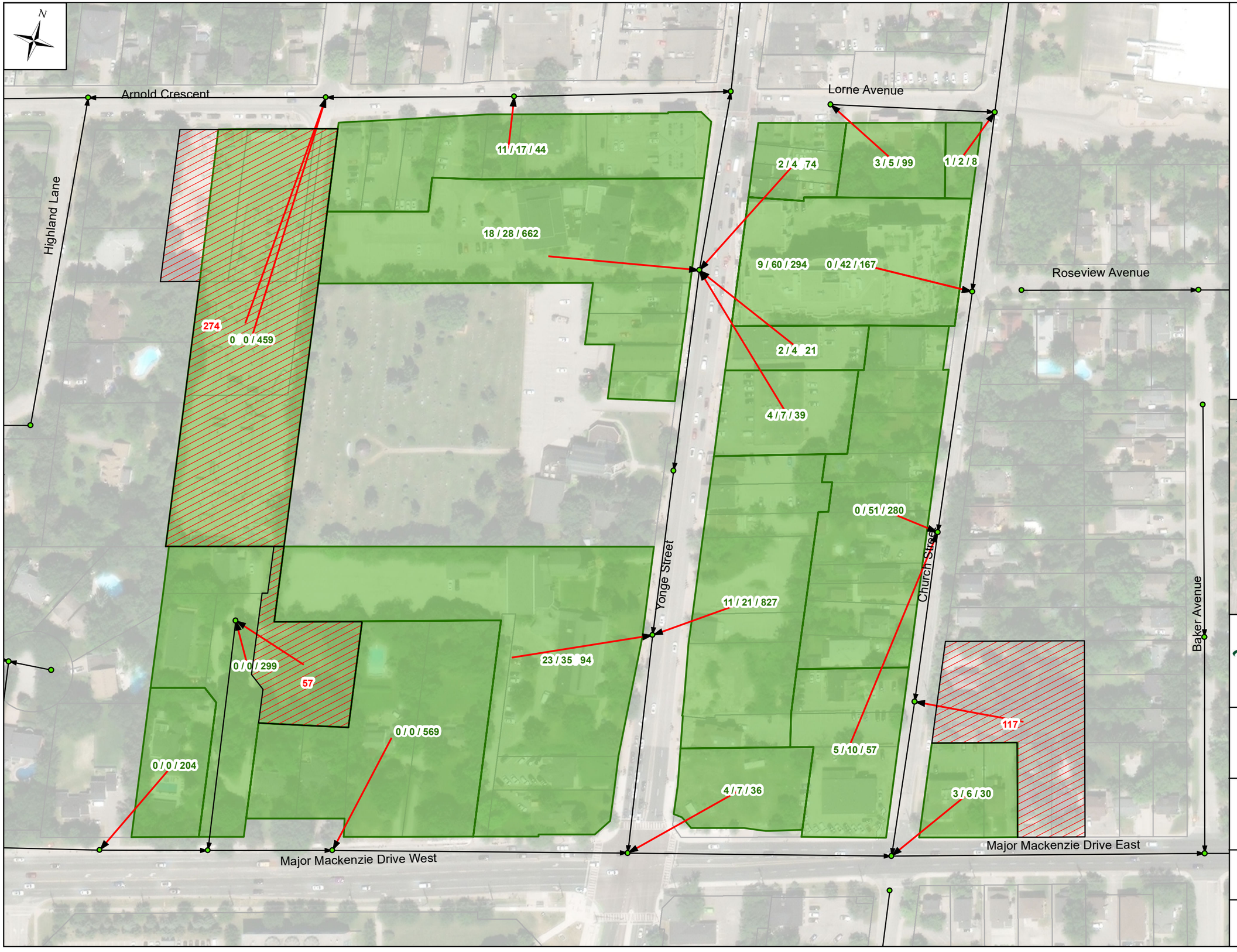
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (30) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

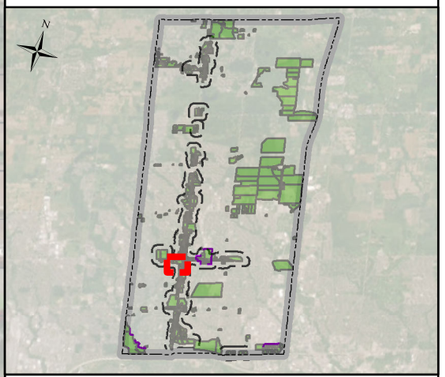
Future Growth and Connection (31) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (32) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

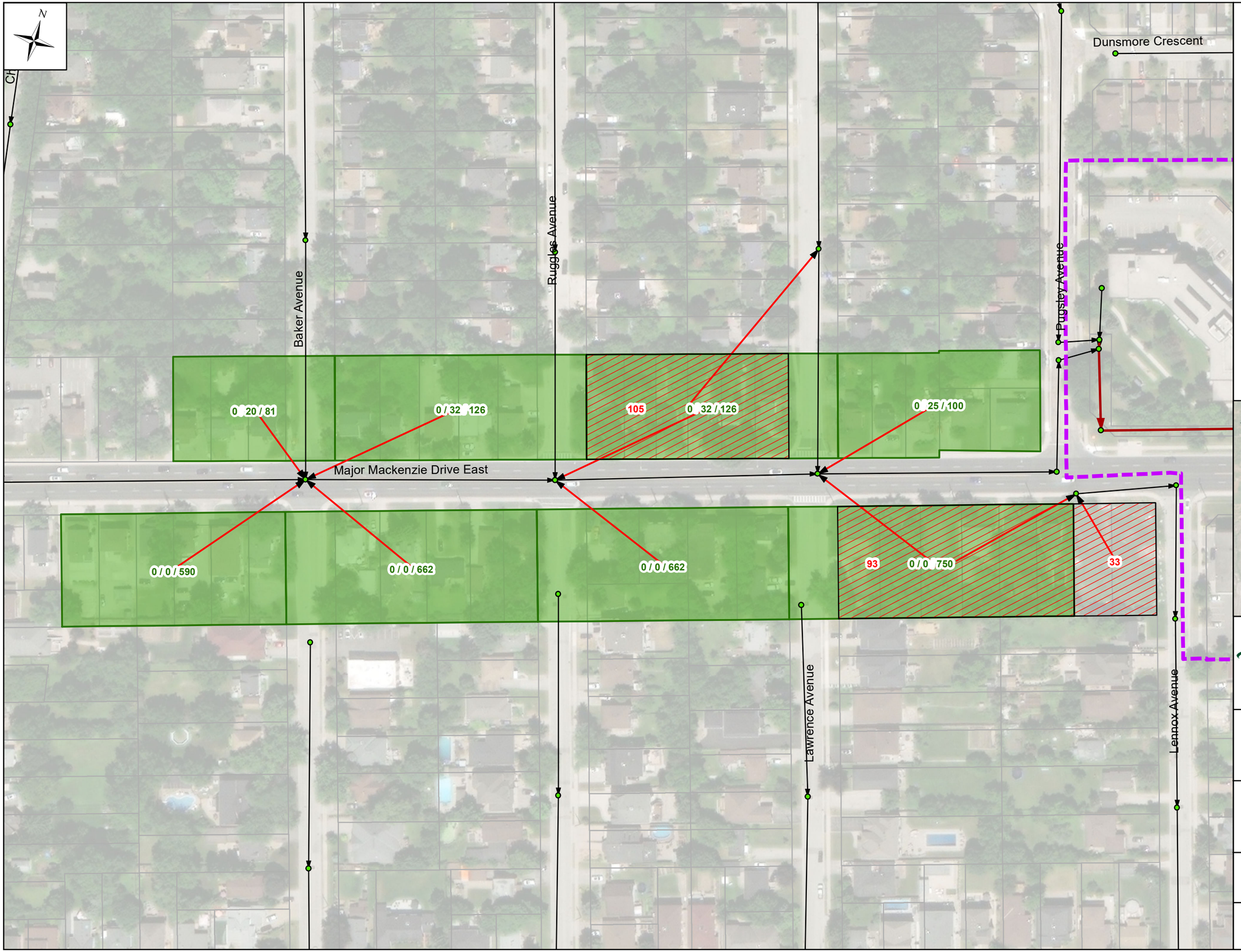
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (33) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50
Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041)
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

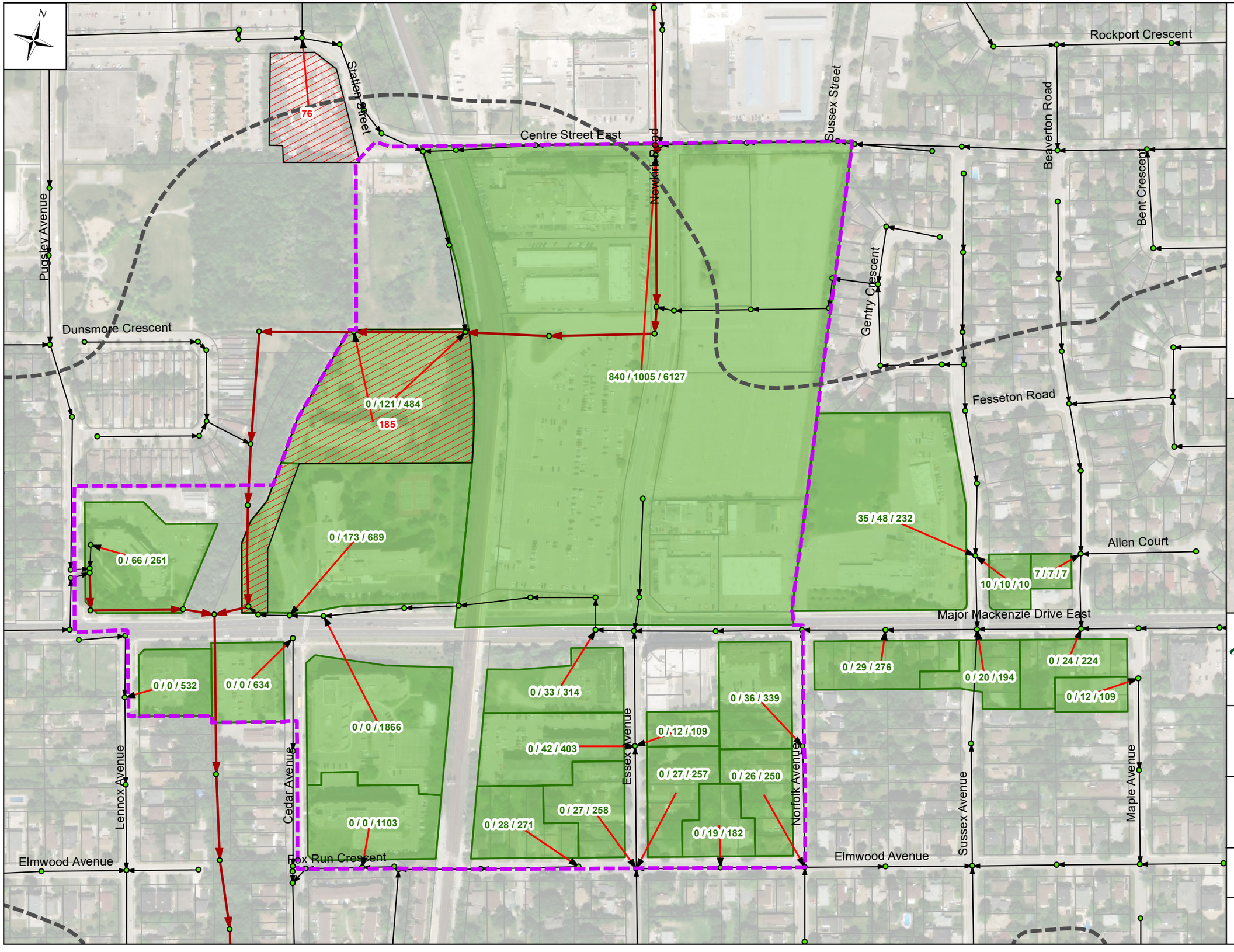
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (34) (2021 Data)

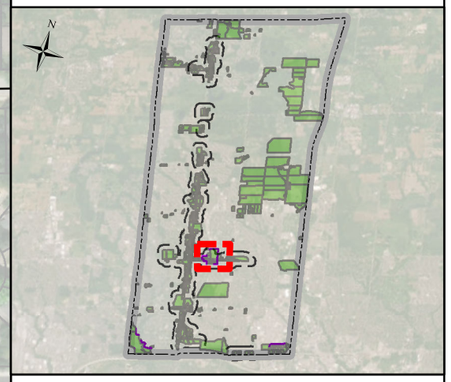
Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- 60 — New Development Application (Population 2041)
- 0 / 2 / 50 — OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

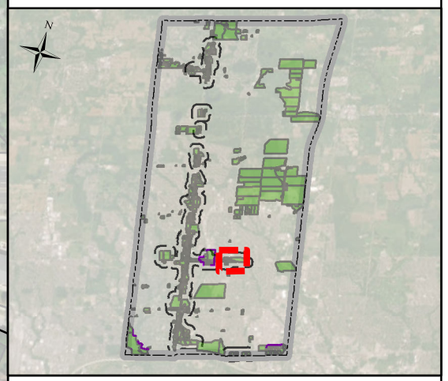
Future Growth and Connection (35) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (36) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (37) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

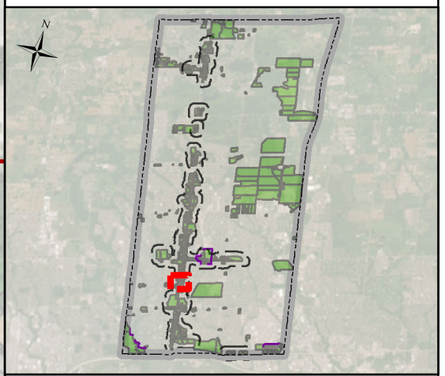
Future Growth and Connection (38) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



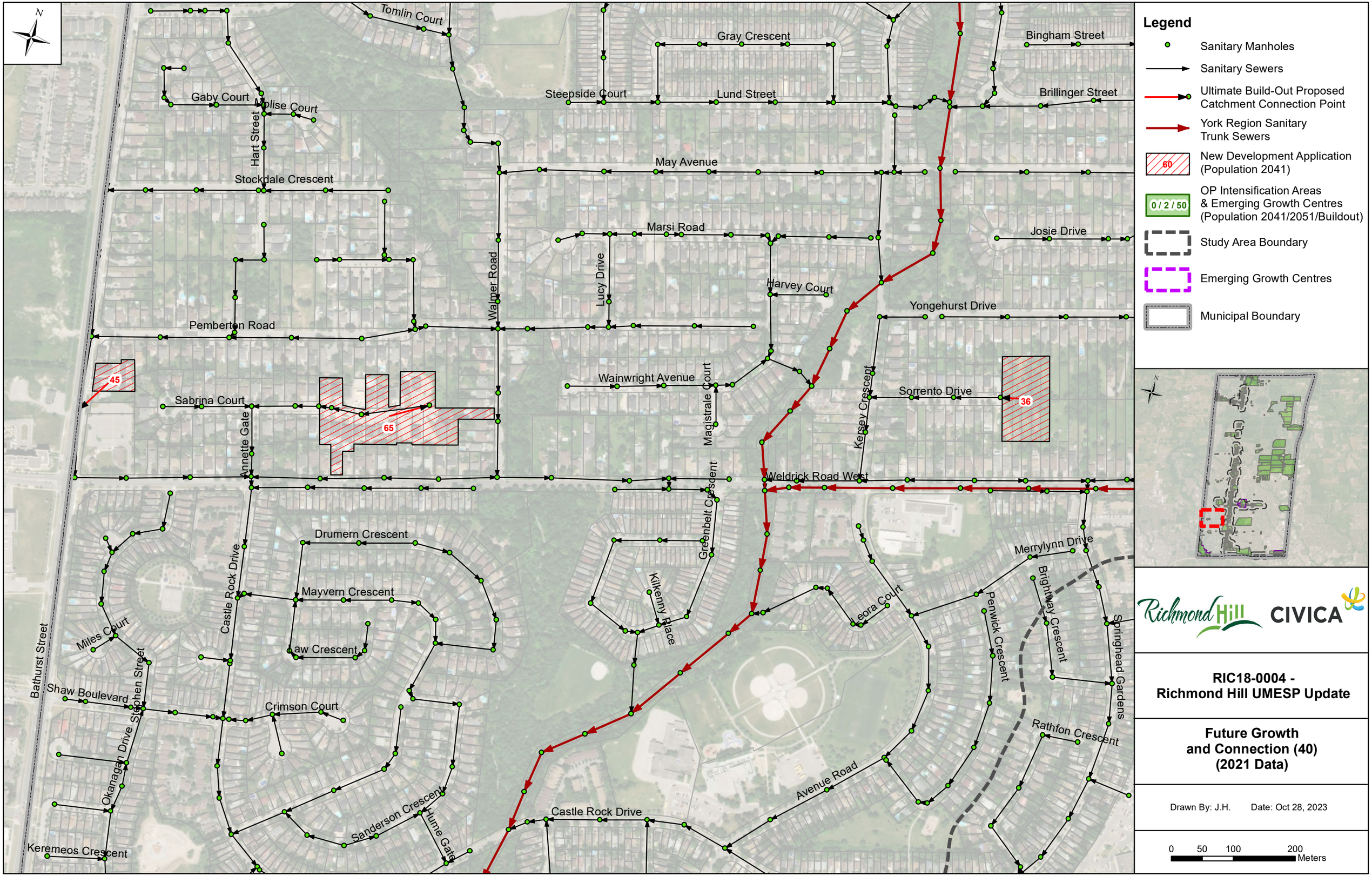
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (39) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

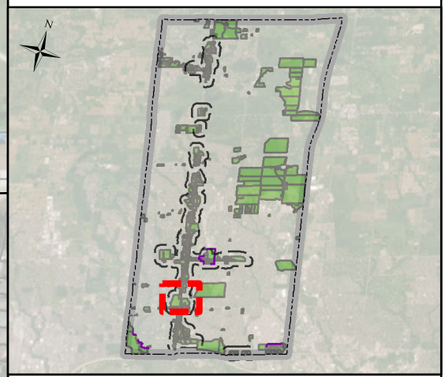
Future Growth and Connection (40) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



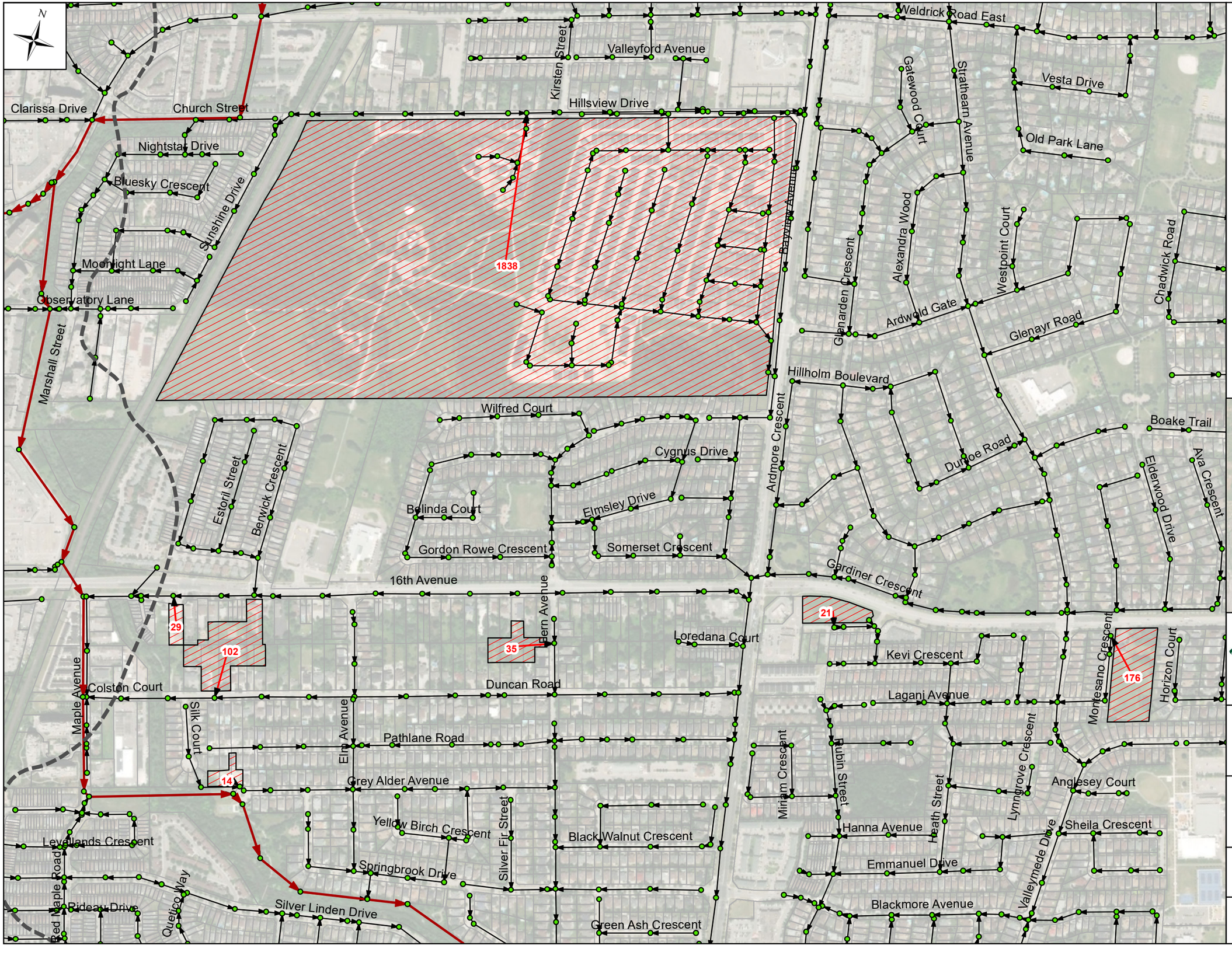
Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (41) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

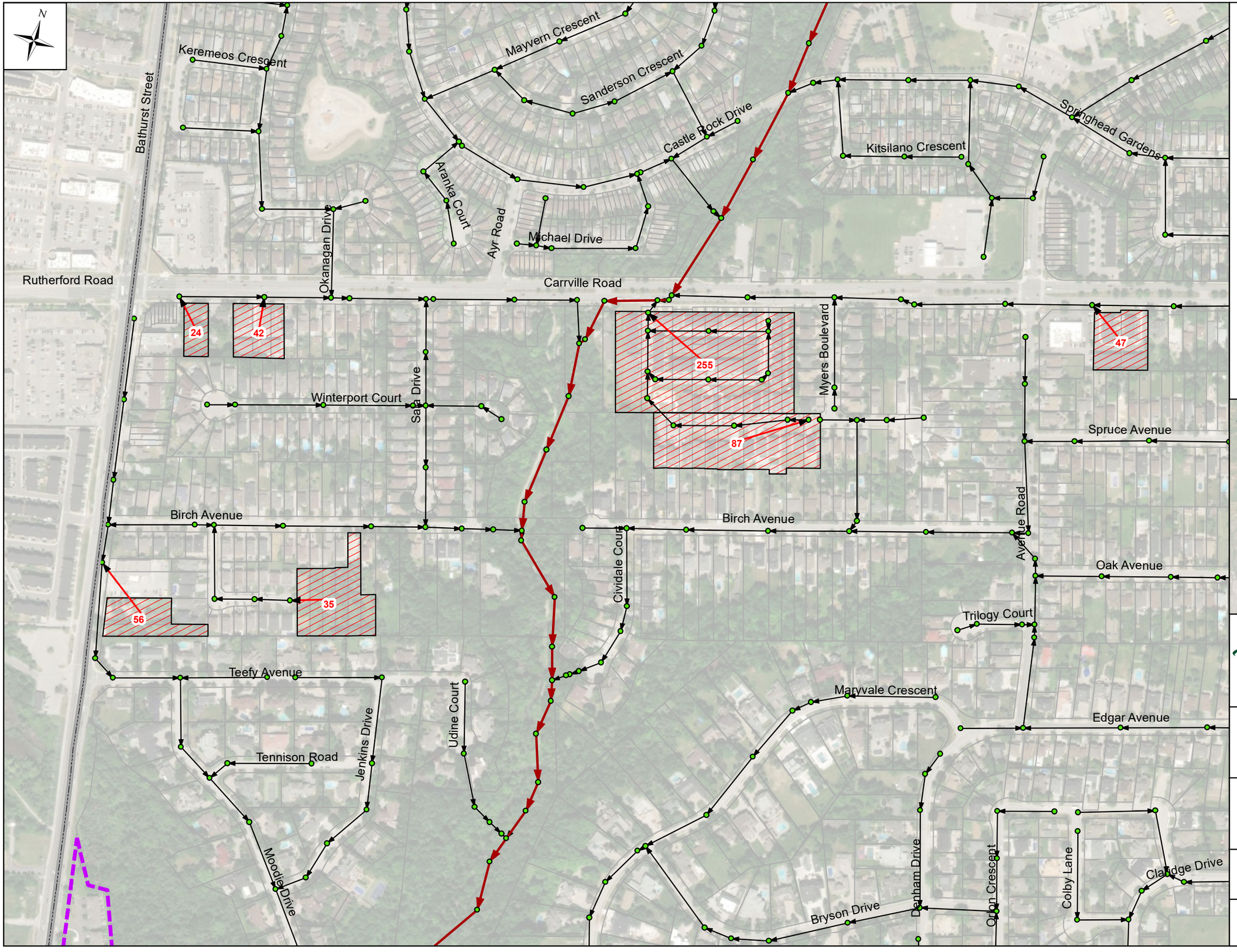
Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (42) (2021 Data)

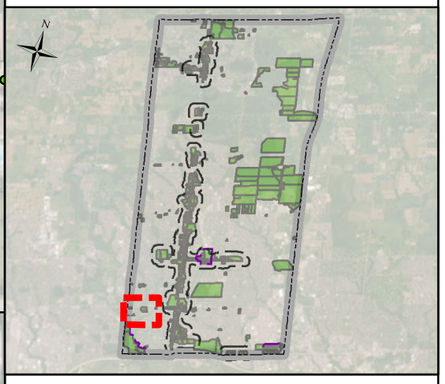
Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

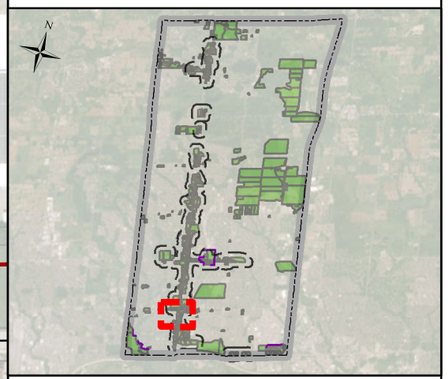
Future Growth and Connection (43) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

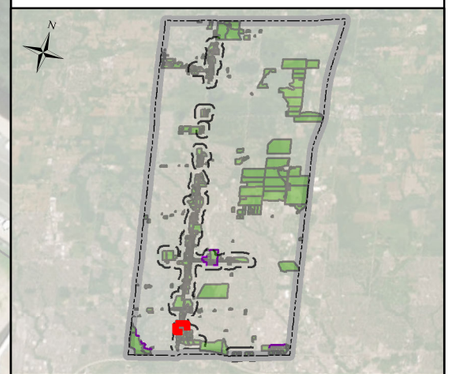
Future Growth and Connection (44) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- 2041 & 2051 Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

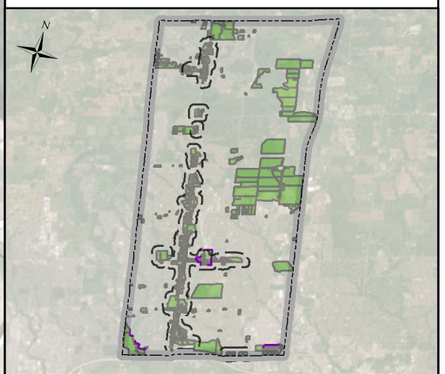
Future Growth and Connection (45)
(2041 & 2051)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population Ultimate Build-Out)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

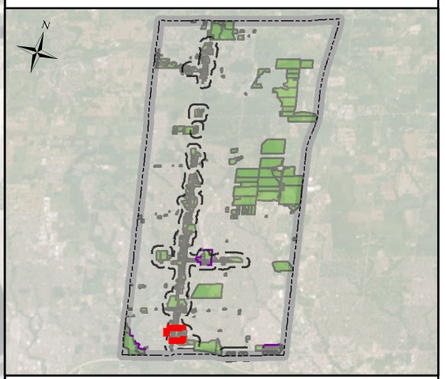
Future Growth and Connection (45)
(Ultimate Build-Out)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- 2041 & 2051 Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

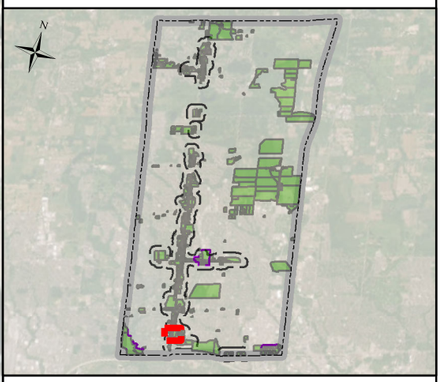
Future Growth and Connection (46)
(2041 & 2051)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population Ultimate Build-Out)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (46)
(Ultimate Build-Out)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

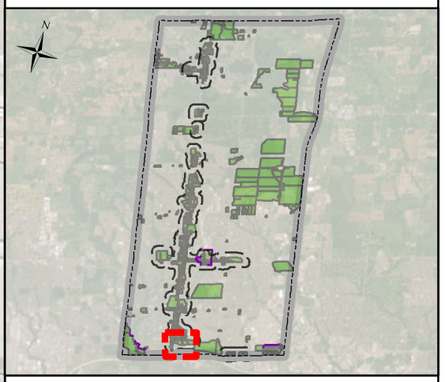
Future Growth and Connection (47) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- 2041 & 2051 Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

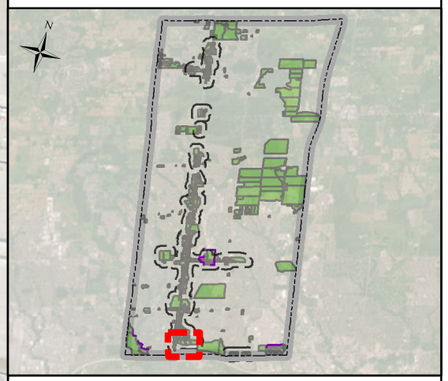
Future Growth and Connection (48)
(2041 & 2051)
(2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population Ultimate Build-Out)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



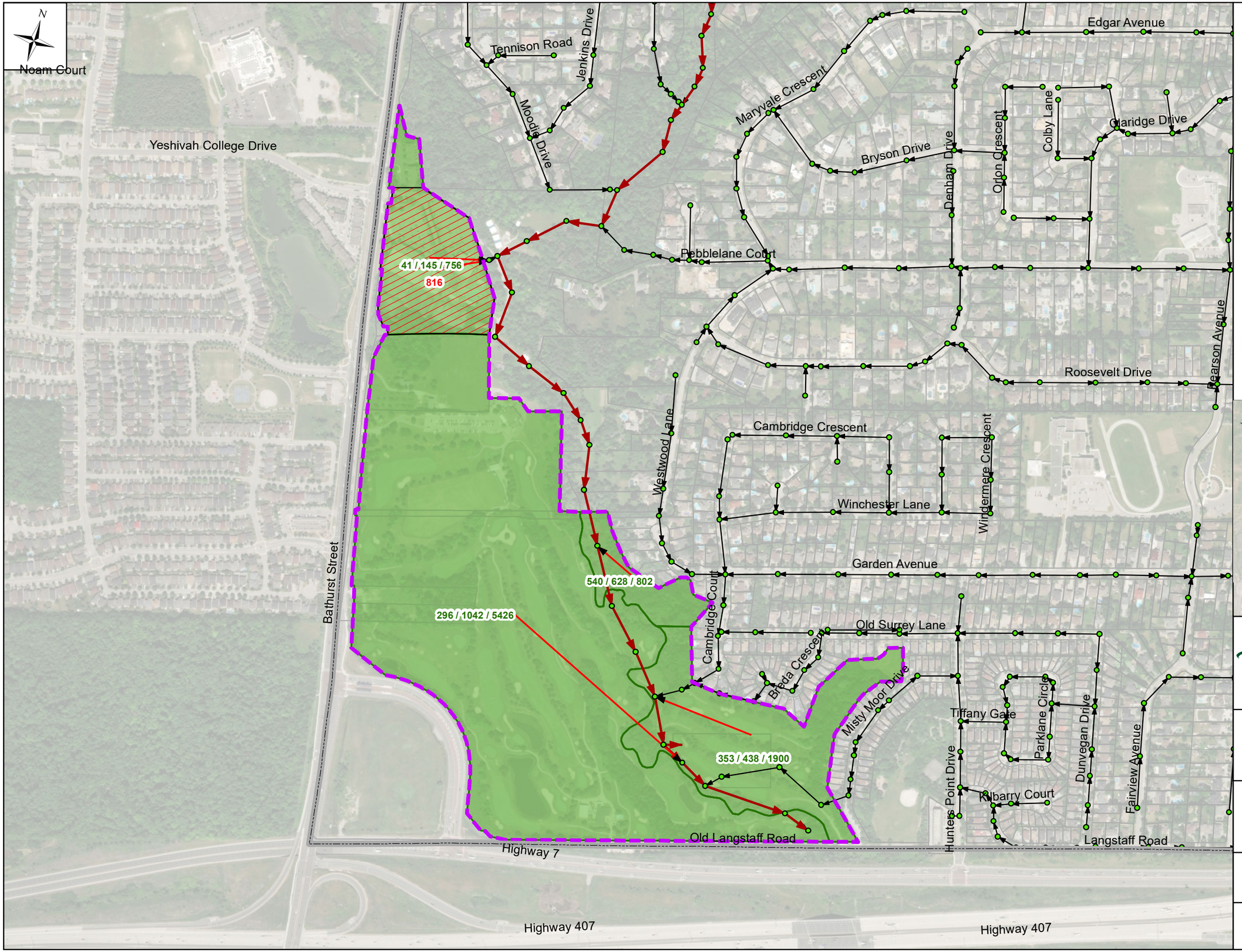
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (48)
(Ultimate Build-Out)
(2021 Data)

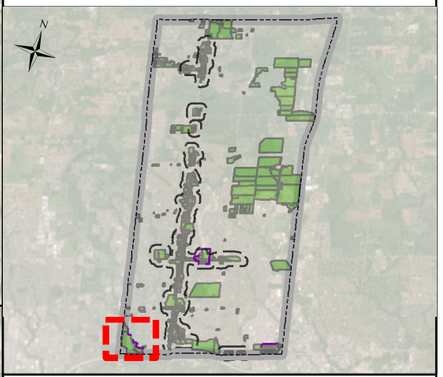
Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary



Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (49) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041)
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout)
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Future Growth and Connection (50) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (51) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Reid Street
Fulton Way
East Beaver Creek Road
West Pearce Street
East Pearce Street
West Beaver Creek Road
Wertheim Court
York Boulevard
Highway 7
Highway 404
Commerce Valley Drive West
Leslie Street
Commerce Valley Drive East
Minthorn Court

0 / 468 / 489
46 / 52 / 302
52 / 57 / 334
55 / 61 / 359
68 / 68 / 443
66 / 66 / 429
91 / 100 / 588
386
130 / 144 / 840
807
94 / 105 / 613
70 / 77 / 452
67 / 74 / 434
80 / 88 / 517
36 / 39 / 230
61 / 68 / 397
13 / 14 / 83
105 / 116 / 680
21 / 23 / 135
205 / 227 / 1330
60 / 66 / 389
113 / 125 / 732
22 / 25 / 144
155 / 172 / 1006
105 / 116 / 681
57 / 63 / 367
29 / 32 / 188

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Development Application (Population 2041) — 60
- OP Intensification Areas & Emerging Growth Centres (Population 2041/2051/Buildout) — 0 / 2 / 50
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary

Richmond Hill CIVICA

RIC18-0004 - Richmond Hill UMESP Update

Future Growth and Connection (52) (2021 Data)

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

CIVICA
Municipal Water Resources

Appendix II
Recommended Wastewater Projects

CIVICA

Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
WW-1	SL2656	SA2576	SA2429	CIRC	250	300	117.2	Sewer Upsizing	Yes	**No**	**No**
	SL2657	SA2429	SA2428	CIRC	250	300	88.6	Sewer Upsizing	Yes	**No**	**No**
	SL2540	SA2428	SA2427	CIRC	250	375	62.8	Sewer Upsizing	Yes	Yes	Yes
	SL2541	SA2427	SA2426	CIRC	250	375	69.3	Sewer Upsizing	Yes	Yes	Yes
	SL2542	SA2426	SA2411	CIRC	250	375	32.1	Sewer Upsizing	Yes	Yes	Yes
	SL2543	SA2411	SA2410	CIRC	250	375	44.2	Sewer Upsizing	Yes	Yes	Yes
	SL2544	SA2410	SA2409	CIRC	250	375	56	Sewer Upsizing	Yes	**No**	**No**
WW-2	New Pipe	San_MH10A	San_MH11A	CIRC	NA	450	110.0	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH11A	San_MH6A	CIRC	NA	450	42.6	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH6A	San_MH12A	CIRC	NA	450	110.0	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH12A	San_MH13A	CIRC	NA	450	110.0	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH13A	San_MH14A	CIRC	NA	450	110.0	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH14A	San_MH15A	CIRC	NA	450	63.8	New Sewer	Yes	Yes	Yes
	New Pipe	San_MH15A	SA7761	CIRC	NA	450	12.2	New Sewer	Yes	Yes	Yes
WW-3	New Pipe	WW3_SAN_MH7A	WW3_SAN_MH5A	CIRC	NA	250	40.1	New Sewer	Yes	Yes	Yes
	New Pipe	WW3_SAN_MH5A	WW3_SAN_MH4A	CIRC	NA	250	45.7	New Sewer	Yes	Yes	Yes
	New Pipe	WW3_SAN_MH4A	WW3_SAN_MH3A	CIRC	NA	250	4.2	New Sewer	Yes	Yes	Yes
	New Pipe	WW3_SAN_MH3A	WW3_SAN_MH104A	CIRC	NA	250	44.7	New Sewer	Yes	Yes	Yes
	New Pipe	WW3_SAN_MH104A	SAN_MH102A	CIRC	NA	250	10.0	New Sewer	Yes	Yes	Yes
	SL6446	SA6403	SA6421	CIRC	250	300	73	Sewer Upsizing	Yes	**No**	**No**
	SL6447	SA6421	SA6424	CIRC	250	300	94.7	Sewer Upsizing	Yes	**No**	**No**
	SL6435	SA6411	SA6412	CIRC	250	300	22.8	Sewer Upsizing	Yes	**No**	**No**
	SL6436	SA6412	SA6413	CIRC	250	300	41	Sewer Upsizing	Yes	**No**	**No**
	SL6437	SA6413	SA6414	CIRC	250	375	96.5	Sewer Upsizing	Yes	**No**	**No**
	SL6438	SA6414	SA6416	CIRC	250	375	41	Sewer Upsizing	Yes	**No**	**No**
WW-4	New Pipe	NewMH_OP3_8	XXXX000162	CIRC	NA	250	121	New Sewer	Yes	Yes	Yes
WW-5	New Pipe	NewMH_OP3_11	NewMH_OP3_12	CIRC	NA	250	48.6	New Sewer	Yes	Yes	Yes
WW-6	New Pipe	NewMH_OP3_13	NewMH_OP3_14	CIRC	NA	300	101.5	New Sewer	Yes	Yes	Yes
	New Pipe	NewMH_OP3_14	SA4815	CIRC	NA	300	13.3	New Sewer	Yes	Yes	Yes

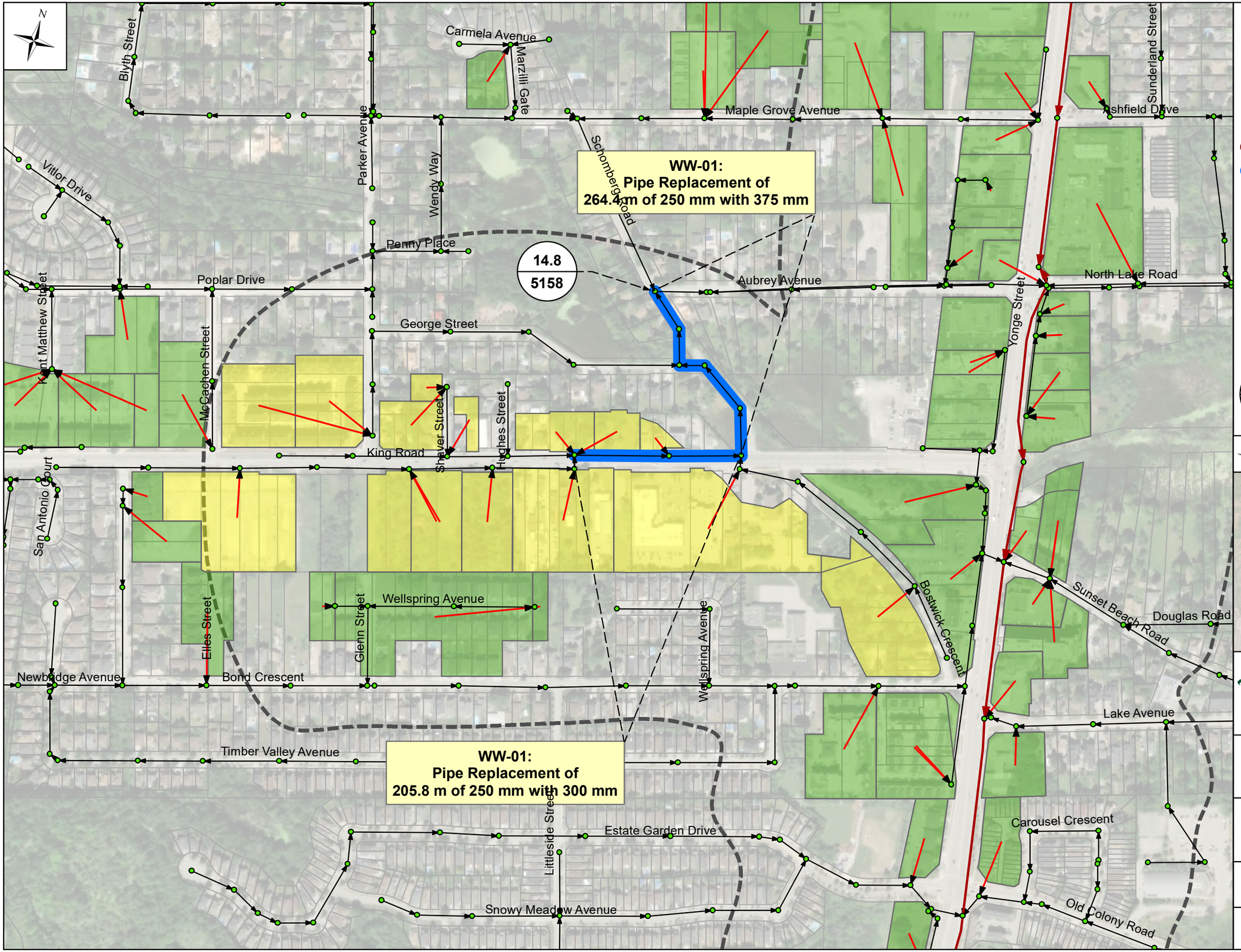
Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
WW-7	SL0532	SA0531	SA0329	CIRC	300	375	58.2	Sewer Upsizing	Yes	Yes	Yes
	SL0334	SA0329	SA0330	CIRC	250	375	41.1	Sewer Upsizing	Yes	Yes	Yes
	SL0335	SA0330	SA0331	CIRC	250	375	86.1	Sewer Upsizing	Yes	Yes	Yes
	SL0336	SA0331	SA0332	CIRC	250	375	81.5	Sewer Upsizing	Yes	Yes	Yes
	SL0337	SA0332	SA0333	CIRC	200	375	10	Sewer Upsizing	Yes	Yes	Yes
	SL0368	SA0333	SA0363	CIRC	250	375	104.6	Sewer Upsizing	Yes	Yes	Yes
	SL0369	SA0363	SA0361	CIRC	250	375	104.6	Sewer Upsizing	Yes	Yes	Yes
	SL0370	SA0361	SA0362	CIRC	250	375	103.5	Sewer Upsizing	Yes	Yes	Yes
	SL0371	SA0362	SA0353	CIRC	250	375	113.8	Sewer Upsizing	Yes	Yes	Yes
	SL0357	SA0353	SA0354	CIRC	250	375	60.4	Sewer Upsizing	Yes	Yes	Yes
	SL0355	SA0354	SA0348	CIRC	250	375	27.4	Upsized sewer connect to the Trunk	Yes	Yes	Yes
WW-8	SL0449	SA0443	SA0442	CIRC	300	375	108.8	Sewer Upsizing	Yes	**No**	**No**
	SL0448	SA0441	SA0440	CIRC	300	450	57.9	Sewer Upsizing	Yes	**No**	**No**
	SL0446	SA0440	SA8534	CIRC	300	450	95	Sewer Upsizing	Yes	Yes	Yes
	SL8527	SA8534	SA0439	CIRC	300	450	16.6	Sewer Upsizing	Yes	Yes	Yes
	SL0445	SA0439	SA0438	CIRC	300	450	85.5	Sewer Upsizing	Yes	Yes	Yes
	SL8537	SA0438	SA8544	CIRC	300	525	33.6	Sewer Upsizing	Yes	Yes	Yes
	SL1219	SA8544	SA0399	CIRC	300	525	75.4	Sewer Upsizing	Yes	Yes	Yes
	SL0541	SA0399	SA0546	CIRC	300	525	105.5	Sewer Upsizing	Yes	Yes	Yes
	SL0540	SA0546	SA0540	CIRC	375	525	15.2	Sewer Upsizing	Yes	Yes	Yes
WW-9	SL0543	SA0542	SA0544	CIRC	250	375	86.6	Sewer Upsizing	Yes	Yes	**No**
	SL0544	SA0544	SA0545	CIRC	250	375	88.5	Sewer Upsizing	Yes	Yes	**No**
	SL8489	SA0545	SA8511	CIRC	250	375	22.7	Sewer Upsizing	Yes	**No**	**No**
	SL0545	SA8511	SA0546	CIRC	250	375	68.5	Sewer Upsizing	Yes	**No**	**No**
WW-10	SL9331	SA0540	SA9356	CIRC	375	525	5.5	Sewer Upsizing	Yes	Yes	Yes
	SL0395	SA9356	SA0383	CIRC	375	600	114	Sewer Upsizing	Yes	Yes	Yes
	SL0392	SA0383	SA0382	CIRC	450	600	70.2	Sewer Upsizing	Yes	Yes	Yes
	SL0393	SA0382	SA0381	CIRC	450	600	48.8	Sewer Upsizing	Yes	Yes	Yes
	SL0394	SA0381	SA0384	CIRC	450	600	105.7	Sewer Upsizing	Yes	Yes	Yes

Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
WW-11	SL1215	SA0384	SA0372	CIRC	450	675	5.3	Sewer Upsizing	Yes	Yes	Yes
	SL0388	SA0372	SA0385	CIRC	375	675	86.3	Sewer Upsizing	Yes	Yes	Yes
	SL0389	SA0385	SA0386	CIRC	300	525	92.7	Sewer Upsizing	Yes	Yes	Yes
	SL0390	SA0386	SA0387	CIRC	300	525	87.8	Sewer Upsizing	Yes	Yes	Yes
	SL0440	SA0387	SA0435	CIRC	300	525	90.8	Sewer Upsizing	Yes	Yes	Yes
	SL0441	SA0435	SA0389	CIRC	450	525	131	Sewer Upsizing	Yes	**No**	**No**
	SL0387	SA0389	SA0388	CIRC	450	600	61	Sewer Upsizing	Yes	**No**	**No**
	SL0866	SA0388	SA0522	CIRC	450	600	72	Sewer Upsizing	Yes	**No**	**No**
	SL1168	SA0522	SA0875	CIRC	450	600	68	Sewer Upsizing	Yes	Yes	**No**
	SL1172	SA0875	SA0873	CIRC	450	600	135	Sewer Upsizing	Yes	**No**	**No**
	SL0867	SA0873	SA0874	CIRC	375	600	17	Sewer Upsizing	Yes	Yes	Yes
WW-12	SL0479	SA0216	SA0476	CIRC	250	375	83.8	Sewer Upsizing	Yes	**No**	**No**
	SL0480	SA0476	SA0475	CIRC	250	300	85	Sewer Upsizing	Yes	**No**	**No**
	SL0481	SA0475	SA0474	CIRC	250	300	74.4	Sewer Upsizing	Yes	**No**	**No**
	SL1312	SA0474	SA0478	CIRC	250	300	73.6	Sewer Upsizing	Yes	**No**	**No**
	SL0917	SA0477	SA0925	CIRC	300	450	96.9	Sewer Upsizing	Yes	**No**	**No**
	SL0918	SA0925	SA0926	CIRC	375	525	75.7	Sewer Upsizing	Yes	Yes	Yes
	SL0919	SA0926	SA0919	CIRC	375	525	75.3	Sewer Upsizing	Yes	Yes	Yes
	SL0920	SA0919	SA0927	CIRC	375	525	74.1	Sewer Upsizing	Yes	Yes	Yes
	SL0921	SA0927	SA0895	CIRC	375	525	75.3	Sewer Upsizing	Yes	Yes	Yes
	SL1174	SA0895	SA1152	CIRC	375	450	30.8	Sewer Upsizing	Yes	**No**	**No**
	SL1175	SA1152	SA1153	CIRC	375	450	31.3	Sewer Upsizing	Yes	**No**	**No**
	SL1192	SA1153	SA1169	CIRC	375	450	64.1	Sewer Upsizing	Yes	**No**	**No**
	SL1753	SA1701	SA1700	CIRC	250	375	94	Sewer Upsizing	Yes	Yes	Yes
	SL1754	SA1700	SA1702	CIRC	250	375	10.2	Sewer Upsizing	Yes	Yes	**No**
	SL2302	SA1702	SA2271	CIRC	250	375	60.5	Sewer Upsizing	Yes	Yes	**No**
	SL2303	SA2271	SA1382	CIRC	250	375	7.2	Sewer Upsizing	Yes	Yes	**No**
	SL1435	SA1378	SA1377	CIRC	300	450	94.8	Sewer Upsizing	Yes	Yes	Yes
	SL1436	SA1377	SA1373	CIRC	300	450	41.8	Sewer Upsizing	Yes	Yes	Yes
	SL1434	SA1373	SA1370	CIRC	300	450	6.1	Sewer Upsizing	Yes	Yes	Yes

Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
WW-13	SL1426	SA1370	SA1369	CIRC	350	450	128.8	Sewer Upsizing	Yes	Yes	Yes
	SL1427	SA1369	SA1371	CIRC	350	450	58.3	Sewer Upsizing	Yes	Yes	Yes
	SL1428	SA1371	SA1358	CIRC	350	450	121.9	Sewer Upsizing	Yes	Yes	Yes
	SL1417	SA1358	SA1356	CIRC	375	525	33.1	Sewer Upsizing	Yes	Yes	Yes
	SL1416	SA1356	SA1359	CIRC	375	525	80.8	Sewer Upsizing	Yes	Yes	Yes
	SL1413	SA1359	SA1354	CIRC	375	525	62.2	Sewer Upsizing	Yes	Yes	Yes
	SL1488	SA1447	XXXX000124	CIRC	525	600	70.9	Sewer Upsizing	Yes	**No**	**No**
	SL1489	XXXX000124	SA1445	CIRC	525	600	77.1	Sewer Upsizing	Yes	**No**	**No**
	SL2337	SA1445	SA2281	CIRC	525	600	48.1	Sewer Upsizing	Yes	**No**	**No**
	SL2338	SA2281	SA1401	CIRC	525	600	64.6	Sewer Upsizing	Yes	**No**	**No**
	SL1490	SA1401	SA1398	CIRC	525	600	91.4	Sewer Upsizing	Yes	**No**	**No**
	SL1447	SA1398	SA1399	CIRC	525	600	103.6	Sewer Upsizing	Yes	**No**	**No**
	SL1604	SA1395	SA1550	CIRC	525	600	41.1	Sewer Upsizing	Yes	**No**	**No**
	SL1605	SA1550	SA1549	CIRC	525	600	84.1	Sewer Upsizing	Yes	**No**	**No**
	SL1596	SA1549	SA1548	CIRC	525	600	76.7	Sewer Upsizing	Yes	**No**	**No**
	SL1597	SA1548	XXXX000146	CIRC	525	600	60.6	Sewer Upsizing	Yes	**No**	**No**
	SL1598	XXXX000146	SA1542	CIRC	525	600	74.3	Sewer Upsizing	Yes	**No**	**No**
	SL1599	SA1542	SA1541	CIRC	525	600	84.9	Sewer Upsizing	Yes	**No**	**No**
	SL1590	SA1541	SA1540	CIRC	525	600	30.5	Sewer Upsizing	Yes	**No**	**No**
WW-14	New Pipe	100A	101A	CIRC	NA	375	129.0	New Sewer	Yes	Yes	Yes
	New Pipe	101A	102A	CIRC	NA	375	10.3	New Sewer	Yes	Yes	Yes
	New Pipe	102A	103A	CIRC	NA	375	13.1	New Sewer	Yes	Yes	Yes
	New Pipe	103A	104A	CIRC	NA	375	58.8	New Sewer	Yes	Yes	Yes
	New Pipe	104A	105A	CIRC	NA	375	54.4	New Sewer	Yes	Yes	Yes
	New Pipe	105A	106A	CIRC	NA	375	97.3	New Sewer	Yes	Yes	Yes
	New Pipe	106A	SA0484	CIRC	NA	375	99.0	New Sewer	Yes	Yes	Yes
WW-15	SL0859	SA0878	SA0877	CIRC	200	300	86.5	Sewer Upsizing	Yes	**No**	**No**
	SL0860	SA0877	SA0876	CIRC	200	300	12.7	Sewer Upsizing	Yes	**No**	**No**
	SL0861	SA0876	SA0864	CIRC	200	300	91.5	Sewer Upsizing	Yes	**No**	**No**
	SL0851	SA0864	SA0866	CIRC	200	300	96.9	Sewer Upsizing	Yes	**No**	**No**

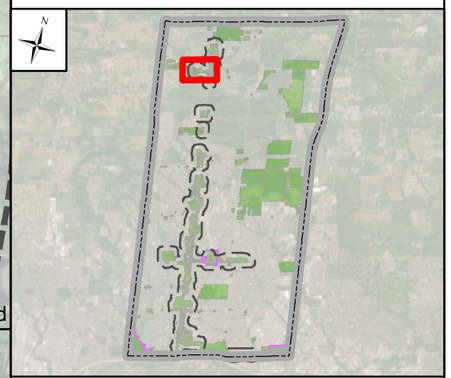
Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
WW-16	SL2329	SA2269	SA2268	CIRC	250	375	18.9	Sewer Upsizing	Yes	**No**	**No**
	SL2330	SA2268	SA2267	CIRC	250	375	52	Sewer Upsizing	Yes	**No**	**No**
	SL2331	SA2267	SA2266	CIRC	250	375	33.1	Sewer Upsizing	Yes	**No**	**No**
	SL2332	SA2266	SA2265	CIRC	250	375	18.6	Sewer Upsizing	Yes	**No**	**No**
	SL2333	SA2265	SA2264	CIRC	250	375	69.5	Sewer Upsizing	Yes	**No**	**No**
	SL2334	SA2264	SA2263	CIRC	250	375	16.2	Sewer Upsizing	Yes	**No**	**No**
	SL2350	SA2263	SA1365	CIRC	250	375	47.3	Sewer Upsizing	Yes	**No**	**No**
	SL2335	SA1365	SA2279	CIRC	250	375	5.1	Sewer Upsizing	Yes	**No**	**No**
	SL2336	SA2279	SA2280	CIRC	250	375	12.6	Sewer Upsizing	Yes	**No**	**No**
	SL1504	SA2280	SA1453	CIRC	300	375	69.2	Sewer Upsizing	Yes	**No**	**No**
WW-17	SL2358	SA2299	SA2298	CIRC	300	375	105.0	Sewer Upsizing	Yes	**No**	**No**
	SL2359	SA2298	SA2297	CIRC	300	375	106.5	Sewer Upsizing	Yes	**No**	**No**
	SL2360	SA2297	SA2296	CIRC	300	375	102.1	Sewer Upsizing	Yes	**No**	**No**
	SL2357	SA2295	SA2294	CIRC	300	375	110.8	Sewer Upsizing	Yes	**No**	**No**
	SL2355	SA2293	SA1409	CIRC	300	375	104.4	Sewer Upsizing	Yes	**No**	**No**
	SL2288	SA1409	SA2244	CIRC	300	375	108.8	Sewer Upsizing	Yes	**No**	**No**
	SL2278	SA2244	SA2249	CIRC	300	375	109.2	Sewer Upsizing	Yes	**No**	**No**
	SL2279	SA2249	SA2248	CIRC	300	375	18.6	Sewer Upsizing	Yes	**No**	**No**
	SL2280	SA2248	SA2247	CIRC	300	375	105.5	Sewer Upsizing	Yes	**No**	**No**
	SL2277	SA2247	SA2246	CIRC	300	375	105.5	Sewer Upsizing	Yes	**No**	**No**
WW-18	New Pipe	NewSANMH1A	SA7298	CIRC	NA	300	32.5	New Sewer	Yes	Yes	Yes
	SL7332	SA7298	SA7286	CIRC	250	300	46.0	Sewer Upsizing	Yes	**No**	**No**
WW-19	New Pipe	RHC_MH1	RHC_MH2	CIRC	NA	250	111.1	New Sewer	Yes	**No**	**No**
	New Pipe	RHC_MH2	SA5615	CIRC	NA	250	62.3	New Sewer	Yes	**No**	**No**
	New Pipe	SA2043	RHC_MH3	CIRC	NA	300	103.3	New Sewer	Yes	**No**	**No**
	New Pipe	RHC_MH3	SA5622	CIRC	NA	300	48.0	New Sewer	Yes	**No**	**No**
	New Pipe	SA2285	NewSANMH2	CIRC	NA	300	41.1	New Sewer	Yes	**No**	**No**
	New Pipe	SA7313	21	CIRC	NA	450	96.7	New Sewer	Yes	**No**	**No**
	New Pipe	21	25	CIRC	NA	450	238.0	New Sewer	Yes	**No**	**No**
	New Pipe	25	23	CIRC	NA	525	199.1	New Sewer	Yes	**No**	**No**

Project ID	Pipe ID	US Node ID	DS Node ID	Shape	Existing Size (mm)	Proposed Enlarged Size (mm)	Length (m)	Sewer Improvement Type	Ultimate Buildout	2051 Solution	2041 Solution
	New Pipe	23	15	CIRC	NA	675	183.2	New Sewer	Yes	**No**	**No**
	New Pipe	15	17	CIRC	NA	675	149.5	New Sewer	Yes	**No**	**No**
	New Pipe	17	19	CIRC	NA	675	117.4	New Sewer	Yes	**No**	**No**
	New Pipe	19	MH 10A	CIRC	NA	675	56.1	New Sewer	Yes	**No**	**No**
WW-20	SL5717	SA5755	SA5756	CIRC	250	300	99.1	Sewer Upsizing	Yes	**No**	**No**
	SL5718	SA5756	SA4397	CIRC	250	300	14.5	Sewer Upsizing	Yes	**No**	**No**
	SL4395	SA4397	SA4395	CIRC	300	450	47.0	Sewer Upsizing	Yes	**No**	**No**
	SL4394	SA4395	SA4393	CIRC	300	450	110.7	Sewer Upsizing	Yes	**No**	**No**
	SL4393	SA4393	SA4392	CIRC	300	450	53.5	Sewer Upsizing	Yes	**No**	**No**
	SL4392	SA4392	SA4441	CIRC	300	450	39.9	Sewer Upsizing	Yes	**No**	**No**



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)



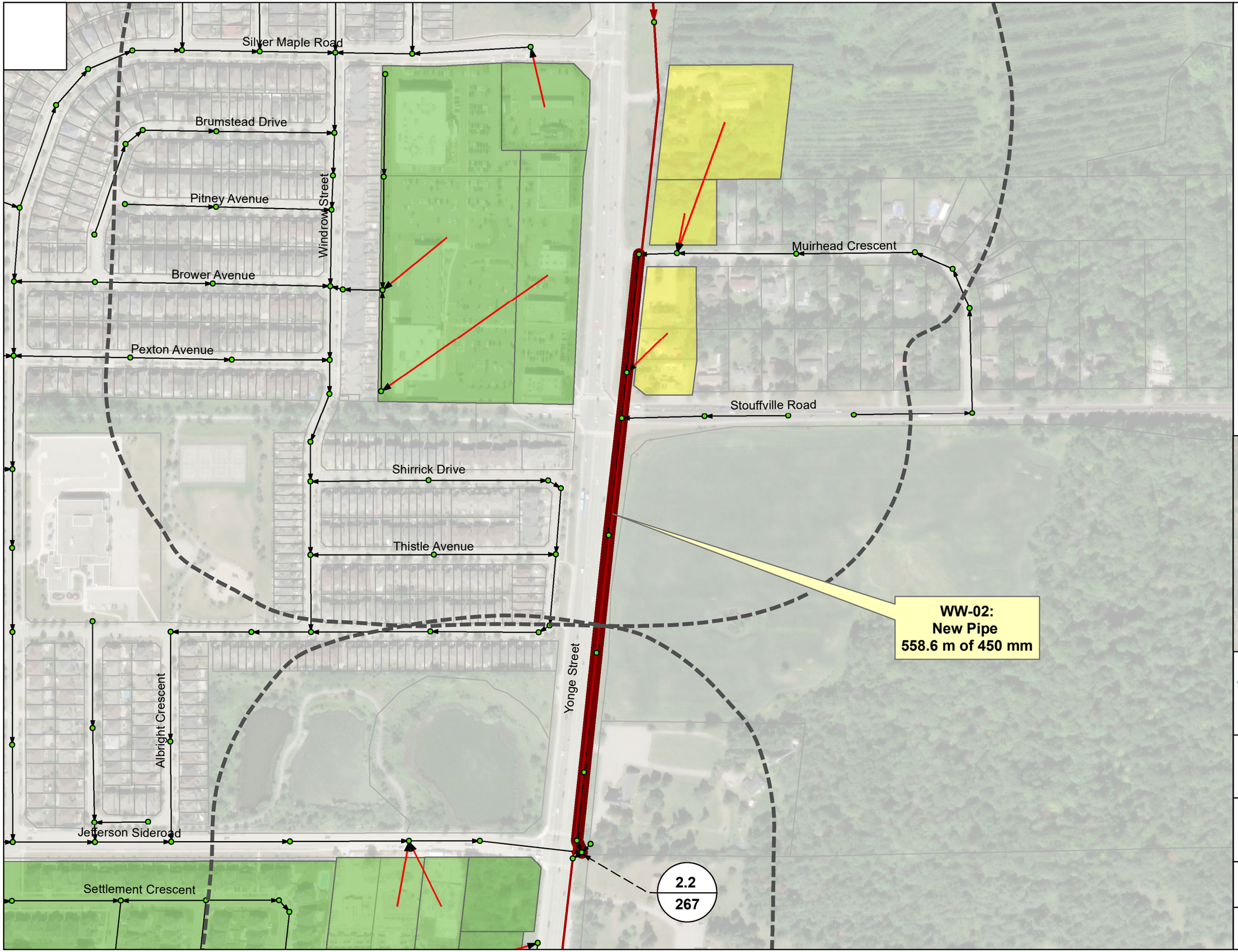
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-01

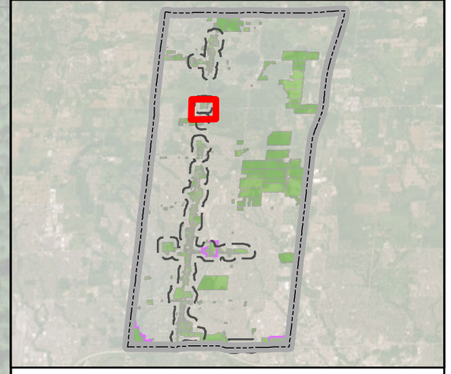
Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-02

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Braehead Drive
Silver Maple Road
Albright Crescent
Jefferson Sideroad
Yuan Drive
Rhine River Street
Settlement Crescent
Harris Avenue
Harris Avenue
Germani Court
Brocton Avenue
Grange Drive
Wicker Drive
Brass Drive
Tower Hill Road
Mockingbird Drive
Noranda Avenue
Edelweiss Avenue
Townwood Drive
Yonge Street
Port Arthur Crescent
Paper Mills Crescent
Riding Mountain Drive

WW-03:
New Pipe
144.7 m of 250 mm

WW-03:
Pipe Replacement of
167.7 m of 250 mm with 300 mm

WW-03:
Pipe Replacement of
63.8 m of 250 mm with 300 mm

WW-03:
Pipe Replacement of
137.5 m of 250 mm with 375 mm

17.9
4363

Legend

- Sanitary Manholes
- Sanitary Sewers
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- New Pipes
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- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

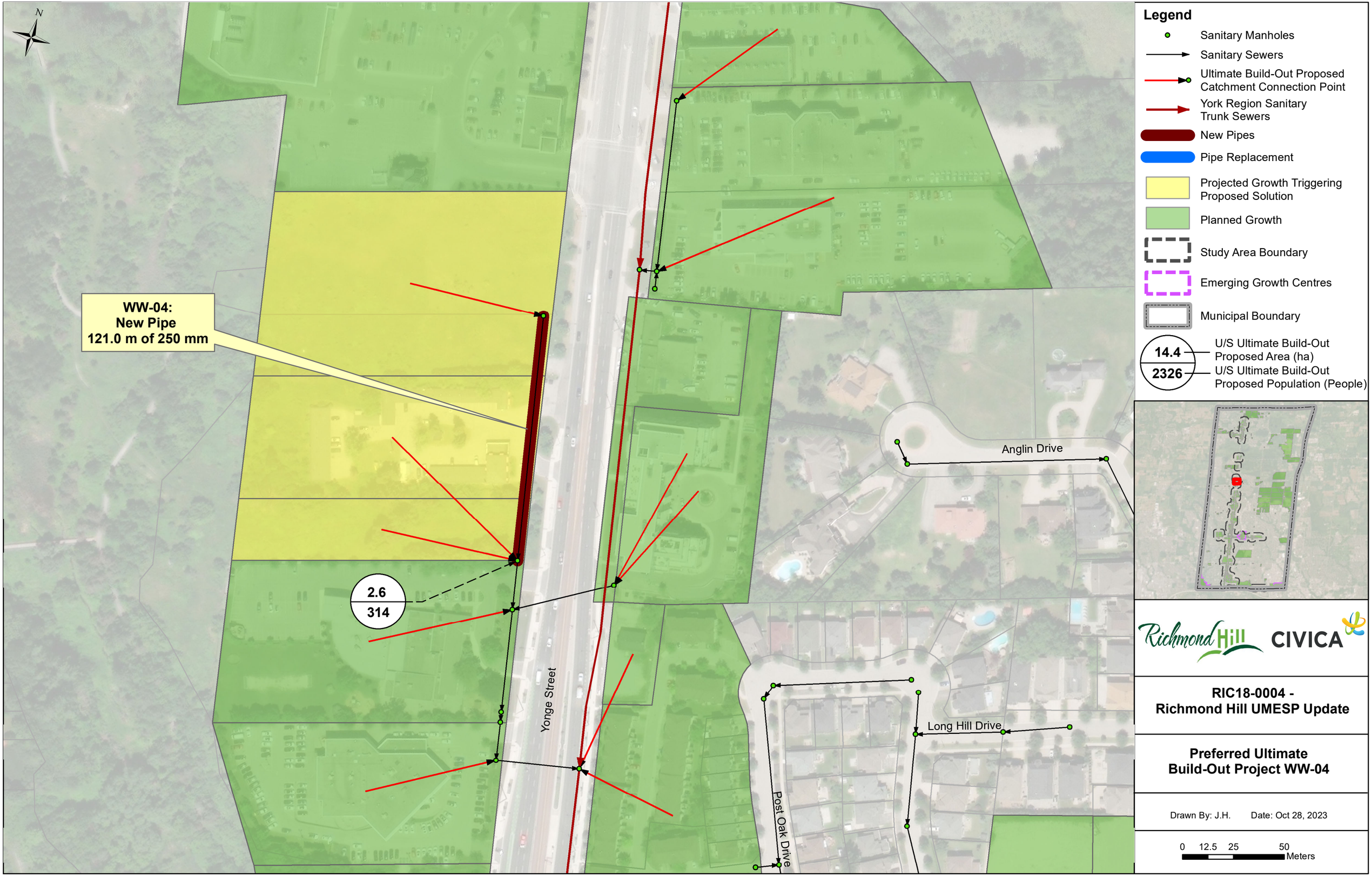
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-03

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters


N
WW-04:
New Pipe
121.0 m of 250 mm
2.6
314
Yonge Street
Anglin Drive
Long Hill Drive
Post Oak Drive
Legend
Sanitary Manholes
Sanitary Sewers
Ultimate Build-Out Proposed Catchment Connection Point
York Region Sanitary Trunk Sewers
New Pipes
Pipe Replacement
Projected Growth Triggering Proposed Solution
Planned Growth
Study Area Boundary
Emerging Growth Centres
Municipal Boundary
14.4
U/S Ultimate Build-Out Proposed Area (ha)
2326
U/S Ultimate Build-Out Proposed Population (People)
Richmond Hill
CIVICA
RIC18-0004 -
Richmond Hill UMESP Update
Preferred Ultimate
Build-Out Project WW-04
Drawn By: J.H.
Date: Oct 28, 2023
0 12.5 25 50
Meters

Nottingham Drive

Devonsleigh Boulevard

Lacewood Drive

Yonge Street

WW-05:
New Pipe
48.6 m of 250 mm

2.3
546

Legend

- Sanitary Manholes
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- Planned Growth
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- Municipal Boundary
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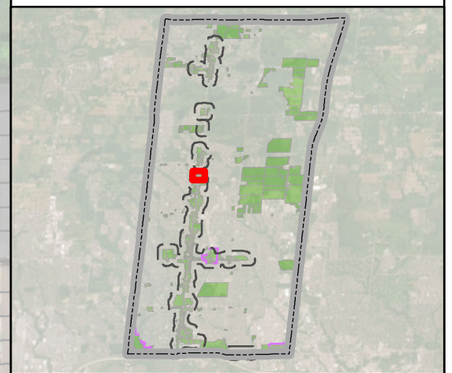
- 2326 — U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-05

Drawn By: J.H. Date: Oct 28, 2023

0 12.5 25 50
Meters

Aladdin Cre
Rothbury Road
Brookside Road
Brookgreene Crescent
Leyburn Avenue
Ormerod Lane
Silverwood Avenue
Yorkland Street
Bernard Avenue
Squire Drive
Yonge Street
Stancroft Drive
Naughton Drive
Naughton Drive
Naughton Drive
Abitibi Street
Lane N
Debonair Street
Canyon Hill Avenue
Bernard Avenue
Lorraine Street

4.4
8012

WW-06:
New Pipes
114.8 m of 300 mm

Legend

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- Sanitary Sewers
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- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

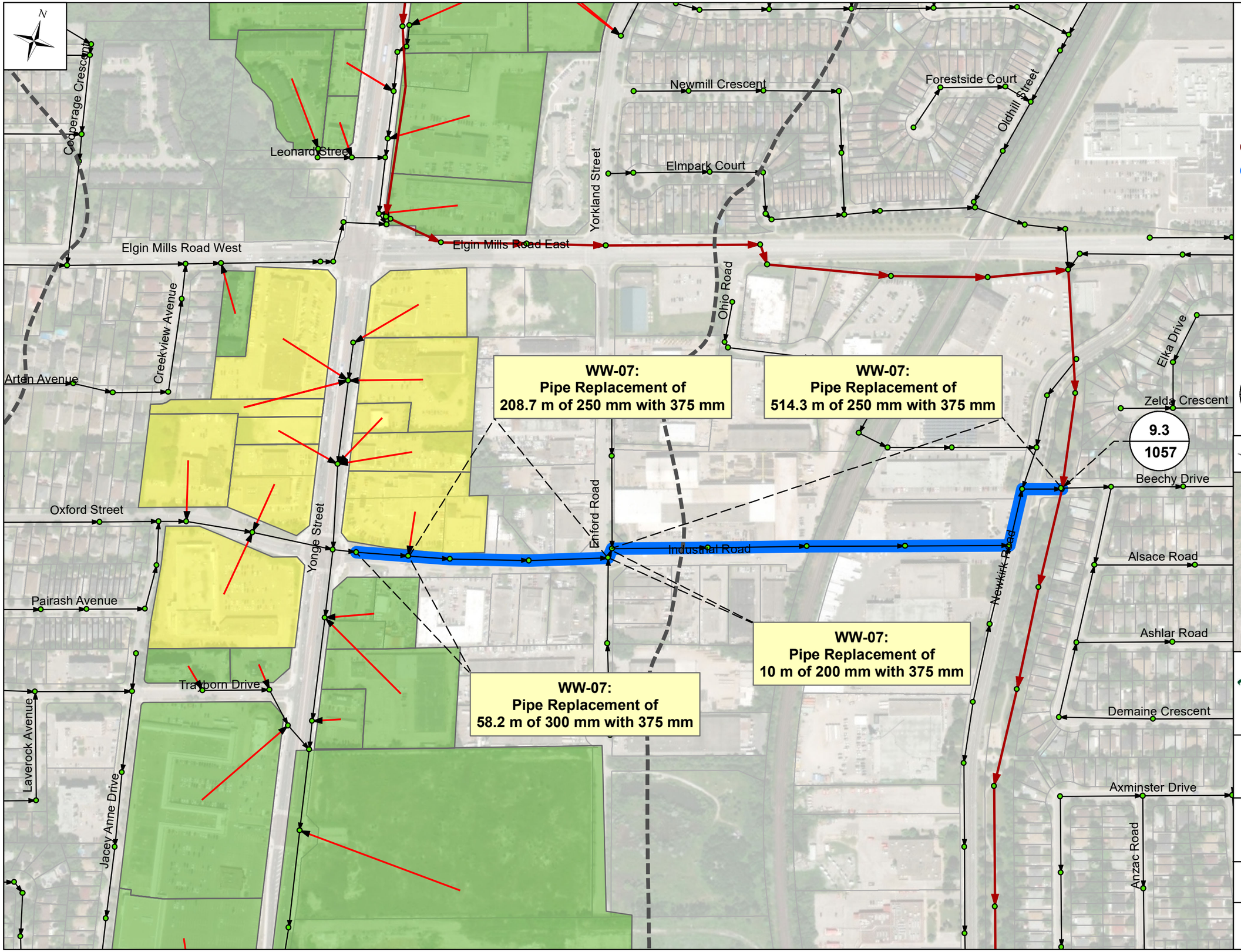
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-06

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

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- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
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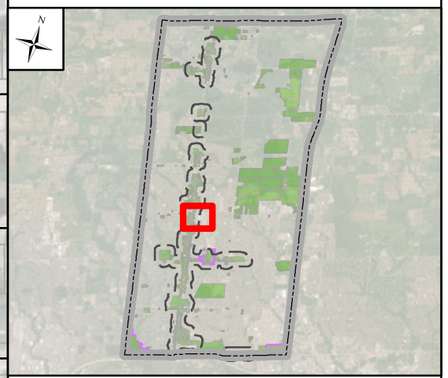
- Municipal Boundary
- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)



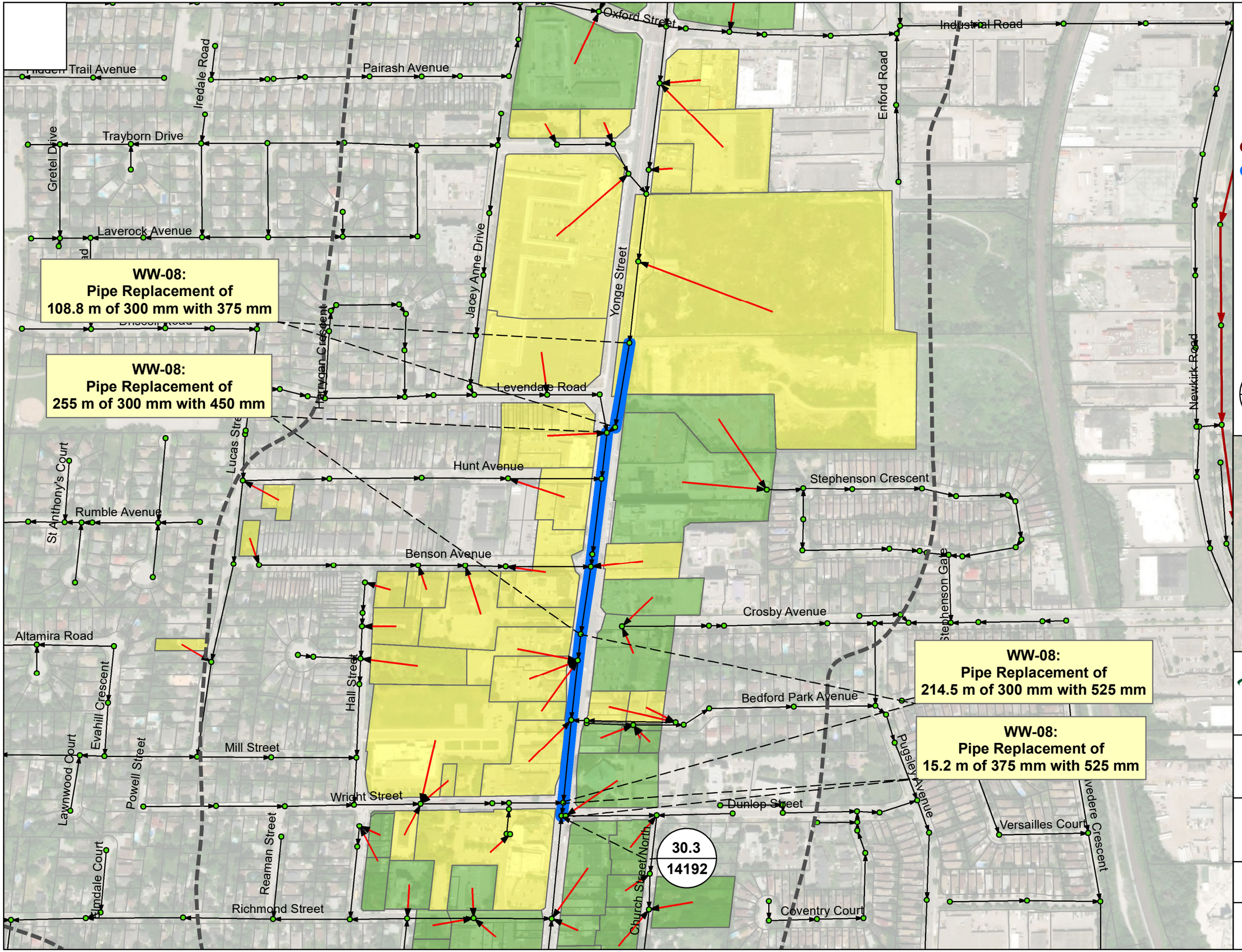
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-07

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

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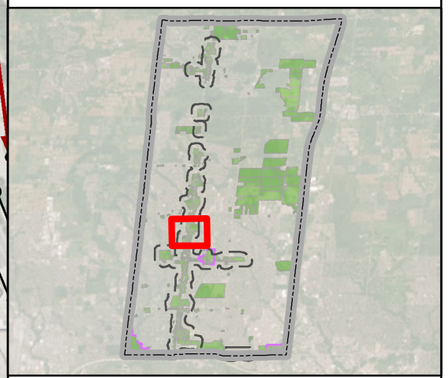
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-08

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Hunt Avenue
Parkston Court
Rumble Avenue
Marla Court
Lucas Street
Benson Avenue
Stephenson Crescent
Crosby Avenue
Mill Walk Court
Hall Street
Bedford Park Avenue
Mill Street
Powell Street
Yonge Street
6.2
3963
Wright Street
Dunlop Street
Richmond Street
Church Street North
Elizabeth Street North
Coventry Court

WW-09:
Pipe Replacement of
266.3 m of 250 mm with 375 mm

Legend

- Sanitary Manholes
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- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-09

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

WW-09:
Pipe Replacement of
266.3 m of 250 mm with 375 mm

WW-08:
Pipe Replacement of
214.5 m of 300 mm with 525 mm

WW-08:
Pipe Replacement of
15.2 m of 375 mm with 525 mm

WW-10:
Pipe Replacement of
5.5 m of 375 mm with 525 mm
114 m of 375 mm with 600 mm

WW-10:
Pipe Replacement of
224.7 m of 450 mm with 600 mm

41.2
19482

Legend

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- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

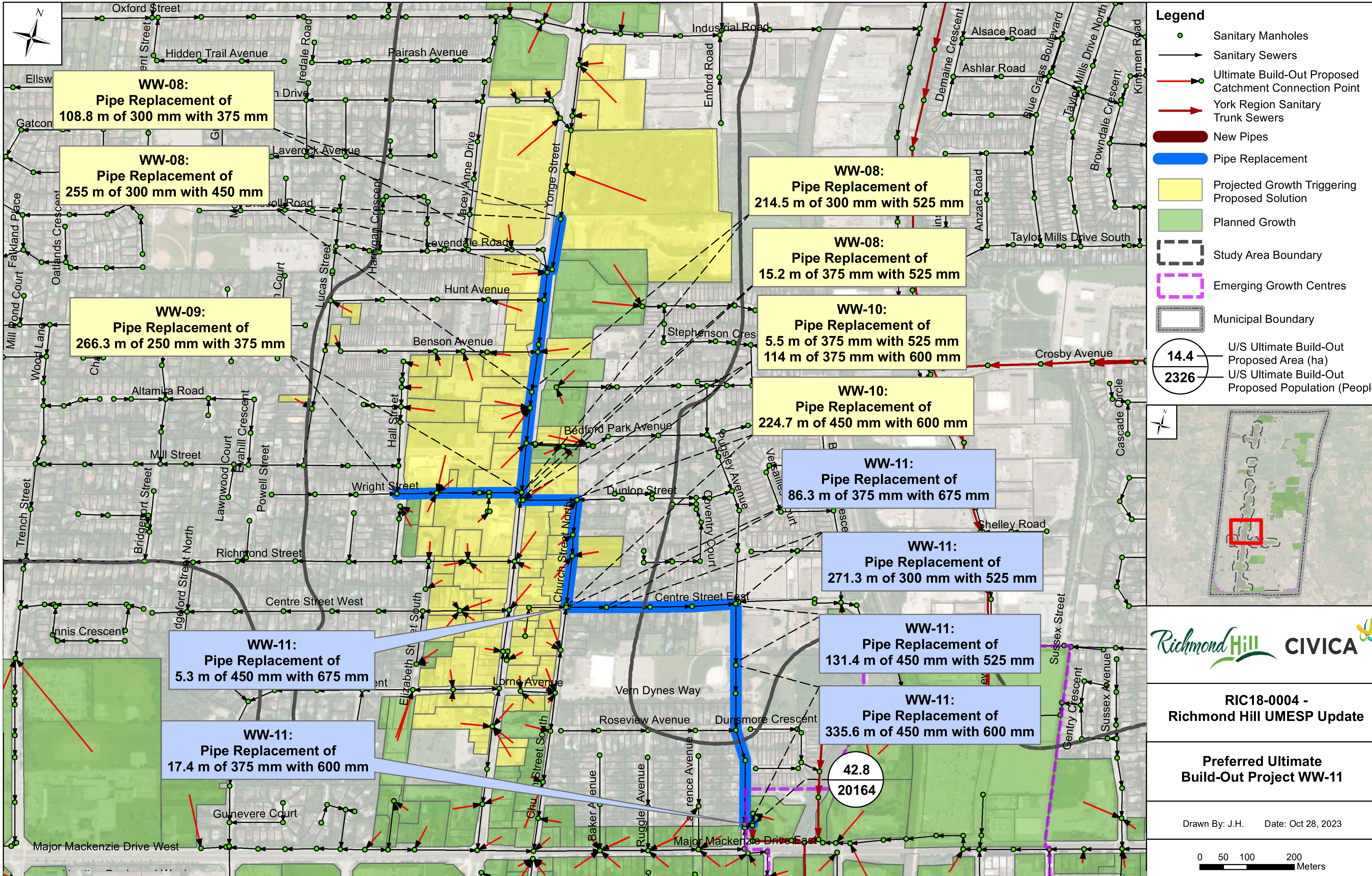
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-10

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



WW-08: Pipe Replacement of 108.8 m of 300 mm with 375 mm
WW-08: Pipe Replacement of 255 m of 300 mm with 450 mm
WW-08: Pipe Replacement of 214.5 m of 300 mm with 525 mm
WW-08: Pipe Replacement of 15.2 m of 375 mm with 525 mm
WW-09: Pipe Replacement of 266.3 m of 250 mm with 375 mm
WW-10: Pipe Replacement of 5.5 m of 375 mm with 525 mm 114 m of 375 mm with 600 mm
WW-10: Pipe Replacement of 224.7 m of 450 mm with 600 mm
WW-11: Pipe Replacement of 86.3 m of 375 mm with 675 mm
WW-11: Pipe Replacement of 271.3 m of 300 mm with 525 mm
WW-11: Pipe Replacement of 131.4 m of 450 mm with 525 mm
WW-11: Pipe Replacement of 335.6 m of 450 mm with 600 mm
WW-11: Pipe Replacement of 5.3 m of 450 mm with 675 mm
WW-11: Pipe Replacement of 17.4 m of 375 mm with 600 mm
42.8
20164
Oxford Street
Hidden Trail Avenue
Pairash Avenue
Industrial Road
Alsace Road
Ashlar Road
Laverock Avenue
Yonge Street
Levendale Road
Hunt Avenue
Benson Avenue
Stephenson Cres
Crosby Avenue
Taylor Mills Drive South
Altamira Road
Bedford Park Avenue
Mill Street
Wright Street
Dunlop Street
Shelley Road
Richmond Street
Centre Street West
Centre Street East
Innis Crescent
Lorne Avenue
Vern Dynes Way
Roseview Avenue
Dunsmore Crescent
Guinevere Court
Major Mackenzie Drive West
Major Mackenzie Drive East
Legend
Sanitary Manholes
Sanitary Sewers
Ultimate Build-Out Proposed Catchment Connection Point
York Region Sanitary Trunk Sewers
New Pipes
Pipe Replacement
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14.4
2326
U/S Ultimate Build-Out Proposed Area (ha)
U/S Ultimate Build-Out Proposed Population (People)
Richmond Hill
CIVICA
RIC18-0004 - Richmond Hill UMESP Update
Preferred Ultimate Build-Out Project WW-11
Drawn By: J.H.
Date: Oct 28, 2023
0 50 100 200
Meters

WW-12:
Pipe Replacement of
126.2 m of 375 mm with 450 mm

WW-12:
Pipe Replacement of
233.2 m of 250 mm with 300 mm

WW-12:
Pipe Replacement of
83.8 m of 250 mm with 375 mm

WW-12:
Pipe Replacement of
300.4 m of 375 mm with 525 mm

WW-12:
Pipe Replacement of
96.9 m of 300 mm with 450 mm

14.0
7071

Newkirk Road
Beaverton Road South
Bent Crescent
Benfer Road
Maralim Road
Fernleigh Circle North
Fesserton Road
Allen Court
Cassata Avenue
Major Mackenzie Drive East
Old Markham Road
Essex Avenue
Norfolk Avenue
Maple Avenue
Colborne Avenue
Elmwood Avenue
Forest Hill Drive
Chiltern Hill
Bayview Avenue
Fernwood Court
Palmer Avenue
Sussex Avenue
Conestoga Avenue
Boisdale Avenue
Paliser Crescent North

Legend

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- Sanitary Sewers
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Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-12

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

WW-13:
Pipe Replacement of
171.9 m of 250 mm with 375 mm

WW-13:
Pipe Replacement of
142.7 m of 300 mm with 450 mm

WW-13:
Pipe Replacement of
309.0 m of 350 mm with 450 mm

WW-13:
Pipe Replacement of
176.1 m of 375 mm with 525 mm

WW-16:
Pipe Replacement of
69.2 m of 300 mm with 375 mm

WW-13:
Pipe Replacement of
455.7 m of 525 mm with 600 mm

WW-13:
Pipe Replacement of
452.2 m of 525 mm with 600 mm

WW-16:
Pipe Replacement of
273.3 m of 250 mm with 375 mm

Parcel C
Parcel B
Parcel A

35.8
21947

Lippincott Court
McCallum Drive
Tomlin Crescent
Gray Crescent
Bingham Street
Ritva Court
Steepleview Crescent
Harding Boulevard West
Addison Street
Elmwood Avenue
Baker Avenue
Lawrence Avenue
Palmer Avenue
Ruggles Avenue
Harding Boulevard
Canterbury Court
Langford Street
Guildwood Drive
Dunbarton Court
Mary Gapper Crescent
Kersey Crescent
Stockdale Crescent
Josie Drive
Yongehurst Road
Clarissa Drive
Yonge Street
Weldrick Road East
Church Street South
Nightstar Drive
Bluesky Crescent
Sunshine Drive
Constellation Crescent
Moonlight Lane
Observatory Lane
Walnut Street
Wainwright Avenue
Sorrento Drive
Dexter Road
Drumern
Leora Court
Merrylynn Drive
Briarway Crescent
Baif Boulevard
Hillcrest Gate
Penwick Crescent
Rathfon Crescent
Donava Gate
Avenue Roa
Sanderson Cres
Castle Rock Drive
Springhead Gardens
Lillooet Crescent
Carrville Road
16th Avenue
Red Maple Road
Estoril Street

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-13

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Court

Major Mackenzie Drive West

Major Mackenzie Drive East

Atki

Hopkins Street

Parcel C

Parcel B

Parcel A

Addison Street

Yonge Street

Church Street South

Elmwood Avenue

Palmer Avenue

Harding Boulevard West

Harding Boulevard

Mary Gapper Crescent

Canterbury Court

Ruggles Avenue

Bingham Street

Brillinger Street

WW-14:
New Pipe
362.9 m of 375 mm

WW-14:
Pipe Replacement of
99 m of 200 mm with 375 mm

9.0
4600

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

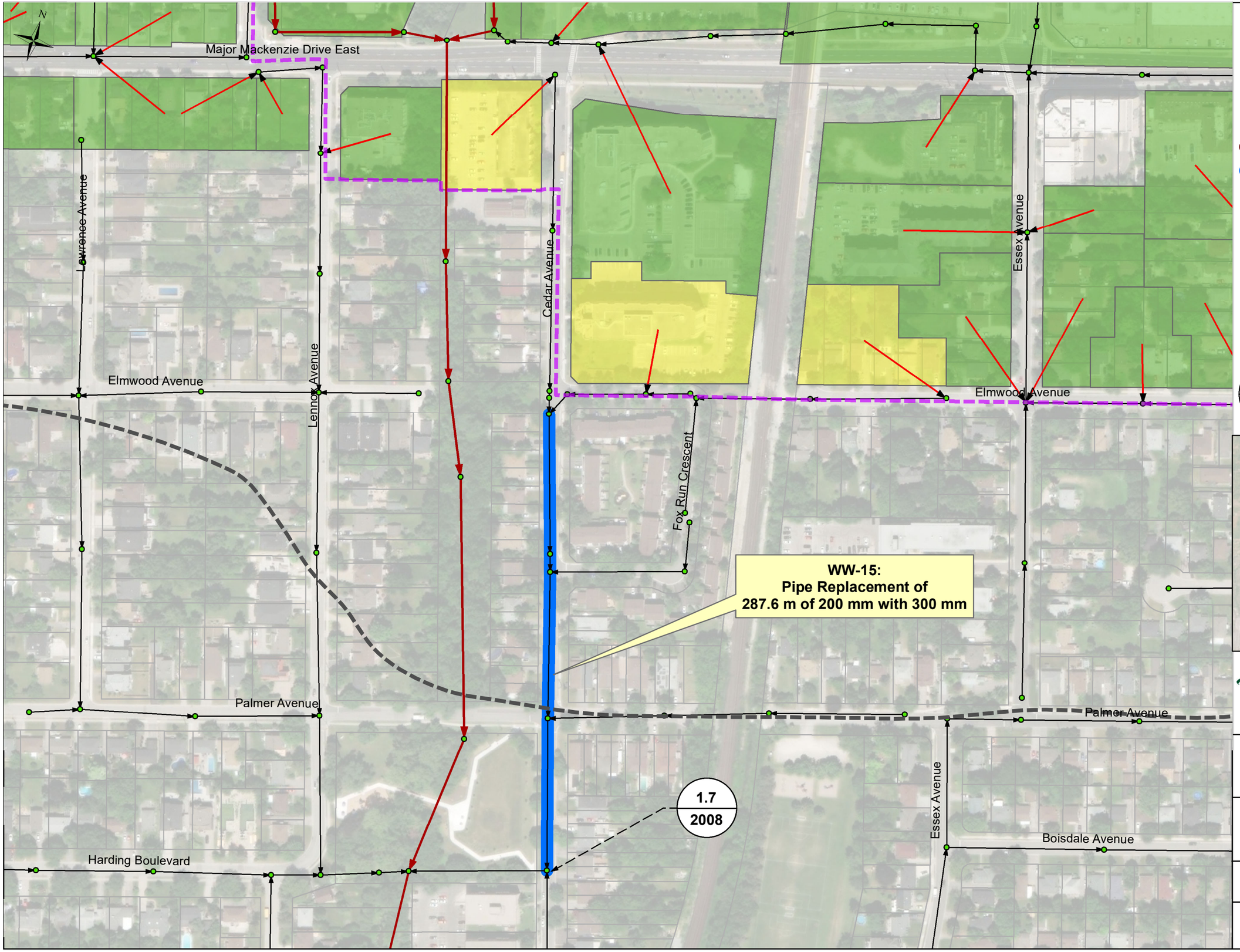
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-14

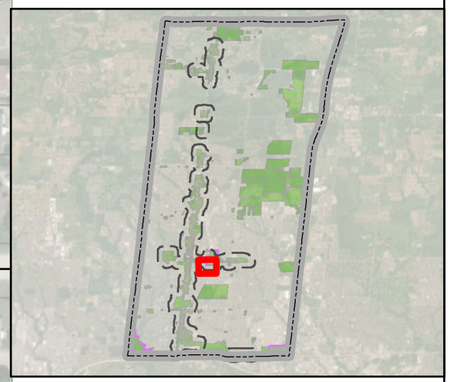
Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate Build-Out Project WW-15

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

Weldrick Road West

Weldrick Road East

Merrylynn Drive

Yonge Street

WW-16:
Pipe Replacement of
69.2 m of 300 mm with 375 mm

Baif Boulevard

Observatory Lane

Hillcrest Gate

WW-16:
Pipe Replacement of
273.3 m of 250 mm with 375 mm

2.3
10268

Brightway Crescent

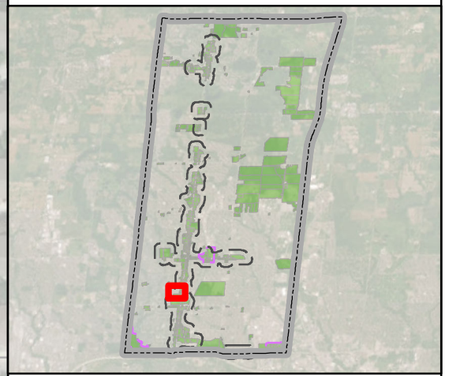
Rathfon Crescent

Springhead Gardens

Denava Gate

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- **14.4** — U/S Ultimate Build-Out Proposed Area (ha)
- **2326** — U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-16

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

WW-17:
Pipe Replacement of
313.6 m of 300 mm with 375 mm

WW-17:
Pipe Replacement of
110.8 m of 300 mm with 375 mm

WW-17:
Pipe Replacement of
552.0 m of 300 mm with 375 mm

6.9
7201

Drumern Crescent
Kilkenny Place
Leora Court
Merrylynn Drive
Penwick Crescent
Brightway Crescent
Hillcrest Gate
Baif Boulevard
Observatory Lane
Denava Gate
Rainton Cresce
Yonge Street
Sanderson Crescent
Castle Rock Drive
Springhead Gardens
Lillooet Crescen
Plaisance Road
Michael Drive
Carrville Road
16th Avenue
Nardini Lane
Duncombe Lane
Shining Willow Court
Myers Boulev
Spruce Avenue
Northern Heights Drive
Vanity Crescent
Birch Avenue
Avenue Road
Cividale Court
Oak Avenue
Trilogy Court
Frontier Drive
Lane A
Lane B
Ellesmere Street
Coburg Crescent
Revelstoke Crescent
Edgar Avenue
Pearson Avenue
Orlon Crescent
Colby Lane
Claridge Drive
Denham Drive
Bryson Drive
Scott Drive
Clinton Drive
Bantry Avenue
Manvale Crescent

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 — U/S Ultimate Build-Out Proposed Area (ha)
- 2326 — U/S Ultimate Build-Out Proposed Population (People)

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-17

Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters

Spruce Avenue
Vanity Crescent
Yonge Street
Frontier Drive
Lane A
Lane B
Edgar Avenue
Dalemo Gate
Fesmere Str
Coburg Crescent
Merrill Avenue
Prince Patrick Avenue
King William Crescent
Rideau Drive
Macgregor Avenue
Clinton Drive
Scott Drive
Bantry Avenue
Road

WW-18:
New Pipe
32.5 m of 300 mm

WW-18:
Pipe Replacement of
46.0 m of 250 mm with 300 mm

5.7
3922

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)

Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-18

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

WW-18:
New Pipe
32.5 m of 300 mm

WW-18:
Pipe Replacement of
46.0 m of 250 mm with 300 mm

WW-19:
New Pipes
334.7 m of 450 mm

WW-19:
New Pipes
173.4 m of 250 mm

WW-19:
New Pipes
199.1 m of 525 mm

WW-19:
New Pipes
506.2 m of 675 mm

WW-19:
New Pipes
151.3 m of 300 mm

WW-19:
New Pipes
41.1 m of 300 mm

0.9
570

2.3
2070

3.9
2553

22.5
36569

Spruce Avenue
Northern Heights Drive
Vanity Crescent
Colston Court
Duncan Road
Elm Avenue
Pathlane Road
Grey Alder Avenue
Oak Avenue
Pearson Avenue
Edgar Avenue
Frontier Drive
Yonge Street
Lane A
Lane B
Ellesmere Street
Coburg Crescent
Revelstoke Cres.
Prince Patrick Avenue
Springbrook Drive
King William Crescent
Macgregor Avenue
Claridge Drive
Scott Drive
Clinton Drive
Lane C
Baffin Court
Lane J
Lane K
Selkirk Drive
Melville Street
Baltic Street
Frobisher Street
Ludford Drive
Lane F
Lane D
Bassett Avenue
Sibley Street
Nahanni Drive
Grasslands Avenue
Moresby Street
Ferris Street
Holmwood Street
Silver Linden Drive
Navarre Street
Westwood Lane
Beresford Drive
Sunnywood Crescent
Roosevelt Drive
Oneida Crescent
Red Maple Road
High Tech Road
Eleanor Circle
Garden Avenue
Fairview Avenue
Red Cedar Avenue

Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)

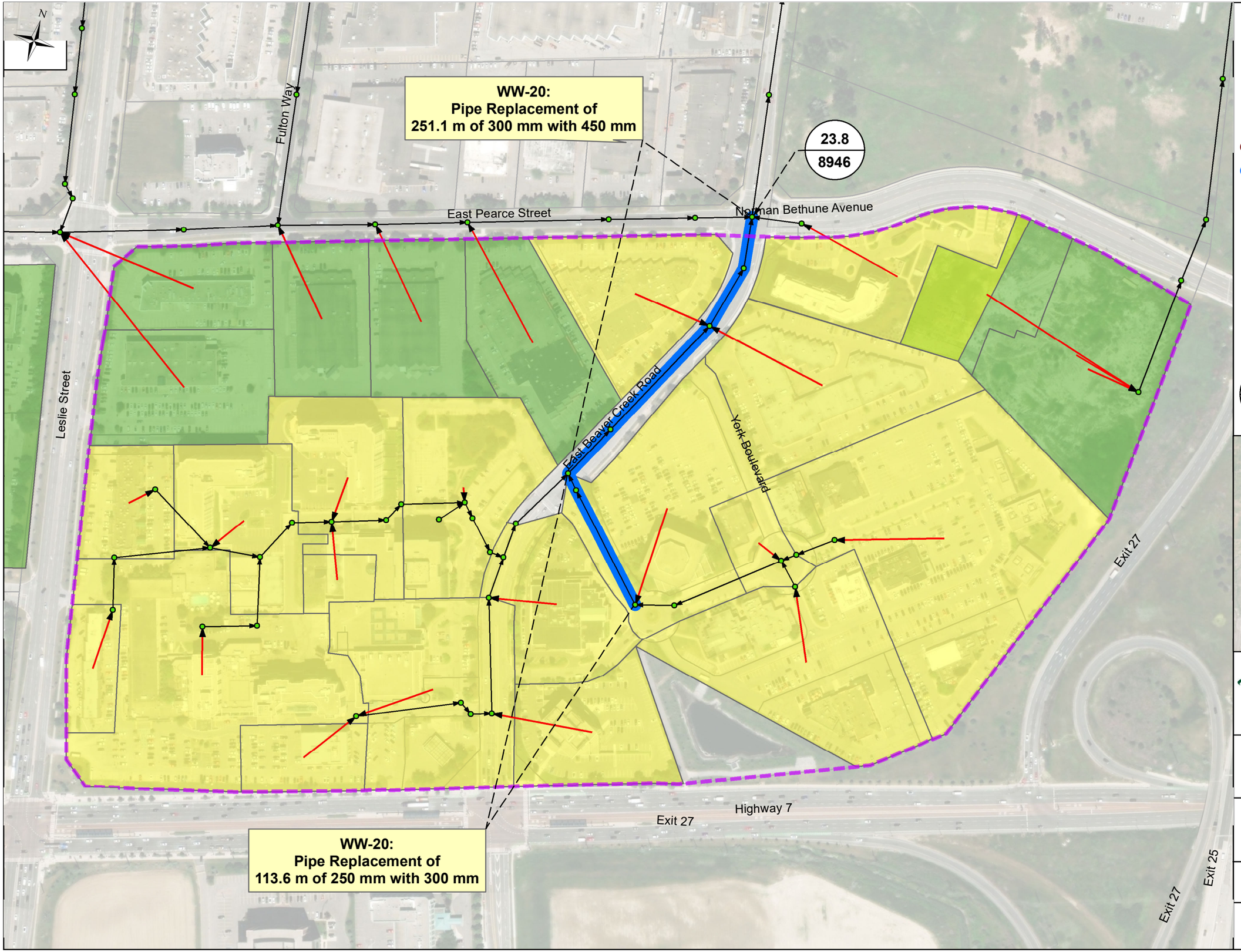
Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-19

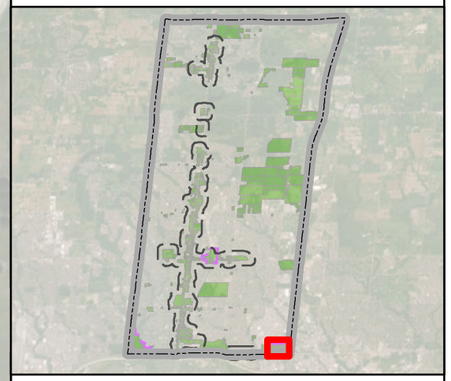
Drawn By: J.H. Date: Oct 28, 2023

0 50 100 200 Meters



Legend

- Sanitary Manholes
- Sanitary Sewers
- Ultimate Build-Out Proposed Catchment Connection Point
- York Region Sanitary Trunk Sewers
- New Pipes
- Pipe Replacement
- Projected Growth Triggering Proposed Solution
- Planned Growth
- Study Area Boundary
- Emerging Growth Centres
- Municipal Boundary
- 14.4 / 2326 — U/S Ultimate Build-Out Proposed Area (ha) / U/S Ultimate Build-Out Proposed Population (People)



Richmond Hill CIVICA

RIC18-0004 -
Richmond Hill UMESP Update

Preferred Ultimate
Build-Out Project WW-20

Drawn By: J.H. Date: Oct 28, 2023

0 25 50 100 Meters

CIVICA
Municipal Water Resources

Appendix III
Cost Estimates

CIVICA

Project ID **WW-1**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**205.8**	**m**	**$ 1,420**	**$ 292,236**	**$ 341,118**
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**220.2**	**m**	**$ 1,800**	**$ 396,360**	**$ 462,659**
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth (Note: Cross the river)	**44.2**	**m**	**$ 2,700**	**$ 119,340**	**$ 139,302**
	Capital Cost				**$ 807,936**	**$ 943,079**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 201,984**	**$ 235,770**
	Sub-Total (A+B)				**$ 1,009,920**	**$ 1,178,848**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 252,480**	**$ 294,712**
	Sub-Total Project Cost				**$ 1,262,400**	**$ 1,473,560**
	HST (@ 13%)					**$ 191,563**
	Total Project Cost					**$ 1,665,123**

Project ID **WW-2**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	558.6	m	m 1,900	$ 1,061,340	$ 1,238,869
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 4.5 m to 6.0 m in depth	7	each	$ 17,800	$ 124,600	$ 145,442
	Capital Cost				$ 1,185,940	$ 1,384,311
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			25%	$ 296,485	$ 346,078
	Sub-Total (A+B)				$ 1,482,425	$ 1,730,389
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			25%	$ 370,606	$ 432,597
	Sub-Total Project Cost				$ 1,853,031	$ 2,162,986
	HST (@ 13%)					$ 281,188
	Total Project Cost					$ 2,444,174

Project ID **WW-3**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 250 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**144.7**	**m**	**$ 1,400**	**$ 202,580**	**$ 236,465**
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**231.5**	**m**	**$ 1,420**	**$ 328,730**	**$ 383,716**
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**137.5**	**m**	**$ 1,650**	**$ 226,875**	**$ 264,824**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 3.0 m to 4.5 m in depth	**5**	**each**	**$ 15,900**	**$ 79,500**	**$ 92,798**
	Capital Cost				**$ 837,685**	**$ 977,804**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 209,421**	**$ 244,451**
	Sub-Total (A+B)				**$ 1,047,106**	**$ 1,222,255**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 261,777**	**$ 305,564**
	Sub-Total Project Cost				**$ 1,308,883**	**$ 1,527,818**
	HST (@ 13%)					**$ 198,616**
	Total Project Cost					**$ 1,726,435**

Project ID **WW-4**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 250 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**121**	**m**	**$ 1,400**	**$ 169,400**	**$ 197,735**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 3.0 m to 4.5 m in depth	**1**	**each**	**$ 15,900**	**$ 15,900**	**$ 18,560**
	Capital Cost				**$ 185,300**	**$ 216,295**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 46,325**	**$ 54,074**
	Sub-Total (A+B)				**$ 231,625**	**$ 270,369**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 57,906**	**$ 67,592**
	Sub-Total Project Cost				**$ 289,531**	**$ 337,961**
	HST (@ 13%)					**$ 43,935**
	Total Project Cost					**$ 381,896**

Project ID **WW-5**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 250 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**48.6**	**m**	**$ 1,400**	**$ 68,040**	**$ 79,421**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 3.0 m to 4.5 m in depth	**2**	**each**	**$ 15,900**	**$ 31,800**	**$ 37,119**
	Capital Cost				**$ 99,840**	**$ 116,540**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 24,960**	**$ 29,135**
	Sub-Total (A+B)				**$ 124,800**	**$ 145,675**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 31,200**	**$ 36,419**
	Sub-Total Project Cost				**$ 156,000**	**$ 182,094**
	HST (@ 13%)					**$ 23,672**
	Total Project Cost					**$ 205,766**

Project ID **WW-6**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**114.8**	**m**	**$ 1,420**	**$ 163,016**	**$ 190,284**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 3.0 m to 4.5 m in depth	**2**	**each**	**$ 15,900**	**$ 31,800**	**$ 37,119**
	Capital Cost				**$ 194,816**	**$ 227,403**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 48,704**	**$ 56,851**
	Sub-Total (A+B)				**$ 243,520**	**$ 284,253**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 60,880**	**$ 71,063**
	Sub-Total Project Cost				**$ 304,400**	**$ 355,317**
	HST (@ 13%)					**$ 46,191**
	Total Project Cost					**$ 401,508**

Project ID **WW-7**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**606.2**	**m**	**$ 1,650**	**$ 1,000,230**	**$ 1,167,537**
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth (Note: Cross the river/railway)	**185.0**	**m**	**$ 2,475**	**$ 457,875**	**$ 534,463**
	Capital Cost				**$ 1,458,105**	**$ 1,702,001**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 364,526**	**$ 425,500**
	Sub-Total (A+B)				**$ 1,822,631**	**$ 2,127,501**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 455,658**	**$ 531,875**
	Sub-Total Project Cost				**$ 2,278,289**	**$ 2,659,376**
	HST (@ 13%)					**$ 345,719**
	Total Project Cost					**$ 3,005,095**

Project ID **WW-8**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**108.8**	**m**	**$ 1,650**	**$ 179,520**	**$ 209,548**
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**255**	**m**	**$ 1,550**	**$ 395,250**	**$ 461,363**
	Supply and install 525 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**229.7**	**m**	**$ 1,750**	**$ 401,975**	**$ 469,213**
	Capital Cost				**$ 976,745**	**$ 1,140,124**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 244,186**	**$ 285,031**
	Sub-Total (A+B)				**$ 1,220,931**	**$ 1,425,155**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 305,233**	**$ 356,289**
	Sub-Total Project Cost				**$ 1,526,164**	**$ 1,781,444**
	HST (@ 13%)					**$ 231,588**
	Total Project Cost					**$ 2,013,032**

Project ID **WW-9**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**266.3**	**m**	**$ 1,650**	**$ 439,395**	**$ 512,892**
	Capital Cost				**$ 439,395**	**$ 512,892**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 109,849**	**$ 128,223**
	Sub-Total (A+B)				**$ 549,244**	**$ 641,115**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 137,311**	**$ 160,279**
	Sub-Total Project Cost				**$ 686,555**	**$ 801,394**
	HST (@ 13%)					**$ 104,181**
	Total Project Cost					**$ 905,575**

Project ID **WW-10**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 525 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**5.5**	**m**	**$ 1,750**	**$ 9,625**	**$ 11,235**
	Supply and install 600 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**338.7**	**m**	**$ 1,800**	**$ 609,660**	**$ 711,637**
	Capital Cost				**$ 619,285**	**$ 722,872**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 154,821**	**$ 180,718**
	Sub-Total (A+B)				**$ 774,106**	**$ 903,590**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 193,527**	**$ 225,898**
	Sub-Total Project Cost				**$ 967,633**	**$ 1,129,488**
	HST (@ 13%)					**$ 146,833**
	Total Project Cost					**$ 1,276,321**

Project ID **WW-11**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 675 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**91.6**	**m**	**$ 1,900**	**$ 174,040**	**$ 203,151**
	Supply and install 525 mm reinforced concrete pipe, CL 65D including core break into and connect to maintenance hole - up to 3.0 m in depth	**402.7**	**m**	**$ 1,680**	**$ 676,536**	**$ 789,700**
	Supply and install 600 mm reinforced concrete pipe, CL 65D including core break into and connect to maintenance hole - up to 3.0 m in depth	**353**	**m**	**$ 1,700**	**$ 600,100**	**$ 700,478**
	Capital Cost				**$ 1,450,676**	**$ 1,693,329**
B.	**Project Delivery Allowance** Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 362,669**	**$ 423,332**
	Sub-Total (A+B)				**$ 1,813,345**	**$ 2,116,661**
C.	**Contingency** Class 4 Cost Estimate Multiplier			**25%**	**$ 453,336**	**$ 529,165**
	Sub-Total Project Cost				**$ 2,266,681**	**$ 2,645,827**
	HST (@ 13%)					**$ 343,957**
	Total Project Cost					**$ 2,989,784**

Project ID **WW-12**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**83.8**	**m**	**$ 1,650**	**$ 138,270**	**$ 161,398**
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**233**	**m**	**$ 1,420**	**$ 330,860**	**$ 386,203**
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**223.1**	**m**	**$ 1,550**	**$ 345,805**	**$ 403,647**
	Supply and install 525 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**300.4**	**m**	**$ 1,750**	**$ 525,700**	**$ 613,633**
	Capital Cost				**$ 1,340,635**	**$ 1,564,882**
B.	**Project Delivery Allowance** Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 335,159**	**$ 391,220**
	Sub-Total (A+B)				**$ 1,675,794**	**$ 1,956,102**
C.	**Contingency** Class 4 Cost Estimate Multiplier			**25%**	**$ 418,948**	**$ 489,026**
	Sub-Total Project Cost				**$ 2,094,742**	**$ 2,445,128**
	HST (@ 13%)					**$ 317,867**
	Total Project Cost					**$ 2,762,994**

Project ID **WW-13**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**171.9**	**m**	**$ 1,800**	**$ 309,420**	**$ 361,176**
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**451.7**	**m**	**$ 1,550**	**$ 700,135**	**$ 817,246**
	Supply and install 525 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**176.1**	**m**	**$ 1,970**	**$ 346,917**	**$ 404,945**
	Supply and install 600 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**907.9**	**m**	**$ 2,000**	**$ 1,815,800**	**$ 2,119,527**
	Capital Cost				**$ 3,172,272**	**$ 3,702,895**
B.	**Project Delivery Allowance** Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 793,068**	**$ 925,724**
	Sub-Total (A+B)				**$ 3,965,340**	**$ 4,628,618**
C.	**Contingency** Class 4 Cost Estimate Multiplier			**25%**	**$ 991,335**	**$ 1,157,155**
	Sub-Total Project Cost				**$ 4,956,675**	**$ 5,785,773**
	HST (@ 13%)					**$ 752,151**
	Total Project Cost					**$ 6,537,924**

Project ID **WW-14**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**461.9**	**m**	**$ 1,650**	**$ 762,135**	**$ 889,617**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 3.0 m to 4.5 m in depth	**7**	**each**	**$ 15,900**	**$ 111,300**	**$ 129,917**
	Capital Cost				**$ 873,435**	**$ 1,019,534**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 218,359**	**$ 254,883**
	Sub-Total (A+B)				**$ 1,091,794**	**$ 1,274,417**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 272,948**	**$ 318,604**
	Sub-Total Project Cost				**$ 1,364,742**	**$ 1,593,021**
	HST (@ 13%)					**$ 207,093**
	Total Project Cost					**$ 1,800,114**

Project ID **WW-15**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**287.6**	**m**	**$ 1,420**	**$ 408,392**	**$ 476,703**
	Capital Cost				**$ 408,392**	**$ 476,703**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 102,098**	**$ 119,176**
	Sub-Total (A+B)				**$ 510,490**	**$ 595,879**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 127,623**	**$ 148,970**
	Sub-Total Project Cost				**$ 638,113**	**$ 744,849**
	HST (@ 13%)					**$ 96,830**
	Total Project Cost					**$ 841,679**

Project ID **WW-16**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**342.5**	**m**	**$ 1,650**	**$ 565,125**	**$ 659,653**
	Capital Cost				**$ 565,125**	**$ 659,653**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 141,281**	**$ 164,913**
	Sub-Total (A+B)				**$ 706,406**	**$ 824,566**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 176,602**	**$ 206,142**
	Sub-Total Project Cost				**$ 883,008**	**$ 1,030,708**
	HST (@ 13%)					**$ 133,992**
	Total Project Cost					**$ 1,164,700**

Project ID **WW-17**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 375 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**976.4**	**m**	**$ 1,650**	**$ 1,611,060**	**$ 1,880,540**
	Capital Cost				**$ 1,611,060**	**$ 1,880,540**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 402,765**	**$ 470,135**
	Sub-Total (A+B)				**$ 2,013,825**	**$ 2,350,676**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 503,456**	**$ 587,669**
	Sub-Total Project Cost				**$ 2,517,281**	**$ 2,938,344**
	HST (@ 13%)					**$ 381,985**
	Total Project Cost					**$ 3,320,329**

Project ID **WW-18**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**78.5**	**m**	**$ 1,675**	**$ 131,488**	**$ 153,481**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 4.5 m to 6.0 m in depth	**1**	**each**	**$ 17,800**	**$ 17,800**	**$ 20,777**
	Capital Cost				**$ 149,288**	**$ 174,259**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 37,322**	**$ 43,565**
	Sub-Total (A+B)				**$ 186,609**	**$ 217,823**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 46,652**	**$ 54,456**
	Sub-Total Project Cost				**$ 233,262**	**$ 272,279**
	HST (@ 13%)					**$ 35,396**
	Total Project Cost					**$ 307,675**

Project ID **WW-19**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 250 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**173.4**	**m**	**$ 1,400**	**$ 242,760**	**$ 283,366**
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**192.4**	**m**	**$ 1,675**	**$ 322,270**	**$ 376,176**
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**334.7**	**m**	**$ 1,900**	**$ 635,930**	**$ 742,301**
	Supply and install 525 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**199.1**	**m**	**$ 1,970**	**$ 392,227**	**$ 457,834**
	Supply and install 675 mm reinforced concrete pipe, CL 140D including core break into and connect to maintenance hole - over 6.0 m in depth	**506.2**	**m**	**$ 2,250**	**$ 1,138,950**	**$ 1,329,461**
	Supply and install precast concrete maintenance hole including benching and frame and cover - 1200 mm diameter - over 4.5 m to 6.0 m in depth	**10**	**each**	**$ 17,800**	**$ 178,000**	**$ 207,774**
	Capital Cost				**$ 2,910,137**	**$ 3,396,913**
B.	**Project Delivery Allowance** Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 727,534**	**$ 849,228**
	Sub-Total (A+B)				**$ 3,637,671**	**$ 4,246,141**
C.	**Contingency** Class 4 Cost Estimate Multiplier			**25%**	**$ 909,418**	**$ 1,061,535**
	Sub-Total Project Cost				**$ 4,547,089**	**$ 5,307,676**
	HST (@ 13%)					**$ 689,998**
	Total Project Cost					**$ 5,997,674**

Project ID **WW-20**

Item	Description	Qty	Unit	Rate (2020)	Amount (2020)	Amount (2023)
A.	**Construction**					
	Supply and install 300 mm PVC sewer DR 35 including core break into and connect to maintenance hole - over 3.0 m to 4.5 m in depth	**113.6**	**m**	**$ 1,420**	**$ 161,312**	**$ 188,294**
	Supply and install 450 mm reinforced concrete pipe, CL 100D including core break into and connect to maintenance hole - over 4.5 m to 6.0 m in depth	**251.1**	**m**	**$ 1,900**	**$ 477,090**	**$ 556,892**
	Capital Cost				**$ 638,402**	**$ 745,187**
B.	**Project Delivery Allowance**					
	Multiplier for Preliminary Design, Tendering, Construction Services, Insurance, Mobilization & Demobilization, Traffic Control, Utility Impacts/Relocations			**25%**	**$ 159,601**	**$ 186,297**
	Sub-Total (A+B)				**$ 798,003**	**$ 931,484**
C.	**Contingency**					
	Class 4 Cost Estimate Multiplier			**25%**	**$ 199,501**	**$ 232,871**
	Sub-Total Project Cost				**$ 997,503**	**$ 1,164,354**
	HST (@ 13%)					**$ 151,366**
	Total Project Cost					**$ 1,315,721**