



83-85 Hickory Street West & 265-267 Hemlock Street

Functional Servicing and Stormwater Management Report

Project Location:

83-85 Hickory Street West & 265-267 Hemlock Street
Waterloo, ON

Prepared for:

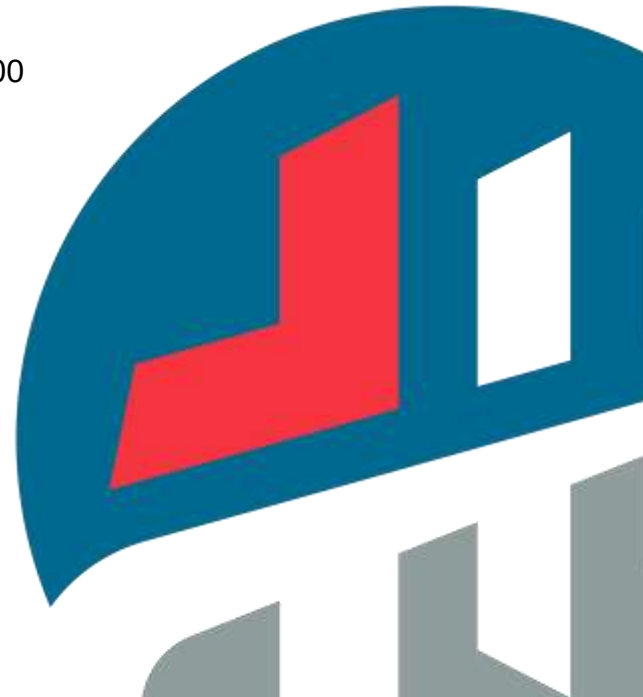
Masri O Inc. Architects
609 Kumpf Drive, Kitchener, ON N2B 3X9

Prepared by:

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

August 25, 2022

MTE File No.: 51272-100





Contents

1.0	Introduction	1
2.0	Existing Conditions	1
2.1	Existing Topography	1
2.2	Existing Servicing.....	3
2.2.1	Water	3
2.2.2	Sanitary	3
2.2.3	Storm.....	3
2.3	Existing Soils Information.....	3
2.4	Reviewing Agencies.....	4
3.0	Proposed Grading and Servicing Strategy.....	4
3.1	Proposed Grading.....	4
3.2	Proposed Servicing.....	4
3.2.1	Water	4
3.2.2	Sanitary	5
3.2.3	Storm.....	5
4.0	Preliminary Stormwater Management Design.....	6
4.1	SWM Criteria	6
4.2	Water Quantity Control.....	6
4.3	Water Quality Control.....	9
4.4	Erosion & Sediment Control.....	9
5.0	Conclusions.....	10

Figures

Figure 1.0 – Site Location Plan	2
Figure 2.0 – Pre-Development SWM Catchment Area	7
Figure 3.0 – Post-Development SWM Catchment Area.....	8

Tables

Table 2.1 – Results of Flow Tests (completed April 29, 2022 by CFLS)	3
Table 4.1 – Catchment Parameters.....	6
Table 4.2 – Summary of Flows.....	9

Appendices

Appendix A	Fire Flow Test Results and Analysis
Appendix B	Sanitary Sewer Design Sheet
Appendix C	Storm Sewer Design Sheet
Appendix D	MIDUSS Output

Drawings

Removals Plan	
MTE Drawing No. C1.1	Appended
Functional Site Grading and Servicing Plan	
MTE Drawing No. C2.1	Appended

1.0 Introduction

MTE Consultants Inc. was retained by the property owner to complete a Functional Servicing and Stormwater Management (FSSWM) Report for a new residential development to be constructed at 83-85 Hickory Street and 265-267 Hemlock Street West (herein referred to as 'the Site') in the City of Waterloo in support of the Zoning By-Law Amendment Application.

The Site is located at the intersection of Hickory Street West and Hemlock Street in the City of Waterloo. The property is bounded to the north by Hickory Street, to the east by Hemlock Street and to the south and the west by existing residential developments. For the exact location of the Site refer to Figure 1.0.

The proposed development for the Site is the construction of a 6-storey residential building, with 168 units, complete with 1-storey of underground parking. An access ramp to the underground parking is proposed at the south side of the building.

The purpose of this study is to support the Zoning By-Law Amendment Application. This will be accomplished by reviewing the opportunities and constraints for the subject property with respect to servicing, grading, and stormwater management; reviewing the requirements of the reviewing agencies; describing the development concept; and demonstrating the functional serviceability of the property. Pending approval of the Amendment application, detailed design of the site will commence and be submitted to the City in support of Site Plan Approval.

2.0 Existing Conditions

2.1 Existing Topography

The Site encompasses an area of 0.311ha and currently comprises of four single-detached residential dwellings. In the existing condition, surface runoff from the Site drains from south to north and from west to east. There is an elevation difference of approximately 3.3m across the property, with the lowest elevation within the Site at an elevation of approximately 340.0m and the highest elevation within the Site at an elevation of approximately 343.3m. The site is approximately 22% impervious in the existing condition.



2.2 Existing Servicing

2.2.1 Water

There are existing 150mm diameter municipal watermains along both Hemlock Street and Hickory Street West. It is assumed that each of the existing dwellings have private domestic water services connected to these mains, although exact locations of the services are unknown. All existing private services will need to be located, removed and capped at the mains as part of the proposed development.

There are two existing municipal fire hydrants in close proximity to the Site: one located near the southeast corner of the Site on Hemlock Street and one located on the far side of Hickory Street West. A flow test was performed by CFLS on these two hydrants on April 29, 2022. Refer to Table 2.1 below for a summary of flow test results.

Table 2.1 – Results of Flow Tests (completed April 29, 2022 by CFLS)

Test #	Outlet Inside Diameter (in.)	Number of Outlets	Pitot Pressure (psi)	Residual Pressure (psi)	Flow @ Residual (gal/min)
1	n/a	n/a	n/a	49	0
2	1.75	1	25	47	524
3	1.75	2	19+15	46	862

Refer to Appendix A for further details.

2.2.2 Sanitary

There is an existing 200mm diameter municipal sanitary sewer along Hemlock Street which drains toward the north. There is an existing 200mm diameter municipal sanitary sewer along Hickory Street West which drains toward the east. These two sewers converge at a manhole located at the intersection of Hemlock and Hickory, where drainage continues on to the east. The manhole at the intersection of Hemlock and Hickory is approximately 3.8m deep. There is one other sanitary manhole along the eastern frontage of the site, on Hemlock Street, which is approximately 2.5m deep.

2.2.3 Storm

There is an existing 250mm diameter storm sewer along Hickory Street West that drains towards the east. The closest existing storm manhole is located at the intersection of Hemlock Street and Hickory Street, and is approximately 2.8 metres deep. Existing catchbasins located at the north end of Hemlock Street are connected to this manhole via 250mm and 300mm diameter storm sewers. Surface runoff from a majority of the site is conveyed overland to the northeast corner of the site where it enters the Hickory Street West storm sewer.

2.3 Existing Soils Information

A geotechnical investigation for the Site was completed by Chung and Vander Doelen Engineering Ltd. on June 13 and 14, 2022. Five boreholes were advanced to depths between 8.1 and 9.6m below existing grade to determine the underlying soil conditions on the Site. The subsurface stratigraphy is generally comprised of topsoil and pavement overlying layers of fill materials with varying percentage of sand, silt, and clay. Fill material and pavement structure at Borehole 5 were underlain by a clayey silt till layer, contained trace sand and trace gravel. Natural moisture contents of samples indicated a saturated moisture condition. Groundwater

conditions were monitored during advancement of boreholes. Groundwater was measured at depths 4.3 and 5.2 metres below ground surface at Boreholes 3 and 4, respectively. The observed groundwater table will fluctuate seasonally and in response to major weather events.

For more information, refer to the Geotechnical Investigation Report by Chung and Vander Doelen Engineering Ltd., dated July 28, 2022, included separately with this submission.

2.4 Reviewing Agencies

Grading, servicing and stormwater management designs as well as this Functional Servicing and SWM Report will be required for submission to the City of Waterloo in support of the Zoning By-Law Amendment and the Site Plan Applications. The City will also be responsible for the review and approval of site plans, site grading, servicing, stormwater management, lighting and landscape design and ultimately issuing building permits.

3.0 Proposed Grading and Servicing Strategy

Preliminary grading and servicing strategies for the proposed development have been developed based on the topographic survey, plan and profile information, and the Site Plan prepared by Masri O Inc. Architects, dated August 4, 2022. Refer to appended MTE Drawing C2.1 for details.

3.1 Proposed Grading

The proposed development consists of a 6-storey apartment building, complete with one driveway access from Hemlock Street and one level of underground parking. The proposed grading strategy will respect the existing grades along the south and west property lines. The proposed grades along the north and east property lines will match into existing grades along the back edge of the existing concrete sidewalk on Hemlock Street and Hickory Street West. Runoff from patios of street fronting units will drain overland towards the right-of-ways. Runoff from the remainder of the site will be collected in a series of area drains and conveyed via private storm sewer to the Hickory Street West storm sewer.

The geotechnical investigation by Chung and Vander Doelen Engineering Ltd. recommended that the basement floor level be established 0.6m higher than the high groundwater level. The building will have a finished floor elevation of approximately 341.40m and a basement finished floor elevation of approximately 338.20m. The finished floor elevation is as elevated as possible in order to adhere as closely as possible to recommendations made in the geotechnical investigation regarding clearance to groundwater. The finished floor elevations are subject to change during detailed design.

3.2 Proposed Servicing

3.2.1 Water

A new connection to the 150mm diameter municipal watermain along Hemlock Street will be required in order to service the proposed building. The required private watermain size will be determined during detailed design, but will likely be 150mm diameter.

Water Demand

It is expected that the existing municipal fire hydrant along Hemlock Street located at the southeast corner of the Site will be sufficient to provide fire protection for the building. The fire department connection of the building will likely be proposed to be within 45m of this existing fire hydrant. The pressures and flows at the hydrant must be sufficient for firefighting conditions as

established by the Ontario Building Code (2012). The minimum residual pressure under firefighting conditions is 140kPa (20.3psi) per OBC 2012 A-3.2.5.7 3(b).

For this design, information obtained from hydrant flow testing on the municipal hydrant located on Hemlock Street, as detailed in Section 2.2.1, was utilized.

The maximum flow rate specified by the OBC 2012 is 9,000 litres/min for all building classification groups. Therefore, rather than calculate the required flow, the worst case scenario of 9,000 litres/min was used in this analysis. The residual pressure at the proposed hydrant was calculated to be 203.0kPa for a flow rate of 9,000 litres/min, which is greater than the minimum allowable pressure of 140kPa per OBC 2012. Refer to Appendix A for calculations.

3.2.2 Sanitary

A sanitary flow design sheet has been prepared to determine the flows anticipated to be generated by the proposed development. It is proposed that the site will be serviced by a new 200mm diameter sanitary sewer at the north east corner of the Site, complete with new manhole at the municipal sewer on Hemlock Street. The proposed 200mm diameter sanitary service will have a minimum slope of 2.0% and a resulting minimum capacity of 46.4L/s.

Per City standards, the design flow rate for residential development is 275 L/d/person. The person per unit rate for apartment development is 1.76 persons/unit per City of Waterloo Development Manual (2013). With the proposed building having 168 units and a total area of 0.311ha, the anticipated peak sanitary flow rate from the Site was calculated to be 3.84L/s. Refer to Appendix B for the sanitary flow design sheet. Therefore, there is sufficient capacity in the proposed private sanitary connection to convey the sanitary flow from the proposed Site. Service inverts and size will be confirmed at detailed design.

3.2.3 Storm

A private storm sewer system including area drains, flow control roof drains, and a manhole will be installed on-site to collect rooftop runoff as well as runoff from the driveway and amenity areas. The collected runoff will be directed through the underground parking, on to the proposed manhole at the property line, which will connect to the existing storm sewer on Hemlock Street.

The proposed 250mm diameter storm service will have a slope of 2.5% and a capacity of 94.0L/s. During the 5-year storm event, the entire proposed development will produce a stormwater runoff rate of 29.0L/s. A portion of this flow will be piped and a portion will flow overland towards the storm sewer system in the right of way. Therefore, the proposed storm service connection will have adequate capacity to convey the flow from the proposed development. The sewer design is subject to change and the service inverts will be confirmed at detailed design. Refer to Appendix C for the storm sewer design sheet.

4.0 Preliminary Stormwater Management Design

4.1 SWM Criteria

The stormwater management design criteria for the subject site, as established by the City of Waterloo, are as follows:

- i) Attenuation of the post-development peak flows for the 2-, 5- and 100-year storm event;
- ii) Implementation of water quality controls; and,
- iii) Implementation of erosion and sediment control measures.

4.2 Water Quantity Control

In order to successfully complete the preliminary stormwater management design for the site, the following specific tasks were undertaken:

- i) Calculate the allowable runoff rates using MIDUSS NET;
- ii) Determine the percent impervious of the site and catchment parameters for inclusion in MIDUSS modeling; and,
- iii) Calculate post-development runoff hydrographs using MIDUSS NET.

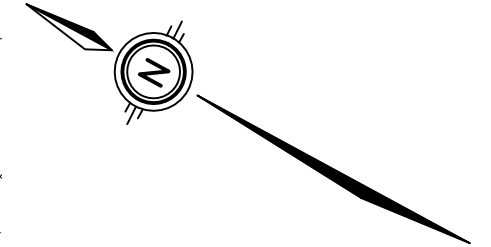
The following table summarizes the catchments used in modeling of the site. The post-development condition was separated into two catchment areas: the controlled building rooftop and the uncontrolled area. Figure 2.0 illustrates the limits of the pre-development catchment area. Figure 3.0 illustrates the limits of the post-development catchment areas.

Table 4.1 – Catchment Parameters

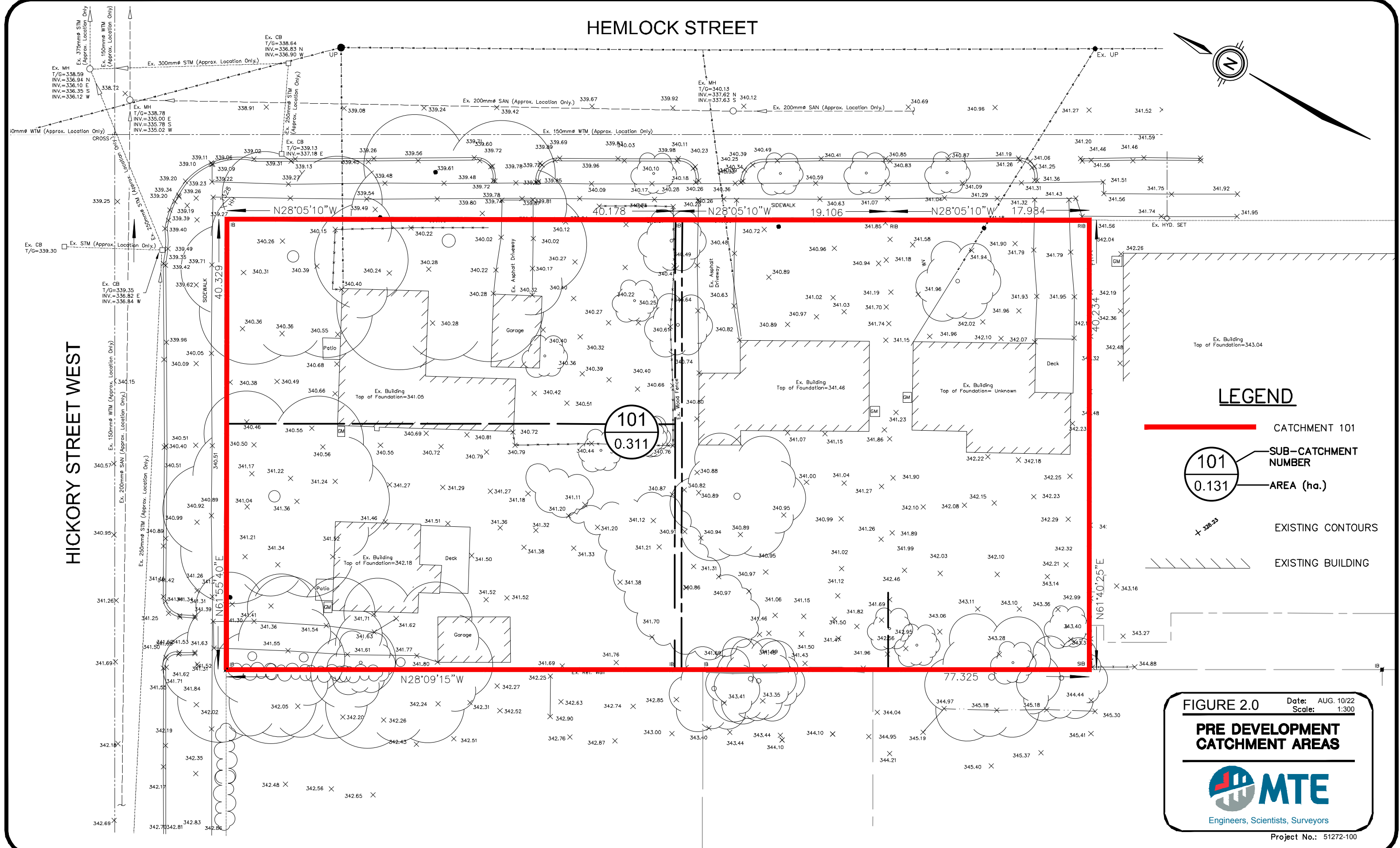
#	Catchment	Area (ha)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Pre-Development Catchment Area							
101	Total Site	0.311	22	74	98	7.0	25
Post-Development Catchment Areas							
201	Controlled Building Rooftop	0.250	100	74	98	2.0	7.5
202	Uncontrolled Area	0.061	45	74	98	20.0	4.0

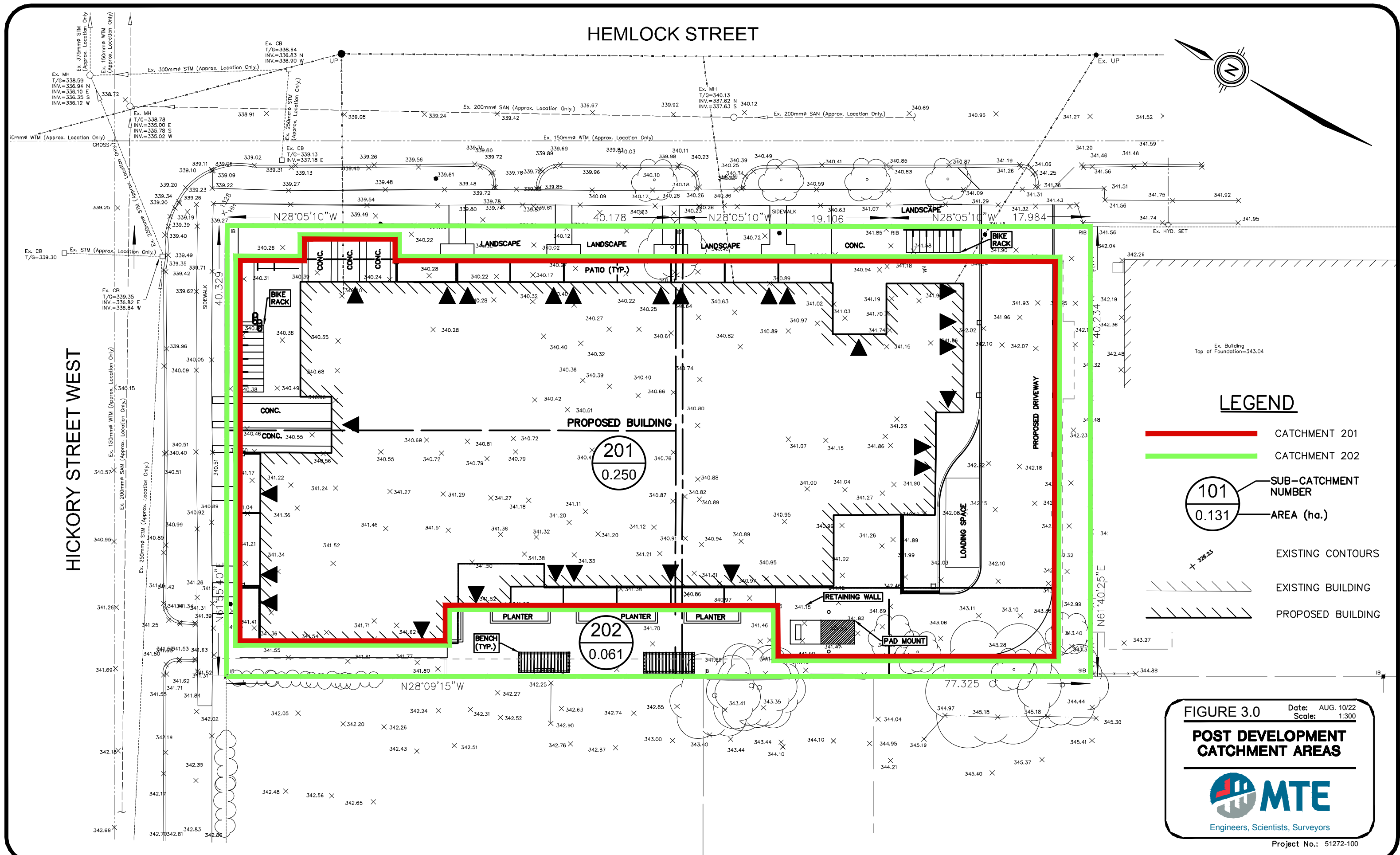
The geotechnical investigation undertaken by Chung and Vander Doelen Engineering Ltd. revealed the Site is primarily topsoil and pavement structure overlying a layers of fill comprised of varying percentage of sand, silt, and clay, underlain by layers of clayey silt till and granular deposits. Therefore, a pervious CN of 74 for grass areas is appropriate.

HEMLOCK STREET



HICKORY STREET WEST





A MIDUSS model was created to demonstrate the pre- and post-development flow rates leaving the site. The site's impervious percentage under the existing condition is approximately 22% and will increase to approximately 97% under proposed development conditions. Runoff generated from the roof area will be controlled using flow control roof drains. The following table summarizes the expected flows that will be generated by the whole site. Please note that these flows are subject to change at the detailed design stage.

Table 4.2 – Summary of Flows

Modeling Condition	2-Year Storm Event (m ³ /s)	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Pre-Development	0.016	0.024	0.071
Post-Development	0.021	0.029	0.055

With the installation of 9 flow control roof drains, the post-development runoff from the controlled portion of the site for the 2-, 5-, and 100-year storm event is controlled to 0.021, 0.029, and 0.055m³/s. As shown in the above table, the 2- and 5-year post-development flow rates are slightly higher than the pre-development flow rates, both by 0.005m³/s. With the proposed street fronting unit style, it is not feasible to collect and control more runoff from the Site. The 100-year post-development flow rates are controlled to rates lower than pre-development flow rates. Refer to Appendix D for the MIDUSS output.

4.3 Water Quality Control

A majority of the Site is covered with roof, which generates “clean” runoff. Further, uncovered portions of the site are primarily pedestrian accesses and amenity space, which also generate “clean” runoff. Only a small portion of the driveway ramp is uncovered. Given the existing residential driveways on-site, the proposed development is expected to result in no net change to water quality from the Site. A snout will be installed in the storm manhole at property line as a best management water quality practice. No other on-site water quality controls are proposed at this time.

4.4 Erosion & Sediment Control

Precautions will need to be taken during construction to limit erosion and sedimentation. Typically, the following measures are recommended during construction for erosion and sedimentation control:

- Erosion and sedimentation facilities are to be installed prior to any grading operations;
- All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required; and,
- All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance from leaving the site.

5.0 Conclusions

Based on the foregoing analysis, it is concluded that:

- The proposed grading design will respect the natural topography of the Site, while keeping in mind recommendations made in the Geotechnical Investigation;
- Existing municipal infrastructure for water, sanitary and storm is available along Hickory Street West and Hemlock Street; and,
- The proposed stormwater management design provides adequate attenuation of the 100-year storm event, and small overages for the 2- and 5-year storm events.

Additional grading, servicing and stormwater management details will be provided during detailed design.

All of which is respectfully submitted,

MTE Consultants Inc.

51272-100



Lynn Ingram, P.Eng.

Design Engineer

519-743-6500 ext.1381

lingram@mte85.com

JHN:dlb

M:\51272\100\Report\FSSWM\rpt_2022-08-25_FSSWM.docx

Appendix A

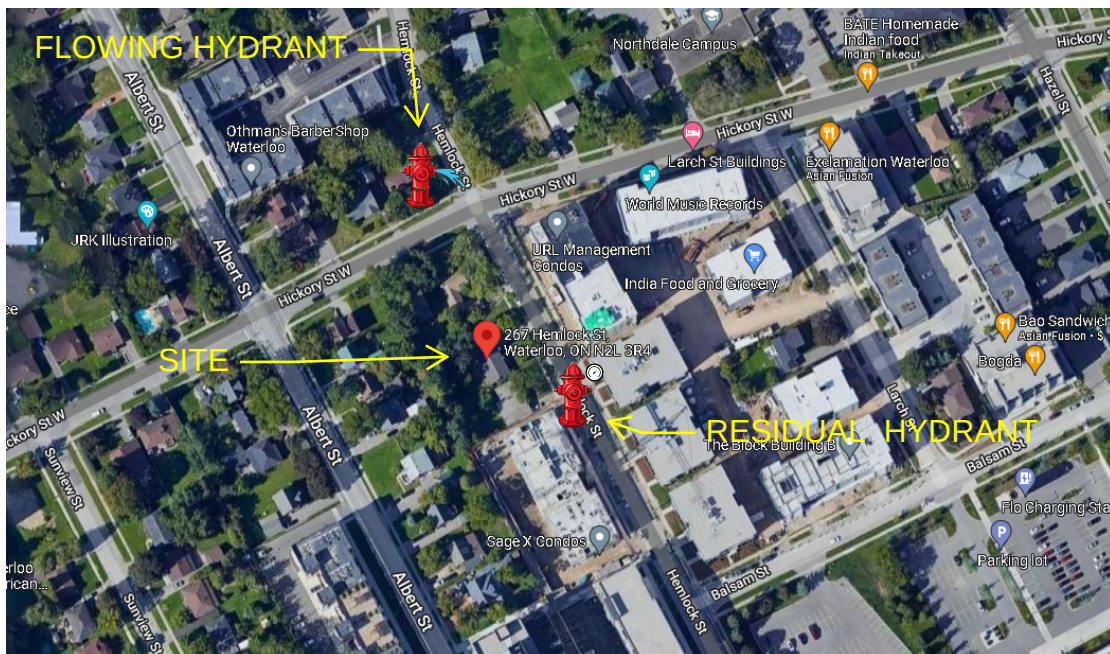
Fire Flow Test Results and Analysis

PROJECT INFORMATION

Project Name:	Hickory St W/Hemlock Flow Test	Const. Project #:	22 CAM-690-0536
Site Address:	Hickory St W/Hemlock Waterloo	Design Project #:	2022-CFLS-212
City Contact:	Mona	Phone #:	519-886-2310 3027
CFLS Contact:	Mike Ruck	Phone #:	519-546-1955
Technical Contact:	Andy Coghlin	Phone #:	519-476-0761

SITE INFORMATION

SITE MAP



Note: If the main is a dead end, the flowing hydrant shall be closest to the dead end

ITEMS TO LABEL ON MAP	HYDRANTS USED	MAIN SIZE
☒ Static / Residual & Flow Hydrants	☒ City Hydrant(s)	City: 6"
☐ Flow Direction (if the main is dead end)	☐ Site Hydrant(s)	Site:
SITE NOTES		

TEST INFORMATION							
Minimum Required Flow:	NA				Min Ports:	2	
CFLS Personnel Present:	Mike Ruck				Test Date:	2022-04-29	
City / External Company:	City of Waterloo				Test Time:	8:25 am	
TEST EQUIPMENT							
☐ Hose Monsters with built in Pitot				Hose length used: 25 ft			
☐ Hand held pitot gauge				☐ Pollard diffuser elbow with built in Pitot			
☒ Other: Little Hose Monster with pitotless nozzle							
TEST RESULTS							
Number of Ports	Outlet Size (IN)	Discharge Coefficient	Pitot Reading (PSI)			Total Flow (GPM)	Static / Residual Pressure (PSI)
0 Ports	STATIC						49
1 Port	1.75	0.9	25			524	47
2 Ports	1.75	0.9	19	15		862	46
3 Ports	2.5	0.9				0	
4 Ports	2.5	0.9				0	
0 Ports	STATIC RE-CHECK						50
TEST NOTES							
Little Hose Monster used for flow test with pitotless nozzles flow rates need to be adjusted 25= 524 gpm 19= 456 gpm 15= 406 gpm							

HYDRAULIC ADJUSTMENTS (FOR OFFICE USE ONLY)			
ADJUSTMENTS FOR HYDRAULIC GRADE LINE (HGL)			
Reservoir HGL (m):		Site Elevation (m):	
Theoretical Static Head (PSI):	0	PSI to subtract from test pressures:	49
OTHER HYDRAULIC ADJUSTMENTS			
Other adjustment as required by the City / AHJ:			



85 Hickory St W FIRE FLOW ANALYSIS

Waterloo, Ontario

Project Number: 51272-100

Date: August 12, 2022

Design By: JHN

File: Q:\51272\100\fire flow\Site Fire Flow Analysis A.xlsx

CALCULATION OF RESIDUAL PRESSURE AT ON-SITE HYDRANT

1. Boundary Conditions (Based on Fire Flow Test Results):			
	Metric	Imperial	
P0 - Starting Pressure	34.46 m	49 psi	
P1 - Pressure at Q1	32.35 m	46 psi	
Q1 - From Fire Flow Test	3263 L/min	862 U.S. gal/min	
Q2 - Required Flow	9000 L/min	2378 U.S. gal/min	From: Water Demand calculations by MTE
P-loss 1	2.11 m	3 psi	
P-loss 2	13.81 m	20 psi	
P2 - Residual Pressure	20.65 m	29 psi	Extrapolated from Fire Flow Test Results

Residual Pressure after Losses	20.65 m		
	203 kPa	29.4 psi	PASS

<i>Allowable Residual Pressure</i>	<i>140 kPa</i>	<i>20.3 psi</i>	
------------------------------------	----------------	-----------------	--

Appendix B

Sanitary Sewer Design Sheet



83-85 Hickory St W and 265-267 Hemlock St CITY OF WATERLOO				SANITARY SEWER DESIGN SHEET ENGINEERING AND PUBLIC WORKS								Design Parameters																				
Project Number: 51272-100 Date: August 12, 2022 Design By: JHN Checked By: CAD File: Q:\51272\100\Sanitary Sewer Design Sheet Waterloo (SSMS) Rev7.xls												Drainage Area Plan No: N/A								Average Daily Flow												
				Mannings "n" 0.013																												
				Residential 0.00318 L/s/c Commercial 0.95 L/s/ha Industrial 0.40 L/s/ha Inst. / School 0.25 L/s/ha																												
												Min. Velocity 0.6 m/sec Max. Velocity 3.0 m/sec Residential Harmon Peaking Factor (F) $F = 1 + 14/(4 + P^{0.5})$ Commercial Peaking Factor = 2.5 Residential Areas Infiltration 0.25 L/s/ha																				
LOCATION				RESIDENTIAL AREAS AND POPULATION								SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN							
STREET	AREA NO.	MANHOLE LOCATION		AREA	No. UNITS @ 3.30 PPU	No. UNITS @ 1.76 PPU	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING												TOTALS- C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
		FROM MH	TO MH								0.25 L/s/ha				0.95 L/s/ha				0.40 L/s/ha													
											AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW													
											ha	ha	L/sec	ha	ha	L/sec	ha	ha	L/sec	L/sec	ha	ha	L/sec	L/sec	m	%	mm	L/sec.	m/s			
Hemlock St to Hickory	1	Site	Prop. MH	0.31		168	0.296	0.296	4.081145	3.84																						

Note:
1. Sanitary peak flow is calculated based on the proposed 168 apartment units.
2. Population densities for sanitary sewer capacity calculations are 1.76 persons per unit for apartments, based on the 2012 Development Charge Background Study.

Appendix C

Storm Sewer Design Sheet



83-85 Hickory St W & 265-267 Hemlock St CITY OF WATERLOO				STORM SEWER DESIGN SHEET ENGINEERING AND PUBLIC WORKS				Design Parameters									
Project Number: 51272-100 Date: August 12, 2022 Design By: JHN Checked By: LEI File: Q:\51272\100\Storm Sewer Design Sheet Waterloo(SSMS)_Rev9.xlsx								5 YEAR STORM									
								Drainage Area Plan No: N/A								Q=kAIR, k=0.00277 Manning's "n" 0.013 Intensity (I) = a/(tc+b) ^c Min. Velocity 0.600 m/s a = 1755 Max. Velocity 6.000 m/s b = 12.347 c = 0.895	
LOCATION				STORMWATER FLOW 5 YEAR STORM								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION		AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION		RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL	
		FROM MH	TO MH					TOTAL	IN PIPE							VELOCITY	PIPE FULL
				ha		ha	ha	min	min	mm/hr	L/s	mm	m	%	L/s	m/s	%
		MH1	Ex. CB	0.311	0.84	0.2613	0.2613	10.0140	0.0613	108.76339	29.00 ¹	250	6.2	2.50	94.02642	1.9155	30.84

Note:
1. Runoff from all post-development catchments 201 and 202 is ultimately draining towards the Hickory Street right-of-way. Therefore, the peak flow rate for the total site of 29.00 L/s taken from 5-year storm event MIDUSS model, was used as the post-development flow. This is considered conservative.

Appendix D

MIDUSS Output

Pre-Development

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        Q:\51272\100\MIDUSS"
"          Output filename:                    2 Year Pre.out"
"          Licensee name:                      A"
"          Company                            "
"          Date & Time last used:              7/22/2022 at 10:35:19 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1101.000 Coefficient A"
"          9.258  Constant B"
"          0.882  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          105.659  mm/hr"
"          Total depth                32.400  mm"
"          6  002hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 101"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          101  Pre development"
"          22.000 % Impervious"
"          0.311  Total Area"
"          25.000 Flow length"
"          7.000  Overland Slope"
"          0.243  Pervious Area"
"          25.000 Pervious length"
"          7.000  Pervious slope"
"          0.068  Impervious Area"
"          25.000 Impervious length"
"          7.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.163  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.832  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.016  0.000  0.000  0.000 c.m/sec"

```

	Catchment 101	Pervious	Impervious	Total Area	
"	Surface Area	0.243	0.068	0.311	hectare"
"	Time of concentration	17.241	1.383	7.876	minutes"
"	Time to Centroid	120.283	88.341	101.420	minutes"
"	Rainfall depth	32.400	32.400	32.400	mm"
"	Rainfall volume	78.60	22.17	100.76	c.m"
"	Rainfall losses	27.128	5.442	22.357	mm"
"	Runoff depth	5.272	26.959	10.043	mm"
"	Runoff volume	12.79	18.45	31.23	c.m"
"	Runoff coefficient	0.163	0.832	0.310	"
"	Maximum flow	0.005	0.015	0.016	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.016	0.016	0.000	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.016	0.016	0.016	0.000"	
" 40	HYDROGRAPH Combine 1"				
"	6 Combine "				
"	1 Node #"				
"	Total Site"				
"	Maximum flow	0.016	c.m/sec"		
"	Hydrograph volume	31.234	c.m"		
"	0.016	0.016	0.016	0.016"	
" 38	START/RE-START TOTALS 101"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.311	hectare"	
"	Total Impervious area		0.068	hectare"	
"	Total % impervious		22.000"		
" 19	EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                          Q:\51272\100\MIDUSS"
"          Output filename:                     5 Year Pre.out"
"          Licensee name:                      A"
"          Company                             "
"          Date & Time last used:               7/22/2022 at 10:37:05 AM"
" 31          TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1  Chicago storm"
"          1755.000 Coefficient A"
"          12.347  Constant B"
"          0.895  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    136.512  mm/hr"
"          Total depth                          47.549  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          101  Pre development"
"          22.000  % Impervious"
"          0.311  Total Area"
"          25.000  Flow length"
"          7.000  Overland Slope"
"          0.243  Pervious Area"
"          25.000  Pervious length"
"          7.000  Pervious slope"
"          0.068  Impervious Area"
"          25.000  Impervious length"
"          7.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious SCS Curve No."
"          0.259  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.873  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.024  0.000  0.000  0.000 c.m/sec"

```

	Catchment 101	Pervious	Impervious	Total Area	
"	Surface Area	0.243	0.068	0.311	hectare"
"	Time of concentration	11.838	1.229	6.667	minutes"
"	Time to Centroid	112.328	87.561	100.257	minutes"
"	Rainfall depth	47.549	47.549	47.549	mm"
"	Rainfall volume	115.34	32.53	147.88	c.m"
"	Rainfall losses	35.242	6.061	28.822	mm"
"	Runoff depth	12.307	41.488	18.727	mm"
"	Runoff volume	29.85	28.39	58.24	c.m"
"	Runoff coefficient	0.259	0.873	0.394	"
"	Maximum flow	0.013	0.021	0.024	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.024	0.024	0.000	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.024	0.024	0.024	0.000"	
" 40	HYDROGRAPH Combine 1"				
"	6 Combine "				
"	1 Node #"				
"	Total Site"				
"	Maximum flow	0.024	c.m/sec"		
"	Hydrograph volume	58.241	c.m"		
"	0.024	0.024	0.024	0.024"	
" 38	START/RE-START TOTALS 101"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.311	hectare"	
"	Total Impervious area		0.068	hectare"	
"	Total % impervious		22.000"		
" 19	EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        Q:\51272\100\MIDUSS"
"          Output filename:                    100 Year Pre.out"
"          Licensee name:                      A"
"          Company                            "
"          Date & Time last used:              7/22/2022 at 10:38:05 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          4692.000 Coefficient A"
"          17.437  Constant B"
"          0.956  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                239.793  mm/hr"
"          Total depth                      89.960  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 101"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          101  Pre development"
"          22.000  % Impervious"
"          0.311  Total Area"
"          25.000  Flow length"
"          7.000  Overland Slope"
"          0.243  Pervious Area"
"          25.000  Pervious length"
"          7.000  Pervious slope"
"          0.068  Impervious Area"
"          25.000  Impervious length"
"          7.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious SCS Curve No."
"          0.442  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.907  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.079  0.000  0.000  0.000 c.m/sec"

```

	Catchment 101	Pervious	Impervious	Total Area	
"	Surface Area	0.243	0.068	0.311	hectare"
"	Time of concentration	7.191	0.969	4.908	minutes"
"	Time to Centroid	102.274	85.436	96.097	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	218.23	61.55	279.78	c.m"
"	Rainfall losses	50.243	8.375	41.032	mm"
"	Runoff depth	39.718	81.585	48.928	mm"
"	Runoff volume	96.35	55.82	152.17	c.m"
"	Runoff coefficient	0.442	0.907	0.544	"
"	Maximum flow	0.057	0.040	0.079	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.079	0.079	0.000	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.079	0.079	0.079	0.000"	
" 40	HYDROGRAPH Combine 1"				
"	6 Combine "				
"	1 Node #"				
"	Total Site"				
"	Maximum flow	0.079	c.m/sec"		
"	Hydrograph volume	152.167	c.m"		
"	0.079	0.079	0.079	0.079"	
" 38	START/RE-START TOTALS 101"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.311	hectare"	
"	Total Impervious area		0.068	hectare"	
"	Total % impervious		22.000"		
" 19	EXIT"				

Post-Development

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        Q:\51272\100\MIDUSS\08-11-22"
"          Output filename:                    2 Year Post d.out"
"          Licensee name:                      A"
"          Company                            "
"          Date & Time last used:              8/11/2022 at 3:56:56 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1101.000 Coefficient A"
"          9.258  Constant B"
"          0.882  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          105.659  mm/hr"
"          Total depth                32.400  mm"
"          6  002hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          201  Controlled Building Rooftop"
"          100.000 % Impervious"
"          0.211  Total Area"
"          7.500  Flow length"
"          2.000  Overland Slope"
"          0.000  Pervious Area"
"          7.500  Pervious length"
"          2.000  Pervious slope"
"          0.211  Impervious Area"
"          7.500  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.000 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.816 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.049  0.000  0.000  0.000 c.m/sec"

```

Catchment 201	Pervious	Impervious	Total Area	
Surface Area	0.000	0.211	0.211	hectare"
Time of concentration	12.192	0.978	0.978	minutes"
Time to Centroid	114.375	87.837	87.837	minutes"
Rainfall depth	32.400	32.400	32.400	mm"
Rainfall volume	0.00	68.36	68.36	c.m"
Rainfall losses	27.140	5.951	5.951	mm"
Runoff depth	5.260	26.449	26.449	mm"
Runoff volume	0.00	55.81	55.81	c.m"
Runoff coefficient	0.000	0.816	0.816	"
Maximum flow	0.000	0.049	0.049	c.m/sec"
HYDROGRAPH Add Runoff "				
4 Add Runoff "				
	0.049	0.049	0.000	0.000"
POND DESIGN"				
0.049 Current peak flow	c.m/sec"			
0.071 Target outflow	c.m/sec"			
55.8 Hydrograph volume	c.m"			
11. Number of stages"				
0.000 Minimum water level	metre"			
0.150 Maximum water level	metre"			
0.000 Starting water level	metre"			
0 Keep Design Data: 1 = True; 0 = False"				
Level Discharge	Volume"			
0.000 0.000	0.000"			
0.01500 0.00203	0.09669"			
0.03000 0.00405	0.7735"			
0.04500 0.00607	2.611"			
0.06000 0.00810	6.188"			
0.07500 0.01013	12.086"			
0.09000 0.01215	20.885"			
0.1050 0.01417	33.164"			
0.1200 0.01620	49.505"			
0.1350 0.01822	70.486"			
0.1500 0.02025	94.324"			
1. ROOFTOP"				
Roof area	Store area	Area/drain	Drain flow	Roof slope"
hectare	hectare	sq.metre	L/min/25mm	g H:1V"
0.211	0.159	185.000	22.500	50.000"
Using 9 roofdrains on roofstorage area of 1590. square metre"				
Peak outflow		0.012	c.m/sec"	
Maximum level		0.092	metre"	
Maximum storage		22.699	c.m"	
Centroidal lag		1.781	hours"	
0.049 0.049		0.012	0.000 c.m/sec"	
HYDROGRAPH Combine 1"				
6 Combine "				
1 Node #"				
Total Site"				
Maximum flow		0.012	c.m/sec"	

"	Hydrograph volume	55.862	c.m"
"	0.049 0.049 0.012	0.012"	
" 40	HYDROGRAPH Start - New Tributary"		
"	2 Start - New Tributary"		
"	0.049 0.000 0.012	0.012"	
" 33	CATCHMENT 202"		
"	1 Triangular SCS"		
"	1 Equal length"		
"	1 SCS method"		
"	202 Uncontrolled Area"		
"	49.000 % Impervious"		
"	0.100 Total Area"		
"	4.000 Flow length"		
"	20.000 Overland Slope"		
"	0.051 Pervious Area"		
"	4.000 Pervious length"		
"	20.000 Pervious slope"		
"	0.049 Impervious Area"		
"	4.000 Impervious length"		
"	20.000 Impervious slope"		
"	0.250 Pervious Manning 'n'"		
"	75.000 Pervious SCS Curve No."		
"	0.161 Pervious Runoff coefficient"		
"	0.100 Pervious Ia/S coefficient"		
"	8.467 Pervious Initial abstraction"		
"	0.015 Impervious Manning 'n'"		
"	98.000 Impervious SCS Curve No."		
"	0.739 Impervious Runoff coefficient"		
"	0.100 Impervious Ia/S coefficient"		
"	0.518 Impervious Initial abstraction"		
"	0.012 0.000 0.012	0.012 c.m/sec"	
"	Catchment 202 Pervious Impervious Total Area "		
"	Surface Area 0.051 0.049 0.100	hectare"	
"	Time of concentration 4.190 0.336 1.048	minutes"	
"	Time to Centroid 105.116 87.212 90.517	minutes"	
"	Rainfall depth 32.400 32.400 32.400	mm"	
"	Rainfall volume 16.52 15.88 32.40	c.m"	
"	Rainfall losses 27.192 8.459 18.013	mm"	
"	Runoff depth 5.208 23.941 14.387	mm"	
"	Runoff volume 2.66 11.73 14.39	c.m"	
"	Runoff coefficient 0.161 0.739 0.444	"	
"	Maximum flow 0.001 0.011 0.012	c.m/sec"	
" 40	HYDROGRAPH Add Runoff "		
"	4 Add Runoff "		
"	0.012 0.012 0.012	0.012"	
" 40	HYDROGRAPH Copy to Outflow"		
"	8 Copy to Outflow"		
"	0.012 0.012 0.012	0.012"	
" 40	HYDROGRAPH Combine 1"		
"	6 Combine "		

"	1	Node #"				
"		Total Site"				
"		Maximum flow	0.021	c.m/sec"		
"		Hydrograph volume	70.249	c.m"		
"		0.012 0.012	0.012	0.021"		
" 38		START/RE-START TOTALS 202"				
"	3	Runoff Totals on EXIT"				
"		Total Catchment area	0.311	hectare"		
"		Total Impervious area	0.260	hectare"		
"		Total % impervious	83.601"			
" 19		EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        Q:\51272\100\MIDUSS\08-11-22"
"          Output filename:                    5 Year Post d.out"
"          Licensee name:                      A"
"          Company                            "
"          Date & Time last used:              8/11/2022 at 3:55:44 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1755.000 Coefficient A"
"          12.347  Constant B"
"          0.895  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          136.512  mm/hr"
"          Total depth                47.549  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          201  Controlled Building Rooftop"
"          100.000 % Impervious"
"          0.211  Total Area"
"          7.500  Flow length"
"          2.000  Overland Slope"
"          0.000  Pervious Area"
"          7.500  Pervious length"
"          2.000  Pervious slope"
"          0.211  Impervious Area"
"          7.500  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious SCS Curve No."
"          0.000  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.852  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.067  0.000  0.000  0.000 c.m/sec"
"          Catchment 201          Pervious  Impervious Total Area "

```

"	Surface Area	0.000	0.211	0.211	hectare"
"	Time of concentration	8.371	0.869	0.869	minutes"
"	Time to Centroid	108.068	87.072	87.072	minutes"
"	Rainfall depth	47.549	47.549	47.549	mm"
"	Rainfall volume	0.00	100.33	100.33	c.m"
"	Rainfall losses	35.238	7.061	7.061	mm"
"	Runoff depth	12.311	40.488	40.488	mm"
"	Runoff volume	0.00	85.43	85.43	c.m"
"	Runoff coefficient	0.000	0.852	0.852	"
"	Maximum flow	0.000	0.067	0.067	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		0.067	0.067	0.000	0.000"
" 54	POND DESIGN"				
"	0.067	Current peak flow	c.m/sec"		
"	0.071	Target outflow	c.m/sec"		
"	85.4	Hydrograph volume	c.m"		
"	11.	Number of stages"			
"	0.000	Minimum water level	metre"		
"	0.150	Maximum water level	metre"		
"	0.000	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"		0.000	0.000	0.000"	
"		0.01500	0.00203	0.09669"	
"		0.03000	0.00405	0.7735"	
"		0.04500	0.00607	2.611"	
"		0.06000	0.00810	6.188"	
"		0.07500	0.01013	12.086"	
"		0.09000	0.01215	20.885"	
"		0.1050	0.01417	33.164"	
"		0.1200	0.01620	49.505"	
"		0.1350	0.01822	70.486"	
"		0.1500	0.02025	94.324"	
"	1.	ROOFTOP"			
"		Roof area	Store area	Area/drain	Drain flow
"		hectare	hectare	sq.metre	L/min/25mm
"		0.211	0.159	185.000	22.500
"					g H:1V"
"					50.000"
"		Using 9 roofdrains on roofstorage area of 1590. square metre"			
"		Peak outflow	0.015	c.m/sec"	
"		Maximum level	0.109	metre"	
"		Maximum storage	37.876	c.m"	
"		Centroidal lag	1.911	hours"	
"		0.067	0.067	0.015	0.000 c.m/sec"
" 40	HYDROGRAPH Combine 1"				
"	6	Combine "			
"	1	Node #"			
"		Total Site"			
"		Maximum flow	0.015	c.m/sec"	
"		Hydrograph volume	85.399	c.m"	
"		0.067	0.067	0.015	0.015"

```

" 40      HYDROGRAPH Start - New Tributary"
"          2      Start - New Tributary"
"              0.067      0.000      0.015      0.015"
" 33      CATCHMENT 202"
"          1      Triangular SCS"
"          1      Equal length"
"          1      SCS method"
"          202      Uncontrolled Area"
"          49.000      % Impervious"
"          0.100      Total Area"
"          4.000      Flow length"
"          20.000      Overland Slope"
"          0.051      Pervious Area"
"          4.000      Pervious length"
"          20.000      Pervious slope"
"          0.049      Impervious Area"
"          4.000      Impervious length"
"          20.000      Impervious slope"
"          0.250      Pervious Manning 'n'"
"          75.000      Pervious SCS Curve No."
"          0.254      Pervious Runoff coefficient"
"          0.100      Pervious Ia/S coefficient"
"          8.467      Pervious Initial abstraction"
"          0.015      Impervious Manning 'n'"
"          98.000      Impervious SCS Curve No."
"          0.772      Impervious Runoff coefficient"
"          0.100      Impervious Ia/S coefficient"
"          0.518      Impervious Initial abstraction"
"              0.018      0.000      0.015      0.015 c.m/sec"
"          Catchment 202      Pervious      Impervious      Total Area "
"          Surface Area      0.051      0.049      0.100      hectare"
"          Time of concentration      2.877      0.299      0.956      minutes"
"          Time to Centroid      101.453      86.296      90.162      minutes"
"          Rainfall depth      47.549      47.549      47.549      mm"
"          Rainfall volume      24.25      23.30      47.55      c.m"
"          Rainfall losses      35.474      10.835      23.401      mm"
"          Runoff depth      12.075      36.714      24.148      mm"
"          Runoff volume      6.16      17.99      24.15      c.m"
"          Runoff coefficient      0.254      0.772      0.508      "
"          Maximum flow      0.004      0.015      0.018      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4      Add Runoff "
"              0.018      0.018      0.015      0.015"
" 40      HYDROGRAPH Copy to Outflow"
"          8      Copy to Outflow"
"              0.018      0.018      0.018      0.015"
" 40      HYDROGRAPH Combine 1"
"          6      Combine "
"          1      Node #"
"          Total Site"
"          Maximum flow      0.029      c.m/sec"

```

"	Hydrograph volume	109.547	c.m"
"	0.018 0.018	0.018	0.029"
" 38	START/RE-START TOTALS 202"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	0.311	hectare"
"	Total Impervious area	0.260	hectare"
"	Total % impervious	83.601"	
" 19	EXIT"		

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        Q:\51272\100\MIDUSS\08-11-22"
"          Output filename:                    100 Year Post d.out"
"          Licensee name:                      A"
"          Company                            "
"          Date & Time last used:              8/11/2022 at 3:54:15 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          4692.000 Coefficient A"
"          17.437  Constant B"
"          0.956  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity      239.793  mm/hr"
"          Total depth            89.960  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          201  Controlled Building Rooftop"
"          100.000 % Impervious"
"          0.211  Total Area"
"          7.500  Flow length"
"          2.000  Overland Slope"
"          0.000  Pervious Area"
"          7.500  Pervious length"
"          2.000  Pervious slope"
"          0.211  Impervious Area"
"          7.500  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious SCS Curve No."
"          0.000  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.875  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.121  0.000  0.000  0.000 c.m/sec"
"          Catchment 201      Pervious  Impervious Total Area "

```

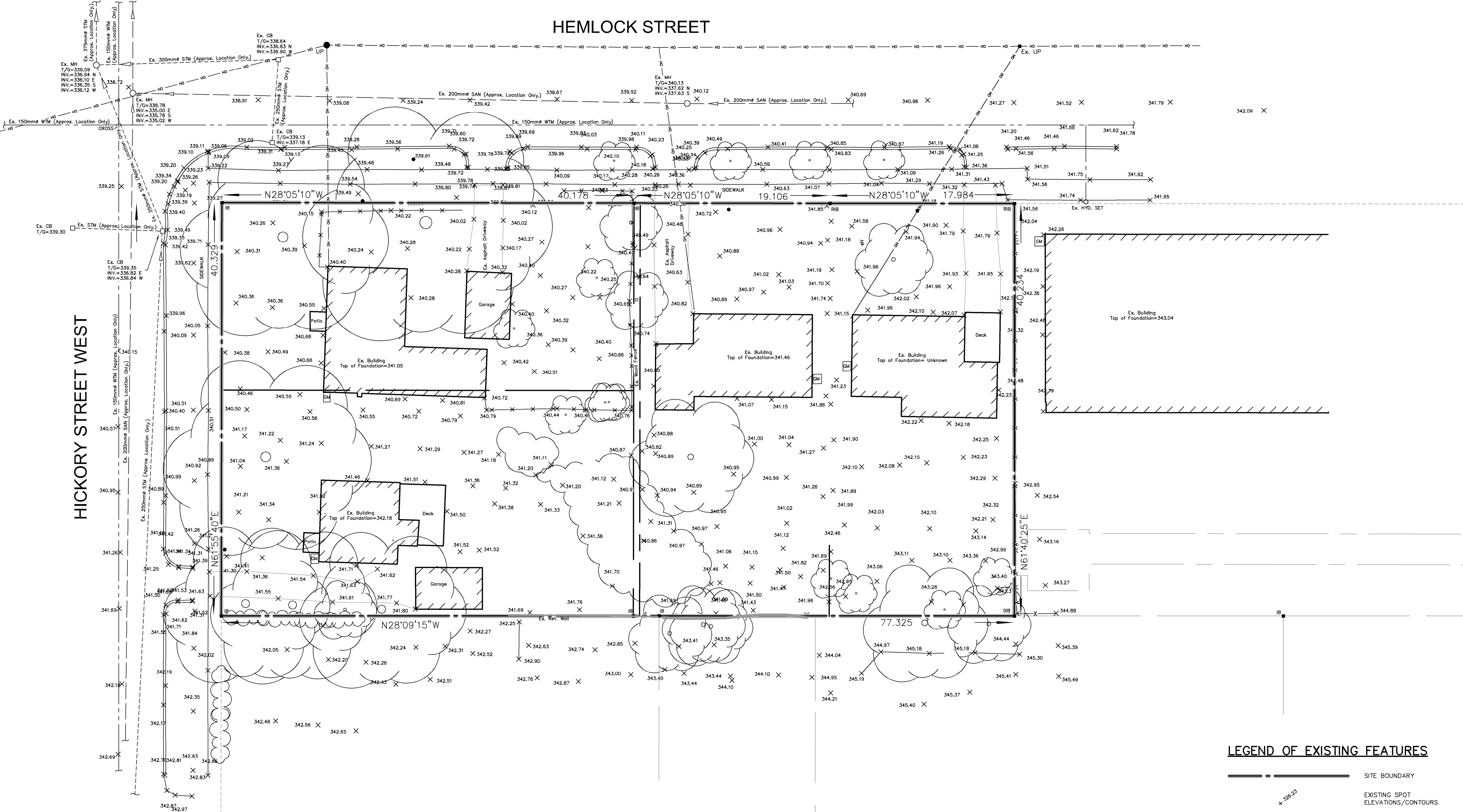
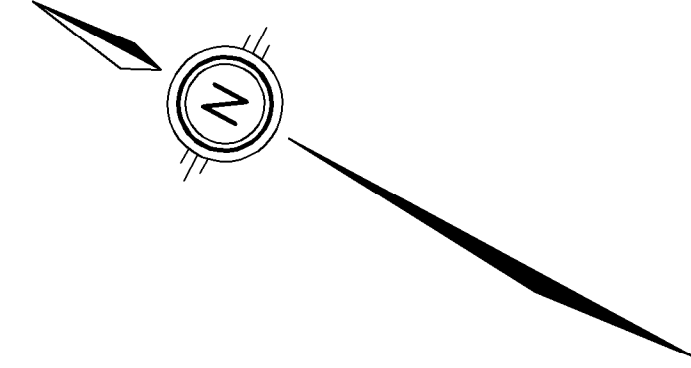
"	Surface Area	0.000	0.211	0.211	hectare"
"	Time of concentration	5.085	0.685	0.685	minutes"
"	Time to Centroid	99.564	85.208	85.208	minutes"
"	Rainfall depth	89.960	89.960	89.960	mm"
"	Rainfall volume	0.00	189.82	189.82	c.m"
"	Rainfall losses	50.240	11.221	11.221	mm"
"	Runoff depth	39.720	78.739	78.739	mm"
"	Runoff volume	0.00	166.14	166.14	c.m"
"	Runoff coefficient	0.000	0.875	0.875	"
"	Maximum flow	0.000	0.121	0.121	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		0.121	0.121	0.000	0.000"
" 54	POND DESIGN"				
"	0.121	Current peak flow	c.m/sec"		
"	0.071	Target outflow	c.m/sec"		
"	166.1	Hydrograph volume	c.m"		
"	11.	Number of stages"			
"	0.000	Minimum water level	metre"		
"	0.150	Maximum water level	metre"		
"	0.000	Starting water level	metre"		
"	0	Keep Design Data: 1 = True; 0 = False"			
"		Level Discharge	Volume"		
"		0.000	0.000	0.000"	
"		0.01500	0.00203	0.09669"	
"		0.03000	0.00405	0.7735"	
"		0.04500	0.00607	2.611"	
"		0.06000	0.00810	6.188"	
"		0.07500	0.01013	12.086"	
"		0.09000	0.01215	20.885"	
"		0.1050	0.01417	33.164"	
"		0.1200	0.01620	49.505"	
"		0.1350	0.01822	70.486"	
"		0.1500	0.02025	94.324"	
"	1.	ROOFTOP"			
"		Roof area	Store area	Area/drain	Drain flow
"		hectare	hectare	sq.metre	L/min/25mm
"		0.211	0.159	185.000	22.500
"					g H:1V"
"					50.000"
"		Using 9 roofdrains on roofstorage area of 1590. square metre"			
"		Peak outflow	0.020	c.m/sec"	
"		Maximum level	0.146	metre"	
"		Maximum storage	88.718	c.m"	
"		Centroidal lag	2.255	hours"	
"		0.121	0.121	0.020	0.000 c.m/sec"
" 40	HYDROGRAPH Combine 1"				
"	6	Combine "			
"	1	Node #"			
"		Total Site"			
"		Maximum flow	0.020	c.m/sec"	
"		Hydrograph volume	166.199	c.m"	
"		0.121	0.121	0.020	0.020"

```

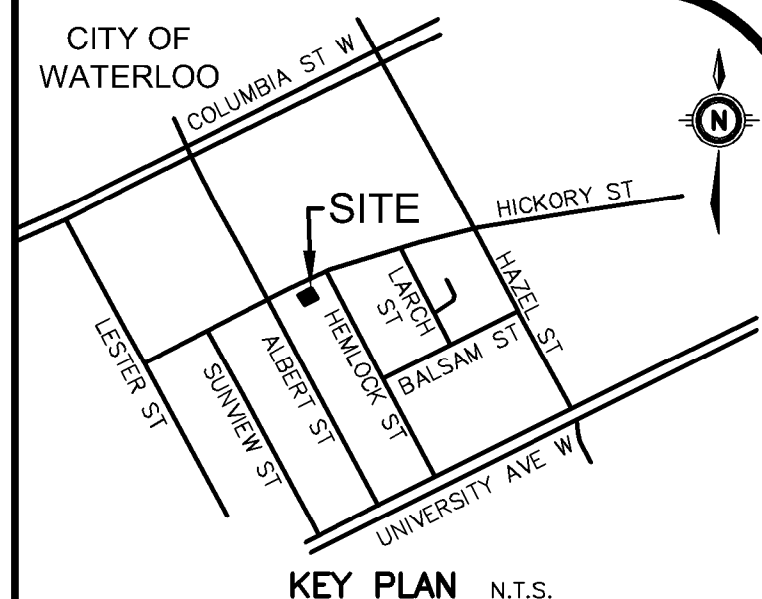
" 40      HYDROGRAPH Start - New Tributary"
"          2      Start - New Tributary"
"              0.121      0.000      0.020      0.020"
" 33      CATCHMENT 202"
"          1      Triangular SCS"
"          1      Equal length"
"          1      SCS method"
"          202      Uncontrolled Area"
"          49.000      % Impervious"
"          0.100      Total Area"
"          4.000      Flow length"
"          20.000      Overland Slope"
"          0.051      Pervious Area"
"          4.000      Pervious length"
"          20.000      Pervious slope"
"          0.049      Impervious Area"
"          4.000      Impervious length"
"          20.000      Impervious slope"
"          0.250      Pervious Manning 'n'"
"          75.000      Pervious SCS Curve No."
"          0.439      Pervious Runoff coefficient"
"          0.100      Pervious Ia/S coefficient"
"          8.467      Pervious Initial abstraction"
"          0.015      Impervious Manning 'n'"
"          98.000      Impervious SCS Curve No."
"          0.808      Impervious Runoff coefficient"
"          0.100      Impervious Ia/S coefficient"
"          0.518      Impervious Initial abstraction"
"              0.040      0.000      0.020      0.020 c.m/sec"
"          Catchment 202      Pervious      Impervious      Total Area "
"          Surface Area      0.051      0.049      0.100      hectare"
"          Time of concentration      1.748      0.235      0.781      minutes"
"          Time to Centroid      95.100      84.055      88.042      minutes"
"          Rainfall depth      89.960      89.960      89.960      mm"
"          Rainfall volume      45.88      44.08      89.96      c.m"
"          Rainfall losses      50.483      17.239      34.194      mm"
"          Runoff depth      39.477      72.721      55.766      mm"
"          Runoff volume      20.13      35.63      55.77      c.m"
"          Runoff coefficient      0.439      0.808      0.620      "
"          Maximum flow      0.012      0.028      0.040      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4      Add Runoff "
"              0.040      0.040      0.020      0.020"
" 40      HYDROGRAPH Copy to Outflow"
"          8      Copy to Outflow"
"              0.040      0.040      0.040      0.020"
" 40      HYDROGRAPH Combine 1"
"          6      Combine "
"          1      Node #"
"          Total Site"
"          Maximum flow      0.055      c.m/sec"

```

"	Hydrograph volume	221.965	c.m"
"	0.040 0.040	0.040	0.055"
" 38	START/RE-START TOTALS 202"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	0.311	hectare"
"	Total Impervious area	0.260	hectare"
"	Total % impervious	83.601"	
" 19	EXIT"		



LEGEND OF EXISTING FEATURES	
	SITE BOUNDARY
	EXISTING SPOT ELEVATIONS/CONTOURS
	EXISTING STORM SEWER
	EXISTING SANITARY SEWER
	EXISTING WATERMAIN
	EXISTING BUILDING
	EXISTING FENCE
	EXISTING RETAINING WALL



GEODETIC BM ELEV. = m
REFER TO PLAN BY McKECHNIE SURVEYING LTD. FOR BENCHMARK INFO.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :
DO NOT SCALE DRAWINGS.
CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.
THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

- NOTES:**
1. ALL THE ELEVATIONS ARE SHOWN HERE ARE TAKEN FROM PLAN A-3189 PREPARED BY McKECHNIE SURVEYING LTD, DATED 2021-07-30.
 2. P.L. IS APPROXIMATE ONLY.
 3. SERVICING INFO WITHIN RIGHT OF WAY IS TAKEN FROM PLAN AND PROFILES BY THE CITY OF WATERLOO, DATED APRIL 2, 2014 AND NOV 7, 2014. EXISTING INVERTS TAKEN FROM PLAN BY McKECHNIE SURVEYING LTD., DATED JULY 30, 2022.

8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.			
No. REVISION		BY YYYY-MM-DD	



Engineers, Scientists, Surveyors

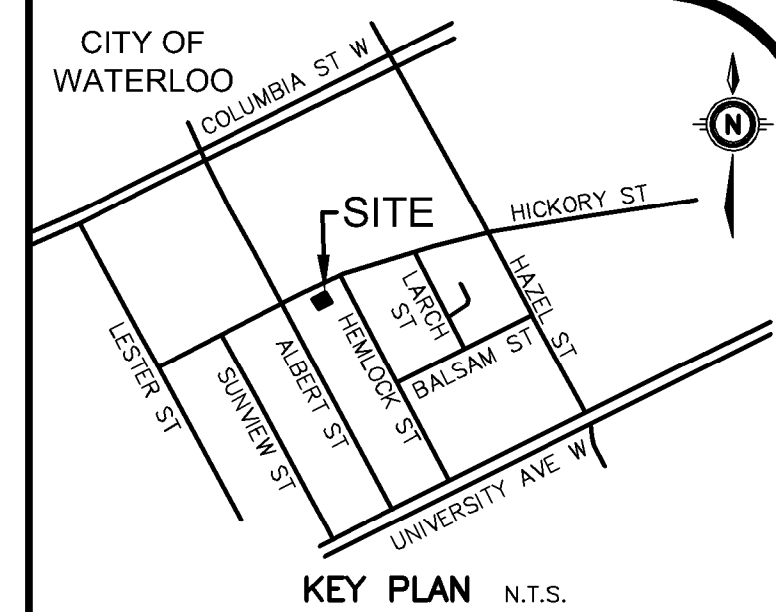
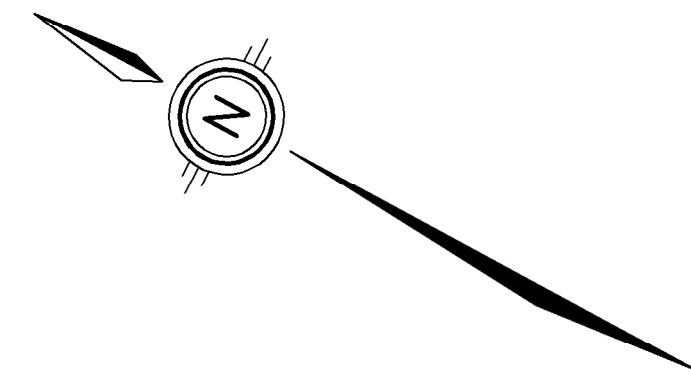
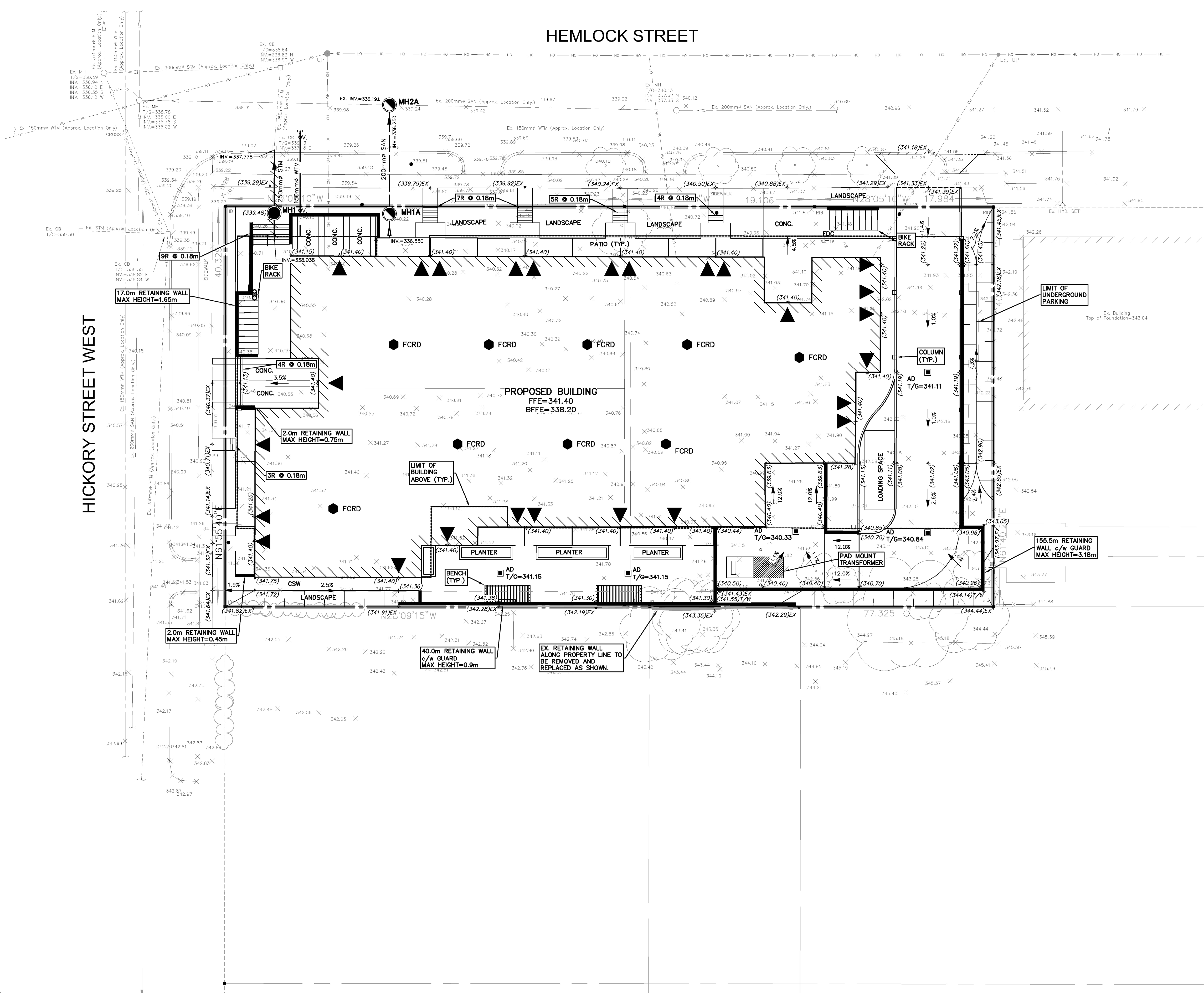
519-743-6500

OWNER
DCB DEVELOPMENT CANADA

118 MAY AVENUE RICHMOND HILL
PROJECT
83-85 HICKORY STREET WEST & 265-267 HEMLOCK STREET
WATERLOO

DRAWING
REMOVALS PLAN

Project Manager	P. DOUGLAS	Project No.	51272-100
Design By	JHN	Checked By	
Drawn By	NND	Checked By	JHN
Surveyed By	OTHERS	Drawing No.	
Date	Jun.02/22		
Scale	1:200	Sheet 1 of 2	



GEODETIC BM ELEV. = m
REFER TO PLAN BY McKECHNIE SURVEYING LTD. FOR BENCHMARK INFO.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :
DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

NOTES:
1. ALL THE ELEVATIONS ARE SHOWN HERE ARE TAKEN FROM PLAN A-3189 PREPARED BY McKECHNIE SURVEYING LTD, DATED 2021-07-30.
2. P.L. IS APPROXIMATE ONLY.

3. SERVICING INFO WITHIN RIGHT OF WAY IS TAKEN FROM PLAN AND PROFILES BY THE CITY OF WATERLOO, DATED APRIL 2, 2014 AND NOV 7, 2014. EXISTING INVERTS TAKEN FROM PLAN BY McKECHNIE SURVEYING LTD., DATED JULY 30, 2022.

LEGEND OF EXISTING FEATURES

	SITE BOUNDARY
	EXISTING SPOT ELEVATIONS
	EXISTING SANITARY SEWER
	EXISTING STORM SEWER
	EXISTING WATERMAIN
	EXISTING BUILDING
	EXISTING FENCE

LEGEND OF PROPOSED FEATURES

	PROPOSED BUILDING
	BUILDING ABOVE
	U/G PARKING BELOW
	MAN DOOR
	CONCRETE CURB
	RETAINING WALL
	EMBANKMENT (SLOPE AS NOTED)
	SANITARY SEWER
	STORM SEWER
	WATERMAIN
	SHALLOW PIPE INSULATION
	PROPOSED SPOT ELEVATIONS
	EX = MAINTAIN EXISTING
	T/G = TOP OF CASTING/GRATE
	INV = INVERT ELEVATION
	FFE = FINISHED FLOOR ELEVATION
	DIRECTION OF DRAINAGE/SWALE
	DRAINAGE SPLIT (RIDGE)
	FLOW CONTROL ROOF DRAIN
	SAW CUT

8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.			

No. REVISION BY YYYY-MM-DD



Engineers, Scientists, Surveyors

519-743-6500

OWNER
DCB DEVELOPMENT CANADA

118 MAY AVENUE RICHMOND HILL

PROJECT
83-85 HICKORY STREET WEST & 265-267 HEMLOCK STREET
WATERLOO

DRAWING
FUNCTIONAL SITE GRADING AND SERVICING PLAN

Project Manager P. DOUGLAS	Project No. 51272-100
Design By JHN	Checked By LEI
Drawn By NND	Checked By LEI
Surveyed By OTHERS	Drawing No.
Date Jun.03/22	C2.1
Scale 1:200	Sheet 2 of 2