Lithos

August 2023

UD22-064

Functional Servicing and Stormwater Management Report

Project: 75 Centennial Parkway North, Hamilton
Hammer LP

Lithos Group Inc.
150 Bermondsey Road
Toronto, ON M4A-1Y1
Tel: (416) 750-7769
Email: info@LithosGroup.ca

PREPARED BY:

Dimitra Frysali, P.E., M.A.Sc.

Project Designer

REVIEWED BY:

Catherina Agiou, P.E., M.A.Sc.
Project Design Manager

AUTHORIZED FOR ISSUE BY:

LITHOS GROUP INC.

Nick Moutzouris, P.Eng., M.A.Sc.

Principal

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Executive Summary

Lithos Group Inc. (Lithos) was retained by Hammer LP (the "Owner") to prepare a Functional Servicing and Stormwater Management (FSR-SWM) Report in support of a Draft Plan of Subdivision Application for a proposed mixed-use development at 75 Centennial Parkway North, in the City of Hamilton (the "City"). The following is a summary of our conclusions:

Storm Drainage

A detailed Storm Water Management (SWM) Report will be prepared at the Site Plan Application stage. The site stormwater discharge will be controlled to the pre-development conditions for all flows up to 100-year storm event. In order to achieve the target flow and meet the City's Regulations, quantity controls will be utilized and approximately 871.4 m^3 of on-site storage will be required for the entire property. The stormwater management (SWM) system will be designed to provide enhanced level (Level 1) protection, as specified by the Ministry of Environment, Conservation and Parks (MECP). Detailed water quantity calculations and quality measures for each block will be provided during Site Plan Application.

Sanitary Sewers

The site under proposed conditions will consist of ten (10) mixed-use blocks and three (3) parkland blocks, plus blocks for road widening.

The sanitary flow from Blocks B, C, F, and a portion of Block A (north of Block D), will be discharged into the 375 mm diameter sanitary sewer along Kenora Avenue, finally reaching the trunk sewer along Queen Elizabeth Way (Route A). The sanitary flow from Block I will be discharged into the 250mm diameter sanitary sewer along Queenston Road, reaching the trunk sewer along Queen Elizabeth Way through Kenora Avenue (Route A). Sanitary flow from the remaining Blocks (Blocks D, E, G, H, J, K, M, L and the portion of Block A east of Block G) will be discharged into the 375 mm diameter sanitary sewer along Centennial Parkway North, finally discharging into the trunk sewer along Queen Elizabeth Way (Route B), through a proposed public sanitary sewer network.

Sanitary flow for Route A will result in an additional net flow of 53.59 L/s towards the sanitary sewer system along Kenora Avenue, while sanitary flow from the remaining blocks of the proposed development (Route B) will result in an additional net flow of 67.11 L/s towards the proposed sanitary sewer system, which will eventually discharge into the trunk sewer along Queen Elizabeth Way.

Water Supply

The site under proposed conditions will consist of ten (10) mixed-use blocks and three (3) parkland blocks. Therefore, thirteen (13) separate connections will be provided for the proposed mixed-use buildings and parkland areas. Water supply for the proposed blocks K, I will be connected to the 300mm watermain along Queenston Road. Furthermore, the proposed blocks F, B and part of Block A will be connected to the 400mm watermain along Kenora Avneue. The proposed blocks C, E, H, J, M, L, G, D and part of block A, will be connected to the proposed watermain, located in the proposed public road, finally connected to the existing 400mm watermain in Kenora Avenue and 1200mm existing watermain along Centennial Parkway North. A detailed Watermain Analysis will be provided at a later stage.

Site Grading

The proposed grades will match current drainage patterns and will improve the existing drainage conditions to meet the City's requirements. Grades will be maintained along the property line wherever feasible and overland flow will be directed towards the adjacent right of ways (ROW).

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1.0 Introduction

Lithos Group Inc. (Lithos) was retained by Hammer LP (the "Owner") to prepare a Functional Servicing and Stormwater Management (FSR-SWM) Report in support of a Draft Plan of Subdivision Application for a proposed mixed-use development at 75 Centennial Parkway North, in the City of Hamilton (the "City").

The purpose of this report is to provide site-specific information for the City's review with respect to infrastructure required to support the proposed development. More specifically, the report will present details on sanitary discharge, water supply and an outline of the storm drainage pattern.

We contacted the City's engineering department to obtain existing information in preparation of this report. The following documents were available for our review:

- Plan and Profile drawing of Centennial Parkway North, drawing No. 13-H-62 (7-9), dated March, 2014;
- Plan and Profile drawing of Centennial Parkway North, drawing No. 13-W-02 (7-9), dated March, 2014;
- Plan and Profile drawing of Centennial Parkway North, drawing No. 14-S-01 (4), dated March, 2014;
- Plan and Profile drawing of Centennial Parkway North, drawing No. 72-S-320 (1-2), dated November, 1971;
- Plan and Profile drawing of Delawana Drive, drawing No. 72-S-320 (3-4), dated November, 1971;
- Plan and Profile drawing of Delawana Drive, drawing No. 72-W-349 (1-2), dated March, 1972;
- Plan and Profile drawing of Kenora Avenue, drawing No. 72-H-401 (2-5), dated May, 1972;
- Plan and Profile drawing of Kenora Avenue, drawing No. 85-H-3 (1);
- Plan and Profile drawing of Kenora Avenue, drawing No. 87-S-35 (1,3), dated June, 1986;
- Plan and Profile drawing of Queenston Road, drawing No. 13-H-34-01, dated March, 2014;
- Plan and Profile drawing of Queenston Road, drawing No. 13-H-34-T1, dated March, 2014;
- Plan and Profile drawing of Queenston Road, drawing No. 15-H-43-02, dated April, 2016;
- Plan and Profile drawing of Queenston Road, drawing No. 79-S-63-1, dated September, 1979;
- Plan and Profile drawing of Queenston Road, drawing No. H-167-S1AB, dated December, 1962;
- Plan and Profile drawing of Queenston Road, drawing No. Q-76-H, dated September, 1964;
- Site Statistics prepared by BDP. Quadrangle, dated May 31, 2023;
- Site Plan prepared by BDP. Quadrangle, dated May 31, 2023; and,
- Topographical Survey prepared by A.T. McLAaren Limited, dated October 25, 2022.

2.0 Site Description

The existing site is approximately 17.677 hectares and is located on the north-west corner of the intersection between Queenston Road and Centennial Parkway North, in the City of Hamilton (the 'City'). Property is currently occupied by a commercial shopping centre known as Eastgate Square with associated outdoor surface parking areas located around the peripheries of the site. The north portion of the existing shopping centre will be maintained, while mixed-use development is proposed at the southern end of the site. The site area is bound by Centennial Parkway North to the east, Queenston Road to the south, Kenora Avenue to the west and Delawana Drive to the north. Refer to **Figures 1** and **2** following this report, site photographs in **Appendix A** and the topographic survey in **Appendix B**.

3.0 Site Proposal

The proposed mixed-use development will consist of thirteen (13) blocks. The existing retail building in the north portion will be retained, while new buildings will be constructed to the north and south of the new public road. Additionally, there will be three (3) parkland areas along the central axis of the proposed development. The project includes a total of 3,957 residential units, 11,367 m^2 of new non-residential Gross Floor Area and 36,776 m^2 of the existing shopping centre which will be retained. The overall development will encompass approximately 333,499 square meters of Gross Floor Area (GFA). Please refer to **Appendix B** for the proposed site plan and building site statistics.

4.0 Terms of Reference and Methodology

4.1. Terms of Reference

The Terms of Reference used for the scope of this report were based on the City's Storm Drainage Policy dated May 2004, City of Hamilton Criteria and Guidelines for Stormwater Management Infrastructure, dated September 2007, Engineering Guidelines for Servicing Land Under Development Application, dated December 2012, and the Ontario Building Code.

4.2. Methodology: Stormwater Drainage and Management

This report provides an overview of the pre and post-development conditions, and comments on opportunities to reduce peak flows. A detailed Stormwater Management (SWM) Report will be prepared at the Site Plan Application stage.

The proposed development will be designed to meet the City's Design Criteria and Standard Drawings, the Hamilton Conservation Authority and the standards of the Province of Ontario as set out in the Ministry of Environment, Conservation and Parks (MECP) 2003, and the Stormwater Management Planning and Design Manual (SWMPD). The following design criteria will be reviewed:

- Post-development peak flows for all events up to the 100-year storm flow from the site, should be controlled to the pre-development conditions; and
- A safe overland flow will be provided for all flows in excess of the 100-year storm event.

4.3. Methodology: Sanitary Discharge

The sanitary sewage discharge from the site will be determined using sanitary sewer design sheets that incorporate the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge that considers infiltration.

The estimated sanitary discharge flows from the proposed site will be calculated based on the criteria shown in **Table 4-1** below.

Table 4-1 – Sanitary Flows

Usage	Design Flow	Units	Population Equivalent
Residential	275	Litres / capita / day	1 Bedroom Apartments = 2 persons/unit 2 Bedroom Apartments = 4 persons/unit 3Bedroom Apartments = 6 persons/unit
Commercial	5	Litres / m^2 / day	-
Parkland	275	Litres / capita / day	25 persons/hectare

Based on the calculated peak flows, the adequacy of the existing infrastructure to support the proposed development will be discussed.

4.4. Methodology: Water Usage

The domestic water usage was calculated based on the City's design criteria outlined in **Table 4-2.**

Table 4-2 – Water Usage

Usage	Water Demand	Units
Residential	360	Litres / capita / day
Commercial	5	L/m^2/day

Pressure and flow testing have been conducted on the existing hydrants located near the site to obtain existing flows, and residual and static pressure.

5.0 Stormwater Management and Drainage

5.1. Existing Conditions

The existing site is approximately 17.677 hectares and is currently occupied by retail buildings and outdoor parking area. The proposed development will involve retaining the north portion of the existing mall and site as is, while constructing new mixed-use buildings to the north and south of the proposed public road that will connect Kenora Avenue with Centennial Parkway North. The examined redeveloped portion of the site is approximately 8.703 ha. Under pre-development conditions storm water from the site is draining towards Kenora Avenue. According to available records, there is an existing 1350 mm diameter storm sewer along Kenora Avenue, a 375 mm storm sewer along Queenston Road running west, a 450mm storm sewer along Queenston Road running East, a 525 mm storm sewer along Centennial Parkway North and a 1200 mm storm sewer along Delawana Drive.

Table 5-1 shows the input parameters which are illustrated on the pre-development drainage area plan in **Figure DAP-1** in **Appendix C.**

Table 5-1 – Pre-development Input Parameters

Drainage Area	Drainage Area (ha)	Design "C"	Tc (min.)
A1 Pre	0.561	0.84	10
A2 Pre	0.598	0.85	10
A3 Pre	0.743	0.85	10
A4 Pre	0.710	0.88	10
A5 Pre	0.761	0.90	10
A6 Pre	0.491	0.90	10
A7 Pre	0.290	0.86	10
A8 Pre	0.927	0.89	10
A9 Pre	0.505	0.78	10
A10 Pre	0.315	0.90	10
A11 Pre	0.899	0.88	10
A12 Pre	0.464	0.90	10
A13 Pre	0.202	0.90	10
A14 Pre	0.820	0.89	10
A15 Pre	0.416	0.87	10

The pre-development target flows were determined using the Rational Method and the City's IDF data. Peak flows calculated for the existing conditions are shown in Error! Reference source not found. below. Detailed calculations are in **Appendix C**.

Table 5-2 – Target Peak Flows

Catchment	Peak Flow Rational Method (L/s)					
	2-year	5-year	10-year	25-year	50-year	100-year
A1 Pre	97.3	135.3	160.6	191.9	216.2	238.8
A2 Pre	104.8	145.7	172.9	206.6	232.7	257.0
A3 Pre	129.3	179.8	213.3	254.9	287.2	317.2
A4 Pre	129.0	179.4	212.9	254.3	286.6	316.5
A5 Pre	140.3	195.1	231.5	276.6	311.6	344.2
A6 Pre	91.0	126.5	150.1	179.3	202.1	223.2
A7 Pre	51.1	71.1	84.4	100.8	113.6	125.4
A8 Pre	170.3	236.8	281.0	335.7	378.3	417.8
A9 Pre	80.9	112.5	133.5	159.5	179.7	198.4
A10 Pre	58.4	81.1	96.3	115.1	129.6	143.2
A11 Pre	162.5	225.9	268.1	320.3	360.9	398.6
A12 Pre	86.0	119.5	141.9	169.5	190.9	210.9
A13 Pre	37.4	52.0	61.8	73.8	83.1	91.8
A14 Pre	150.1	208.7	247.7	295.9	333.4	368.2
A15 Pre	74.5	103.6	123.0	147.0	165.6	182.9

5.2. Stormwater Management

In order to meet the stormwater management criteria, the post-development flow rate is to be controlled to the pre-development conditions, as established in **Section 5.1**. The post-development site will consist of fourteen (14) internal drainage areas:

1. A1 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
2. A2 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
3. A3 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
4. A4 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
5. A5 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
6. A6 Post – Controlled storm runoff from Parkland Area;
7. A7 Post – Controlled storm runoff from Parkland Area;
8. A8 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
9. A9 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
10. A10 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
11. A11 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
12. A12 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;
13. A13 Post – Controlled storm runoff from Parkland Area;
14. A14 Post – Public Street;
15. A15 Post – Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas;

The post-development drainage areas and runoff coefficients are indicated on **Figure DAP-2**, located in **Appendix C,** and summarized in **Table 5-3** below.

Table 5-3 - Post-development Input Parameters

Drainage Area	Drainage Area (ha)	"C"	Tc (min.)
A1 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.561	0.90	10
A2 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.598	0.90	10
A3 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.743	0.90	10
A4 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.710	0.90	10
A5 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.761	0.90	10
A6 Post (Controlled storm runoff from Parkland Area)	0.491	0.25	10
A7 Post (Controlled storm runoff from Parkland Area)	0.290	0.25	10
A8 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.927	0.90	10
A9 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.505	0.90	10
A10 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.315	0.90	10
A11 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.899	0.90	10
A12 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.464	0.90	10
A13 Post (Controlled storm runoff from Parkland Area)	0.202	0.25	10
A14 Post (Public Street)	0.820	0.90	10
A15 Post (Controlled storm runoff from Rooftops/Driveway/Landscaped/Hardscaped Areas)	0.416	0.90	10

5.2.1. Quantity Controls

Using the City's intensity-duration-frequency (IDF) data, modified rational method calculations were undertaken to determine the maximum storage required during each storm event. Results for the 2, 5, 10, 25, 50 and 100-year storm events are provided in **Table 5-4** below. The detailed post-development quantity control calculations are provided in **Appendix C**.

Table 5-4 – Post-development Quantity Control as per City Requirements

Drainage Area	Storm Event	Target Flow (L/s)	Minimum Storage Required (m^3)
A1 Post (Controlled)	2-year	97.3	4.0
	5-year	135.3	5.5
	10-year	160.6	6.6
	25-year	191.9	7.8
	50-year	216.2	8.8
	100-year	238.8	9.7
A2 Post (Controlled)	2-year	104.8	3.6
	5-year	145.7	5.0
	10-year	172.9	6.0
	25-year	206.6	7.1
	50-year	232.7	8.0
	100-year	257.0	8.9
A3 Post (Controlled)	2-year	129.3	5.0
	5-year	179.8	7.0
	10-year	213.3	8.3
	25-year	254.9	9.9
	50-year	287.2	11.2
	100-year	317.2	12.3
A4 Post (Controlled)	2-year	129.0	1.5
	5-year	179.4	2.1
	10-year	212.9	2.5
	25-year	254.3	3.0
	50-year	286.6	3.4
	100-year	316.5	3.7
A5 Post (Controlled)	2-year	140.3	0.4
	5-year	195.1	0.6
	10-year	231.5	0.7
	25-year	276.6	0.8
	50-year	311.6	0.9
	100-year	344.2	1.0
A6 Post (Controlled)	2-year	91.0	0.0
	5-year	126.5	0.0
	10-year	150.1	0.0
	25-year	179.3	0.0
	50-year	202.1	0.0
	100-year	223.2	0.0
A7 Post (Controlled)	2-year	51.1	0.0
	5-year	71.1	0.0
	10-year	84.4	0.0
	25-year	100.8	0.0
	50-year	113.6	0.0
	100-year	125.4	0.0
A8 Post (Controlled)	2-year	170.3	0.9
	5-year	236.8	1.2
	10-year	281.0	1.4
	25-year	335.7	1.7
	50-year	378.3	1.9
	100-year	417.8	2.1

Drainage Area	Storm Event	Target Flow (L/s)	Minimum Storage Required (m^3)
A9 Post (Controlled)	2-year	80.9	7.6
	5-year	112.5	10.6
	10-year	133.5	12.5
	25-year	159.5	15.0
	50-year	179.7	16.9
	100-year	198.4	18.7
A10 Post (Controlled)	2-year	58.4	0.0
	5-year	81.1	0.0
	10-year	96.3	0.0
	25-year	115.1	0.0
	50-year	129.6	0.0
	100-year	143.2	0.0
A11 Post (Controlled)	2-year	162.5	2.4
	5-year	225.9	3.4
	10-year	268.1	4.0
	25-year	320.3	4.8
	50-year	360.9	5.4
	100-year	398.6	6.0
A12 Post (Controlled)	2-year	86.0	0.0
	5-year	119.5	0.0
	10-year	141.9	0.0
	25-year	169.5	0.0
	50-year	190.9	0.0
	100-year	210.9	0.0
A13 Post (Controlled)	2-year	37.4	0.0
	5-year	52.0	0.0
	10-year	61.8	0.0
	25-year	73.8	0.0
	50-year	83.1	0.0
	100-year	91.8	0.0
A14 Post (Controlled)	2-year	150.1	1.1
	5-year	208.7	1.6
	10-year	247.7	1.9
	25-year	295.9	2.3
	50-year	333.4	2.6
	100-year	368.2	2.8
A15 Post (Controlled)	2-year	74.5	1.5
	5-year	103.6	2.1
	10-year	123.0	2.5
	25-year	147.0	3.0
	50-year	165.6	3.4
	100-year	182.9	3.7

As shown in **Table 5-4,** the post-development peak flows from the site will be controlled to the pre-development conditions. This can be achieved through the design and installation of stormwater holding tanks, flow control devices and/or roof storage, details of which will be provided through the detailed design stage of the Site Plan Application.

5.3. Proposed Storm Connection

5.3.1. Proposed Development

The storm flow from six (6) of the total (13) blocks (blocks B, C, D, E, F and part of Block A north of Block D), will discharge into the 1350 mm diameter storm sewer in Kenora Avenue. Storm flow from Block I will be discharged to the existing 375mm diameter storm sewer along Queenston Road, flowing west. Storm flow from Block K will be discharged to the existing 450mm diameter storm sewer along Queenston Road, flowing east. Part of Block A (east of Block g), along with five (5) blocks will be discharging to the existing 450mm diameter sewer along Centennial Parkway North, through the proposed public sewer network.

Details of the proposed Stormwater Management System will be provided during the detailed design stage of Site Plan Application. Refer to engineering drawing **"SS-01"** for stormwater service connection (submitted separately).

5.3.2. Proposed Public Road

Under post-development conditions, a portion of the site will be conveyed to the City for the purpose of constructing a Public Road. Storm runoff from the Public Road will be collected by its catchbasins and directed through two (2) new storm sewer networks that will be constructed in accordance with the City's Standards. These networks will connect to the existing storm sewer networks along Kenora Avenue and Centennial Parkway North.

For connection details refer to the **'Site Servicing Plan'**, engineering drawing "**SS-01**" submitted separately. Details of the proposed Stormwater Management Design will be provided during the stage of the Site Plan Application.

6.0 Sanitary Drainage System

6.1. Existing Sanitary Drainage System

The existing site is approximately 17.677 hectares and is located on the north-west corner of the intersection between Queenston Road and Centennial Parkway North, in the City of Hamilton (the 'City'). The property is currently occupied by retail buildings and outdoor parking area. The proposed development will involve retaining the north portion of the existing mall and site as is, while constructing new mixed-use buildings to the north and south of the proposed public road that will connect Kenora Avenue with Centennial Parkway North. According to available records, there are five (5) sanitary sewers abutting the subject property. More specifically:

- A 375 sanitary sewer on Centennial Parkway North, flowing north;
- A 1500 trunk sanitary sewer on Centennial Parkway North, flowing north;
- A 300 sanitary sewer on Queenston Road, flowing east;
- A 250 sanitary sewer on Queenston Road, flowing west;
- A 375 sanitary sewer on Kenora Avenue, flowing north;
- A 250 sanitary sewer on Delawana Drive, flowing west;

Under existing conditions, the sanitary flow from the site is being discharged into the 375mm sanitary sewer on Kenora Avenue flowing north, into the 375 sanitary sewer on Centennial Parkway North flowing north and into the 250mm sanitary sewer on Delawana Drive, flowing west.

The sanitary flow generated by the proposed development at 75 Centennial Parkway North was compared to the existing flow in order to quantify the net increase in the sanitary sewer network. Using the design criteria outlined in **Section 4.3** and existing site information, the sanitary discharge flow from the existing commercial buildings is estimated at 6.54 L/s.

Under post-development conditions, a portion of the existing mall will be maintained. In addition, thirteen (13) mixed-use blocks will be constructed into the surplus area of the property. The proposed development will include approximately 333,499 m^2 of Gross Floor Area (GFA).

The sanitary flow from Blocks B, C, F and a portion of Block A (north of Block D) will be discharged into the sanitary network along Kenora Avenue, finally reaching the trunk sewer along Queen Elizabeth Way (Route A). The sanitary flow from Block I will be discharged into the sanitary network along Queenston Road, also finally reaching the trunk sewer along Queen Elizabeth Way (Route A). Sanitary flow from the remaining Blocks (Blocks D, E, G, H, J, K, M, L, and the portion of Block A east of Block G) will be discharged into the sanitary network along Centennial Parkway North, finally discharging into the trunk sewer along Queen Elizabeth Way (Route B), through a proposed public sanitary sewer network.

Using the design criteria outlined in **Section 4.3**, a residential population of five thousand and sixty(5,060) people associated with 0.388 L/s of flow derived from the 0.671 ha of commercial use, was considered to estimate the additional sanitary discharge flow of 53.59 L/s towards the sanitary network along Kenora Avenue. In regards to Route B, a residential population of five thousand seven hundred and eighty four (5,784)people associated with 0.388 L/s of flow derived from the 0.671 ha of commercial use, was considered to estimate the additional sanitary flow of 67.11 L/s, which will eventually discharge into the 375 mm diameter sanitary sewer, along Centennial Parkway North. For detailed calculations refer to the sanitary sewer design sheet in **Appendix D**.

6.2. Existing Downstream Capacity

Based on plans provided by the City, topographic information and on-site investigation conducted by our team, a sanitary sewer drainage area plan was developed based on plan and profile maps, to assess existing flow conditions downstream and upstream from the site. The sanitary flows were calculated using the sanitary sewer design sheets typically associated with the design of sewers for municipal design. The data was based on residential / commercial flows, extraneous infiltration quantities, and peaking factors.

According to our review of the sanitary sewer network downstream, the proposed sanitary connection will be along Kenora Avenue and Centennial Parkway North, on the 375mm diameter sanitary sewer ON Kenora Avenue for Route A and along Centennial Parkway North on the 375mm sanitary sewer for Route B. Both of these sanitary sewers, discharge directly into the trunk sewer at the Queen Elizabeth Street. Please refer to the Downstream Combined Network **(DAP 3.1 & DAP 3.2)** for the location of the sewer segments.

Our calculations show that under pre-development conditions, the receiving 375mm sanitary sewer on Kenora Avenue does not carry more than 50.59% of its full flow capacity. Similarly, the receiving 375mm sanitary sewer at Centennial Parkway North does not convey more than 6.20% of its full flow capacity. Under post-development conditions, the full flow capacity of Route A and Route B will be increased to 98.92% and 52.28% respectively. Refer to the "**External Combined Sewer Segments**" design sheet 2 & 4 in **Appendix D**.

In summary, under post-development sanitary flows, the existing infrastructure on Kenora Avenue and on Centennial Parkway North is adequate to service this development.

6.3. Sanitary Connection

The sanitary flow from Blocks B, C, F and a portion of Block A (north of Block D) will be discharged into the 375 mm diameter sanitary sewer along Kenora Avenue, finally reaching the trunk sewer along Queen Elizabeth Way (Route A). The sanitary flow from Block I will be discharged into the 250mm diameter sanitary sewer along Queenston Road, reaching the trunk sewer along Queen Elizabeth Way through Kenora Avenue (Route A). Sanitary flow from the remaining Blocks (Blocks D, E, G, H, J, K, M, L and the portion of Block A east of Block G) will be discharged into the 375 mm diameter sanitary sewer along Centennial Parkway North, finally discharging into the trunk sewer along Queen Elizabeth Way (Route B), through a proposed public sanitary sewer network. For details refer to engineering drawing **"SS-01"** (submitted separately). Details will be provided during SPA.

7.0 Water Supply System

7.1. Existing System

According to available records, around the property, there are five (5) watermains. More specifically:

- a 400mm diameter watermain on Kenora Avenue;
- a 300mm diameter watermain on Queenston Road;
- a 1200mm diameter watermain on Centennial Parkway North;
- a 300mm diameter watermain abandoned on Centennial Parkway North; and
- a 200mm diameter watermain on Delawana Drive.

Hydrant flow tests in the vicinity of the site will be provided in a later stage, which will determine the residual and static pressure into the existing water network.

7.2. Proposed Water Supply Requirements

The proposed development will consist of ten (10) mixed-use blocks and three (3) parkland blocks.

A detailed watermain analysis will be prepared in a later stage.

7.3. Proposed Watermain Connection

The site under proposed conditions will consist of ten (10) mixed-use blocks and three (3) parkland blocks. In addition, thirteen (13) separate connections will be provided for the proposed mixed-use buildings and parkland areas.

Block A

The proposed buildings located north of Block D will we serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the existing watermain located north of Block B.

The proposed buildings located east of Block G will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block B

The proposed buildings will we serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the existing 400mm diameter watermain located along Kenora Avenue.

Block C

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block D

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block E

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block F

The proposed buildings will we serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the existing 400mm diameter watermain located along Kenora Avenue.

Block G

The proposed parkland will be serviced by a 200mm diameter water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block H

The proposed parkland will be serviced by a 200mm diameter water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block I

The proposed parkland will be serviced by a 200mm diameter water service. The proposed water service will be connected to the existing 300mm diameter watermain that will run along Queenston Road.

Block J

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block K

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the existing 300mm diameter watermain that will run along Queenston Road.

Block L

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

Block M

The proposed buildings will be serviced by a 200mm diameter fire and a 150mm diameter domestic water service. The proposed water service will be connected to the new 300mm diameter watermain that will run along the new Public Road.

8.0 Site Grading

8.1. Existing Grades

The existing site is approximately 17.677 hectares and is located on the north west corner of the intersection between Queenston Road and Centennial Parkway North, in the City of Hamilton (the 'City'). The property is currently occupied by retail buildings and outdoor parking area. The existing retail building in the north portion will be retained, while new buildings will be constructed to the north and south of the new public road. The site area is bound by Centennial Parkway North to the east, Queenston Road to the south, Kenora Avenue to the west and Delawana Drive to the north. The existing site, slopes towards Kenora Avenue and Centennial Parkway North. Refer to **Figures 1** and **2** following this report, site photographs in **Appendix A** and the topographic survey in **Appendix B**.

8.2. Proposed Grades

The proposed grades will improve the existing drainage conditions to meet the City's requirements, while grades will be maintained along the property line wherever feasible.

9.0 Conclusions and Recommendations

Based on our investigations, we conclude the following:

Storm Drainage

A detailed Storm Water Management (SWM) Report will be prepared at the Site Plan Application stage. The site stormwater discharge will be controlled to the pre-development conditions for all flows up to 100-year storm event. In order to achieve the target flow and meet the City's Regulations, quantity controls will be utilized and approximately 871.4 m^3 of on-site storage will be required for the entire property. The stormwater management (SWM) system will be designed to provide enhanced level (Level 1) protection, as specified by the Ministry of Environment, Conservation and Parks (MECP). Detailed water quantity calculations and quality measures for each block will be provided during Site Plan Application.

Sanitary Sewers

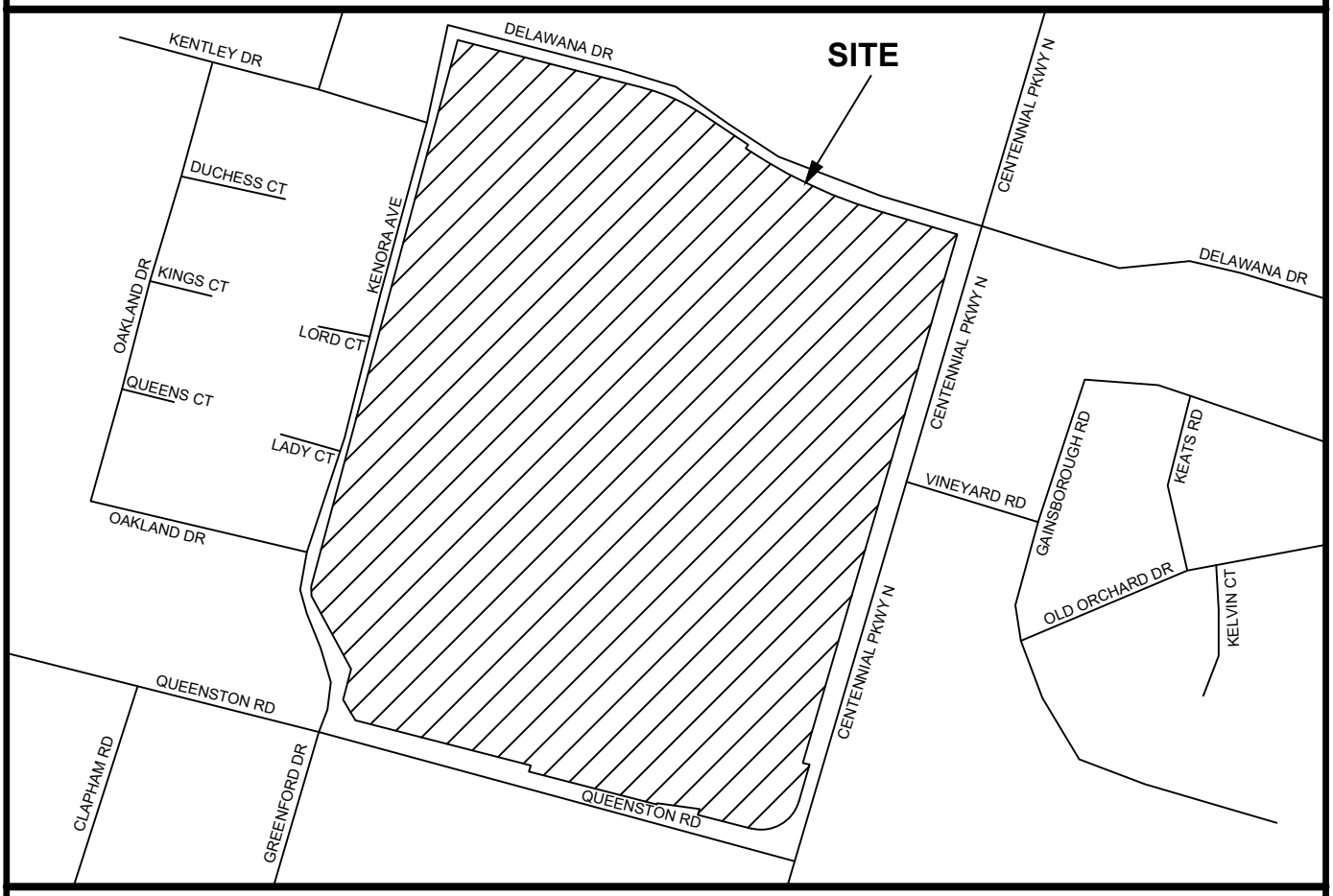
The site under proposed conditions will consist of ten (10) mixed-use blocks and three (3) parkland blocks.

The sanitary flow from Blocks B, C, F, and a portion of Block A (north of Block D), will be discharged into the 375 mm diameter sanitary sewer along Kenora Avenue, finally reaching the trunk sewer along Queen Elizabeth Way (Route A). The sanitary flow from Block I will be discharged into the 250mm diameter sanitary sewer along Queenston Road, reaching the trunk sewer along Queen Elizabeth Way through Kenora Avenue (Route A). Sanitary flow from the remaining Blocks (Blocks D, E, G, H, J, K, M, L and the portion of Block A east of Block G) will be discharged into the 375 mm diameter sanitary sewer along Centennial Parkway North, finally discharging into the trunk sewer along Queen Elizabeth Way (Route B), through a proposed public sanitary sewer network.

Sanitary flow for Route A will result in an additional net flow of 53.59 L/s towards the sanitary sewer system along Kenora Avenue, while sanitary flow from the remaining blocks of the proposed development (Route B) will result in an additional net flow of 67.11 L/s towards the proposed sanitary sewer system, which eventually discharged into the trunk sewer along Queen Elizabeth Way.

Water Supply

The site under proposed conditions will consist of ten (10) mixed-use blocks and three (3) parkland blocks. Therefore, thirteen (13) separate connections will be provided for the proposed mixed-use buildings and parkland areas. Water supply for the proposed blocks K, I will be connected to the 300mm watermain along Queenston Road. Furthermore, the proposed blocks F, B and part of Block A will be connected to the 400mm watermain along Kenora Avneue. The proposed blocks C, E, H, J, M, L, G, D and part of block A, will be connected to the proposed watermain, located in the proposed public road, finally connected to the existing 400mm watermain in Kenora Avenue and 1200mm existing watermain along Centennial Parkway North. A detailed Watermain Analysis will be provided at a later stage.



Lithos

150 Bermondsey Road, Toronto, Ontario M4A 1Y1

LOCATION PLAN

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

DATE:	AUGUST 2023	PROJECT No:	UD22-064
SCALE:	N.T.S.	FIGURE No:	FIG 1

Lithos

150 Bermondsey Road, Toronto, Ontario M4A 1Y1

AERIAL PLAN

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

DATE:	AUGUST 2023	PROJECT No:	UD22-064
SCALE:	N.T.S.	FIGURE No:	FIG 2

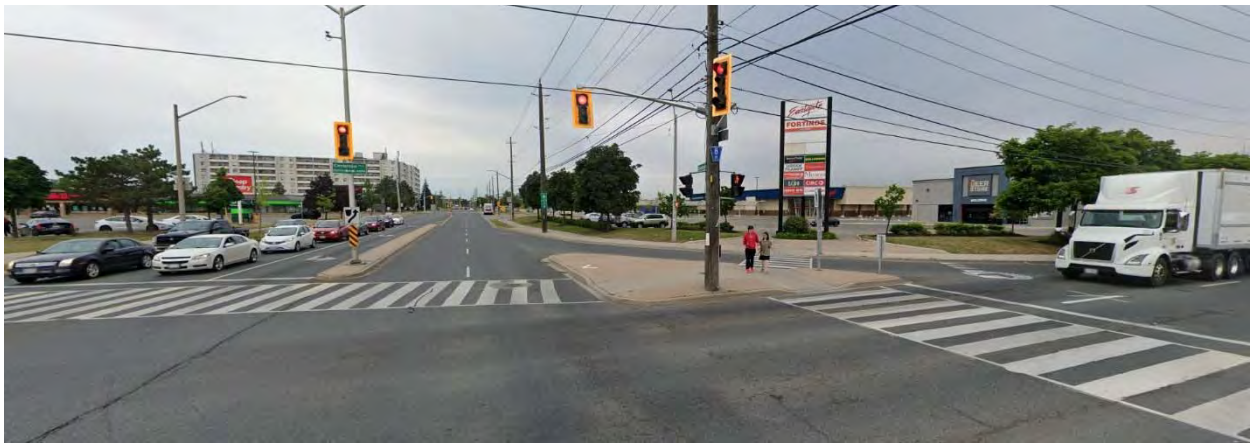
Appendix A

Site Photographs

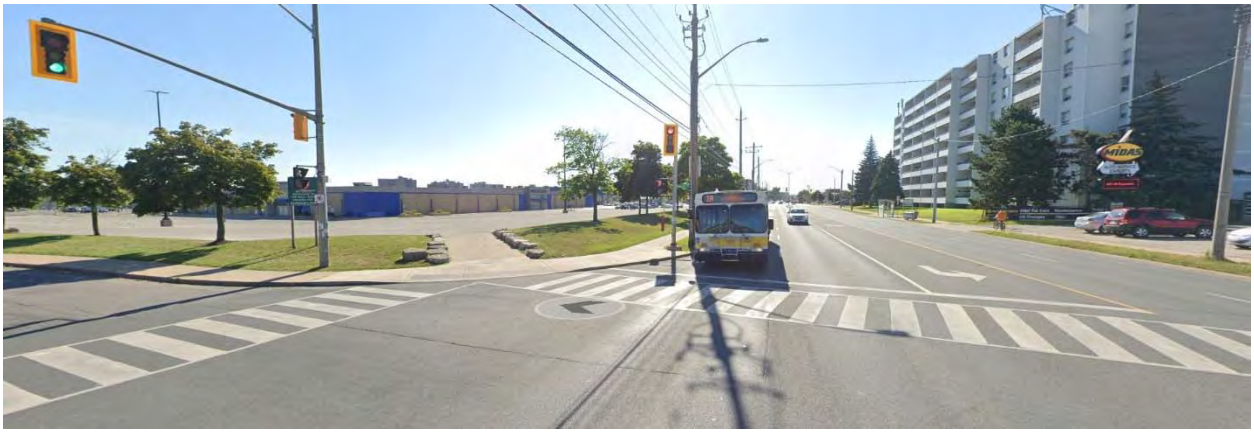
South center side of Property along Hwy 8 facing North.

East center side of Property along Centennial Parkway facing West.

West center side of Property along Kenora Avenue facing East.



South-East corner of Property at intersection between Hwy 8 and Centennial Parkway facing South-West.



South-West corner of Property at intersection between Hwy 8 and Kenora Avenue facing South-East.

Appendix B

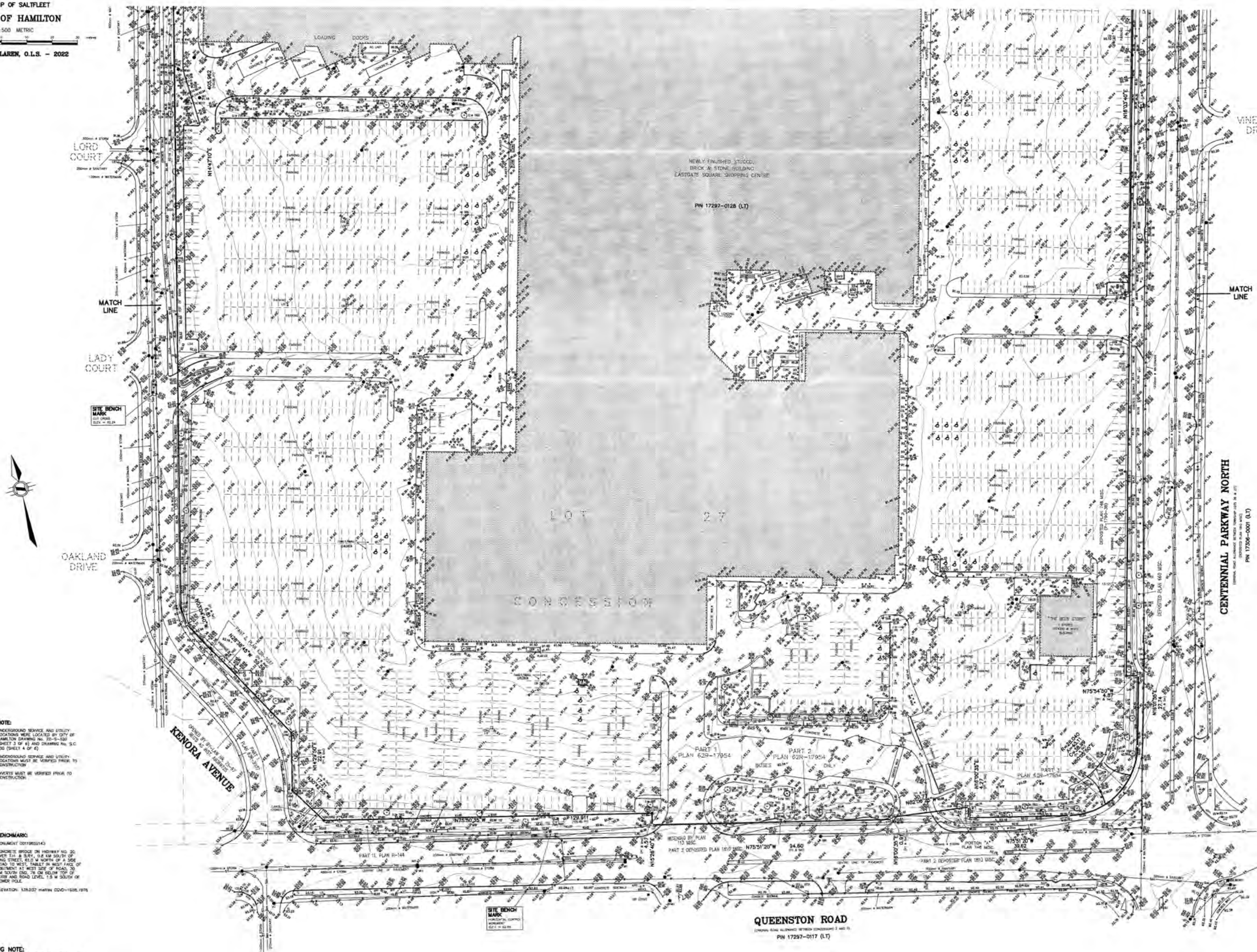
Background Information

SURVEYOR'S REAL PROPERTY REPORT
PART 1, PLAN OF PART OF
LOT 27
CONCESSION 2
GEOGRAPHIC
TOWNSHIP OF SALTFLEET
IN THE
CITY OF HAMILTON

SCALE 1:500 METRIC

R.A. McLAREN, O.L.S. – 2022

SURVEYOR'S REAL PROPERTY REPORT (PART 2)
PART OF LOT 27, CONCESSION 2 AS ILLUSTRATED ON THE PLAN.
THIS PLAN DOES NOT CERTIFY COMPLIANCE WITH ZONING BY-LAWS.
THIS PLAN WAS PREPARED FOR HAMMER LP



NOTE:

UNDERGROUND SERVICE AND UTILITY LOCATIONS WERE LOCATED BY CITY OF HAMILTON DRAWING No. 72-S-320 (SHEET 3 OF 6) AND DRAWING No. S.C. 100 (SHEET 4 OF 6)

UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

BENCHMARK:

MONUMENT 0011965U143

CONCRETE BRIDGE ON HIGHWAY NO. 20 OVER T.H. & B.RY., 0.8 KM SOUTH OF KING STREET, 61.0 M NORTH OF A SIDE ROAD TO WEST, TABLET IN WEST FACE OF ABUTMENT AT WEST SIDE OF ROAD, 30 CM SOUTH END, 76 CM BELOW TOP OF CURB AND ROAD LEVEL, 1.5 M SOUTH OF POWER POLE.

ELEVATION: 129.037 metres CGVD-1928:1978

BEARING NOTE:
BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

NOTE:
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.99971454[illegible]

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP's): UTM ZONE 17, NAD83 (CSRS) (2010.0) COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10		
POINT ID	NORTHING	EASTING
ORP Ⓐ	4787474.240	600107.462
ORP Ⓑ	4786984.277	600165.761
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN		

LEGEND:

- □ DENOTES MONUMENT SET
- ■ MONUMENT FOUND
- IRON BAR
- PLASTIC BAR
- CUT CROSS
- STANDARD IRON BAR
- SHORT STANDARD IRON BAR
- A.T. McLAREN, O.L.S.
- A.J. CLARKE, O.L.S.
- CITY OF HAMILTON
- DEPARTMENT OF HIGHWAYS OF ONTARIO
- ORIGIN UNKNOWN
- MEASURED
- PLAN BY A.J. CLARKE, O.L.S. DATED JUNE 8, 2020 FILE 7-1378[illegible]
- GAS VALVE
- CONCRETE CURB
- WROUGHT IRON FENCE
- FIRE HYDRANT
- WATER VALVE
- VALVE CHAMBER
- MANHOLE
- CATCH BASIN
- HAND HOLE
- BELL MANHOLE
- HYDRO MANHOLE
- WATER MANHOLE
- STONE RETAINING WALL
- ROCK RETAINING WALL
- CONCRETE RETAINING WALL
- WOOD RETAINING WALL
- TOP OF WALL
- STAND PIPE
- CONCRETE
- SIDEWALK
- LIGHT STANDARD
- TRAFFIC LIGHT
- DOOR SILL
- GARAGE FLOOR
- LANDSCAPED AREA
- EDGE OF ASPHALT
- GUY POLE
- GUY WIRE
- HYDRO POLE
- OVERHEAD UTILITIES
- INTER-LOCKING STONE
- TOP OF BANK
- BOTTOM OF BANK
- BELL BOX
- TRAFFIC CONTROL BOX
- ELECTRICAL BOX
- COLUMN
- PILLAR
- APPROACH
- CARRIAGE CAN
- ENTRANCE
- IRRIGATION CONTROL VALVE
- BOLLARD
- LS ON CONCRETE BASE
- EVERGREEN
- SAPLING
- NOT TO SCALE

METRIC NOTE:
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE:
I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 20th DAY OF OCTOBER, 2022

25OCT22
DATE

R.A. McLAREN, O.L.S.

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER [illegible]

SHEET 1 OF 2

A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO L8N 2B9
PHONE (905) 527-8559 FAX (905) 527-0032

Drawn	Checked	Crew Chief	Scale	Dwg.No.
[illegible]	[illegible]	[illegible]	1:500	27150-1

SURVEYOR'S REAL PROPERTY REPORT
PART 1, PLAN OF PART OF
LOT 27
CONCESSION 2
GEOGRAPHIC
TOWNSHIP OF SALTFLEET
IN THE
CITY OF HAMILTON
SCALE 1:500 METRIC

R.A. McLAREN, O.L.S. – 2022

SURVEYOR'S REAL PROPERTY REPORT (PART 2)
PART OF LOT 27, CONCESSION 2
AS ILLUSTRATED ON THE PLAN.
THIS PLAN DOES NOT CERTIFY COMPLIANCE WITH ZONING BY-LAWS.
THIS PLAN WAS PREPARED FOR HAMMER LP

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MONUMENT 0011965U143

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ELEVATION: 136.037 metres CGVD-1928:1978

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NOTE:
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999714543

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP's): UTM ZONE 17, NAD83 (CSRS) (2010.0). COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP A	4787474.240	600107.862
ORP B	4788004.277	[illegible]

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN

METRIC NOTE:
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE:
I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 20th DAY OF OCTOBER, 2022

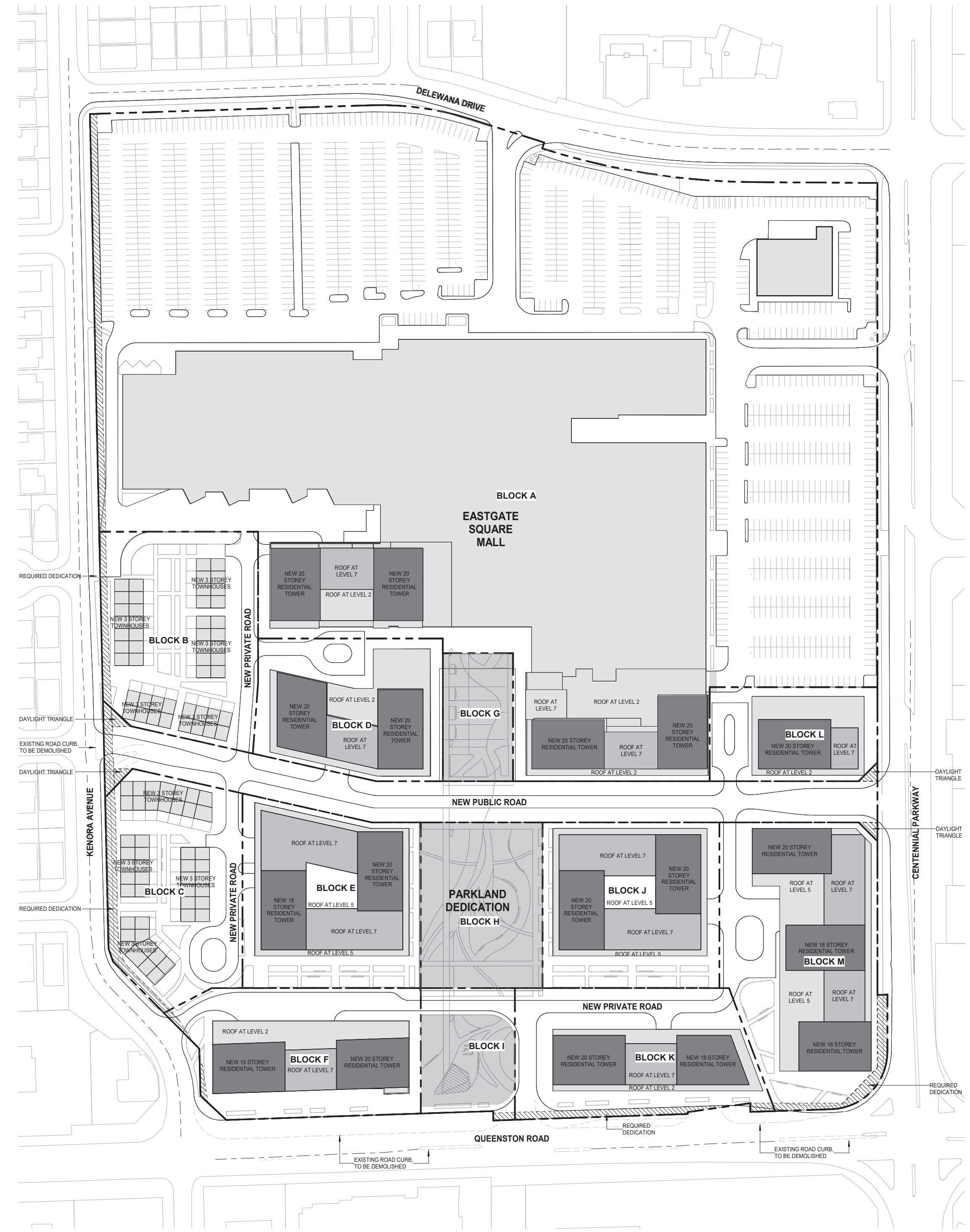
25 OCT 22
DATE

R.A. McLAREN, O.L.S.

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER [illegible]

SHEET 2 OF 2

A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527-8559 FAX (905) 527-0032



1 A101.S SITE PLAN

REVISION RECORD

ISSUE RECORD

BDP. Quadrangle

Quadrangle Architects Limited
901 King Street West, Suite 701 Toronto, ON M5V 3H5
t 416 598 1240 www.bdpquadrangle.com

Eastgate Square Master Plan

East Hamilton, Ontario

for
Harrison Equity Partners

21043	1 : 1000	VT	
PROJECT	SCALE	DRAWN	REVIEWED

Site Plan

A101.S

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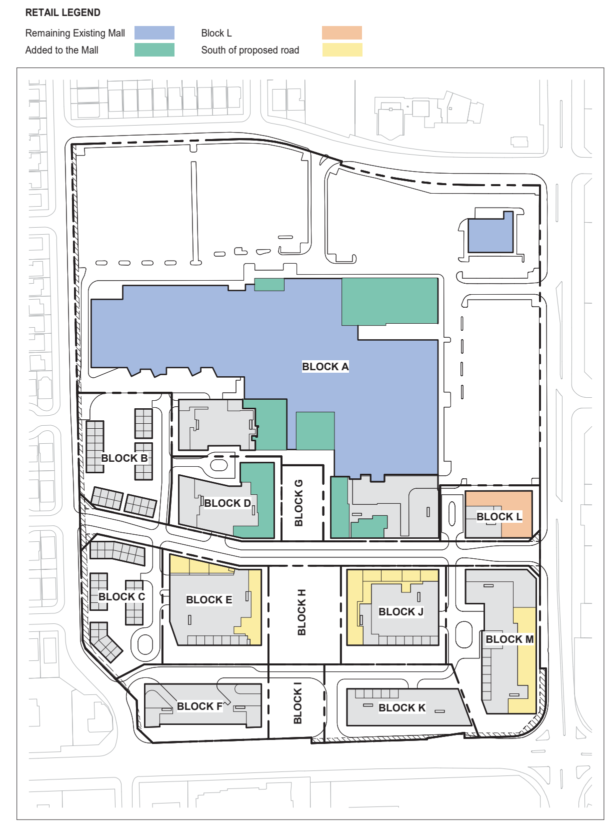
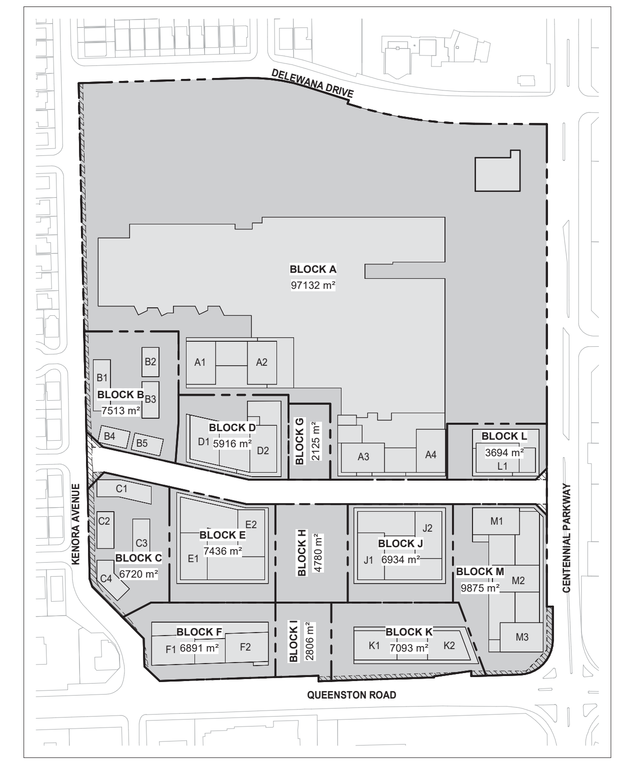
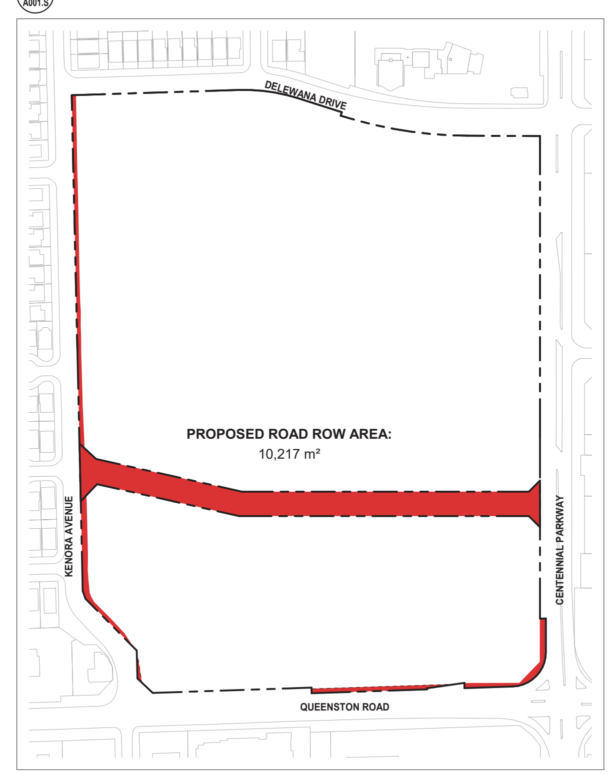
BDP. Quadrangle



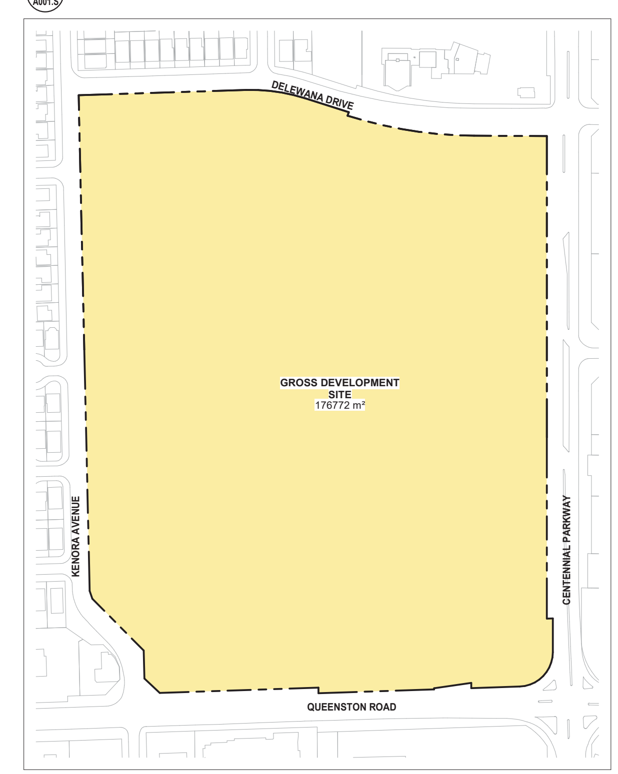
4 A001.S GROUND FLOOR RETAIL DIAGRAM



2 A001.S DEVELOPMENT BLOCKS & AREAS



3 A001.S PROPOSED PUBLIC ROADS AND ROW WIDENINGS



1 A001.S GROSS DEVELOPMENT SITE

5 Statistics

REVISION RECORD

ISSUE RECORD

BDP. Quadrangle

Quadrangle Architects Limited
901 King Street West, Suite 701 Toronto, ON M5V 3H5
t 416 598 1240 www.bdpquadrangle.com

Eastgate Square Master Plan

East Hamilton, Ontario

for
Harrison Equity Partners

21043	1:2000	VT	
PROJECT	SCALE	DRAWN	REVIEWED

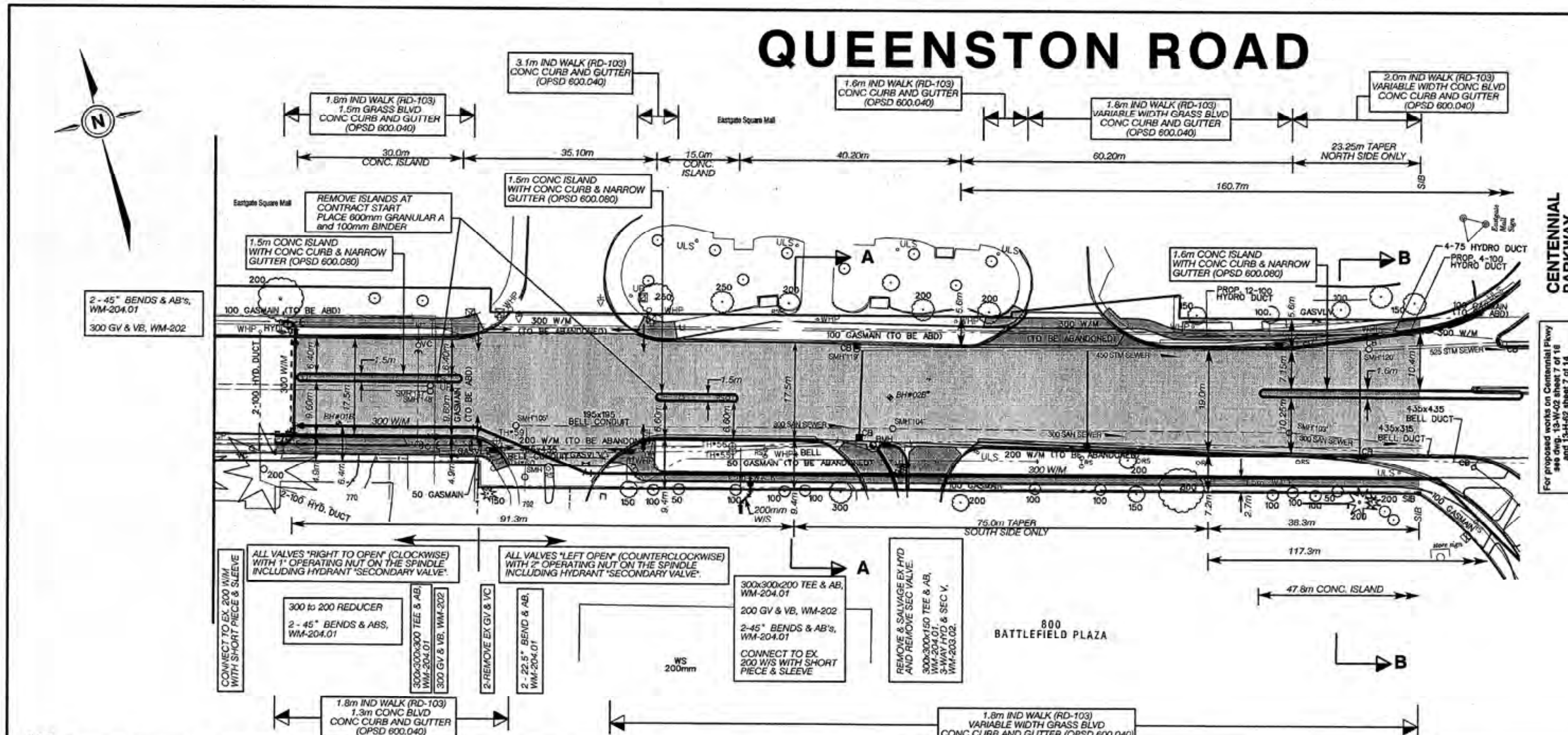
Project Statistics & Site Area Breakdown

A001.S

5/31/2023 3:07:48 PM

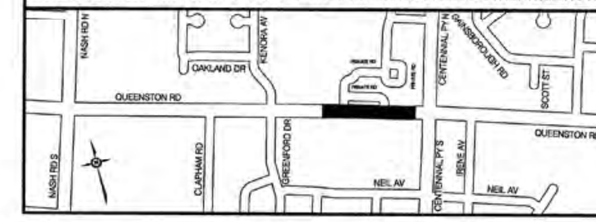
QUEENSTON ROAD

QUEENSTON ROAD



FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-H-34 (1)	SHEET No. 1 OF 4

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



LEGEND:

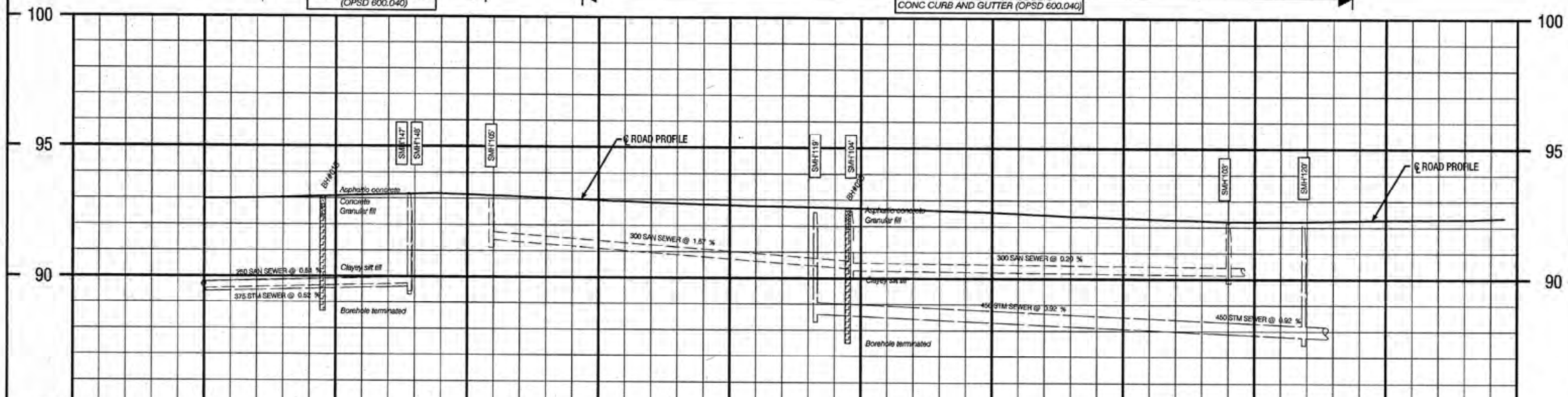
PROPOSED ROAD STRUCTURE

50mm SURFACE COURSE ASPHALT
110mm 30MPa CONCRETE ROAD BASE
150mm GRANULAR "A"
450mm GRANULAR "B"

SURFACE COURSE = SP 12.5 FC2 SURFACE COURSE ASPHALT, TRAFFIC CATEGORY "D", PG 64-28

ISLAND BULLNOSES PER OPSD 504.010

CROSS SECTION SEE SHEET 3



SEWER REPAIRS and OVERFLOWS

C.B. REMOVALS/REPLACEMENTS

3+56 north, 3+57 south
REMOVE EXISTING SINGLE CATCH BASIN AND REPLACE WITH SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD

4+47 south
REMOVE EXISTING SINGLE CATCH BASIN AND REPLACE WITH SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD AS PER RD-110.01

3+98 south,
CONSTRUCT SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD

4+35 north,
CONSTRUCT TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD AS PER RD-110.02

4+48 north
REMOVE EXISTING SINGLE CATCH BASIN AND CAP THE LEAD

EXISTING SEWER MANHOLES

Ⓓ SMH'147' W-INV=89.740	HR10A147 CHAINAGE=2+78.985 TOP OF GRATE=93.193
Ⓓ SMH'148' W-INV=89.620	HR10B148 CHAINAGE=2+79.164 TOP OF GRATE=93.195
Ⓓ SMH'106' E-INV=91.430	SD07A106 CHAINAGE=2+94.617 TOP OF GRATE=92.896
Ⓓ SMH'119' E-INV=88.610	SD07B119 CHAINAGE=3+56.495 TOP OF GRATE=92.627
Ⓓ SMH'104' W-INV=90.370 E-INV=90.290	SD07A104 CHAINAGE=3+63.192 TOP OF GRATE=92.677
Ⓓ SMH'103' W-INV=90.150	SD07A103 CHAINAGE=4+34.782 TOP OF GRATE=92.148
Ⓓ SMH'103' W-INV=90.150 E-INV=90.150	SD07A103 CHAINAGE=4+34.782 TOP OF GRATE=92.148
Ⓒ SMH'120' W-INV=88.12 E-INV=88.05 N-INV=90.60 S-INV=90.28	SD07B120 CHAINAGE=4+40.627 TOP OF GRATE=92.08

PROPOSED SANITARY SEWER																			PROPOSED SANITARY SEWER
PROPOSED STORM SEWER																			PROPOSED STORM SEWER
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	92.96	93.02	93.11	93.18	93.08	92.95	92.84	92.76	92.71	92.63	92.55	92.40	92.30	92.22	92.22	92.28	92.31	92.39	EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE	2+40	2+55	2+70	2+85	3+00	3+15	3+30	3+45	3+60	3+75	3+90	4+05	4+20	4+35	4+50	4+65	4+80	4+94	EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE

No.	REVISIONS	INITIAL	DATE

DRAWN BY: MM/ST — DATE: March, 2014

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans : IR02931, Q-48-S, Q-47-S, C-333_SAB, G-255_S1, H-167_S1AB, 79-S-63, 98-S-34
Water Plans : IR08304, IR02855, H-84-W_01
Road Plan : Q-78_H, 70-H-204,

Geodetic Bench Mark Index No. — Elevation=
Borehole Report - GTR - 1549

SCALES
HORIZONTAL 1:500 (0 5m 10m 20m)
VERTICAL 1:100 (0 1m 2m 4m)

LICENSED PROFESSIONAL ENGINEER — R. NIKOLOVA 100106607 — March 31, 2014 — PROVINCE OF ONTARIO

Project Manager (Design)
Roumiana Nikolova, P.Eng.
Manager of Design
Susan Jacob, P. Eng.

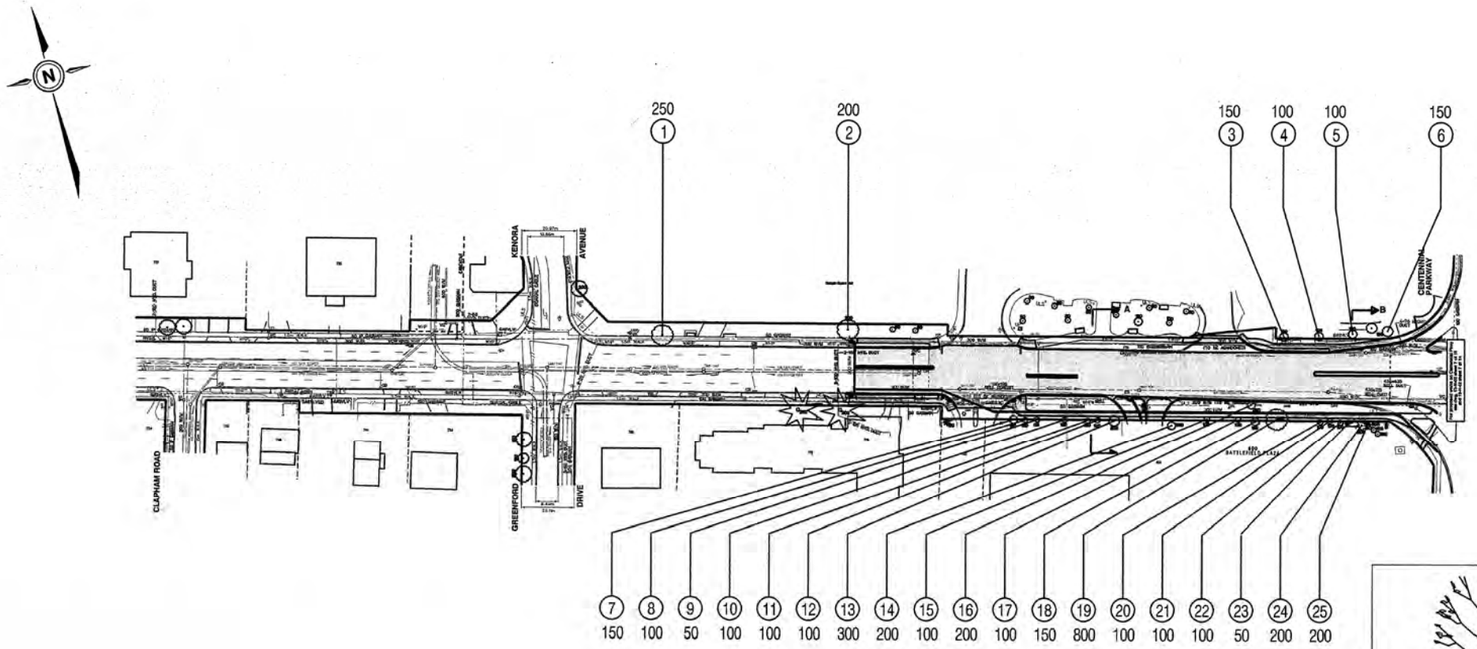
CITY OF HAMILTON
Public Works Department

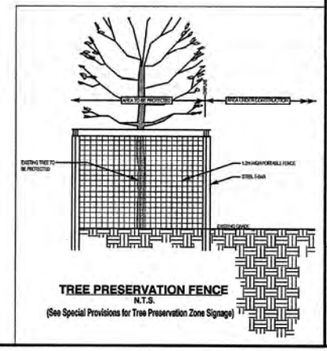
QUEENSTON ROAD
300mm Watermain Replacement
Road and Sidewalk Reconstruction and Associated Works
From : Signalized Entrance to Eastgate Square Mall
To : Irene Ave

13-H-34 (1)

QUEENSTON ROAD

QUEENSTON ROAD

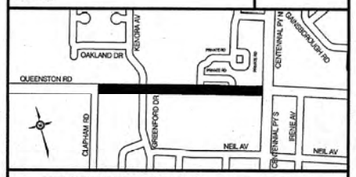




TREE PRESERVATION FENCE
N.T.S.
(See Special Provisions for Tree Preservation Zone Signage)

CONTRACT No. C15-14-14 (HSW)
DRAWING No. 13-H-34 (T1)
FILE No.

SHEET No.
T1 OF T1



DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

LEGEND *(Proposed Works)*

- *EXISTING DECIDUOUS TREE (TO REMAIN)*
- *EXISTING DECIDUOUS TREE (Remove)*
- *EXISTING CONIFEROUS TREE (TO REMAIN)*
- *EXISTING CONIFEROUS TREE (Remove)*

GENERAL NOTES

(Unless scheduled for removal on this drawing, all trees to be protected by tree preservation fencing)

All contractors, engineers and architects working in the vicinity of municipally owned trees shall adhere to the following:

1) All existing trees to remain on site, or on adjacent properties, shall be fully protected with tree preservation fencing, to the satisfaction of the Manager of Forestry and Horticulture or his designate to protect the roots, trunks and branches during construction. Areas within the protective fencing zone shall remain undisturbed and shall not be used for the storage of building materials, structures or equipment. The tree protection zone shall be completed prior to the commencement of site clearance, demolition, or any type of construction.

2) Surplus soil, equipment, vehicles, tools, debris or materials shall not be placed over the root systems of the trees within the Tree Protection Zone. No contaminants shall be dumped or flushed where feeder roots of trees exist.

3) The Contractor shall, wherever possible, avoid cutting surface roots. If root cuts are necessary, they should be done quickly, making smooth flush cuts. The roots shall be back-filled and watered before they have a chance to dry out.

4) Where limbs or portions of trees must be removed to accommodate construction work, Forestry personnel in accordance with accepted Arboricultural practices will remove them. Contractor shall take measures to prevent any further damage.

5) Where necessary, the trees will be given an overall pruning by the City of Hamilton Forestry personnel at appropriate stages during construction.

6) The Contractor shall, wherever possible, avoid disturbing original grades around trees in areas of protective fencing.

7) At no time shall the Contractor place, deposit or stored any stone, brick, sand, concrete, soil or any other material or equipment which may impede the free passage of water, air or nutrients to the tree.

8) No cables or ropes of any type shall be wrapped around or installed in trees.

9) At no time, under any circumstances, shall any part of the tree that is to remain after construction is completed have signs or fences nailed to it or survey markings or paint applied to the tree.

10) The Manager of Forestry & Horticulture or his designate shall be notified to inspect all Tree Protection measures. Those measures shall remain in effect until the completion of construction, at which time authorization from the Manager of Forestry & Horticulture or his designate must be obtained for the removal of the Tree Protection Zone.

11) The Manager of Forestry & Horticulture must be notified immediately when any municipally owned tree is injured ordestroyed during construction

TREE PROTECTION ZONE SIGNAGE

(See Special Provisions for Tree Preservation Zone Signage)

TREE ID No.	COMMON NAME	BOTANICAL NAME	DIA. (mm)	CONDITION	LOCATION	OWNERSHIP	ACTION
1	Norway Maple	Acer platanoides	260	Fair-Good	behind walk	City	
2	Norway Maple	Acer platanoides	260	Fair-Good	behind walk	City	
3	Norway Maple	Acer platanoides	250	Poor-Fair	behind walk	Private	
4	Norway Maple	Acer platanoides	100	Fair	behind walk	Private	
5	Norway Maple	Acer platanoides	170	Fair	behind walk	Private	
6	Norway Maple	Acer platanoides	180	Fair-Good	behind walk	Private	
7	Norway Maple	Acer platanoides	210	Fair	behind walk	Private	
8	Norway Maple	Acer platanoides	150	Fair	behind walk	Private	
9	Norway Maple	Acer platanoides	70	Good	behind walk	Private	
10	Norway Maple	Acer platanoides	100	Fair	behind walk	Private	
11	Norway Maple	Acer platanoides	150	Fair	behind walk	Private	
12	Norway Maple	Acer platanoides	110	Poor	behind walk	Private	
13	Honey Locust (Thornless)	Gleditsia triacanthos inermis	350	Good	behind walk	Private	
14	Honey Locust (Thornless)	Gleditsia triacanthos inermis	260	Fair-Good	behind walk	Private	
15	Norway Maple	Acer platanoides	140	Fair	behind walk	City	
16	Shagbark hickory	Carya ovata	260	Poor-Fair	in boulevard	City	

TREE ID No.	COMMON NAME	BOTANICAL NAME	DIA. (mm)	CONDITION	LOCATION	OWNERSHIP	ACTION
17	Norway Maple	Acer platanoides	160	Fair-Good	behind walk	City	
18	Norway Maple	Acer platanoides	180	Fair-Good	behind walk	Private	
19	Ash species	Fraxinus sp.	520	Fair-Good	behind walk	City	
20	Norway Maple	Acer platanoides	180	Fair-Good	behind walk	Private	
21	Norway Maple	Acer platanoides	180	Fair-Good	behind walk	City/Private	
22	Norway Maple	Acer platanoides	150	Fair	behind walk	Private	
23	Norway Maple	Acer platanoides	100	Poor-Fair	behind walk	City	
24	Austrian Pine	Pinus nigra	220	Fair-Good	behind walk	Private	
25	Austrian Pine	Pinus nigra	220	Fair -Good	behind walk	Private	

TREE ID No.	COMMON NAME	BOTANICAL NAME	DIA. (mm)	CONDITION	LOCATION	OWNERSHIP	ACTION

No.	REVISIONS	INITIAL	DATE

DRAWN BY: ST
DATE: MARCH 2014

Reviewed and Approved

Forestry & Horticulture — Date 03/26/2014

SCALES

0 20m 40m

1:1000

Project Manager (Design)
Roumiana Nikolova, P.Eng

Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

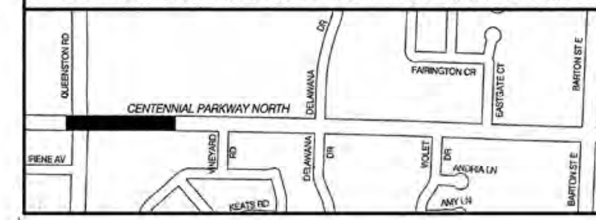
QUEENSTON ROAD
Tree Preservation \ Removal Plan
From : Signalized Entrance to Eastgate Square Mall
To : Centennial Parkway

13-H-34 (T1)

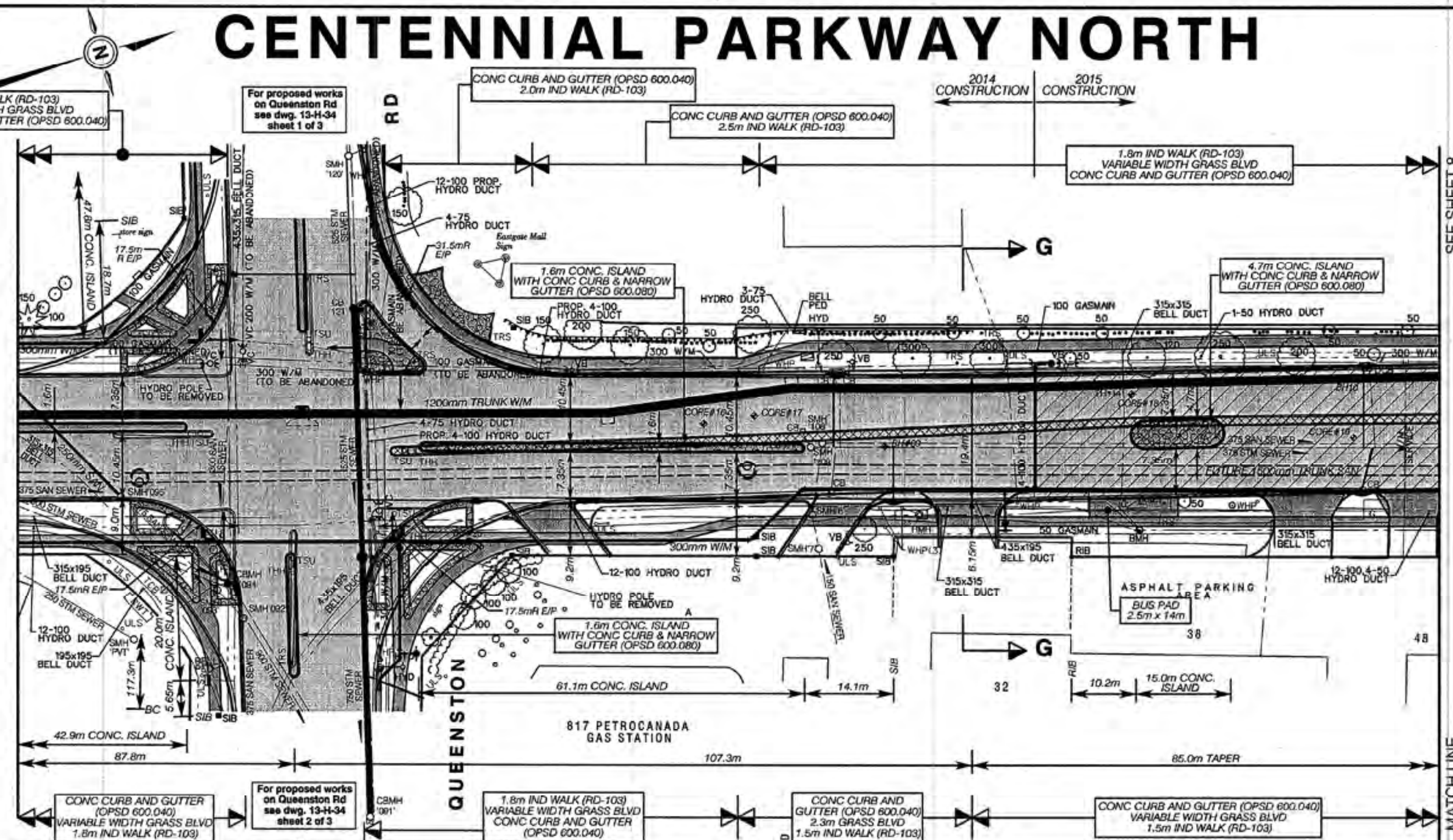
CENTENNIAL PARKWAY NORTH

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-H-62	SHEET No. 7 OF 15

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



CENTENNIAL PARKWAY NORTH



FOR WATERMAIN CONSTRUCTION SEE 13-W-02

FOR SEWER CONSTRUCTION SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS SEE 13-H-62 SHEETS 14 & 15

LEGEND:

PROPOSED ROAD STRUCTURE

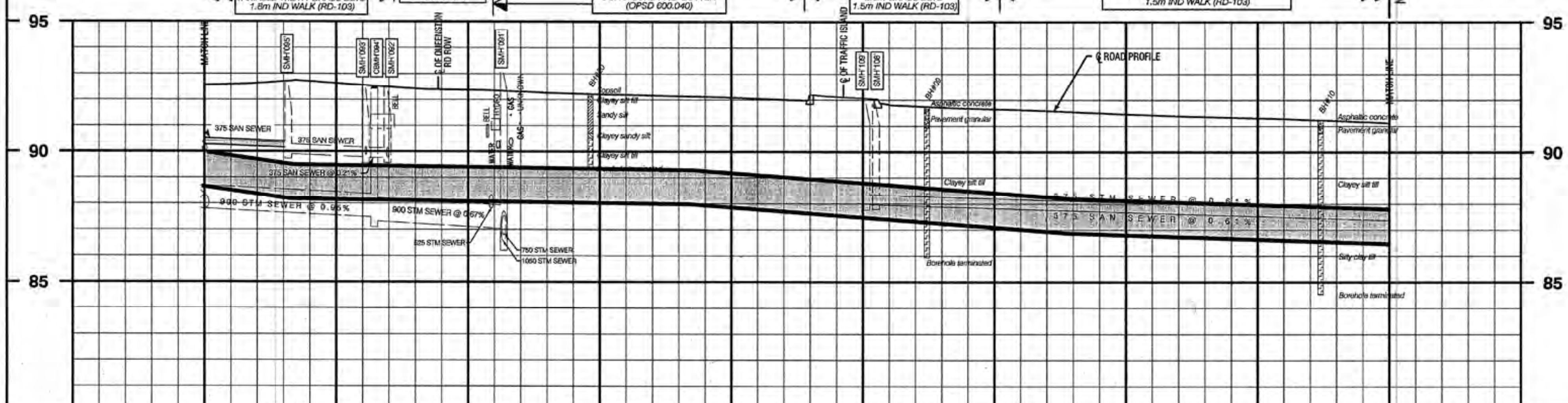
50mm SURFACE ASPHALT
110mm BINDER ASPHALT
150mm GRANULAR "A"
450mm GRANULAR "B"

SURFACE COURSE = SP 12.5 SURFACE COURSE ASPHALT, TRAFFIC CATEGORY "D", PG 64-28
BINDER COURSE = SP 19.0 BINDER COURSE ASPHALT, PG 64-28

STRIP EXISTING ASPHALT
SUPPLY AND PLACE 50mm SP 12.5FC2 SURFACE COURSE ASPHALT, TRAFFIC CATEGORY "D", PG 64-28
AND 110mm SP 19.0 BINDER COURSE ASPHALT, PG 64-28

REMOVE ISLANDS NORTH OF QUEENSTON RD AT CONTRACT START
PLACE 680mm GRANULAR A and 80mm BINDER

DECORATIVE STAMPED AND COLOURED CONCRETE



EXISTING SEWER MANHOLES

(D) SMH'095' S-INV=89.974 NE-INV=89.899	SD07A095 CHAINAGE=10+06.0 TOP OF GRATE=92.35
(A) SMH'093' NE-INV=89.754 SW-INV=89.784 W-INV=89.874	SD07A093 CHAINAGE=10+20.7 TOP OF GRATE=92.134
(A) CBMH'094' NE-INV=87.094 SW=87.224 S=87.784	CHAINAGE=10+22.4 TOP OF GRATE=92.134
(D) SMH'092' SW-INV=89.757 E-INV=89.757	SD07A092 CHAINAGE=10+25.0 TOP OF GRATE=92.08
(A) SMH'120' N-INV=90.608 S-INV=90.285 E-INV=88.055 W-INV=88.115	SD07B120 TOP OF GRATE=92.085
(A) CBMH'091' S-INV=90.347 E-INV=86.067 W-INV=86.947 SW-INV=86.557	SD07B091 TOP OF GRATE=91.987
(D) SMH'109' N-INV=87.968	HR09B109 CHAINAGE=11+15.8 TOP OF GRATE=91.85

EXISTING SEWER MANHOLES

(A) SMH'6' E-INV=89.606 W-INV=89.586	
(A) SMH'7' E-INV=89.819 W-INV=89.779 SE-INV=89.809	
(D) SMH'108' N-INV=87.956	HR09A108 CHAINAGE=11+17.6 TOP OF GRATE=91.85

C.B. REMOVALS/REPLACEMENTS

1+024 east, 1+045 east, 1+063 east, 1+129 east
CONSTRUCT SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD AS PER RD-110.01

1+024 west
REMOVE EXISTING SINGLE CATCH BASIN AND REPLACE WITH SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD

1+203.0 east
REMOVE EXISTING SINGLE CATCH BASIN AND REPLACE WITH SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD AS PER RD-110.010

1+120west, 1+203.0 west
REMOVE EXISTING DOUBLE CATCH BASIN AND REPLACE WITH TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD

1+044 west, 1+046 east, 1+115 west, 1+119 east
REMOVE EXISTING CATCH BASIN AND CAP THE LEAD

PROPOSED WATERMAIN INVERTS																*PROPOSED WATERMAIN INVERTS*
PROPOSED WATERMAIN CHAINAGE																*PROPOSED WATERMAIN CHAINAGE*
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	92.39	92.70	92.56	92.40	92.32	92.21	92.14	92.06	92.13	91.77	91.66	91.55	91.43	91.34	91.25	91.13	EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROADWAY CHAINAGE	0+990	1+005	1+020	1+035	1+050	1+065	1+080	1+095	1+110	1+125	1+140	1+155	1+170	1+185	1+200	1+215	EXISTING ℄ OF ROADWAY CHAINAGE

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB DATE: March, 2014

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : B-383, B-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans : 71-W-250, 72-W-372, 74-W-530, 85-W-20, 98-W-17, 04-W-16
Road Plans : H-365, 85-H-79, 88-H-32, 95-H-13
Plans: LSP0272

Geodetic Bench Mark Index No. 8-19 Elevation=87.376m
Borehole Report- GTR-1549

SCALES
0 5m 10m 20m HORIZONTAL 1:500
0 1m 2m 4m VERTICAL 1:100

LICENSED PROFESSIONAL ENGINEER R. NIKOLOVA 100106607 MARCH 31, 2014 PROVINCE OF ONTARIO

Project Manager (Design)
Roumiana Nikolova, P. Eng.

Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

CENTENNIAL PARKWAY NORTH
Road and Sidewalk Reconstruction
Sidewalk Construction and Associated Works
From : Approximately 105m South of King Street
To : Arrowsmith Road

CENTENNIAL PARKWAY NORTH

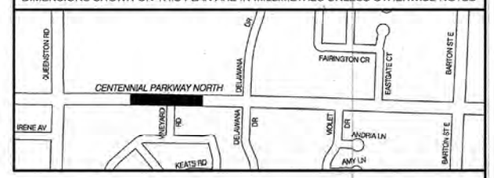
13-H-62 (7)

CENTENNIAL PARKWAY NORTH

CENTENNIAL PARKWAY NORTH

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-H-62	SHEET No. 8 OF 15

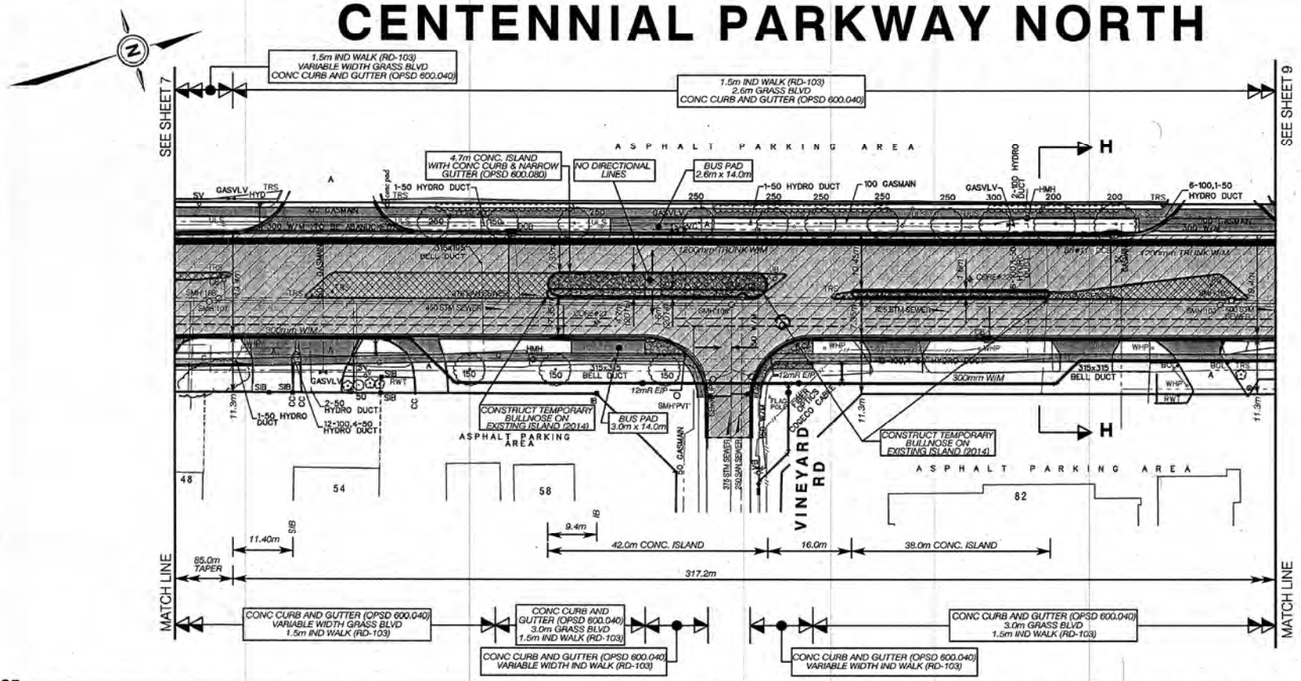
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



FOR WATERMAIN CONSTRUCTION
SEE 13-W-02

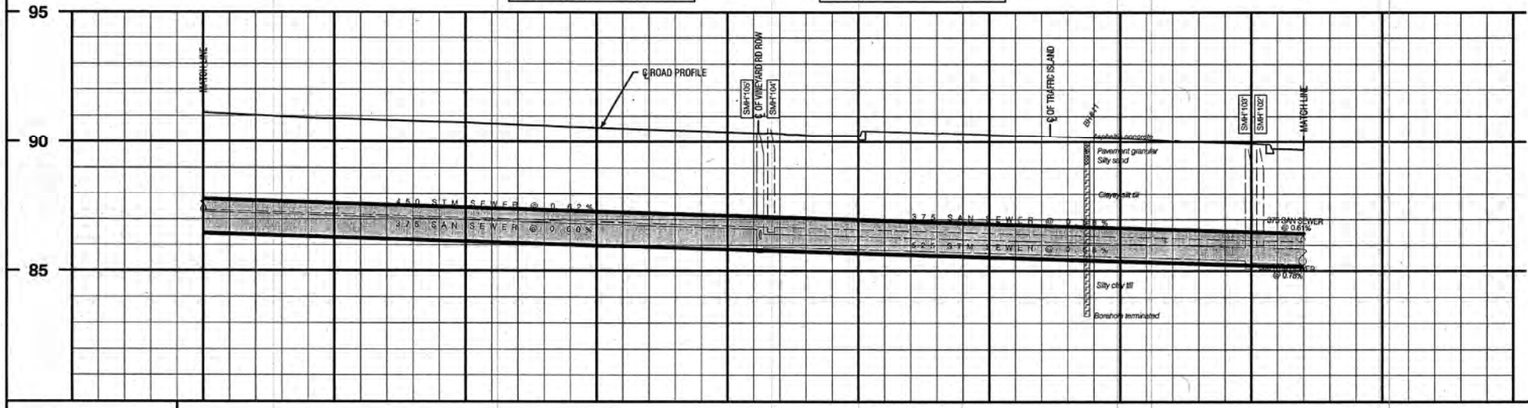
FOR SEWER CONSTRUCTION
SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS
SEE 13-H-02 SHEETS 14 & 15



LEGEND:

- STRIP EXISTING ASPHALT
  SUPPLY AND PLACE 50mm SP 12.5FC2 SURFACE COURSE ASPHALT,
  TRAFFIC CATEGORY 'D', PG 64-28
  AND 110mm SP 19.0 BINDER COURSE ASPHALT, PG 64-28
- REMOVE ISLANDS NORTH OF QUEENSTON RD AT CONTRACT START
  PLACE 680mm GRANULAR A and 50mm BINDER
- DECORATIVE STAMPED AND COLOURED CONCRETE



SEWER REPAIRS and OVERFLOWS

C.B. REMOVALS/REPLACEMENTS

1+290.0 east
CONSTRUCT TWIN INLET CATCH BASIN
(OPSD 705.020) & 250 CB LEAD
AS PER RD-110.02

1+317 east, 1+325 east
REMOVE EXISTING SINGLE CATCH BASIN PUP
AND REPLACE WITH SINGLE CATCH BASIN
(OPSD 705.010) & 250 CB LEAD

1+278.6 west, 1+352.6 west, 1+370.3 east
REMOVE EXISTING DOUBLE CATCH BASIN AND
REPLACEWITH TWIN INLET CATCH BASIN
(OPSD 705.020) & 250 CB LEAD
AS PER RD-110.02

1+225.0 by existing island
REMOVE EXISTING CATCH BASIN
AND CAP THE LEAD

EXISTING SEWER MANHOLES

(7)	SMH'107' S-INV=87.326 N-INV=87.252	HR09B107 CHAINAGE=12+21.8 TOP OF GRATE=91.06
(6)	SMH'106' S-INV=87.316 N-INV=87.316	HR09A106 CHAINAGE=12+23.65 TOP OF GRATE=91.03
(5)	SMH'105' S-INV=86.639 E-INV=86.234 N-INV=86.926	HR09B105 CHAINAGE=13+21.45 TOP OF GRATE=90.31
(4)	SMH'104' E-INV=86.938 S-INV=86.719 N-INV=86.719	HR09A104 CHAINAGE=13+23.5 TOP OF GRATE=90.52
(3)	SMH'103' S-INV=86.300 N-INV=86.314	HR09B103 CHAINAGE=14+14.7 TOP OF GRATE=89.71
(2)	SMH'102' S-INV=86.183 N-INV=86.183	HR09A102 CHAINAGE=14+16.9 TOP OF GRATE=89.75

PROPOSED WATERMAIN INVERTS																	PROPOSED WATERMAIN INVERTS
PROPOSED WATERMAIN CHAINAGE																	PROPOSED WATERMAIN CHAINAGE
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	91.13	90.98	90.88	90.79	90.68	90.57	90.46	90.36	90.25	90.39	90.30	90.19	90.09	89.98	89.69		EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROADWAY CHAINAGE	1+215	1+230	1+245	1+260	1+275	1+290	1+305	1+320	1+335	1+350	1+365	1+380	1+395	1+410	1+425		EXISTING ℄ OF ROADWAY CHAINAGE

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB DATE: March, 2014

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : B-383, B-458, H-173, H-174, H-177, H-178, H-375, 69-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-09
Water Plans : 71-W-250, 72-W-372, 74-W-530, 85-W-20, 99-W-17, 04-W-16
Road Plans : H-365, 85-H-79, 88-H-32, 95-H-13

Geodetic Bench Mark Index No. 8-19 Elevation=87.376m
Borehole Report- GTR.-16-99

SCALES
HORIZONTAL 1:500 (0, 5m, 10m, 20m)
VERTICAL 1:100 (0, 1m, 2m, 4m)

LICENSED PROFESSIONAL ENGINEER
R. NIKOLOVA
100108807
MARCH 31, 2014
PROVINCE OF ONTARIO

[Project Manager (Design)
Roumiana Nikolova, P. Eng.
Manager of Design
Susan Jacob, P. Eng.

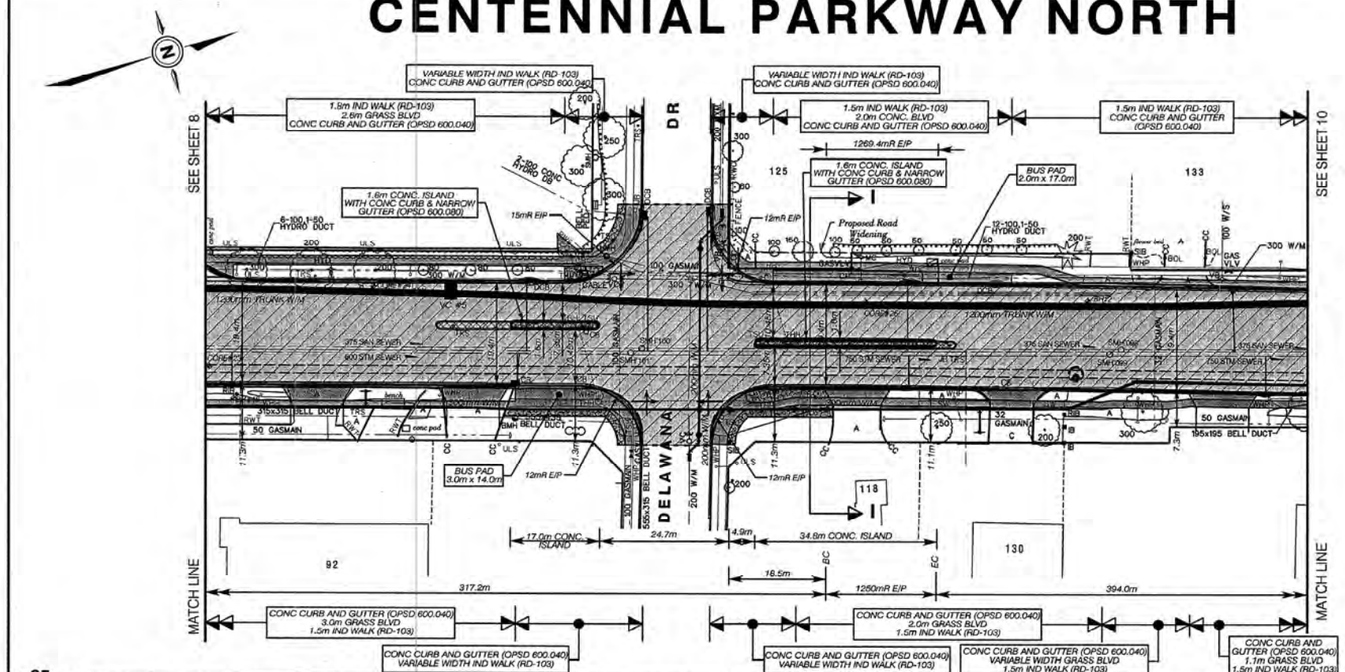
CITY OF HAMILTON
Public Works Department

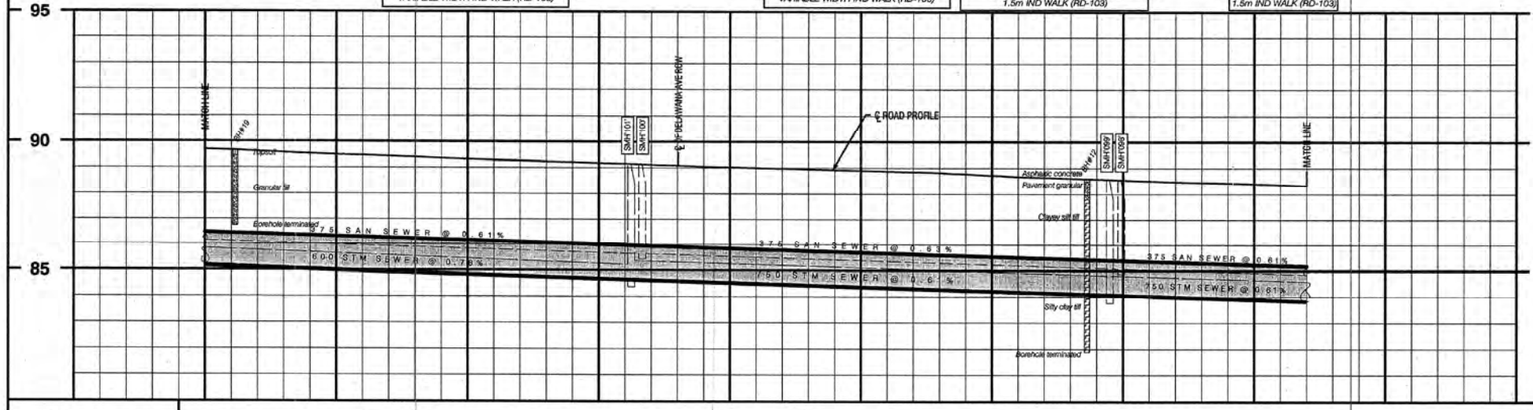
CENTENNIAL PARKWAY NORTH
Road and Sidewalk Reconstruction
Sidewalk Construction and
Associated Works
From : Approximately 105m South of King Street
To : Arrowsmith Road

13-H-62 (8)

CENTENNIAL PARKWAY NORTH

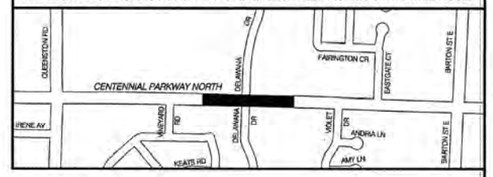
CENTENNIAL PARKWAY NORTH





FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-H-62	SHEET No. 9 OF 15

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



FOR WATERMAIN CONSTRUCTION
SEE 13-W-02

FOR SEWER CONSTRUCTION
SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS
SEE 13-H-62 SHEETS 14 & 15

LEGEND:

- STRIP EXISTING ASPHALT SUPPLY AND PLACE 50mm SP 12.5FC2 SURFACE COURSE ASPHALT, TRAFFIC CATEGORY "D", PG 64-28 AND 110mm SP 19.0 BINDER COURSE ASPHALT, PG 64-28
- REMOVE ISLANDS NORTH OF QUEENSTON RD AT CONTRACT START PLACE 880mm GRANULAR A and 80mm BINDER
- DECORATIVE STAMPED AND COLOURED CONCRETE

C.B. REMOVALS/REPLACEMENTS

1+490.0 east, 1+627.0 east
CONSTRUCT SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD AS PER RD-110.01

1+621.0 west
CONSTRUCT SINGLE CATCH BASIN (OPSD 705.010) & 250 CB LEAD

1+556.0 east
CONSTRUCT TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD AS PER RD-110.02

1+485.0 east
REMOVE EXISTING SINGLE CATCH BASIN AND REPLACE WITH TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD

1+ 487.0 west, 1+560.0 west
REMOVE EXISTING DOUBLE CATCH BASIN AND REPLACE WITH TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD AS PER RD-110.02

1+ 510.0 west, 1+530.0 west
REMOVE EXISTING DOUBLE CATCH BASIN AND REPLACE WITH TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD

1+ 497.0 east, 1+497.0 by ex island, 1+575.0 east 1+ 575.0 west
REMOVE EXISTING CATCH BASIN AND CAP THE LEAD

EXISTING SEWER MANHOLES

(1) SMH'101'	S-INV=84.812 N-INV=84.612	HR006101 CHAINAGE=15+06.4 TOP OF GRATE=89.16
(2) SMH'100'	S-INV=85.834 N-INV=85.634	HR094100 CHAINAGE=15+08.5 TOP OF GRATE=89.16
(3) SMH'099'	S-INV=84.064 N-INV=84.064	HR006099 CHAINAGE=15+97.7 TOP OF GRATE=88.56
(4) SMH'098'	S-INV=85.067 N-INV=85.067	HR094098 CHAINAGE=15+99.9 TOP OF GRATE=86.58

PROPOSED WATERMAIN INVERTS																	PROPOSED WATERMAIN INVERTS
PROPOSED WATERMAIN CHAINAGE																	PROPOSED WATERMAIN CHAINAGE
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	89.68	89.57	89.47	89.36	89.27	89.19	89.06	89.01	88.93	88.86	88.73	88.62	88.52	88.43	88.34		EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROADWAY CHAINAGE	1+425	1+440	1+455	1+470	1+485	1+500	1+515	1+530	1+545	1+560	1+575	1+590	1+605	1+620	1+635		EXISTING ℄ OF ROADWAY CHAINAGE

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB DATE: March, 2014

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : B-383, B-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-236, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans : 71-W-250, 72-W-372, 74-W-530. 85-W-20, 98-W-17, 04-W-16
Road Plans : H-365, 85-H-79, 88-H-32, 95-H-13

Geodetic Bench Mark Index No. 8-19 Elevation=87.376m
GTR-1549

SCALES
HORIZONTAL 1:500
VERTICAL 1:100

LICENSED PROFESSIONAL ENGINEER R.NIKOLOVA 100106607 MARCH 31,20 PROVINCE OF ONTARIO

Project Manager (Design)
Roumiana Nikolova, P. Eng.
Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

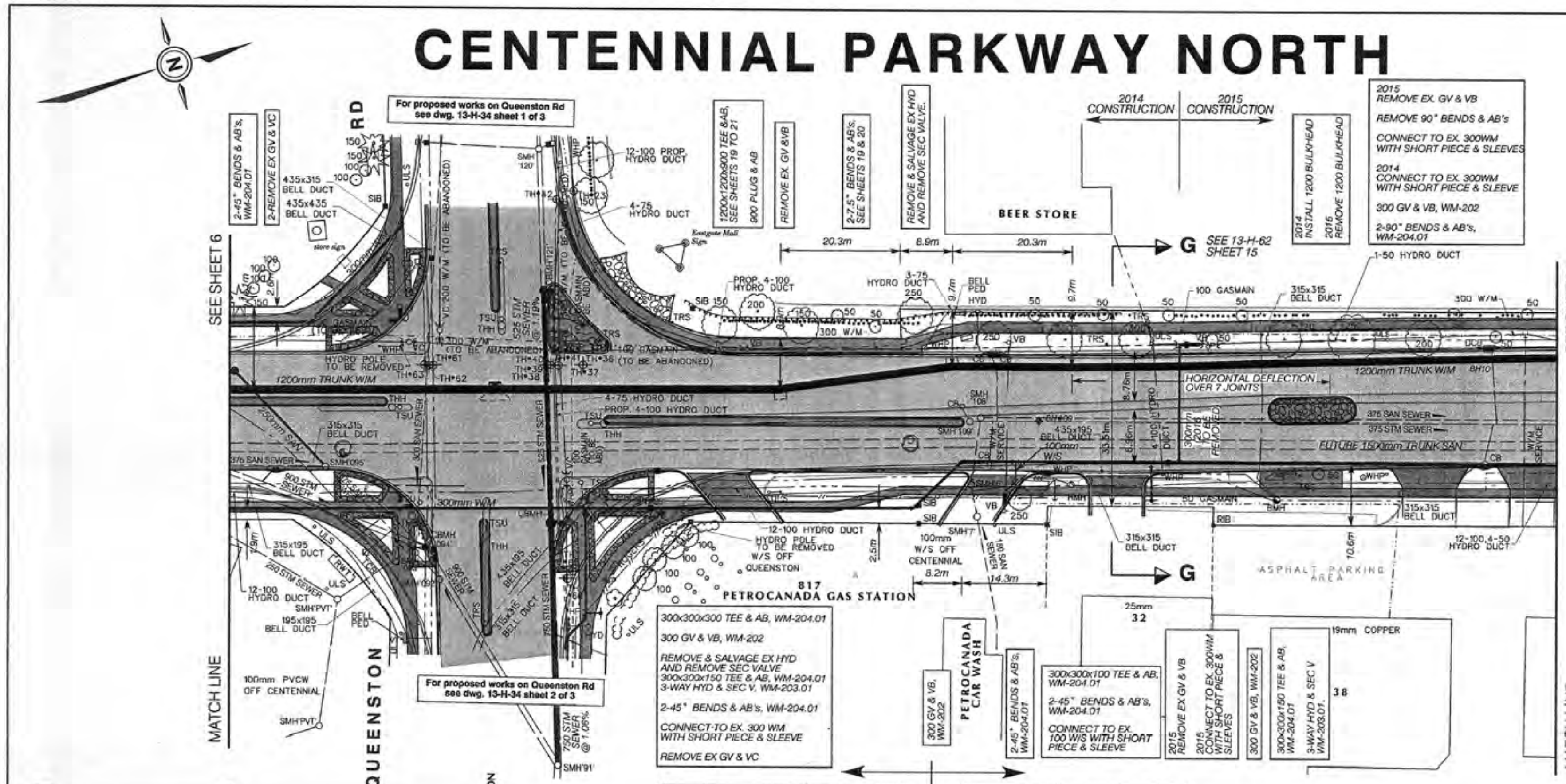
CENTENNIAL PARKWAY NORTH
Road and Sidewalk Reconstruction
Sidewalk Construction and
Associated Works
From : Approximately 105m South of King Street
To : Arrowsmith Road

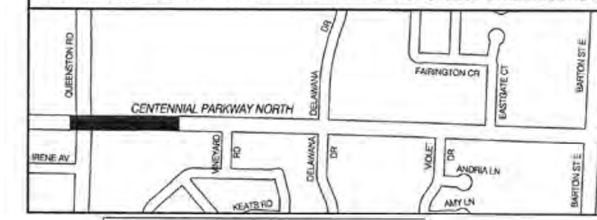
13-H-62 (9)

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-W-02 (7)	SHEET No. 7 OF 21

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

CENTENNIAL PARKWAY NORTH





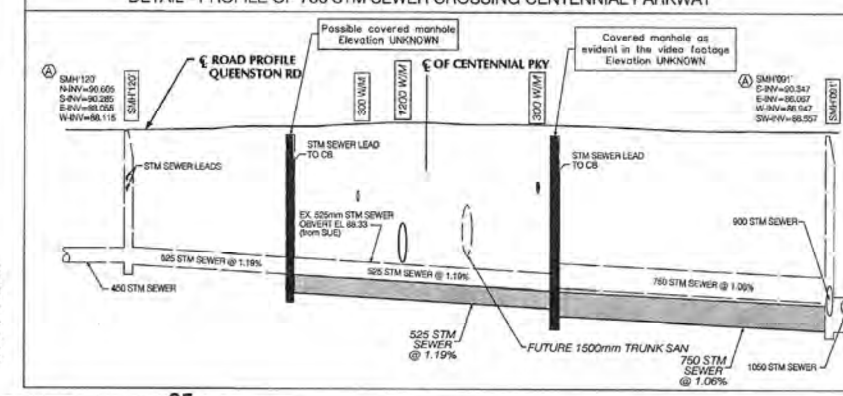
ALL CB LEADS AND SEWER CROSSING OVER THE 1200mm W/M TO BE INSTALLED USING WATER TIGHT MATERIALS.

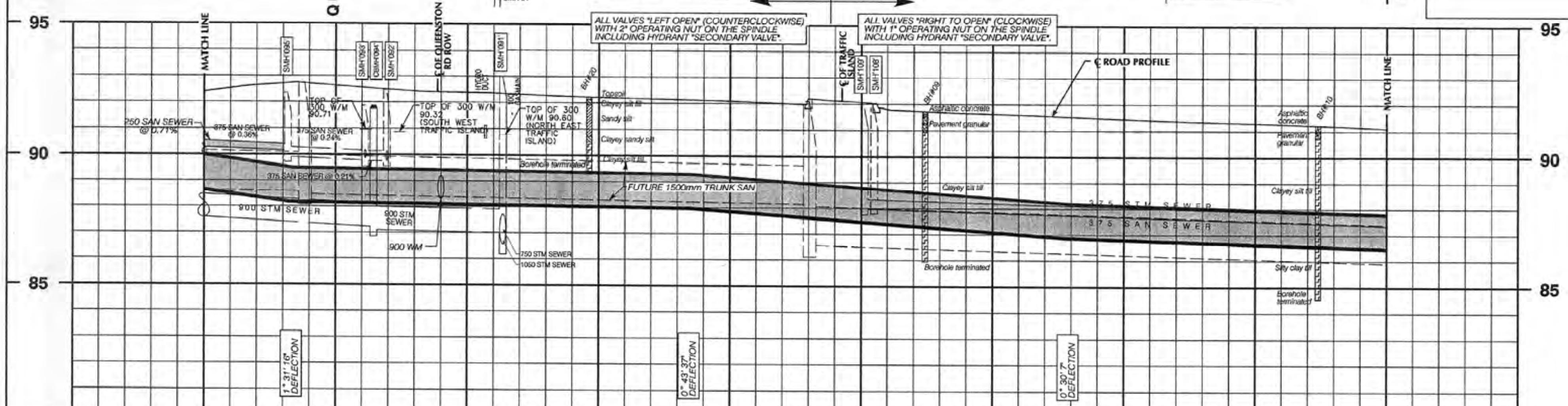
FOR ROAD CONSTRUCTION SEE 13-H-62

FOR SEWER CONSTRUCTION SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS SEE 13-H-62 SHEETS 14 & 15

DETAIL - PROFILE OF 750 STM SEWER CROSSING CENTENNIAL PARKWAY





EXISTING SEWER MANHOLES

Manhole	Inverts	Details
(D) SMH'095'	S-INV=89.974, NE-INV=89.899	SD07A095, CHAINAGE=10+06.0, TOP OF GRATE=92.35
(A) SMH'093'	NE-INV=89.754, SW-INV=89.784, W-INV=89.874	SD07A093, CHAINAGE=10+20.7, TOP OF GRATE=92.134
(A) CBMH'094'	NE-INV=87.094, SW=87.224, S=87.784	CHAINAGE=10+22.4, TOP OF GRATE=92.134
(D) SMH'092'	SW-INV=89.757, E-INV=89.757	SD07A092, CHAINAGE=10+25.0, TOP OF GRATE=92.08
(A) SMH'120'	N-INV=90.605, S-INV=90.285, E-INV=88.055, W-INV=88.115	SD07B120, TOP OF GRATE=92.085
(A) SMH'091'	S-INV=90.347, E-INV=86.067, W-INV=86.947, SW-INV=86.557	SD07B091, TOP OF GRATE=91.987
(D) SMH'109'	N-INV=87.968	HR09B109, CHAINAGE=11+15.8, TOP OF GRATE=91.85

EXISTING SEWER MANHOLES

Manhole	Inverts	Details
(A) SMH'6'	E-INV=89.596, W-INV=89.586	
(A) SMH'7'	E-INV=89.619, W-INV=89.779, SE-INV=89.809	
(D) SMH'108'	N-INV=87.956	HR09A108, CHAINAGE=11+17.6, TOP OF GRATE=91.85

PROPOSED 1200mm WATERMAIN	40.042m - 1200mm W/M @ -2.922%		75.647m - 1200mm W/M @ -0.251%						72.482m - 1200mm W/M @ -1.531%						132.334m - 1200mm W/M @ -0.650%	
PROPOSED 1200mm WATERMAIN INVERTS		88.22					88.03					86.92				
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	92.39	92.70	92.56	92.40	92.32	92.21	92.14	92.06	92.13	91.77	91.66	91.55	91.43	91.34	91.25	91.13
EXISTING ℄ OF ROADWAY CHAINAGE	0+990	1+005	1+020	1+035	1+050	1+065	1+080	1+095	1+110	1+125	1+140	1+155	1+170	1+185	1+200	1+215

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB — DATE: MARCH 13, 2014

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : B-383, B-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans : 71-W-250, 72-W-372, 74-W-530, 85-W-20, 98-W-17, 04-W-16
Road Plans : H-365, 65-H-79, 88-H-32, 95-H-13
Plans: LSP0272

Geodetic Bench Mark Index No. 8-19 — Elevation=87.376m
GTR_1549

SCALES: HORIZONTAL 1:500 (0, 5m, 10m, 20m); VERTICAL 1:100 (0, 1m, 2m, 4m)

LICENSED PROFESSIONAL ENGINEER — J.S. ROBERTS — MARCH 20, 2014 — PROVINCE OF ONTARIO

Project Manager (Design): Roumiana Nikolova, P.Eng.
Manager of Design: Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

CENTENNIAL PARKWAY NORTH
300mm Watermain Replacement
1200mm Trunk Watermain Installation
From : Approximately 105m South of King Street
To : Arrowsmith Road

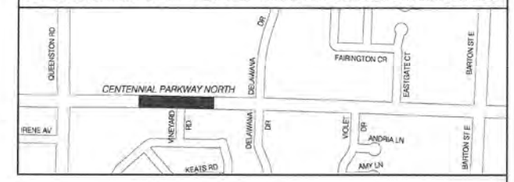
13-W-02 (7)

CENTENNIAL PARKWAY NORTH

CENTENNIAL PARKWAY NORTH

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-W-02 (8)	SHEET No. 8 OF 21

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



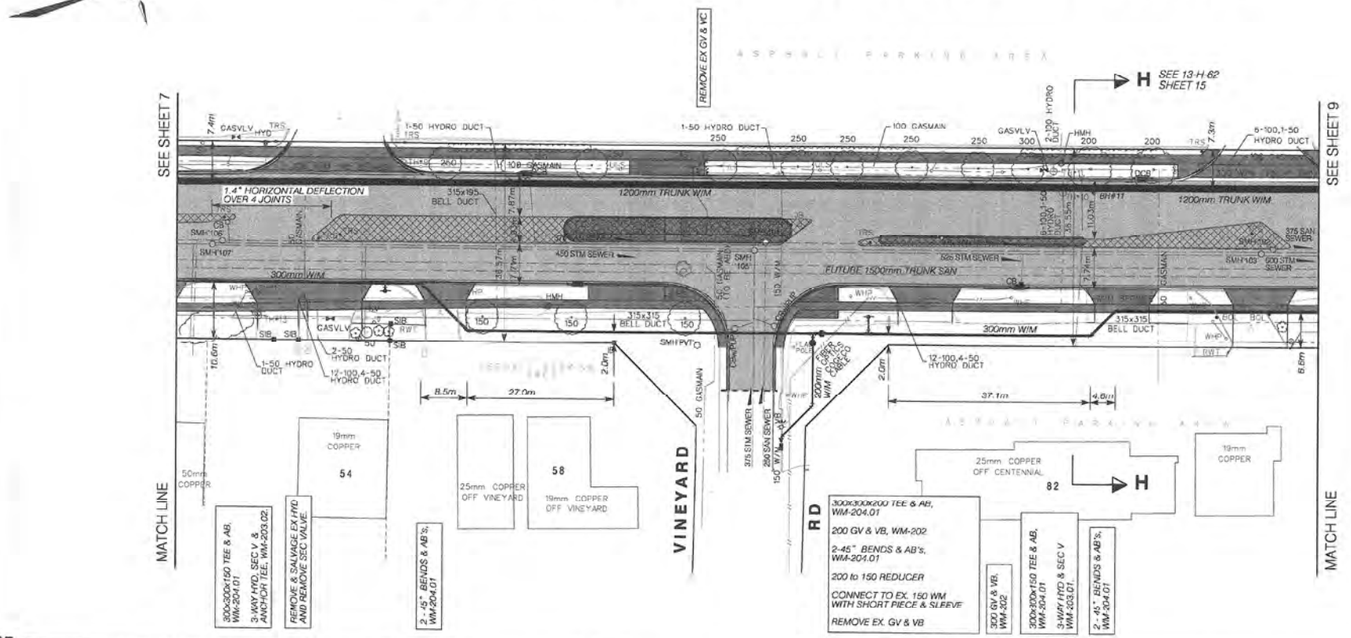
FOR ROAD CONSTRUCTION
SEE 13-H-62

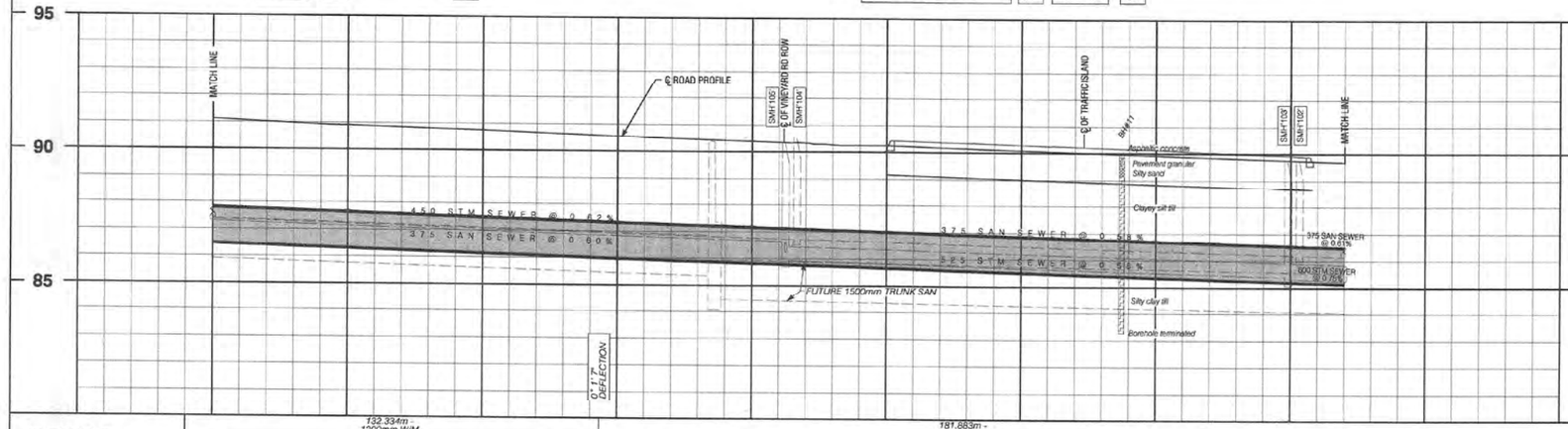
FOR SEWER CONSTRUCTION
SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS
SEE 13-H-62 SHEETS 14 & 15

ALL VALVES "RIGHT TO OPEN" (CLOCKWISE) WITH 1" OPERATING NUT ON THE SPINDLE INCLUDING HYDRANT "SECONDARY VALVE".

ALL CB LEADS AND SEWER CROSSING OVER THE 1200mm WM TO BE INSTALLED USING WATER TIGHT MATERIALS.





PROPOSED 1200mm WATERMAIN	132.334m - 1200mm W/M @ -0.650%									181.883m - 1200mm W/M @ -0.621%					PROPOSED 1200mm WATERMAIN
PROPOSED 1200mm WATERMAIN INVERTS	86.06														PROPOSED 1200mm WATERMAIN INVERTS
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	91.13	90.98	90.88	90.79	90.68	90.57	90.46	90.36	90.25	90.39	90.30	90.19	90.09	89.96	89.89	EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROADWAY CHAINAGE	1+215	1+230	1+245	1+260	1+275	1+290	1+305	1+320	1+335	1+350	1+365	1+380	1+395	1+410	1+425	EXISTING ℄ OF ROADWAY CHAINAGE

SEWER REPAIRS and OVERFLOWS

C.B. REMOVALS/REPLACEMENTS

EXISTING SEWER MANHOLES

(1) SMH'107'	S-INV=87.328 N-INV=87.252	HR09Q107 CHAINAGE=12+21.8 TOP OF GRATE=91.06
(2) SMH'106'	S-INV=87.316 N-INV=87.316	HR09A106 CHAINAGE=12+23.55 TOP OF GRATE=91.03
(3) SMH'105'	S-INV=86.839 E-INV=86.234 N-INV=85.926	HR09B105 CHAINAGE=13+21.45 TOP OF GRATE=90.31
(4) SMH'104'	E-INV=86.938 S-INV=86.719 N-INV=86.719	HR09A104 CHAINAGE=13+23.5 TOP OF GRATE=90.52
(5) SMH'103'	S-INV=85.390 N-INV=85.314	HR09B103 CHAINAGE=14+14.7 TOP OF GRATE=89.71
(6) SMH'102'	S-INV=86.183 N-INV=86.183	HR09A102 CHAINAGE=14+16.9 TOP OF GRATE=89.75

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB DATE: MARCH 13, 2014

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : 3-383, 8-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans : 71-W-250 72-W-372, 74-W-330, 85-W-20, 98-W-17, 04-W-16
Road Plans : H-365, 85-H-79, 88-H-32, 95-H-13

Geodetic Bench Mark Index No. 8-18 Elevation=87.376m
GTR-1549

SCALES
HORIZONTAL 1:500
VERTICAL 1:100

LICENCED PROFESSIONAL ENGINEER J.S. ROBERTS PROVINCE OF ONTARIO 3/20/14

Project Manager (Design)
Roumiana Nikolova, P.Eng

Manager of Design
Susan Jacob, P. Eng

CITY OF HAMILTON
Public Works Department

CENTENNIAL PARKWAY NORTH
300mm Watermain Replacement
1200mm Trunk Watermain Installation
From : Approximately 105m South of King Street
To : Arrowsmith Road

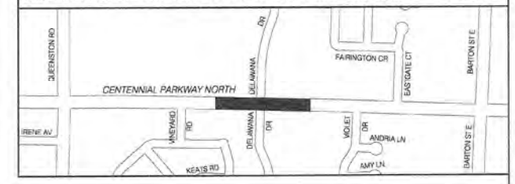
13-W-02 (8)

CENTENNIAL PARKWAY NORTH

CENTENNIAL PARKWAY NORTH

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 13-W-02 (9)	SHEET No. 9 OF 21

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



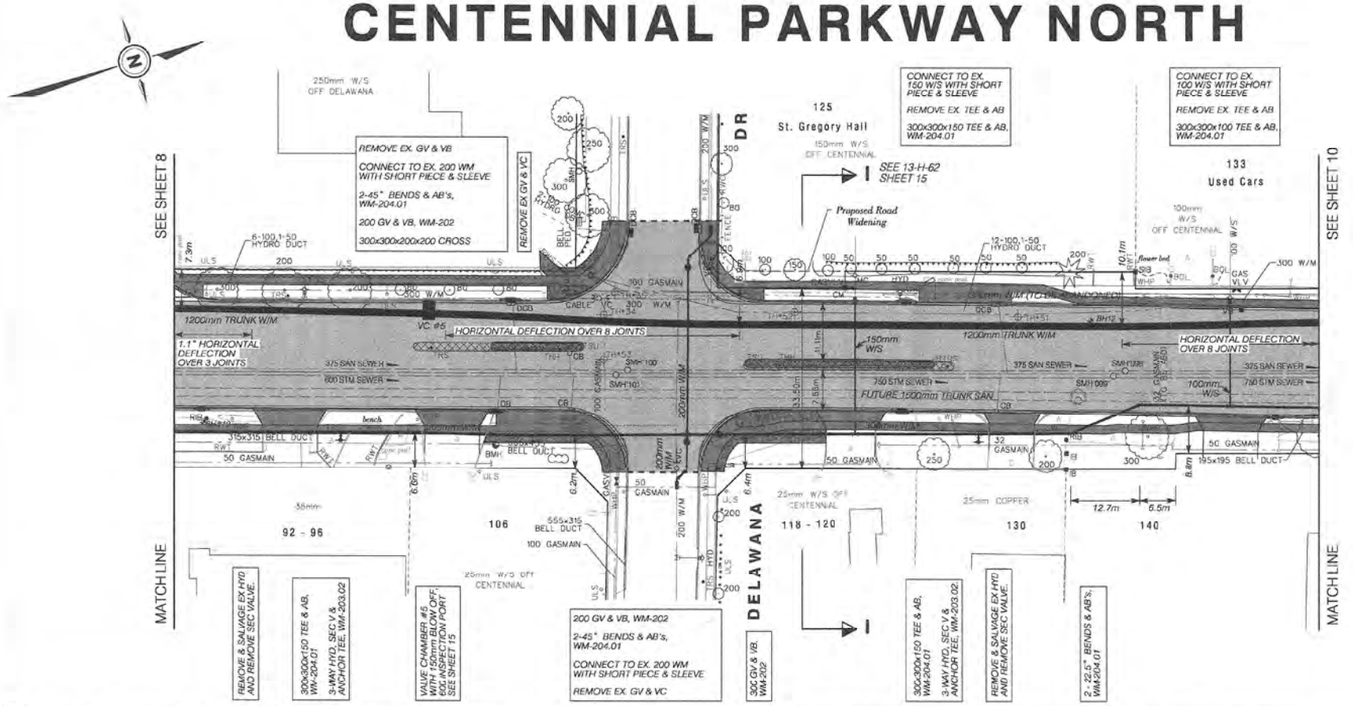
FOR ROAD CONSTRUCTION
SEE 13-H-62

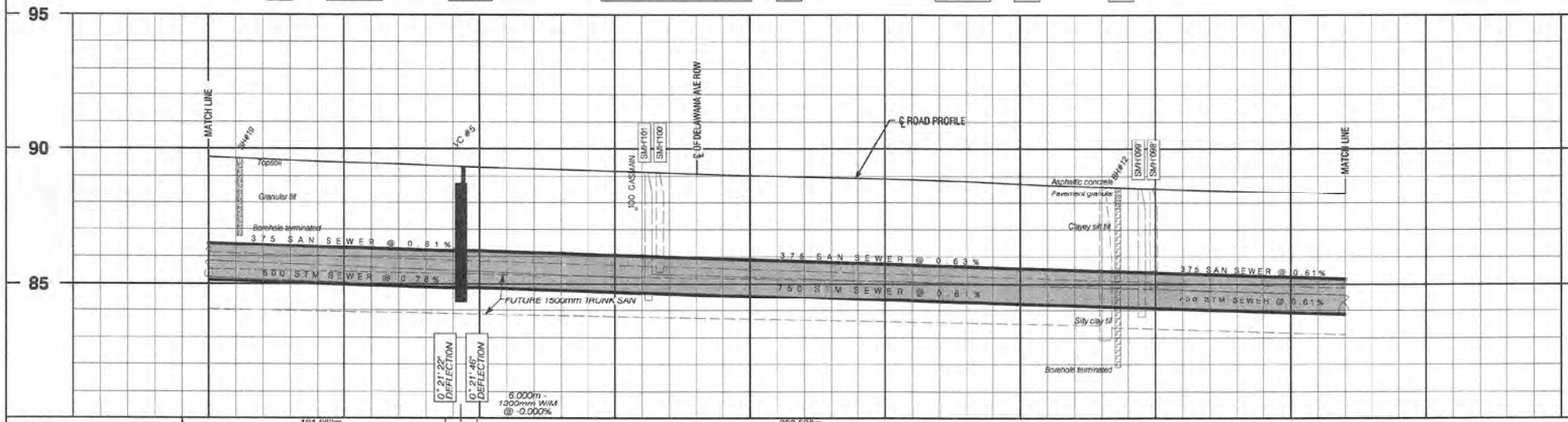
FOR SEWER CONSTRUCTION
SEE 14-S-01

FOR TYPICAL SECTIONS AND DETAILS
SEE 13-H-62 SHEETS 14 & 15

ALL VALVES "RIGHT TO OPEN" (CLOCKWISE) WITH 1" OPERATING NUT ON THE SPINDLE INCLUDING HYDRANT "SECONDARY VALVE".

ALL CB LEADS AND SEWER CROSSING OVER THE 1200mm WM TO BE INSTALLED USING WATER TIGHT MATERIALS.





PROPOSED 1200mm WATERMAIN	181.683m - 1200mm W/M @ -0.621%								320.536m - 1200mm W/M @ -0.633%							PROPOSED 1200mm WATERMAIN
PROPOSED 1200mm WATERMAIN INVERTS					84.93	84.03										PROPOSED 1200mm WATERMAIN INVERTS
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	89.69	89.57	89.47	89.36	89.27	89.19	89.09	89.01	88.93	88.86	88.73	88.62	88.52	88.43	88.34	EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROADWAY CHAINAGE	1+425	1+440	1+455	1+470	1+485	1+500	1+515	1+530	1+545	1+560	1+575	1+590	1+605	1+620	1+635	EXISTING ℄ OF ROADWAY CHAINAGE

SEWER REPAIRS and OVERFLOWS

C.B. REMOVALS/REPLACEMENTS

EXISTING SEWER MANHOLES

SMH'101'	S-INV=84.612 N-INV=84.612	HR09B101 CHAINAGE=15+06.4 TOP OF GRATE=89.16
SMH'100'	S-INV=85.634 N-INV=85.634	HR09A100 CHAINAGE=15+08.5 TOP OF GRATE=89.16
SMH'099'	S-INV=84.064 N-INV=84.064	HR09B099 CHAINAGE=15+97.7 TOP OF GRATE=88.56
SMH'098'	S-INV=85.067 N-INV=85.067	HR09A098 CHAINAGE=15+99.9 TOP OF GRATE=88.58

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB DATE: MARCH 13, 2014

REFERENCE MATERIAL
Surveyed By: J. Hough
Sewer Plans : B-383, B-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans : 71-W-250, 72-W-372, 74-W-530, 85-W-20, 98-W-17, 04-W-16
Road Plans : H-365, 85-H-79, 88-H-32, 95-H-13

Geodetic Bench Mark Index No. 8-19 Elevation=87.376m
GTR-1549

SCALES
HORIZONTAL 1:500
VERTICAL 1:100

LICENSED PROFESSIONAL ENGINEER J.S. ROBERTS PROVINCE OF ONTARIO 3/10/14

Project Manager (Design)
Roumiana Nikolova, P.Eng

Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

CENTENNIAL PARKWAY NORTH
300mm Watermain Replacement
1200mm Trunk Watermain Installation
From : Approximately 105m South of King Street
To : Arrowsmith Road

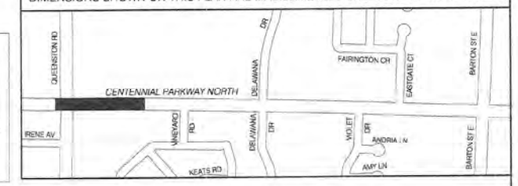
13-W-02 (9)

CENTENNIAL PARKWAY NORTH

CENTENNIAL PARKWAY NORTH

FILE No.	CONTRACT No. C15-14-14 (HSW) DRAWING No. 14-S-01 (4)	SHEET No. 4 OF 4

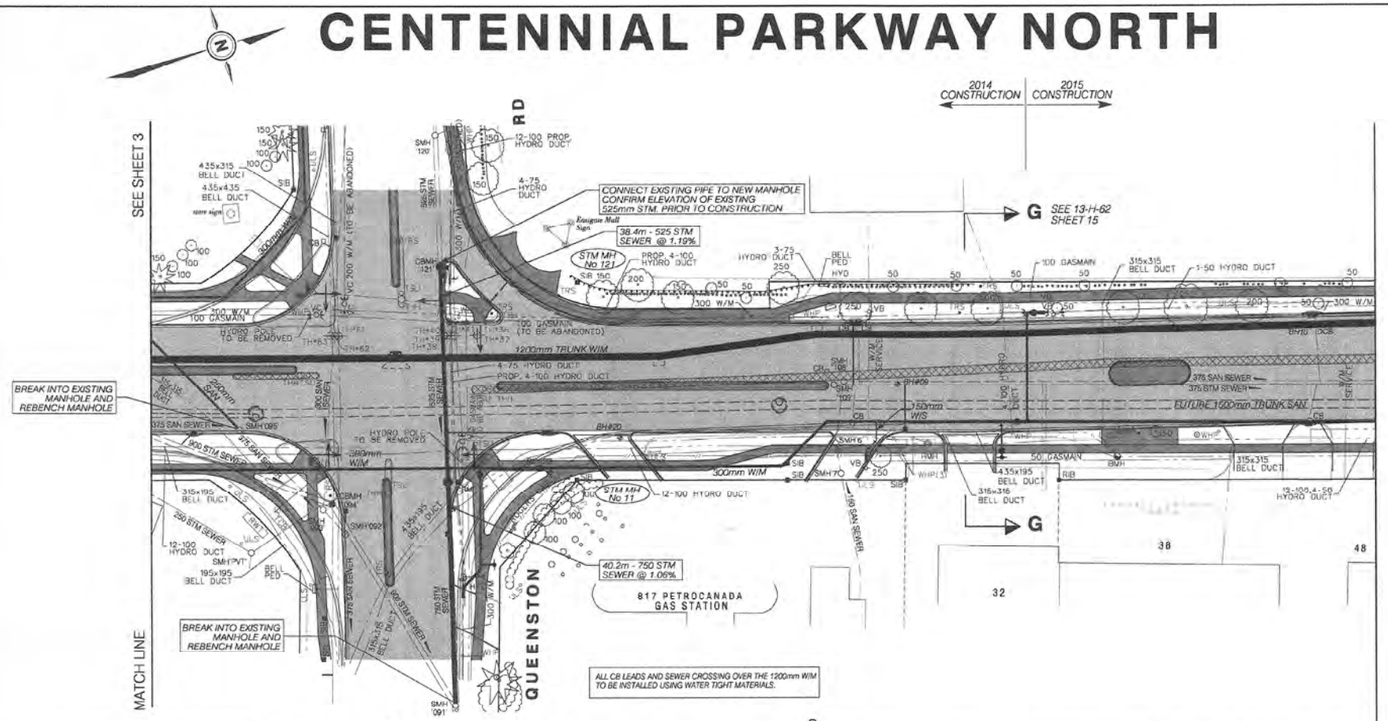
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



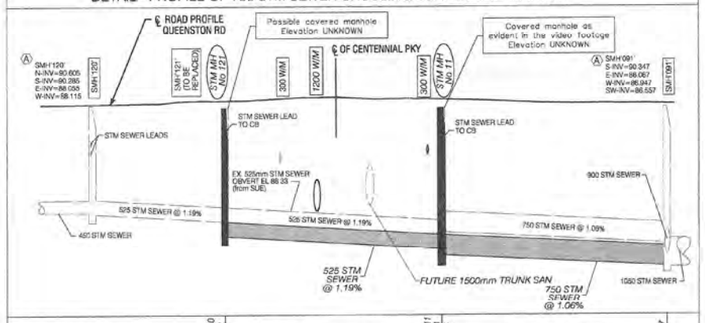
FOR WATERMAIN CONSTRUCTION
SEE 13-W-02

FOR ROAD CONSTRUCTION
SEE 13-H-62

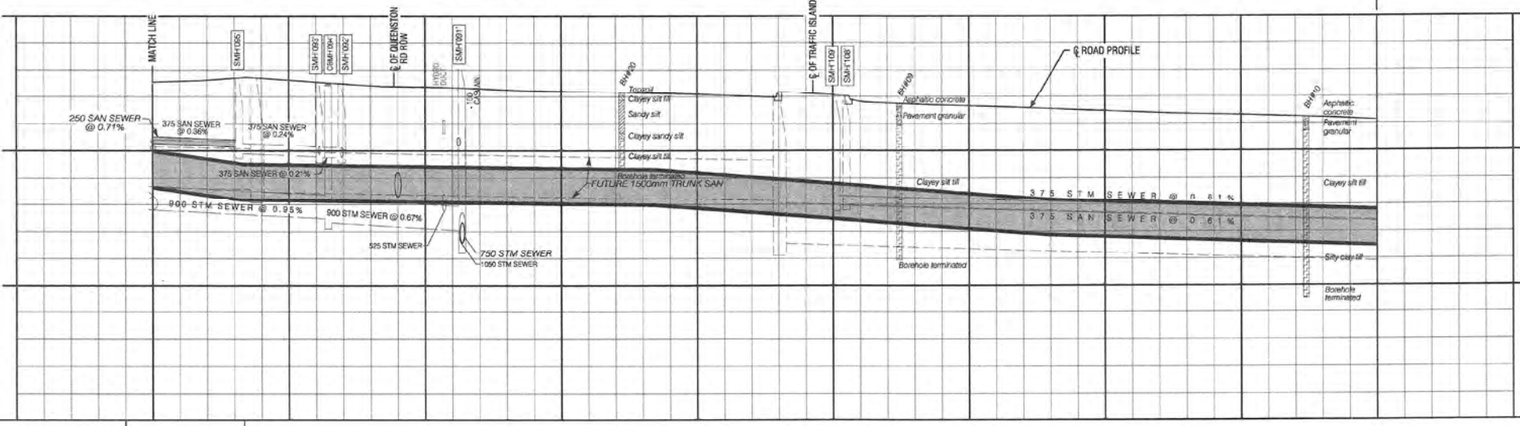
FOR TYPICAL SECTIONS AND DETAILS
SEE 13-H-62 SHEETS 14 & 15



DETAIL - PROFILE OF 750 STM SEWER CROSSING CENTENNIAL PARKWAY



PROPOSED STORM SEWER — OPSD 701.010 W 87.780 E 87.321 — 38.4m - 525 STM SEWER @ 1.19% CSA A257.2 (65-D) — OPSD 701.011 W 86.564 E 86.525 — 40.2m - 750 STM SEWER @ 1.06% CSA A257.2 (65-D) — W 86.092



EXISTING SEWER MANHOLES

(D) SMH 095	SD07A095	
S-INV=89.974	CHAINAGE=10+06.0	
NE-INV=89.899	TOP OF GRATE=92.35	
(A) SMH 093	SD07A093	
NE-INV=89.754	CHAINAGE=10+20.7	
SW-INV=89.784	TOP OF GRATE=92.134	
W-INV=89.874		
(A) CBMH 094	CHAINAGE=10+22.4	
NE-INV=87.004	TOP OF GRATE=92.134	
SW=87.224		
S=87.784		
(D) SMH 092	SD07A092	
SW-INV=89.757	CHAINAGE=10+25.0	
E-INV=89.757	TOP OF GRATE=92.08	
(A) SMH 120	SD07B120	
N-INV=90.605	TOP OF GRATE=92.065	
S-INV=90.285		
E-INV=88.055		
W-INV=88.115		
(A) SMH 091	SD07B091	
S-INV=90.347	TOP OF GRATE=91.987	
E-INV=86.067		
W-INV=86.947		
SW-INV=86.557		
(D) SMH 109	HR09B109	
N-INV=87.968	CHAINAGE=11+15.8	
	TOP OF GRATE=91.85	

EXISTING SEWER MANHOLES

(A) SMH 6	
E-INV=89.586	
W-INV=89.596	
(A) SMH 7	
E-INV=89.819	
W-INV=89.779	
SE-INV=89.839	
(D) SMH 108	HR09A108
N-INV=87.958	CHAINAGE=11+17.6
	TOP OF GRATE=91.85

C.B. REMOVALS/REPLACEMENTS

PROPOSED SANITARY SEWER — S 90.10 — 23.88m - 250 SAN SEWER @ 0.72%

PROPOSED STORM SEWER

EXISTING ℄ OF ROAD PROFILE ELEVATIONS	92.39	92.70	92.56	92.40	92.32	92.21	92.14	92.06	92.13	91.77	91.66	91.55	91.43	91.34	91.25	91.13
EXISTING ℄ OF ROADWAY CHAINAGE	0+990	1+005	1+020	1+035	1+050	1+065	1+080	1+095	1+110	1+125	1+140	1+155	1+170	1+185	1+200	1+215

PROPOSED SANITARY SEWER

PROPOSED STORM SEWER

EXISTING ℄ OF ROAD PROFILE ELEVATIONS

EXISTING ℄ OF ROADWAY CHAINAGE

No.	REVISIONS	INITIAL	DATE

DRAWN BY: RCP/MB — DATE: MARCH 13, 2014

REFERENCE MATERIAL:
Surveyed By: J. Hough
Sewer Plans: R-383, R-458, H-173, H-174, H-177, H-178, H-375, 68-S-29, 71-S-238, 90-S-19, 91-S-55 Sewer Sheets: HR-06, HR-07, HR-08
Water Plans: 71-W-250, 72-W-372, 74-W-530, 89-W-20, 98-W-17, 04-W-16
Road Plans: H-365, 85-H-79, 88-H-32, 95-H-13
Plans: LSP0272
Geodetic Bench Mark Index No. 8-19 — Elevation=87.376m
Borehole Report- GRT2-1549

SCALES
HORIZONTAL 1:500 (0, 5m, 10m, 20m)
VERTICAL 1:100 (0, 1m, 2m, 4m)

LICENSED PROFESSIONAL ENGINEER — J.S. ROBERTS — PROVINCE OF ONTARIO — 3/20/14

Project Manager (Design)
Roumiana Nikolova, P.Eng.
Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

CENTENNIAL PARKWAY NORTH
Lowering of Existing 525 mm and 750 mm Storm Sewer
250 mm Sanitary Sewer Construction
From : Approximately 20m West of Centennial Parkway North
To : Approximately 60m East of Centennial Parkway North

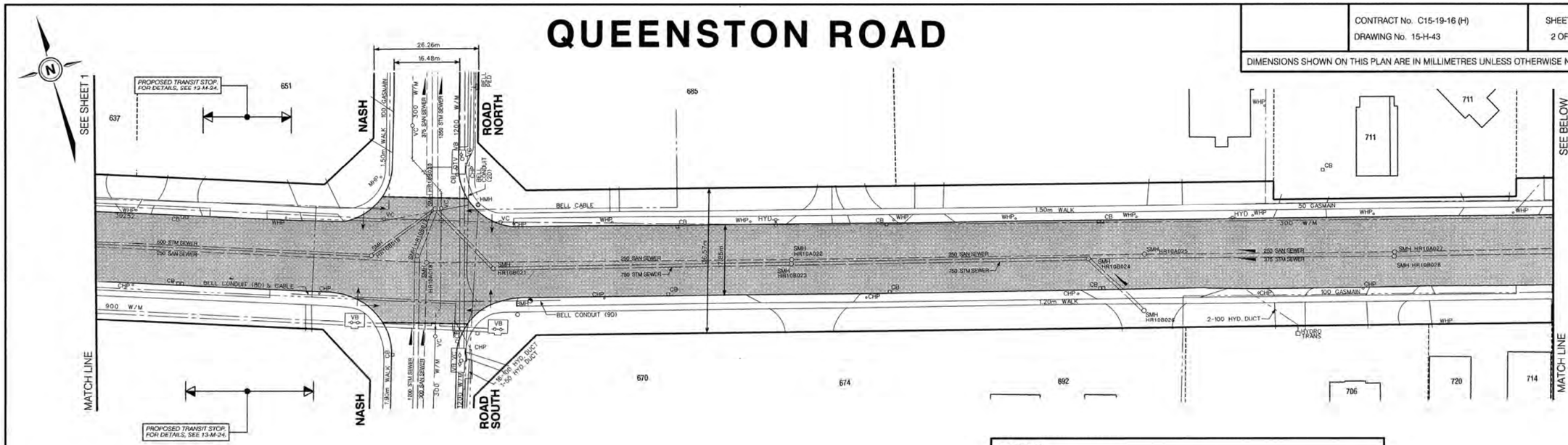
14-S-01 (4)

QUEENSTON ROAD

QUEENSTON ROAD

	CONTRACT No. C15-19-16 (H)	SHEET No.
	DRAWING No. 15-H-43	2 OF 2

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



LEGEND

STRIP EXISTING ASPHALT TO CONCRETE BASE (AVERAGE DEPTH 110mm). SUPPLY AND PLACE 40mm SP 12.5 FC2, TRAFFIC CATEGORY 'D', ASPHALT, PG 64-28. SUPPLY AND PLACE 40mm SP 12.5 TRAFFIC CATEGORY 'D', ASPHALT, PG 64-28 (AS BASE COURSE).

NOTES

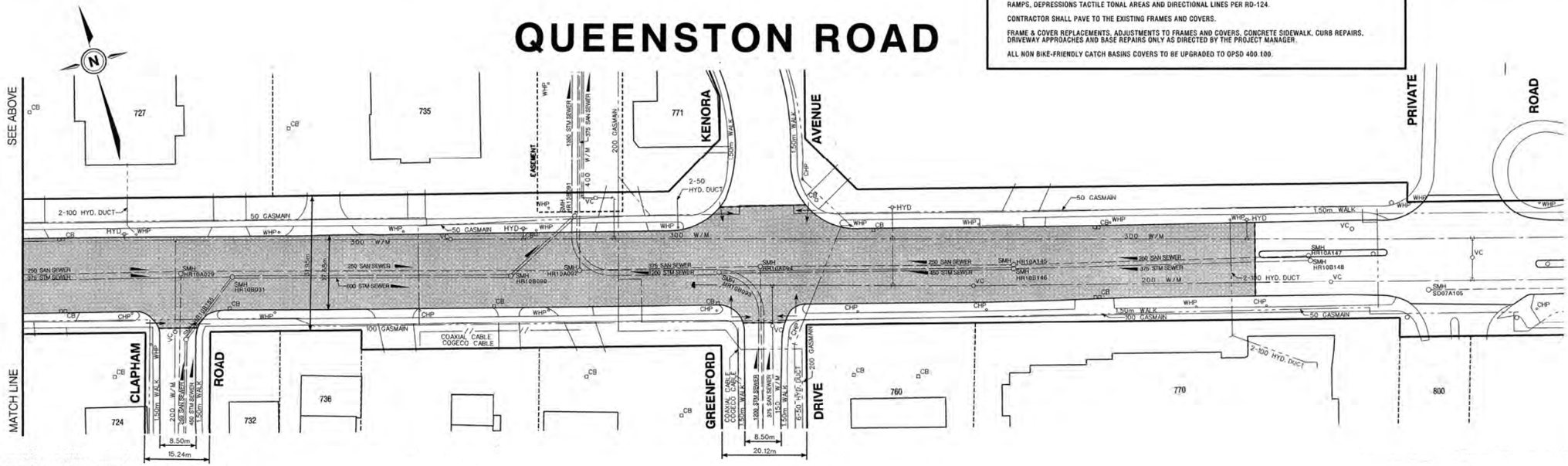
RAMPS, DEPRESSIONS TACTILE TONAL AREAS AND DIRECTIONAL LINES PER RD-124.

CONTRACTOR SHALL PAVE TO THE EXISTING FRAMES AND COVERS.

FRAME & COVER REPLACEMENTS, ADJUSTMENTS TO FRAMES AND COVERS, CONCRETE SIDEWALK, CURB REPAIRS, DRIVEWAY APPROACHES AND BASE REPAIRS ONLY AS DIRECTED BY THE PROJECT MANAGER.

ALL NON BIKE-FRIENDLY CATCH BASINS COVERS TO BE UPGRADED TO OPSD 400.100.

QUEENSTON ROAD



No	REVISIONS	INITIAL	DATE

DRAWN BY: LB/MM/SG DATE: APRIL, 2016

REFERENCE MATERIAL:
Data displayed on this plan is compiled from digital mapping, aerial photos(2014), Teranet parcel plans and digitized terrain models. Field survey work has not been completed at this time.

Geodetic Bench Mark Index No. Elevation=

Borehole Report -

SCALES
0 5m 10m 20m
HORIZONTAL 1:500

Project Manager (Design)
Andrew Pelinczak, C.E.T.

Manager of Design
Susan Jacob, P. Eng.

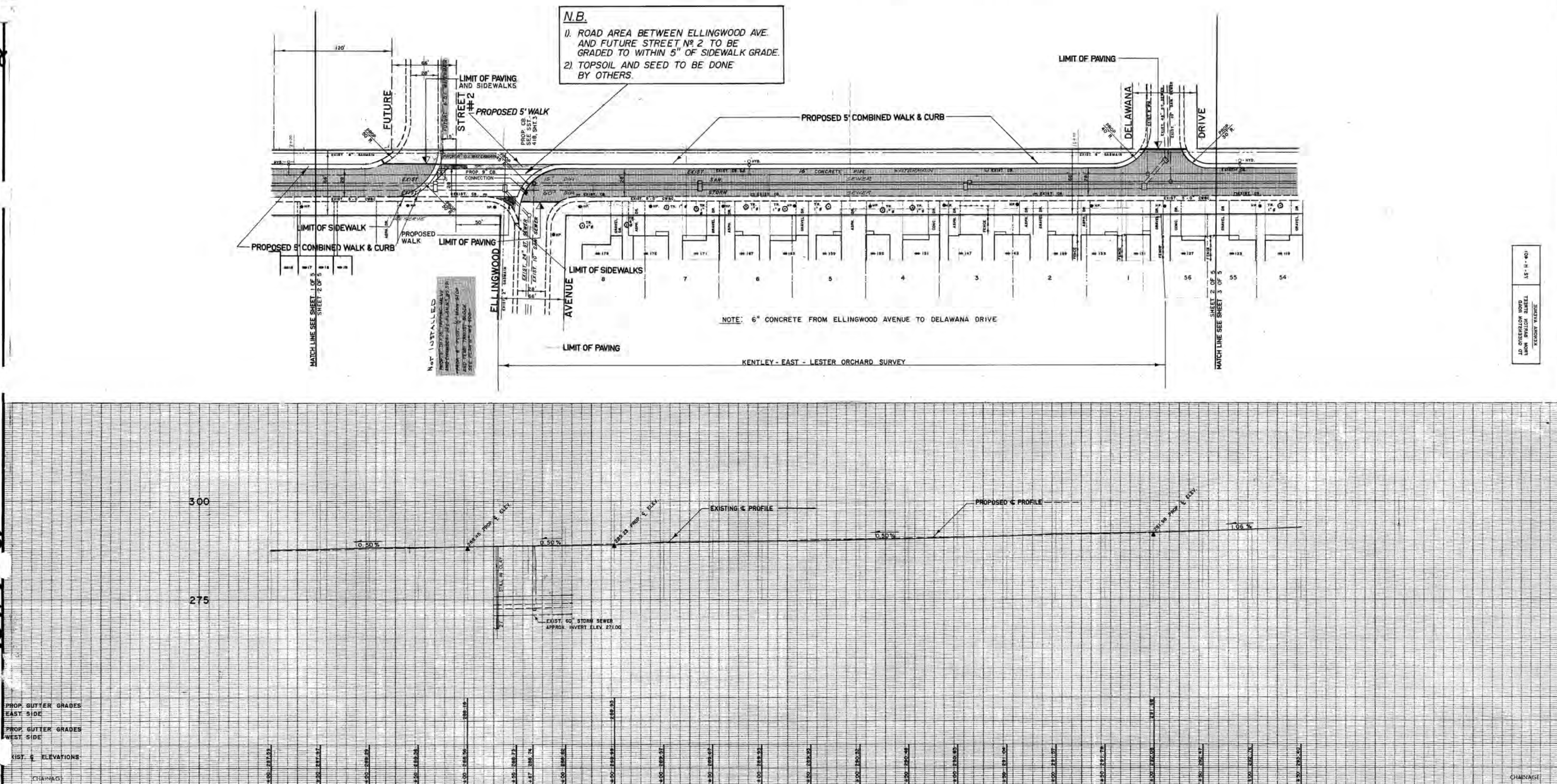
CITY OF HAMILTON
Public Works Department

QUEENSTON ROAD
Road Resurfacing
From : Pottruff Road
To : Signalized Access to Eastgate Square

15-H-43 (2)

KENORA AVENUE

PROPOSED ASPHALT ON CONCRETE ROAD



NOTES: • TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
• ALL ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
• CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

ER-69-43	
ER-71-17	0406-11576
ER-71-19	0406-11577
ERS-71-33	0406-11217
ERS-71-34	0406-11220
ERS-71-35	0406-11218
ERS-71-37	0406-11219

SCALE: VERTICAL / HORIZONTAL

REVISIONS:

UTILITIES: [signature]

REF. DWG'S: G-181, P-615, P-711, NS-1947 SURVEYS, B-371, K-131, 72-S-320 SEWERS, 70-H-222 E. of W., RDK-56

SURVEY BY	G. DIBACCO, E. MESKAUSKAS
FIELD BOOKS	BLK. 88, Pages 55-57 & 65-74
DATE	MAY 15, 1972
BENCH MARK	CITY OF HAMILTON B.M. # 69 ELEV. 303.857
DRAWN BY	GARY WELLS
CHECKED BY	[signature]

ASST. DIRECTOR, ENGRG. DESIGN: [signature]
DIRECTOR, ENGRG. DESIGN: [signature]

APPROVED [signature]
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

PROJECT No. SEE NOTES | ACCOUNT No. SEE NOTES

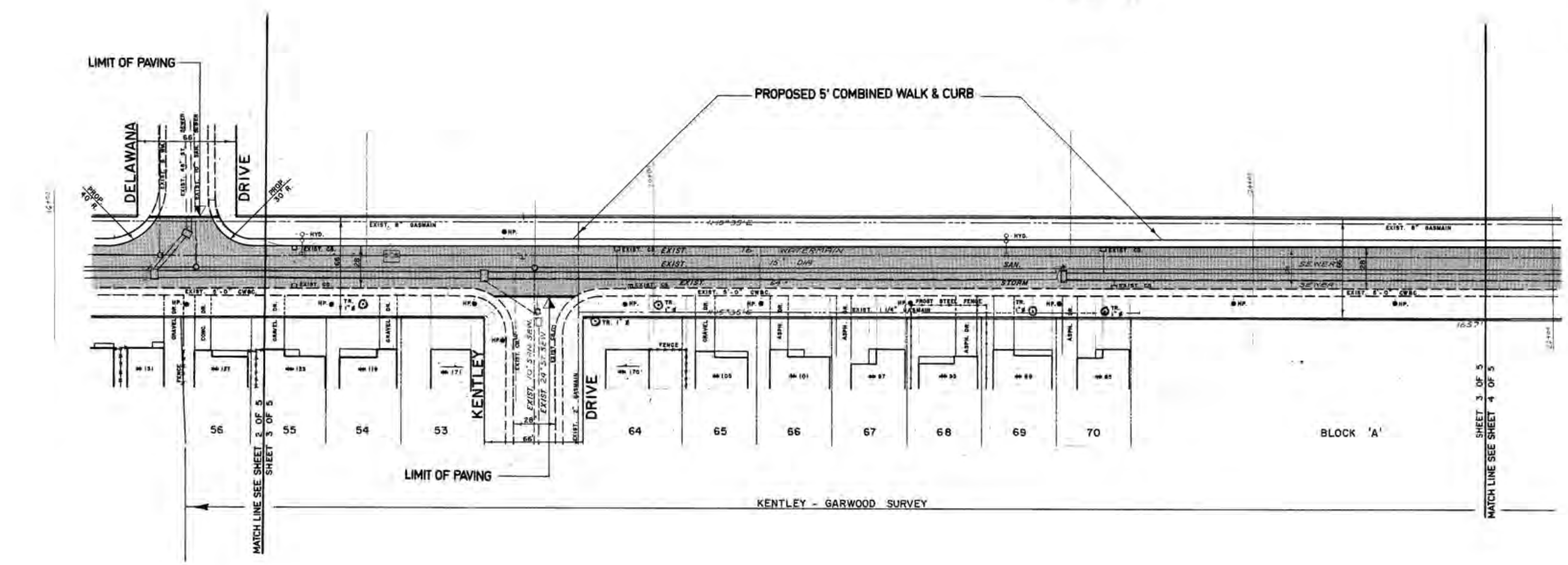
KENORA AVENUE
FROM BARTON STREET TO QUEENSTON ROAD

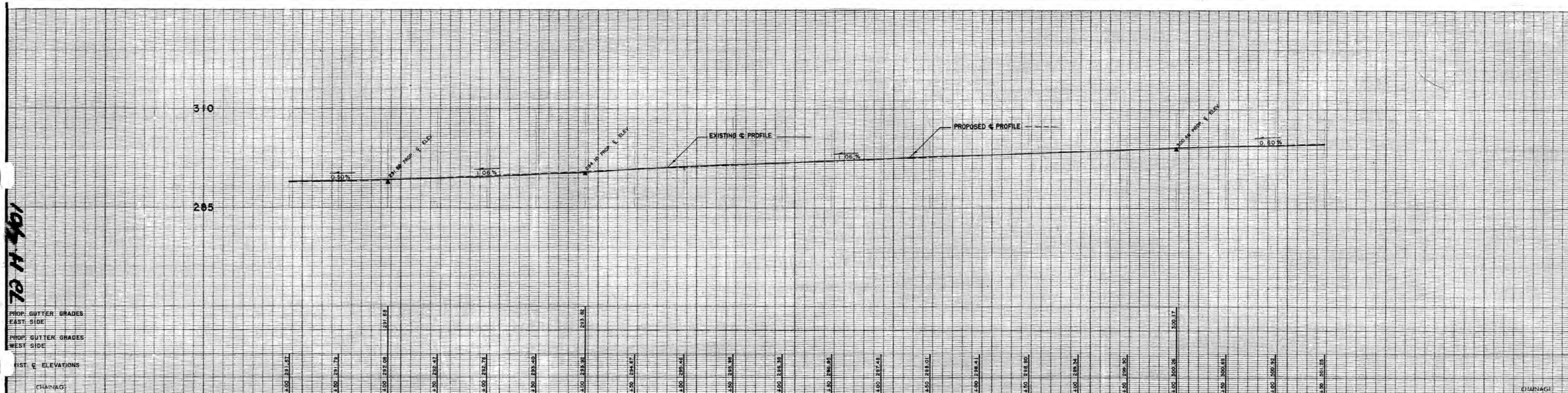
DRAWING No. 72-H-401 | SHEET 2 OF 5

KENORA AVENUE

PROPOSED ASPHALT ON CONCRETE ROAD

NOTE: 8" CONCRETE FROM THE NORTH LIMIT OF DELAWANA DRIVE TO QUEENSTON ROAD.





NOTES: TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
ALL ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

ER-69-43	
ER-71-17	0406-11576
ER-71-19	0406-11577
ERS-71-33	0406-11217
ERS-71-34	0406-11220
ERS-71-35	0406-11218
ERS-71-37	0406-11219

SCALE: VERTICAL / HORIZONTAL

REVISIONS:

UTILITIES: Dec 5/72

REF. DWG'S: S-161, P-615, P-711, NS-1947 SURVEYS, S-371, X-131, 72-S-320 SEWERS, 70-H-222 B. of W., RDK-56

SURVEY BY	G. DIBACCO, K. MESKAUSKAS
FIELD BOOKS	BLK. 88, Pages 55-57 & 65-74
DATE	MAY 15, 1972
BENCH MARK	CITY OF HAMILTON B.M. # 69 ELEV. 303.857
DRAWN BY	GARY WELLS
CHECKED BY	[signature]

ASST. DIRECTOR, ENGRG. DESIGN.: [signature]
DIRECTOR, ENGRG. DESIGN.: [signature]

APPROVED: [signature]
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

PROJECT No. SEE NOTES — ACCOUNT No. SEE NOTES

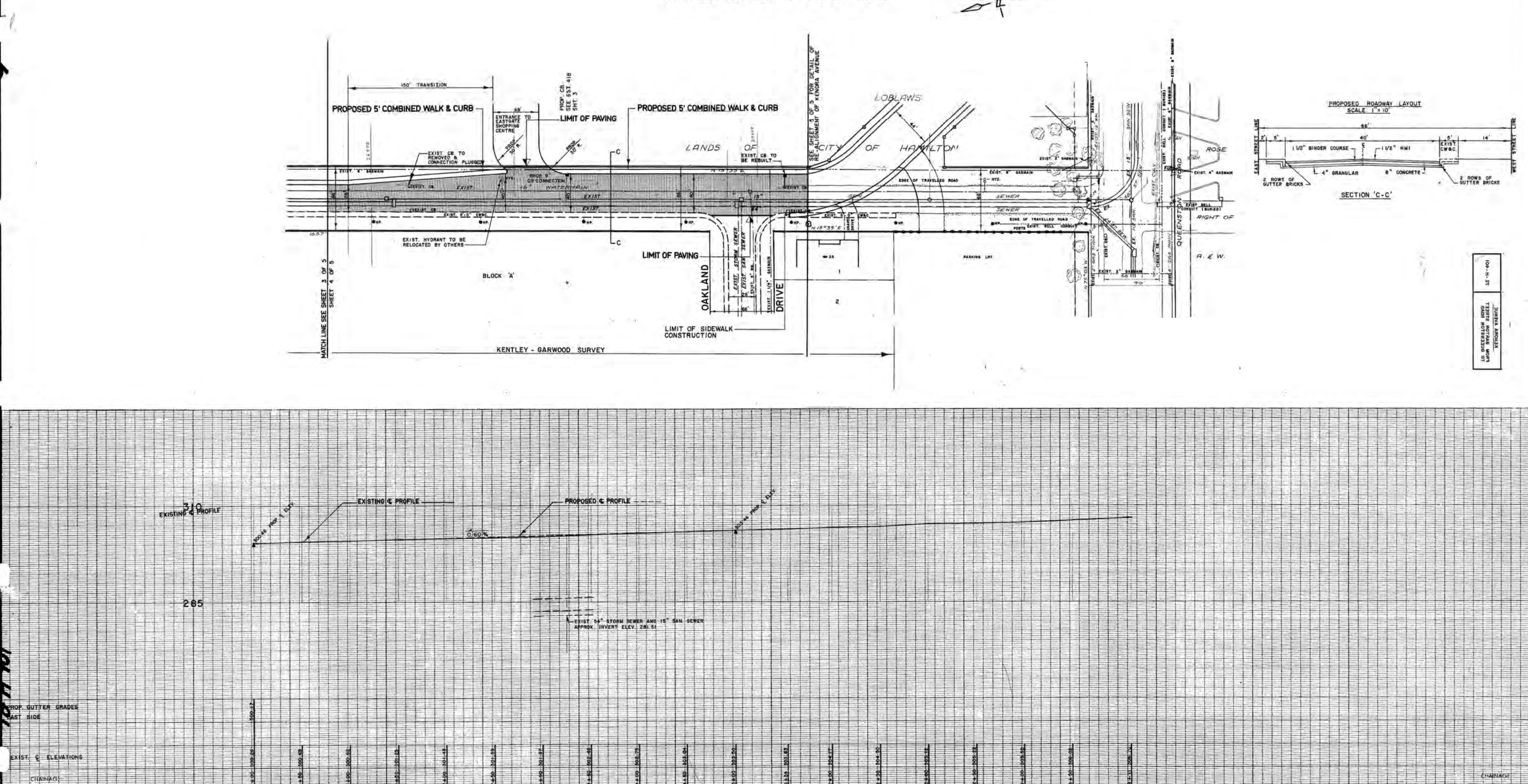
KENORA AVENUE
FROM BARTON STREET TO QUEENSTON ROAD

DRAWING No. 72 - H - 401 — SHEET 3 OF 5

SEQ# 09026

KENORA AVENUE

PROPOSED ASPHALT ON CONCRETE ROAD



NOTES • TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
• ALL ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
• CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

ER-69-43	
ER-71-17	0406-11576
ER-71-19	0406-11577
ERS-71-33	0406-11217
ERS-71-34	0406-11220
ERS-71-35	0406-11216
ERS-71-37	0406-11219

SCALE: VERTICAL 5 0 10 — HORIZONTAL 20 0 40

REVISIONS:

UTILITIES:

REF. DWG'S: G-161, P-615, P-711, NS-1947 SURVEYS; B-371, K-131, 72-S-320 SEWERS; 70-H-222 R. of W.; RDK-56

SURVEY BY	G. DIBACCO, K. MESKAUSKAS	DRAWN BY	GARY WELLS
FIELD BOOKS	BLK. 88, Pages 55-57 & 65-74	CHECKED BY	
DATE	MAY 15, 1972		
BENCH MARK	CITY OF HAMILTON	B.M. 69	ELEV. 303.857

ASST. DIRECTOR, ENGRG. DESIGN:
DIRECTOR, ENGRG. DESIGN:

APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

PROJECT No. SEE NOTES | ACCOUNT No. SEE NOTES

KENORA AVENUE
FROM BARTON STREET TO QUEENSTON ROAD

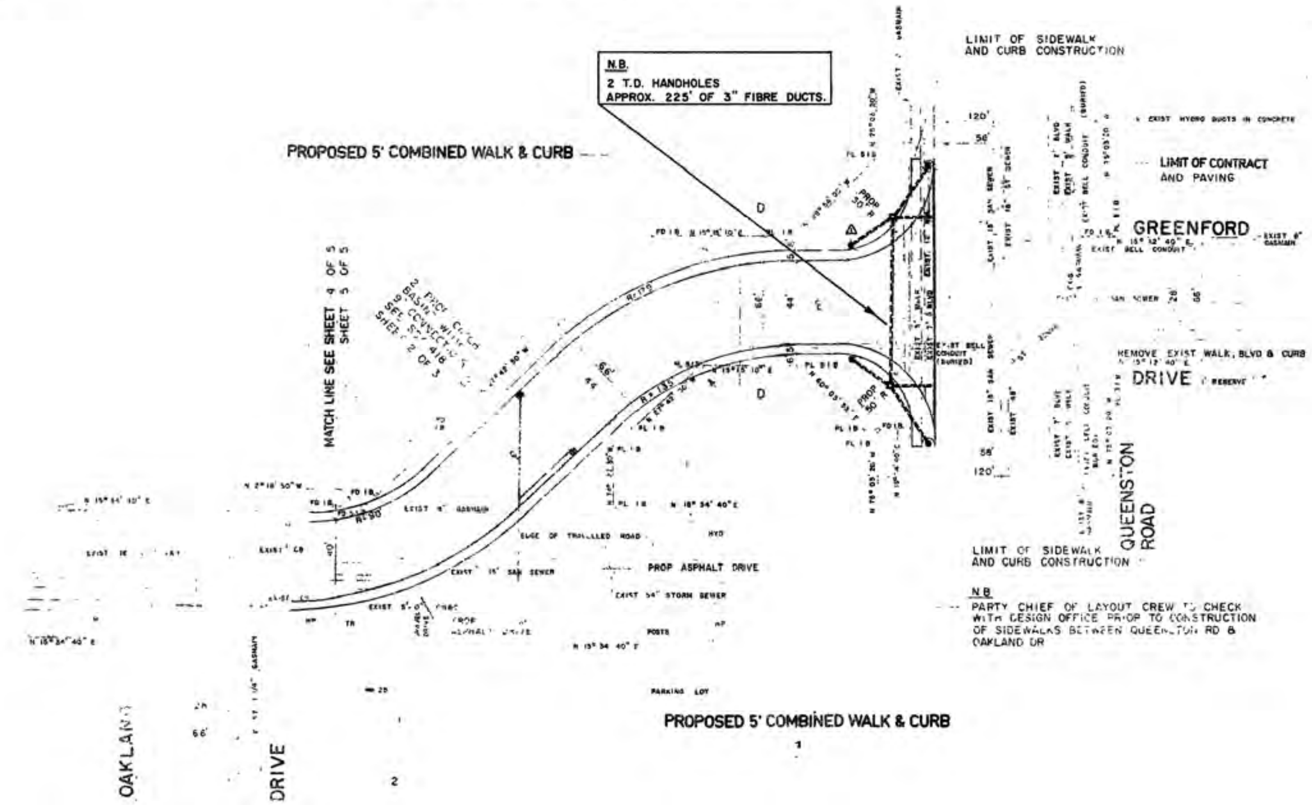
DRAWING No. 72 - H - 401 | SHEET 4 OF 5

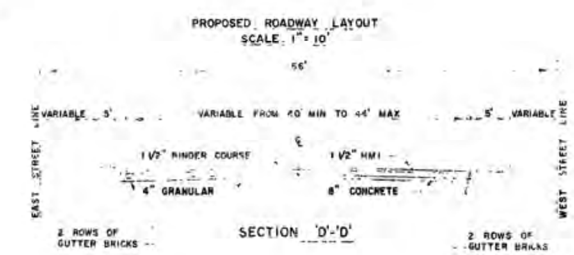
SEC. 09027

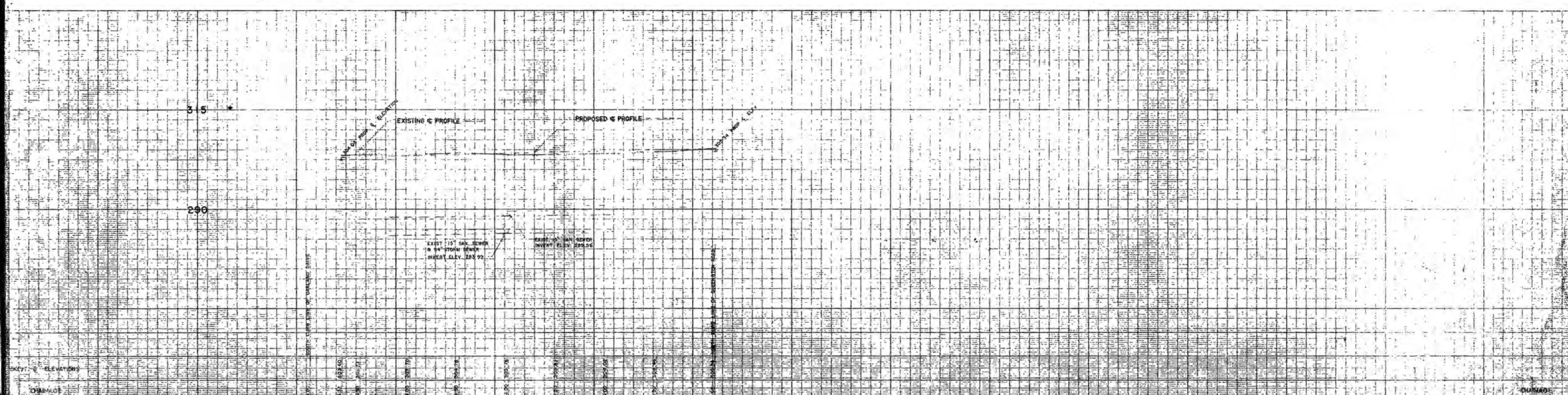
5A

KENORA AVENUE

PROPOSED ASPHALT ON CONCRETE ROAD







NOTE: TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
ALL UTILITY LOCATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

SCALE: VERTICAL / HORIZONTAL	REVISIONS: TRAFFIC INFORMATION ADDED MAY 19, 1972 - G. WELLS	REF. DWG'S: G-161, P-615, P-711, NS-1947 SURVEYS, B-371, K-151, 72-S-320 SEWERS, 70-H-222 B. of W, RDK-56	SURVEY BY: G. DIBBACCO	DRAWN BY: GARY WELLS
	UTILITIES		FIELD BOOKS	CHECKED BY
			DATE: MAY 15, 1972	
			BENCH MARK: CITY OF HAMILTON B.M. # 403 ELEV 306.44	

ASST. DIRECTOR ENGRG. DESIGN
DIRECTOR ENGRG. DESIGN
APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

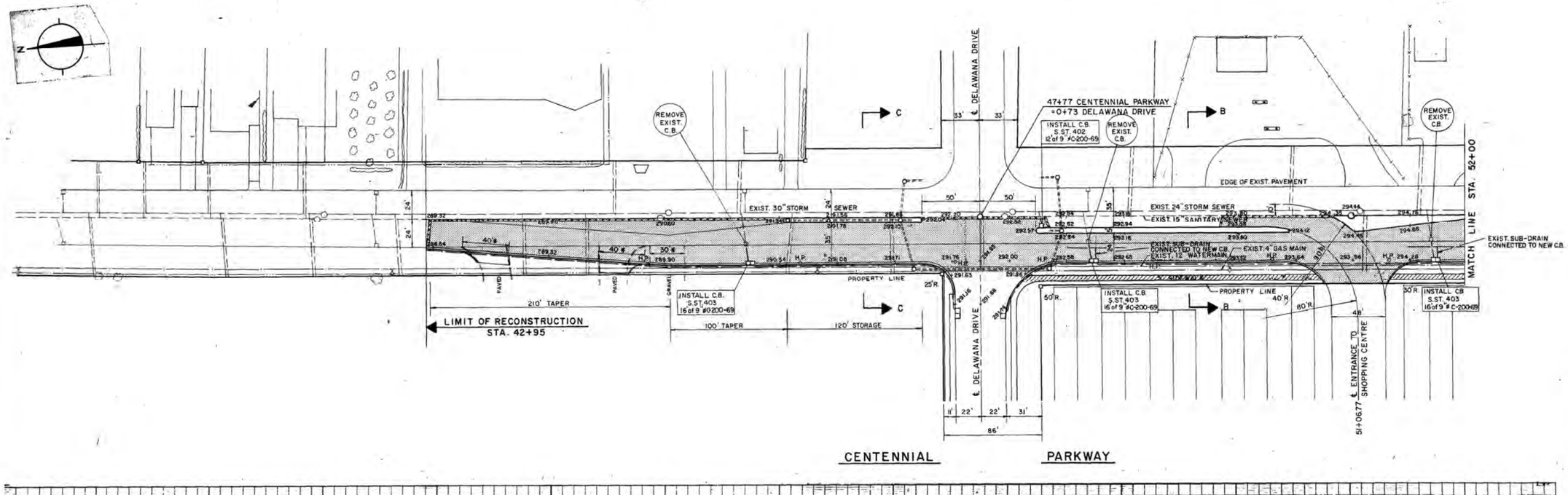
PROJECT No. ER-69-43 | ACCOUNT No.

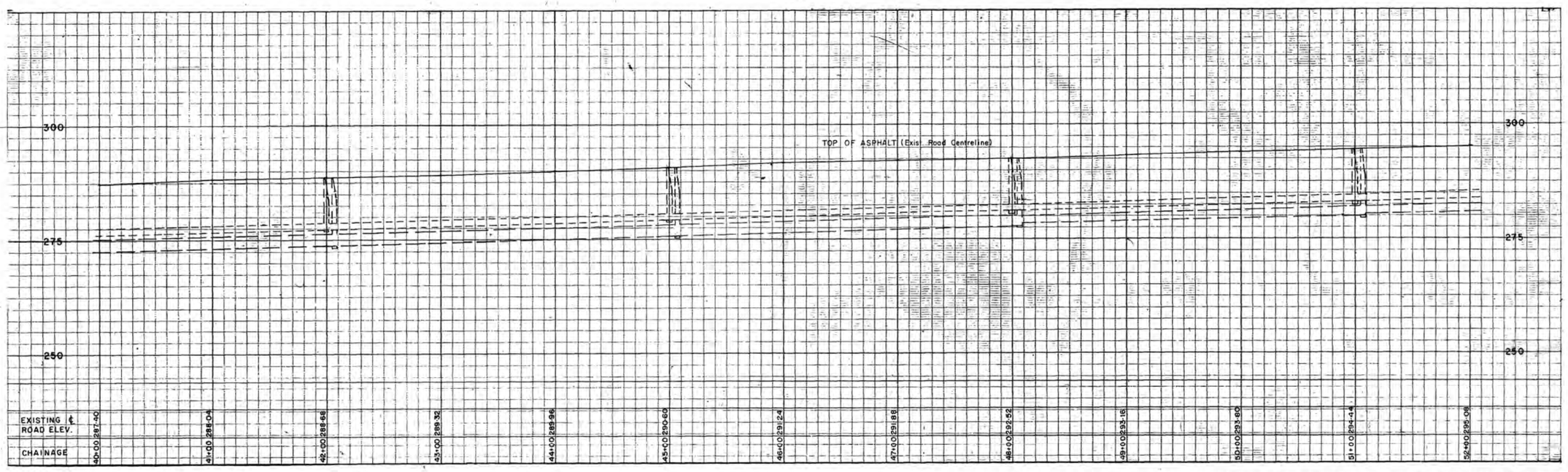
KENORA AVENUE
FROM BARTON STREET TO QUEENSTON ROAD

DRAWING No. 72-H-401 | SHEET 5 OF 5

500-07029

72H401





NOTES:
1. SEE SHEET Nº5 FOR TYPICAL X-SECTIONS
2. ALL C.B. LEADS TO BE 9" ℄ CLAY PIPE, C-200-69

- AREA TO BE PAVED
- CONCRETE SIDEWALK
- 3" P.V.C. DUCT
- HANDHOLE (TRAFFIC)
- JUNCTION BOX
- BURN OFF EXISTING ASPHALT 1½" DEEP X 2' WIDE
- 30'* DROP CURB AT ENTRANCE
- 291.73 TOP OF PAVEMENT ELEVATION
- 6" DIA. SUB-DRAIN

Nº	DATE	REVISIONS	BY
	30/9/74	AS CONSTRUCTED	D.H.

REGISTERED PROFESSIONAL ENGINEER W. J. McSHANE PROVINCE OF ONTARIO

C.C. PARKER AND ASSOCIATES LTD.
CONSULTING ENGINEERS
HAMILTON ONTARIO

EASTGATE SHOPPING CENTRE

DESIGN: W.J.McS. | DRAWN: D.C.H.
CHECKED: W.J.McS.
DATE: NOV. 1971
SCALE 1" = 40' HORIZ. 1" = 10' VERT.

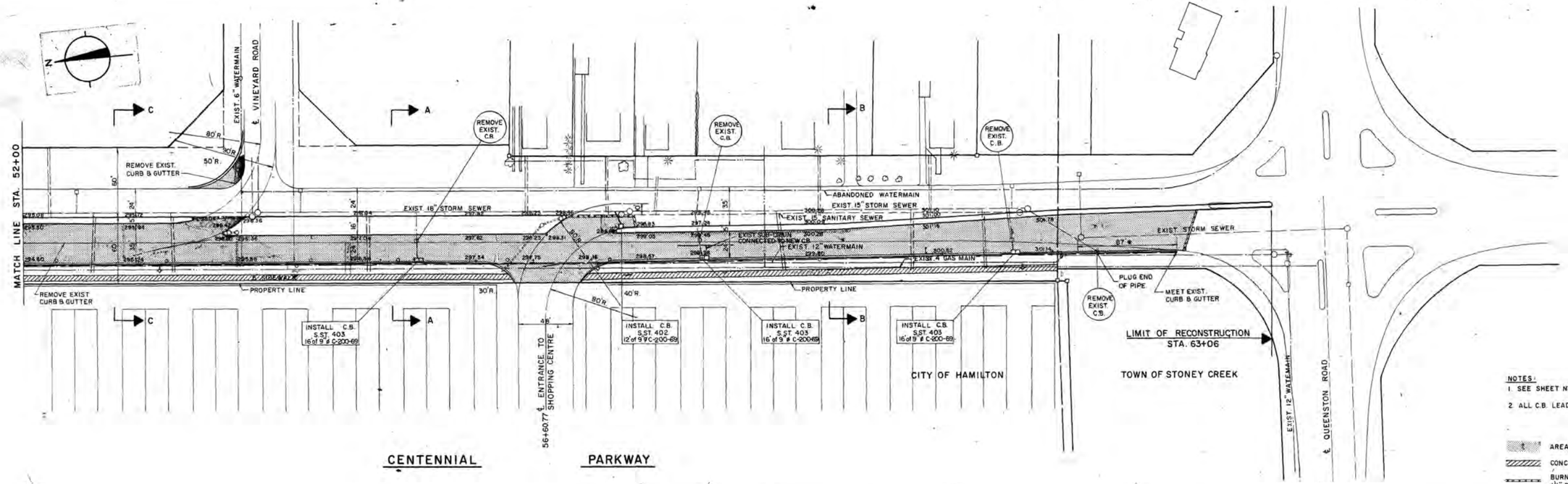
CENTENNIAL PARKWAY — WIDENING

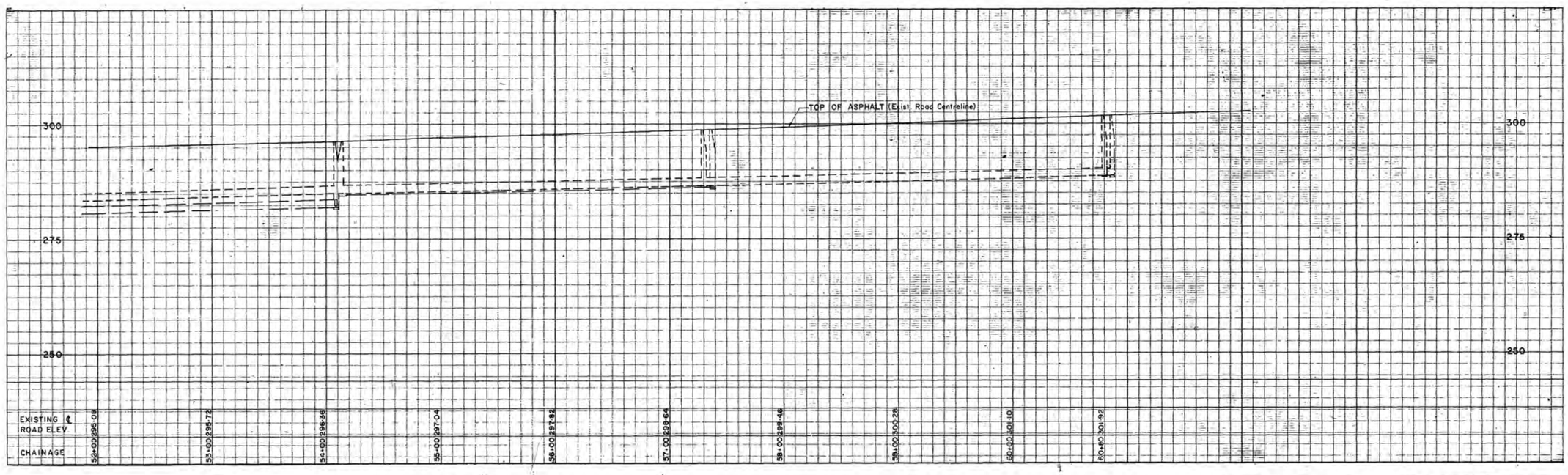
PLAN No. S.C. 100 SHEET 1 OF 6

APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
PROJECT No.
ACCOUNT No.

13898





NOTES:
1. SEE SHEET Nº 5 FOR TYPICAL X-SECTIONS
2. ALL C.B. LEADS TO BE 9" ø CLAY PIPE, C-200-69

AREA TO BE PAVED
CONCRETE SIDEWALK
BURN OFF EXISTING ASPHALT 1½" DEEP X 2' WIDE
87'± DROP CURB AT ENTRANCE
291.73 TOP OF PAVEMENT ELEVATION
6" DIA. SUB-DRAIN

Nº	DATE	REVISIONS	BY
	30/9/74	AS CONSTRUCTED	D.H.

REGISTERED PROFESSIONAL ENGINEER W. J. McSHANE PROVINCE OF ONTARIO

C.C. PARKER AND ASSOCIATES LTD.
CONSULTING ENGINEERS
HAMILTON ONTARIO

EASTGATE SHOPPING CENTRE

DESIGN: W.J.McS. DRAWN: D.C.H.
CHECKED: W.J.McS.
DATE: NOV. 1971
SCALE 1" = 40' HORIZ. 1" = 10' VERT.

CENTENNIAL PARKWAY — WIDENING

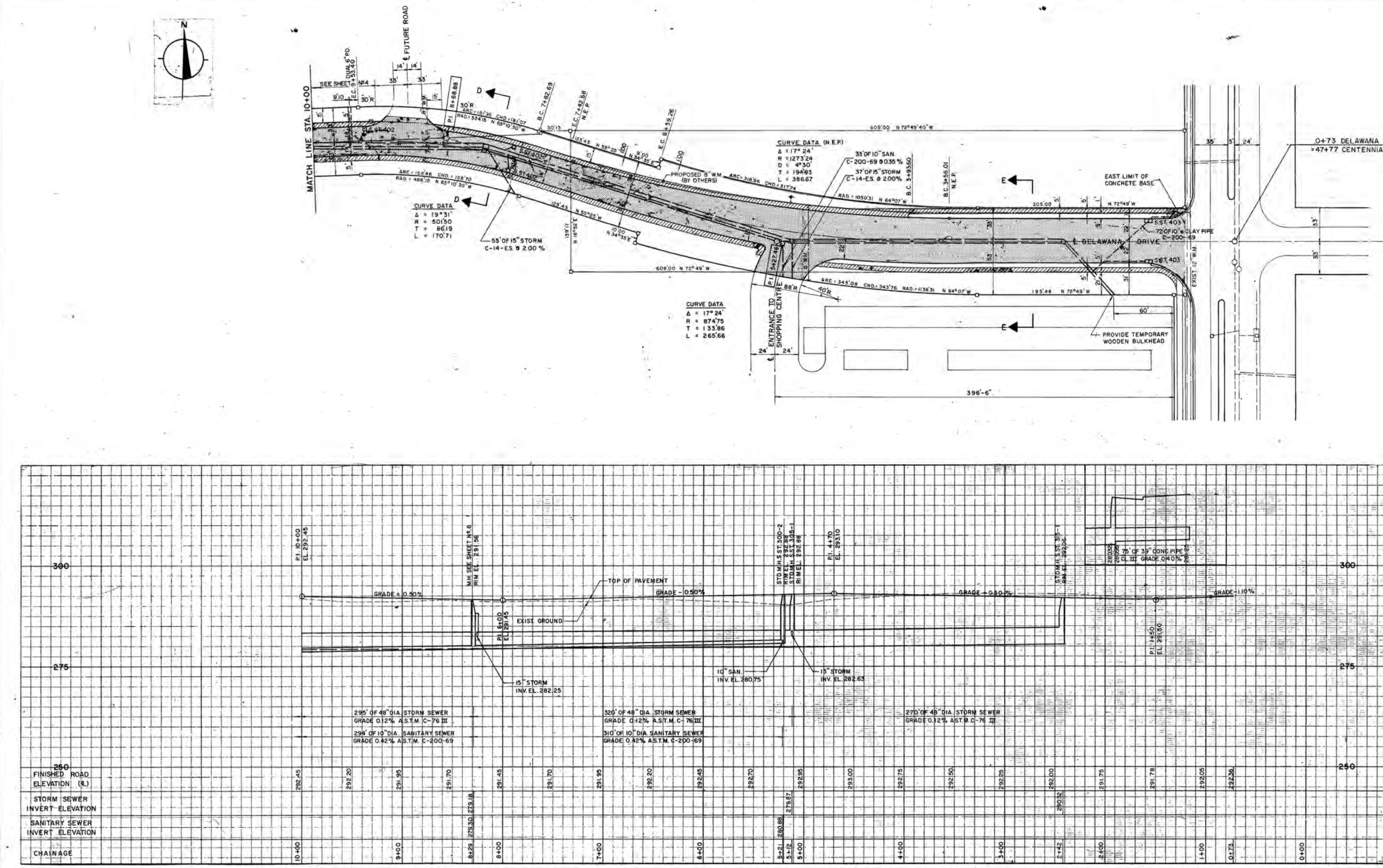
PLAN No. S.C. 100 SHEET 2 OF 6

APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING

PROJECT No. ACCOUNT No.

13899 13899 72-3-32



NOTES:
1. SEE SHEET Nº. 4 FOR TYPICAL X-SECTIONS
2. ALL C.B. LEADS TO BE 9" Ø CLAY PIPE, C-200-69 EXCEPT WHERE OTHERWISE NOTED.

Nº	DATE	REVISIONS	BY
	30/9/7	AS CONSTRUCTED	D.H.

C.C. PARKER AND ASSOCIATES LTD.
CONSULTING ENGINEERS
ONTARIO

CENTENNIAL SHOPPING CENTRE

DESIGNED … D.C.H.
CHECKED …
DATE …

SCALE
1" = 40' HORIZ.
1" = 10' VERT.

APPROVED

CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING

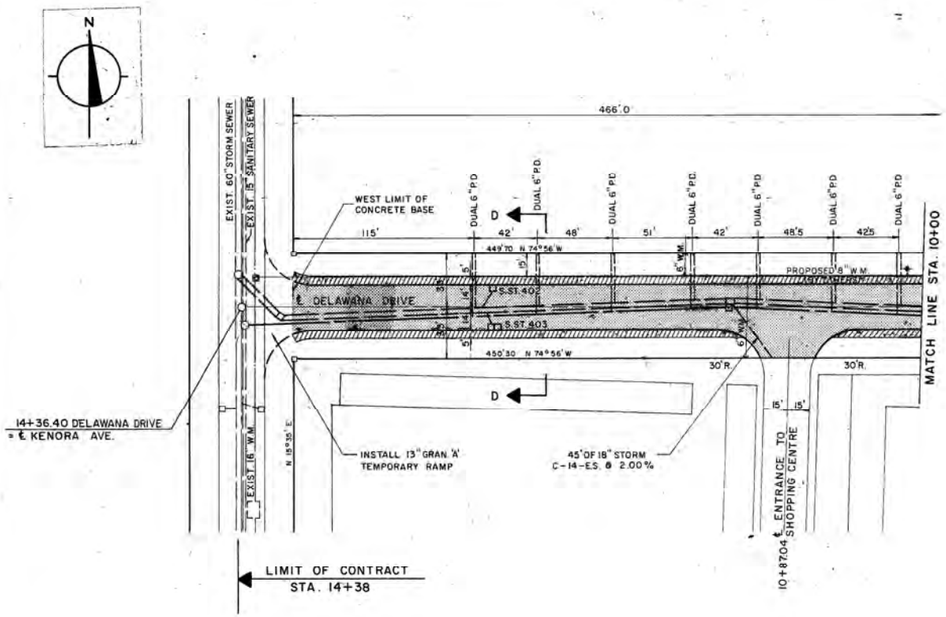
PROJECT No

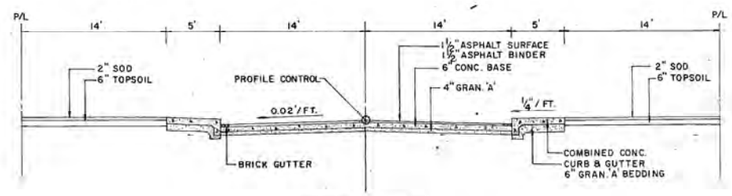
ACCOUNT No

… DRIVE — PLAN & PROFILE

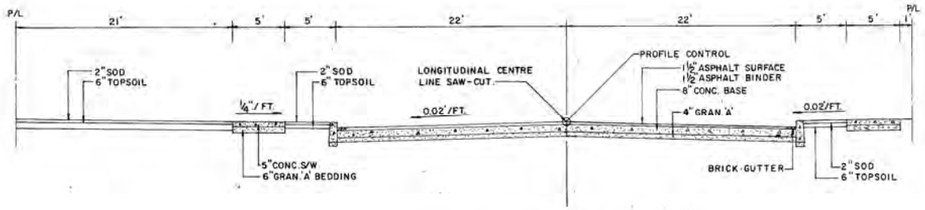
SHEET 3 OF 6

72-S-320



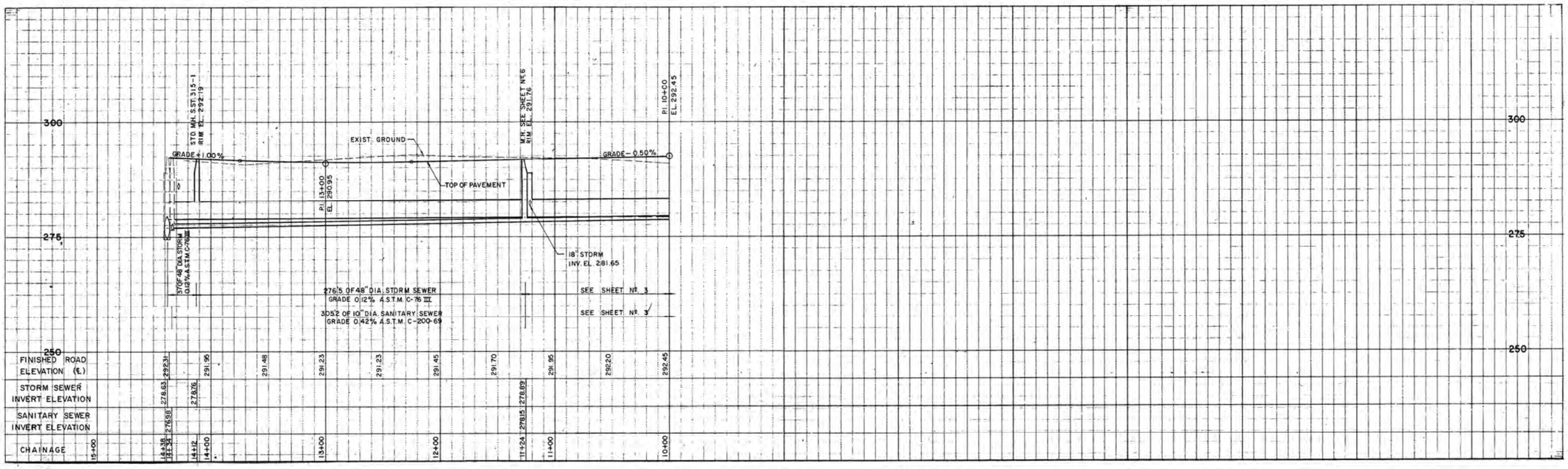


SECTION D-D



SECTION E-E

NOTE:
1. ALL C.B. LEADS TO BE 9" ϕ CLAY PIPE, C-200-69



Nº	DATE	REVISIONS	BY
	30/9/74	AS CONSTRUCTED	D.H.

W. J. McSHANE — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

C.C. PARKER AND ASSOCIATES LTD.
CONSULTING ENGINEERS
HAMILTON ONTARIO

CENTENNIAL SHOPPING CENTRE

DESIGN: W.J. McS.	DRAWN: D.C.H.	SCALE 1" = 40' HORIZ. 1" = 10' VERT.
CHECKED: W.J. McS.		
DATE: NOV. 1971		

DELAWANA DRIVE — PLAN & PROFILE

PLAN No. S.C. 100 SHEET 4 OF 6

APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

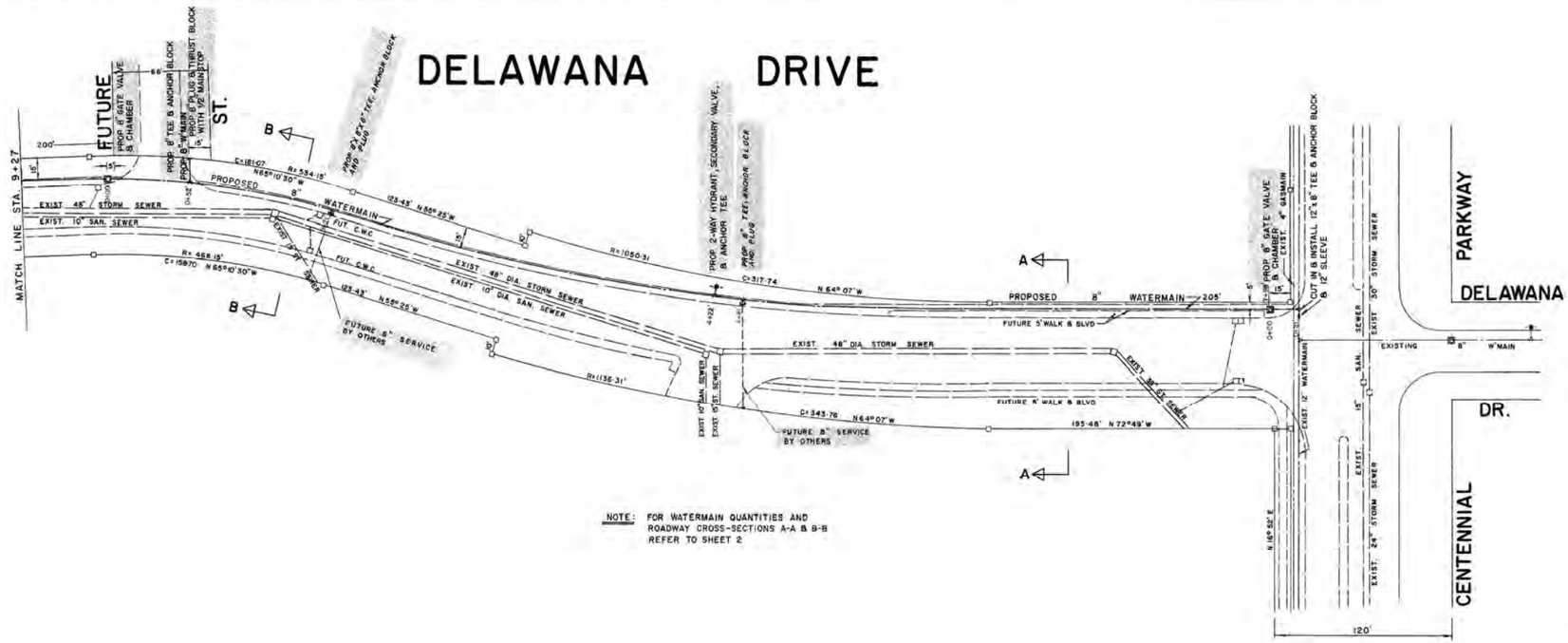
CITY OF HAMILTON
DEPARTMENT OF ENGINEERING

PROJECT No. ACCOUNT No.

13901 72-S-320

FORM S.P. 3

DELAWANA DRIVE



NOTE: FOR WATERMAIN QUANTITIES AND ROADWAY CROSS-SECTIONS A-A & B-B REFER TO SHEET 2

WATERMAIN QUANTITIES

SUPPLY AND INSTALL THE FOLLOWING

WATERMAIN PIPE TO A MIN. DEPTH OF " BELOW THE FUTURE ROAD GRADE OR GRADE SHOWN.

LIN. FT. OF 4" DIA. CEMENT LINED
LIN. FT. OF 6" DIA. CEMENT LINED PIPE
LIN. FT. OF 8" DIA. CEMENT LINED
LIN. FT. OF 12" DIA. CEMENT LINED
LIN. FT. OF DIA. CONCRETE PRESSURE PIPE.

INSTALL	DWG. No.
GATE VALVES AND CHAMBERS	W.S. 300
GATE VALVES AND CHAMBERS	

2 - WAY HYDRANTS WITH SECONDARY VALVES
2 - WAY HYDRANTS WITH SECONDARY VALVES
LIN. FT. OF 3/4" AND 1" WATER SERVICE PIPE FROM MAIN TO STREET LINE FOR APPROX. SERVICES.

REFERENCE DRAWINGS
WS 400

BEDDING AND BACKFILL REQUIREMENTS FOR WATERMAINS

(1) BEDDING MATERIAL SHALL BE
(2) BACKFILL MATERIAL SHALL BE GRANULAR "B"

REFER TO W.S. 500 OR W.S. 502

BEDDING AND BACKFILL MATERIALS

GRANULAR "A"
GRANULAR "B"
SELECTED EXCAVATED EARTH FROM TRENCH MECHANICALLY TAMPED IN 1'-0" LAYERS.

NOTE
ALL WATERMAIN VALVE CHAMBER COVERS TO BE SET " BELOW THE FUTURE ROAD GRADE.

FUTURE FINISHED & ROAD ELEVATIONS	292.45	292.20	291.95	291.70	291.45	291.70	291.95	292.20	292.45	292.70	292.95	293.00	292.75	292.50	292.25	292.00	291.75	291.78	292.05	292.36
CHAINAGE	9+27		8+27		7+27		6+27		5+27		4+27		3+27		2+27		1+27		0+27	0+00

CHAINAGE

NOTES • TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
• ALL ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
• CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

SCALE: 0 10 VERTICAL; 30 0 40 HORIZONTAL

REVISIONS:

UTILITIES:

REF. DWG'S.

SURVEY BY :
FIELD BOOKS :
DATE : MARCH 20TH 1972
BENCH MARK : CITY OF HAMILTON BENCH MARK NO. 69

DRAWN BY : R.L.G.
CHECKED BY :

ASST. DIRECTOR, ENGRG. DESIGN :
DIRECTOR, ENGRG. DESIGN :

APPROVED
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

PROJECT No. 1029-0003 ACCOUNT No.

DELAWANA DRIVE
FROM KENORA AVE. TO CENTENNIAL PARKWAY

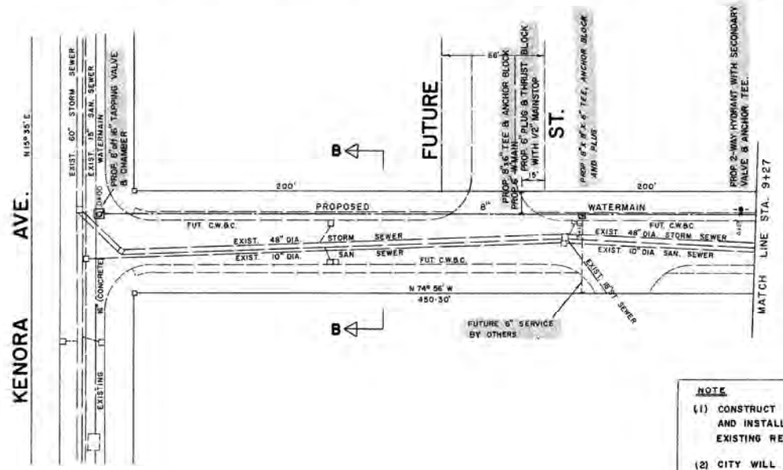
DRAWING No. 72-W-349 SHEET 1 OF 2

24636

FORM S-P-71

FORM S.P. 3

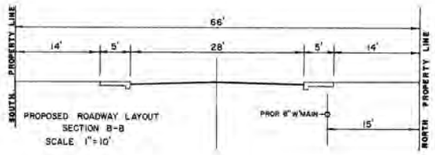
DELAWANA DRIVE

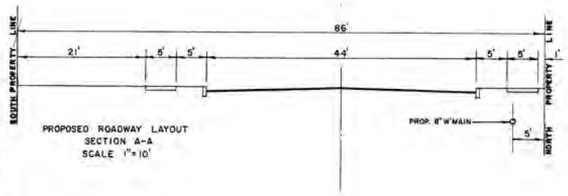


NOTE

(1) CONSTRUCT 8" TAPPING VALVE CONCRETE CHAMBER AND INSTALL PROPOSED 8" TAPPING VALVE OFF 16" DIA EXISTING REINFORCED CONCRETE PRESSURE PIPE WATERMAIN.

(2) CITY WILL SUPPLY SADDLE FOR 8" TAPPING VALVE OFF 16" CONCRETE PIPE AND 8" TAPPING VALVE WITH MECHANICAL JOINT END.





WATERMAIN QUANTITIES

SUPPLY AND INSTALL THE FOLLOWING

WATERMAIN PIPE TO A MIN. DEPTH OF 5'-0" BELOW THE FUTURE ROAD GRADE OR GRADE SHOWN.

LIN. FT. OF 4" DIA. CEMENT LINED
LIN. FT. OF 6" DIA. CEMENT LINED PIPE
1305 LIN. FT. OF 8" DIA. DUCTILE IRON PIPE
LIN. FT. OF 12" DIA. CEMENT LINED
LIN. FT. OF DIA. CONCRETE PRESSURE PIPE.

INSTALL		DWG. No.
2 — 8"	GATE VALVES AND CHAMBERS	W.S. 300
1 — 8"	GATE VALVES AND CHAMBERS TAPPING VALVE AND CHAMBERS	W.S. 301

3 - WAY HYDRANTS WITH SECONDARY VALVES
2 — 2 - WAY HYDRANTS WITH SECONDARY VALVES
LIN. FT. OF AND WATER SERVICE PIPE FROM MAIN TO STREET LINE FOR APPROX. SERVICES.

REFERENCE DRAWINGS
WS 400

BEDDING AND BACKFILL REQUIREMENTS FOR WATERMAINS

(1) BEDDING MATERIAL SHALL BE TYPE 2 GRANULAR "B"

(2) BACKFILL MATERIAL SHALL BE TYPE 2 GRANULAR "B"

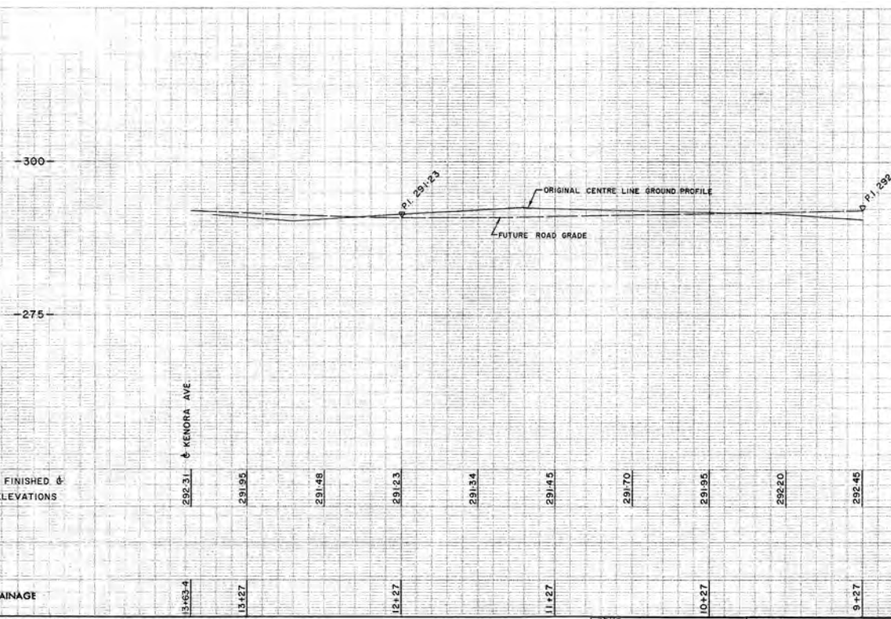
REFER TO W.S. 500

BEDDING AND BACKFILL MATERIALS

GRANULAR "A"
GRANULAR "B"
SELECTED EXCAVATED EARTH FROM TRENCH MECHANICALLY TAMPED IN 1'-0" LAYERS.

NOTE

1. ALL WATERMAIN VALVE CHAMBER COVERS TO BE SET AT THE FUTURE SIDEWALK LEVEL.
2. AT THE TIME OF CONSTRUCTION, THE CENTRE LINE ROAD ELEVATION WILL BE APPROXIMATELY 6" BELOW FUTURE ROAD GRADE SHOWN.



NOTES • TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
• ALL ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
• CITY INSPECTOR TO CHECK OFFICE COPY PRIOR TO CONSTRUCTION FOR DATA.

SCALE: 5 0 10 VERTICAL; 20 0 40 HORIZONTAL

REVISIONS:

UTILITIES:

REF. DWG'S:

SURVEY BY :
FIELD BOOKS :
DATE : MARCH 20TH 1972
BENCH MARK : CITY OF HAMILTON BENCH MARK Nº 69 ELEVATION 303.857
DRAWN BY : R.L.G.
CHECKED BY :

ASST. DIRECTOR, ENGRG. DESIGN.:
DIRECTOR, ENGRG. DESIGN:

APPROVED:
CITY ENGINEER AND MANAGER OF WATER WORKS

CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
DESIGN SECTION

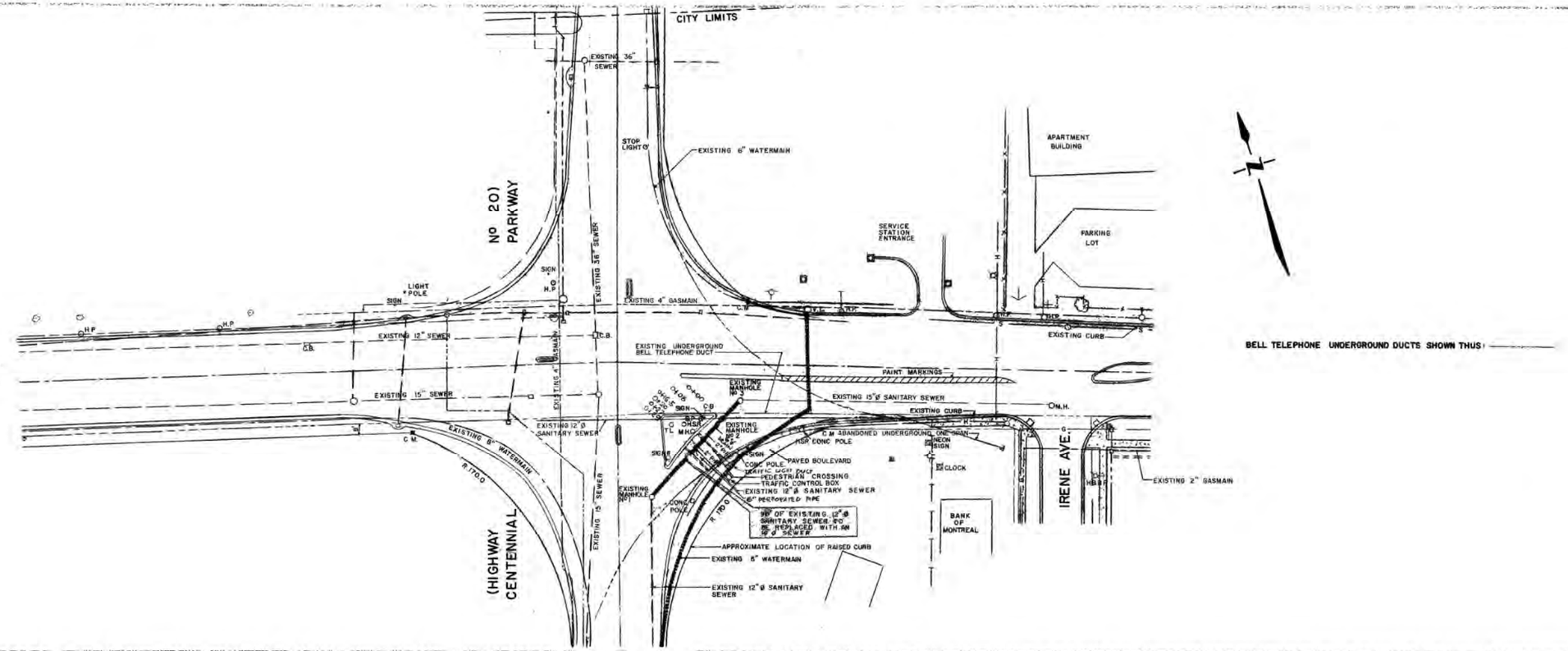
PROJECT No. 1029-0003 ACCOUNT No.

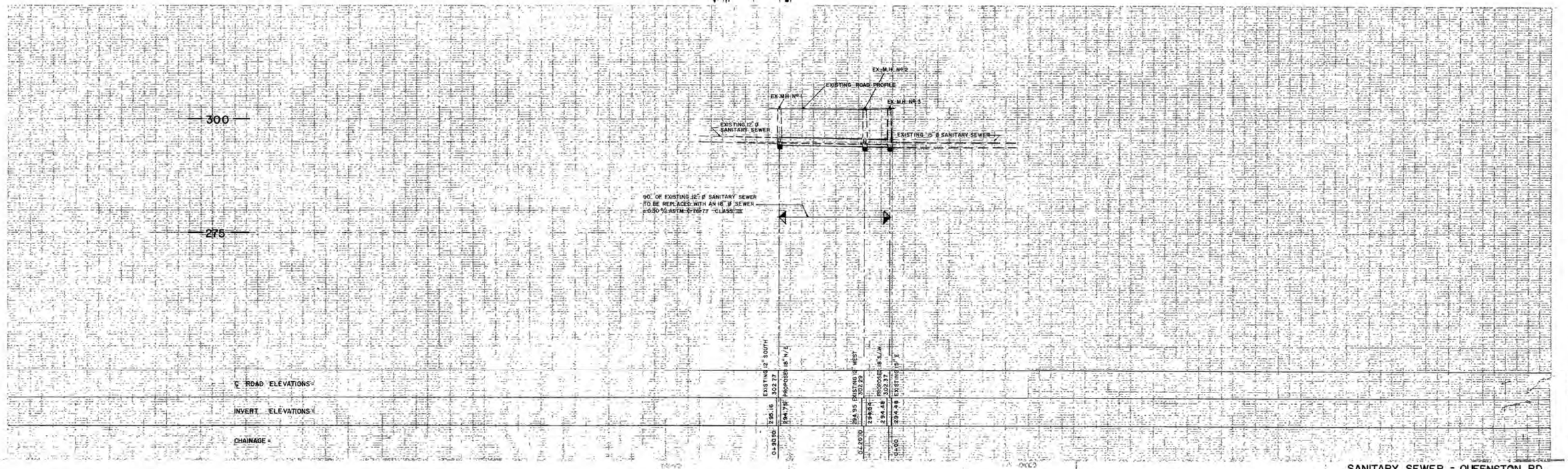
DELAWANA DRIVE
FROM KENORA AVE. TO CENTENNIAL PARKWAY

DRAWING No. 72-W-349 SHEET 2 OF 2

24637

FORM S.P. 3-71





1. "AS BUILT" INFORMATION 82-06-09 I H

INDEX No 9-03

DATE: 79 09 28

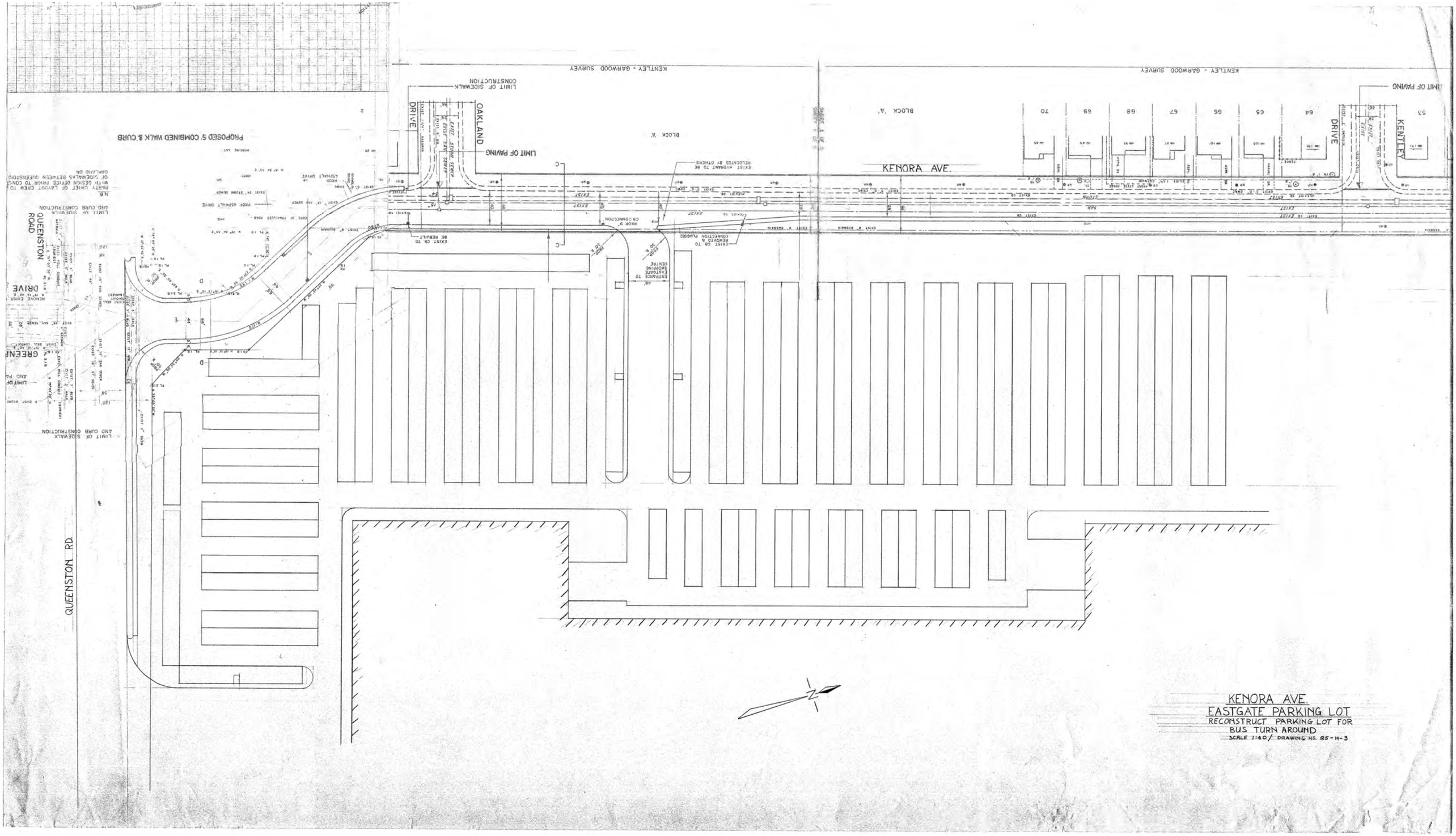
808-17

SANITARY SEWER - QUEENSTON RD & CENTENNIAL PKWY.

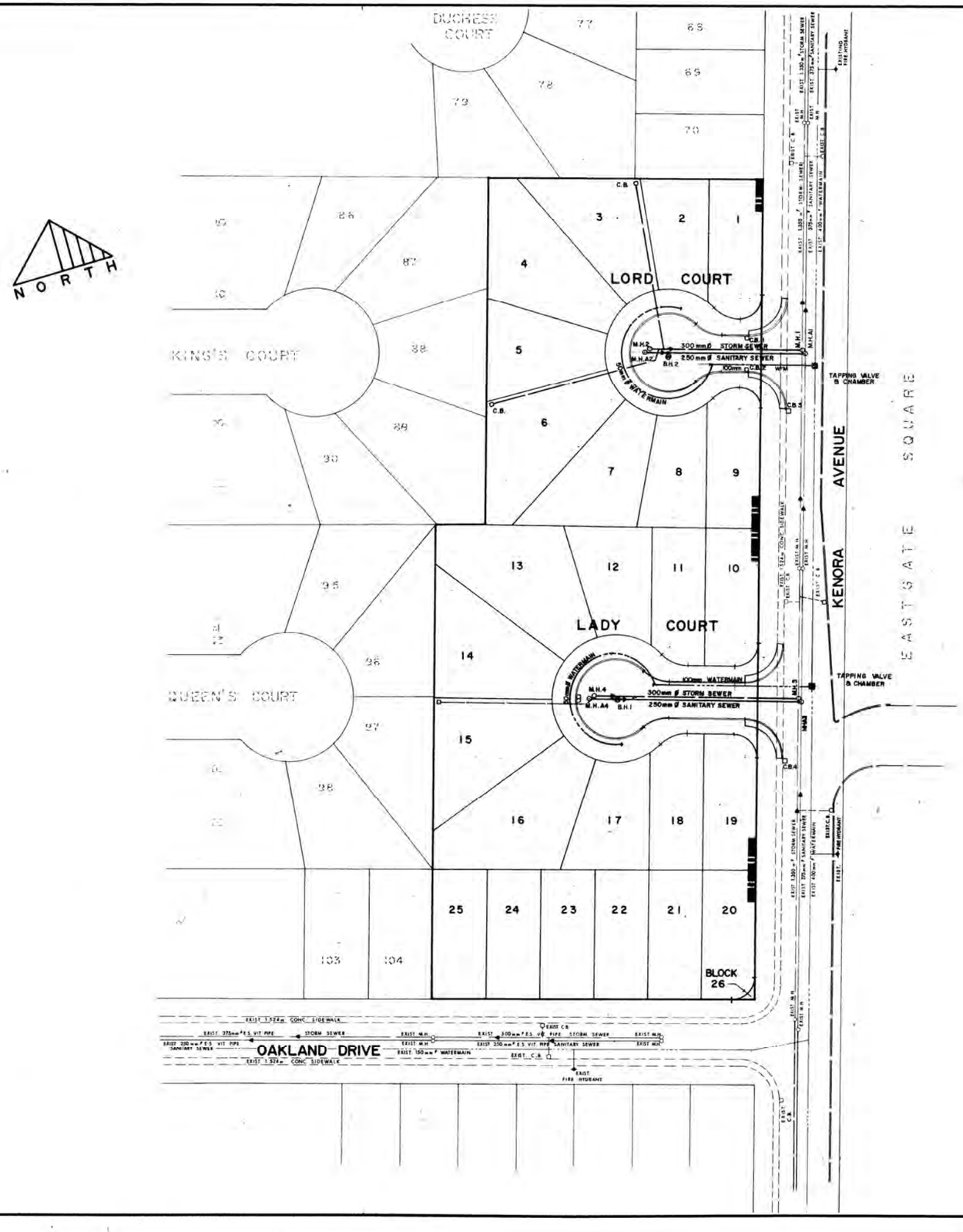
RECONSTRUCTION OF SANITARY SEWER

79-S-63

SHEET 1 OF 1

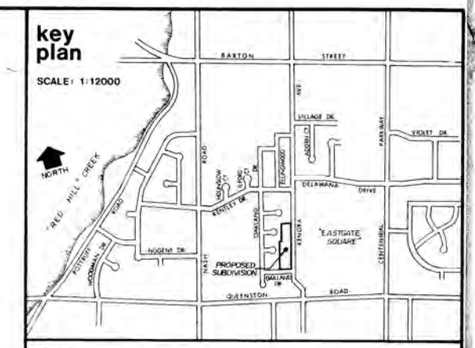


KENORA AVE.
EASTGATE PARKING LOT
RECONSTRUCT PARKING LOT FOR
BUS TURN AROUND
SCALE 1:40 / DRAWING NO. 85-H-3



key plan

SCALE: 1:12000



LEGEND

250 mm	- DENOTES PROPOSED 250mm ø SANITARY SEWER
300mm	- DENOTES PROPOSED 300mm ø STORM SEWER
150mm	- DENOTES PROPOSED 150mm ø WATERMAIN
G.V.	- DENOTES PROPOSED GATE VALVE
B.H. 1	- DENOTES BOREHOLE Nº
	- DENOTES PPROPOSED ACOUSTICAL WALL AS PER DLR CONSULTANTS Ltd.

LEGEND

SHEET Nº	DESCRIPTION
1	GENERAL PLAN OF SERVICES
2	PLAN AND PROFILE OF LORD COURT AND LADY COURT
3	PLAN AND PROFILE OF KENORA AVENUE
4	PLAN AND PROFILE OF OAKLAND DRIVE
5	LOT GRADING PLAN
6	DETAILS
7	SANITARY DRAINAGE AREAS
8	STORM DRAINAGE AREAS

APPROVALS

DATE

Commissioner of Engineering

DATE

BENCH MARK - HAMILTON BENCH MARK Nº 9-03
Midas Muffler Shop on the south-east corner of Queenston Road and Greenford Drive. Tablet set in the west wall, 0.23m north of the south-west corner of the building, 0.23m above walk.
ELEVATION = 93.982 m

SITE BENCH MARK
Road side arm of fire hydrant, located on the east side of Kenora Avenue, just north of Oakland Drive.
ELEVATION = 92.88m

DATE	DESCRIPTION
NOV. 24/92	AS CONSTRUCTED INFORMATION ADDED.
AUG. 4/87	C.B. ADDED - LOT 15

REVISIONS

PLAN SHOWING

GENERAL PLAN OF SERVICES

ON

GARWOOD ADDITION

IN THE

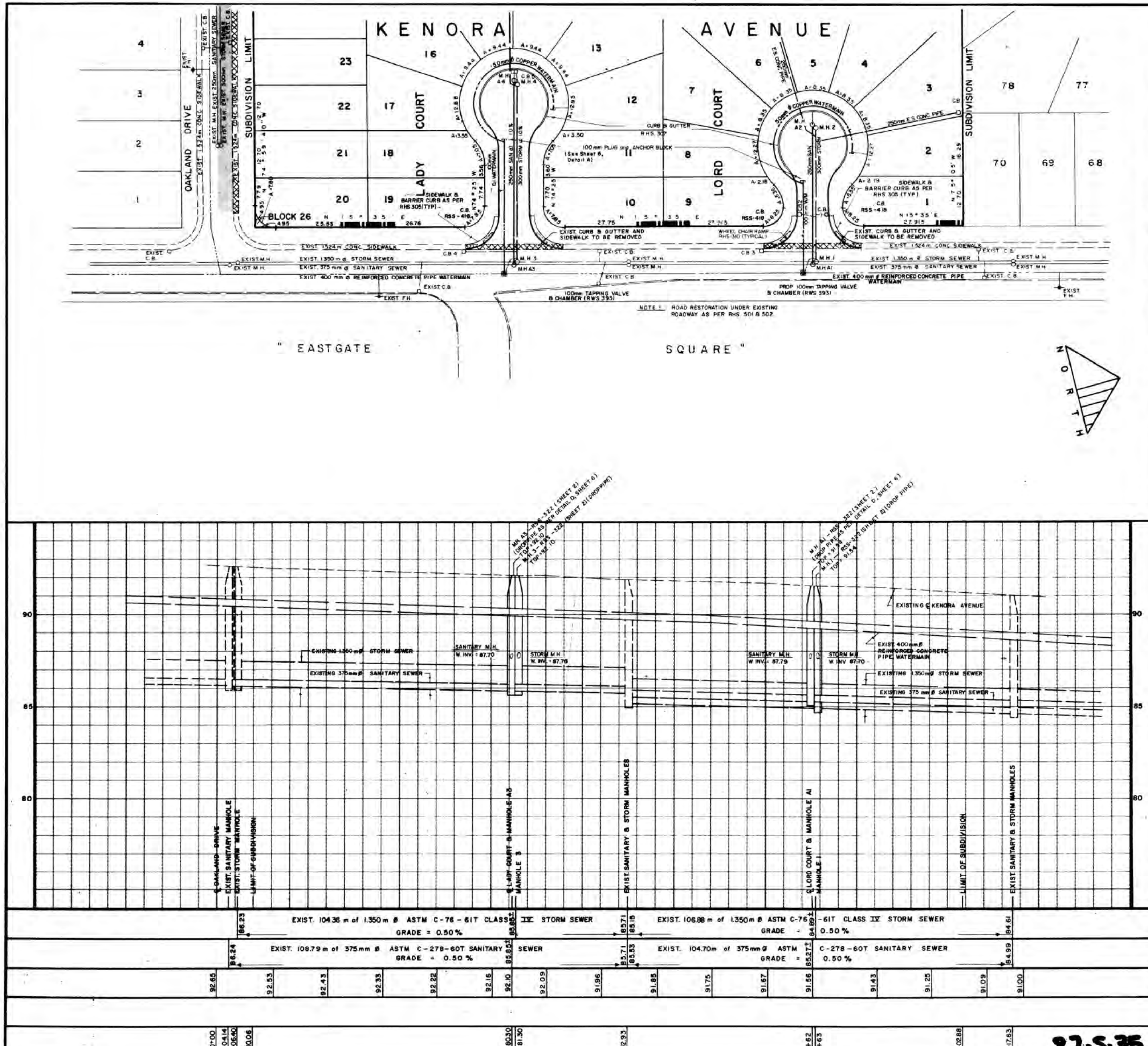
CITY OF HAMILTON

REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH

87·5·35

SCALE = 1:500	DRAWING NO. 85-383-1	DATE JUNE, 1986	FILE NO. 8558

ASHENHURST NOUWENS LIMITED
PROFESSIONAL ENGINEERS & ONTARIO LAND SURVEYORS
180 JAMES STREET SOUTH
HAMILTON, ONTARIO L8P 4V1
(416) 528-8316
(416) 529-4314
CONSULTATION OFFICE:
17TH STREET, BOX 315
JORDAN STATION, ONTARIO LOR 1S0
(416) 562-5023



KEY PLAN
Scale = 1:12000

NOTES

GENERAL

1. All construction to conform to Regional Municipality of Hamilton – Wentworth Standards, Books "A" and "B".
2. Tenderers shall satisfy themselves as to the nature of the ground and bid accordingly.
3. Contractor shall verify all locations of all utilities, including gasmains, watermains, television cables, hydro and telephone ducts, etc.
4. All underground concrete products are to be made with Type '50' Cement.
5. Any information pertaining to soils and all Borehole Logs, are furnished by the Engineer as a matter of general information only and Borehole descriptions or Logs are not to be interpreted as descriptive of conditions at locations other than those described by the boreholes themselves.

SEWERS AND PRIVATE DRAINS

1. Sewer bedding as per RSS-200 and RSS-201.
2. 'D' denotes Dual Private Drains (150mm ø E.S Concrete Class 3 Sanitary and Storm) located as per detail Dwg 85383-6 (unless otherwise shown), with min 2% Fall, 2.2m cover at Lot Line (measured from proposed ℄ Road elevation), and bedding as per RSS-205.
3. All manholes, catchbasins, etc., to be ramped after installation of HM5 Base Asphalt.
4. Reinforced Concrete Pipe – CSA A257.2 M1982, Cl 650, 1000, 1400
Concrete Pipe – CSA A257.1 – M1982, CLASS 3
All Concrete Pipe to be with Type '50' Cement and Rubber Gasket Joints with min 75mm – 15 MPa Concrete Encasement.

WATERMAINS AND WATERSERVICES

1. Watermains to be D.I.T.J. – Class 52, cement lined Pipe and Fittings with min 1.6m cover and Granular 'B' bedding, RWS-500-2, Hydrants and Secondary Valves as per RWS-604, Anchor Blocks as per RWS-400.
2. 'W' denotes 19mm dia. Type 'K', Soft Copper Waterservice (RWS-500-1), with Curb Stop adjacent to the streetline as per RWS-700, sheet 2 of 2 (Rev 84 08 13), located min. 2.0m from sewer service trench.

CERTIFICATE OF COMPLETION
THIS CERTIFIES ALL INFORMATION SHOWN ON THIS DRAWING IS AS CONSTRUCTED IN THE FIELD.
Nov. 24/92 — DATE
D. SENFT P. ENG.

AS CONSTRUCTED INFORMATION ADDED NOV. 23/92
REVISED AUG-4, 1987 - REAR LOT C.B. ADDED - LOT 15

APPROVALS

DATE:	DATE:
COMMISSIONER OF ENGINEERING	

GARWOOD ADDITION

IN THE
CITY OF HAMILTON
REGIONAL MUNICIPALITY OF HAMILTON – WENTWORTH

PLAN AND PROFILE OF: KENORA AVENUE
FROM: ℄ OF OAKLAND DRIVE
TO: NORTHERLY LIMIT OF SUBDIVISION

ASHENHURST NOUWENS LIMITED
PROFESSIONAL ENGINEERS & ONTARIO LAND SURVEYORS
180 JAMES STREET SOUTH
HAMILTON, ONTARIO L8P 4V1
(416) 529-6316
(416) 529-4314
CONSULTATION OFFICE:
17TH STREET, BOX 315
JORDAN STATION, ONTARIO L0R 1S0
(416) 562-5923

BENCH MARK: CITY OF HAMILTON INDEX Nº 9-03 – LOCATED AT THE MIDAS MUFFLER SHOP ELEVATION = 93.982 m

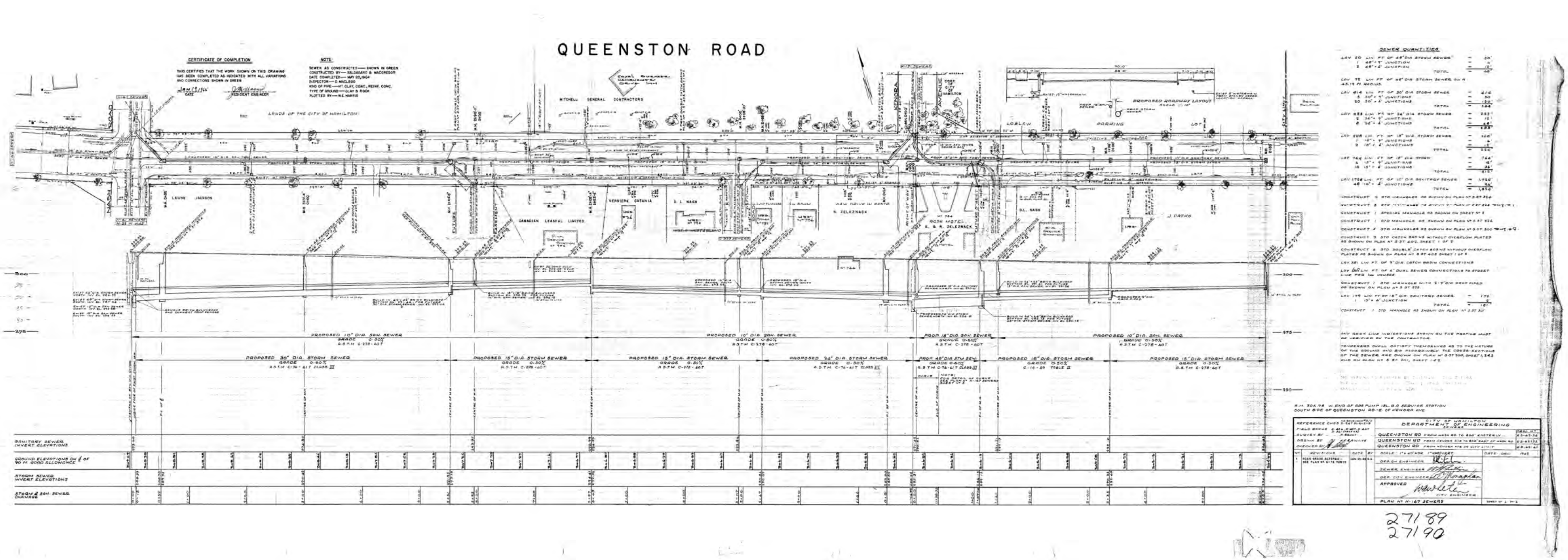
SITE BENCH MARK: ROAD SIDE ARM OF FIRE HYDRANT LOCATED ON EAST SIDE OF KENORA AVENUE, JUST NORTH OF OAKLAND DRIVE ELEVATION = 92.88m

SCALE: HORIZONTAL = 1:500 VERTICAL = 1:100

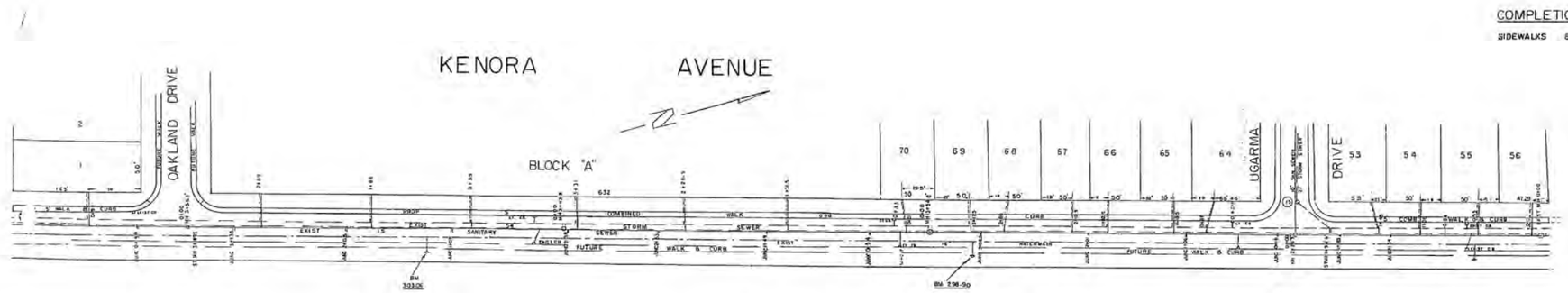
DATE: JUNE 1986

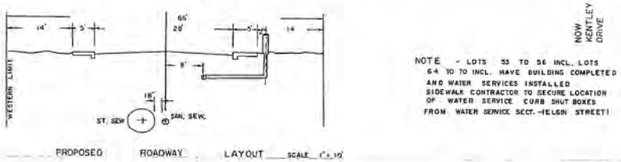
DWG. Nº - 85383AC SHEET 3 OF 8

87-S-35



QUEENSTON ROAD
CERTIFICATE OF COMPLETION
THIS CERTIFIES THAT THE WORK SHOWN ON THIS DRAWING HAS BEEN COMPLETED AS INDICATED WITH ALL VARIATIONS AND CORRECTIONS SHOWN IN GREEN
JAN 13, 1966
DATE
RESIDENT ENGINEER
NOTE
SEWER AS CONSTRUCTED — SHOWN IN GREEN
CONSTRUCTED BY — BALDASARO & MACGREGOR
DATE COMPLETED — MAY 20, 1964
INSPECTOR — D. MACLEOD
KIND OF PIPE — VIT. CLAY, CONC., REINF. CONC.
TYPE OF GROUND — CLAY & ROCK
PLOTTED BY — W.E. HARRIS
LANDS OF THE CITY OF HAMILTON
MITCHELL GENERAL CONTRACTORS
NASH ROAD
KENORA AVENUE
LOBLAW PARKING LOT
PROPOSED ROADWAY LAYOUT
CITY LIMIT
LEONE JACKSON
CANADIAN LEASEAL LIMITED
VERRIERE CATANIA
D.L. NASH
S. ZELEZNACK
ROSA MOTEL
D.L. NASH
J. PATKO
PROPOSED 10" DIA. SAN. SEWER
PROPOSED 15" DIA. SAN. SEWER
PROPOSED 30" DIA. STORM SEWER
PROPOSED 15" DIA. STORM SEWER
PROPOSED 24" DIA. STORM SEWER
PROP. 48" DIA. STM. SEWER
PROPOSED 18" DIA. STORM SEWER
SANITARY SEWER INVERT ELEVATIONS
GROUND ELEVATIONS ON ℄ OF 90 FT. ROAD ALLOWANCE
STORM SEWER INVERT ELEVATIONS
STORM & SAN. SEWER CHAINAGE
SEWER QUANTITIES
LAY 30 LIN. FT. OF 48" DIA. STORM SEWER = 30'
1 48" × 9" JUNCTION = 4'
3 48" × 4" JUNCTION = 12'
TOTAL = 46'
LAY 72 LIN. FT. OF 48" DIA. STORM SEWER ON A 43.19 FT. RADIUS
LAY 414 LIN. FT. OF 30" DIA. STORM SEWER = 414
5 30" × 9" JUNCTIONS = 30
30 30" × 4" JUNCTIONS = 120'
TOTAL = 564
LAY 223 LIN. FT. OF 24" DIA. STORM SEWER
LAY 208 LIN. FT. OF 18" DIA. STORM SEWER
LAY 744 LIN. FT. OF 15" DIA. STORM
LAY 1728 LIN. FT. OF 10" DIA. SANITARY SEWER
48 10" × 4" JUNCTIONS
CONSTRUCT 1 SPECIAL MANHOLE AS SHOWN ON SHEET No 3
CONSTRUCT 9 STD. CATCH BASINS WITHOUT OVERFLOW PLATES AS SHOWN ON PLAN No 3.ST.402, SHEET 1 OF 3
CONSTRUCT 6 STD. DOUBLE CATCH BASINS WITHOUT OVERFLOW PLATES AS SHOWN ON PLAN No 3.ST.403 SHEET 1 OF 3
LAY 381 LIN. FT. OF 9" DIA. CATCH BASIN CONNECTIONS
LAY LIN. FT. OF 4" DUAL SEWER CONNECTIONS TO STREET LINE FOR HOUSES
LAY 179 LIN. FT. OF 15" DIA. SANITARY SEWER = 179
1 15" × 4" JUNCTION
TOTAL = 181
ANY ROCK LINE INDICATIONS SHOWN ON THE PROFILE MUST BE VERIFIED BY THE CONTRACTOR.
TENDERERS SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY. THE CROSS-SECTIONS OF THE SEWER ARE SHOWN ON PLAN No 3.ST.300, SHEET 1, 2 & 3 AND ON PLAN No 3.ST.301, SHEET 1 & 2
B.M. 306.78 W. END OF GAS PUMP ISL. B.A. SERVICE STATION SOUTH SIDE OF QUEENSTON RD. E. OF KENORA AVE.
CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
SEWERS
QUEENSTON RD FROM NASH RD. TO 800' EASTERLY
QUEENSTON RD FROM KENORA AVE TO 800' EAST OF NASH RD.
QUEENSTON RD FROM KENORA AVE TO CITY LIMIT
REFERENCE DWGS
FIELD BOOKS
SURVEY BY
DRAWN BY
CHECKED BY
REVISIONS
1 ROAD GRADE ALTERED - SEE PLAN No G-78
DESIGN ENGINEER
SEWER ENGINEER
DEP. CITY ENGINEER
APPROVED
CITY ENGINEER
PLAN No H-167 SEWERS
27189
27190





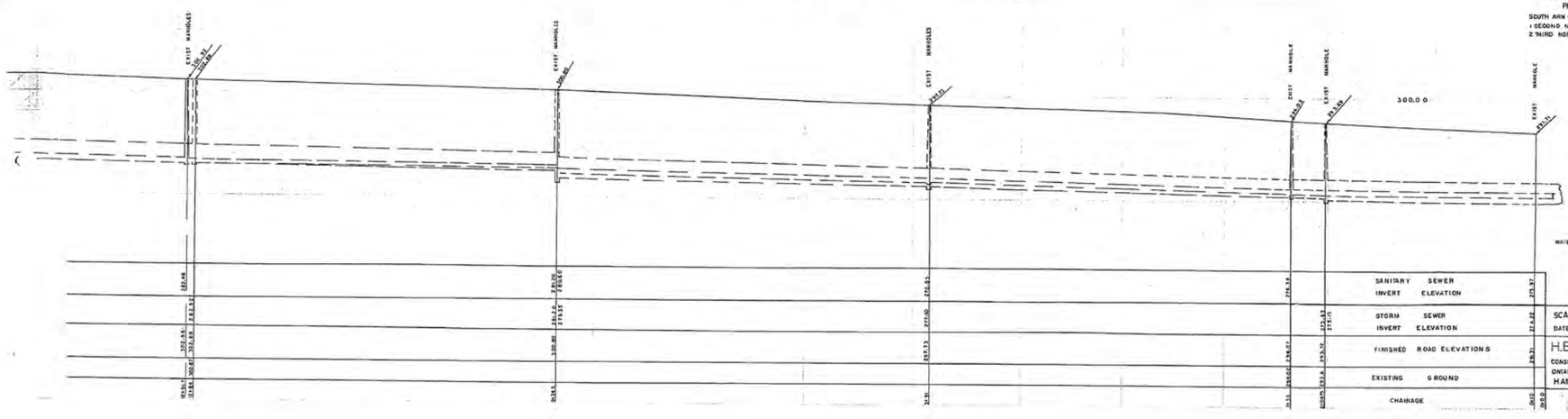
PROPOSED ROADWAY LAYOUT SCALE 1"=10'

NOW KENTLEY DRIVE

NOTE - LOTS 53 TO 56 INCL. LOTS 64 TO 70 INCL. HAVE BUILDING COMPLETED AND WATER SERVICES INSTALLED SIDEWALK CONTRACTOR TO SECURE LOCATION OF WATER SERVICE CURB SHUT BOXES FROM WATER SERVICE SECT.-HELGA STREET!

NOTE DUAL SEWER SERVICES TO BE INSTALLED TO STREET LINE FOR EACH LOT & BLOCK A LOCATED AS SHOWN. LOCATION FOR BLOCK A TO BE DETERMINED LATER

PROJECT BENCH MARKS
SOUTH ARM OF HYDRANTS ON KENORA
1 SECOND NORTH OF HWY 8 303.06
2 THIRD NORTH OF HWY 8 298.90



COMPLETIONS

SIDEWALKS & CURBS— CONTRACTOR, A. COPE & SONS LIMITED
COMPLETION DATE, NOVEMBER 23, 1966

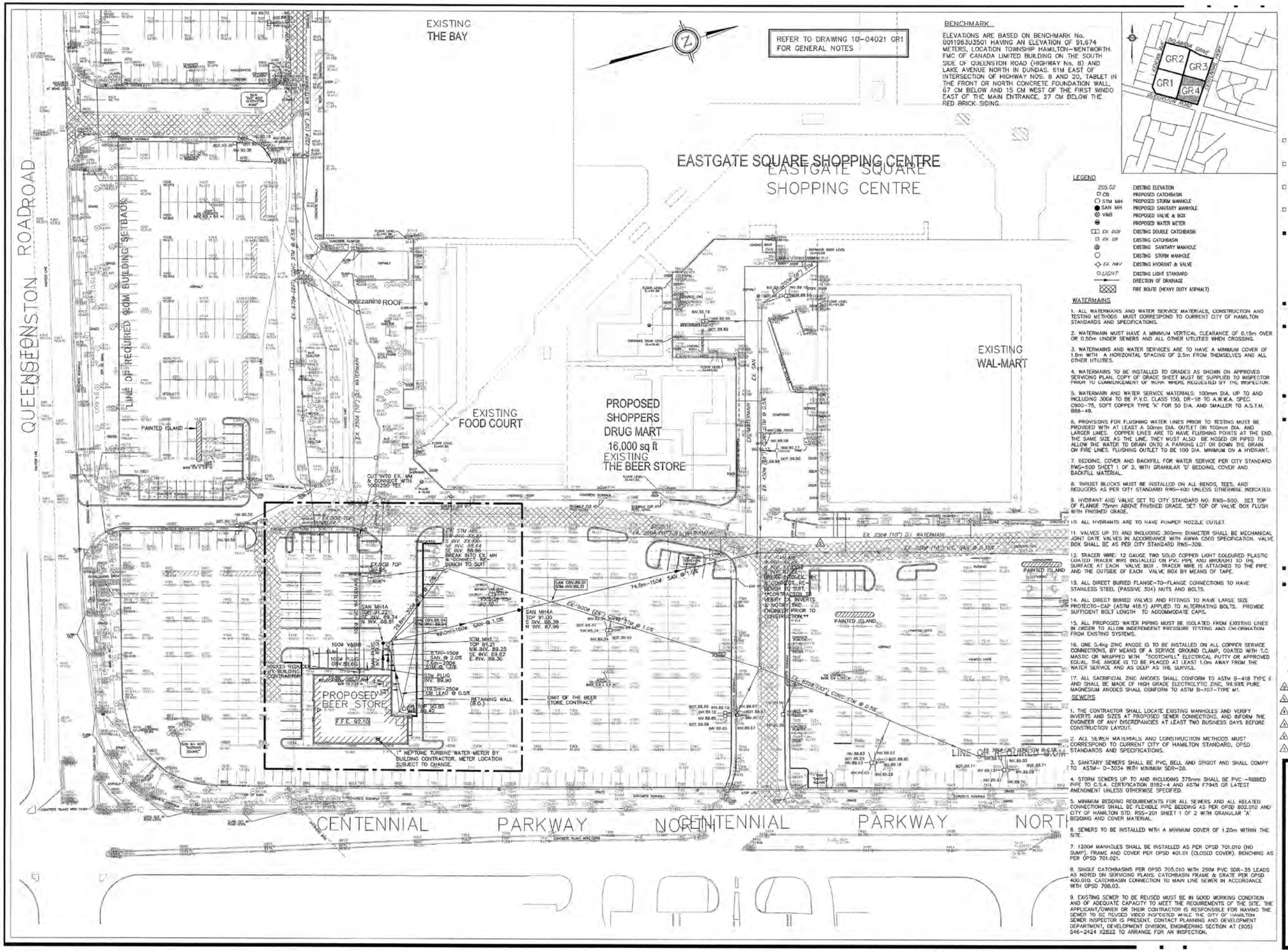
PLAN & PROFILE
SHOWING AS CONSTRUCTED
SIDEWALKS & CURBS
PRIVATE DRAINS
ON
KENORA AVENUE
FOR
KENTLEY-EASTGARWOOD SURVEY
A SUBDIVISION IN THE
CITY OF HAMILTON

WATERMAINS ADDED JULY 16 1968

SCALES HORIZ 1"= 40'
VERT 1"= 10'
DATE JULY 16 1968

H.B. ASHENHURST
CONSULTING PROFESSIONAL ENGINEER
ONTARIO LAND SURVEYOR
HAMILTO

ENGINEER'S SEAL



BENCHMARK

ELEVATIONS ARE BASED ON BENCHMARK No. 001196JU3501 HAVING AN ELEVATION OF 91.674 METERS, LOCATION TOWNSHIP HAMILTON-WENTWORTH. FMC OF CANADA LIMITED BUILDING ON THE SOUTH SIDE OF QUEENSTON ROAD (HIGHWAY No. 8) AND LAKE AVENUE NORTH IN DUNDAS. 61M EAST OF INTERSECTION OF HIGHWAY NOS. 8 AND 20, TABLET IN THE FRONT OR NORTH CONCRETE FOUNDATION WALL, 67 CM BELOW AND 15 CM WEST OF THE FIRST WINDO EAST OF THE MAIN ENTRANCE, 27 CM BELOW THE RED BRICK SIDING.

LEGEND

205.02	EXISTING ELEVATION
CB	PROPOSED CATCHBASIN
STM MH	PROPOSED STORM MANHOLE
SAN MH	PROPOSED SANITARY MANHOLE
VMB	PROPOSED VALVE & BOX
	PROPOSED WATER METER
EX DCB	EXISTING DOUBLE CATCHBASIN
EX CB	EXISTING CATCHBASIN
	EXISTING SANITARY MANHOLE
	EXISTING STORM MANHOLE
EX HYD	EXISTING HYDRANT & VALVE
LIGHT	EXISTING LIGHT STANDARD
	DIRECTION OF DRAINAGE
	FIRE ROUTE (HEAVY DUTY ASPHALT)

WATERMAINS

1. ALL WATERMAINS AND WATER SERVICE MATERIALS, CONSTRUCTION AND TESTING METHODS MUST CORRESPOND TO CURRENT CITY OF HAMILTON STANDARDS AND SPECIFICATIONS.

2. WATERMAIN MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.15m OVER OR 0.50m UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.

3. WATERMAINS AND WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.8m WITH A HORIZONTAL SPACING OF 2.5m FROM THEMSELVES AND ALL OTHER UTILITIES.

4. WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SERVICING PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCMENT OF WORK WHERE REQUESTED BY THE INSPECTOR.

5. WATERMAIN AND WATER SERVICE MATERIALS: 100mm DIA. UP TO AND INCLUDING 300Ø TO BE P.V.C. CLASS 150, DR-18 TO A.W.W.A. SPEC. C900-75, SOFT COPPER TYPE 'K' FOR 50 DIA. AND SMALLER TO A.S.T.M. B88-49.

6. PROVISIONS FOR FLUSHING WATER LINES PRIOR TO TESTING MUST BE PROVIDED WITH AT LEAST A 50mm DIA. OUTLET ON 100mm DIA. AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END. THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT OR DOWN THE DRAIN. ON FIRE LINES. FLUSHING OUTLET TO BE 100 DIA. MINIMUM ON A HYDRANT.

7. BEDDING, COVER AND BACKFILL FOR WATER SERVICE PER CITY STANDARD RWS-500 SHEET 1 OF 2, WITH GRANULAR 'D' BEDDING, COVER AND BACKFILL MATERIAL.

8. THRUST BLOCKS MUST BE INSTALLED ON ALL BENDS, TEES, AND REDUCERS AS PER CITY STANDARD RWS-400 UNLESS OTHERWISE INDICATED.

9. HYDRANT AND VALVE SET TO CITY STANDARD NO. RWS-500. SET TOP OF FLANGE 75mm ABOVE FINISHED GRADE. SET TOP OF VALVE BOX FLUSH WITH FINISHED GRADE.

10. ALL HYDRANTS ARE TO HAVE PUMPER NOZZLE OUTLET.

11. VALVES UP TO AND INCLUDING 300mm DIAMETER SHALL BE MECHANICAL JOINT GATE VALVES IN ACCORDANCE WITH AWWA C500 SPECIFICATION. VALVE BOX SHALL BE AS PER CITY STANDARD RWS-309.

12. TRACER WIRE: 12 GAUGE TWO SOLID COPPER LIGHT COLOURED PLASTIC COATED TRACER WIRE INSTALLED ON PVC PIPE AND BROUGHT TO THE SURFACE AT EACH VALVE BOX - TRACER WIRE IS ATTACHED TO THE PIPE AND THE OUTSIDE OF EACH VALVE BOX BY MEANS OF TAPE.

13. ALL DIRECT BURIED FLANGE-TO-FLANGE CONNECTIONS TO HAVE STAINLESS STEEL (PASSIVE 304) NUTS AND BOLTS.

14. ALL DIRECT BURIED VALVES AND FITTINGS TO HAVE LARGE SIZE PROTECTO-CAP (ASTM 416.1) APPLIED TO ALTERNATING BOLTS. PROVIDE SUFFICIENT BOLT LENGTH TO ACCOMMODATE CAPS.

15. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATION FROM EXISTING SYSTEMS.

16. ONE 5.4kg ZINC ANODE IS TO BE INSTALLED ON ALL COPPER SERVICE CONNECTIONS, BY MEANS OF A SERVICE GROUND CLAMP, COATED WITH T.C. MASTIC OR WRAPPED WITH "SCOTCHFILL" ELECTRICAL PUTTY OR APPROVED EQUAL. THE ANODE IS TO BE PLACED AT LEAST 1.0m AWAY FROM THE WATER SERVICE AND AS DEEP AS THE SERVICE.

17. ALL SACRIFICIAL ZINC ANODES SHALL CONFORM TO ASTM B-418 TYPE II AND SHALL BE MADE OF HIGH GRADE ELECTROLYTIC ZINC, 99.99% PURE. MAGNESIUM ANODES SHALL CONFORM TO ASTM B-107-TYPE M1.

SEWERS

1. THE CONTRACTOR SHALL LOCATE EXISTING MANHOLES AND VERIFY INVERTS AND SIZES AT PROPOSED SEWER CONNECTIONS, AND INFORM THE ENGINEER OF ANY DISCREPANCIES AT LEAST TWO BUSINESS DAYS BEFORE CONSTRUCTION LAYOUT.

2. ALL SEWER MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO CURRENT CITY OF HAMILTON STANDARD, OPSD STANDARDS AND SPECIFICATIONS.

3. SANITARY SEWERS SHALL BE PVC, BELL AND SPIGOT AND SHALL COMPLY TO ASTM- D-3034 WITH MINIMUM SDR-28.

4. STORM SEWERS UP TO AND INCLUDING 375mm SHALL BE PVC -RIBBED PIPE TO C.S.A. CERTIFICATION B182-4 AND ASTM F7945 OR LATEST AMENDMENT UNLESS OTHERWISE SPECIFIED.

5. MINIMUM BEDDING REQUIREMENTS FOR ALL SEWERS AND ALL RELATED CONNECTIONS SHALL BE FLEXIBLE PIPE BEDDING AS PER OPSD 802.010 AND CITY OF HAMILTON STD. RSS-201 SHEET 1 OF 2 WITH GRANULAR 'A' BEDDING AND COVER MATERIAL.

6. SEWERS TO BE INSTALLED WITH A MINIMUM COVER OF 1.20m WITHIN THE SITE.

7. 1200Ø MANHOLES SHALL BE INSTALLED AS PER OPSD 701.010 (NO SUMP). FRAME AND COVER PER OPSD 401.01 (CLOSED COVER). BENCHING AS PER OPSD 701.021.

8. SINGLE CATCHBASINS PER OPSD 705.010 WITH 250Ø PVC SDR-35 LEADS AS NOTED ON SERVICING PLANS. CATCHBASIN FRAME & GRATE PER OPSD 400.010. CATCHBASIN CONNECTION TO MAIN LINE SEWER IN ACCORDANCE WITH OPSD 708.03.

9. EXISTING SEWER TO BE REUSED MUST BE IN GOOD WORKING CONDITION AND OF ADEQUATE CAPACITY TO MEET THE REQUIREMENTS OF THE SITE. THE APPLICANT/OWNER OR THEIR CONTRACTOR IS RESPONSIBLE FOR HAVING THE SEWER TO BE REUSED VIDEO INSPECTED WHILE THE CITY OF HAMILTON SEWER INSPECTOR IS PRESENT. CONTACT PLANNING AND DEVELOPMENT DEPARTMENT, DEVELOPMENT DIVISION, ENGINEERING SECTION AT (905) 546-2424 X2822 TO ARRANGE FOR AN INSPECTION.

Marshall Macklin Monaghan
PROJECT MANAGERS ENGINEERS SURVEYORS PLANNERS
80 Commerce Valley Dr. East
Thornhill, Ont. L3T 7N4
Tel (905) 882-1100
Fax (905) 882-0055
www.mmm.ca

construction north

REDCLIFF
REALTY MANAGEMENT INC.

LSP_2958_1

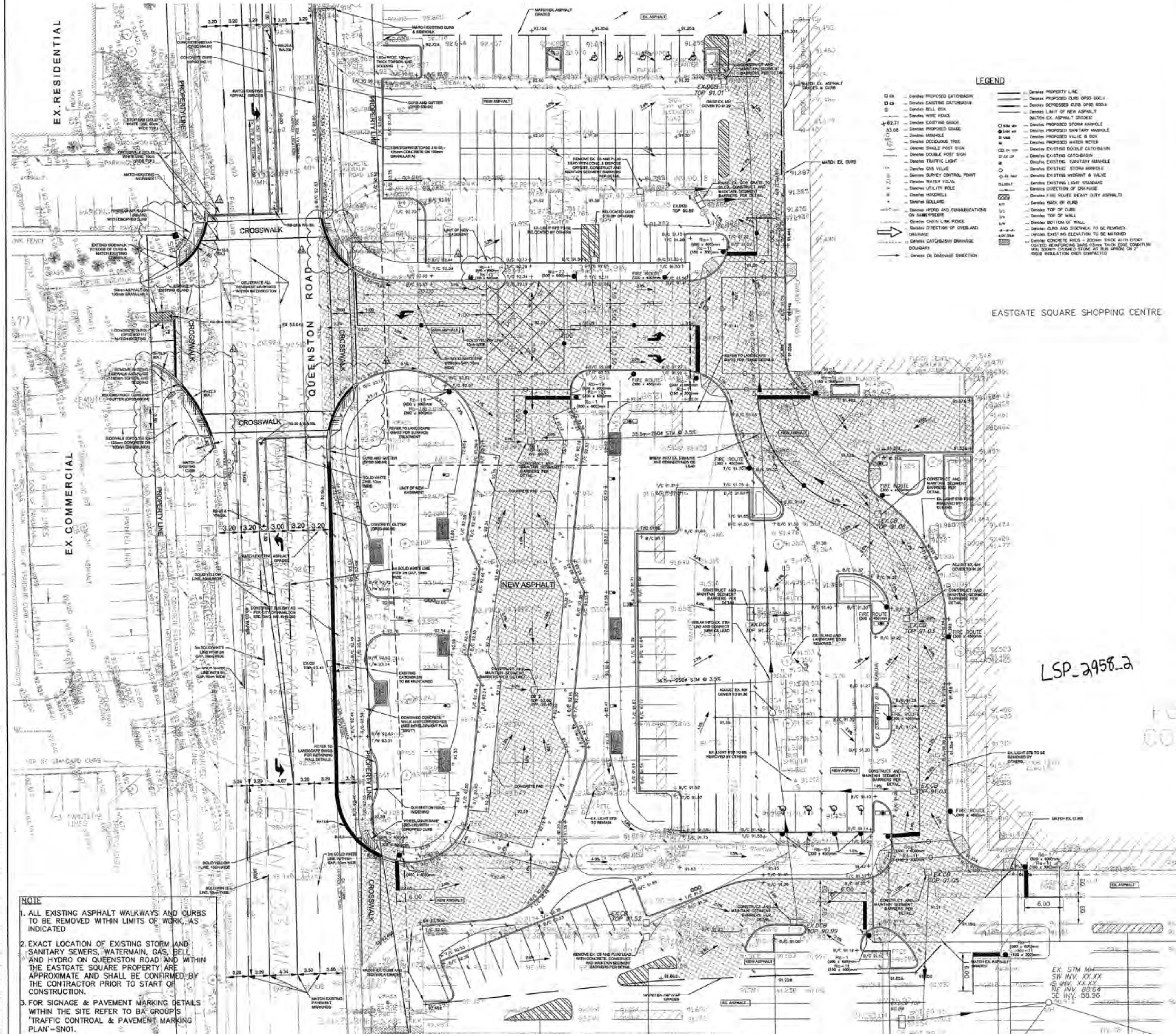
7	REVISED WATERMAIN & SEWER NOTES	28 JUNE 05
6	REVISED SANITARY SEWER	4 OCT. 04
5	REVISED PER CITY COMMENTS	25 AUG. 04
4	RE-ISSUED FOR SITE PLAN APPROVAL	12 JULY 04
3	ISSUED FOR TENDER	09 JULY 04
2	ISSUED FOR SITE PLAN APPROVAL	11 MAY 04

project
redevelopment of existing mall for:
REDCLIFF REALTY GROUP CORP.
EASTGATE SQUARE SHOPPING CENTRE
Centennial Pkwy. & Queenston Rd.
Stoney Creek

SITE SERVICING PLAN

(SHEET 4 OF 4)

drawn by	10/12CAD
checked	JS
date	MAY,2004
issued date	-
scale	1:500
project number	10-04021-SS4



NOTE

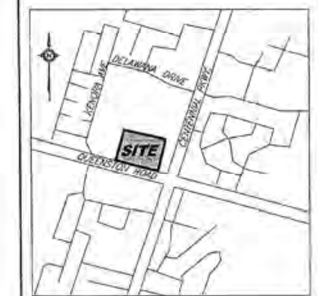
1. ALL EXISTING ASPHALT WALKWAYS AND CURBS TO BE REMOVED WITHIN LIMITS OF WORK, AS INDICATED
2. EXACT LOCATION OF EXISTING STORM AND SANITARY SEWERS, WATERMAIN, GAS, BELL AND HYDRO ON QUEENSTON ROAD AND WITHIN THE EASTGATE SQUARE PROPERTY ARE APPROXIMATE AND SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO START OF CONSTRUCTION.
3. FOR SIGNAGE & PAVEMENT MARKING DETAILS WITHIN THE SITE REFER TO BA GROUP'S 'TRAFFIC CONTROAL & PAVEMENT MARKING PLAN'-SN01.

FILE NAME: K:\10-04021\2007 Transit Terminal\04021SSG1.dwg_SSG1 PRINTED ON: Tuesday 08/07/2007

REVISIONS

NO.	DESCRIPTION	DATE	CHECKED
10	REV'D S/W RAMPS AT NEW INTERSECTION & REV'D SIGNAGE	AUG 8/07	JS
9	REV'D S/W RAMPS AT NEW INTERSECTION & REV'D PAV'T MARKING GRID AND SIGNAGE AT PROP'D TERMINAL EXIT	JUL 26/07	JS
8	REVISED CURB ON QUEENSTON & PAVE'T MARKINGS ADDED	JUL 24/07	JS
7	REVISED SIDEWALK GRADES	JUL 16/07	JS
6	ISSUED FOR CONSTRUCTION	JUL 10/07	JS
5	REVISED PER CURB LAYOUT	JUN 21/07	JS
4	REVISED PER CITY COMMENTS	JUN 1/07	JS
3	ISSUED FOR TENDER	MAR 9/07	JS
2	ISSUED FOR APPROVAL	FEB 20/07	JS
1	PRELIMINARILY ISSUED	JAN 26/07	JS

ISSUED FOR



K.E. SHERIDAN 100069180 — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DRAWN BY 10/12 CAD	SCALE 1:200
CHECKED BY AES/JS	DATE 07.01.15
PRINTED	FILE 04021

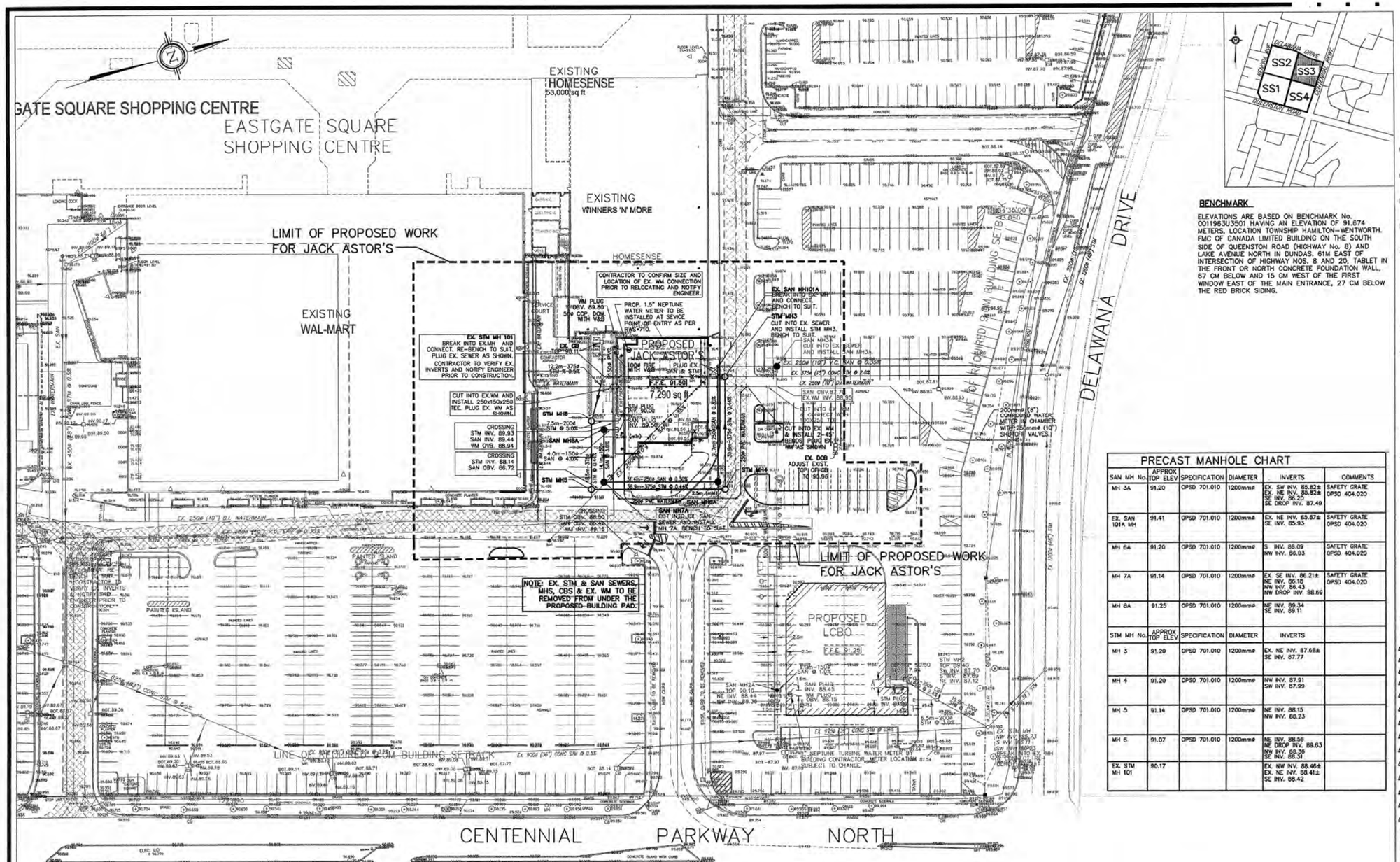
Eastgate Square
Stoney Creek, Ontario
TRANSIT TERMINAL

REDCLIFF
REALTY MANAGEMENT INC.

DRAWING TITLE:
SITE SERVICING AND GRADING
EASTGATE SQUARE – NEW TRANSIT TERMINAL
75 CENTENNIAL ROAD NORTH

MMM GROUP

DRAWING NO. SSG1



BENCHMARK

ELEVATIONS ARE BASED ON BENCHMARK No. DD1198JU3501 HAVING AN ELEVATION OF 91.674 METERS, LOCATION TOWNSHIP HAMILTON-WENTWORTH. FMC OF CANADA LIMITED BUILDING ON THE SOUTH SIDE OF QUEENSTON ROAD (HIGHWAY No. 8) AND LAKE AVENUE NORTH IN DUNDAS. 61M EAST OF INTERSECTION OF HIGHWAY NOS. 8 AND 20. TABLET IN THE FRONT OR NORTH CONCRETE FOUNDATION WALL, 67 CM BELOW AND 15 CM WEST OF THE FIRST WINDOW EAST OF THE MAIN ENTRANCE, 27 CM BELOW THE RED BRICK SIDING.

PRECAST MANHOLE CHART

SAN MH No.	APPROX TOP ELEV	SPECIFICATION	DIAMETER	INVERTS	COMMENTS
MH 3A	91.20	OPSD 701.010	1200mmø	EX. SW INV. 85.82± EX. NE INV. 85.82± SE INV. 86.20 SE DROP INV. 87.49	SAFETY GRATE OPSD 404.020
EX. SAN 101A MH	91.41	OPSD 701.010	1200mmø	EX. NE INV. 85.87± SE INV. 85.93	SAFETY GRATE OPSD 404.020
MH 6A	91.20	OPSD 701.010	1200mmø	S INV. 86.09 NW INV. 86.03	SAFETY GRATE OPSD 404.020
MH 7A	91.14	OPSD 701.010	1200mmø	EX. SE INV. 86.21± NE INV. 86.18 NW INV. 86.43 NW DROP INV. 86.69	SAFETY GRATE OPSD 404.020
MH 8A	91.25	OPSD 701.010	1200mmø	NE INV. 89.34 SE INV. 89.11	
STM MH No.	APPROX TOP ELEV	SPECIFICATION	DIAMETER	INVERTS	
MH 3	91.20	OPSD 701.010	1200mmø	EX. NE INV. 87.68± SE INV. 87.77	
MH 4	91.20	OPSD 701.010	1200mmø	NW INV. 87.91 SW INV. 87.99	
MH 5	91.14	OPSD 701.010	1200mmø	NE INV. 88.15 NW INV. 88.23	
MH 6	91.07	OPSD 701.010	1200mmø	NE INV. 88.58 NE DROP INV. 89.63 NW INV. 88.36 SE INV. 88.31	
EX. STM MH 101	90.17			EX. NW INV. 88.46± EX. NE INV. 88.41± SE INV. 88.42	

LSP-2958-3

REFER TO DRAWING NOS. 10-04021 GR1 & SS4 FOR GENERAL & SERVICING NOTES.

Marshall Macklin Monaghan
PROJECT MANAGERS ENGINEERS · SURVEYORS PLANNERS
80 Commerce Valley Dr. East
Thornhill, Ont. L3T 7N4
Tel (905) 882-1100
Fax (905) 882-0055
www.mmm.ca

construction north

REDCLIFF
REALTY MANAGEMENT INC.

J. SFRAMELI — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

A.E. SHERIDAN 100059189 — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

REVISED PER CITY COMMENTS	20 SEPT 06
REVISED PER CITY COMMENTS	18 SEPT 06
REVISED PER CITY COMMENTS	13 SEPT 06
REVISED PER CITY COMMENTS	24 AUG 06
ISSUED FOR SERVICING PERMIT	14 JULY 06
SERVICES FOR JACK ASTORS ADDED	23 JUN 06
REVISED LCBO SERVICE CONNECTIONS	31 JAN 06
REVISED LCBO WATER SERVICE CONNECTION	16 NOV 05
LCBO WATER METER ADDED	28 JUNE 05
REVISED LCBO SITE PLAN & SERVICES	14 FEB 05
ISSUED FOR CITY'S APPROVAL	25 AUG 04
REVISED LCBO SANITARY&STORM CONNECTIONS	20 AUG 04
ISSUED FOR TENDER	09 JULY 04
ISSUED FOR SITE PLAN APPROVAL	11 MAY 04

project
redevelopment of existing mall for: REDCLIFF REALTY GROUP CORP.
EASTGATE SQUARE SHOPPING CENTRE
Centennial Pkwy. & Queenston Rd. Stoney Creek

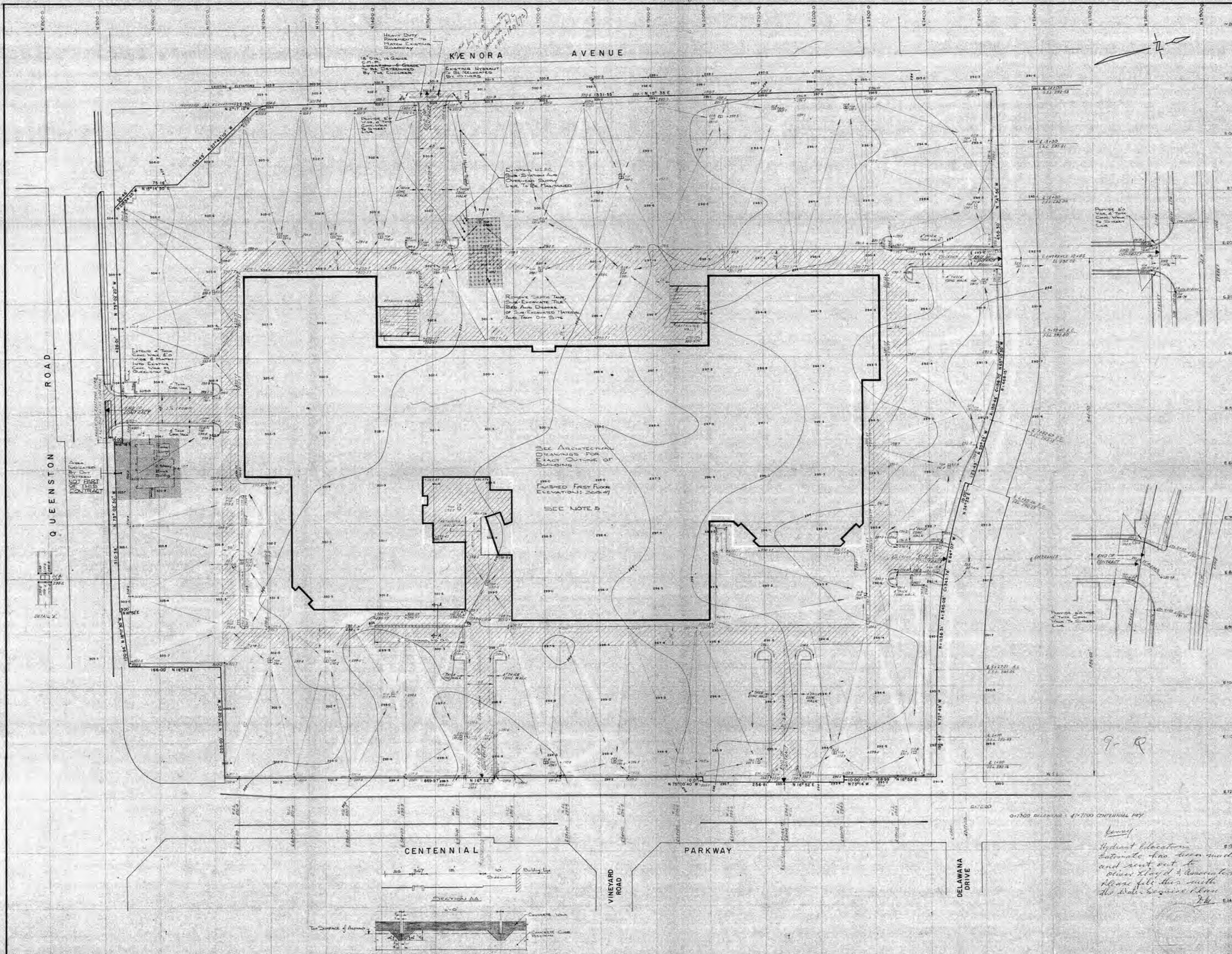
75 CENTENNIAL ROAD NORTH

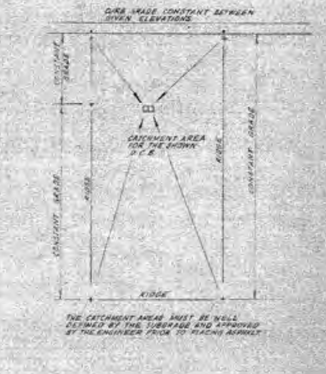
SITE SERVICING PLAN JACK ASTOR'S

(SHEET 3 OF 4)

drawn by	10/12CAD
checked	JS
date	MAY,2004
issued date	-
scale	1:500
project number	10-04021-SS3

K:\10-04021\Servicing\04021SS3.dwg SS3 Sep 20, 2006 - 2:51pm





THE CATCHMENT AREAS MUST BE WELL DEFINED BY THE SUBGRADE AND APPROVED BY THE ENGINEER PRIOR TO PLACING ASPHALT.

LEGEND

- • TOP OF CURB
- • TOP OF ASPHALT
- —— CURB
- ☐ C.B. SINGLE CATCHBASIN
- ☐☐ D.C.B. DOUBLE "
- ——> DRAINAGE FLOW
- 291.8 EXISTING GRADES
- —292— EXISTING CONTOURS
- HEAVY DUTY PAVING.

NOTES:

1. CONTRACTOR TO MAINTAIN CLOSE LIAISON WITH C.C. PARKER AND/OR THE CONTRACTOR CONSTRUCTING DELAWANA DRIVE AND CENTENNIAL PKWY. TO ENSURE COMPATIBLE ROAD AND CURB GRADES.
2. SEE DRWG. 04 FOR DETAILS OF CURBS, PARKING LOT, HEAVY DUTY PAVING AND 4" THICK CONCRETE WALKS.
3. Demolition of Existing Buildings on Site To Existing Ground Level, To Be Done By Others. Removal And Disposition Off-Site of All Foundation Walls, Basement Walls, Footings, And Basement Floor Slabs Is To Be INCLUDED As Part of This Contract.
4. All Water, Sanitary And Storm Sewer Connections To Existing Buildings On Site Are To Be Disconnected And Plugged To The Satisfaction Of The Authority Having Jurisdiction.
5. The Contractor Should Be Aware That The Area Under The Proposed Building Has Been Partially Brought To Grade Under A Previous Contract. The Extent of The Grading Is Shown On Dwg. Nº 7131 By Oliver Lloyd And Associates Ltd. For The Purpose of Site Grading ONLY. This Area Is EXCLUDED From This Contract For All Other Purposes. This Area Is INCLUDED In This Contract.

GEODETIC BENCH MARK No. 65-4-133.
"BUSY 'B' DISCOUNT FOOD STORE, TABLET IN EAST CONCRETE FOUNDATION WALL, 3 FEET FROM N.E. CORNER, 6" BELOW BRICK, ELEVATION 303.86."

NO.	REVISIONS MARK VOID ALL COPIES PREVIOUS TO FINAL DATE	DATE	BY

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

OLIVER LLOYD AND ASSOCIATES LIMITED
CONSULTING ENGINEERS
170 DONWAY WEST DON MILLS, ONTARIO
TELEPHONE 447-6401

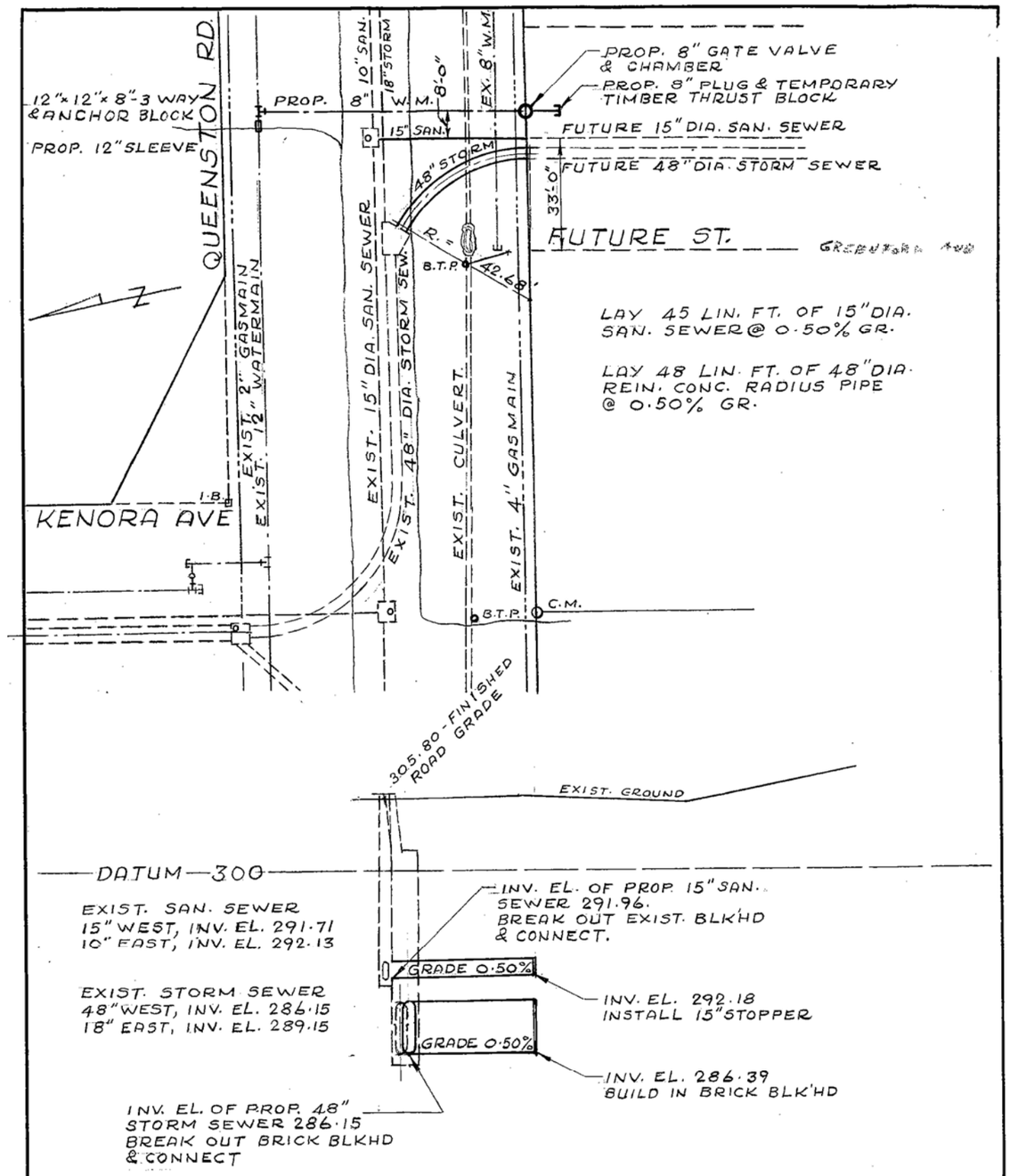
SCALE: 1" = 60'-0"

SITE SERVICES
GRADING

PETROFF & JERUZALSKI ARCHITECTS
491 LAWRENCE AVE. WEST TORONTO 787-4256

DRAWN BY	B. B.		E. 7131
CHECKED BY	DLB		
DATE	FEBRUARY, 1972	DWG. NO.	03
ISSUED			

LSP_1529



CITY OF HAMILTON
DEPARTMENT OF ENGINEERING

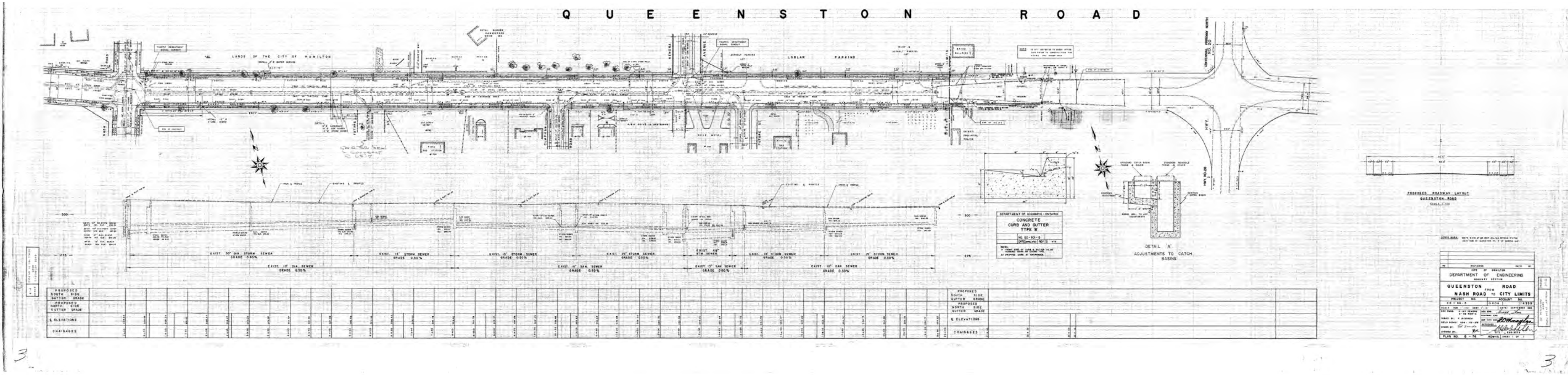
SEWER ENG'R

SEWER & WATERMAIN STUBS ON QUEENSTON RD. AT GLENN AVE.

REVISIONS	DATE	SCALE	APPROVED
	APRIL 8, 1964	HOR. 1" = 40' VERT. 1" = 10"	

PLAN No Q-47 SEWERS

03610


QUEENSTON ROAD
LANDS OF THE CITY OF HAMILTON
TRAFFIC DEPARTMENT SIGNAL CONDUIT
ROYAL BURGER HAMBURGER DRIVE INN
NASH ROAD
CLAPHAM ROAD
KENORA AVENUE
LOBLAW PARKING
ASPHALT PARKING LOT
FUTURE ST.
ROSE MOTEL
A & W DRIVE IN RESTAURANT
FINA GAS STATION
BRICK BUILDING
ONTARIO PROVINCIAL POLICE
CITY LIMITS
CENTENNIAL PARKWAY NORTH NO. 20
HWY. NO. 20
EXIST. 30" DIA. STORM SEWER GRADE 0.60%
EXIST. 10" DIA. SEWER GRADE 0.50%
EXIST. 12" STORM SEWER GRADE 0.50%
EXIST. 10" STORM SEWER GRADE 0.50%
EXIST. 10" SAN. SEWER GRADE 0.50%
EXIST. 24" STORM SEWER GRADE 0.50%
EXIST. 48" STM. SEWER
EXIST. 12" SAN. SEWER GRADE 0.60%
EXIST. 18" STORM SEWER GRADE 0.50%
EXIST. 15" STORM SEWER GRADE 0.50%
EXIST. 10" SAN. SEWER GRADE 0.30%
PROPOSED SOUTH SIDE GUTTER GRADE
PROPOSED NORTH SIDE GUTTER GRADE
℄ ELEVATIONS
CHAINAGES
DEPARTMENT OF HIGHWAYS - ONTARIO
CONCRETE CURB AND GUTTER TYPE 'B'
NO. 20-601-9
DETAIL 'A'
ADJUSTMENTS TO CATCH BASINS
STANDARD CATCH BASIN FRAME & COVER
STANDARD MANHOLE FRAME & COVER
PROPOSED ROADWAY LAYOUT
QUEENSTON ROAD
CITY OF HAMILTON
DEPARTMENT OF ENGINEERING
ROADWAY SECTION
QUEENSTON ROAD FROM NASH ROAD TO CITY LIMITS
PROJECT NO. ER - 64 - 3
ACCOUNT NO. 0406 14359
PLAN NO. G - 76 RDWYS.
3

Dye Test Report

PUD22-064

75 Centennial Parkway North, Hamilton

April 2023

Lithos
Professional Engineering Services

Lithos Group Inc.
150 Bermondsey Road, Unit 200
Toronto, Ontario, M4A 1Y1

T: 416-750-7769
E: info@lithosgroup.ca
www.LithosGroup.ca

Professional Engineers
Ontario

Lithos

Site Investigation and Dye Test Report

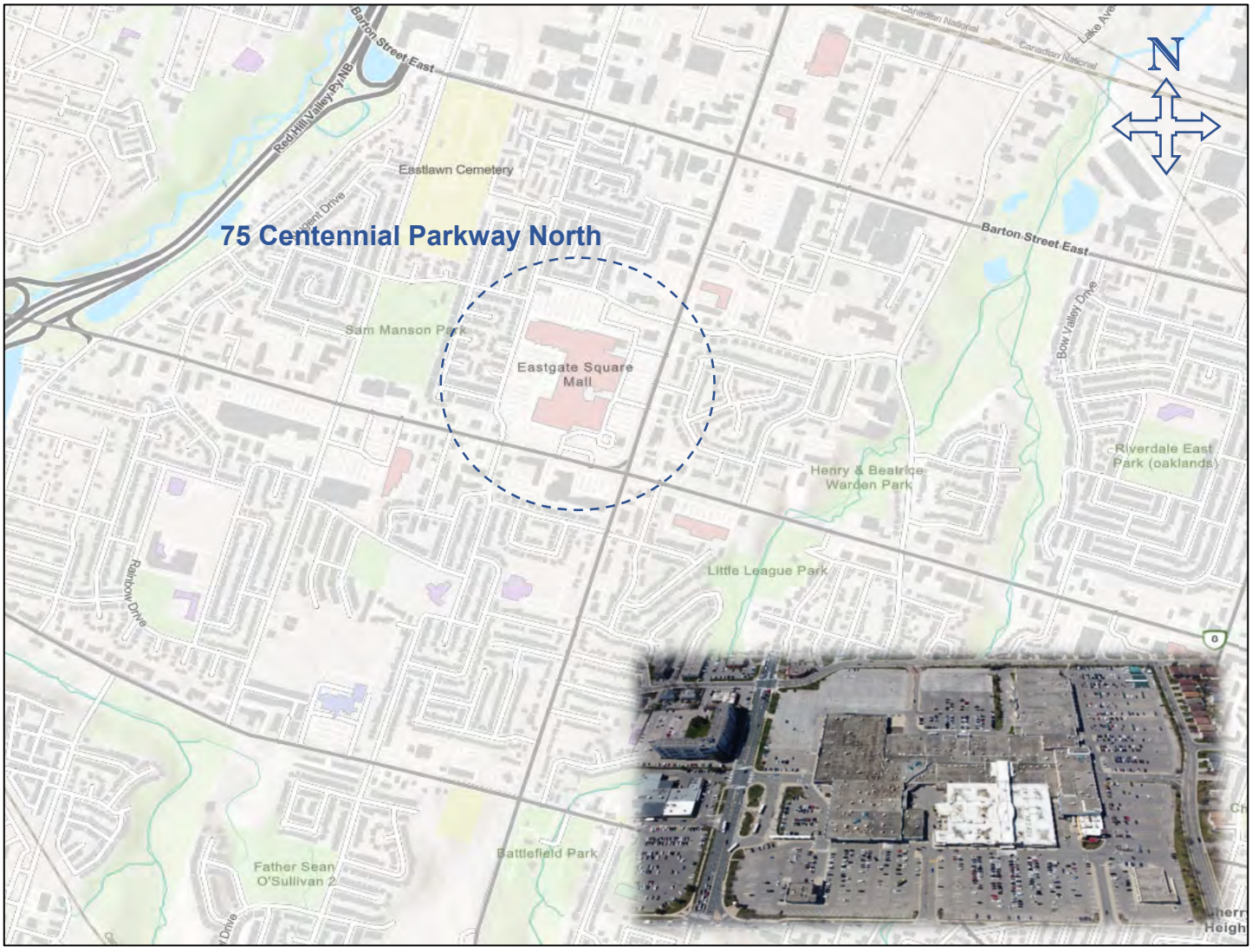
General Information	
Date: **April 14, 2023**	Report No. : **R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality: **Ontario/ City of Hamilton**

Attendants			
	Name	Title	Contact Info.
Lithos Inspector	**Panagiotis Varsos**	**Senior Inspector**	**437-215-1144**
Lithos Inspector	**Alma Loshe**	**Project Inspector**	**647-901-3495**
Lithos Inspector	**Pradeep Oleti**	**Construction Inspector**	**905-609-3435**

Weather Condition			
☑ Sunny	☐ Cold	☐ Light Rain	☐ Windy
☐ Partly Cloudy	☐ Cool	☐ Heavy Rain	☐ Fogy
☐ Overcast	☐ Warm	☐ Light Snow	
Temprature : **30°C**	☑ Hot	☐ Heavy Snow	

Existing Facilities at Project/Site
Currently the site is occupied by a commercial shopping mall, LCBO Store and Beer Store

Site Location



Site Investigation and Dye Test Report

General Information	
Date: **April 14, 2023**	Report No. **: R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality**: Ontario/ City of Hamilton**

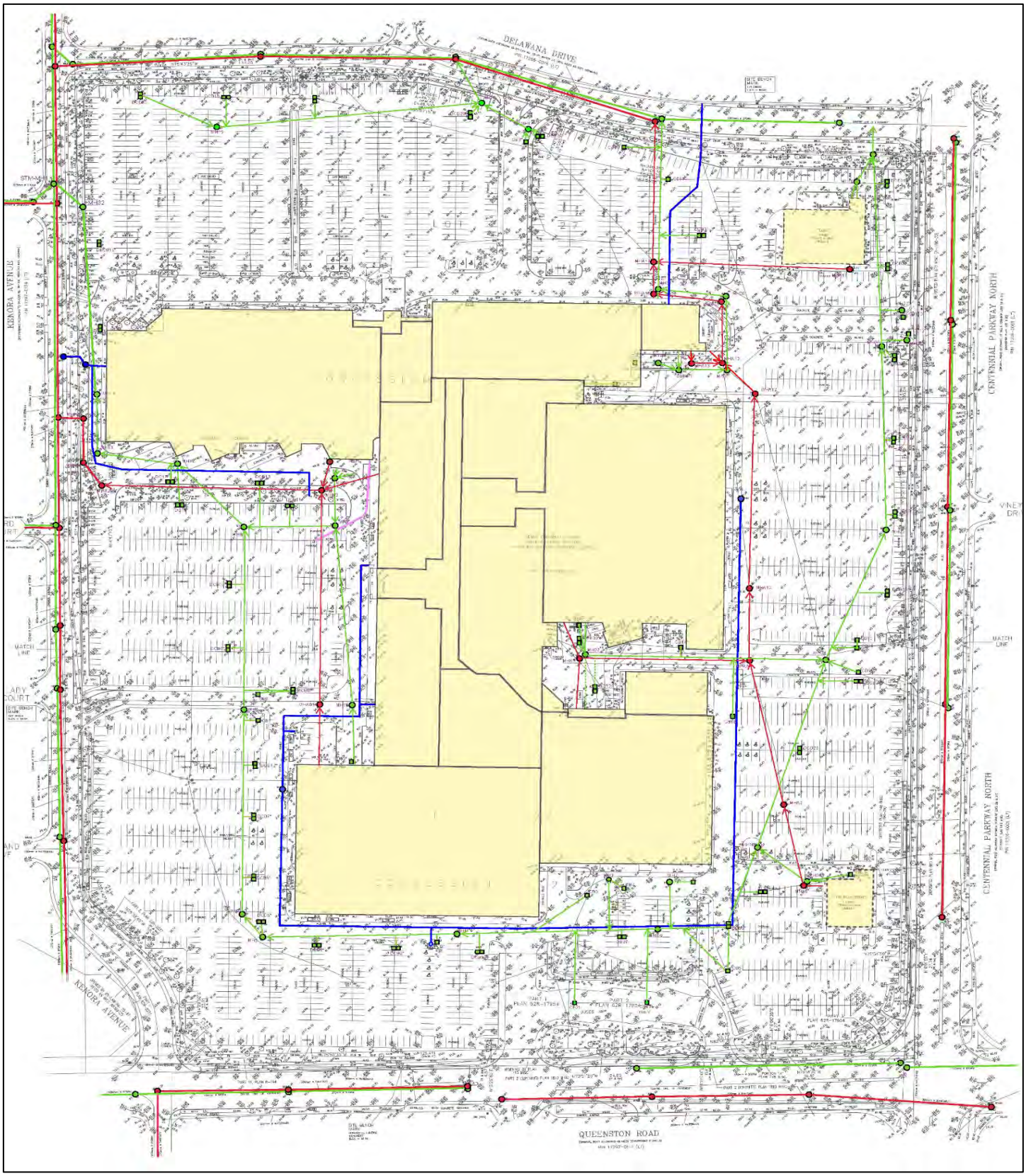
Summary of Findings

1. All Storm runoff within the rooftop of Areas A, is conveyed into the existing 1350mmØ Concrete Storm Sewer, along Kenora Ave.

2. All Sanitary discharge from existing building at area A, is conveyed into the existing 370mmØ Concrete Sanitary Sewer, along Kenora Ave.

General Information	
Date: **April 14, 2023**	Report No. **: R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality**: Ontario/ City of Hamilton**

Investigation Details



General Information	
Date: **April 14, 2023**	Report No. **: R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
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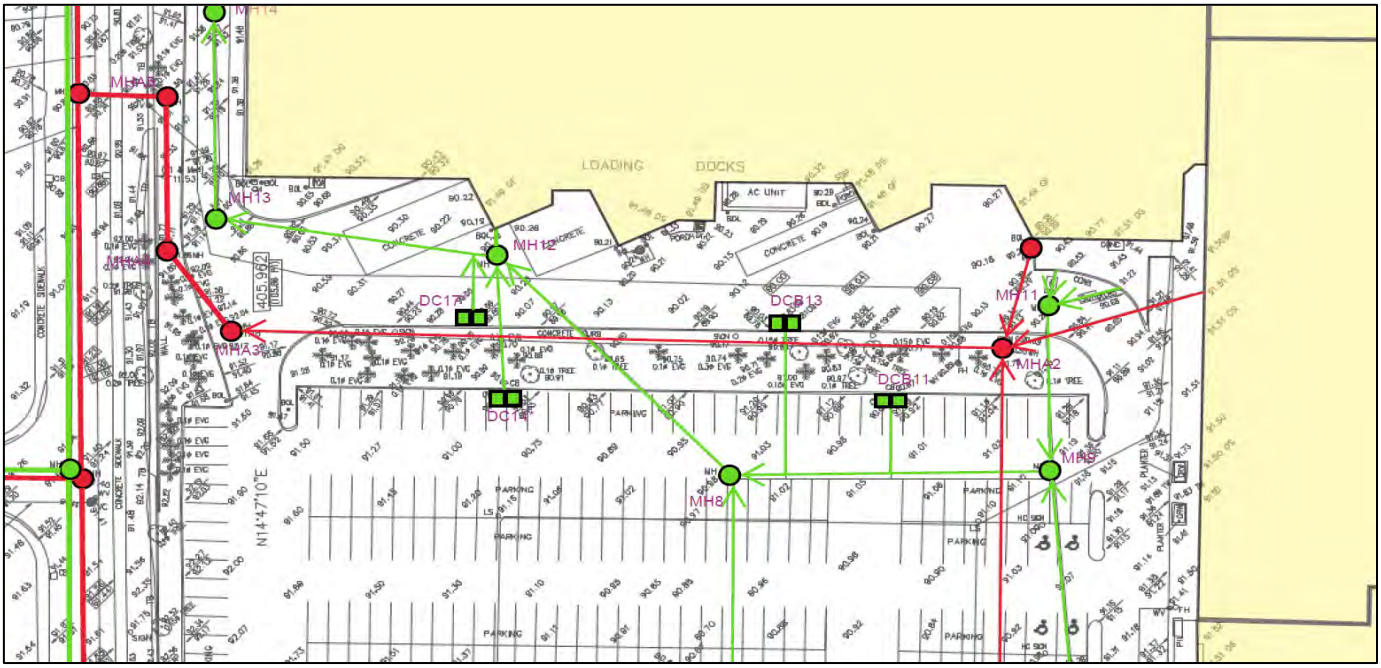
Investigation Details



General Information	
Date: **April 14, 2023**	Report No. : **R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
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Investigation Details

General Information	
Date: **April 14, 2023**	Report No. : **R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality: **Ontario/ City of Hamilton**

Investigation Details

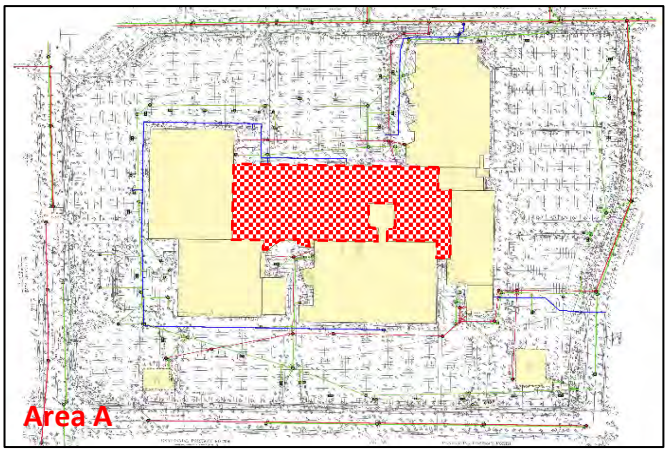
Area A:

This area has been occupied by the existing building at the Shopping Mall.

The existing building has a flat roof and the storm runoff within this area is captured by existing roof drains and is directed via existing network of storm drains within the building.

In order to identify the storm runoff discharge pattern within the site, two dye tests were conducted on a roofdrain located at the North-West area of the roof and another roofdrain located at the South-West area of the roof.

The result of the Dye Tests confirmed that the storm runoff from the subject area is conveyed into the existing 1350mmØ Storm Sewer along Kenora Ave.



General Information	
Date: **April 14, 2023**	Report No. : **R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality: **Ontario/ City of Hamilton**

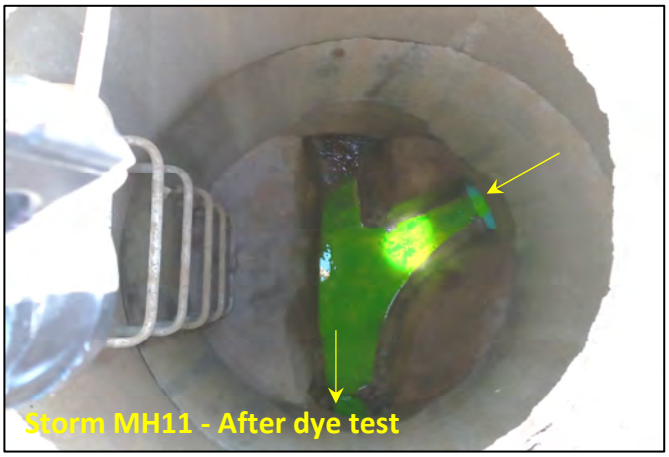
Investigation Details

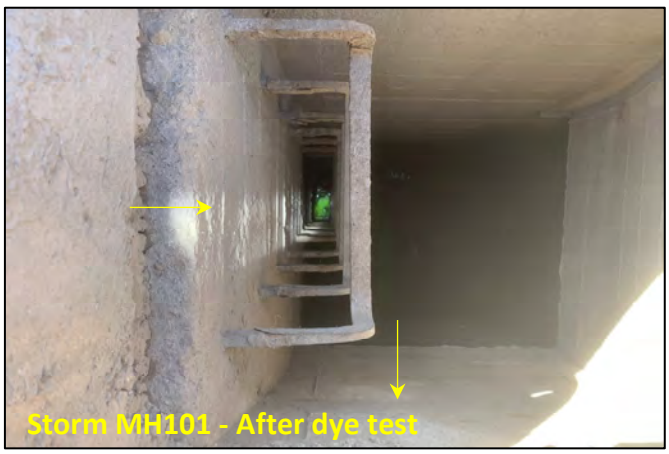
Dye Test #1:

In order to identify the storm runoff discharge pattern within area A, a Dye test was conducted on a roof drain located at North area of the subject area.

The dye was discharged into the roof drain and the dye was observed at MH11, MH9 and MH32, within the site, as well as Storm MH101, located at the intersection of Kenora Avenue and Kentley Road.

The result of this Dye Test confirmed that the storm runoff from North area of the roof is conveyed into the existing 1350mm Ø Storm Sewer along Kenora Avenue.





General Information	
Date: **April 14, 2023**	Report No. **: R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality**: Ontario/ City of Hamilton**

Investigation Details

Dye Test #2:

In order to identify the storm runoff discharge pattern within area A, a Dye test was conducted on a roof drain located at South area of the subject area.
The dye was discharged into the roof drain and the dye was observed at MH9.

The result of this Dye Test confirmed that the storm runoff from South area of the roof is conveyed into the existing 1350mm Ø Storm Sewer along Kenora Avenue.

Discharging the dye at the roof drain

Storm MH9 - After dye test

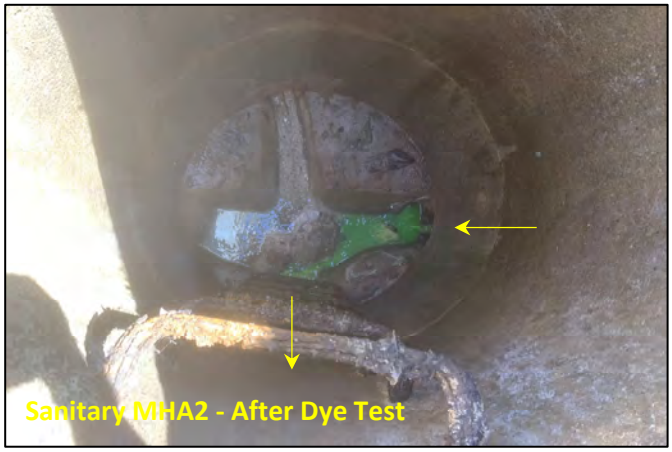
General Information	
Date: **April 14, 2023**	Report No. **: R23-04-14-01**
Project No. : **PUD22-064**	Address : **75 Centennial Parkway North, Hamilton**
Owner : **Hammer LP**	Region/Municipality**: Ontario/ City of Hamilton**

Investigation Details

Dye Test #3:

In order to identify the sanitary discharge pattern within the area A, a Dye test was conducted on the existing sanitary network within the building, located at Sourth side of the Shopping Mall.
The dye was discharged into one of the sanitary sinks and the dye was observed at Sanitary MHA2.
The result of this Dye Test confirmed that the sanitary discharge storm South side of the existing building at Shopping Mall (area A) is conveyed into the existing 370mmØ Sanitary Sewer along Kenora Ave.


Dischargeing the dye into the Sanitary sink


Sanitary MHA2 - After Dye Test

Dye Test #4:

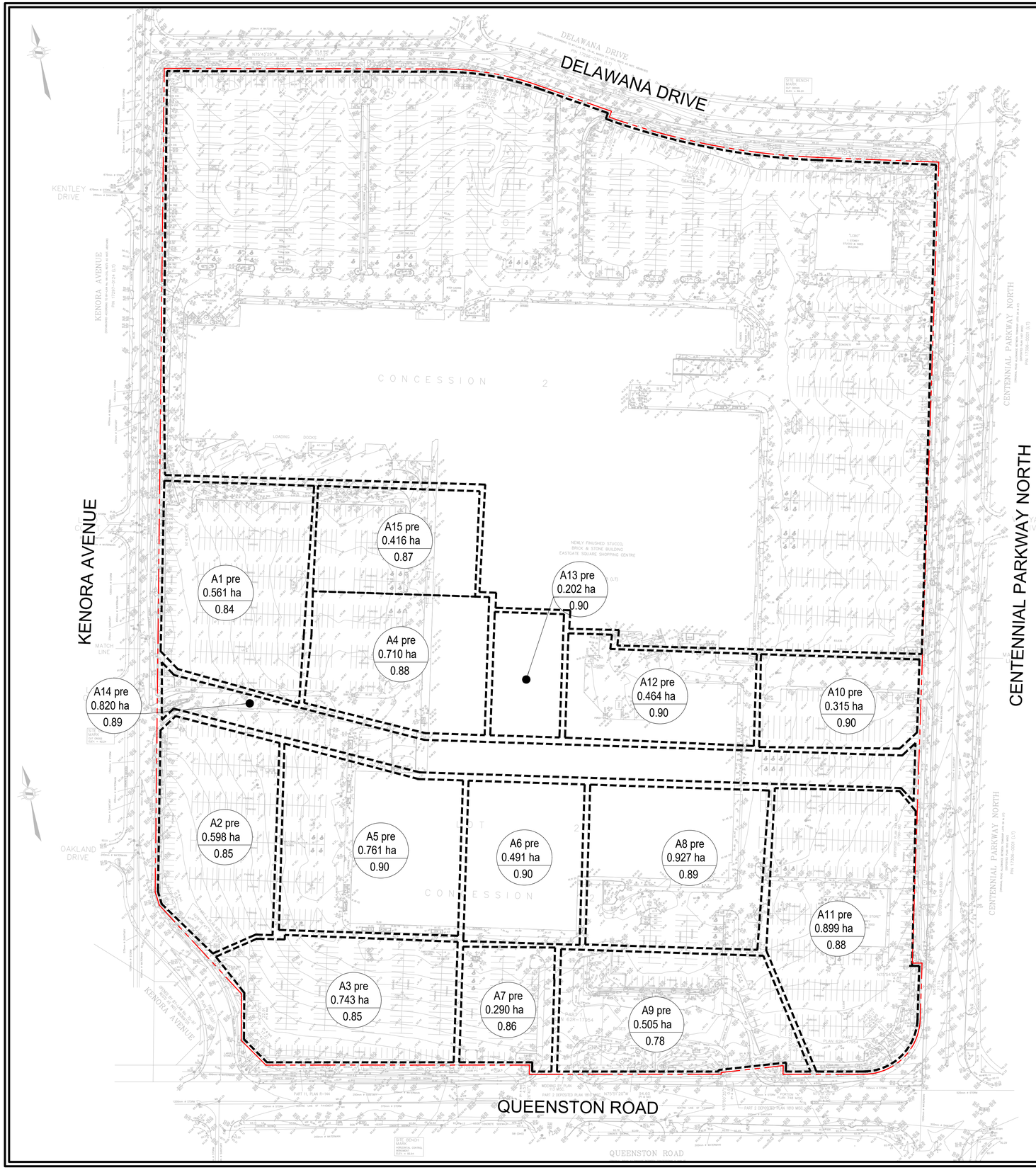
In order to identify the sanitary discharge pattern within the area A, a Dye test was conducted on the existing sanitary network within the building, located at North side of the Shopping Mall.
The dye was discharged into one of the sanitary sinks and the dye was observed at Sanitary MHA2.
The result of this Dye Test confirmed that the sanitary discharge storm North side of the existing building at Shopping Mall (area A) is conveyed into the existing 370mmØ Sanitary Sewer along Kenora Ave.


Dischargeing the dye into the Sanitary sink


Sanitary MHA2 - After Dye Test

Appendix C

Storm Analysis



LOCATION PLAN
NTS

LEGEND

- PRE-DEVELOPMENT STORM DRAINAGE AREA
- PROPERTY LINE
- STORM DRAINAGE AREA NUMBER (A1 pre)
- DRAINAGE AREA (ha) (0.04 ha)
- COMPOSITE RUNOFF COEFFICIENT (0.50)

LIST OF DRAWINGS

SG-01 (SITE GRADING PLAN)
SS-01 (SITE SERVICING PLAN)
EC-01 (EROSION CONTROL PLAN)
DD-01 (DETAIL DRAWINGS)

SITE PLAN INFORMATION

SURVEY INFORMATION

BENCHMARK

DRAINAGE AREA	LAND USE	AREA (ha)	INITIAL COEFFICIENT	COMPOSITE COEFFICIENT	TOTAL AREA (ha)
A1 PRE	LANDSCAPE	0.049	0.25	0.84	8.703
	HARDSCAPE	0.512	0.90		
A2 PRE	LANDSCAPE	0.045	0.25	0.85	
	HARDSCAPE	0.553	0.90		
A3 PRE	LANDSCAPE	0.063	0.25	0.85	
	HARDSCAPE	0.680	0.90		
A4 PRE	LANDSCAPE	0.019	0.25	0.88	
	HARDSCAPE	0.691	0.90		
A5 PRE	LANDSCAPE	0.005	0.25	0.90	
	HARDSCAPE	0.756	0.90		
A6 PRE	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.491	0.90		
A7 PRE	LANDSCAPE	0.019	0.25	0.86	
	HARDSCAPE	0.271	0.90		
A8 PRE	LANDSCAPE	0.011	0.25	0.89	
	HARDSCAPE	0.916	0.90		
A9 PRE	LANDSCAPE	0.095	0.25	0.78	
	HARDSCAPE	0.410	0.90		
A10 PRE	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.315	0.90		
A11 PRE	LANDSCAPE	0.030	0.25	0.88	
	HARDSCAPE	0.869	0.90		
A12 PRE	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.464	0.90		
A13 PRE	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.202	0.90		
A14 PRE	LANDSCAPE	0.014	0.25	0.89	
	HARDSCAPE	0.806	0.90		
A15 PRE	LANDSCAPE	0.019	0.25	0.87	
	HARDSCAPE	0.691	0.90		

NO	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPLICATION	AUG 01, 2023	NM

CITY OF HAMILTON

PRE-DEVELOPMENT DRAINAGE AREA PLAN

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

Lithos
150 Bermondsey Road, Toronto, Ontario M4A 1Y1

DESIGNED BY: DF	DATE: NOVEMBER, 2022	CHECKED BY: NM
DRAWN BY: DF	PROJECT No: UD22-064	APPROVED BY: NM
SCALE: N.T.S.		DRAWING No: DAP1

EXTERNAL STORM FLOW

75 Centennial Parkway North

File No: UD22-064

Date: August 2023

Prepared by: Dimitra Frysali, P.Eng., M.A.Sc.

Reviewed By: Nick Moutzouris, P.Eng., M.A.Sc.

Event 5-Year
A = 1049.50
B = 8.00
C = 0.80

Sewer Segment	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
#1	1.032	0.86	0.88	10	103.0	0.253	252.7
#2	0.725	0.85	0.62	10	103.0	0.177	176.6
#3	0.787	0.84	0.66	10	103.0	0.189	188.6
#4	0.597	0.81	0.48	10	103.0	0.139	138.6
#5	1.367	0.82	1.12	10	103.0	0.321	320.6
#6	1.403	0.63	0.88	10	103.0	0.252	251.9
#7	0.361	0.65	0.23	10	103.0	0.067	67.2
#8	1.065	0.77	0.82	10	103.0	0.234	233.8
#9	4.839	0.65	3.16	10	103.0	0.903	903.1
#10	1.640	0.87	1.43	10	103.0	0.410	409.6
#11	1.307	0.87	1.14	10	103.0	0.326	326.2
Total Pre	15.124	5-year storm flow under pre development conditions					3268.9
Post inflow	4.094	0.744	3.04	10	103.0	0.871	871.4
TOTAL	19.218	5-year storm flow under pre & post development conditions					4140.4

EXTERNAL STORM SEWER SEGMENTS

75 Centennial Parkway North

PRE & POST - DEVELOPMENT CONDITIONS

City of Hamilton

LOCATION				PRE		POST						
DESCRIPTION	Sewer Segment	Drainage Area (hectares)	Drainage Area (cummulative) (hectares)	**STORM FLOW 5-YR PRE (Drainage area)** (L/s)	**TOTAL STORM FLOW 5-YEAR PRE (Cummulative)** (L/s)	**POST STORM INFLOW 5-YEAR POST** (L/s)	**TOTAL 5-YEAR PRE + POST (Cumulative)** (L/s)	GRADE (used) (%)	**Max. Allowable Flow** (L/s)	PIPE SIZE (mm)	Pre-development % of DESIGN CAPACITY (%)	Post-development % of DESIGN CAPACITY (%)
column number	1	2	3	4	5	6	7	8	9	10	11	12
DOWNSTREAM SEWER SEGMENTS												
Storm Sewer Segment	# 1	1.032	1.032	**252.7**	**252.7**	**871.4**	**1124.1**	0.60%	**135.8**	375	186.1%	827.7%
Storm Sewer Segment	# 2	0.725	1.757	**176.6**	**429.2**	**871.4**	**1300.7**	0.62%	**224.5**	450	191.2%	579.4%
Storm Sewer Segment	# 3	0.787	2.545	**188.6**	**617.9**	**871.4**	**1489.3**	0.57%	**324.7**	525	190.3%	458.7%
Storm Sewer Segment	# 4	0.597	3.142	**138.6**	**756.5**	**871.4**	**1628.0**	0.77%	**538.8**	600	140.4%	302.1%
Storm Sewer Segment	# 5	1.367	4.509	**320.6**	**1077.1**	**871.4**	**1948.6**	0.60%	**862.3**	750	124.9%	226.0%
Storm Sewer Segment	# 6	1.403	5.912	**251.9**	**1329.1**	**871.4**	**2200.5**	0.60%	**862.3**	750	154.1%	255.2%
Storm Sewer Segment	# 7	0.361	6.273	**67.2**	**1396.2**	**871.4**	**2267.7**	0.58%	**847.9**	750	164.7%	267.5%
Storm Sewer Segment	# 8	1.065	7.339	**233.8**	**1630.1**	**871.4**	**2501.5**	0.60%	**862.3**	750	189.0%	290.1%
Storm Sewer Segment	# 9	4.839	12.177	**903.1**	**2533.1**	**871.4**	**3404.6**	0.60%	**862.3**	750	293.7%	394.8%
Storm Sewer Segment	# 10	1.640	13.817	**409.6**	**2942.7**	**871.4**	**3814.2**	0.60%	**1402.3**	900	209.9%	272.0%
Storm Sewer Segment	# 11	1.307	15.124	**326.2**	**3268.9**	**871.4**	**4140.4**	0.62%	**1425.5**	900	229.3%	290.5%
Trunk Sewer/Storm												

NOTES:

1. Calculated flows are estimated based on the existing development within the drainage area.
2. The post development flow can be supported by the existing storm network, thus the sewers can support the proposed development.

Lithos	**Prepared by: Dimitra Frysali, P.Eng., M.A.Sc.** **Reviewed By: Nick Moutzouris, P.Eng., M.A.Sc.** **Date: August 2023**	**Project:** **Project:** City of Hamilton

File No: UD22-064

75 Centennial Parkway North

LOCATION PLAN
NTS

LEGEND

- POST-DEVELOPMENT STORM DRAINAGE AREA
- PROPERTY LINE
- A1 post / 0.04 ha / 0.50 — STORM DRAINAGE AREA NUMBER; DRAINAGE AREA (ha); COMPOSITE RUNOFF COEFFICIENT

LIST OF DRAWINGS

SG-01 (SITE GRADING PLAN)
SS-01 (SITE SERVICING PLAN)
EC-01 (EROSION CONTROL PLAN)
DD-01 (DETAIL DRAWINGS)

SITE PLAN INFORMATION

SURVEY INFORMATION

BENCHMARK

DRAINAGE AREA	LAND USE	AREA (ha)	INITIAL COEFFICIENT	COMPOSITE COEFFICIENT	TOTAL AREA (ha)
A1 POST	LANDSCAPE	0.000	0.25	0.90	8.703
	HARDSCAPE	0.561	0.90		
A2 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.598	0.90		
A3 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.743	0.90		
A4 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.710	0.90		
A5 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.761	0.90		
A6 POST	LANDSCAPE	0.491	0.25	0.25	
	HARDSCAPE	0.000	0.90		
A7 POST	LANDSCAPE	0.290	0.25	0.25	
	HARDSCAPE	0.000	0.90		
A8 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.927	0.90		
A9 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.505	0.90		
A10 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.315	0.90		
A11 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.899	0.90		
A12 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.464	0.90		
A13 POST	LANDSCAPE	0.202	0.25	0.25	
	HARDSCAPE	0.000	0.90		
A14 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.820	0.90		
A15 POST	LANDSCAPE	0.000	0.25	0.90	
	HARDSCAPE	0.416	0.90		

NO	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPLICATION	AUG 01, 2023	NM

CITY OF HAMILTON

POST-DEVELOPMENT DRAINAGE AREA PLAN

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

Lithos
150 Bermondsey Road, Toronto, Ontario M4A 1Y1

DESIGNED BY: DF	DATE: NOVEMBER, 2022		CHECKED BY: NM
DRAWN BY: DF	PROJECT No: UD22-064		APPROVED BY: NM
SCALE: N.T.S.			DRAWING No: DAP2

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A1 Pre	0.561	0.84	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.049	0.25
Hardsc. Area	0.512	0.90
Total	0.561	0.84

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	74.1	0.097	97.3

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	103.0	0.135	135.3

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	122.3	0.161	160.6

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	146.1	0.192	191.9

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	164.6	0.216	216.2

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.561	0.84	0.47	10	181.8	0.239	238.8

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= **97.3** L/s
Min. Storage= **4.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	74.1	0.104	62.35	58.39	3.97
15.0	59.9	0.084	75.64	87.58	0.00
20.0	50.7	0.071	85.35	116.77	0.00
25.0	44.2	0.062	93.00	145.96	0.00
30.0	39.3	0.055	99.30	175.16	0.00
35.0	35.5	0.050	104.66	204.35	0.00
40.0	32.5	0.046	109.33	233.54	0.00
45.0	30.0	0.042	113.47	262.73	0.00
50.0	27.9	0.039	117.20	291.93	0.00
55.0	26.1	0.037	120.59	321.12	0.00
60.0	24.5	0.034	123.70	350.31	0.00
65.0	23.1	0.032	126.58	379.51	0.00
70.0	21.9	0.031	129.26	408.70	0.00
75.0	20.9	0.029	131.77	437.89	0.00
80.0	19.9	0.028	134.13	467.08	0.00
85.0	19.1	0.027	136.36	496.28	0.00
90.0	18.3	0.026	138.48	525.47	0.00
95.0	17.6	0.025	140.49	554.66	0.00
100.0	16.9	0.024	142.40	583.86	0.00
105.0	16.3	0.023	144.24	613.05	0.00
110.0	15.8	0.022	145.99	642.24	0.00
115.0	15.3	0.021	147.68	671.43	0.00
120.0	14.8	0.021	149.31	700.63	0.00
125.0	14.3	0.020	150.87	729.82	0.00
130.0	13.9	0.020	152.38	759.01	0.00
135.0	13.5	0.019	153.84	788.20	0.00
140.0	13.2	0.018	155.26	817.40	0.00
145.0	12.8	0.018	156.63	846.59	0.00
150.0	12.5	0.018	157.96	875.78	0.00
155.0	12.2	0.017	159.25	904.98	0.00
160.0	11.9	0.017	160.51	934.17	0.00
165.0	11.6	0.016	161.73	963.36	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= 135.3 L/s
Min. Storage= **5.5** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	103.0	0.145	86.71	81.19	5.52
15.0	84.6	0.119	106.82	121.78	0.00
20.0	72.3	0.101	121.62	162.37	0.00
25.0	63.3	0.089	133.23	202.97	0.00
30.0	56.5	0.079	142.76	243.56	0.00
35.0	51.2	0.072	150.81	284.16	0.00
40.0	46.9	0.066	157.78	324.75	0.00
45.0	43.3	0.061	163.93	365.34	0.00
50.0	40.3	0.056	169.42	405.94	0.00
55.0	37.7	0.053	174.39	446.53	0.00
60.0	35.4	0.050	178.93	487.12	0.00
65.0	33.5	0.047	183.11	527.72	0.00
70.0	31.7	0.045	186.97	568.31	0.00
75.0	30.2	0.042	190.58	608.91	0.00
80.0	28.8	0.040	193.96	649.50	0.00
85.0	27.6	0.039	197.13	690.09	0.00
90.0	26.4	0.037	200.14	730.69	0.00
95.0	25.4	0.036	202.98	771.28	0.00
100.0	24.4	0.034	205.68	811.87	0.00
105.0	23.6	0.033	208.26	852.47	0.00
110.0	22.8	0.032	210.72	893.06	0.00
115.0	22.0	0.031	213.08	933.66	0.00
120.0	21.3	0.030	215.34	974.25	0.00
125.0	20.7	0.029	217.52	1014.84	0.00
130.0	20.1	0.028	219.61	1055.44	0.00
135.0	19.5	0.027	221.63	1096.03	0.00
140.0	19.0	0.027	223.59	1136.62	0.00
145.0	18.5	0.026	225.47	1177.22	0.00
150.0	18.0	0.025	227.30	1217.81	0.00
155.0	17.6	0.025	229.08	1258.41	0.00
160.0	17.1	0.024	230.80	1299.00	0.00
165.0	16.7	0.023	232.47	1339.59	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= 160.6 L/s
Min. Storage= **6.6** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	122.3	0.172	102.91	96.36	6.55
15.0	101.1	0.142	127.63	144.54	0.00
20.0	86.7	0.122	145.88	192.72	0.00
25.0	76.2	0.107	160.20	240.89	0.00
30.0	68.1	0.096	171.93	289.07	0.00
35.0	61.7	0.087	181.83	337.25	0.00
40.0	56.6	0.079	190.37	385.43	0.00
45.0	52.3	0.073	197.88	433.61	0.00
50.0	48.6	0.068	204.58	481.79	0.00
55.0	45.5	0.064	210.61	529.97	0.00
60.0	42.8	0.060	216.11	578.15	0.00
65.0	40.4	0.057	221.16	626.33	0.00
70.0	38.3	0.054	225.83	674.51	0.00
75.0	36.5	0.051	230.17	722.68	0.00
80.0	34.8	0.049	234.23	770.86	0.00
85.0	33.3	0.047	238.04	819.04	0.00
90.0	31.9	0.045	241.63	867.22	0.00
95.0	30.7	0.043	245.03	915.40	0.00
100.0	29.5	0.041	248.25	963.58	0.00
105.0	28.4	0.040	251.32	1011.76	0.00
110.0	27.5	0.039	254.25	1059.94	0.00
115.0	26.6	0.037	257.04	1108.12	0.00
120.0	25.7	0.036	259.73	1156.29	0.00
125.0	24.9	0.035	262.30	1204.47	0.00
130.0	24.2	0.034	264.78	1252.65	0.00
135.0	23.5	0.033	267.17	1300.83	0.00
140.0	22.9	0.032	269.47	1349.01	0.00
145.0	22.3	0.031	271.70	1397.19	0.00
150.0	21.7	0.030	273.85	1445.37	0.00
155.0	21.2	0.030	275.93	1493.55	0.00
160.0	20.6	0.029	277.96	1541.73	0.00
165.0	20.2	0.028	279.92	1589.90	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= **191.9** L/s
Min. Storage= **7.8** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	146.1	0.205	122.94	115.12	7.83
15.0	121.6	0.171	153.48	172.68	0.00
20.0	104.6	0.147	176.12	230.24	0.00
25.0	92.2	0.129	193.92	287.80	0.00
30.0	82.6	0.116	208.49	345.36	0.00
35.0	75.0	0.105	220.77	402.91	0.00
40.0	68.7	0.096	231.35	460.47	0.00
45.0	63.5	0.089	240.63	518.03	0.00
50.0	59.2	0.083	248.89	575.59	0.00
55.0	55.4	0.078	256.33	633.15	0.00
60.0	52.1	0.073	263.08	690.71	0.00
65.0	49.2	0.069	269.27	748.27	0.00
70.0	46.7	0.065	274.99	805.83	0.00
75.0	44.4	0.062	280.29	863.39	0.00
80.0	42.4	0.059	285.24	920.95	0.00
85.0	40.5	0.057	289.87	978.51	0.00
90.0	38.9	0.054	294.24	1036.07	0.00
95.0	37.3	0.052	298.36	1093.62	0.00
100.0	35.9	0.050	302.27	1151.18	0.00
105.0	34.6	0.049	305.98	1208.74	0.00
110.0	33.4	0.047	309.52	1266.30	0.00
115.0	32.3	0.045	312.89	1323.86	0.00
120.0	31.3	0.044	316.13	1381.42	0.00
125.0	30.3	0.043	319.23	1438.98	0.00
130.0	29.5	0.041	322.21	1496.54	0.00
135.0	28.6	0.040	325.08	1554.10	0.00
140.0	27.8	0.039	327.84	1611.66	0.00
145.0	27.1	0.038	330.51	1669.22	0.00
150.0	26.4	0.037	333.09	1726.78	0.00
155.0	25.7	0.036	335.58	1784.34	0.00
160.0	25.1	0.035	338.00	1841.89	0.00
165.0	24.5	0.034	340.35	1899.45	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= 216.2 L/s
Min. Storage= **8.8** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	164.6	0.231	138.52	129.70	8.82
15.0	136.9	0.192	172.80	194.55	0.00
20.0	117.8	0.165	198.19	259.40	0.00
25.0	103.7	0.145	218.12	324.25	0.00
30.0	92.9	0.130	234.41	389.10	0.00
35.0	84.2	0.118	248.13	453.95	0.00
40.0	77.2	0.108	259.94	518.80	0.00
45.0	71.4	0.100	270.29	583.65	0.00
50.0	66.4	0.093	279.49	648.50	0.00
55.0	62.2	0.087	287.77	713.35	0.00
60.0	58.5	0.082	295.30	778.20	0.00
65.0	55.2	0.077	302.18	843.05	0.00
70.0	52.4	0.073	308.53	907.90	0.00
75.0	49.8	0.070	314.43	972.75	0.00
80.0	47.5	0.067	319.92	1037.60	0.00
85.0	45.4	0.064	325.07	1102.45	0.00
90.0	43.6	0.061	329.91	1167.30	0.00
95.0	41.8	0.059	334.49	1232.16	0.00
100.0	40.3	0.056	338.82	1297.01	0.00
105.0	38.8	0.054	342.93	1361.86	0.00
110.0	37.5	0.053	346.85	1426.71	0.00
115.0	36.2	0.051	350.60	1491.56	0.00
120.0	35.1	0.049	354.18	1556.41	0.00
125.0	34.0	0.048	357.61	1621.26	0.00
130.0	33.0	0.046	360.91	1686.11	0.00
135.0	32.0	0.045	364.08	1750.96	0.00
140.0	31.2	0.044	367.14	1815.81	0.00
145.0	30.3	0.043	370.09	1880.66	0.00
150.0	29.5	0.041	372.94	1945.51	0.00
155.0	28.8	0.040	375.70	2010.36	0.00
160.0	28.1	0.039	378.38	2075.21	0.00
165.0	27.4	0.038	380.97	2140.06	0.00

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A1 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A1) = **0.561** ha
"C" = **0.90**
AC = **0.505**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.561	0.90
Total	0.561	0.90

Allowable Release Rate= **238.8** L/s
Min. Storage= **9.7** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A1 Post)** (m^3/s)	**Runoff Volume (A1 Post)** (m^3)	**Target Released Volume (A1 Post)** (m^3)	**Total Required Storage Volume (A1 Post)** (m^3)
10.0	181.8	0.255	153.00	143.26	9.74
15.0	152.1	0.213	191.97	214.89	0.00
20.0	131.3	0.184	220.96	286.51	0.00
25.0	115.9	0.162	243.74	358.14	0.00
30.0	103.9	0.146	262.35	429.77	0.00
35.0	94.4	0.132	278.01	501.40	0.00
40.0	86.6	0.121	291.47	573.03	0.00
45.0	80.1	0.112	303.24	644.66	0.00
50.0	74.6	0.105	313.68	716.29	0.00
55.0	69.8	0.098	323.06	787.91	0.00
60.0	65.7	0.092	331.55	859.54	0.00
65.0	62.0	0.087	339.32	931.17	0.00
70.0	58.8	0.082	346.47	1002.80	0.00
75.0	55.9	0.078	353.08	1074.43	0.00
80.0	53.4	0.075	359.24	1146.06	0.00
85.0	51.0	0.072	365.00	1217.68	0.00
90.0	48.9	0.069	370.41	1289.31	0.00
95.0	47.0	0.066	375.51	1360.94	0.00
100.0	45.2	0.063	380.33	1432.57	0.00
105.0	43.6	0.061	384.91	1504.20	0.00
110.0	42.1	0.059	389.26	1575.83	0.00
115.0	40.7	0.057	393.41	1647.46	0.00
120.0	39.4	0.055	397.37	1719.08	0.00
125.0	38.1	0.053	401.17	1790.71	0.00
130.0	37.0	0.052	404.81	1862.34	0.00
135.0	35.9	0.050	408.31	1933.97	0.00
140.0	34.9	0.049	411.68	2005.60	0.00
145.0	34.0	0.048	414.93	2077.23	0.00
150.0	33.1	0.046	418.06	2148.86	0.00
155.0	32.3	0.045	421.09	2220.48	0.00
160.0	31.5	0.044	424.02	2292.11	0.00
165.0	30.7	0.043	426.86	2363.74	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A2 Pre	0.598	0.85	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.045	0.25
Hardsc. Area	0.553	0.90
Total	0.598	0.85

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	74.1	0.105	104.8

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	103.0	0.146	145.7

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	122.3	0.173	172.9

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	146.1	0.207	206.6

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	164.6	0.233	232.7

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A2 Pre	0.598	0.85	0.51	10	181.8	0.257	257.0

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 104.8 L/s
Min. Storage= **3.6** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	74.1	0.111	66.47	62.86	3.61
15.0	59.9	0.090	80.62	94.29	0.00
20.0	50.7	0.076	90.98	125.72	0.00
25.0	44.2	0.066	99.13	157.14	0.00
30.0	39.3	0.059	105.85	188.57	0.00
35.0	35.5	0.053	111.56	220.00	0.00
40.0	32.5	0.049	116.54	251.43	0.00
45.0	30.0	0.045	120.96	282.86	0.00
50.0	27.9	0.042	124.93	314.29	0.00
55.0	26.1	0.039	128.54	345.72	0.00
60.0	24.5	0.037	131.86	377.15	0.00
65.0	23.1	0.035	134.93	408.57	0.00
70.0	21.9	0.033	137.79	440.00	0.00
75.0	20.9	0.031	140.46	471.43	0.00
80.0	19.9	0.030	142.98	502.86	0.00
85.0	19.1	0.029	145.36	534.29	0.00
90.0	18.3	0.027	147.61	565.72	0.00
95.0	17.6	0.026	149.75	597.15	0.00
100.0	16.9	0.025	151.80	628.58	0.00
105.0	16.3	0.024	153.75	660.00	0.00
110.0	15.8	0.024	155.62	691.43	0.00
115.0	15.3	0.023	157.42	722.86	0.00
120.0	14.8	0.022	159.15	754.29	0.00
125.0	14.3	0.021	160.82	785.72	0.00
130.0	13.9	0.021	162.43	817.15	0.00
135.0	13.5	0.020	163.99	848.58	0.00
140.0	13.2	0.020	165.50	880.01	0.00
145.0	12.8	0.019	166.96	911.43	0.00
150.0	12.5	0.019	168.38	942.86	0.00
155.0	12.2	0.018	169.76	974.29	0.00
160.0	11.9	0.018	171.10	1005.72	0.00
165.0	11.6	0.017	172.40	1037.15	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 145.7 L/s
Min. Storage= **5.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	103.0	0.154	92.43	87.41	5.02
15.0	84.6	0.127	113.87	131.11	0.00
20.0	72.3	0.108	129.64	174.81	0.00
25.0	63.3	0.095	142.02	218.52	0.00
30.0	56.5	0.085	152.17	262.22	0.00
35.0	51.2	0.077	160.76	305.92	0.00
40.0	46.9	0.070	168.19	349.62	0.00
45.0	43.3	0.065	174.74	393.33	0.00
50.0	40.3	0.060	180.60	437.03	0.00
55.0	37.7	0.056	185.89	480.73	0.00
60.0	35.4	0.053	190.73	524.44	0.00
65.0	33.5	0.050	195.18	568.14	0.00
70.0	31.7	0.047	199.31	611.84	0.00
75.0	30.2	0.045	203.15	655.55	0.00
80.0	28.8	0.043	206.75	699.25	0.00
85.0	27.6	0.041	210.14	742.95	0.00
90.0	26.4	0.040	213.34	786.65	0.00
95.0	25.4	0.038	216.37	830.36	0.00
100.0	24.4	0.037	219.25	874.06	0.00
105.0	23.6	0.035	221.99	917.76	0.00
110.0	22.8	0.034	224.62	961.47	0.00
115.0	22.0	0.033	227.13	1005.17	0.00
120.0	21.3	0.032	229.54	1048.87	0.00
125.0	20.7	0.031	231.86	1092.58	0.00
130.0	20.1	0.030	234.10	1136.28	0.00
135.0	19.5	0.029	236.25	1179.98	0.00
140.0	19.0	0.028	238.33	1223.68	0.00
145.0	18.5	0.028	240.35	1267.39	0.00
150.0	18.0	0.027	242.30	1311.09	0.00
155.0	17.6	0.026	244.19	1354.79	0.00
160.0	17.1	0.026	246.02	1398.50	0.00
165.0	16.7	0.025	247.80	1442.20	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 172.9 L/s
Min. Storage= **6.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	122.3	0.183	109.70	103.74	5.96
15.0	101.1	0.151	136.05	155.61	0.00
20.0	86.7	0.130	155.50	207.48	0.00
25.0	76.2	0.114	170.77	259.35	0.00
30.0	68.1	0.102	183.27	311.22	0.00
35.0	61.7	0.092	193.82	363.08	0.00
40.0	56.6	0.085	202.92	414.95	0.00
45.0	52.3	0.078	210.93	466.82	0.00
50.0	48.6	0.073	218.07	518.69	0.00
55.0	45.5	0.068	224.51	570.56	0.00
60.0	42.8	0.064	230.37	622.43	0.00
65.0	40.4	0.060	235.75	674.30	0.00
70.0	38.3	0.057	240.73	726.17	0.00
75.0	36.5	0.055	245.35	778.04	0.00
80.0	34.8	0.052	249.68	829.91	0.00
85.0	33.3	0.050	253.74	881.78	0.00
90.0	31.9	0.048	257.57	933.65	0.00
95.0	30.7	0.046	261.19	985.51	0.00
100.0	29.5	0.044	264.62	1037.38	0.00
105.0	28.4	0.043	267.89	1089.25	0.00
110.0	27.5	0.041	271.01	1141.12	0.00
115.0	26.6	0.040	274.00	1192.99	0.00
120.0	25.7	0.038	276.86	1244.86	0.00
125.0	24.9	0.037	279.60	1296.73	0.00
130.0	24.2	0.036	282.24	1348.60	0.00
135.0	23.5	0.035	284.79	1400.47	0.00
140.0	22.9	0.034	287.24	1452.34	0.00
145.0	22.3	0.033	289.61	1504.21	0.00
150.0	21.7	0.032	291.91	1556.08	0.00
155.0	21.2	0.032	294.13	1607.95	0.00
160.0	20.6	0.031	296.29	1659.81	0.00
165.0	20.2	0.030	298.38	1711.68	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 206.6 L/s
Min. Storage= **7.1** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	146.1	0.218	131.05	123.94	7.12
15.0	121.6	0.182	163.60	185.90	0.00
20.0	104.6	0.156	187.74	247.87	0.00
25.0	92.2	0.138	206.71	309.84	0.00
30.0	82.6	0.123	222.24	371.81	0.00
35.0	75.0	0.112	235.33	433.78	0.00
40.0	68.7	0.103	246.61	495.74	0.00
45.0	63.5	0.095	256.50	557.71	0.00
50.0	59.2	0.088	265.31	619.68	0.00
55.0	55.4	0.083	273.23	681.65	0.00
60.0	52.1	0.078	280.43	743.62	0.00
65.0	49.2	0.074	287.03	805.58	0.00
70.0	46.7	0.070	293.12	867.55	0.00
75.0	44.4	0.066	298.77	929.52	0.00
80.0	42.4	0.063	304.05	991.49	0.00
85.0	40.5	0.061	308.99	1053.46	0.00
90.0	38.9	0.058	313.64	1115.42	0.00
95.0	37.3	0.056	318.04	1177.39	0.00
100.0	35.9	0.054	322.20	1239.36	0.00
105.0	34.6	0.052	326.16	1301.33	0.00
110.0	33.4	0.050	329.93	1363.29	0.00
115.0	32.3	0.048	333.53	1425.26	0.00
120.0	31.3	0.047	336.98	1487.23	0.00
125.0	30.3	0.045	340.28	1549.20	0.00
130.0	29.5	0.044	343.46	1611.17	0.00
135.0	28.6	0.043	346.52	1673.13	0.00
140.0	27.8	0.042	349.46	1735.10	0.00
145.0	27.1	0.040	352.31	1797.07	0.00
150.0	26.4	0.039	355.05	1859.04	0.00
155.0	25.7	0.038	357.71	1921.01	0.00
160.0	25.1	0.038	360.29	1982.97	0.00
165.0	24.5	0.037	362.79	2044.94	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 232.7 L/s
Min. Storage= **8.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	164.6	0.246	147.65	139.63	8.02
15.0	136.9	0.205	184.20	209.45	0.00
20.0	117.8	0.176	211.26	279.27	0.00
25.0	103.7	0.155	232.51	349.09	0.00
30.0	92.9	0.139	249.87	418.90	0.00
35.0	84.2	0.126	264.49	488.72	0.00
40.0	77.2	0.115	277.08	558.54	0.00
45.0	71.4	0.107	288.12	628.36	0.00
50.0	66.4	0.099	297.93	698.17	0.00
55.0	62.2	0.093	306.75	767.99	0.00
60.0	58.5	0.087	314.77	837.81	0.00
65.0	55.2	0.083	322.11	907.63	0.00
70.0	52.4	0.078	328.88	977.44	0.00
75.0	49.8	0.074	335.16	1047.26	0.00
80.0	47.5	0.071	341.02	1117.08	0.00
85.0	45.4	0.068	346.51	1186.90	0.00
90.0	43.6	0.065	351.67	1256.71	0.00
95.0	41.8	0.063	356.55	1326.53	0.00
100.0	40.3	0.060	361.16	1396.35	0.00
105.0	38.8	0.058	365.55	1466.17	0.00
110.0	37.5	0.056	369.73	1535.98	0.00
115.0	36.2	0.054	373.72	1605.80	0.00
120.0	35.1	0.052	377.54	1675.62	0.00
125.0	34.0	0.051	381.20	1745.44	0.00
130.0	33.0	0.049	384.71	1815.25	0.00
135.0	32.0	0.048	388.10	1885.07	0.00
140.0	31.2	0.047	391.36	1954.89	0.00
145.0	30.3	0.045	394.50	2024.71	0.00
150.0	29.5	0.044	397.54	2094.52	0.00
155.0	28.8	0.043	400.48	2164.34	0.00
160.0	28.1	0.042	403.33	2234.16	0.00
165.0	27.4	0.041	406.10	2303.98	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A2 Post - BLOCK B

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A2) = **0.598** ha
"C" = **0.90**
AC = **0.538**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.598	0.90
Total	0.598	0.90

Allowable Release Rate= 257.0 L/s
Min. Storage= **8.9** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A2 Post)** (m^3/s)	**Runoff Volume (A2 Post)** (m^3)	**Target Released Volume (A2 Post)** (m^3)	**Total Required Storage Volume (A2 Post)** (m^3)
10.0	181.8	0.272	163.09	154.23	8.86
15.0	152.1	0.227	204.63	231.34	0.00
20.0	131.3	0.196	235.53	308.46	0.00
25.0	115.9	0.173	259.82	385.57	0.00
30.0	103.9	0.155	279.66	462.69	0.00
35.0	94.4	0.141	296.34	539.80	0.00
40.0	86.6	0.129	310.69	616.92	0.00
45.0	80.1	0.120	323.24	694.03	0.00
50.0	74.6	0.111	334.37	771.15	0.00
55.0	69.8	0.104	344.36	848.26	0.00
60.0	65.7	0.098	353.42	925.38	0.00
65.0	62.0	0.093	361.70	1002.49	0.00
70.0	58.8	0.088	369.32	1079.61	0.00
75.0	55.9	0.084	376.37	1156.72	0.00
80.0	53.4	0.080	382.93	1233.84	0.00
85.0	51.0	0.076	389.08	1310.95	0.00
90.0	48.9	0.073	394.84	1388.07	0.00
95.0	47.0	0.070	400.28	1465.18	0.00
100.0	45.2	0.068	405.42	1542.30	0.00
105.0	43.6	0.065	410.29	1619.41	0.00
110.0	42.1	0.063	414.93	1696.53	0.00
115.0	40.7	0.061	419.35	1773.64	0.00
120.0	39.4	0.059	423.58	1850.76	0.00
125.0	38.1	0.057	427.63	1927.87	0.00
130.0	37.0	0.055	431.51	2004.99	0.00
135.0	35.9	0.054	435.24	2082.10	0.00
140.0	34.9	0.052	438.83	2159.22	0.00
145.0	34.0	0.051	442.29	2236.33	0.00
150.0	33.1	0.050	445.63	2313.45	0.00
155.0	32.3	0.048	448.86	2390.56	0.00
160.0	31.5	0.047	451.99	2467.68	0.00
165.0	30.7	0.046	455.02	2544.79	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A3 Pre	0.743	0.85	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.063	0.25
Hardsc. Area	0.680	0.90
Total	0.743	0.85

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	74.1	0.129	129.3

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	103.0	0.180	179.8

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	122.3	0.213	213.3

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	146.1	0.255	254.9

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	164.6	0.287	287.2

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A3 Pre	0.743	0.85	0.63	10	181.8	0.317	317.2

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= 129.3 L/s
Min. Storage= **5.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	74.1	0.138	82.58	77.56	5.02
15.0	59.9	0.111	100.17	116.34	0.00
20.0	50.7	0.094	113.04	155.12	0.00
25.0	44.2	0.082	123.17	193.90	0.00
30.0	39.3	0.073	131.51	232.68	0.00
35.0	35.5	0.066	138.61	271.47	0.00
40.0	32.5	0.060	144.80	310.25	0.00
45.0	30.0	0.056	150.28	349.03	0.00
50.0	27.9	0.052	155.22	387.81	0.00
55.0	26.1	0.048	159.71	426.59	0.00
60.0	24.5	0.046	163.83	465.37	0.00
65.0	23.1	0.043	167.65	504.15	0.00
70.0	21.9	0.041	171.20	542.93	0.00
75.0	20.9	0.039	174.52	581.71	0.00
80.0	19.9	0.037	177.65	620.49	0.00
85.0	19.1	0.035	180.60	659.27	0.00
90.0	18.3	0.034	183.40	698.05	0.00
95.0	17.6	0.033	186.06	736.83	0.00
100.0	16.9	0.031	188.60	775.61	0.00
105.0	16.3	0.030	191.03	814.40	0.00
110.0	15.8	0.029	193.36	853.18	0.00
115.0	15.3	0.028	195.59	891.96	0.00
120.0	14.8	0.027	197.74	930.74	0.00
125.0	14.3	0.027	199.82	969.52	0.00
130.0	13.9	0.026	201.82	1008.30	0.00
135.0	13.5	0.025	203.75	1047.08	0.00
140.0	13.2	0.024	205.63	1085.86	0.00
145.0	12.8	0.024	207.44	1124.64	0.00
150.0	12.5	0.023	209.21	1163.42	0.00
155.0	12.2	0.023	210.92	1202.20	0.00
160.0	11.9	0.022	212.58	1240.98	0.00
165.0	11.6	0.022	214.20	1279.76	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= **179.8** L/s
Min. Storage= **7.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	103.0	0.191	114.84	107.85	6.98
15.0	84.6	0.157	141.48	161.78	0.00
20.0	72.3	0.134	161.07	215.70	0.00
25.0	63.3	0.118	176.46	269.63	0.00
30.0	56.5	0.105	189.07	323.56	0.00
35.0	51.2	0.095	199.74	377.48	0.00
40.0	46.9	0.087	208.97	431.41	0.00
45.0	43.3	0.080	217.11	485.34	0.00
50.0	40.3	0.075	224.39	539.26	0.00
55.0	37.7	0.070	230.97	593.19	0.00
60.0	35.4	0.066	236.98	647.11	0.00
65.0	33.5	0.062	242.51	701.04	0.00
70.0	31.7	0.059	247.63	754.97	0.00
75.0	30.2	0.056	252.41	808.89	0.00
80.0	28.8	0.054	256.88	862.82	0.00
85.0	27.6	0.051	261.09	916.75	0.00
90.0	26.4	0.049	265.06	970.67	0.00
95.0	25.4	0.047	268.83	1024.60	0.00
100.0	24.4	0.045	272.41	1078.52	0.00
105.0	23.6	0.044	275.82	1132.45	0.00
110.0	22.8	0.042	279.08	1186.38	0.00
115.0	22.0	0.041	282.21	1240.30	0.00
120.0	21.3	0.040	285.20	1294.23	0.00
125.0	20.7	0.038	288.08	1348.15	0.00
130.0	20.1	0.037	290.86	1402.08	0.00
135.0	19.5	0.036	293.54	1456.01	0.00
140.0	19.0	0.035	296.12	1509.93	0.00
145.0	18.5	0.034	298.62	1563.86	0.00
150.0	18.0	0.033	301.05	1617.79	0.00
155.0	17.6	0.033	303.39	1671.71	0.00
160.0	17.1	0.032	305.67	1725.64	0.00
165.0	16.7	0.031	307.89	1779.56	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= 213.3 L/s
Min. Storage= **8.3** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	122.3	0.227	136.29	128.01	8.29
15.0	101.1	0.188	169.04	192.01	0.00
20.0	86.7	0.161	193.21	256.01	0.00
25.0	76.2	0.141	212.18	320.01	0.00
30.0	68.1	0.127	227.71	384.02	0.00
35.0	61.7	0.115	240.81	448.02	0.00
40.0	56.6	0.105	252.13	512.02	0.00
45.0	52.3	0.097	262.08	576.02	0.00
50.0	48.6	0.090	270.94	640.03	0.00
55.0	45.5	0.085	278.94	704.03	0.00
60.0	42.8	0.080	286.23	768.03	0.00
65.0	40.4	0.075	292.91	832.03	0.00
70.0	38.3	0.071	299.10	896.04	0.00
75.0	36.5	0.068	304.85	960.04	0.00
80.0	34.8	0.065	310.22	1024.04	0.00
85.0	33.3	0.062	315.26	1088.04	0.00
90.0	31.9	0.059	320.02	1152.05	0.00
95.0	30.7	0.057	324.52	1216.05	0.00
100.0	29.5	0.055	328.79	1280.05	0.00
105.0	28.4	0.053	332.85	1344.06	0.00
110.0	27.5	0.051	336.73	1408.06	0.00
115.0	26.6	0.049	340.44	1472.06	0.00
120.0	25.7	0.048	343.99	1536.06	0.00
125.0	24.9	0.046	347.40	1600.07	0.00
130.0	24.2	0.045	350.68	1664.07	0.00
135.0	23.5	0.044	353.84	1728.07	0.00
140.0	22.9	0.042	356.89	1792.07	0.00
145.0	22.3	0.041	359.84	1856.08	0.00
150.0	21.7	0.040	362.69	1920.08	0.00
155.0	21.2	0.039	365.45	1984.08	0.00
160.0	20.6	0.038	368.13	2048.08	0.00
165.0	20.2	0.037	370.73	2112.09	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= **254.9** L/s
Min. Storage= **9.9** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	146.1	0.271	162.83	152.93	9.90
15.0	121.6	0.226	203.27	229.39	0.00
20.0	104.6	0.194	233.26	305.85	0.00
25.0	92.2	0.171	256.84	382.32	0.00
30.0	82.6	0.153	276.13	458.78	0.00
35.0	75.0	0.139	292.39	535.25	0.00
40.0	68.7	0.128	306.40	611.71	0.00
45.0	63.5	0.118	318.70	688.17	0.00
50.0	59.2	0.110	329.64	764.64	0.00
55.0	55.4	0.103	339.48	841.10	0.00
60.0	52.1	0.097	348.43	917.56	0.00
65.0	49.2	0.091	356.63	994.03	0.00
70.0	46.7	0.087	364.20	1070.49	0.00
75.0	44.4	0.082	371.22	1146.96	0.00
80.0	42.4	0.079	377.77	1223.42	0.00
85.0	40.5	0.075	383.91	1299.88	0.00
90.0	38.9	0.072	389.69	1376.35	0.00
95.0	37.3	0.069	395.15	1452.81	0.00
100.0	35.9	0.067	400.33	1529.27	0.00
105.0	34.6	0.064	405.24	1605.74	0.00
110.0	33.4	0.062	409.93	1682.20	0.00
115.0	32.3	0.060	414.40	1758.67	0.00
120.0	31.3	0.058	418.69	1835.13	0.00
125.0	30.3	0.056	422.79	1911.59	0.00
130.0	29.5	0.055	426.74	1988.06	0.00
135.0	28.6	0.053	430.54	2064.52	0.00
140.0	27.8	0.052	434.20	2140.98	0.00
145.0	27.1	0.050	437.73	2217.45	0.00
150.0	26.4	0.049	441.15	2293.91	0.00
155.0	25.7	0.048	444.45	2370.38	0.00
160.0	25.1	0.047	447.65	2446.84	0.00
165.0	24.5	0.046	450.76	2523.30	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= 287.2 L/s
Min. Storage= **11.2** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	164.6	0.306	183.46	172.30	11.16
15.0	136.9	0.254	228.86	258.45	0.00
20.0	117.8	0.219	262.49	344.60	0.00
25.0	103.7	0.193	288.88	430.75	0.00
30.0	92.9	0.172	310.46	516.90	0.00
35.0	84.2	0.156	328.62	603.05	0.00
40.0	77.2	0.143	344.27	689.20	0.00
45.0	71.4	0.133	357.98	775.35	0.00
50.0	66.4	0.123	370.17	861.49	0.00
55.0	62.2	0.115	381.13	947.64	0.00
60.0	58.5	0.109	391.10	1033.79	0.00
65.0	55.2	0.103	400.22	1119.94	0.00
70.0	52.4	0.097	408.63	1206.09	0.00
75.0	49.8	0.093	416.43	1292.24	0.00
80.0	47.5	0.088	423.71	1378.39	0.00
85.0	45.4	0.084	430.53	1464.54	0.00
90.0	43.6	0.081	436.94	1550.69	0.00
95.0	41.8	0.078	443.00	1636.84	0.00
100.0	40.3	0.075	448.74	1722.99	0.00
105.0	38.8	0.072	454.19	1809.14	0.00
110.0	37.5	0.070	459.38	1895.29	0.00
115.0	36.2	0.067	464.34	1981.44	0.00
120.0	35.1	0.065	469.08	2067.59	0.00
125.0	34.0	0.063	473.63	2153.74	0.00
130.0	33.0	0.061	478.00	2239.89	0.00
135.0	32.0	0.060	482.20	2326.04	0.00
140.0	31.2	0.058	486.25	2412.19	0.00
145.0	30.3	0.056	490.16	2498.33	0.00
150.0	29.5	0.055	493.94	2584.48	0.00
155.0	28.8	0.054	497.59	2670.63	0.00
160.0	28.1	0.052	501.13	2756.78	0.00
165.0	27.4	0.051	504.56	2842.93	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A3 Post - BLOCK C

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A3) = **0.743** ha
"C" = **0.90**
AC = **0.669**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.743	0.90
Total	0.743	0.90

Allowable Release Rate= 317.2 L/s
Min. Storage= **12.3** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A3 Post)** (m^3/s)	**Runoff Volume (A3 Post)** (m^3)	**Target Released Volume (A3 Post)** (m^3)	**Total Required Storage Volume (A3 Post)** (m^3)
10.0	181.8	0.338	202.63	190.31	12.32
15.0	152.1	0.282	254.25	285.46	0.00
20.0	131.3	0.244	292.64	380.62	0.00
25.0	115.9	0.215	322.81	475.77	0.00
30.0	103.9	0.193	347.47	570.92	0.00
35.0	94.4	0.175	368.20	666.08	0.00
40.0	86.6	0.161	386.02	761.23	0.00
45.0	80.1	0.149	401.61	856.39	0.00
50.0	74.6	0.138	415.45	951.54	0.00
55.0	69.8	0.130	427.86	1046.69	0.00
60.0	65.7	0.122	439.12	1141.85	0.00
65.0	62.0	0.115	449.40	1237.00	0.00
70.0	58.8	0.109	458.87	1332.15	0.00
75.0	55.9	0.104	467.63	1427.31	0.00
80.0	53.4	0.099	475.79	1522.46	0.00
85.0	51.0	0.095	483.42	1617.62	0.00
90.0	48.9	0.091	490.58	1712.77	0.00
95.0	47.0	0.087	497.33	1807.92	0.00
100.0	45.2	0.084	503.72	1903.08	0.00
105.0	43.6	0.081	509.78	1998.23	0.00
110.0	42.1	0.078	515.54	2093.39	0.00
115.0	40.7	0.076	521.04	2188.54	0.00
120.0	39.4	0.073	526.29	2283.69	0.00
125.0	38.1	0.071	531.32	2378.85	0.00
130.0	37.0	0.069	536.14	2474.00	0.00
135.0	35.9	0.067	540.77	2569.16	0.00
140.0	34.9	0.065	545.24	2664.31	0.00
145.0	34.0	0.063	549.54	2759.46	0.00
150.0	33.1	0.062	553.69	2854.62	0.00
155.0	32.3	0.060	557.70	2949.77	0.00
160.0	31.5	0.058	561.59	3044.93	0.00
165.0	30.7	0.057	565.35	3140.08	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A4 Pre	0.710	0.88	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.019	0.25
Hardsc. Area	0.691	0.90
Total	0.710	0.88

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	74.1	0.129	129.0

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	103.0	0.179	179.4

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	122.3	0.213	212.9

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	146.1	0.254	254.3

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	164.6	0.287	286.6

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.710	0.88	0.63	10	181.8	0.317	316.5

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= **129.0** L/s
Min. Storage= **1.5** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	74.1	0.132	78.92	77.40	1.52
15.0	59.9	0.106	95.72	116.09	0.00
20.0	50.7	0.090	108.02	154.79	0.00
25.0	44.2	0.078	117.70	193.49	0.00
30.0	39.3	0.070	125.67	232.19	0.00
35.0	35.5	0.063	132.45	270.89	0.00
40.0	32.5	0.058	138.37	309.59	0.00
45.0	30.0	0.053	143.61	348.28	0.00
50.0	27.9	0.049	148.33	386.98	0.00
55.0	26.1	0.046	152.62	425.68	0.00
60.0	24.5	0.043	156.56	464.38	0.00
65.0	23.1	0.041	160.20	503.08	0.00
70.0	21.9	0.039	163.59	541.78	0.00
75.0	20.9	0.037	166.77	580.47	0.00
80.0	19.9	0.035	169.76	619.17	0.00
85.0	19.1	0.034	172.58	657.87	0.00
90.0	18.3	0.032	175.26	696.57	0.00
95.0	17.6	0.031	177.80	735.27	0.00
100.0	16.9	0.030	180.23	773.97	0.00
105.0	16.3	0.029	182.55	812.66	0.00
110.0	15.8	0.028	184.77	851.36	0.00
115.0	15.3	0.027	186.91	890.06	0.00
120.0	14.8	0.026	188.96	928.76	0.00
125.0	14.3	0.025	190.94	967.46	0.00
130.0	13.9	0.025	192.86	1006.15	0.00
135.0	13.5	0.024	194.70	1044.85	0.00
140.0	13.2	0.023	196.49	1083.55	0.00
145.0	12.8	0.023	198.23	1122.25	0.00
150.0	12.5	0.022	199.91	1160.95	0.00
155.0	12.2	0.022	201.55	1199.65	0.00
160.0	11.9	0.021	203.14	1238.34	0.00
165.0	11.6	0.021	204.69	1277.04	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= 179.4 L/s
Min. Storage= **2.1** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	103.0	0.183	109.74	107.62	2.11
15.0	84.6	0.150	135.19	161.43	0.00
20.0	72.3	0.128	153.92	215.25	0.00
25.0	63.3	0.112	168.62	269.06	0.00
30.0	56.5	0.100	180.67	322.87	0.00
35.0	51.2	0.091	190.86	376.68	0.00
40.0	46.9	0.083	199.69	430.49	0.00
45.0	43.3	0.077	207.47	484.30	0.00
50.0	40.3	0.071	214.42	538.12	0.00
55.0	37.7	0.067	220.71	591.93	0.00
60.0	35.4	0.063	226.45	645.74	0.00
65.0	33.5	0.059	231.74	699.55	0.00
70.0	31.7	0.056	236.63	753.36	0.00
75.0	30.2	0.054	241.20	807.17	0.00
80.0	28.8	0.051	245.47	860.98	0.00
85.0	27.6	0.049	249.49	914.80	0.00
90.0	26.4	0.047	253.29	968.61	0.00
95.0	25.4	0.045	256.89	1022.42	0.00
100.0	24.4	0.043	260.31	1076.23	0.00
105.0	23.6	0.042	263.57	1130.04	0.00
110.0	22.8	0.040	266.69	1183.85	0.00
115.0	22.0	0.039	269.67	1237.67	0.00
120.0	21.3	0.038	272.54	1291.48	0.00
125.0	20.7	0.037	275.29	1345.29	0.00
130.0	20.1	0.036	277.94	1399.10	0.00
135.0	19.5	0.035	280.50	1452.91	0.00
140.0	19.0	0.034	282.97	1506.72	0.00
145.0	18.5	0.033	285.36	1560.53	0.00
150.0	18.0	0.032	287.67	1614.35	0.00
155.0	17.6	0.031	289.92	1668.16	0.00
160.0	17.1	0.030	292.10	1721.97	0.00
165.0	16.7	0.030	294.22	1775.78	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= 212.9 L/s
Min. Storage= **2.5** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	122.3	0.217	130.24	127.73	2.51
15.0	101.1	0.179	161.53	191.60	0.00
20.0	86.7	0.154	184.62	255.47	0.00
25.0	76.2	0.135	202.75	319.33	0.00
30.0	68.1	0.121	217.59	383.20	0.00
35.0	61.7	0.110	230.12	447.07	0.00
40.0	56.6	0.100	240.93	510.93	0.00
45.0	52.3	0.093	250.44	574.80	0.00
50.0	48.6	0.086	258.91	638.67	0.00
55.0	45.5	0.081	266.55	702.53	0.00
60.0	42.8	0.076	273.51	766.40	0.00
65.0	40.4	0.072	279.91	830.27	0.00
70.0	38.3	0.068	285.81	894.13	0.00
75.0	36.5	0.065	291.31	958.00	0.00
80.0	34.8	0.062	296.44	1021.87	0.00
85.0	33.3	0.059	301.26	1085.73	0.00
90.0	31.9	0.057	305.81	1149.60	0.00
95.0	30.7	0.054	310.11	1213.46	0.00
100.0	29.5	0.052	314.19	1277.33	0.00
105.0	28.4	0.050	318.07	1341.20	0.00
110.0	27.5	0.049	321.77	1405.06	0.00
115.0	26.6	0.047	325.32	1468.93	0.00
120.0	25.7	0.046	328.71	1532.80	0.00
125.0	24.9	0.044	331.97	1596.66	0.00
130.0	24.2	0.043	335.11	1660.53	0.00
135.0	23.5	0.042	338.13	1724.40	0.00
140.0	22.9	0.041	341.04	1788.26	0.00
145.0	22.3	0.040	343.86	1852.13	0.00
150.0	21.7	0.039	346.58	1916.00	0.00
155.0	21.2	0.038	349.22	1979.86	0.00
160.0	20.6	0.037	351.78	2043.73	0.00
165.0	20.2	0.036	354.27	2107.60	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= **254.3** L/s
Min. Storage= **3.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	146.1	0.259	155.60	152.60	3.00
15.0	121.6	0.216	194.24	228.90	0.00
20.0	104.6	0.186	222.90	305.20	0.00
25.0	92.2	0.164	245.43	381.51	0.00
30.0	82.6	0.147	263.86	457.81	0.00
35.0	75.0	0.133	279.40	534.11	0.00
40.0	68.7	0.122	292.79	610.41	0.00
45.0	63.5	0.113	304.54	686.71	0.00
50.0	59.2	0.105	314.99	763.01	0.00
55.0	55.4	0.098	324.40	839.31	0.00
60.0	52.1	0.092	332.96	915.61	0.00
65.0	49.2	0.087	340.79	991.92	0.00
70.0	46.7	0.083	348.02	1068.22	0.00
75.0	44.4	0.079	354.73	1144.52	0.00
80.0	42.4	0.075	360.99	1220.82	0.00
85.0	40.5	0.072	366.86	1297.12	0.00
90.0	38.9	0.069	372.39	1373.42	0.00
95.0	37.3	0.066	377.60	1449.72	0.00
100.0	35.9	0.064	382.55	1526.02	0.00
105.0	34.6	0.061	387.25	1602.32	0.00
110.0	33.4	0.059	391.72	1678.63	0.00
115.0	32.3	0.057	396.00	1754.93	0.00
120.0	31.3	0.056	400.09	1831.23	0.00
125.0	30.3	0.054	404.01	1907.53	0.00
130.0	29.5	0.052	407.79	1983.83	0.00
135.0	28.6	0.051	411.41	2060.13	0.00
140.0	27.8	0.049	414.91	2136.43	0.00
145.0	27.1	0.048	418.29	2212.73	0.00
150.0	26.4	0.047	421.55	2289.03	0.00
155.0	25.7	0.046	424.71	2365.34	0.00
160.0	25.1	0.045	427.77	2441.64	0.00
165.0	24.5	0.044	430.74	2517.94	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= 286.6 L/s
Min. Storage= **3.4** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	164.6	0.292	175.31	171.93	3.38
15.0	136.9	0.243	218.70	257.90	0.00
20.0	117.8	0.209	250.83	343.87	0.00
25.0	103.7	0.184	276.05	429.83	0.00
30.0	92.9	0.165	296.67	515.80	0.00
35.0	84.2	0.150	314.03	601.76	0.00
40.0	77.2	0.137	328.97	687.73	0.00
45.0	71.4	0.127	342.08	773.70	0.00
50.0	66.4	0.118	353.73	859.66	0.00
55.0	62.2	0.110	364.21	945.63	0.00
60.0	58.5	0.104	373.73	1031.60	0.00
65.0	55.2	0.098	382.44	1117.56	0.00
70.0	52.4	0.093	390.48	1203.53	0.00
75.0	49.8	0.088	397.94	1289.49	0.00
80.0	47.5	0.084	404.89	1375.46	0.00
85.0	45.4	0.081	411.41	1461.43	0.00
90.0	43.6	0.077	417.54	1547.39	0.00
95.0	41.8	0.074	423.32	1633.36	0.00
100.0	40.3	0.071	428.81	1719.33	0.00
105.0	38.8	0.069	434.02	1805.29	0.00
110.0	37.5	0.067	438.98	1891.26	0.00
115.0	36.2	0.064	443.71	1977.22	0.00
120.0	35.1	0.062	448.25	2063.19	0.00
125.0	34.0	0.060	452.59	2149.16	0.00
130.0	33.0	0.059	456.77	2235.12	0.00
135.0	32.0	0.057	460.78	2321.09	0.00
140.0	31.2	0.055	464.65	2407.06	0.00
145.0	30.3	0.054	468.39	2493.02	0.00
150.0	29.5	0.052	472.00	2578.99	0.00
155.0	28.8	0.051	475.49	2664.96	0.00
160.0	28.1	0.050	478.87	2750.92	0.00
165.0	27.4	0.049	482.15	2836.89	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A4 Post - BLOCK D

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A4) = **0.710** ha
"C" = **0.90**
AC = **0.639**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.710	0.90
Total	0.710	0.90

Allowable Release Rate= 316.5 L/s
Min. Storage= **3.7** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A4 Post)** (m^3/s)	**Runoff Volume (A4 Post)** (m^3)	**Target Released Volume (A4 Post)** (m^3)	**Total Required Storage Volume (A4 Post)** (m^3)
10.0	181.8	0.323	193.63	189.90	3.73
15.0	152.1	0.270	242.95	284.85	0.00
20.0	131.3	0.233	279.64	379.81	0.00
25.0	115.9	0.206	308.48	474.76	0.00
30.0	103.9	0.184	332.04	569.71	0.00
35.0	94.4	0.168	351.85	664.66	0.00
40.0	86.6	0.154	368.88	759.61	0.00
45.0	80.1	0.142	383.78	854.56	0.00
50.0	74.6	0.132	396.99	949.52	0.00
55.0	69.8	0.124	408.86	1044.47	0.00
60.0	65.7	0.117	419.61	1139.42	0.00
65.0	62.0	0.110	429.44	1234.37	0.00
70.0	58.8	0.104	438.49	1329.32	0.00
75.0	55.9	0.099	446.86	1424.27	0.00
80.0	53.4	0.095	454.66	1519.23	0.00
85.0	51.0	0.091	461.95	1614.18	0.00
90.0	48.9	0.087	468.79	1709.13	0.00
95.0	47.0	0.083	475.25	1804.08	0.00
100.0	45.2	0.080	481.35	1899.03	0.00
105.0	43.6	0.077	487.14	1993.98	0.00
110.0	42.1	0.075	492.65	2088.94	0.00
115.0	40.7	0.072	497.90	2183.89	0.00
120.0	39.4	0.070	502.91	2278.84	0.00
125.0	38.1	0.068	507.72	2373.79	0.00
130.0	37.0	0.066	512.33	2468.74	0.00
135.0	35.9	0.064	516.76	2563.69	0.00
140.0	34.9	0.062	521.02	2658.65	0.00
145.0	34.0	0.060	525.13	2753.60	0.00
150.0	33.1	0.059	529.10	2848.55	0.00
155.0	32.3	0.057	532.93	2943.50	0.00
160.0	31.5	0.056	536.64	3038.45	0.00
165.0	30.7	0.055	540.24	3133.40	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A5 Pre	0.761	0.90	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.005	0.25
Hardsc. Area	0.756	0.90
Total	0.761	0.90

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	74.1	0.140	140.3

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	103.0	0.195	195.1

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	122.3	0.232	231.5

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	146.1	0.277	276.6

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	164.6	0.312	311.6

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A5 Pre	0.761	0.90	0.68	10	181.8	0.344	344.2

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= 140.3 L/s
Min. Storage= **0.4** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	74.1	0.141	84.58	84.17	0.42
15.0	59.9	0.114	102.60	126.25	0.00
20.0	50.7	0.096	115.78	168.34	0.00
25.0	44.2	0.084	126.15	210.42	0.00
30.0	39.3	0.075	134.70	252.50	0.00
35.0	35.5	0.068	141.97	294.59	0.00
40.0	32.5	0.062	148.30	336.67	0.00
45.0	30.0	0.057	153.92	378.76	0.00
50.0	27.9	0.053	158.98	420.84	0.00
55.0	26.1	0.050	163.58	462.92	0.00
60.0	24.5	0.047	167.80	505.01	0.00
65.0	23.1	0.044	171.71	547.09	0.00
70.0	21.9	0.042	175.34	589.17	0.00
75.0	20.9	0.040	178.75	631.26	0.00
80.0	19.9	0.038	181.95	673.34	0.00
85.0	19.1	0.036	184.98	715.43	0.00
90.0	18.3	0.035	187.84	757.51	0.00
95.0	17.6	0.033	190.57	799.59	0.00
100.0	16.9	0.032	193.17	841.68	0.00
105.0	16.3	0.031	195.66	883.76	0.00
110.0	15.8	0.030	198.04	925.85	0.00
115.0	15.3	0.029	200.33	967.93	0.00
120.0	14.8	0.028	202.54	1010.01	0.00
125.0	14.3	0.027	204.66	1052.10	0.00
130.0	13.9	0.027	206.71	1094.18	0.00
135.0	13.5	0.026	208.69	1136.27	0.00
140.0	13.2	0.025	210.61	1178.35	0.00
145.0	12.8	0.024	212.47	1220.43	0.00
150.0	12.5	0.024	214.27	1262.52	0.00
155.0	12.2	0.023	216.03	1304.60	0.00
160.0	11.9	0.023	217.73	1346.68	0.00
165.0	11.6	0.022	219.39	1388.77	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= 195.1 L/s
Min. Storage= **0.6** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	103.0	0.196	117.62	117.04	0.58
15.0	84.6	0.161	144.90	175.56	0.00
20.0	72.3	0.137	164.98	234.08	0.00
25.0	63.3	0.120	180.73	292.60	0.00
30.0	56.5	0.108	193.65	351.12	0.00
35.0	51.2	0.097	204.57	409.64	0.00
40.0	46.9	0.089	214.03	468.16	0.00
45.0	43.3	0.082	222.37	526.67	0.00
50.0	40.3	0.077	229.82	585.19	0.00
55.0	37.7	0.072	236.57	643.71	0.00
60.0	35.4	0.067	242.72	702.23	0.00
65.0	33.5	0.064	248.38	760.75	0.00
70.0	31.7	0.060	253.63	819.27	0.00
75.0	30.2	0.057	258.52	877.79	0.00
80.0	28.8	0.055	263.10	936.31	0.00
85.0	27.6	0.052	267.41	994.83	0.00
90.0	26.4	0.050	271.49	1053.35	0.00
95.0	25.4	0.048	275.34	1111.87	0.00
100.0	24.4	0.047	279.01	1170.39	0.00
105.0	23.6	0.045	282.50	1228.91	0.00
110.0	22.8	0.043	285.84	1287.43	0.00
115.0	22.0	0.042	289.04	1345.95	0.00
120.0	21.3	0.041	292.11	1404.47	0.00
125.0	20.7	0.039	295.06	1462.98	0.00
130.0	20.1	0.038	297.91	1521.50	0.00
135.0	19.5	0.037	300.65	1580.02	0.00
140.0	19.0	0.036	303.30	1638.54	0.00
145.0	18.5	0.035	305.86	1697.06	0.00
150.0	18.0	0.034	308.34	1755.58	0.00
155.0	17.6	0.033	310.74	1814.10	0.00
160.0	17.1	0.033	313.08	1872.62	0.00
165.0	16.7	0.032	315.35	1931.14	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= 231.5 L/s
Min. Storage= **0.7** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	122.3	0.233	139.60	138.91	0.69
15.0	101.1	0.192	173.13	208.36	0.00
20.0	86.7	0.165	197.89	277.82	0.00
25.0	76.2	0.145	217.32	347.27	0.00
30.0	68.1	0.130	233.22	416.72	0.00
35.0	61.7	0.117	246.65	486.18	0.00
40.0	56.6	0.108	258.24	555.63	0.00
45.0	52.3	0.099	268.42	625.09	0.00
50.0	48.6	0.093	277.51	694.54	0.00
55.0	45.5	0.087	285.70	764.00	0.00
60.0	42.8	0.081	293.16	833.45	0.00
65.0	40.4	0.077	300.01	902.90	0.00
70.0	38.3	0.073	306.34	972.36	0.00
75.0	36.5	0.069	312.23	1041.81	0.00
80.0	34.8	0.066	317.73	1111.27	0.00
85.0	33.3	0.063	322.90	1180.72	0.00
90.0	31.9	0.061	327.77	1250.17	0.00
95.0	30.7	0.058	332.38	1319.63	0.00
100.0	29.5	0.056	336.75	1389.08	0.00
105.0	28.4	0.054	340.92	1458.54	0.00
110.0	27.5	0.052	344.89	1527.99	0.00
115.0	26.6	0.051	348.68	1597.44	0.00
120.0	25.7	0.049	352.32	1666.90	0.00
125.0	24.9	0.047	355.82	1736.35	0.00
130.0	24.2	0.046	359.18	1805.81	0.00
135.0	23.5	0.045	362.41	1875.26	0.00
140.0	22.9	0.044	365.54	1944.72	0.00
145.0	22.3	0.042	368.56	2014.17	0.00
150.0	21.7	0.041	371.48	2083.62	0.00
155.0	21.2	0.040	374.31	2153.08	0.00
160.0	20.6	0.039	377.05	2222.53	0.00
165.0	20.2	0.038	379.71	2291.99	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= **276.6** L/s
Min. Storage= **0.8** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	146.1	0.278	166.77	165.95	0.82
15.0	121.6	0.231	208.19	248.93	0.00
20.0	104.6	0.199	238.91	331.91	0.00
25.0	92.2	0.175	263.06	414.88	0.00
30.0	82.6	0.157	282.82	497.86	0.00
35.0	75.0	0.143	299.47	580.84	0.00
40.0	68.7	0.131	313.82	663.81	0.00
45.0	63.5	0.121	326.42	746.79	0.00
50.0	59.2	0.113	337.62	829.77	0.00
55.0	55.4	0.105	347.71	912.74	0.00
60.0	52.1	0.099	356.87	995.72	0.00
65.0	49.2	0.094	365.27	1078.70	0.00
70.0	46.7	0.089	373.02	1161.67	0.00
75.0	44.4	0.084	380.21	1244.65	0.00
80.0	42.4	0.081	386.92	1327.63	0.00
85.0	40.5	0.077	393.22	1410.60	0.00
90.0	38.9	0.074	399.14	1493.58	0.00
95.0	37.3	0.071	404.73	1576.56	0.00
100.0	35.9	0.068	410.03	1659.53	0.00
105.0	34.6	0.066	415.06	1742.51	0.00
110.0	33.4	0.064	419.86	1825.48	0.00
115.0	32.3	0.062	424.44	1908.46	0.00
120.0	31.3	0.060	428.83	1991.44	0.00
125.0	30.3	0.058	433.04	2074.41	0.00
130.0	29.5	0.056	437.08	2157.39	0.00
135.0	28.6	0.054	440.97	2240.37	0.00
140.0	27.8	0.053	444.72	2323.34	0.00
145.0	27.1	0.052	448.34	2406.32	0.00
150.0	26.4	0.050	451.83	2489.30	0.00
155.0	25.7	0.049	455.22	2572.27	0.00
160.0	25.1	0.048	458.50	2655.25	0.00
165.0	24.5	0.047	461.68	2738.23	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= 311.6 L/s
Min. Storage= **0.9** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	164.6	0.313	187.90	186.97	0.93
15.0	136.9	0.260	234.41	280.46	0.00
20.0	117.8	0.224	268.85	373.95	0.00
25.0	103.7	0.197	295.88	467.44	0.00
30.0	92.9	0.177	317.98	560.92	0.00
35.0	84.2	0.160	336.58	654.41	0.00
40.0	77.2	0.147	352.61	747.90	0.00
45.0	71.4	0.136	366.65	841.39	0.00
50.0	66.4	0.126	379.14	934.87	0.00
55.0	62.2	0.118	390.37	1028.36	0.00
60.0	58.5	0.111	400.57	1121.85	0.00
65.0	55.2	0.105	409.91	1215.33	0.00
70.0	52.4	0.100	418.53	1308.82	0.00
75.0	49.8	0.095	426.52	1402.31	0.00
80.0	47.5	0.090	433.97	1495.80	0.00
85.0	45.4	0.086	440.96	1589.28	0.00
90.0	43.6	0.083	447.53	1682.77	0.00
95.0	41.8	0.080	453.73	1776.26	0.00
100.0	40.3	0.077	459.61	1869.75	0.00
105.0	38.8	0.074	465.19	1963.23	0.00
110.0	37.5	0.071	470.51	2056.72	0.00
115.0	36.2	0.069	475.59	2150.21	0.00
120.0	35.1	0.067	480.44	2243.70	0.00
125.0	34.0	0.065	485.10	2337.18	0.00
130.0	33.0	0.063	489.58	2430.67	0.00
135.0	32.0	0.061	493.88	2524.16	0.00
140.0	31.2	0.059	498.03	2617.64	0.00
145.0	30.3	0.058	502.03	2711.13	0.00
150.0	29.5	0.056	505.90	2804.62	0.00
155.0	28.8	0.055	509.65	2898.11	0.00
160.0	28.1	0.053	513.27	2991.59	0.00
165.0	27.4	0.052	516.79	3085.08	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A5 Post - BLOCK E

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A5) = **0.761** ha
"C" = **0.90**
AC = **0.685**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.761	0.90
Total	0.761	0.90

Allowable Release Rate= 344.2 L/s
Min. Storage= **1.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A5 Post)** (m^3/s)	**Runoff Volume (A5 Post)** (m^3)	**Target Released Volume (A5 Post)** (m^3)	**Total Required Storage Volume (A5 Post)** (m^3)
10.0	181.8	0.346	207.54	206.52	1.02
15.0	152.1	0.289	260.41	309.78	0.00
20.0	131.3	0.250	299.73	413.03	0.00
25.0	115.9	0.220	330.63	516.29	0.00
30.0	103.9	0.198	355.89	619.55	0.00
35.0	94.4	0.180	377.12	722.81	0.00
40.0	86.6	0.165	395.37	826.07	0.00
45.0	80.1	0.152	411.34	929.33	0.00
50.0	74.6	0.142	425.51	1032.59	0.00
55.0	69.8	0.133	438.23	1135.85	0.00
60.0	65.7	0.125	449.76	1239.10	0.00
65.0	62.0	0.118	460.29	1342.36	0.00
70.0	58.8	0.112	469.98	1445.62	0.00
75.0	55.9	0.106	478.96	1548.88	0.00
80.0	53.4	0.102	487.31	1652.14	0.00
85.0	51.0	0.097	495.13	1755.40	0.00
90.0	48.9	0.093	502.47	1858.66	0.00
95.0	47.0	0.089	509.38	1961.92	0.00
100.0	45.2	0.086	515.93	2065.17	0.00
105.0	43.6	0.083	522.13	2168.43	0.00
110.0	42.1	0.080	528.03	2271.69	0.00
115.0	40.7	0.077	533.66	2374.95	0.00
120.0	39.4	0.075	539.04	2478.21	0.00
125.0	38.1	0.073	544.19	2581.47	0.00
130.0	37.0	0.070	549.13	2684.73	0.00
135.0	35.9	0.068	553.87	2787.99	0.00
140.0	34.9	0.066	558.44	2891.24	0.00
145.0	34.0	0.065	562.85	2994.50	0.00
150.0	33.1	0.063	567.10	3097.76	0.00
155.0	32.3	0.061	571.21	3201.02	0.00
160.0	31.5	0.060	575.19	3304.28	0.00
165.0	30.7	0.058	579.04	3407.54	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A6 Pre	0.491	0.90	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.000	0.25
Hardsc. Area	0.491	0.90
Total	0.491	0.90

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	74.1	0.091	91.0

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	103.0	0.126	126.5

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	122.3	0.150	150.1

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	146.1	0.179	179.3

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	164.6	0.202	202.1

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A6 Pre	0.491	0.90	0.44	10	181.8	0.223	223.2

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= 91.0 L/s
Min. Storage= **0.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	74.1	0.025	15.16	54.57	0.00
15.0	59.9	0.020	18.39	81.86	0.00
20.0	50.7	0.017	20.75	109.15	0.00
25.0	44.2	0.015	22.61	136.44	0.00
30.0	39.3	0.013	24.14	163.72	0.00
35.0	35.5	0.012	25.44	191.01	0.00
40.0	32.5	0.011	26.58	218.30	0.00
45.0	30.0	0.010	27.59	245.58	0.00
50.0	27.9	0.009	28.49	272.87	0.00
55.0	26.1	0.009	29.32	300.16	0.00
60.0	24.5	0.008	30.07	327.45	0.00
65.0	23.1	0.008	30.77	354.73	0.00
70.0	21.9	0.007	31.43	382.02	0.00
75.0	20.9	0.007	32.04	409.31	0.00
80.0	19.9	0.007	32.61	436.59	0.00
85.0	19.1	0.007	33.15	463.88	0.00
90.0	18.3	0.006	33.67	491.17	0.00
95.0	17.6	0.006	34.15	518.46	0.00
100.0	16.9	0.006	34.62	545.74	0.00
105.0	16.3	0.006	35.07	573.03	0.00
110.0	15.8	0.005	35.49	600.32	0.00
115.0	15.3	0.005	35.90	627.60	0.00
120.0	14.8	0.005	36.30	654.89	0.00
125.0	14.3	0.005	36.68	682.18	0.00
130.0	13.9	0.005	37.05	709.46	0.00
135.0	13.5	0.005	37.40	736.75	0.00
140.0	13.2	0.004	37.75	764.04	0.00
145.0	12.8	0.004	38.08	791.33	0.00
150.0	12.5	0.004	38.40	818.61	0.00
155.0	12.2	0.004	38.72	845.90	0.00
160.0	11.9	0.004	39.02	873.19	0.00
165.0	11.6	0.004	39.32	900.47	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= 126.5 L/s
Min. Storage= **0.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	103.0	0.035	21.08	75.89	0.00
15.0	84.6	0.029	25.97	113.83	0.00
20.0	72.3	0.025	29.57	151.78	0.00
25.0	63.3	0.022	32.39	189.72	0.00
30.0	56.5	0.019	34.71	227.66	0.00
35.0	51.2	0.017	36.66	265.61	0.00
40.0	46.9	0.016	38.36	303.55	0.00
45.0	43.3	0.015	39.85	341.49	0.00
50.0	40.3	0.014	41.19	379.44	0.00
55.0	37.7	0.013	42.40	417.38	0.00
60.0	35.4	0.012	43.50	455.33	0.00
65.0	33.5	0.011	44.52	493.27	0.00
70.0	31.7	0.011	45.46	531.21	0.00
75.0	30.2	0.010	46.33	569.16	0.00
80.0	28.8	0.010	47.15	607.10	0.00
85.0	27.6	0.009	47.93	645.05	0.00
90.0	26.4	0.009	48.66	682.99	0.00
95.0	25.4	0.009	49.35	720.93	0.00
100.0	24.4	0.008	50.00	758.88	0.00
105.0	23.6	0.008	50.63	796.82	0.00
110.0	22.8	0.008	51.23	834.76	0.00
115.0	22.0	0.008	51.80	872.71	0.00
120.0	21.3	0.007	52.35	910.65	0.00
125.0	20.7	0.007	52.88	948.60	0.00
130.0	20.1	0.007	53.39	986.54	0.00
135.0	19.5	0.007	53.88	1024.48	0.00
140.0	19.0	0.006	54.36	1062.43	0.00
145.0	18.5	0.006	54.82	1100.37	0.00
150.0	18.0	0.006	55.26	1138.32	0.00
155.0	17.6	0.006	55.69	1176.26	0.00
160.0	17.1	0.006	56.11	1214.20	0.00
165.0	16.7	0.006	56.52	1252.15	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= 150.1 L/s
Min. Storage= **0.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	122.3	0.042	25.02	90.07	0.00
15.0	101.1	0.034	31.03	135.10	0.00
20.0	86.7	0.030	35.47	180.14	0.00
25.0	76.2	0.026	38.95	225.17	0.00
30.0	68.1	0.023	41.80	270.20	0.00
35.0	61.7	0.021	44.20	315.24	0.00
40.0	56.6	0.019	46.28	360.27	0.00
45.0	52.3	0.018	48.11	405.31	0.00
50.0	48.6	0.017	49.74	450.34	0.00
55.0	45.5	0.016	51.20	495.37	0.00
60.0	42.8	0.015	52.54	540.41	0.00
65.0	40.4	0.014	53.77	585.44	0.00
70.0	38.3	0.013	54.90	630.47	0.00
75.0	36.5	0.012	55.96	675.51	0.00
80.0	34.8	0.012	56.95	720.54	0.00
85.0	33.3	0.011	57.87	765.58	0.00
90.0	31.9	0.011	58.74	810.61	0.00
95.0	30.7	0.010	59.57	855.64	0.00
100.0	29.5	0.010	60.35	900.68	0.00
105.0	28.4	0.010	61.10	945.71	0.00
110.0	27.5	0.009	61.81	990.75	0.00
115.0	26.6	0.009	62.49	1035.78	0.00
120.0	25.7	0.009	63.14	1080.81	0.00
125.0	24.9	0.009	63.77	1125.85	0.00
130.0	24.2	0.008	64.37	1170.88	0.00
135.0	23.5	0.008	64.95	1215.92	0.00
140.0	22.9	0.008	65.51	1260.95	0.00
145.0	22.3	0.008	66.05	1305.98	0.00
150.0	21.7	0.007	66.58	1351.02	0.00
155.0	21.2	0.007	67.08	1396.05	0.00
160.0	20.6	0.007	67.58	1441.09	0.00
165.0	20.2	0.007	68.05	1486.12	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= **179.3** L/s
Min. Storage= **0.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	146.1	0.050	29.89	107.60	0.00
15.0	121.6	0.041	37.31	161.41	0.00
20.0	104.6	0.036	42.82	215.21	0.00
25.0	92.2	0.031	47.15	269.01	0.00
30.0	82.6	0.028	50.69	322.81	0.00
35.0	75.0	0.026	53.67	376.61	0.00
40.0	68.7	0.023	56.24	430.41	0.00
45.0	63.5	0.022	58.50	484.22	0.00
50.0	59.2	0.020	60.51	538.02	0.00
55.0	55.4	0.019	62.32	591.82	0.00
60.0	52.1	0.018	63.96	645.62	0.00
65.0	49.2	0.017	65.47	699.42	0.00
70.0	46.7	0.016	66.85	753.23	0.00
75.0	44.4	0.015	68.14	807.03	0.00
80.0	42.4	0.014	69.35	860.83	0.00
85.0	40.5	0.014	70.47	914.63	0.00
90.0	38.9	0.013	71.53	968.43	0.00
95.0	37.3	0.013	72.54	1022.24	0.00
100.0	35.9	0.012	73.49	1076.04	0.00
105.0	34.6	0.012	74.39	1129.84	0.00
110.0	33.4	0.011	75.25	1183.64	0.00
115.0	32.3	0.011	76.07	1237.44	0.00
120.0	31.3	0.011	76.86	1291.24	0.00
125.0	30.3	0.010	77.61	1345.05	0.00
130.0	29.5	0.010	78.33	1398.85	0.00
135.0	28.6	0.010	79.03	1452.65	0.00
140.0	27.8	0.009	79.70	1506.45	0.00
145.0	27.1	0.009	80.35	1560.25	0.00
150.0	26.4	0.009	80.98	1614.06	0.00
155.0	25.7	0.009	81.59	1667.86	0.00
160.0	25.1	0.009	82.17	1721.66	0.00
165.0	24.5	0.008	82.74	1775.46	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= **202.1** L/s
Min. Storage= **0.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	164.6	0.056	33.68	121.23	0.00
15.0	136.9	0.047	42.01	181.85	0.00
20.0	117.8	0.040	48.18	242.47	0.00
25.0	103.7	0.035	53.03	303.08	0.00
30.0	92.9	0.032	56.99	363.70	0.00
35.0	84.2	0.029	60.32	424.32	0.00
40.0	77.2	0.026	63.20	484.94	0.00
45.0	71.4	0.024	65.71	545.55	0.00
50.0	66.4	0.023	67.95	606.17	0.00
55.0	62.2	0.021	69.96	666.79	0.00
60.0	58.5	0.020	71.79	727.40	0.00
65.0	55.2	0.019	73.47	788.02	0.00
70.0	52.4	0.018	75.01	848.64	0.00
75.0	49.8	0.017	76.44	909.25	0.00
80.0	47.5	0.016	77.78	969.87	0.00
85.0	45.4	0.015	79.03	1030.49	0.00
90.0	43.6	0.015	80.21	1091.11	0.00
95.0	41.8	0.014	81.32	1151.72	0.00
100.0	40.3	0.014	82.37	1212.34	0.00
105.0	38.8	0.013	83.37	1272.96	0.00
110.0	37.5	0.013	84.33	1333.57	0.00
115.0	36.2	0.012	85.24	1394.19	0.00
120.0	35.1	0.012	86.11	1454.81	0.00
125.0	34.0	0.012	86.94	1515.42	0.00
130.0	33.0	0.011	87.74	1576.04	0.00
135.0	32.0	0.011	88.51	1636.66	0.00
140.0	31.2	0.011	89.26	1697.28	0.00
145.0	30.3	0.010	89.98	1757.89	0.00
150.0	29.5	0.010	90.67	1818.51	0.00
155.0	28.8	0.010	91.34	1879.13	0.00
160.0	28.1	0.010	91.99	1939.74	0.00
165.0	27.4	0.009	92.62	2000.36	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A6 Post - BLOCK F

Parkland Area

Area (A6) = **0.491** ha
"C" = **0.25**
AC = **0.123**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.491	0.25
Hardsc. Area	0.000	0.90
Total	0.491	0.25

Allowable Release Rate= **223.2** L/s
Min. Storage= **0.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A6 Post)** (m^3/s)	**Runoff Volume (A6 Post)** (m^3)	**Target Released Volume (A6 Post)** (m^3)	**Total Required Storage Volume (A6 Post)** (m^3)
10.0	181.8	0.062	37.20	133.91	0.00
15.0	152.1	0.052	46.67	200.86	0.00
20.0	131.3	0.045	53.72	267.81	0.00
25.0	115.9	0.040	59.26	334.76	0.00
30.0	103.9	0.035	63.78	401.72	0.00
35.0	94.4	0.032	67.59	468.67	0.00
40.0	86.6	0.030	70.86	535.62	0.00
45.0	80.1	0.027	73.72	602.57	0.00
50.0	74.6	0.025	76.26	669.53	0.00
55.0	69.8	0.024	78.54	736.48	0.00
60.0	65.7	0.022	80.61	803.43	0.00
65.0	62.0	0.021	82.49	870.39	0.00
70.0	58.8	0.020	84.23	937.34	0.00
75.0	55.9	0.019	85.84	1004.29	0.00
80.0	53.4	0.018	87.34	1071.24	0.00
85.0	51.0	0.017	88.74	1138.20	0.00
90.0	48.9	0.017	90.05	1205.15	0.00
95.0	47.0	0.016	91.29	1272.10	0.00
100.0	45.2	0.015	92.47	1339.06	0.00
105.0	43.6	0.015	93.58	1406.01	0.00
110.0	42.1	0.014	94.64	1472.96	0.00
115.0	40.7	0.014	95.64	1539.91	0.00
120.0	39.4	0.013	96.61	1606.87	0.00
125.0	38.1	0.013	97.53	1673.82	0.00
130.0	37.0	0.013	98.42	1740.77	0.00
135.0	35.9	0.012	99.27	1807.72	0.00
140.0	34.9	0.012	100.09	1874.68	0.00
145.0	34.0	0.012	100.88	1941.63	0.00
150.0	33.1	0.011	101.64	2008.58	0.00
155.0	32.3	0.011	102.37	2075.54	0.00
160.0	31.5	0.011	103.09	2142.49	0.00
165.0	30.7	0.010	103.78	2209.44	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A7 Pre	0.290	0.86	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.019	0.25
Hardsc. Area	0.271	0.90
Total	0.290	0.86

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	74.1	0.051	51.1

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	103.0	0.071	71.1

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	122.3	0.084	84.4

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	146.1	0.101	100.8

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	164.6	0.114	113.6

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A7 Pre	0.290	0.86	0.25	10	181.8	0.125	125.4

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) = **0.290** ha
"C" = **0.25**
AC = **0.073**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= 51.1 L/s
Min. Storage= **0.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	74.1	0.015	8.95	30.68	0.00
15.0	59.9	0.012	10.86	46.01	0.00
20.0	50.7	0.010	12.26	61.35	0.00
25.0	44.2	0.009	13.35	76.69	0.00
30.0	39.3	0.008	14.26	92.03	0.00
35.0	35.5	0.007	15.03	107.37	0.00
40.0	32.5	0.007	15.70	122.70	0.00
45.0	30.0	0.006	16.29	138.04	0.00
50.0	27.9	0.006	16.83	153.38	0.00
55.0	26.1	0.005	17.32	168.72	0.00
60.0	24.5	0.005	17.76	184.06	0.00
65.0	23.1	0.005	18.18	199.39	0.00
70.0	21.9	0.004	18.56	214.73	0.00
75.0	20.9	0.004	18.92	230.07	0.00
80.0	19.9	0.004	19.26	245.41	0.00
85.0	19.1	0.004	19.58	260.75	0.00
90.0	18.3	0.004	19.88	276.08	0.00
95.0	17.6	0.004	20.17	291.42	0.00
100.0	16.9	0.003	20.45	306.76	0.00
105.0	16.3	0.003	20.71	322.10	0.00
110.0	15.8	0.003	20.96	337.44	0.00
115.0	15.3	0.003	21.21	352.77	0.00
120.0	14.8	0.003	21.44	368.11	0.00
125.0	14.3	0.003	21.66	383.45	0.00
130.0	13.9	0.003	21.88	398.79	0.00
135.0	13.5	0.003	22.09	414.12	0.00
140.0	13.2	0.003	22.29	429.46	0.00
145.0	12.8	0.003	22.49	444.80	0.00
150.0	12.5	0.003	22.68	460.14	0.00
155.0	12.2	0.002	22.87	475.48	0.00
160.0	11.9	0.002	23.05	490.81	0.00
165.0	11.6	0.002	23.22	506.15	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) =	**0.290**	ha
"C" =	**0.25**	
AC =	**0.073**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= **71.1** L/s
Min. Storage= **0.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	103.0	0.021	12.45	42.66	0.00
15.0	84.6	0.017	15.34	63.98	0.00
20.0	72.3	0.015	17.46	85.31	0.00
25.0	63.3	0.013	19.13	106.64	0.00
30.0	56.5	0.011	20.50	127.97	0.00
35.0	51.2	0.010	21.66	149.30	0.00
40.0	46.9	0.009	22.66	170.62	0.00
45.0	43.3	0.009	23.54	191.95	0.00
50.0	40.3	0.008	24.33	213.28	0.00
55.0	37.7	0.008	25.04	234.61	0.00
60.0	35.4	0.007	25.69	255.94	0.00
65.0	33.5	0.007	26.29	277.26	0.00
70.0	31.7	0.006	26.85	298.59	0.00
75.0	30.2	0.006	27.37	319.92	0.00
80.0	28.8	0.006	27.85	341.25	0.00
85.0	27.6	0.006	28.31	362.58	0.00
90.0	26.4	0.005	28.74	383.91	0.00
95.0	25.4	0.005	29.15	405.23	0.00
100.0	24.4	0.005	29.53	426.56	0.00
105.0	23.6	0.005	29.90	447.89	0.00
110.0	22.8	0.005	30.26	469.22	0.00
115.0	22.0	0.004	30.60	490.55	0.00
120.0	21.3	0.004	30.92	511.87	0.00
125.0	20.7	0.004	31.23	533.20	0.00
130.0	20.1	0.004	31.53	554.53	0.00
135.0	19.5	0.004	31.82	575.86	0.00
140.0	19.0	0.004	32.11	597.19	0.00
145.0	18.5	0.004	32.38	618.51	0.00
150.0	18.0	0.004	32.64	639.84	0.00
155.0	17.6	0.004	32.89	661.17	0.00
160.0	17.1	0.003	33.14	682.50	0.00
165.0	16.7	0.003	33.38	703.83	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) = **0.290** ha
"C" = **0.25**
AC = **0.073**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= **84.4** L/s
Min. Storage= **0.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	122.3	0.025	14.78	50.63	0.00
15.0	101.1	0.020	18.33	75.94	0.00
20.0	86.7	0.017	20.95	101.25	0.00
25.0	76.2	0.015	23.00	126.57	0.00
30.0	68.1	0.014	24.69	151.88	0.00
35.0	61.7	0.012	26.11	177.19	0.00
40.0	56.6	0.011	27.34	202.51	0.00
45.0	52.3	0.011	28.41	227.82	0.00
50.0	48.6	0.010	29.38	253.13	0.00
55.0	45.5	0.009	30.24	278.45	0.00
60.0	42.8	0.009	31.03	303.76	0.00
65.0	40.4	0.008	31.76	329.07	0.00
70.0	38.3	0.008	32.43	354.39	0.00
75.0	36.5	0.007	33.05	379.70	0.00
80.0	34.8	0.007	33.63	405.01	0.00
85.0	33.3	0.007	34.18	430.33	0.00
90.0	31.9	0.006	34.70	455.64	0.00
95.0	30.7	0.006	35.18	480.95	0.00
100.0	29.5	0.006	35.65	506.27	0.00
105.0	28.4	0.006	36.09	531.58	0.00
110.0	27.5	0.006	36.51	556.89	0.00
115.0	26.6	0.005	36.91	582.21	0.00
120.0	25.7	0.005	37.29	607.52	0.00
125.0	24.9	0.005	37.66	632.83	0.00
130.0	24.2	0.005	38.02	658.15	0.00
135.0	23.5	0.005	38.36	683.46	0.00
140.0	22.9	0.005	38.69	708.77	0.00
145.0	22.3	0.004	39.01	734.09	0.00
150.0	21.7	0.004	39.32	759.40	0.00
155.0	21.2	0.004	39.62	784.71	0.00
160.0	20.6	0.004	39.91	810.03	0.00
165.0	20.2	0.004	40.19	835.34	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) = **0.290** ha
"C" = **0.25**
AC = **0.073**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= **100.8** L/s
Min. Storage= **0.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	146.1	0.029	17.65	60.48	0.00
15.0	121.6	0.024	22.04	90.73	0.00
20.0	104.6	0.021	25.29	120.97	0.00
25.0	92.2	0.019	27.85	151.21	0.00
30.0	82.6	0.017	29.94	181.45	0.00
35.0	75.0	0.015	31.70	211.69	0.00
40.0	68.7	0.014	33.22	241.93	0.00
45.0	63.5	0.013	34.55	272.18	0.00
50.0	59.2	0.012	35.74	302.42	0.00
55.0	55.4	0.011	36.81	332.66	0.00
60.0	52.1	0.010	37.78	362.90	0.00
65.0	49.2	0.010	38.67	393.14	0.00
70.0	46.7	0.009	39.49	423.38	0.00
75.0	44.4	0.009	40.25	453.63	0.00
80.0	42.4	0.009	40.96	483.87	0.00
85.0	40.5	0.008	41.62	514.11	0.00
90.0	38.9	0.008	42.25	544.35	0.00
95.0	37.3	0.008	42.84	574.59	0.00
100.0	35.9	0.007	43.40	604.84	0.00
105.0	34.6	0.007	43.94	635.08	0.00
110.0	33.4	0.007	44.44	665.32	0.00
115.0	32.3	0.007	44.93	695.56	0.00
120.0	31.3	0.006	45.39	725.80	0.00
125.0	30.3	0.006	45.84	756.04	0.00
130.0	29.5	0.006	46.27	786.29	0.00
135.0	28.6	0.006	46.68	816.53	0.00
140.0	27.8	0.006	47.08	846.77	0.00
145.0	27.1	0.005	47.46	877.01	0.00
150.0	26.4	0.005	47.83	907.25	0.00
155.0	25.7	0.005	48.19	937.50	0.00
160.0	25.1	0.005	48.53	967.74	0.00
165.0	24.5	0.005	48.87	997.98	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) = **0.290** ha
"C" = **0.25**
AC = **0.073**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= 113.6 L/s
Min. Storage= **0.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	164.6	0.033	19.89	68.15	0.00
15.0	136.9	0.028	24.81	102.22	0.00
20.0	117.8	0.024	28.46	136.29	0.00
25.0	103.7	0.021	31.32	170.36	0.00
30.0	92.9	0.019	33.66	204.44	0.00
35.0	84.2	0.017	35.63	238.51	0.00
40.0	77.2	0.016	37.33	272.58	0.00
45.0	71.4	0.014	38.81	306.65	0.00
50.0	66.4	0.013	40.13	340.73	0.00
55.0	62.2	0.013	41.32	374.80	0.00
60.0	58.5	0.012	42.40	408.87	0.00
65.0	55.2	0.011	43.39	442.94	0.00
70.0	52.4	0.011	44.30	477.02	0.00
75.0	49.8	0.010	45.15	511.09	0.00
80.0	47.5	0.010	45.94	545.16	0.00
85.0	45.4	0.009	46.68	579.23	0.00
90.0	43.6	0.009	47.37	613.31	0.00
95.0	41.8	0.008	48.03	647.38	0.00
100.0	40.3	0.008	48.65	681.45	0.00
105.0	38.8	0.008	49.24	715.52	0.00
110.0	37.5	0.008	49.81	749.60	0.00
115.0	36.2	0.007	50.34	783.67	0.00
120.0	35.1	0.007	50.86	817.74	0.00
125.0	34.0	0.007	51.35	851.81	0.00
130.0	33.0	0.007	51.82	885.89	0.00
135.0	32.0	0.006	52.28	919.96	0.00
140.0	31.2	0.006	52.72	954.03	0.00
145.0	30.3	0.006	53.14	988.10	0.00
150.0	29.5	0.006	53.55	1022.18	0.00
155.0	28.8	0.006	53.95	1056.25	0.00
160.0	28.1	0.006	54.33	1090.32	0.00
165.0	27.4	0.006	54.70	1124.39	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A7 Post - BLOCK G

Parkland Area

Area (A7) = **0.290** ha
"C" = **0.25**
AC = **0.073**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.290	0.25
Hardsc. Area	0.000	0.90
Total	0.290	0.25

Allowable Release Rate= 125.4 L/s
Min. Storage= **0.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A7 Post)** (m^3/s)	**Runoff Volume (A7 Post)** (m^3)	**Target Released Volume (A7 Post)** (m^3)	**Total Required Storage Volume (A7 Post)** (m^3)
10.0	181.8	0.037	21.97	75.27	0.00
15.0	152.1	0.031	27.57	112.90	0.00
20.0	131.3	0.026	31.73	150.54	0.00
25.0	115.9	0.023	35.00	188.17	0.00
30.0	103.9	0.021	37.67	225.80	0.00
35.0	94.4	0.019	39.92	263.44	0.00
40.0	86.6	0.017	41.85	301.07	0.00
45.0	80.1	0.016	43.54	338.70	0.00
50.0	74.6	0.015	45.04	376.34	0.00
55.0	69.8	0.014	46.39	413.97	0.00
60.0	65.7	0.013	47.61	451.61	0.00
65.0	62.0	0.012	48.72	489.24	0.00
70.0	58.8	0.012	49.75	526.87	0.00
75.0	55.9	0.011	50.70	564.51	0.00
80.0	53.4	0.011	51.58	602.14	0.00
85.0	51.0	0.010	52.41	639.78	0.00
90.0	48.9	0.010	53.19	677.41	0.00
95.0	47.0	0.009	53.92	715.04	0.00
100.0	45.2	0.009	54.61	752.68	0.00
105.0	43.6	0.009	55.27	790.31	0.00
110.0	42.1	0.008	55.89	827.94	0.00
115.0	40.7	0.008	56.49	865.58	0.00
120.0	39.4	0.008	57.06	903.21	0.00
125.0	38.1	0.008	57.60	940.85	0.00
130.0	37.0	0.007	58.13	978.48	0.00
135.0	35.9	0.007	58.63	1016.11	0.00
140.0	34.9	0.007	59.11	1053.75	0.00
145.0	34.0	0.007	59.58	1091.38	0.00
150.0	33.1	0.007	60.03	1129.02	0.00
155.0	32.3	0.007	60.47	1166.65	0.00
160.0	31.5	0.006	60.89	1204.28	0.00
165.0	30.7	0.006	61.29	1241.92	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A8 Pre	0.927	0.89	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.011	0.25
Hardsc. Area	0.916	0.90
Total	0.927	0.89

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	74.1	0.170	170.3

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	103.0	0.237	236.8

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	122.3	0.281	281.0

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	146.1	0.336	335.7

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	164.6	0.378	378.3

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A8 Pre	0.927	0.89	0.83	10	181.8	0.418	417.8

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= 170.3 L/s
Min. Storage= **0.9** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	74.1	0.172	103.04	102.17	0.87
15.0	59.9	0.139	124.98	153.25	0.00
20.0	50.7	0.118	141.04	204.33	0.00
25.0	44.2	0.102	153.67	255.42	0.00
30.0	39.3	0.091	164.08	306.50	0.00
35.0	35.5	0.082	172.94	357.58	0.00
40.0	32.5	0.075	180.65	408.67	0.00
45.0	30.0	0.069	187.50	459.75	0.00
50.0	27.9	0.065	193.66	510.83	0.00
55.0	26.1	0.060	199.26	561.92	0.00
60.0	24.5	0.057	204.40	613.00	0.00
65.0	23.1	0.054	209.16	664.08	0.00
70.0	21.9	0.051	213.59	715.17	0.00
75.0	20.9	0.048	217.74	766.25	0.00
80.0	19.9	0.046	221.64	817.33	0.00
85.0	19.1	0.044	225.33	868.42	0.00
90.0	18.3	0.042	228.82	919.50	0.00
95.0	17.6	0.041	232.14	970.58	0.00
100.0	16.9	0.039	235.31	1021.67	0.00
105.0	16.3	0.038	238.34	1072.75	0.00
110.0	15.8	0.037	241.24	1123.83	0.00
115.0	15.3	0.035	244.03	1174.92	0.00
120.0	14.8	0.034	246.71	1226.00	0.00
125.0	14.3	0.033	249.30	1277.08	0.00
130.0	13.9	0.032	251.80	1328.17	0.00
135.0	13.5	0.031	254.21	1379.25	0.00
140.0	13.2	0.031	256.55	1430.33	0.00
145.0	12.8	0.030	258.82	1481.42	0.00
150.0	12.5	0.029	261.01	1532.50	0.00
155.0	12.2	0.028	263.15	1583.58	0.00
160.0	11.9	0.028	265.23	1634.67	0.00
165.0	11.6	0.027	267.25	1685.75	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= 236.8 L/s
Min. Storage= **1.2** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	103.0	0.239	143.27	142.07	1.21
15.0	84.6	0.196	176.51	213.10	0.00
20.0	72.3	0.167	200.96	284.13	0.00
25.0	63.3	0.147	220.15	355.17	0.00
30.0	56.5	0.131	235.89	426.20	0.00
35.0	51.2	0.119	249.20	497.23	0.00
40.0	46.9	0.109	260.72	568.27	0.00
45.0	43.3	0.100	270.88	639.30	0.00
50.0	40.3	0.093	279.96	710.33	0.00
55.0	37.7	0.087	288.17	781.37	0.00
60.0	35.4	0.082	295.67	852.40	0.00
65.0	33.5	0.078	302.56	923.43	0.00
70.0	31.7	0.074	308.96	994.47	0.00
75.0	30.2	0.070	314.92	1065.50	0.00
80.0	28.8	0.067	320.50	1136.53	0.00
85.0	27.6	0.064	325.75	1207.57	0.00
90.0	26.4	0.061	330.71	1278.60	0.00
95.0	25.4	0.059	335.40	1349.64	0.00
100.0	24.4	0.057	339.87	1420.67	0.00
105.0	23.6	0.055	344.13	1491.70	0.00
110.0	22.8	0.053	348.20	1562.74	0.00
115.0	22.0	0.051	352.09	1633.77	0.00
120.0	21.3	0.049	355.83	1704.80	0.00
125.0	20.7	0.048	359.43	1775.84	0.00
130.0	20.1	0.047	362.89	1846.87	0.00
135.0	19.5	0.045	366.23	1917.90	0.00
140.0	19.0	0.044	369.45	1988.94	0.00
145.0	18.5	0.043	372.58	2059.97	0.00
150.0	18.0	0.042	375.60	2131.00	0.00
155.0	17.6	0.041	378.53	2202.04	0.00
160.0	17.1	0.040	381.37	2273.07	0.00
165.0	16.7	0.039	384.14	2344.10	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= 281.0 L/s
Min. Storage= **1.4** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	122.3	0.283	170.05	168.61	1.43
15.0	101.1	0.234	210.90	252.92	0.00
20.0	86.7	0.201	241.05	337.23	0.00
25.0	76.2	0.176	264.72	421.53	0.00
30.0	68.1	0.158	284.10	505.84	0.00
35.0	61.7	0.143	300.45	590.15	0.00
40.0	56.6	0.131	314.57	674.45	0.00
45.0	52.3	0.121	326.98	758.76	0.00
50.0	48.6	0.113	338.04	843.06	0.00
55.0	45.5	0.105	348.02	927.37	0.00
60.0	42.8	0.099	357.11	1011.68	0.00
65.0	40.4	0.094	365.45	1095.98	0.00
70.0	38.3	0.089	373.17	1180.29	0.00
75.0	36.5	0.085	380.34	1264.60	0.00
80.0	34.8	0.081	387.04	1348.90	0.00
85.0	33.3	0.077	393.34	1433.21	0.00
90.0	31.9	0.074	399.27	1517.52	0.00
95.0	30.7	0.071	404.89	1601.82	0.00
100.0	29.5	0.068	410.21	1686.13	0.00
105.0	28.4	0.066	415.28	1770.44	0.00
110.0	27.5	0.064	420.12	1854.74	0.00
115.0	26.6	0.062	424.74	1939.05	0.00
120.0	25.7	0.060	429.18	2023.36	0.00
125.0	24.9	0.058	433.43	2107.66	0.00
130.0	24.2	0.056	437.52	2191.97	0.00
135.0	23.5	0.055	441.47	2276.28	0.00
140.0	22.9	0.053	445.27	2360.58	0.00
145.0	22.3	0.052	448.95	2444.89	0.00
150.0	21.7	0.050	452.51	2529.19	0.00
155.0	21.2	0.049	455.96	2613.50	0.00
160.0	20.6	0.048	459.30	2697.81	0.00
165.0	20.2	0.047	462.54	2782.11	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= 335.7 L/s
Min. Storage= **1.7** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	146.1	0.339	203.15	201.44	1.71
15.0	121.6	0.282	253.61	302.16	0.00
20.0	104.6	0.243	291.03	402.88	0.00
25.0	92.2	0.214	320.44	503.60	0.00
30.0	82.6	0.191	344.51	604.32	0.00
35.0	75.0	0.174	364.79	705.04	0.00
40.0	68.7	0.159	382.28	805.77	0.00
45.0	63.5	0.147	397.62	906.49	0.00
50.0	59.2	0.137	411.27	1007.21	0.00
55.0	55.4	0.128	423.55	1107.93	0.00
60.0	52.1	0.121	434.72	1208.65	0.00
65.0	49.2	0.114	444.95	1309.37	0.00
70.0	46.7	0.108	454.39	1410.09	0.00
75.0	44.4	0.103	463.15	1510.81	0.00
80.0	42.4	0.098	471.33	1611.53	0.00
85.0	40.5	0.094	478.99	1712.25	0.00
90.0	38.9	0.090	486.20	1812.97	0.00
95.0	37.3	0.086	493.01	1913.69	0.00
100.0	35.9	0.083	499.47	2014.41	0.00
105.0	34.6	0.080	505.60	2115.13	0.00
110.0	33.4	0.077	511.45	2215.85	0.00
115.0	32.3	0.075	517.03	2316.58	0.00
120.0	31.3	0.073	522.37	2417.30	0.00
125.0	30.3	0.070	527.50	2518.02	0.00
130.0	29.5	0.068	532.42	2618.74	0.00
135.0	28.6	0.066	537.16	2719.46	0.00
140.0	27.8	0.064	541.72	2820.18	0.00
145.0	27.1	0.063	546.13	2920.90	0.00
150.0	26.4	0.061	550.39	3021.62	0.00
155.0	25.7	0.060	554.52	3122.34	0.00
160.0	25.1	0.058	558.51	3223.06	0.00
165.0	24.5	0.057	562.39	3323.78	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= **378.3** L/s
Min. Storage= **1.9** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	164.6	0.381	228.89	226.96	1.93
15.0	136.9	0.317	285.54	340.44	0.00
20.0	117.8	0.273	327.49	453.92	0.00
25.0	103.7	0.240	360.42	567.40	0.00
30.0	92.9	0.215	387.34	680.87	0.00
35.0	84.2	0.195	410.00	794.35	0.00
40.0	77.2	0.179	429.52	907.83	0.00
45.0	71.4	0.165	446.63	1021.31	0.00
50.0	66.4	0.154	461.84	1134.79	0.00
55.0	62.2	0.144	475.52	1248.27	0.00
60.0	58.5	0.136	487.95	1361.75	0.00
65.0	55.2	0.128	499.33	1475.23	0.00
70.0	52.4	0.121	509.82	1588.71	0.00
75.0	49.8	0.115	519.56	1702.19	0.00
80.0	47.5	0.110	528.64	1815.66	0.00
85.0	45.4	0.105	537.15	1929.14	0.00
90.0	43.6	0.101	545.15	2042.62	0.00
95.0	41.8	0.097	552.71	2156.10	0.00
100.0	40.3	0.093	559.86	2269.58	0.00
105.0	38.8	0.090	566.66	2383.06	0.00
110.0	37.5	0.087	573.14	2496.54	0.00
115.0	36.2	0.084	579.33	2610.02	0.00
120.0	35.1	0.081	585.24	2723.50	0.00
125.0	34.0	0.079	590.92	2836.98	0.00
130.0	33.0	0.076	596.37	2950.46	0.00
135.0	32.0	0.074	601.61	3063.93	0.00
140.0	31.2	0.072	606.67	3177.41	0.00
145.0	30.3	0.070	611.54	3290.89	0.00
150.0	29.5	0.068	616.26	3404.37	0.00
155.0	28.8	0.067	620.82	3517.85	0.00
160.0	28.1	0.065	625.23	3631.33	0.00
165.0	27.4	0.064	629.52	3744.81	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A8 Post - BLOCK H

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A8) = **0.927** ha
"C" = **0.90**
AC = **0.834**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.927	0.90
Total	0.927	0.90

Allowable Release Rate= 417.8 L/s
Min. Storage= **2.1** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A8 Post)** (m^3/s)	**Runoff Volume (A8 Post)** (m^3)	**Target Released Volume (A8 Post)** (m^3)	**Total Required Storage Volume (A8 Post)** (m^3)
10.0	181.8	0.421	252.81	250.68	2.13
15.0	152.1	0.352	317.21	376.02	0.00
20.0	131.3	0.304	365.11	501.36	0.00
25.0	115.9	0.269	402.76	626.70	0.00
30.0	103.9	0.241	433.52	752.04	0.00
35.0	94.4	0.219	459.38	877.38	0.00
40.0	86.6	0.201	481.62	1002.72	0.00
45.0	80.1	0.186	501.07	1128.06	0.00
50.0	74.6	0.173	518.33	1253.40	0.00
55.0	69.8	0.162	533.82	1378.74	0.00
60.0	65.7	0.152	547.86	1504.08	0.00
65.0	62.0	0.144	560.69	1629.42	0.00
70.0	58.8	0.136	572.50	1754.76	0.00
75.0	55.9	0.130	583.44	1880.10	0.00
80.0	53.4	0.124	593.61	2005.44	0.00
85.0	51.0	0.118	603.13	2130.78	0.00
90.0	48.9	0.113	612.07	2256.12	0.00
95.0	47.0	0.109	620.50	2381.46	0.00
100.0	45.2	0.105	628.47	2506.80	0.00
105.0	43.6	0.101	636.03	2632.14	0.00
110.0	42.1	0.097	643.21	2757.48	0.00
115.0	40.7	0.094	650.07	2882.82	0.00
120.0	39.4	0.091	656.62	3008.16	0.00
125.0	38.1	0.088	662.89	3133.50	0.00
130.0	37.0	0.086	668.91	3258.84	0.00
135.0	35.9	0.083	674.69	3384.18	0.00
140.0	34.9	0.081	680.26	3509.52	0.00
145.0	34.0	0.079	685.63	3634.86	0.00
150.0	33.1	0.077	690.81	3760.20	0.00
155.0	32.3	0.075	695.81	3885.54	0.00
160.0	31.5	0.073	700.66	4010.88	0.00
165.0	30.7	0.071	705.35	4136.22	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A9 Pre	0.505	0.78	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.095	0.25
Hardsc. Area	0.410	0.90
Total	0.505	0.78

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	74.1	0.081	80.9

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	103.0	0.112	112.5

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	122.3	0.133	133.5

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	146.1	0.159	159.5

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	164.6	0.180	179.7

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A9 Pre	0.505	0.78	0.39	10	181.8	0.198	198.4

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= 80.9 L/s
Min. Storage= **7.6** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	74.1	0.094	56.13	48.53	7.60
15.0	59.9	0.076	68.09	72.79	0.00
20.0	50.7	0.064	76.83	97.05	0.00
25.0	44.2	0.056	83.71	121.32	0.00
30.0	39.3	0.050	89.38	145.58	0.00
35.0	35.5	0.045	94.21	169.84	0.00
40.0	32.5	0.041	98.41	194.10	0.00
45.0	30.0	0.038	102.14	218.37	0.00
50.0	27.9	0.035	105.50	242.63	0.00
55.0	26.1	0.033	108.55	266.89	0.00
60.0	24.5	0.031	111.35	291.16	0.00
65.0	23.1	0.029	113.95	315.42	0.00
70.0	21.9	0.028	116.36	339.68	0.00
75.0	20.9	0.026	118.62	363.95	0.00
80.0	19.9	0.025	120.74	388.21	0.00
85.0	19.1	0.024	122.75	412.47	0.00
90.0	18.3	0.023	124.65	436.73	0.00
95.0	17.6	0.022	126.46	461.00	0.00
100.0	16.9	0.021	128.19	485.26	0.00
105.0	16.3	0.021	129.84	509.52	0.00
110.0	15.8	0.020	131.42	533.79	0.00
115.0	15.3	0.019	132.94	558.05	0.00
120.0	14.8	0.019	134.40	582.31	0.00
125.0	14.3	0.018	135.81	606.58	0.00
130.0	13.9	0.018	137.17	630.84	0.00
135.0	13.5	0.017	138.49	655.10	0.00
140.0	13.2	0.017	139.76	679.36	0.00
145.0	12.8	0.016	140.99	703.63	0.00
150.0	12.5	0.016	142.19	727.89	0.00
155.0	12.2	0.015	143.36	752.15	0.00
160.0	11.9	0.015	144.49	776.42	0.00
165.0	11.6	0.015	145.59	800.68	0.00

Lithos

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= 112.5 L/s
Min. Storage= **10.6** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	103.0	0.130	78.05	67.48	10.57
15.0	84.6	0.107	96.16	101.22	0.00
20.0	72.3	0.091	109.48	134.95	0.00
25.0	63.3	0.080	119.93	168.69	0.00
30.0	56.5	0.071	128.51	202.43	0.00
35.0	51.2	0.065	135.76	236.17	0.00
40.0	46.9	0.059	142.03	269.91	0.00
45.0	43.3	0.055	147.57	303.65	0.00
50.0	40.3	0.051	152.51	337.39	0.00
55.0	37.7	0.048	156.98	371.13	0.00
60.0	35.4	0.045	161.07	404.86	0.00
65.0	33.5	0.042	164.83	438.60	0.00
70.0	31.7	0.040	168.31	472.34	0.00
75.0	30.2	0.038	171.56	506.08	0.00
80.0	28.8	0.036	174.60	539.82	0.00
85.0	27.6	0.035	177.46	573.56	0.00
90.0	26.4	0.033	180.16	607.30	0.00
95.0	25.4	0.032	182.72	641.04	0.00
100.0	24.4	0.031	185.15	674.77	0.00
105.0	23.6	0.030	187.47	708.51	0.00
110.0	22.8	0.029	189.69	742.25	0.00
115.0	22.0	0.028	191.81	775.99	0.00
120.0	21.3	0.027	193.85	809.73	0.00
125.0	20.7	0.026	195.80	843.47	0.00
130.0	20.1	0.025	197.69	877.21	0.00
135.0	19.5	0.025	199.51	910.95	0.00
140.0	19.0	0.024	201.27	944.68	0.00
145.0	18.5	0.023	202.97	978.42	0.00
150.0	18.0	0.023	204.61	1012.16	0.00
155.0	17.6	0.022	206.21	1045.90	0.00
160.0	17.1	0.022	207.76	1079.64	0.00
165.0	16.7	0.021	209.27	1113.38	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= 133.5 L/s
Min. Storage= **12.5** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	122.3	0.154	92.64	80.09	12.55
15.0	101.1	0.128	114.89	120.13	0.00
20.0	86.7	0.109	131.32	160.17	0.00
25.0	76.2	0.096	144.21	200.22	0.00
30.0	68.1	0.086	154.77	240.26	0.00
35.0	61.7	0.078	163.68	280.30	0.00
40.0	56.6	0.071	171.37	320.34	0.00
45.0	52.3	0.066	178.13	360.39	0.00
50.0	48.6	0.061	184.15	400.43	0.00
55.0	45.5	0.057	189.59	440.47	0.00
60.0	42.8	0.054	194.54	480.52	0.00
65.0	40.4	0.051	199.09	520.56	0.00
70.0	38.3	0.048	203.29	560.60	0.00
75.0	36.5	0.046	207.20	600.65	0.00
80.0	34.8	0.044	210.85	640.69	0.00
85.0	33.3	0.042	214.28	680.73	0.00
90.0	31.9	0.040	217.51	720.77	0.00
95.0	30.7	0.039	220.57	760.82	0.00
100.0	29.5	0.037	223.47	800.86	0.00
105.0	28.4	0.036	226.23	840.90	0.00
110.0	27.5	0.035	228.87	880.95	0.00
115.0	26.6	0.034	231.39	920.99	0.00
120.0	25.7	0.032	233.80	961.03	0.00
125.0	24.9	0.031	236.12	1001.08	0.00
130.0	24.2	0.031	238.35	1041.12	0.00
135.0	23.5	0.030	240.50	1081.16	0.00
140.0	22.9	0.029	242.57	1121.20	0.00
145.0	22.3	0.028	244.57	1161.25	0.00
150.0	21.7	0.027	246.51	1201.29	0.00
155.0	21.2	0.027	248.39	1241.33	0.00
160.0	20.6	0.026	250.21	1281.38	0.00
165.0	20.2	0.025	251.98	1321.42	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= **159.5** L/s
Min. Storage= **15.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	146.1	0.184	110.67	95.68	14.99
15.0	121.6	0.154	138.16	143.52	0.00
20.0	104.6	0.132	158.54	191.36	0.00
25.0	92.2	0.116	174.56	239.20	0.00
30.0	82.6	0.104	187.68	287.04	0.00
35.0	75.0	0.095	198.73	334.87	0.00
40.0	68.7	0.087	208.25	382.71	0.00
45.0	63.5	0.080	216.61	430.55	0.00
50.0	59.2	0.075	224.05	478.39	0.00
55.0	55.4	0.070	230.74	526.23	0.00
60.0	52.1	0.066	236.82	574.07	0.00
65.0	49.2	0.062	242.39	621.91	0.00
70.0	46.7	0.059	247.54	669.75	0.00
75.0	44.4	0.056	252.31	717.59	0.00
80.0	42.4	0.053	256.76	765.43	0.00
85.0	40.5	0.051	260.94	813.27	0.00
90.0	38.9	0.049	264.87	861.11	0.00
95.0	37.3	0.047	268.58	908.95	0.00
100.0	35.9	0.045	272.09	956.79	0.00
105.0	34.6	0.044	275.44	1004.62	0.00
110.0	33.4	0.042	278.62	1052.46	0.00
115.0	32.3	0.041	281.66	1100.30	0.00
120.0	31.3	0.040	284.57	1148.14	0.00
125.0	30.3	0.038	287.36	1195.98	0.00
130.0	29.5	0.037	290.04	1243.82	0.00
135.0	28.6	0.036	292.63	1291.66	0.00
140.0	27.8	0.035	295.11	1339.50	0.00
145.0	27.1	0.034	297.52	1387.34	0.00
150.0	26.4	0.033	299.84	1435.18	0.00
155.0	25.7	0.032	302.08	1483.02	0.00
160.0	25.1	0.032	304.26	1530.86	0.00
165.0	24.5	0.031	306.37	1578.70	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= 179.7 L/s
Min. Storage= **16.9** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	164.6	0.208	124.69	107.80	16.89
15.0	136.9	0.173	155.55	161.70	0.00
20.0	117.8	0.149	178.41	215.60	0.00
25.0	103.7	0.131	196.35	269.50	0.00
30.0	92.9	0.117	211.01	323.39	0.00
35.0	84.2	0.106	223.36	377.29	0.00
40.0	77.2	0.097	233.99	431.19	0.00
45.0	71.4	0.090	243.31	485.09	0.00
50.0	66.4	0.084	251.60	538.99	0.00
55.0	62.2	0.078	259.05	592.89	0.00
60.0	58.5	0.074	265.82	646.79	0.00
65.0	55.2	0.070	272.02	700.69	0.00
70.0	52.4	0.066	277.74	754.59	0.00
75.0	49.8	0.063	283.04	808.49	0.00
80.0	47.5	0.060	287.99	862.39	0.00
85.0	45.4	0.057	292.62	916.29	0.00
90.0	43.6	0.055	296.98	970.18	0.00
95.0	41.8	0.053	301.10	1024.08	0.00
100.0	40.3	0.051	305.00	1077.98	0.00
105.0	38.8	0.049	308.70	1131.88	0.00
110.0	37.5	0.047	312.23	1185.78	0.00
115.0	36.2	0.046	315.60	1239.68	0.00
120.0	35.1	0.044	318.82	1293.58	0.00
125.0	34.0	0.043	321.91	1347.48	0.00
130.0	33.0	0.042	324.88	1401.38	0.00
135.0	32.0	0.040	327.74	1455.28	0.00
140.0	31.2	0.039	330.49	1509.18	0.00
145.0	30.3	0.038	333.15	1563.07	0.00
150.0	29.5	0.037	335.72	1616.97	0.00
155.0	28.8	0.036	338.20	1670.87	0.00
160.0	28.1	0.035	340.61	1724.77	0.00
165.0	27.4	0.035	342.94	1778.67	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A9 Post - BLOCK I

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A9) = **0.505** ha
"C" = **0.90**
AC = **0.455**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.505	0.90
Total	0.505	0.90

Allowable Release Rate= 198.4 L/s
Min. Storage= **18.7** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A9 Post)** (m^3/s)	**Runoff Volume (A9 Post)** (m^3)	**Target Released Volume (A9 Post)** (m^3)	**Total Required Storage Volume (A9 Post)** (m^3)
10.0	181.8	0.230	137.72	119.07	18.66
15.0	152.1	0.192	172.81	178.60	0.00
20.0	131.3	0.166	198.90	238.13	0.00
25.0	115.9	0.146	219.41	297.66	0.00
30.0	103.9	0.131	236.17	357.20	0.00
35.0	94.4	0.119	250.26	416.73	0.00
40.0	86.6	0.109	262.37	476.26	0.00
45.0	80.1	0.101	272.97	535.79	0.00
50.0	74.6	0.094	282.37	595.33	0.00
55.0	69.8	0.088	290.81	654.86	0.00
60.0	65.7	0.083	298.46	714.39	0.00
65.0	62.0	0.078	305.45	773.93	0.00
70.0	58.8	0.074	311.88	833.46	0.00
75.0	55.9	0.071	317.84	892.99	0.00
80.0	53.4	0.067	323.38	952.52	0.00
85.0	51.0	0.064	328.57	1012.06	0.00
90.0	48.9	0.062	333.44	1071.59	0.00
95.0	47.0	0.059	338.03	1131.12	0.00
100.0	45.2	0.057	342.37	1190.65	0.00
105.0	43.6	0.055	346.49	1250.19	0.00
110.0	42.1	0.053	350.40	1309.72	0.00
115.0	40.7	0.051	354.14	1369.25	0.00
120.0	39.4	0.050	357.71	1428.79	0.00
125.0	38.1	0.048	361.12	1488.32	0.00
130.0	37.0	0.047	364.40	1547.85	0.00
135.0	35.9	0.045	367.55	1607.38	0.00
140.0	34.9	0.044	370.58	1666.92	0.00
145.0	34.0	0.043	373.51	1726.45	0.00
150.0	33.1	0.042	376.33	1785.98	0.00
155.0	32.3	0.041	379.06	1845.51	0.00
160.0	31.5	0.040	381.70	1905.05	0.00
165.0	30.7	0.039	384.25	1964.58	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A10 Pre	0.315	0.90	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	74.1	0.058	58.4

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	103.0	0.081	81.1

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	122.3	0.096	96.3

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	146.1	0.115	115.1

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	164.6	0.130	129.6

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A10 Pre	0.315	0.90	0.28	10	181.8	0.143	143.2

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) = **0.315** ha
"C" = **0.90**
AC = **0.284**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= **58.4** L/s
Min. Storage= **0.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	74.1	0.058	35.01	35.01	0.00
15.0	59.9	0.047	42.47	52.52	0.00
20.0	50.7	0.040	47.93	70.02	0.00
25.0	44.2	0.035	52.22	87.53	0.00
30.0	39.3	0.031	55.75	105.04	0.00
35.0	35.5	0.028	58.76	122.54	0.00
40.0	32.5	0.026	61.39	140.05	0.00
45.0	30.0	0.024	63.71	157.55	0.00
50.0	27.9	0.022	65.81	175.06	0.00
55.0	26.1	0.021	67.71	192.57	0.00
60.0	24.5	0.019	69.46	210.07	0.00
65.0	23.1	0.018	71.07	227.58	0.00
70.0	21.9	0.017	72.58	245.08	0.00
75.0	20.9	0.016	73.99	262.59	0.00
80.0	19.9	0.016	75.31	280.10	0.00
85.0	19.1	0.015	76.57	297.60	0.00
90.0	18.3	0.014	77.75	315.11	0.00
95.0	17.6	0.014	78.88	332.61	0.00
100.0	16.9	0.013	79.96	350.12	0.00
105.0	16.3	0.013	80.99	367.63	0.00
110.0	15.8	0.012	81.98	385.13	0.00
115.0	15.3	0.012	82.92	402.64	0.00
120.0	14.8	0.012	83.84	420.14	0.00
125.0	14.3	0.011	84.71	437.65	0.00
130.0	13.9	0.011	85.56	455.16	0.00
135.0	13.5	0.011	86.38	472.66	0.00
140.0	13.2	0.010	87.18	490.17	0.00
145.0	12.8	0.010	87.95	507.67	0.00
150.0	12.5	0.010	88.69	525.18	0.00
155.0	12.2	0.010	89.42	542.69	0.00
160.0	11.9	0.009	90.13	560.19	0.00
165.0	11.6	0.009	90.81	577.70	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) =	**0.315**	ha
"C" =	**0.90**	
AC =	**0.284**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= **81.1** L/s
Min. Storage= **0.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	103.0	0.081	48.69	48.69	0.00
15.0	84.6	0.067	59.98	73.03	0.00
20.0	72.3	0.057	68.29	97.37	0.00
25.0	63.3	0.050	74.81	121.71	0.00
30.0	56.5	0.045	80.16	146.06	0.00
35.0	51.2	0.040	84.68	170.40	0.00
40.0	46.9	0.037	88.59	194.74	0.00
45.0	43.3	0.034	92.05	219.09	0.00
50.0	40.3	0.032	95.13	243.43	0.00
55.0	37.7	0.030	97.92	267.77	0.00
60.0	35.4	0.028	100.47	292.11	0.00
65.0	33.5	0.026	102.81	316.46	0.00
70.0	31.7	0.025	104.99	340.80	0.00
75.0	30.2	0.024	107.01	365.14	0.00
80.0	28.8	0.023	108.91	389.48	0.00
85.0	27.6	0.022	110.69	413.83	0.00
90.0	26.4	0.021	112.38	438.17	0.00
95.0	25.4	0.020	113.97	462.51	0.00
100.0	24.4	0.019	115.49	486.86	0.00
105.0	23.6	0.019	116.94	511.20	0.00
110.0	22.8	0.018	118.32	535.54	0.00
115.0	22.0	0.017	119.64	559.88	0.00
120.0	21.3	0.017	120.91	584.23	0.00
125.0	20.7	0.016	122.14	608.57	0.00
130.0	20.1	0.016	123.31	632.91	0.00
135.0	19.5	0.015	124.45	657.26	0.00
140.0	19.0	0.015	125.54	681.60	0.00
145.0	18.5	0.015	126.60	705.94	0.00
150.0	18.0	0.014	127.63	730.28	0.00
155.0	17.6	0.014	128.63	754.63	0.00
160.0	17.1	0.013	129.59	778.97	0.00
165.0	16.7	0.013	130.53	803.31	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) = **0.315** ha
"C" = **0.90**
AC = **0.284**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= 96.3 L/s
Min. Storage= **0.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	122.3	0.096	57.78	57.78	0.00
15.0	101.1	0.080	71.66	86.67	0.00
20.0	86.7	0.068	81.91	115.57	0.00
25.0	76.2	0.060	89.95	144.46	0.00
30.0	68.1	0.054	96.54	173.35	0.00
35.0	61.7	0.049	102.09	202.24	0.00
40.0	56.6	0.045	106.89	231.13	0.00
45.0	52.3	0.041	111.11	260.02	0.00
50.0	48.6	0.038	114.87	288.91	0.00
55.0	45.5	0.036	118.26	317.81	0.00
60.0	42.8	0.034	121.35	346.70	0.00
65.0	40.4	0.032	124.18	375.59	0.00
70.0	38.3	0.030	126.80	404.48	0.00
75.0	36.5	0.029	129.24	433.37	0.00
80.0	34.8	0.027	131.52	462.26	0.00
85.0	33.3	0.026	133.66	491.15	0.00
90.0	31.9	0.025	135.67	520.05	0.00
95.0	30.7	0.024	137.58	548.94	0.00
100.0	29.5	0.023	139.39	577.83	0.00
105.0	28.4	0.022	141.11	606.72	0.00
110.0	27.5	0.022	142.76	635.61	0.00
115.0	26.6	0.021	144.33	664.50	0.00
120.0	25.7	0.020	145.84	693.39	0.00
125.0	24.9	0.020	147.28	722.29	0.00
130.0	24.2	0.019	148.67	751.18	0.00
135.0	23.5	0.019	150.01	780.07	0.00
140.0	22.9	0.018	151.31	808.96	0.00
145.0	22.3	0.018	152.56	837.85	0.00
150.0	21.7	0.017	153.77	866.74	0.00
155.0	21.2	0.017	154.94	895.63	0.00
160.0	20.6	0.016	156.07	924.53	0.00
165.0	20.2	0.016	157.17	953.42	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) = **0.315** ha
"C" = **0.90**
AC = **0.284**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= **115.1** L/s
Min. Storage= **0.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	146.1	0.115	69.03	69.03	0.00
15.0	121.6	0.096	86.18	103.55	0.00
20.0	104.6	0.082	98.89	138.07	0.00
25.0	92.2	0.073	108.89	172.58	0.00
30.0	82.6	0.065	117.07	207.10	0.00
35.0	75.0	0.059	123.96	241.62	0.00
40.0	68.7	0.054	129.90	276.13	0.00
45.0	63.5	0.050	135.11	310.65	0.00
50.0	59.2	0.047	139.75	345.16	0.00
55.0	55.4	0.044	143.93	379.68	0.00
60.0	52.1	0.041	147.72	414.20	0.00
65.0	49.2	0.039	151.20	448.71	0.00
70.0	46.7	0.037	154.40	483.23	0.00
75.0	44.4	0.035	157.38	517.75	0.00
80.0	42.4	0.033	160.16	552.26	0.00
85.0	40.5	0.032	162.76	586.78	0.00
90.0	38.9	0.031	165.21	621.30	0.00
95.0	37.3	0.029	167.53	655.81	0.00
100.0	35.9	0.028	169.72	690.33	0.00
105.0	34.6	0.027	171.81	724.85	0.00
110.0	33.4	0.026	173.79	759.36	0.00
115.0	32.3	0.025	175.69	793.88	0.00
120.0	31.3	0.025	177.50	828.40	0.00
125.0	30.3	0.024	179.25	862.91	0.00
130.0	29.5	0.023	180.92	897.43	0.00
135.0	28.6	0.023	182.53	931.94	0.00
140.0	27.8	0.022	184.08	966.46	0.00
145.0	27.1	0.021	185.58	1000.98	0.00
150.0	26.4	0.021	187.03	1035.49	0.00
155.0	25.7	0.020	188.43	1070.01	0.00
160.0	25.1	0.020	189.79	1104.53	0.00
165.0	24.5	0.019	191.10	1139.04	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) = **0.315** ha
"C" = **0.90**
AC = **0.284**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= **129.6** L/s
Min. Storage= **0.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	164.6	0.130	77.78	77.78	0.00
15.0	136.9	0.108	97.03	116.67	0.00
20.0	117.8	0.093	111.28	155.55	0.00
25.0	103.7	0.082	122.47	194.44	0.00
30.0	92.9	0.073	131.62	233.33	0.00
35.0	84.2	0.066	139.32	272.22	0.00
40.0	77.2	0.061	145.95	311.11	0.00
45.0	71.4	0.056	151.77	350.00	0.00
50.0	66.4	0.052	156.94	388.89	0.00
55.0	62.2	0.049	161.58	427.78	0.00
60.0	58.5	0.046	165.81	466.66	0.00
65.0	55.2	0.044	169.67	505.55	0.00
70.0	52.4	0.041	173.24	544.44	0.00
75.0	49.8	0.039	176.55	583.33	0.00
80.0	47.5	0.037	179.63	622.22	0.00
85.0	45.4	0.036	182.53	661.11	0.00
90.0	43.6	0.034	185.25	700.00	0.00
95.0	41.8	0.033	187.81	738.89	0.00
100.0	40.3	0.032	190.25	777.77	0.00
105.0	38.8	0.031	192.56	816.66	0.00
110.0	37.5	0.030	194.76	855.55	0.00
115.0	36.2	0.029	196.86	894.44	0.00
120.0	35.1	0.028	198.87	933.33	0.00
125.0	34.0	0.027	200.80	972.22	0.00
130.0	33.0	0.026	202.65	1011.11	0.00
135.0	32.0	0.025	204.43	1049.99	0.00
140.0	31.2	0.025	206.15	1088.88	0.00
145.0	30.3	0.024	207.81	1127.77	0.00
150.0	29.5	0.023	209.41	1166.66	0.00
155.0	28.8	0.023	210.96	1205.55	0.00
160.0	28.1	0.022	212.46	1244.44	0.00
165.0	27.4	0.022	213.91	1283.33	0.00

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A10 Post - BLOCK J

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A10) = **0.315** ha
"C" = **0.90**
AC = **0.284**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.315	0.90
Total	0.315	0.90

Allowable Release Rate= 143.2 L/s
Min. Storage= **0.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A10 Post)** (m^3/s)	**Runoff Volume (A10 Post)** (m^3)	**Target Released Volume (A10 Post)** (m^3)	**Total Required Storage Volume (A10 Post)** (m^3)
10.0	181.8	0.143	85.91	85.91	0.00
15.0	152.1	0.120	107.79	128.86	0.00
20.0	131.3	0.103	124.07	171.81	0.00
25.0	115.9	0.091	136.86	214.77	0.00
30.0	103.9	0.082	147.31	257.72	0.00
35.0	94.4	0.074	156.10	300.67	0.00
40.0	86.6	0.068	163.66	343.63	0.00
45.0	80.1	0.063	170.27	386.58	0.00
50.0	74.6	0.059	176.13	429.53	0.00
55.0	69.8	0.055	181.40	472.49	0.00
60.0	65.7	0.052	186.17	515.44	0.00
65.0	62.0	0.049	190.53	558.39	0.00
70.0	58.8	0.046	194.54	601.35	0.00
75.0	55.9	0.044	198.25	644.30	0.00
80.0	53.4	0.042	201.71	687.25	0.00
85.0	51.0	0.040	204.95	730.21	0.00
90.0	48.9	0.039	207.99	773.16	0.00
95.0	47.0	0.037	210.85	816.11	0.00
100.0	45.2	0.036	213.56	859.07	0.00
105.0	43.6	0.034	216.13	902.02	0.00
110.0	42.1	0.033	218.57	944.97	0.00
115.0	40.7	0.032	220.90	987.93	0.00
120.0	39.4	0.031	223.12	1030.88	0.00
125.0	38.1	0.030	225.25	1073.83	0.00
130.0	37.0	0.029	227.30	1116.79	0.00
135.0	35.9	0.028	229.26	1159.74	0.00
140.0	34.9	0.028	231.16	1202.70	0.00
145.0	34.0	0.027	232.98	1245.65	0.00
150.0	33.1	0.026	234.74	1288.60	0.00
155.0	32.3	0.025	236.44	1331.56	0.00
160.0	31.5	0.025	238.09	1374.51	0.00
165.0	30.7	0.024	239.68	1417.46	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A11 Pre	0.899	0.88	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.030	0.25
Hardsc. Area	0.869	0.90
Total	0.899	0.88

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	74.1	0.162	162.5

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	103.0	0.226	225.9

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	122.3	0.268	268.1

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	146.1	0.320	320.3

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	164.6	0.361	360.9

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A11 Pre	0.899	0.88	0.79	10	181.8	0.399	398.6

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= 162.5 L/s
Min. Storage= **2.4** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	74.1	0.167	99.92	97.48	2.44
15.0	59.9	0.135	121.21	146.22	0.00
20.0	50.7	0.114	136.78	194.96	0.00
25.0	44.2	0.099	149.03	243.70	0.00
30.0	39.3	0.088	159.12	292.44	0.00
35.0	35.5	0.080	167.71	341.18	0.00
40.0	32.5	0.073	175.20	389.92	0.00
45.0	30.0	0.067	181.84	438.66	0.00
50.0	27.9	0.063	187.81	487.40	0.00
55.0	26.1	0.059	193.24	536.15	0.00
60.0	24.5	0.055	198.23	584.89	0.00
65.0	23.1	0.052	202.84	633.63	0.00
70.0	21.9	0.049	207.14	682.37	0.00
75.0	20.9	0.047	211.16	731.11	0.00
80.0	19.9	0.045	214.95	779.85	0.00
85.0	19.1	0.043	218.52	828.59	0.00
90.0	18.3	0.041	221.91	877.33	0.00
95.0	17.6	0.039	225.13	926.07	0.00
100.0	16.9	0.038	228.20	974.81	0.00
105.0	16.3	0.037	231.14	1023.55	0.00
110.0	15.8	0.035	233.96	1072.29	0.00
115.0	15.3	0.034	236.66	1121.03	0.00
120.0	14.8	0.033	239.26	1169.77	0.00
125.0	14.3	0.032	241.77	1218.51	0.00
130.0	13.9	0.031	244.19	1267.25	0.00
135.0	13.5	0.030	246.53	1315.99	0.00
140.0	13.2	0.030	248.80	1364.73	0.00
145.0	12.8	0.029	251.00	1413.47	0.00
150.0	12.5	0.028	253.13	1462.21	0.00
155.0	12.2	0.027	255.20	1510.95	0.00
160.0	11.9	0.027	257.22	1559.70	0.00
165.0	11.6	0.026	259.18	1608.44	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= **225.9** L/s
Min. Storage= **3.4** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	103.0	0.232	138.95	135.55	3.40
15.0	84.6	0.190	171.18	203.33	0.00
20.0	72.3	0.162	194.89	271.10	0.00
25.0	63.3	0.142	213.50	338.88	0.00
30.0	56.5	0.127	228.76	406.65	0.00
35.0	51.2	0.115	241.67	474.43	0.00
40.0	46.9	0.105	252.85	542.21	0.00
45.0	43.3	0.097	262.70	609.98	0.00
50.0	40.3	0.091	271.50	677.76	0.00
55.0	37.7	0.085	279.46	745.53	0.00
60.0	35.4	0.080	286.73	813.31	0.00
65.0	33.5	0.075	293.43	881.08	0.00
70.0	31.7	0.071	299.63	948.86	0.00
75.0	30.2	0.068	305.40	1016.63	0.00
80.0	28.8	0.065	310.82	1084.41	0.00
85.0	27.6	0.062	315.91	1152.19	0.00
90.0	26.4	0.059	320.72	1219.96	0.00
95.0	25.4	0.057	325.27	1287.74	0.00
100.0	24.4	0.055	329.61	1355.51	0.00
105.0	23.6	0.053	333.73	1423.29	0.00
110.0	22.8	0.051	337.68	1491.06	0.00
115.0	22.0	0.049	341.46	1558.84	0.00
120.0	21.3	0.048	345.08	1626.62	0.00
125.0	20.7	0.046	348.57	1694.39	0.00
130.0	20.1	0.045	351.93	1762.17	0.00
135.0	19.5	0.044	355.17	1829.94	0.00
140.0	19.0	0.043	358.30	1897.72	0.00
145.0	18.5	0.042	361.32	1965.49	0.00
150.0	18.0	0.040	364.25	2033.27	0.00
155.0	17.6	0.039	367.09	2101.04	0.00
160.0	17.1	0.039	369.85	2168.82	0.00
165.0	16.7	0.038	372.53	2236.60	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= 268.1 L/s
Min. Storage= **4.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	122.3	0.275	164.91	160.88	4.03
15.0	101.1	0.227	204.53	241.32	0.00
20.0	86.7	0.195	233.77	321.76	0.00
25.0	76.2	0.171	256.73	402.20	0.00
30.0	68.1	0.153	275.52	482.64	0.00
35.0	61.7	0.139	291.37	563.08	0.00
40.0	56.6	0.127	305.07	643.52	0.00
45.0	52.3	0.117	317.10	723.96	0.00
50.0	48.6	0.109	327.83	804.40	0.00
55.0	45.5	0.102	337.51	884.84	0.00
60.0	42.8	0.096	346.32	965.28	0.00
65.0	40.4	0.091	354.41	1045.72	0.00
70.0	38.3	0.086	361.90	1126.16	0.00
75.0	36.5	0.082	368.85	1206.60	0.00
80.0	34.8	0.078	375.35	1287.04	0.00
85.0	33.3	0.075	381.46	1367.48	0.00
90.0	31.9	0.072	387.21	1447.92	0.00
95.0	30.7	0.069	392.66	1528.36	0.00
100.0	29.5	0.066	397.82	1608.80	0.00
105.0	28.4	0.064	402.74	1689.24	0.00
110.0	27.5	0.062	407.43	1769.68	0.00
115.0	26.6	0.060	411.91	1850.12	0.00
120.0	25.7	0.058	416.21	1930.56	0.00
125.0	24.9	0.056	420.34	2011.00	0.00
130.0	24.2	0.054	424.31	2091.44	0.00
135.0	23.5	0.053	428.13	2171.88	0.00
140.0	22.9	0.051	431.82	2252.32	0.00
145.0	22.3	0.050	435.39	2332.76	0.00
150.0	21.7	0.049	438.84	2413.20	0.00
155.0	21.2	0.048	442.18	2493.64	0.00
160.0	20.6	0.046	445.42	2574.08	0.00
165.0	20.2	0.045	448.57	2654.52	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= **320.3** L/s
Min. Storage= **4.8** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	146.1	0.328	197.02	192.20	4.82
15.0	121.6	0.273	245.95	288.30	0.00
20.0	104.6	0.235	282.24	384.41	0.00
25.0	92.2	0.207	310.76	480.51	0.00
30.0	82.6	0.186	334.10	576.61	0.00
35.0	75.0	0.168	353.78	672.71	0.00
40.0	68.7	0.154	370.73	768.81	0.00
45.0	63.5	0.143	385.61	864.91	0.00
50.0	59.2	0.133	398.85	961.01	0.00
55.0	55.4	0.124	410.76	1057.11	0.00
60.0	52.1	0.117	421.59	1153.22	0.00
65.0	49.2	0.111	431.51	1249.32	0.00
70.0	46.7	0.105	440.66	1345.42	0.00
75.0	44.4	0.100	449.16	1441.52	0.00
80.0	42.4	0.095	457.09	1537.62	0.00
85.0	40.5	0.091	464.52	1633.72	0.00
90.0	38.9	0.087	471.52	1729.82	0.00
95.0	37.3	0.084	478.12	1825.93	0.00
100.0	35.9	0.081	484.38	1922.03	0.00
105.0	34.6	0.078	490.33	2018.13	0.00
110.0	33.4	0.075	496.00	2114.23	0.00
115.0	32.3	0.073	501.41	2210.33	0.00
120.0	31.3	0.070	506.59	2306.43	0.00
125.0	30.3	0.068	511.56	2402.53	0.00
130.0	29.5	0.066	516.34	2498.64	0.00
135.0	28.6	0.064	520.93	2594.74	0.00
140.0	27.8	0.063	525.36	2690.84	0.00
145.0	27.1	0.061	529.64	2786.94	0.00
150.0	26.4	0.059	533.77	2883.04	0.00
155.0	25.7	0.058	537.77	2979.14	0.00
160.0	25.1	0.056	541.64	3075.24	0.00
165.0	24.5	0.055	545.40	3171.34	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= 360.9 L/s
Min. Storage= **5.4** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	164.6	0.370	221.97	216.55	5.43
15.0	136.9	0.308	276.91	324.82	0.00
20.0	117.8	0.265	317.60	433.10	0.00
25.0	103.7	0.233	349.54	541.37	0.00
30.0	92.9	0.209	375.64	649.65	0.00
35.0	84.2	0.189	397.62	757.92	0.00
40.0	77.2	0.174	416.55	866.20	0.00
45.0	71.4	0.160	433.14	974.47	0.00
50.0	66.4	0.149	447.89	1082.75	0.00
55.0	62.2	0.140	461.16	1191.02	0.00
60.0	58.5	0.131	473.21	1299.30	0.00
65.0	55.2	0.124	484.25	1407.57	0.00
70.0	52.4	0.118	494.42	1515.84	0.00
75.0	49.8	0.112	503.87	1624.12	0.00
80.0	47.5	0.107	512.67	1732.39	0.00
85.0	45.4	0.102	520.92	1840.67	0.00
90.0	43.6	0.098	528.68	1948.94	0.00
95.0	41.8	0.094	536.01	2057.22	0.00
100.0	40.3	0.090	542.95	2165.49	0.00
105.0	38.8	0.087	549.55	2273.77	0.00
110.0	37.5	0.084	555.83	2382.04	0.00
115.0	36.2	0.081	561.83	2490.32	0.00
120.0	35.1	0.079	567.57	2598.59	0.00
125.0	34.0	0.076	573.07	2706.86	0.00
130.0	33.0	0.074	578.36	2815.14	0.00
135.0	32.0	0.072	583.44	2923.41	0.00
140.0	31.2	0.070	588.34	3031.69	0.00
145.0	30.3	0.068	593.07	3139.96	0.00
150.0	29.5	0.066	597.64	3248.24	0.00
155.0	28.8	0.065	602.06	3356.51	0.00
160.0	28.1	0.063	606.35	3464.79	0.00
165.0	27.4	0.062	610.50	3573.06	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A11 Post - BLOCK K

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A11) = **0.899** ha
"C" = **0.90**
AC = **0.809**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.899	0.90
Total	0.899	0.90

Allowable Release Rate= 398.6 L/s
Min. Storage= **6.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A11 Post)** (m^3/s)	**Runoff Volume (A11 Post)** (m^3)	**Target Released Volume (A11 Post)** (m^3)	**Total Required Storage Volume (A11 Post)** (m^3)
10.0	181.8	0.409	245.18	239.18	5.99
15.0	152.1	0.342	307.63	358.77	0.00
20.0	131.3	0.295	354.08	478.37	0.00
25.0	115.9	0.260	390.59	597.96	0.00
30.0	103.9	0.234	420.42	717.55	0.00
35.0	94.4	0.212	445.51	837.14	0.00
40.0	86.6	0.195	467.07	956.73	0.00
45.0	80.1	0.180	485.94	1076.32	0.00
50.0	74.6	0.168	502.67	1195.92	0.00
55.0	69.8	0.157	517.70	1315.51	0.00
60.0	65.7	0.148	531.31	1435.10	0.00
65.0	62.0	0.139	543.76	1554.69	0.00
70.0	58.8	0.132	555.21	1674.28	0.00
75.0	55.9	0.126	565.81	1793.87	0.00
80.0	53.4	0.120	575.68	1913.47	0.00
85.0	51.0	0.115	584.91	2033.06	0.00
90.0	48.9	0.110	593.58	2152.65	0.00
95.0	47.0	0.106	601.76	2272.24	0.00
100.0	45.2	0.102	609.48	2391.83	0.00
105.0	43.6	0.098	616.81	2511.42	0.00
110.0	42.1	0.095	623.79	2631.02	0.00
115.0	40.7	0.091	630.43	2750.61	0.00
120.0	39.4	0.088	636.79	2870.20	0.00
125.0	38.1	0.086	642.87	2989.79	0.00
130.0	37.0	0.083	648.71	3109.38	0.00
135.0	35.9	0.081	654.31	3228.97	0.00
140.0	34.9	0.079	659.71	3348.56	0.00
145.0	34.0	0.076	664.92	3468.16	0.00
150.0	33.1	0.074	669.94	3587.75	0.00
155.0	32.3	0.073	674.80	3707.34	0.00
160.0	31.5	0.071	679.50	3826.93	0.00
165.0	30.7	0.069	684.05	3946.52	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A12 Pre	0.464	0.90	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	74.1	0.086	86.0

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	103.0	0.120	119.5

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	122.3	0.142	141.9

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	146.1	0.169	169.5

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	164.6	0.191	190.9

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A12 Pre	0.464	0.90	0.42	10	181.8	0.211	210.9

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) = **0.464** ha
"C" = **0.90**
AC = **0.418**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= **86.0** L/s
Min. Storage= **0.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	74.1	0.086	51.57	51.57	0.00
15.0	59.9	0.070	62.56	77.36	0.00
20.0	50.7	0.059	70.60	103.15	0.00
25.0	44.2	0.051	76.92	128.93	0.00
30.0	39.3	0.046	82.13	154.72	0.00
35.0	35.5	0.041	86.56	180.51	0.00
40.0	32.5	0.038	90.42	206.29	0.00
45.0	30.0	0.035	93.85	232.08	0.00
50.0	27.9	0.032	96.93	257.87	0.00
55.0	26.1	0.030	99.74	283.65	0.00
60.0	24.5	0.028	102.31	309.44	0.00
65.0	23.1	0.027	104.69	335.23	0.00
70.0	21.9	0.025	106.91	361.01	0.00
75.0	20.9	0.024	108.99	386.80	0.00
80.0	19.9	0.023	110.94	412.59	0.00
85.0	19.1	0.022	112.78	438.37	0.00
90.0	18.3	0.021	114.53	464.16	0.00
95.0	17.6	0.020	116.20	489.95	0.00
100.0	16.9	0.020	117.78	515.73	0.00
105.0	16.3	0.019	119.30	541.52	0.00
110.0	15.8	0.018	120.75	567.31	0.00
115.0	15.3	0.018	122.15	593.09	0.00
120.0	14.8	0.017	123.49	618.88	0.00
125.0	14.3	0.017	124.79	644.66	0.00
130.0	13.9	0.016	126.04	670.45	0.00
135.0	13.5	0.016	127.24	696.24	0.00
140.0	13.2	0.015	128.41	722.02	0.00
145.0	12.8	0.015	129.55	747.81	0.00
150.0	12.5	0.015	130.65	773.60	0.00
155.0	12.2	0.014	131.72	799.38	0.00
160.0	11.9	0.014	132.76	825.17	0.00
165.0	11.6	0.014	133.77	850.96	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) =	**0.464**	ha
"C" =	**0.90**	
AC =	**0.418**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= **119.5** L/s
Min. Storage= **0.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	103.0	0.120	71.71	71.71	0.00
15.0	84.6	0.098	88.35	107.57	0.00
20.0	72.3	0.084	100.59	143.43	0.00
25.0	63.3	0.073	110.20	179.29	0.00
30.0	56.5	0.066	118.07	215.14	0.00
35.0	51.2	0.059	124.73	251.00	0.00
40.0	46.9	0.054	130.50	286.86	0.00
45.0	43.3	0.050	135.58	322.72	0.00
50.0	40.3	0.047	140.13	358.57	0.00
55.0	37.7	0.044	144.24	394.43	0.00
60.0	35.4	0.041	147.99	430.29	0.00
65.0	33.5	0.039	151.45	466.15	0.00
70.0	31.7	0.037	154.65	502.00	0.00
75.0	30.2	0.035	157.63	537.86	0.00
80.0	28.8	0.033	160.42	573.72	0.00
85.0	27.6	0.032	163.05	609.57	0.00
90.0	26.4	0.031	165.53	645.43	0.00
95.0	25.4	0.029	167.88	681.29	0.00
100.0	24.4	0.028	170.12	717.15	0.00
105.0	23.6	0.027	172.25	753.00	0.00
110.0	22.8	0.026	174.29	788.86	0.00
115.0	22.0	0.026	176.24	824.72	0.00
120.0	21.3	0.025	178.11	860.58	0.00
125.0	20.7	0.024	179.91	896.43	0.00
130.0	20.1	0.023	181.64	932.29	0.00
135.0	19.5	0.023	183.31	968.15	0.00
140.0	19.0	0.022	184.93	1004.01	0.00
145.0	18.5	0.021	186.49	1039.86	0.00
150.0	18.0	0.021	188.00	1075.72	0.00
155.0	17.6	0.020	189.47	1111.58	0.00
160.0	17.1	0.020	190.89	1147.43	0.00
165.0	16.7	0.019	192.28	1183.29	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) = **0.464** ha
"C" = **0.90**
AC = **0.418**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= 141.9 L/s
Min. Storage= **0.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	122.3	0.142	85.12	85.12	0.00
15.0	101.1	0.117	105.56	127.67	0.00
20.0	86.7	0.101	120.66	170.23	0.00
25.0	76.2	0.088	132.50	212.79	0.00
30.0	68.1	0.079	142.20	255.35	0.00
35.0	61.7	0.072	150.39	297.90	0.00
40.0	56.6	0.066	157.45	340.46	0.00
45.0	52.3	0.061	163.66	383.02	0.00
50.0	48.6	0.056	169.20	425.58	0.00
55.0	45.5	0.053	174.20	468.13	0.00
60.0	42.8	0.050	178.75	510.69	0.00
65.0	40.4	0.047	182.92	553.25	0.00
70.0	38.3	0.044	186.78	595.81	0.00
75.0	36.5	0.042	190.37	638.36	0.00
80.0	34.8	0.040	193.73	680.92	0.00
85.0	33.3	0.039	196.88	723.48	0.00
90.0	31.9	0.037	199.85	766.04	0.00
95.0	30.7	0.036	202.66	808.59	0.00
100.0	29.5	0.034	205.33	851.15	0.00
105.0	28.4	0.033	207.86	893.71	0.00
110.0	27.5	0.032	210.29	936.27	0.00
115.0	26.6	0.031	212.60	978.82	0.00
120.0	25.7	0.030	214.82	1021.38	0.00
125.0	24.9	0.029	216.95	1063.94	0.00
130.0	24.2	0.028	219.00	1106.50	0.00
135.0	23.5	0.027	220.97	1149.05	0.00
140.0	22.9	0.027	222.88	1191.61	0.00
145.0	22.3	0.026	224.72	1234.17	0.00
150.0	21.7	0.025	226.50	1276.73	0.00
155.0	21.2	0.025	228.22	1319.28	0.00
160.0	20.6	0.024	229.90	1361.84	0.00
165.0	20.2	0.023	231.52	1404.40	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) = **0.464** ha
"C" = **0.90**
AC = **0.418**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= **169.5** L/s
Min. Storage= **0.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	146.1	0.169	101.69	101.69	0.00
15.0	121.6	0.141	126.94	152.53	0.00
20.0	104.6	0.121	145.67	203.37	0.00
25.0	92.2	0.107	160.39	254.22	0.00
30.0	82.6	0.096	172.44	305.06	0.00
35.0	75.0	0.087	182.59	355.90	0.00
40.0	68.7	0.080	191.35	406.75	0.00
45.0	63.5	0.074	199.02	457.59	0.00
50.0	59.2	0.069	205.86	508.43	0.00
55.0	55.4	0.064	212.01	559.28	0.00
60.0	52.1	0.060	217.59	610.12	0.00
65.0	49.2	0.057	222.71	660.96	0.00
70.0	46.7	0.054	227.44	711.81	0.00
75.0	44.4	0.052	231.83	762.65	0.00
80.0	42.4	0.049	235.92	813.49	0.00
85.0	40.5	0.047	239.75	864.34	0.00
90.0	38.9	0.045	243.36	915.18	0.00
95.0	37.3	0.043	246.77	966.02	0.00
100.0	35.9	0.042	250.00	1016.87	0.00
105.0	34.6	0.040	253.07	1067.71	0.00
110.0	33.4	0.039	256.00	1118.55	0.00
115.0	32.3	0.038	258.79	1169.40	0.00
120.0	31.3	0.036	261.47	1220.24	0.00
125.0	30.3	0.035	264.03	1271.08	0.00
130.0	29.5	0.034	266.50	1321.93	0.00
135.0	28.6	0.033	268.87	1372.77	0.00
140.0	27.8	0.032	271.15	1423.61	0.00
145.0	27.1	0.031	273.36	1474.46	0.00
150.0	26.4	0.031	275.49	1525.30	0.00
155.0	25.7	0.030	277.56	1576.14	0.00
160.0	25.1	0.029	279.56	1626.99	0.00
165.0	24.5	0.028	281.50	1677.83	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) = **0.464** ha
"C" = **0.90**
AC = **0.418**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= **190.9** L/s
Min. Storage= **0.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	164.6	0.191	114.57	114.57	0.00
15.0	136.9	0.159	142.92	171.85	0.00
20.0	117.8	0.137	163.92	229.13	0.00
25.0	103.7	0.120	180.41	286.42	0.00
30.0	92.9	0.108	193.88	343.70	0.00
35.0	84.2	0.098	205.22	400.99	0.00
40.0	77.2	0.090	214.99	458.27	0.00
45.0	71.4	0.083	223.56	515.55	0.00
50.0	66.4	0.077	231.17	572.84	0.00
55.0	62.2	0.072	238.02	630.12	0.00
60.0	58.5	0.068	244.24	687.40	0.00
65.0	55.2	0.064	249.93	744.69	0.00
70.0	52.4	0.061	255.19	801.97	0.00
75.0	49.8	0.058	260.06	859.25	0.00
80.0	47.5	0.055	264.60	916.54	0.00
85.0	45.4	0.053	268.86	973.82	0.00
90.0	43.6	0.051	272.87	1031.11	0.00
95.0	41.8	0.049	276.65	1088.39	0.00
100.0	40.3	0.047	280.23	1145.67	0.00
105.0	38.8	0.045	283.64	1202.96	0.00
110.0	37.5	0.043	286.88	1260.24	0.00
115.0	36.2	0.042	289.98	1317.52	0.00
120.0	35.1	0.041	292.94	1374.81	0.00
125.0	34.0	0.039	295.78	1432.09	0.00
130.0	33.0	0.038	298.51	1489.38	0.00
135.0	32.0	0.037	301.13	1546.66	0.00
140.0	31.2	0.036	303.66	1603.94	0.00
145.0	30.3	0.035	306.10	1661.23	0.00
150.0	29.5	0.034	308.46	1718.51	0.00
155.0	28.8	0.033	310.74	1775.79	0.00
160.0	28.1	0.033	312.95	1833.08	0.00
165.0	27.4	0.032	315.10	1890.36	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A12 Post - BLOCK L

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A12) = **0.464** ha
"C" = **0.90**
AC = **0.418**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.464	0.90
Total	0.464	0.90

Allowable Release Rate= 210.9 L/s
Min. Storage= **0.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A12 Post)** (m^3/s)	**Runoff Volume (A12 Post)** (m^3)	**Target Released Volume (A12 Post)** (m^3)	**Total Required Storage Volume (A12 Post)** (m^3)
10.0	181.8	0.211	126.54	126.54	0.00
15.0	152.1	0.176	158.78	189.81	0.00
20.0	131.3	0.152	182.75	253.08	0.00
25.0	115.9	0.134	201.60	316.36	0.00
30.0	103.9	0.121	216.99	379.63	0.00
35.0	94.4	0.109	229.94	442.90	0.00
40.0	86.6	0.100	241.07	506.17	0.00
45.0	80.1	0.093	250.81	569.44	0.00
50.0	74.6	0.086	259.44	632.71	0.00
55.0	69.8	0.081	267.20	695.98	0.00
60.0	65.7	0.076	274.23	759.25	0.00
65.0	62.0	0.072	280.65	822.52	0.00
70.0	58.8	0.068	286.56	885.79	0.00
75.0	55.9	0.065	292.03	949.07	0.00
80.0	53.4	0.062	297.13	1012.34	0.00
85.0	51.0	0.059	301.89	1075.61	0.00
90.0	48.9	0.057	306.37	1138.88	0.00
95.0	47.0	0.054	310.58	1202.15	0.00
100.0	45.2	0.052	314.57	1265.42	0.00
105.0	43.6	0.051	318.36	1328.69	0.00
110.0	42.1	0.049	321.95	1391.96	0.00
115.0	40.7	0.047	325.39	1455.23	0.00
120.0	39.4	0.046	328.66	1518.50	0.00
125.0	38.1	0.044	331.80	1581.78	0.00
130.0	37.0	0.043	334.82	1645.05	0.00
135.0	35.9	0.042	337.71	1708.32	0.00
140.0	34.9	0.041	340.50	1771.59	0.00
145.0	34.0	0.039	343.18	1834.86	0.00
150.0	33.1	0.038	345.78	1898.13	0.00
155.0	32.3	0.037	348.28	1961.40	0.00
160.0	31.5	0.037	350.71	2024.67	0.00
165.0	30.7	0.036	353.06	2087.94	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A13 Pre	0.202	0.90	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.000	0.25
Hardsc. Area	0.202	0.90
Total	0.202	0.90

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	74.1	0.037	37.4

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	103.0	0.052	52.0

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	122.3	0.062	61.8

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	146.1	0.074	73.8

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	164.6	0.083	83.1

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A13 Pre	0.202	0.90	0.18	10	181.8	0.092	91.8

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) = **0.202** ha
"C" = **0.25**
AC = **0.051**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **37.4** L/s
Min. Storage= **0.0** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	74.1	0.010	6.24	22.45	0.00
15.0	59.9	0.008	7.57	33.68	0.00
20.0	50.7	0.007	8.54	44.90	0.00
25.0	44.2	0.006	9.30	56.13	0.00
30.0	39.3	0.006	9.93	67.36	0.00
35.0	35.5	0.005	10.47	78.58	0.00
40.0	32.5	0.005	10.93	89.81	0.00
45.0	30.0	0.004	11.35	101.03	0.00
50.0	27.9	0.004	11.72	112.26	0.00
55.0	26.1	0.004	12.06	123.49	0.00
60.0	24.5	0.003	12.37	134.71	0.00
65.0	23.1	0.003	12.66	145.94	0.00
70.0	21.9	0.003	12.93	157.16	0.00
75.0	20.9	0.003	13.18	168.39	0.00
80.0	19.9	0.003	13.42	179.62	0.00
85.0	19.1	0.003	13.64	190.84	0.00
90.0	18.3	0.003	13.85	202.07	0.00
95.0	17.6	0.002	14.05	213.30	0.00
100.0	16.9	0.002	14.24	224.52	0.00
105.0	16.3	0.002	14.43	235.75	0.00
110.0	15.8	0.002	14.60	246.97	0.00
115.0	15.3	0.002	14.77	258.20	0.00
120.0	14.8	0.002	14.93	269.43	0.00
125.0	14.3	0.002	15.09	280.65	0.00
130.0	13.9	0.002	15.24	291.88	0.00
135.0	13.5	0.002	15.39	303.10	0.00
140.0	13.2	0.002	15.53	314.33	0.00
145.0	12.8	0.002	15.67	325.56	0.00
150.0	12.5	0.002	15.80	336.78	0.00
155.0	12.2	0.002	15.93	348.01	0.00
160.0	11.9	0.002	16.05	359.23	0.00
165.0	11.6	0.002	16.18	370.46	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) = **0.202** ha
"C" = **0.25**
AC = **0.051**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **52.0** L/s
Min. Storage= **0.0** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	103.0	0.014	8.67	31.22	0.00
15.0	84.6	0.012	10.68	46.83	0.00
20.0	72.3	0.010	12.16	62.44	0.00
25.0	63.3	0.009	13.33	78.05	0.00
30.0	56.5	0.008	14.28	93.66	0.00
35.0	51.2	0.007	15.08	109.27	0.00
40.0	46.9	0.007	15.78	124.88	0.00
45.0	43.3	0.006	16.40	140.49	0.00
50.0	40.3	0.006	16.95	156.10	0.00
55.0	37.7	0.005	17.44	171.71	0.00
60.0	35.4	0.005	17.90	187.32	0.00
65.0	33.5	0.005	18.31	202.93	0.00
70.0	31.7	0.004	18.70	218.54	0.00
75.0	30.2	0.004	19.06	234.15	0.00
80.0	28.8	0.004	19.40	249.76	0.00
85.0	27.6	0.004	19.72	265.38	0.00
90.0	26.4	0.004	20.02	280.99	0.00
95.0	25.4	0.004	20.30	296.60	0.00
100.0	24.4	0.003	20.57	312.21	0.00
105.0	23.6	0.003	20.83	327.82	0.00
110.0	22.8	0.003	21.08	343.43	0.00
115.0	22.0	0.003	21.31	359.04	0.00
120.0	21.3	0.003	21.54	374.65	0.00
125.0	20.7	0.003	21.76	390.26	0.00
130.0	20.1	0.003	21.97	405.87	0.00
135.0	19.5	0.003	22.17	421.48	0.00
140.0	19.0	0.003	22.36	437.09	0.00
145.0	18.5	0.003	22.55	452.70	0.00
150.0	18.0	0.003	22.73	468.31	0.00
155.0	17.6	0.002	22.91	483.92	0.00
160.0	17.1	0.002	23.08	499.53	0.00
165.0	16.7	0.002	23.25	515.14	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) = **0.202** ha
"C" = **0.25**
AC = **0.051**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **61.8** L/s
Min. Storage= **0.0** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	122.3	0.017	10.29	37.05	0.00
15.0	101.1	0.014	12.77	55.58	0.00
20.0	86.7	0.012	14.59	74.11	0.00
25.0	76.2	0.011	16.02	92.64	0.00
30.0	68.1	0.010	17.20	111.16	0.00
35.0	61.7	0.009	18.19	129.69	0.00
40.0	56.6	0.008	19.04	148.22	0.00
45.0	52.3	0.007	19.79	166.74	0.00
50.0	48.6	0.007	20.46	185.27	0.00
55.0	45.5	0.006	21.07	203.80	0.00
60.0	42.8	0.006	21.62	222.33	0.00
65.0	40.4	0.006	22.12	240.85	0.00
70.0	38.3	0.005	22.59	259.38	0.00
75.0	36.5	0.005	23.02	277.91	0.00
80.0	34.8	0.005	23.43	296.44	0.00
85.0	33.3	0.005	23.81	314.96	0.00
90.0	31.9	0.004	24.17	333.49	0.00
95.0	30.7	0.004	24.51	352.02	0.00
100.0	29.5	0.004	24.83	370.54	0.00
105.0	28.4	0.004	25.14	389.07	0.00
110.0	27.5	0.004	25.43	407.60	0.00
115.0	26.6	0.004	25.71	426.13	0.00
120.0	25.7	0.004	25.98	444.65	0.00
125.0	24.9	0.003	26.24	463.18	0.00
130.0	24.2	0.003	26.48	481.71	0.00
135.0	23.5	0.003	26.72	500.23	0.00
140.0	22.9	0.003	26.95	518.76	0.00
145.0	22.3	0.003	27.17	537.29	0.00
150.0	21.7	0.003	27.39	555.82	0.00
155.0	21.2	0.003	27.60	574.34	0.00
160.0	20.6	0.003	27.80	592.87	0.00
165.0	20.2	0.003	28.00	611.40	0.00

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) =	**0.202**	ha
"C" =	**0.25**	
AC =	**0.051**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **73.8** L/s
Min. Storage= **0.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	146.1	0.020	12.30	44.27	0.00
15.0	121.6	0.017	15.35	66.40	0.00
20.0	104.6	0.015	17.62	88.54	0.00
25.0	92.2	0.013	19.40	110.67	0.00
30.0	82.6	0.012	20.85	132.81	0.00
35.0	75.0	0.011	22.08	154.94	0.00
40.0	68.7	0.010	23.14	177.07	0.00
45.0	63.5	0.009	24.07	199.21	0.00
50.0	59.2	0.008	24.89	221.34	0.00
55.0	55.4	0.008	25.64	243.48	0.00
60.0	52.1	0.007	26.31	265.61	0.00
65.0	49.2	0.007	26.93	287.75	0.00
70.0	46.7	0.007	27.50	309.88	0.00
75.0	44.4	0.006	28.03	332.02	0.00
80.0	42.4	0.006	28.53	354.15	0.00
85.0	40.5	0.006	28.99	376.28	0.00
90.0	38.9	0.005	29.43	398.42	0.00
95.0	37.3	0.005	29.84	420.55	0.00
100.0	35.9	0.005	30.23	442.69	0.00
105.0	34.6	0.005	30.60	464.82	0.00
110.0	33.4	0.005	30.96	486.96	0.00
115.0	32.3	0.005	31.30	509.09	0.00
120.0	31.3	0.004	31.62	531.22	0.00
125.0	30.3	0.004	31.93	553.36	0.00
130.0	29.5	0.004	32.23	575.49	0.00
135.0	28.6	0.004	32.51	597.63	0.00
140.0	27.8	0.004	32.79	619.76	0.00
145.0	27.1	0.004	33.06	641.90	0.00
150.0	26.4	0.004	33.32	664.03	0.00
155.0	25.7	0.004	33.56	686.17	0.00
160.0	25.1	0.004	33.81	708.30	0.00
165.0	24.5	0.003	34.04	730.43	0.00

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) = **0.202** ha
"C" = **0.25**
AC = **0.051**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **83.1** L/s
Min. Storage= **0.0** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	164.6	0.023	13.85	49.88	0.00
15.0	136.9	0.019	17.28	74.81	0.00
20.0	117.8	0.017	19.82	99.75	0.00
25.0	103.7	0.015	21.82	124.69	0.00
30.0	92.9	0.013	23.45	149.63	0.00
35.0	84.2	0.012	24.82	174.57	0.00
40.0	77.2	0.011	26.00	199.51	0.00
45.0	71.4	0.010	27.03	224.44	0.00
50.0	66.4	0.009	27.96	249.38	0.00
55.0	62.2	0.009	28.78	274.32	0.00
60.0	58.5	0.008	29.54	299.26	0.00
65.0	55.2	0.008	30.22	324.20	0.00
70.0	52.4	0.007	30.86	349.13	0.00
75.0	49.8	0.007	31.45	374.07	0.00
80.0	47.5	0.007	32.00	399.01	0.00
85.0	45.4	0.006	32.51	423.95	0.00
90.0	43.6	0.006	33.00	448.89	0.00
95.0	41.8	0.006	33.46	473.82	0.00
100.0	40.3	0.006	33.89	498.76	0.00
105.0	38.8	0.005	34.30	523.70	0.00
110.0	37.5	0.005	34.69	548.64	0.00
115.0	36.2	0.005	35.07	573.58	0.00
120.0	35.1	0.005	35.42	598.52	0.00
125.0	34.0	0.005	35.77	623.45	0.00
130.0	33.0	0.005	36.10	648.39	0.00
135.0	32.0	0.004	36.42	673.33	0.00
140.0	31.2	0.004	36.72	698.27	0.00
145.0	30.3	0.004	37.02	723.21	0.00
150.0	29.5	0.004	37.30	748.14	0.00
155.0	28.8	0.004	37.58	773.08	0.00
160.0	28.1	0.004	37.85	798.02	0.00
165.0	27.4	0.004	38.10	822.96	0.00

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A13 Post - BLOCK N

Parkland Area

Area (A13) =	**0.202**	ha
"C" =	**0.25**	
AC =	**0.051**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min

Tributary Area	ha	C
Landsc. Area	0.202	0.25
Hardsc. Area	0.000	0.90
Total	0.202	0.25

Allowable Release Rate= **91.8** L/s
Min. Storage= **0.0** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A13 Post)** (m^3/s)	**Runoff Volume (A13 Post)** (m^3)	**Target Released Volume (A13 Post)** (m^3)	**Total Required Storage Volume (A13 Post)** (m^3)
10.0	181.8	0.026	15.30	55.09	0.00
15.0	152.1	0.021	19.20	82.63	0.00
20.0	131.3	0.018	22.10	110.18	0.00
25.0	115.9	0.016	24.38	137.72	0.00
30.0	103.9	0.015	26.24	165.27	0.00
35.0	94.4	0.013	27.81	192.81	0.00
40.0	86.6	0.012	29.15	220.36	0.00
45.0	80.1	0.011	30.33	247.90	0.00
50.0	74.6	0.010	31.37	275.45	0.00
55.0	69.8	0.010	32.31	302.99	0.00
60.0	65.7	0.009	33.16	330.54	0.00
65.0	62.0	0.009	33.94	358.08	0.00
70.0	58.8	0.008	34.65	385.63	0.00
75.0	55.9	0.008	35.32	413.17	0.00
80.0	53.4	0.007	35.93	440.72	0.00
85.0	51.0	0.007	36.51	468.26	0.00
90.0	48.9	0.007	37.05	495.80	0.00
95.0	47.0	0.007	37.56	523.35	0.00
100.0	45.2	0.006	38.04	550.89	0.00
105.0	43.6	0.006	38.50	578.44	0.00
110.0	42.1	0.006	38.93	605.98	0.00
115.0	40.7	0.006	39.35	633.53	0.00
120.0	39.4	0.006	39.75	661.07	0.00
125.0	38.1	0.005	40.12	688.62	0.00
130.0	37.0	0.005	40.49	716.16	0.00
135.0	35.9	0.005	40.84	743.71	0.00
140.0	34.9	0.005	41.18	771.25	0.00
145.0	34.0	0.005	41.50	798.80	0.00
150.0	33.1	0.005	41.81	826.34	0.00
155.0	32.3	0.005	42.12	853.89	0.00
160.0	31.5	0.004	42.41	881.43	0.00
165.0	30.7	0.004	42.69	908.98	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A14 Pre	0.820	0.89	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.014	0.25
Hardsc. Area	0.806	0.90
Total	0.820	0.89

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	74.1	0.150	150.1

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	103.0	0.209	208.7

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	122.3	0.248	247.7

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	146.1	0.296	295.9

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	164.6	0.333	333.4

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A14 Pre	0.820	0.89	0.73	10	181.8	0.368	368.2

Lithos

Modified Rational Method -Two Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= 150.1 L/s
Min. Storage= **1.1** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	74.1	0.152	91.20	90.05	1.15
15.0	59.9	0.123	110.62	135.07	0.00
20.0	50.7	0.104	124.83	180.10	0.00
25.0	44.2	0.091	136.01	225.12	0.00
30.0	39.3	0.081	145.23	270.14	0.00
35.0	35.5	0.073	153.07	315.17	0.00
40.0	32.5	0.067	159.90	360.19	0.00
45.0	30.0	0.061	165.96	405.22	0.00
50.0	27.9	0.057	171.41	450.24	0.00
55.0	26.1	0.053	176.37	495.26	0.00
60.0	24.5	0.050	180.92	540.29	0.00
65.0	23.1	0.047	185.13	585.31	0.00
70.0	21.9	0.045	189.05	630.34	0.00
75.0	20.9	0.043	192.72	675.36	0.00
80.0	19.9	0.041	196.18	720.38	0.00
85.0	19.1	0.039	199.44	765.41	0.00
90.0	18.3	0.038	202.53	810.43	0.00
95.0	17.6	0.036	205.47	855.46	0.00
100.0	16.9	0.035	208.27	900.48	0.00
105.0	16.3	0.033	210.95	945.50	0.00
110.0	15.8	0.032	213.52	990.53	0.00
115.0	15.3	0.031	215.99	1035.55	0.00
120.0	14.8	0.030	218.37	1080.58	0.00
125.0	14.3	0.029	220.66	1125.60	0.00
130.0	13.9	0.029	222.87	1170.62	0.00
135.0	13.5	0.028	225.00	1215.65	0.00
140.0	13.2	0.027	227.07	1260.67	0.00
145.0	12.8	0.026	229.08	1305.70	0.00
150.0	12.5	0.026	231.02	1350.72	0.00
155.0	12.2	0.025	232.92	1395.74	0.00
160.0	11.9	0.024	234.75	1440.77	0.00
165.0	11.6	0.024	236.54	1485.79	0.00

Modified Rational Method -Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= **208.7** L/s
Min. Storage= **1.6** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	103.0	0.211	126.81	125.22	1.60
15.0	84.6	0.174	156.23	187.82	0.00
20.0	72.3	0.148	177.87	250.43	0.00
25.0	63.3	0.130	194.86	313.04	0.00
30.0	56.5	0.116	208.79	375.65	0.00
35.0	51.2	0.105	220.57	438.25	0.00
40.0	46.9	0.096	230.77	500.86	0.00
45.0	43.3	0.089	239.75	563.47	0.00
50.0	40.3	0.083	247.79	626.08	0.00
55.0	37.7	0.077	255.06	688.69	0.00
60.0	35.4	0.073	261.69	751.29	0.00
65.0	33.5	0.069	267.80	813.90	0.00
70.0	31.7	0.065	273.46	876.51	0.00
75.0	30.2	0.062	278.73	939.12	0.00
80.0	28.8	0.059	283.67	1001.72	0.00
85.0	27.6	0.057	288.32	1064.33	0.00
90.0	26.4	0.054	292.71	1126.94	0.00
95.0	25.4	0.052	296.87	1189.55	0.00
100.0	24.4	0.050	300.82	1252.15	0.00
105.0	23.6	0.048	304.59	1314.76	0.00
110.0	22.8	0.047	308.19	1377.37	0.00
115.0	22.0	0.045	311.64	1439.98	0.00
120.0	21.3	0.044	314.95	1502.59	0.00
125.0	20.7	0.042	318.13	1565.19	0.00
130.0	20.1	0.041	321.19	1627.80	0.00
135.0	19.5	0.040	324.15	1690.41	0.00
140.0	19.0	0.039	327.01	1753.02	0.00
145.0	18.5	0.038	329.77	1815.62	0.00
150.0	18.0	0.037	332.44	1878.23	0.00
155.0	17.6	0.036	335.04	1940.84	0.00
160.0	17.1	0.035	337.55	2003.45	0.00
165.0	16.7	0.034	340.00	2066.06	0.00

Lithos

Modified Rational Method -Ten Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= 247.7 L/s
Min. Storage= **1.9** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	122.3	0.251	150.51	148.61	1.90
15.0	101.1	0.207	186.67	222.92	0.00
20.0	86.7	0.178	213.36	297.23	0.00
25.0	76.2	0.156	234.31	371.53	0.00
30.0	68.1	0.140	251.46	445.84	0.00
35.0	61.7	0.127	265.93	520.14	0.00
40.0	56.6	0.116	278.42	594.45	0.00
45.0	52.3	0.107	289.41	668.76	0.00
50.0	48.6	0.100	299.20	743.06	0.00
55.0	45.5	0.093	308.03	817.37	0.00
60.0	42.8	0.088	316.08	891.68	0.00
65.0	40.4	0.083	323.46	965.98	0.00
70.0	38.3	0.079	330.29	1040.29	0.00
75.0	36.5	0.075	336.64	1114.60	0.00
80.0	34.8	0.071	342.57	1188.90	0.00
85.0	33.3	0.068	348.14	1263.21	0.00
90.0	31.9	0.065	353.40	1337.52	0.00
95.0	30.7	0.063	358.36	1411.82	0.00
100.0	29.5	0.061	363.08	1486.13	0.00
105.0	28.4	0.058	367.57	1560.43	0.00
110.0	27.5	0.056	371.85	1634.74	0.00
115.0	26.6	0.054	375.94	1709.05	0.00
120.0	25.7	0.053	379.86	1783.35	0.00
125.0	24.9	0.051	383.63	1857.66	0.00
130.0	24.2	0.050	387.25	1931.97	0.00
135.0	23.5	0.048	390.75	2006.27	0.00
140.0	22.9	0.047	394.11	2080.58	0.00
145.0	22.3	0.046	397.37	2154.89	0.00
150.0	21.7	0.045	400.52	2229.19	0.00
155.0	21.2	0.043	403.57	2303.50	0.00
160.0	20.6	0.042	406.52	2377.81	0.00
165.0	20.2	0.041	409.40	2452.11	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= 295.9 L/s
Min. Storage= **2.3** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	146.1	0.300	179.81	177.55	2.26
15.0	121.6	0.249	224.47	266.32	0.00
20.0	104.6	0.215	257.59	355.09	0.00
25.0	92.2	0.189	283.62	443.87	0.00
30.0	82.6	0.169	304.92	532.64	0.00
35.0	75.0	0.154	322.88	621.42	0.00
40.0	68.7	0.141	338.36	710.19	0.00
45.0	63.5	0.130	351.93	798.96	0.00
50.0	59.2	0.121	364.01	887.74	0.00
55.0	55.4	0.114	374.89	976.51	0.00
60.0	52.1	0.107	384.77	1065.28	0.00
65.0	49.2	0.101	393.83	1154.06	0.00
70.0	46.7	0.096	402.18	1242.83	0.00
75.0	44.4	0.091	409.94	1331.60	0.00
80.0	42.4	0.087	417.17	1420.38	0.00
85.0	40.5	0.083	423.95	1509.15	0.00
90.0	38.9	0.080	430.34	1597.92	0.00
95.0	37.3	0.077	436.37	1686.70	0.00
100.0	35.9	0.074	442.08	1775.47	0.00
105.0	34.6	0.071	447.51	1864.25	0.00
110.0	33.4	0.069	452.68	1953.02	0.00
115.0	32.3	0.066	457.62	2041.79	0.00
120.0	31.3	0.064	462.35	2130.57	0.00
125.0	30.3	0.062	466.89	2219.34	0.00
130.0	29.5	0.060	471.24	2308.11	0.00
135.0	28.6	0.059	475.44	2396.89	0.00
140.0	27.8	0.057	479.48	2485.66	0.00
145.0	27.1	0.056	483.38	2574.43	0.00
150.0	26.4	0.054	487.16	2663.21	0.00
155.0	25.7	0.053	490.81	2751.98	0.00
160.0	25.1	0.051	494.34	2840.76	0.00
165.0	24.5	0.050	497.77	2929.53	0.00

Lithos

Modified Rational Method - Fifty Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= **333.4** L/s
Min. Storage= **2.6** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	164.6	0.338	202.59	200.04	2.55
15.0	136.9	0.281	252.73	300.06	0.00
20.0	117.8	0.242	289.86	400.07	0.00
25.0	103.7	0.213	319.01	500.09	0.00
30.0	92.9	0.190	342.84	600.11	0.00
35.0	84.2	0.173	362.90	700.13	0.00
40.0	77.2	0.158	380.17	800.15	0.00
45.0	71.4	0.146	395.31	900.17	0.00
50.0	66.4	0.136	408.77	1000.19	0.00
55.0	62.2	0.128	420.88	1100.21	0.00
60.0	58.5	0.120	431.88	1200.22	0.00
65.0	55.2	0.113	441.96	1300.24	0.00
70.0	52.4	0.107	451.25	1400.26	0.00
75.0	49.8	0.102	459.86	1500.28	0.00
80.0	47.5	0.097	467.90	1600.30	0.00
85.0	45.4	0.093	475.43	1700.32	0.00
90.0	43.6	0.089	482.51	1800.34	0.00
95.0	41.8	0.086	489.20	1900.35	0.00
100.0	40.3	0.083	495.54	2000.37	0.00
105.0	38.8	0.080	501.56	2100.39	0.00
110.0	37.5	0.077	507.29	2200.41	0.00
115.0	36.2	0.074	512.76	2300.43	0.00
120.0	35.1	0.072	518.00	2400.45	0.00
125.0	34.0	0.070	523.02	2500.47	0.00
130.0	33.0	0.068	527.85	2600.48	0.00
135.0	32.0	0.066	532.49	2700.50	0.00
140.0	31.2	0.064	536.96	2800.52	0.00
145.0	30.3	0.062	541.28	2900.54	0.00
150.0	29.5	0.061	545.45	3000.56	0.00
155.0	28.8	0.059	549.49	3100.58	0.00
160.0	28.1	0.058	553.40	3200.60	0.00
165.0	27.4	0.056	557.19	3300.62	0.00

Lithos

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A14 Post - PUBLIC ST

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A14) = **0.820** ha
"C" = **0.90**
AC = **0.738**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.820	0.90
Total	0.820	0.90

Allowable Release Rate= 368.2 L/s
Min. Storage= **2.8** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A14 Post)** (m^3/s)	**Runoff Volume (A14 Post)** (m^3)	**Target Released Volume (A14 Post)** (m^3)	**Total Required Storage Volume (A14 Post)** (m^3)
10.0	181.8	0.373	223.76	220.95	2.82
15.0	152.1	0.312	280.76	331.42	0.00
20.0	131.3	0.269	323.16	441.89	0.00
25.0	115.9	0.238	356.48	552.36	0.00
30.0	103.9	0.213	383.71	662.84	0.00
35.0	94.4	0.194	406.60	773.31	0.00
40.0	86.6	0.178	426.28	883.78	0.00
45.0	80.1	0.164	443.50	994.25	0.00
50.0	74.6	0.153	458.78	1104.73	0.00
55.0	69.8	0.143	472.49	1215.20	0.00
60.0	65.7	0.135	484.91	1325.67	0.00
65.0	62.0	0.127	496.27	1436.15	0.00
70.0	58.8	0.121	506.72	1546.62	0.00
75.0	55.9	0.115	516.40	1657.09	0.00
80.0	53.4	0.109	525.41	1767.56	0.00
85.0	51.0	0.105	533.83	1878.04	0.00
90.0	48.9	0.100	541.75	1988.51	0.00
95.0	47.0	0.096	549.20	2098.98	0.00
100.0	45.2	0.093	556.26	2209.45	0.00
105.0	43.6	0.089	562.95	2319.93	0.00
110.0	42.1	0.086	569.31	2430.40	0.00
115.0	40.7	0.083	575.38	2540.87	0.00
120.0	39.4	0.081	581.18	2651.35	0.00
125.0	38.1	0.078	586.73	2761.82	0.00
130.0	37.0	0.076	592.05	2872.29	0.00
135.0	35.9	0.074	597.17	2982.76	0.00
140.0	34.9	0.072	602.10	3093.24	0.00
145.0	34.0	0.070	606.85	3203.71	0.00
150.0	33.1	0.068	611.44	3314.18	0.00
155.0	32.3	0.066	615.87	3424.65	0.00
160.0	31.5	0.065	620.16	3535.13	0.00
165.0	30.7	0.063	624.31	3645.60	0.00

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Rational Method
Pre-Development Flow Calculation

75 Centennial Parkway North=
City of Hamilton
File No. UD22-064
Date: August 2023

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A15 Pre	0.416	0.87	10

Formula:	$I = A/(t_d+B)^C$	
	A,B,C	Constants
	t_d	Time of concentration
	I	Rainfall intensity (mm)

Tributary Area	ha	C
Landsc.Area	0.019	0.25
Hardsc. Area	0.397	0.90
Total	0.416	0.87

Rational Method Calculation for the City of Hamilton

Event 2 YEAR
A = 646.0 B = 6.0 C = 0.781

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	74.1	0.075	74.5

Event 5 YEAR
A = 1049.5 B = 8.0 C = 0.803

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	103.0	0.104	103.6

Event 10 YEAR
A = 1343.7 B = 9.0 C = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	122.3	0.123	123.0

Event 25 YEAR
A = 1719.5 B = 10.0 C = 0.823

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	146.1	0.147	147.0

Event 50 YEAR
A = 1954.8 B = 10.0 C = 0.826

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	164.6	0.166	165.6

Event 100 YEAR
A = 2317.4 B = 11.0 C = 0.836

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A15 Pre	0.416	0.87	0.36	10	181.8	0.183	182.9

Lithos

Modified Rational Method -Two Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha
"C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= **74.5** L/s
Min. Storage= **1.5** (m^3)

2 Year Design Storm	
A =	646.00
B =	6.00
C =	0.781
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15 Post)** (m^3/s)	**Runoff Volume (A15 Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	74.1	0.077	46.24	44.72	1.52
15.0	59.9	0.062	56.09	67.08	0.00
20.0	50.7	0.053	63.29	89.44	0.00
25.0	44.2	0.046	68.96	111.80	0.00
30.0	39.3	0.041	73.63	134.16	0.00
35.0	35.5	0.037	77.61	156.52	0.00
40.0	32.5	0.034	81.07	178.87	0.00
45.0	30.0	0.031	84.14	201.23	0.00
50.0	27.9	0.029	86.91	223.59	0.00
55.0	26.1	0.027	89.42	245.95	0.00
60.0	24.5	0.025	91.73	268.31	0.00
65.0	23.1	0.024	93.86	290.67	0.00
70.0	21.9	0.023	95.85	313.03	0.00
75.0	20.9	0.022	97.71	335.39	0.00
80.0	19.9	0.021	99.46	357.75	0.00
85.0	19.1	0.020	101.12	380.11	0.00
90.0	18.3	0.019	102.68	402.47	0.00
95.0	17.6	0.018	104.18	424.83	0.00
100.0	16.9	0.018	105.60	447.19	0.00
105.0	16.3	0.017	106.96	469.55	0.00
110.0	15.8	0.016	108.26	491.91	0.00
115.0	15.3	0.016	109.51	514.26	0.00
120.0	14.8	0.015	110.72	536.62	0.00
125.0	14.3	0.015	111.88	558.98	0.00
130.0	13.9	0.014	113.00	581.34	0.00
135.0	13.5	0.014	114.08	603.70	0.00
140.0	13.2	0.014	115.13	626.06	0.00
145.0	12.8	0.013	116.15	648.42	0.00
150.0	12.5	0.013	117.13	670.78	0.00
155.0	12.2	0.013	118.09	693.14	0.00
160.0	11.9	0.012	119.02	715.50	0.00
165.0	11.6	0.012	119.93	737.86	0.00

Lithos

Modified Rational Method -Five Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha "C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= 103.6 L/s
Min. Storage= **2.1** (m^3)

5 Year Design Storm	
A =	1049.50
B =	8.00
C =	0.803
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15 Post)** (m^3/s)	**Runoff Volume (A15 Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	103.0	0.107	64.30	62.18	2.11
15.0	84.6	0.088	79.21	93.27	0.00
20.0	72.3	0.075	90.18	124.37	0.00
25.0	63.3	0.066	98.80	155.46	0.00
30.0	56.5	0.059	105.86	186.55	0.00
35.0	51.2	0.053	111.83	217.64	0.00
40.0	46.9	0.049	117.00	248.73	0.00
45.0	43.3	0.045	121.56	279.82	0.00
50.0	40.3	0.042	125.63	310.92	0.00
55.0	37.7	0.039	129.32	342.01	0.00
60.0	35.4	0.037	132.68	373.10	0.00
65.0	33.5	0.035	135.78	404.19	0.00
70.0	31.7	0.033	138.65	435.28	0.00
75.0	30.2	0.031	141.32	466.37	0.00
80.0	28.8	0.030	143.83	497.47	0.00
85.0	27.6	0.029	146.18	528.56	0.00
90.0	26.4	0.027	148.41	559.65	0.00
95.0	25.4	0.026	150.52	590.74	0.00
100.0	24.4	0.025	152.52	621.83	0.00
105.0	23.6	0.025	154.43	652.92	0.00
110.0	22.8	0.024	156.26	684.01	0.00
115.0	22.0	0.023	158.01	715.11	0.00
120.0	21.3	0.022	159.68	746.20	0.00
125.0	20.7	0.022	161.30	777.29	0.00
130.0	20.1	0.021	162.85	808.38	0.00
135.0	19.5	0.020	164.35	839.47	0.00
140.0	19.0	0.020	165.80	870.56	0.00
145.0	18.5	0.019	167.20	901.66	0.00
150.0	18.0	0.019	168.55	932.75	0.00
155.0	17.6	0.018	169.87	963.84	0.00
160.0	17.1	0.018	171.14	994.93	0.00
165.0	16.7	0.017	172.39	1026.02	0.00

Lithos

Modified Rational Method -Ten Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha
"C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= 123.0 L/s
Min. Storage= **2.5** (m^3)

10 Year Design Storm	
A =	1343.70
B =	9.00
C =	0.814
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15 Post)** (m^3/s)	**Runoff Volume (A15 Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	122.3	0.127	76.31	73.80	2.51
15.0	101.1	0.105	94.64	110.70	0.00
20.0	86.7	0.090	108.17	147.61	0.00
25.0	76.2	0.079	118.80	184.51	0.00
30.0	68.1	0.071	127.49	221.41	0.00
35.0	61.7	0.064	134.83	258.31	0.00
40.0	56.6	0.059	141.17	295.21	0.00
45.0	52.3	0.054	146.73	332.11	0.00
50.0	48.6	0.051	151.70	369.01	0.00
55.0	45.5	0.047	156.18	405.91	0.00
60.0	42.8	0.045	160.26	442.82	0.00
65.0	40.4	0.042	164.00	479.72	0.00
70.0	38.3	0.040	167.46	516.62	0.00
75.0	36.5	0.038	170.68	553.52	0.00
80.0	34.8	0.036	173.69	590.42	0.00
85.0	33.3	0.035	176.51	627.32	0.00
90.0	31.9	0.033	179.18	664.22	0.00
95.0	30.7	0.032	181.70	701.12	0.00
100.0	29.5	0.031	184.09	738.03	0.00
105.0	28.4	0.030	186.36	774.93	0.00
110.0	27.5	0.029	188.53	811.83	0.00
115.0	26.6	0.028	190.61	848.73	0.00
120.0	25.7	0.027	192.60	885.63	0.00
125.0	24.9	0.026	194.51	922.53	0.00
130.0	24.2	0.025	196.34	959.43	0.00
135.0	23.5	0.024	198.11	996.33	0.00
140.0	22.9	0.024	199.82	1033.24	0.00
145.0	22.3	0.023	201.47	1070.14	0.00
150.0	21.7	0.023	203.07	1107.04	0.00
155.0	21.2	0.022	204.61	1143.94	0.00
160.0	20.6	0.021	206.11	1180.84	0.00
165.0	20.2	0.021	207.57	1217.74	0.00

Lithos

Modified Rational Method -Twenty Five Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha
"C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= 147.0 L/s
Min. Storage= **3.0** (m^3)

25 Year Design Storm	
A =	1719.50
B =	10.00
C =	0.823
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15 Post)** (m^3/s)	**Runoff Volume (A15Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	146.1	0.152	91.17	88.17	3.00
15.0	121.6	0.126	113.81	132.26	0.00
20.0	104.6	0.109	130.60	176.34	0.00
25.0	92.2	0.096	143.80	220.43	0.00
30.0	82.6	0.086	154.60	264.51	0.00
35.0	75.0	0.078	163.70	308.60	0.00
40.0	68.7	0.071	171.55	352.69	0.00
45.0	63.5	0.066	178.44	396.77	0.00
50.0	59.2	0.062	184.56	440.86	0.00
55.0	55.4	0.058	190.07	484.94	0.00
60.0	52.1	0.054	195.08	529.03	0.00
65.0	49.2	0.051	199.68	573.12	0.00
70.0	46.7	0.049	203.91	617.20	0.00
75.0	44.4	0.046	207.84	661.29	0.00
80.0	42.4	0.044	211.51	705.37	0.00
85.0	40.5	0.042	214.95	749.46	0.00
90.0	38.9	0.040	218.19	793.54	0.00
95.0	37.3	0.039	221.24	837.63	0.00
100.0	35.9	0.037	224.14	881.72	0.00
105.0	34.6	0.036	226.89	925.80	0.00
110.0	33.4	0.035	229.52	969.89	0.00
115.0	32.3	0.034	232.02	1013.97	0.00
120.0	31.3	0.033	234.42	1058.06	0.00
125.0	30.3	0.032	236.72	1102.14	0.00
130.0	29.5	0.031	238.93	1146.23	0.00
135.0	28.6	0.030	241.05	1190.32	0.00
140.0	27.8	0.029	243.10	1234.40	0.00
145.0	27.1	0.028	245.08	1278.49	0.00
150.0	26.4	0.027	246.99	1322.57	0.00
155.0	25.7	0.027	248.85	1366.66	0.00
160.0	25.1	0.026	250.64	1410.75	0.00
165.0	24.5	0.025	252.38	1454.83	0.00

Lithos

Modified Rational Method - Fifty Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha
"C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= 165.6 L/s
Min. Storage= **3.4** (m^3)

50 Year Design Storm	
A =	1954.80
B =	10.00
C =	0.826
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15Post)** (m^3/s)	**Runoff Volume (A15 Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	164.6	0.171	102.72	99.34	3.38
15.0	136.9	0.142	128.14	149.01	0.00
20.0	117.8	0.122	146.97	198.68	0.00
25.0	103.7	0.108	161.74	248.35	0.00
30.0	92.9	0.097	173.82	298.02	0.00
35.0	84.2	0.088	183.99	347.69	0.00
40.0	77.2	0.080	192.75	397.36	0.00
45.0	71.4	0.074	200.43	447.03	0.00
50.0	66.4	0.069	207.25	496.70	0.00
55.0	62.2	0.065	213.39	546.37	0.00
60.0	58.5	0.061	218.97	596.04	0.00
65.0	55.2	0.057	224.08	645.71	0.00
70.0	52.4	0.054	228.79	695.38	0.00
75.0	49.8	0.052	233.16	745.05	0.00
80.0	47.5	0.049	237.23	794.72	0.00
85.0	45.4	0.047	241.05	844.39	0.00
90.0	43.6	0.045	244.64	894.06	0.00
95.0	41.8	0.044	248.03	943.73	0.00
100.0	40.3	0.042	251.24	993.40	0.00
105.0	38.8	0.040	254.30	1043.07	0.00
110.0	37.5	0.039	257.20	1092.74	0.00
115.0	36.2	0.038	259.98	1142.41	0.00
120.0	35.1	0.036	262.63	1192.08	0.00
125.0	34.0	0.035	265.18	1241.75	0.00
130.0	33.0	0.034	267.63	1291.42	0.00
135.0	32.0	0.033	269.98	1341.09	0.00
140.0	31.2	0.032	272.25	1390.77	0.00
145.0	30.3	0.032	274.44	1440.44	0.00
150.0	29.5	0.031	276.55	1490.11	0.00
155.0	28.8	0.030	278.60	1539.78	0.00
160.0	28.1	0.029	280.58	1589.45	0.00
165.0	27.4	0.029	282.50	1639.12	0.00

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Modified Rational Method - Hundred Year Storm=
Site Flow and Storage Summary
75 Centennial Parkway North
File No. UD22-064
Date: August 2023

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed by: Catherine Agiou, P.E., M.A.Sc.

Drainage Area A15 Post - BLOCK A

Rooftops/Driveway/Landscaped/Hardscaped Areas - Controlled

Area (A15) = **0.416**= ha
"C" = **0.90**
AC = **0.374**
Tc = **10.0** min
Time Increment = **5.0** min

Tributary Area	ha	C
Landsc. Area	0.000	0.25
Hardsc. Area	0.416	0.90
Total	0.416	0.90

Allowable Release Rate= **182.9** L/s
Min. Storage= **3.7** (m^3)

100 Year Design Storm	
A =	2317.40
B =	11.00
C =	0.836
I=	$A / (td+B)^C$

(1)	(2)	(3)	(4)	(5)	(6)
Time (min)	**Rainfall Intensity** (mm/hr)	**Storm Runoff (A15 Post)** (m^3/s)	**Runoff Volume (A15 Post)** (m^3)	**Target Released Volume (A15 Post)** (m^3)	**Total Required Storage Volume (A15 Post)** (m^3)
10.0	181.8	0.189	113.45	109.72	3.73
15.0	152.1	0.158	142.35	164.59	0.00
20.0	131.3	0.137	163.85	219.45	0.00
25.0	115.9	0.120	180.74	274.31	0.00
30.0	103.9	0.108	194.54	329.17	0.00
35.0	94.4	0.098	206.15	384.03	0.00
40.0	86.6	0.090	216.13	438.89	0.00
45.0	80.1	0.083	224.86	493.76	0.00
50.0	74.6	0.078	232.61	548.62	0.00
55.0	69.8	0.073	239.56	603.48	0.00
60.0	65.7	0.068	245.86	658.34	0.00
65.0	62.0	0.065	251.62	713.20	0.00
70.0	58.8	0.061	256.92	768.06	0.00
75.0	55.9	0.058	261.82	822.93	0.00
80.0	53.4	0.055	266.39	877.79	0.00
85.0	51.0	0.053	270.66	932.65	0.00
90.0	48.9	0.051	274.67	987.51	0.00
95.0	47.0	0.049	278.45	1042.37	0.00
100.0	45.2	0.047	282.03	1097.24	0.00
105.0	43.6	0.045	285.42	1152.10	0.00
110.0	42.1	0.044	288.65	1206.96	0.00
115.0	40.7	0.042	291.73	1261.82	0.00
120.0	39.4	0.041	294.66	1316.68	0.00
125.0	38.1	0.040	297.48	1371.54	0.00
130.0	37.0	0.038	300.18	1426.41	0.00
135.0	35.9	0.037	302.78	1481.27	0.00
140.0	34.9	0.036	305.27	1536.13	0.00
145.0	34.0	0.035	307.68	1590.99	0.00
150.0	33.1	0.034	310.01	1645.85	0.00
155.0	32.3	0.034	312.25	1700.72	0.00
160.0	31.5	0.033	314.43	1755.58	0.00
165.0	30.7	0.032	316.53	1810.44	0.00

DOWNSTREAM SANITARY SEWER SEGMENT INFORMATION

SEWER SEGMENT	TYPE	SIZE (mm)	LENGTH (m)	SLOPE (%)
#1	CIRCULAR	375	106.2	0.60
#2	CIRCULAR	450	99.6	0.62
#3	CIRCULAR	525	93.8	0.57
#4	CIRCULAR	600	91.7	0.77
#5	CIRCULAR	750	91.1	0.60
#6	CIRCULAR	750	68.1	0.60
#7	CIRCULAR	750	23.8	0.58
#8	CIRCULAR	750	92.2	0.60
#9	CIRCULAR	750	92.1	0.60
#10	CIRCULAR	900	91.2	0.60
#11	CIRCULAR	900	75.7	0.62

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150 Berdmondsey Rd, Toronto, Ontario M4A 1Y1

LEGEND

- TRUNK SEWER
- DRAINAGE AREA
- EX. STORM SEWER
- EXISTING MANHOLE
- #1 NUMBERED SEGMENT AS INDICATED IN "EXTERNAL STORM SEWER SEGMENTS" DESIGN SHEET

DOWNSTREAM STORM NETWORK
MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

DATE: August 2023	PROJECT No: UD22-064
SCALE: N.T.S.	FIGURE No: DAP4

Appendix D

Sanitary Data Analysis

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SANITARY SEWER DESIGN SHEET - TOTAL

75 Centennial Parkway North

CITY OF HAMILTON

Based on Part 8 of the latest edition of the Code and Guide for Sewage Systems

LOCATION	RESIDENTIAL											COMMERCIAL	PARKLAND		FLOW								SEWER DESIGN					
	SECTION AREA	Single Fam. Dwell.	Townhouse	POPULATION Studio	1 Bed Apts.	2 Bed Apts.	3 Bed Apts.	Dwell. Pop. @ 60 ppha	Town. Pop. @ 110 ppha	Appart. Pop.	SECTION POP.	COMM. AREA	PARK AREA	SECTION POP. @ 25 ppha	AVERAGE APARTMENTS FLOW '@' 275 L/c/d	HARMON PEAKING FACTOR	RES. PEAK FLOW	AVERAGE COMMERCIAL FLOW @5L/m²/d	AVERAGE PARK FLOW @275 L/c/d	TOTAL ACCUM. AREA	INFILT. @ 0.40 L/s/ha.	TOTAL DESIGN FLOW	PIPE LENGTH	PIPE DIA.	SLOPE	FULL FLOW CAPACITY n = 0.015	FULL FLOW VELOCITY n = 0.015	% of DESIGN CAPACITY
	(ha.)	(ha)	(ha)	@ 2 ppu	@ 2 ppu	@ 4 ppu	@ 6 ppu	(persons)	(persons)	(persons)	(persons)	(ha.)	(ha.)	(persons)	(L/s)		(L/s)	(L/s)	(L/s)	(ha.)	(L/s)	(L/s)	(m)	(mm)	(%)	(L/sec)	(m/sec)	(%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Existing Condition																												
Commercial	8.703	0	0	0	0	0	0	0	0	0	0	5.270			0.00	2.0	0.00	3.050		8.703	3.481	**6.54**						
Proposed Condition																												
Mixed-Use	8.703				2883	683	391	0	0	10844	10,844	1.137	0.971	24	34.52	3.1	107.14	0.658	0.077	8.703	3.481	**111.35**		300	2.0%	136.76	1.68	81.4%
																				Total Net Flow		104.81						

Residential Flow Rate - 275 litres/capita/day
Infiltration - 0.40 L/ha
Peaking Factor = $5*P^{-0.2}$, P=Population in thousands
Townhouses - 110 ppha
Commercial flow Rate - 5L/m²/day
Parks - 12 to 25 ppha

min velocity = 0.75 m/s
max velocity = 2.75 m/s
Manning n = 0,015 dia < 600mm
n = 0,013 dia ≥ 600mm

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.=
Reviewed By: Catherine Agiou, P.E., M.A.Sc.=
Date: August 2023

Project: 75 Centennial Parkway North
File No: UD22-064
City of Hamilton

Lithos

SANITARY SEWER DESIGN SHEET - ROUTE A

75 Centennial Parkway North

CITY OF HAMILTON

Based on Part 8 of the latest edition of the Code and Guide for Sewage Systems

LOCATION	RESIDENTIAL											COMMERCIAL	PARKLAND		FLOW								SEWER DESIGN					
	SECTION AREA	Single Fam. Dwell.	Townhouse	POPULATION Studio	1 Bed Apts.	2 Bed Apts.	3 Bed Apts.	Dwell. Pop. @ 60 ppha	Town. Pop. @ 110 ppha	Appart. Pop.	SECTION POP.	COMM. AREA	PARK AREA	SECTION POP. @ 25 ppha	AVERAGE APARTMENTS FLOW '@' 275 L/c/d	HARMON PEAKING FACTOR	RES. PEAK FLOW	AVERAGE COMMERCIAL FLOW @5L/m²/d	AVERAGE PARK FLOW @275 L/c/d	TOTAL ACCUM. AREA	INFILT. @ 0.40 L/s/ha.	TOTAL DESIGN FLOW	PIPE LENGTH	PIPE DIA.	SLOPE	FULL FLOW CAPACITY n = 0.015	FULL FLOW VELOCITY n = 0.015	% of DESIGN CAPACITY
	(ha.)	(ha)	(ha)	@ 2 ppu	@ 2 ppu	@ 4 ppu	@ 6 ppu	(persons)	(persons)	(persons)	(persons)	(ha.)	(ha.)	(persons)	(L/s)		(L/s)	(L/s)	(L/s)	(ha.)	(L/s)	(L/s)	(m)	(mm)	(%)	(L/sec)	(m/sec)	(%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Existing Condition																												
Commercial	8.703	0	0	0	0	0	0	0	0	0	0	5.270			0.00	2.0	0.00	3.050		8.703	3.481	**6.54**						
Proposed Condition																												
Mixed-Use	3.797				1296	284	222	0	0	5060	5,060	0.671		0	16.11	3.6	58.22	0.388	0.000	3.797	1.519	**60.13**		250	2.0%	84.10	1.48	71.5%
																				Total Net Flow		53.59						

Residential Flow Rate - 275 litres/capita/day
Infiltration - 0.40 L/ha
Peaking Factor = $5*P^{-0.2}$, P=Population in thousands
Townhouses - 110 ppha
Commercial flow Rate - 5L/m²/day
Parks - 12 to 25 ppha

min velocity = 0.75 m/s
max velocity = 2.75 m/s
Manning n = 0,015 dia < 600mm
n = 0,013 dia ≥ 600mm

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.=
Reviewed By: Catherine Agiou, P.E., M.A.Sc.=
Date: August 2023

Project: 75 Centennial Parkway North
File No: UD22-064
City of Hamilton

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SANITARY SEWER DESIGN SHEET - ROUTE B

75 Centennial Parkway North

CITY OF HAMILTON

Based on Part 8 of the latest edition of the Code and Guide for Sewage Systems

LOCATION	RESIDENTIAL											COMMERCIAL	PARKLAND		FLOW								SEWER DESIGN					
	SECTION AREA	Single Fam. Dwell.	Townhouse	POPULATION Studio	1 Bed Apts.	2 Bed Apts.	3 Bed Apts.	Dwell. Pop. @ 60 ppha	Town. Pop. @ 110 ppha	Appart. Pop.	SECTION POP.	COMM. AREA	PARK AREA	SECTION POP. @ 25 ppha	AVERAGE APARTMENTS FLOW '@' 275 L/c/d	HARMON PEAKING FACTOR	RES. PEAK FLOW	AVERAGE COMMERCIAL FLOW @5L/m²/d	AVERAGE PARK FLOW @275 L/c/d	TOTAL ACCUM. AREA	INFILT. @ 0.40 L/s/ha.	TOTAL DESIGN FLOW	PIPE LENGTH	PIPE DIA.	SLOPE	FULL FLOW CAPACITY n = 0.015	FULL FLOW VELOCITY n = 0.015	% of DESIGN CAPACITY
	(ha.)	(ha)	(ha)	@ 2 ppu	@ 2 ppu	@ 4 ppu	@ 6 ppu	(persons)	(persons)	(persons)	(persons)	(ha.)	(ha.)	(persons)	(L/s)		(L/s)	(L/s)	(L/s)	(ha.)	(L/s)	(L/s)	(m)	(mm)	(%)	(L/sec)	(m/sec)	(%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Existing Condition																												
-	0.000	0	0	0	0	0	0	0	0	0	0	0.000			0.00	2.0	0.00	0.000		0.000	0.000	**0.00**						
Proposed Condition																												
Mixed-Use	4.906				1587	399	169	0	0	5784	5,784	0.466	0.971	24	18.41	3.5	64.80	0.270	0.077	4.906	1.962	**67.11**		250	2.0%	84.10	1.48	79.8%
																				Total Net Flow		67.11						

Residential Flow Rate - 275 litres/capita/day
Infiltration - 0.40 L/ha
Peaking Factor = $5*P^{-0.2}$, P=Population in thousands
Townhouses - 110 ppha
Commercial flow Rate - 5L/m²/day
Parks - 12 to 25 ppha

min velocity = 0.75 m/s
max velocity = 2.75 m/s
Manning n = 0,015 dia < 600mm
n = 0,013 dia ≥ 600mm

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.=
Reviewed By: Catherine Agiou, P.E., M.A.Sc.=
Date: August 2023

Project: 75 Centennial Parkway North
File No: UD22-064
City of Hamilton

EXTERNAL SANITARY SEWER SEGMENTS - ROUTE A

75 Centennial Parkway North

City of Hamilton

5 L/m^2 /day- commercial for areas over 600m^2
7.5 L/m^2 /day- commercial for areas 400- 600m^2
275 L/c/day - residential
q = average daily per capita flow (c.m./day)
Q (p) = peak population flow (L/s)
Q (I) = peak extraneous flow (L/s)
Q (C) = peak flow from commercial area (L/s)
Q (d) = peak design flow (L/s)

M = Peaking Factor (residential) = 5/P^0.2) where P = population in 1000's
I = unit of peak extraneous flow
Q (Ind) = peak flow from industrial (L/s) Q (Ins) = peak flow from institutional (L/s)
Q(p) = PqM/86.4 (L/s)
Q(I) = IA (L/s) where I = 0.40 L/s/ha, and A = drainage area - commercial area (ha)
Q(C) = based on Y L/p/day - residential equivalent (see below)
Q(d) = Q(p) + Q(I) + Q(Ind) +Q(Ins) + Q(C)

LOCATION											F L O W S (CUMMULATIVE)									
DESCRIPTION	Sewer Segment	Drainage Area (hectares)	Infiltration Area (hectares)	Residential (persons)	Commercial (hectares)	Future Development (Residential) (persons)	Future Development (Commercial) (hectares)	TOTAL RESIDENTIAL (cummulative) (persons)	Peak Factor (residential) M (dimensionless)	Drainage Area (cummulative) (hectares)	Infiltration Area (cummulative) (hectares)	RESIDENTIAL Q (p) (L/s)	INFILTRATION Q (I) (L/s)	COMMERCIAL Q (C) (L/s)	EXISTING PEAK FLOW (Cummulative) (L/s)	PROPOSED FLOW Q(prop.)* (L/s)	TOTAL PEAK DESIGN FLOW (Cummulative) (L/s)	GRADE (used) (%)	Max. Allowable Flow (L/s)	PIPE SIZE (mm)	Pre-development % of DESIGN CAPACITY (%)	Post-development % of DESIGN CAPACITY (%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Sewer Segment	#1	53.76	14.78	2140	2.97			2140	4.29	53.76	14.78	29.25	5.91	1.72	36.89	**53.59**	**90.48**	0.50%	**124.0**	375	29.76%	72.98%
Sewer Segment	#2	1.86	0.25	2	0.00			2142	4.29	55.62	15.02	29.28	6.01	1.72	37.01	**53.59**	**90.60**	0.50%	**124.0**	375	29.85%	73.08%
Sewer Segment	#3	1.35	0.21	24	0.00			2167	4.28	56.96	15.23	29.54	6.09	1.72	37.36	**53.59**	**90.95**	0.50%	**124.0**	375	30.13%	73.36%
Sewer Segment	#4	1.13	0.16	0	0.00			2167	4.28	58.10	15.40	29.54	6.16	1.72	37.42	**53.59**	**91.01**	0.50%	**124.0**	375	30.18%	73.41%
Sewer Segment	#5	1.77	0.24	18	0.00			2184	4.28	59.86	15.64	29.73	6.25	1.72	37.71	**53.59**	**91.30**	0.50%	**124.0**	375	30.42%	73.64%
Sewer Segment	#6	2.76	0.34	13	0.00			2197	4.27	62.63	15.97	29.88	6.39	1.72	37.99	**53.59**	**91.58**	0.50%	**124.0**	375	30.64%	73.87%
Sewer Segment	#7	8.20	2.85	263	0.00			2461	4.18	70.83	18.83	32.71	7.53	1.72	41.96	**53.59**	**95.55**	0.50%	**124.0**	375	33.84%	77.07%
Sewer Segment	#8	2.14	1.02	44	0.45			2504	4.16	72.97	19.85	33.17	7.94	2.11	43.23	**53.59**	**96.82**	0.50%	**124.0**	375	34.87%	78.10%
Sewer Segment	#9	0.72	0.26	25	0.00			2530	4.15	73.69	20.11	33.44	8.04	2.11	43.60	**53.59**	**97.19**	0.50%	**124.0**	375	35.17%	78.39%
Sewer Segment	#10	0.41	0.16	10	0.00			2540	4.15	74.10	20.28	33.55	8.11	2.11	43.77	**53.59**	**97.36**	0.50%	**124.0**	375	35.30%	78.53%
Sewer Segment	#11	3.84	1.50	365	0.00			2905	4.04	77.94	21.78	37.35	8.71	2.11	48.18	**53.59**	**101.77**	0.50%	**124.0**	375	38.86%	82.09%
Sewer Segment	#12	0.06	0.03	0	0.00			2905	4.04	78.01	21.81	37.35	8.72	2.11	48.19	**53.59**	**101.78**	0.50%	**124.0**	375	38.87%	82.10%
Sewer Segment	#13	5.36	1.34	163	0.03			3068	4.00	83.36	23.16	39.01	9.26	2.14	50.42	**53.59**	**104.01**	0.50%	**124.0**	375	40.67%	83.90%
Sewer Segment	#14	1.29	0.15	26	0.00			3093	3.99	84.65	23.31	39.27	9.32	2.14	50.74	**53.59**	**104.33**	0.50%	**124.0**	375	40.93%	84.15%
Sewer Segment	#15	2.71	0.79	100	0.00			3194	3.96	87.36	24.10	40.29	9.64	2.14	52.07	**53.59**	**105.66**	0.50%	**124.0**	375	42.00%	85.23%
Sewer Segment	#16	0.58	0.05	12	0.00			3205	3.96	87.95	24.14	40.41	9.66	2.14	52.21	**53.59**	**105.80**	0.50%	**124.0**	375	42.11%	85.34%
Sewer Segment	#17	1.63	0.17	37	0.00			3242	3.95	89.58	24.31	40.78	9.72	2.14	52.65	**53.59**	**106.24**	0.50%	**124.0**	375	42.47%	85.69%
Sewer Segment	#18	0.87	0.19	9	0.11			3251	3.95	90.45	24.50	40.87	9.80	2.24	52.91	**53.59**	**106.50**	0.50%	**124.0**	375	42.68%	85.90%
Sewer Segment	#19	6.68	1.35	91	0.87			3342	3.93	97.13	25.84	41.79	10.34	2.99	55.12	**53.59**	**108.71**	0.40%	**110.9**	375	49.71%	98.04%
Sewer Segment	#20	3.07	0.32	0	0.99			3342	3.93	100.20	26.16	41.79	10.46	3.85	56.10	**53.59**	**109.69**	0.40%	**110.9**	375	50.59%	98.92%
Sewer Segment	#21	2.63	0.29	0	0.67			3342	3.93	102.83	26.45	41.79	10.58	4.42	56.80	**53.59**	**110.39**	0.40%	**180.3**	450	31.50%	61.22%
Sewer Segment	#22	1.35	0.30	0	0.06			3342	3.93	104.18	26.76	41.79	10.70	4.48	56.97	**53.59**	**110.56**	0.40%	**180.3**	450	31.59%	61.31%
Sewer Segment	#23	1.04	0.27	0	0.52			3342	3.93	105.22	27.02	41.79	10.81	4.93	57.53	**53.59**	**111.12**	0.40%	**180.3**	450	31.90%	61.63%
Sewer Segment	#24	0.10	0.06	0	0.00			3342	3.93	105.32	27.08	41.79	10.83	4.93	57.55	**53.59**	**111.14**	0.40%	**180.3**	450	31.92%	61.64%
Sewer Segment	#25	3.44	1.32	0	0.32			3342	3.93	108.76	28.40	41.79	11.36	5.21	58.36	**53.59**	**111.95**	0.40%	**180.3**	450	32.36%	62.09%
Sewer Segment	#26	0.28	0.28	0	0.00			3342	3.93	109.04	28.68	41.79	11.47	5.21	58.47	**53.59**	**112.06**	0.40%	**180.3**	450	32.43%	62.15%
Sewer Segment	#27	2.59	0.29	0	0.83			3342	3.93	111.63	28.96	41.79	11.59	5.93	59.30	**53.59**	**112.89**	0.40%	**180.3**	450	32.89%	62.61%
Sewer Segment	#28	0.28	0.28	0	0.00			3342	3.93	111.91	29.24	41.79	11.70	5.93	59.41	**53.59**	**113.00**	0.40%	**180.3**	450	32.95%	62.67%
Sewer Segment	#29	1.43	0.25	0	0.47			3342	3.93	113.34	29.49	41.79	11.80	6.33	59.92	**53.59**	**113.51**	0.40%	**180.3**	450	33.23%	62.95%
Sewer Segment	#30	5.35	1.47	0	2.39			3342	3.93	118.69	30.97	41.79	12.39	8.41	62.58	**53.59**	**116.17**	0.40%	**180.3**	450	34.71%	64.43%
Sewer Segment	#31	1.79	0.90	0	0.38			3342	3.93	120.48	31.86	41.79	12.74	8.74	63.27	**53.59**	**116.86**	0.40%	**180.3**	450	35.09%	64.81%
Trunk Sewer																						

NOTES:

1. Calculated flows are estimated based on the existing developments within the drainage area.
2. The post development flow can be supported by the existing sanitary network, thus the sewers can support the proposed development.

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed By: Catherine Agiou, P.E., M.A.Sc.
Date: August 2023

Project: **75 Centennial Parkway North**
File No: **UD22-064**
City of Hamilton

EXTERNAL SANITARY SEWER SEGMENTS - ROUTE B

75 Centennial Parkway North

City of Hamilton

5 L/m^2 /day- commercial for areas over 600m^2
7.5 L/m^2 /day- commercial for areas 400- 600m^2
275 L/c/day - residential
q = average daily per capita flow (c.m./day)
Q (p) = peak population flow (L/s)
Q (I) = peak extraneous flow (L/s)
Q (C) = peak flow from commercial area (L/s)
Q (d) = peak design flow (L/s)

M = Peaking Factor (residential) = 5/P^0.2) where P = population in 1000's
I = unit of peak extraneous flow
Q (Ind) = peak flow from industrial (L/s) Q (Ins) = peak flow from institutional (L/s)
Q(p) = PqM/86.4 (L/s)
Q(I) = IA (L/s) where I = 0.40 L/s/ha, and A = drainage area - commercial area (ha)
Q(C) = based on Y L/p/day - residential equivalent (see below)
Q(d) = Q(p) + Q(I) + Q(Ind) +Q(Ins) + Q(C)

LOCATION											F L O W S (CUMMULATIVE)									
DESCRIPTION	Sewer Segment	Drainage Area (hectares)	Infiltration Area (hectares)	Residential (persons)	Commercial (hectares)	Future Development (Residential) (persons)	Future Development (Commercial) (hectares)	TOTAL RESIDENTIAL (cummulative) (persons)	Peak Factor (residential) M (dimensionless)	Drainage Area (cummulative) (hectares)	Infiltration Area (cummulative) (hectares)	RESIDENTIAL Q (p) (L/s)	INFILTRATION Q (I) (L/s)	COMMERCIAL Q (C) (L/s)	EXISTING PEAK FLOW (Cumulative) (L/s)	PROPOSED FLOW Q(prop.)* (L/s)	TOTAL PEAK DESIGN FLOW (Cumulative) (L/s)	GRADE (used) (%)	Max. Allowable Flow (L/s)	PIPE SIZE (mm)	Pre-development % of DESIGN CAPACITY (%)	Post-development % of DESIGN CAPACITY (%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Sewer Segment	#1	4.06	0.32	0	1.02			0	2.00	4.06	0.32	0.00	0.13	0.59	0.72	**67.11**	**67.83**	0.60%	**135.8**	375	0.53%	49.94%
Sewer Segment	#2	2.64	0.29	0	0.17			0	2.00	6.70	0.61	0.00	0.24	0.73	0.98	**67.11**	**68.09**	0.60%	**135.8**	375	0.72%	50.13%
Sewer Segment	#3	2.59	0.41	0	1.09			0	2.00	9.29	1.02	0.00	0.41	1.68	2.10	**67.11**	**69.21**	0.57%	**132.4**	375	1.59%	52.28%
Sewer Segment	#4	2.34	0.26	0	0.06			0	2.00	11.63	1.28	0.00	0.51	1.74	2.26	**67.11**	**69.37**	0.60%	**135.8**	375	1.66%	51.08%
Sewer Segment	#5	0.57	0.28	0	0.15			0	2.00	12.20	1.56	0.00	0.62	1.87	2.50	**67.11**	**69.61**	0.62%	**138.1**	375	1.81%	50.42%
Sewer Segment	#6	0.76	0.28	0	0.34			0	2.00	12.96	1.83	0.00	0.73	2.17	2.91	**67.11**	**70.02**	0.60%	**135.8**	375	2.14%	51.56%
Sewer Segment	#7	0.91	0.28	0	0.45			0	2.00	13.88	2.11	0.00	0.84	2.56	3.41	**67.11**	**70.52**	0.60%	**135.8**	375	2.51%	51.92%
Sewer Segment	#8	1.12	0.23	0	0.51			0	2.00	14.99	2.34	0.00	0.94	3.00	3.94	**67.11**	**71.05**	0.60%	**220.8**	450	1.78%	32.17%
Sewer Segment	#9	4.23	1.95	85	0.10			85	5.00	19.23	4.29	1.36	1.72	3.08	6.16	**67.11**	**73.27**	0.60%	**220.8**	450	2.79%	33.18%
Sewer Segment	#10	1.00	0.28	0	0.17			85	5.00	20.22	4.57	1.36	1.83	3.23	6.42	**67.11**	**73.53**	0.61%	**222.7**	450	2.88%	33.02%
Sewer Segment	#11	2.44	0.56	0	0.88			85	5.00	22.67	5.13	1.36	2.05	3.99	7.40	**67.11**	**74.51**	0.37%	**173.4**	450	4.27%	42.96%
Sewer Segment	#12	1.38	0.28	0	0.10			85	5.00	24.05	5.42	1.36	2.17	4.07	7.60	**67.11**	**74.71**	0.39%	**178.1**	450	4.27%	41.96%
Sewer Segment	#13	1.40	0.26	0	0.43			85	5.00	25.45	5.67	1.36	2.27	4.45	8.08	**67.11**	**75.19**	0.43%	**187.0**	450	4.32%	40.22%
Sewer Segment	#14	1.05	0.28	0	0.22			85	5.00	26.50	5.95	1.36	2.38	4.64	8.38	**67.11**	**75.49**	0.39%	**178.1**	450	4.71%	42.40%
Sewer Segment	#15	1.89	0.06	0	1.06			85	5.00	28.38	6.01	1.36	2.40	5.56	9.33	**67.11**	**76.44**	0.40%	**180.3**	450	5.17%	42.39%
Sewer Segment	#16	2.36	0.72	0	1.29			85	5.00	30.74	6.72	1.36	2.69	6.68	10.73	**67.11**	**77.84**	0.40%	**180.3**	450	5.95%	43.17%
Sewer Segment	#17	0.09	0.09	0				85	5.00	30.83	6.82	1.36	2.73	6.68	10.77	**67.11**	**77.88**	0.40%	**180.3**	450	5.97%	43.19%
Sewer Segment	#18	0.69	0.20	0	0.12			85	5.00	31.52	7.01	1.36	2.81	6.79	10.95	**67.11**	**78.06**	0.40%	**180.3**	450	6.07%	43.29%
Sewer Segment	#19	0.31	0.29	0	0.01			85	5.00	31.84	7.31	1.36	2.92	6.79	11.08	**67.11**	**78.19**	0.40%	**180.3**	450	6.14%	43.36%
Sewer Segment	#20	0.10	0.10	0				85	5.00	31.94	7.41	1.36	2.96	6.79	11.12	**67.11**	**78.23**	0.40%	**180.3**	450	6.17%	43.38%
Sewer Segment	#21	0.02	0.02	0				85	5.00	31.96	7.43	1.36	2.97	6.79	11.13	**67.11**	**78.24**	0.40%	**180.3**	450	6.17%	43.39%
Sewer Segment	#22	0.05	0.05	0				85	5.00	32.01	7.48	1.36	2.99	6.79	11.15	**67.11**	**78.26**	0.50%	**201.6**	450	5.53%	38.82%
Sewer Segment	#23	0.06	0.06	0				85	5.00	32.07	7.54	1.36	3.02	6.79	11.17	**67.11**	**78.28**	0.50%	**201.6**	450	5.54%	38.83%
Sewer Segment	#24	1.39	0.58	0	0.38			85	5.00	33.46	8.12	1.36	3.25	7.12	11.73	**67.11**	**78.84**	0.50%	**201.6**	450	5.82%	39.11%
Sewer Segment	#25	0.80	0.11	0	0.77			85	5.00	34.25	8.23	1.36	3.29	7.79	12.45	**67.11**	**79.56**	0.50%	**201.6**	450	6.18%	39.46%
Sewer Segment	#26	0.13	0.13	0				85	5.00	34.38	8.35	1.36	3.34	7.79	12.50	**67.11**	**79.61**	0.50%	**201.6**	450	6.20%	39.49%
Sewer Segment	#27	0.43	0.43	0				85	5.00	34.81	8.78	1.36	3.51	7.79	12.67	**67.11**	**79.78**	0.50%	**1015.0**	825	1.25%	7.86%
Sewer Segment	#28	0.02	0.02	0				85	5.00	34.83	8.81	1.36	3.52	7.79	12.68	**67.11**	**79.79**	0.50%	**1015.0**	825	1.25%	7.86%
Trunk Sewer																						

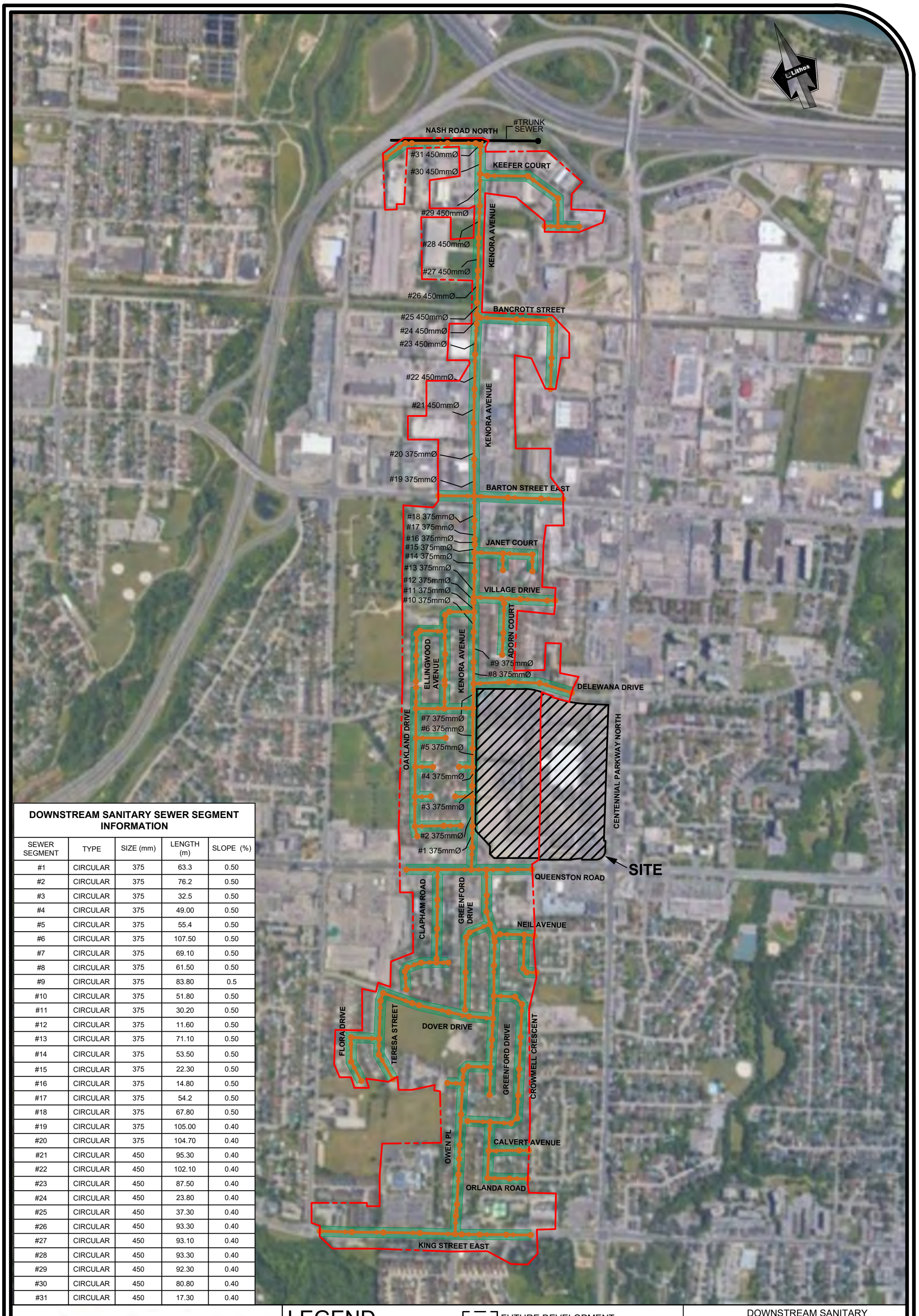
NOTES:

1. Calculated flows are estimated based on the existing developments within the drainage area.
2. The post development flow can be supported by the existing sanitary network, thus the sewers can support the proposed development.

Lithos

Prepared By: Dimitra Frysali, P.E., M.A.Sc.
Reviewed By: Catherine Agiou, P.E., M.A.Sc.
Date: August 2023

Project: **75 Centennial Parkway North**
File No: **UD22-064**
City of Hamilton



DOWNSTREAM SANITARY SEWER SEGMENT INFORMATION

SEWER SEGMENT	TYPE	SIZE (mm)	LENGTH (m)	SLOPE (%)
#1	CIRCULAR	375	63.3	0.50
#2	CIRCULAR	375	76.2	0.50
#3	CIRCULAR	375	32.5	0.50
#4	CIRCULAR	375	49.00	0.50
#5	CIRCULAR	375	55.4	0.50
#6	CIRCULAR	375	107.50	0.50
#7	CIRCULAR	375	69.10	0.50
#8	CIRCULAR	375	61.50	0.50
#9	CIRCULAR	375	83.80	0.5
#10	CIRCULAR	375	51.80	0.50
#11	CIRCULAR	375	30.20	0.50
#12	CIRCULAR	375	11.60	0.50
#13	CIRCULAR	375	71.10	0.50
#14	CIRCULAR	375	53.50	0.50
#15	CIRCULAR	375	22.30	0.50
#16	CIRCULAR	375	14.80	0.50
#17	CIRCULAR	375	54.2	0.50
#18	CIRCULAR	375	67.80	0.50
#19	CIRCULAR	375	105.00	0.40
#20	CIRCULAR	375	104.70	0.40
#21	CIRCULAR	450	95.30	0.40
#22	CIRCULAR	450	102.10	0.40
#23	CIRCULAR	450	87.50	0.40
#24	CIRCULAR	450	23.80	0.40
#25	CIRCULAR	450	37.30	0.40
#26	CIRCULAR	450	93.30	0.40
#27	CIRCULAR	450	93.10	0.40
#28	CIRCULAR	450	93.30	0.40
#29	CIRCULAR	450	92.30	0.40
#30	CIRCULAR	450	80.80	0.40
#31	CIRCULAR	450	17.30	0.40

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150 Berdmondsey Rd, Toronto, Ontario M4A 1Y1

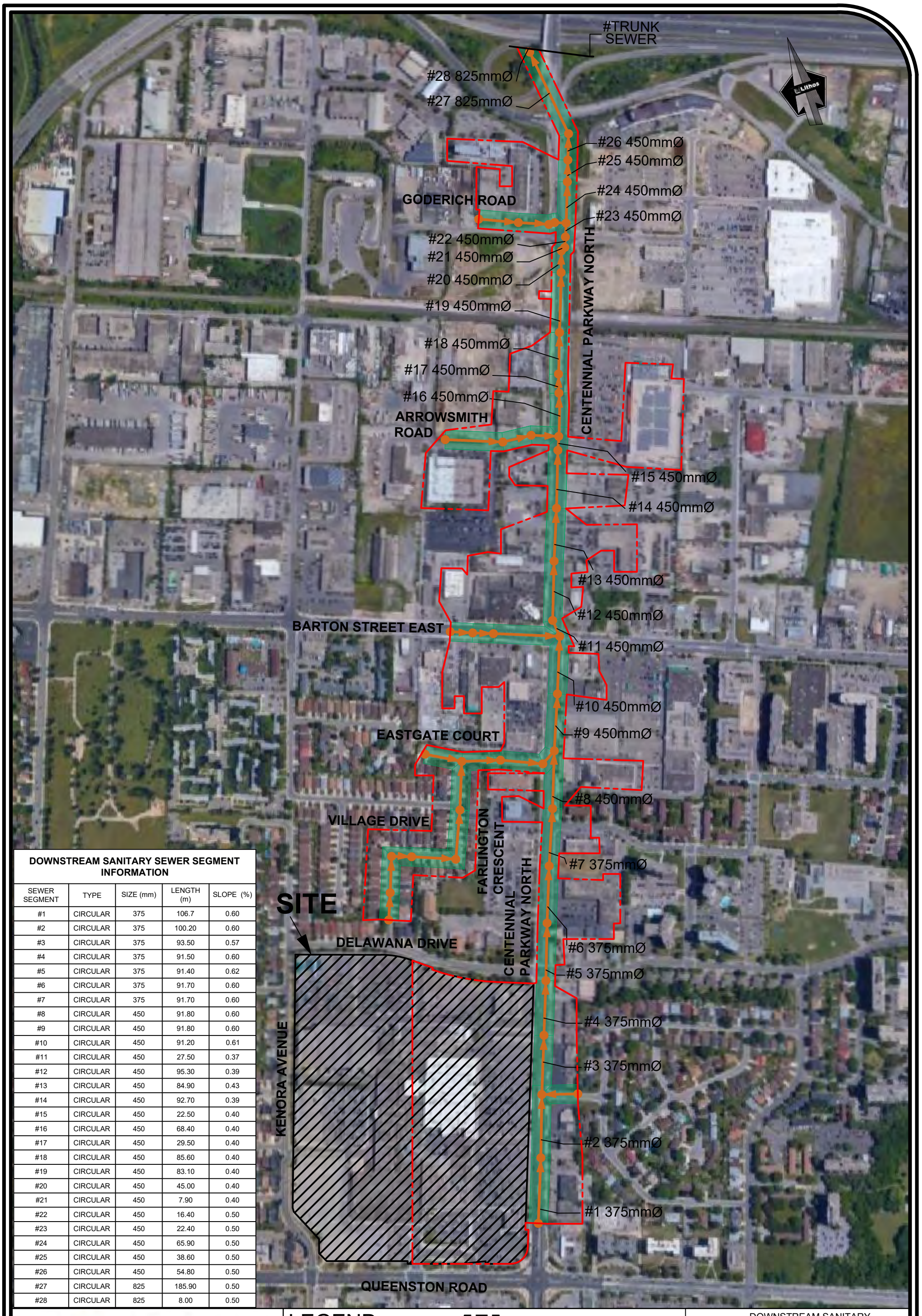
LEGEND

- TRUNK SEWER
- DRAINAGE AREA
- EX. SANITARY. SEWER
- INFILTRATION AREA
- FUTURE DEVELOPMENT
- EXISTING MANHOLE
- #1 NUMBERED SEGMENT AS INDICATED IN "EXTERNAL SANITARY SEWER SEGMENTS" DESIGN SHEET

DOWNSTREAM SANITARY NETWORK - ROUTE A

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

DATE: August 2023	PROJECT No: UD22-064
SCALE: N.T.S.	FIGURE No: DAP3.1



DOWNSTREAM SANITARY SEWER SEGMENT INFORMATION

SEWER SEGMENT	TYPE	SIZE (mm)	LENGTH (m)	SLOPE (%)
#1	CIRCULAR	375	106.7	0.60
#2	CIRCULAR	375	100.20	0.60
#3	CIRCULAR	375	93.50	0.57
#4	CIRCULAR	375	91.50	0.60
#5	CIRCULAR	375	91.40	0.62
#6	CIRCULAR	375	91.70	0.60
#7	CIRCULAR	375	91.70	0.60
#8	CIRCULAR	450	91.80	0.60
#9	CIRCULAR	450	91.80	0.60
#10	CIRCULAR	450	91.20	0.61
#11	CIRCULAR	450	27.50	0.37
#12	CIRCULAR	450	95.30	0.39
#13	CIRCULAR	450	84.90	0.43
#14	CIRCULAR	450	92.70	0.39
#15	CIRCULAR	450	22.50	0.40
#16	CIRCULAR	450	68.40	0.40
#17	CIRCULAR	450	29.50	0.40
#18	CIRCULAR	450	85.60	0.40
#19	CIRCULAR	450	83.10	0.40
#20	CIRCULAR	450	45.00	0.40
#21	CIRCULAR	450	7.90	0.40
#22	CIRCULAR	450	16.40	0.50
#23	CIRCULAR	450	22.40	0.50
#24	CIRCULAR	450	65.90	0.50
#25	CIRCULAR	450	38.60	0.50
#26	CIRCULAR	450	54.80	0.50
#27	CIRCULAR	825	185.90	0.50
#28	CIRCULAR	825	8.00	0.50

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150 Berdmondsey Rd, Toronto, Ontario M4A 1Y1

LEGEND

- TRUNK SEWER
- DRAINAGE AREA
- EX. SANITARY. SEWER
- INFILTRATION AREA
- FUTURE DEVELOPMENT
- EXISTING MANHOLE
- #1 NUMBERED SEGMENT AS INDICATED IN "EXTERNAL SANITARY SEWER SEGMENTS" DESIGN SHEET

DOWNSTREAM SANITARY NETWORK - ROUTE B

MIXED USE DEVELOPMENT
75 CENTENNIAL PARKWAY NORTH
HAMILTON, ONTARIO

DATE: August 2023	PROJECT No: UD22-064
SCALE: N.T.S.	FIGURE No: DAP3.2