NOVATECH

Engineers, Planners & Landscape Architects

Engineering

Land/Site Development

Municipal Infrastructure

Environmental/ Water Resources

Traffic/ Transportation

Recreational

Planning

Land/Site Development

Planning Application Management

Municipal Planning

Urban Design

Expert Witness (OLT)

Wireless Industry

Landscape Architecture

Streetscapes & Public Amenities

Open Space, Parks & Recreation

Community & Residential

Commercial & Institutional

Environmental Restoration

PROPOSED WAREHOUSE PROJECT X

99 Bill Leathem Drive, 2 & 20 Leikin Drive
Ottawa, Ontario

SERVICING AND STORMWATER MANAGEMENT REPORT

Engineering excellence. Planning progress. Liveable landscapes.

PROPOSED WAREHOUSE

99 Bill Leathem Drive, 2 & 20 Leikin Drive
OTTAWA, ONTARIO

SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

October 29, 2024
Revised: December 11, 2024

Novatech File: 124123
Report Ref: R-2024-126

NOVATECH
Engineers, Planners & Landscape Architects

December 11, 2024

City of Ottawa
Planning Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor
Ottawa, ON
K1P 1J1

Attention: Krishon Walker, Planner II

Reference: 99 Bill Leathem Drive, 2 & 20 Leikin Drive, Ottawa
Servicing and Stormwater Management Report
Novatech File No.: 124123

Please find enclosed the 'Servicing and Stormwater Management Report' for the above noted project. This report has been revised as per the City of Ottawa comments in support of the Site Plan Application and is hereby resubmitted for review and approval.

Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH

Matt Hrehoriak, P.Eng.
Project Manager | Land Development Engineering

cc:

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

LIST OF DRAWINGS (enclosed)

LIST OF DRAWINGS (separate)

1.0 INTRODUCTION

Novatech has been retained to prepare a Servicing and Stormwater Management Report for the proposed development located at 99 Bill Leathem Drive, 2 & 20 Leikin Drive within the South Merivale Business Park Development (SMBP) in the City of Ottawa. This report will support a Site Plan Application for the proposed development. **Figure 1** is a Key Plan showing the site location.

This report outlines the site sanitary, water servicing, along with the proposed storm drainage and stormwater management strategy for the proposed development.

1.1 Existing Conditions

The property is approximately 30.6 hectares in size, and currently consists of undeveloped vacant land, and cultivated agricultural land. The property can be accessed from Bill Leathem Drive, Paragon Avenue, and Leikin Drive. There is an existing easement containing a sanitary trunk sewer and overhead hydro lines that bisects the property in an east west orientation.

The property is bound by agricultural lands that are part of the City of Ottawa Greenbelt to the north and west and by the remainder of the South Merivale Business Park to the south and east including Leikin Drive, Paragon Avenue, Bill Leathem Drive, a 3-storey office building and vacant parcels. ***Figure 2*** shows the existing site conditions.

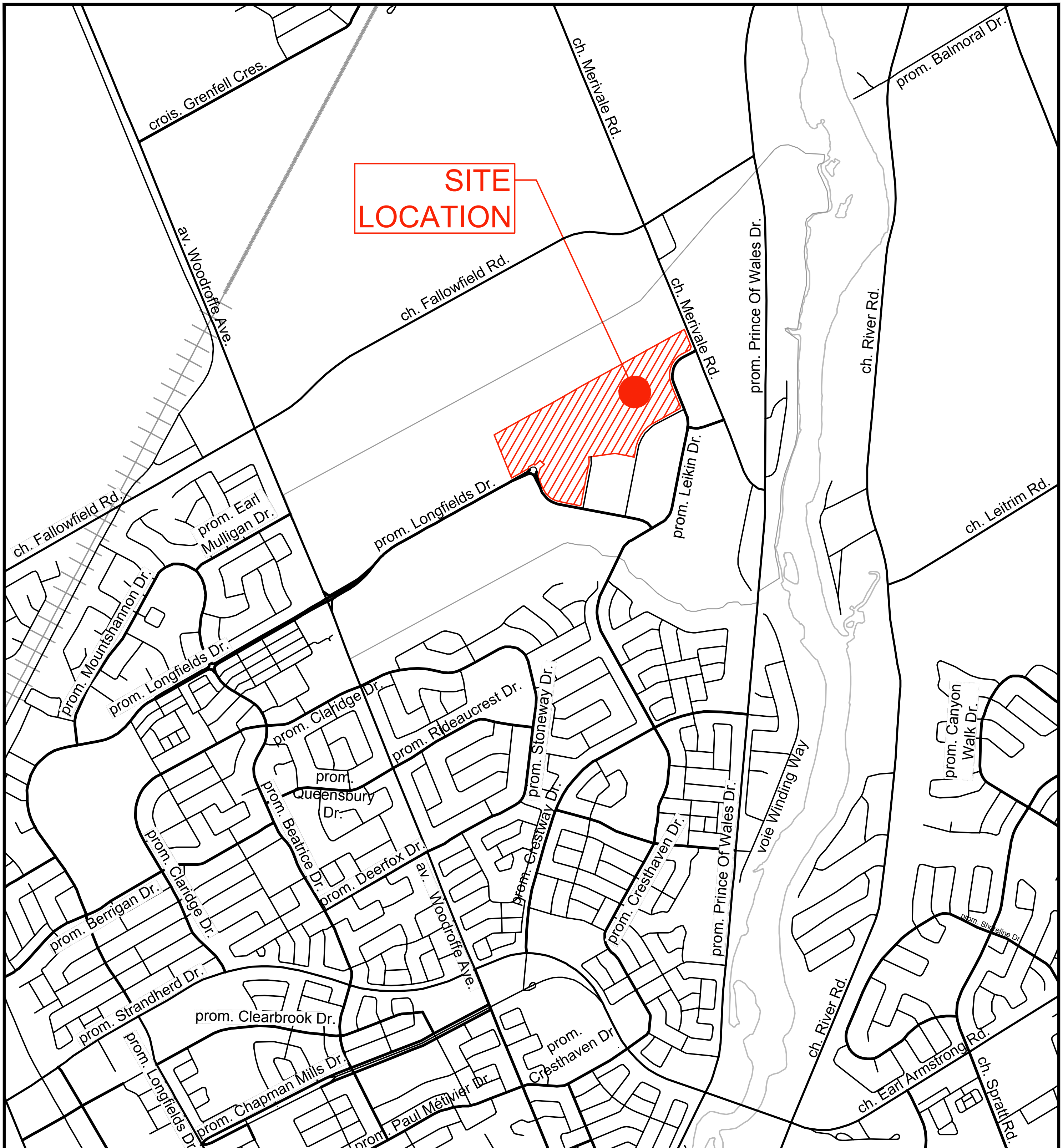
In 1992 the City of Nepean prepared a Development Plan (R-Plan by Farley, Smith & Murray Surveying Ltd.) for the South Merivale Business Park. However, this plan did not include a connection to Woodroffe Avenue via Longfields Drive. In 2009/2010 a connection between Woodroffe Avenue to Bill Leatham Drive was designed and constructed to provide westerly connectivity from the South Merivale Business Park. A contemplated draft plan was developed which revised the alignment of the future section of Bill Leatham Drive from Longfields Drive to Leikin Drive but was never deposited. In early 2021, the City of Ottawa removed the requirement for a connection from Bill Leatham Drive to Leikin Drive by returning unopened road allowances to the owners.

A servicing concept for the South Merivale Business Park has been completed and initial phases have been constructed (i.e. Leikin Drive, Bill Leathem Drive, Paragon Avenue). The servicing design information is provided in a report entitled 'City of Nepean, South Merivale Business Park, Phase II and III, Services Design Report' prepared by Novatech, dated June 23, 1992, hereafter referred to as SMBP Servicing Report. This report outlines the servicing for the roadways with consideration of future lot development.

1.2 Proposed Development

The proposed development consists of a single five-storey prestige office/light industrial building which will cover approximately 30.0 hectares of the 30.6-hectare site. The remaining 0.6 hectares will be allocated to the City of Ottawa parkland dedication. The development will include a truck court and associate parking lot with 59 loading dock spaces, 482 trailer drops, and 980 car parking spaces. The main access to the truck court would be provided from Leikin Drive, a secondary exit from the truck court is provided from Longfields Drive. The access to the associate parking lot will be provided from Leikin Drive and the round-a-bout at the Bill Leathem Drive and Longfields Drive intersection. **Figure 3** shows the proposed development.

It should be noted that this report should be read in conjunction with the engineering drawing set:



NOVATECH

Engineers, Planners & Landscape Architects

Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

N

PROJECT X

99 BILL LEATHEM DRIVE, 2 LEIKIN DRIVE AND 20 LEIKIN DRIVE, CITY OF OTTAWA

PROPERTY LOCATION MAP

SCALE		
N.T.S		
DATE: OCT 2024	JOB: 124123	FIGURE: 1

M:\2024\124123\CAD\Civil\Figures\Servicing\1 - KEY PLAN.dwg, ., Oct 29, 2024 - 6:05pm, lcolbran

SHT8X11.DWG - 216mmx279mm

LEGEND

PROPERTY LINE

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

PROJECT X

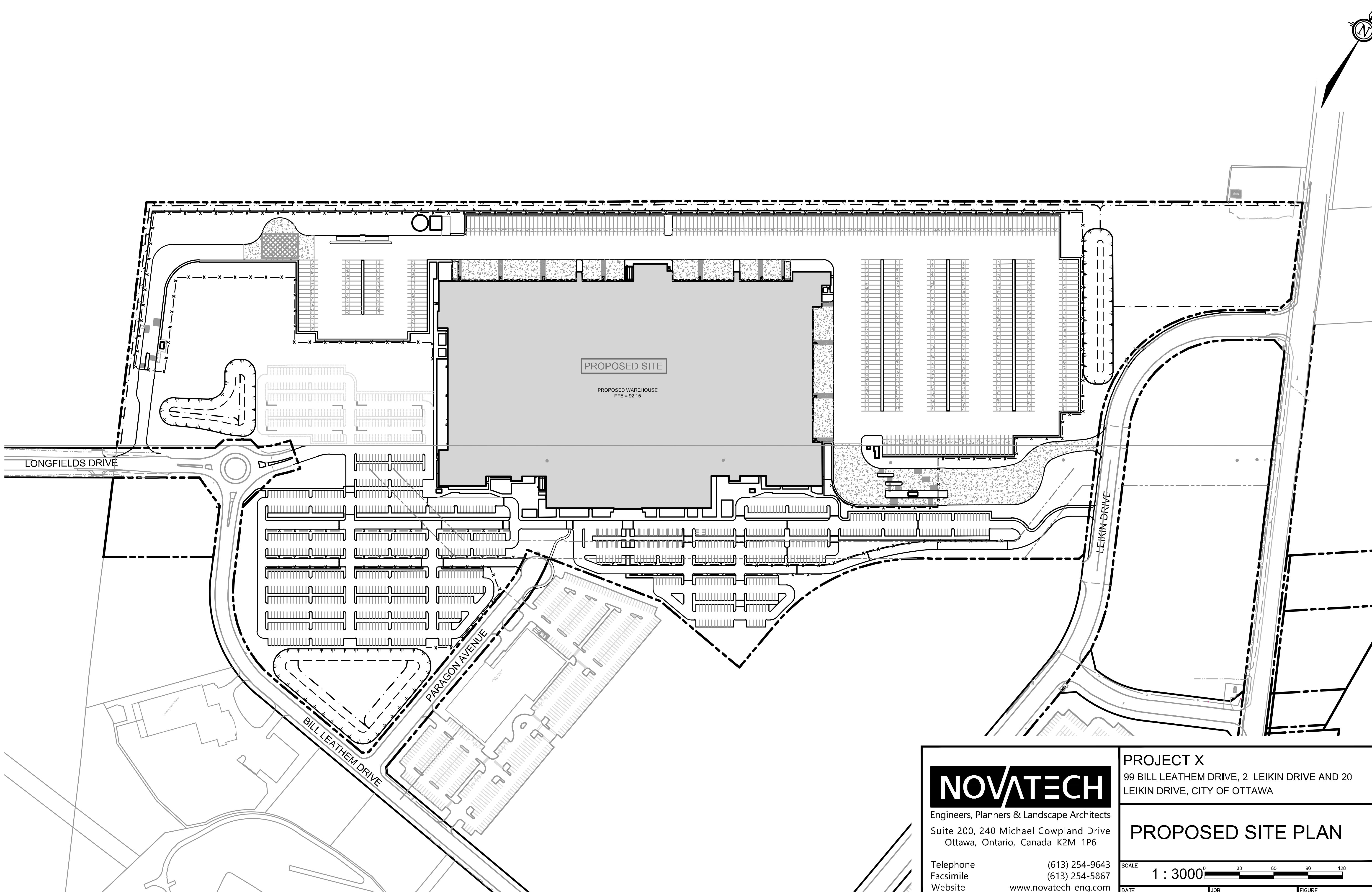
99 BILL LEATHEM DRIVE, 2 LEIKIN DRIVE AND 20 LEIKIN DRIVE, CITY OF OTTAWA

EXISTING CONDITIONS PLAN

SCALE	DATE	JOB	FIGURE
1 : 3000 (0 30 60 90 120)	OCT 2024	124123	2

M:\2024\124123\CAD\Civil\Figures\Servicing\2 - EXCONDITIONS.dwg, EX, Oct 29, 2024 - 6:12pm, lcolbran

SHT11X17.DWG - 279mmX432mm



M:\2024\124123\CAD\Civil\Figures\Servicing\3 - PRSP.dwg, PRSP, Oct 29, 2024 - 6:20pm, lcolbran

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

PROJECT X
99 BILL LEATHEM DRIVE, 2 LEIKIN DRIVE AND 20 LEIKIN DRIVE, CITY OF OTTAWA

PROPOSED SITE PLAN

SCALE 1 : 3000 (0, 30, 60, 90, 120)

DATE OCT 2024 | JOB 124123 | FIGURE 3

SHT11X17.DWG - 279mmX432mm

124123-ND	Notes and Details
124123-GP	General Plan of Services
124123-GR	Grading Plan
124123-ESC	Erosion Sediment Control Plan

1.3 Site Design and Constraints

As indicated previously the subject site is part of the SMBP Development in the City of Ottawa. Servicing design criteria and information for the SMBP Development is provided in a report entitled '*City Of Nepean, South Merivale Business Park Phase II and III, Services Deign Report,*' prepared by Novatech, dated June 23,1992. Stormwater Management design criteria and information is provided in a report entitled *'City of Nepean, South Merivale Business Park, Stormwater Management Report'* prepared by Novatech, revised dated December 3, 1991. The SMBP Reports provide design criteria for the interior sites and designed the overall servicing systems including sanitary sewers, watermain and stormwater management systems. Each system is discussed in more detail in the appropriate sections of this report.

1.4 Background Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing and stormwater management strategies. This report should be read in conjunction with the following:

- *South Merivale Business Park, 99 Bill Leathem Drive, 2 Leikin Drive and 20 Leikin Drive, Serviceability Report, prepared by Novatech dated March 25, 2021.*
- *City of Nepean, South Merivale Business Park Phase II and III, Services Design Report,*' prepared by Novatech, dated June 23,1992.
- *'City of Nepean, South Merivale Business Park, Stormwater Management Report'* prepared by Novatech, revised dated December 3, 1991.

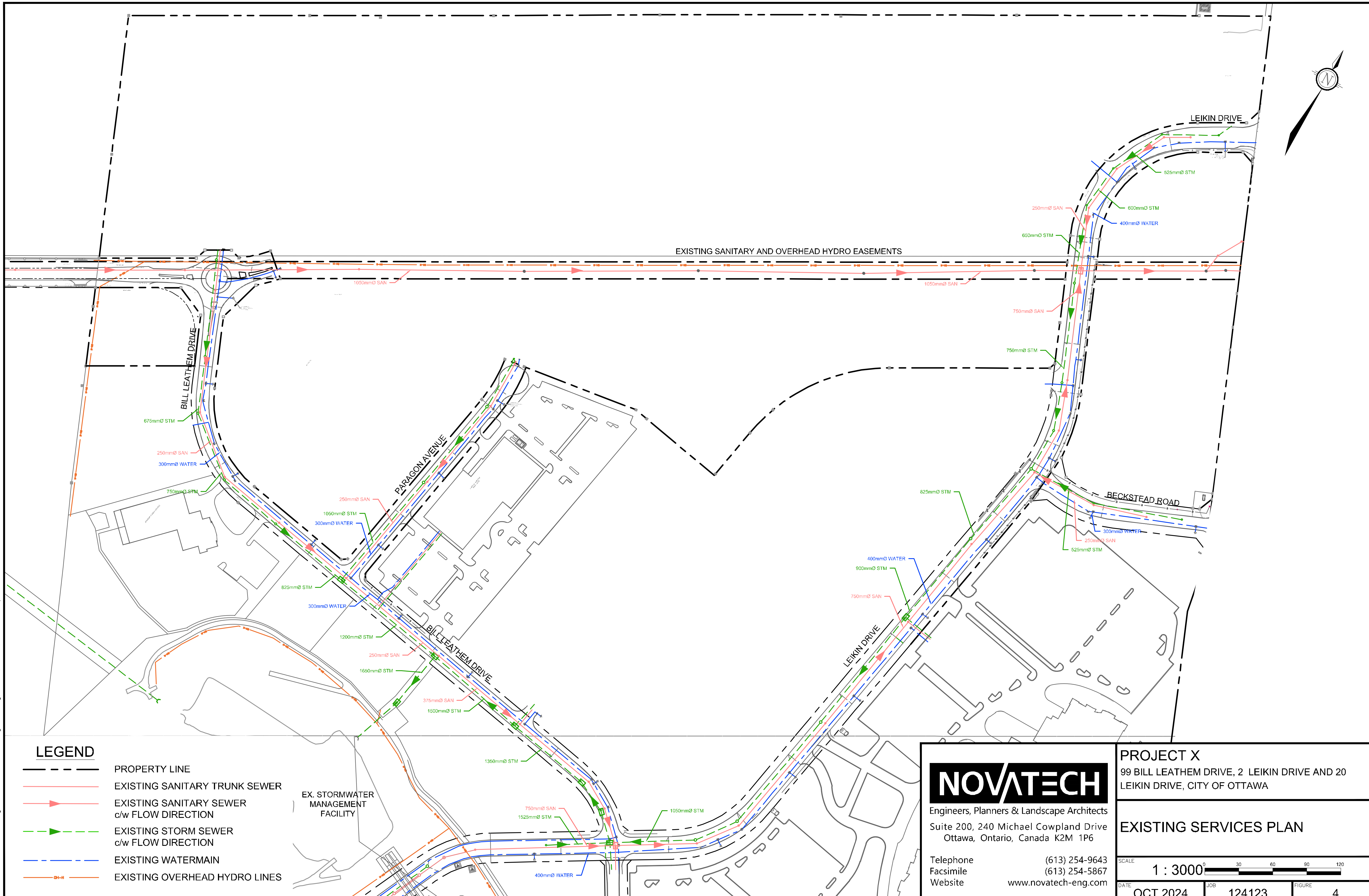
2.0 WATER SERVICING

2.1 Existing Water Services

The subject development is located within the City of Ottawa 2W2C water pressure zone. There are existing 300mm diameter watermains within the Bill Leathem Drive and Paragon Avenue rights-of-way, and an existing 400mm diameter watermain within the Leikin Drive right-of-way. There are existing 200mm and 300mm diameter stubs at the end of Bill Leathem Drive, and Paragon Avenue for use as future service connections to service the subject property. In 2027 The City of Ottawa has plans to introduce a new water pressure zone identified as SUC which splits the subject development into two different pressure zones. It should be noted that the development can only be serviced from one pressure zone. Refer to **Appendix A** for details on the SUC zone reconfiguration. Refer to **Figure 4** for details on the existing water network.

2.2 Proposed Water Servicing

It is proposed to service the proposed development from the existing 300mm diameter watermain in Bill Leathem Drive and Paragon Avenue. The proposed connection locations will be included in the future SUC pressure zone which will yield higher pressures than the current 2W2C pressure zone. Water will be supplied to the building by constructing approximately 475 meters of 300mm



LEGEND

- PROPERTY LINE
- EXISTING SANITARY TRUNK SEWER
- EXISTING SANITARY SEWER c/w FLOW DIRECTION
- EXISTING STORM SEWER c/w FLOW DIRECTION
- EXISTING WATERMAIN
- EXISTING OVERHEAD HYDRO LINES

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

PROJECT X

99 BILL LEATHEM DRIVE, 2 LEIKIN DRIVE AND 20 LEIKIN DRIVE, CITY OF OTTAWA

EXISTING SERVICES PLAN

SCALE	DATE	JOB	FIGURE
1 : 3000	OCT 2024	124123	4

M:\2024\124123\CAD\Civil\Figures\FIG 4 - EX Servicing Plan.dwg, EX-SP, Oct 29, 2024 - 12:58pm, mhrehoriak

SHT11X17.DWG - 279mmX432mm

dia. and 290m of 150mm dia. private watermain on site. The private watermain will supply the development with municipal water for domestic use and fire suppression.

As per the City of Ottawa Technical Bulletin ISDTB-2014-02, the proposed development will require two service connections as the average day demand is greater than 50 cubic meters of water. The two services will be separated by an isolation valve on the existing municipal watermain system in the event maintenance on the system is required. Refer to the General Plan of Services (124123-GP) for water servicing details.

2.2.1 Proposed Development Domestic Water Demands

Design Criteria from the City of Ottawa Water Distribution Guidelines and Section 8 of the Ontario Building Code were used to calculate the theoretical domestic water demands and fire flow requirements for the proposed development. The demand calculations are based on flow requirements for the proposed different uses on site, and are calculated based on the following criteria:

- Industrial Water Demand
  - per each water closet = 950L/day
  - per each loading bay = 150L/day (each)
- Commercial Office Water Demand
  - per each 9.3m² floor space = 75L/day
- Peaking Factor
  - Max Day = 1.5
  - Peak Hour = 1.8

The domestic water demands for the proposed development are summarized in **Table 2.1** below.

Table 2.1: Domestic Water Demand Summary

Use	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/S)
Industrial Flows	0.262	0.392	0.706	**126.2**
Commercial Flows	0.148	0.223	0.399	
Total Domestic Demands	**1.57**	**2.35**	**4.24**	

2.2.2 Proposed Development Fire Protection System

Fire protection systems for this type of development are intricate systems, that require a specialized fire consulting engineer to determine the requirements. Therefore, Civelec Consulting Inc. a specialized fire consulting engineering firm was retained to design the fire protection systems for the proposed development. The results of the Civelec design are summarized below:

- The fire protection system requires a fire flow of 2000 USGPM.
- A fire pumphouse and water storage reservoir will be located near the northwest corner of the building. The fire pumps within the pump house will draw water from the reservoir and pressurize the private fire protection system. The water reservoir will be supplied with municipal water from the city system.
- In addition to the pumps and reservoir the fire protection system includes a high pressure watermain loop around the building which consists of the following:
  - 1195 meters of 250mm dia. high pressure watermain

  - 9 - fire hydrants evenly spaced around the building
  - 8 - 200mm diameter service entries that supply the internal sprinkler system.
- There are two fire hydrants connected to the incoming City watermain, which are located within 45 meters of the Siamese connection.

2.3 Boundary Conditions and Hydraulic Analysis

The domestic water demands, and fire flow calculations were provided to City in request of watermain boundary conditions for the proposed development. The boundary conditions were based on connections to existing 300mm dia. watermains in Bill Leathem Drive and Paragon Avenue, and the 400mm dia. watermain in Leikin Drive. A summary of the site boundary condition results provided by the City of Ottawa are shown below in **Table 2.**.

Table 2.2: Boundary Condition Summary (Existing Conditions)

Condition	Min/Max Allowable Operating Pressures (psi)	Operating Pressures (psi)	
		Connection 1 Longfields Dr	Connection 2 Paragon Ave
High Pressure	80psi (Max)	60.2	60.2
Max Day + Fire Flow	20psi (Min)	45.9	46.7
Peak Hour	40psi (Min)	49.2	49.2

Note: Pressures based on Ground Elevation of 90.5m, 90.4m respectively.

Through correspondence with the City, it is understood that planned watermain improvements (SUC Zone reconfiguration), will result in altered boundary conditions for the site. The future boundary conditions are provided in **Table 2.3**.

Table 2.3: Boundary Condition Summary (Post SUC Zone Reconfiguration)

Condition	Min/Max Allowable Operating Pressures (psi)	Operating Pressures (psi)	
		Connection 1 Longfields Dr	Connection 2 Paragon Ave
High Pressure	80psi (Max)	80.1	80.2
Max Day + Fire Flow	20psi (Min)	68.8	69.7
Peak Hour	40psi (Min)	76.1	76.2

Note: Pressures based on Ground Elevation of 90.7m, 90.4m respectively.

The above boundary conditions were used to create a hydraulic model using EPANET for analyzing the performance of the proposed private watermain system for three theoretical conditions: 1) High Pressure check under Average Day conditions, 2) Peak Hour demand, 3) Maximum Day + Fire Flow Demand. **Table 2.5, and Table 2.6** below summarise the results from the hydraulic water model for the existing conditions and the future SUC zone reconfiguration, respectively.

Table 2.2: Water Analysis Results Summary – Existing Conditions

Condition	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
High Pressure	1.57 L/s	80psi (Max)	60.3 psi (Max)
Max Day + Fire Flow	128.55 L/s	20psi (Min)	42.5 psi (Min)
Peak Hour	4.24 L/s	40psi (min)	46.7 psi (min)

Table 2.3: Water Analysis Results Summary – Post SUC Zone Reconfiguration

Condition	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Limits of Design Operating Pressures (psi)
High Pressure	1.57 L/s	80psi (Max)	80.4 psi (Max)
Max Day + Fire Flow	128.55 L/s	20psi (Min)	65.5 psi (Min)
Peak Hour	4.24 L/s	40psi (min)	73.7 psi (min)

The SUC zone reconfiguration will result in a notable increase in available pressures under all conditions. The future pressure in the high-pressure scenario is nearing 80 psi, which is the allowable pressure threshold. It is recommended that a pressure reduction valve be installed to prevent high pressures within the private water system.

Based on the preceding analysis it can be concluded that the watermain, as designed, will provide adequate system pressures for domestic use and fire protection. Refer to **Appendix A** for detailed model results, model schematics and City of Ottawa boundary conditions. Refer to the General plan of Services (drawing 124123-GP) for details on the water servicing network.

3.0 SANITARY SERVICING

3.1 Existing Sanitary Services

There is an existing easement that bisects the property which contains the existing 1050mm dia. Barrhaven Sanitary Trunk sewer. There are existing 250mm dia. municipal sanitary sewers in Paragon Avenue, Bill Leathem Drive and Leikin Drive. There is also an existing 750mm dia. sanitary trunk sewer in Leikin Drive (south of the trunk sewer easement).

The sanitary sewer outlet for the South Merivale Business Park is the Barrhaven Trunk Sanitary Sewer which flows to the West Rideau Collector Sewer.

Refer to **Figure 4** for details on the existing sanitary servicing network.

3.2 Proposed Sanitary Services

The proposed development requires a realignment of the existing 1050mm diameter Barrhaven trunk sewer. The proposed alignment will reroute the trunk sewer out of the building envelope to the southern property limits. Details on the sewer realignment we be provided under a separate cover.

It is proposed to service the development by constructing approximately 535m of 250mm dia. private sanitary sewer on site. The office/warehouse building, and the eastern main guardhouse will outlet directly to the realigned 1050mm diameter Barrhaven trunk sewer. The western secondary guardhouse will connect to the existing 250mm diameter sanitary stub located at the north leg of the Bill Leathem Drive and Longfields round-a-bout. Refer to the General Plan of Services (124123-GP) for details.

3.2.1 Proposed Peak Sanitary Flows

The total theoretical peak sanitary flow for the proposed development was calculated based on the following criteria from Section 4 of the City of Ottawa Sewer Design Guidelines and Section 8 of the Ontario Building Code:

- Total Development Area = 30.0ha
- Industrial Sanitary Flow
    - per each water closet = 950L/day
    - per each loading bay = 150L/day (each)
- Commercia Office Sanitary Flow
    - per each 9.3m² floor space = 75L/day
- Commercial Peaking Factor = 1.5
- Light Industrial Peaking Factor = 3.1 (Appendix 4-B)
- Infiltration Rate = 0.33L/s/ha

The proposed sanitary flows are summarized below in **Table 3.1**.

Table 3.1: Peak Sanitary Flow Summary

Proposed Use	**Peak Flow (L/s)**
Industrial Flows	3.73
Commercial Flows	0.55
Sewer Infiltration Flow	9.90
Total Peak Flows	**14.18**

3.3 SMBP Sanitary Flow Allotment

The SMBP Phase II and III Services Design Report provides design criteria which was used to calculate the sanitary flow allotments for the development area. Based on the existing sanitary design sheet and drainage area plan there are multiple local municipal sanitary sewer outlets available for the proposed development. The sanitary flow allotment to each sanitary sewer outlet was calculated based on the following design criteria provided SMBP Services Report:

- Population Equivalent = 100 persons/ha
- Design Sanitary Flow = 450 L/person/day (Commercial/Institutional Flow Rate)
- Light Industrial Peaking Factor =2.8
- Infiltration Rate = 0.11L/s/ha

The sanitary flow allotments to each sanitary sewer outlet are summarized below in **Table 3.2**.

Table 3.2: Sanitary Flow Allotment Summary

SEWER OUTLET LOCATION	Area (ha)	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Design Flow (L/s)
Bill Leathem Dr	4.9	7.15	0.53	7.53
Paragon Ave	2.0	2.92	0.21	2.98
Trunk Sewer EX SANMH 62	17.4	25.38	1.91	27.29
Leikin Dr	3.4	4.96	0.37	5.33
Bill Leatham Dr (via Street C)	2.8	4.08	0.31	4.39
Total Allocation	**30.5**	**44.48**	**3.36**	**47.83**

The total flow allotment for the development area to the Barrhaven Sanitary Trunk Sewer was calculated to be 47.8 L/s. A copy of the existing sanitary drainage area plans and sanitary sewer design sheet from the SMBP Phase I and II Report are provided in **Appendix B** for reference.

The proposed 250mm dia. private sanitary sewer on site has a theoretical capacity of 32.5 L/s at the minimum slope of 0.3%. Therefore, there is adequate capacity in the proposed infrastructure to convey the required peak flow of 14.18 L/s from the site. Also, based on the total flow allotment of 47.8 L/s, and correspondence with the City of Ottawa there is capacity in the existing infrastructure for the proposed development and future developments on the site. Refer to **Appendix B**, for the proposed detailed sanitary flow calculations, sanitary drainage area pans, sanitary sewer design sheets and City correspondence.

4.0 STORM SERVICING AND STORMWATER MANAGEMENT

The storm servicing and stormwater management strategy for the site is based on the established criteria in the 1991 SMBP SWM Report.

4.1 Existing Storm Services

The storm infrastructure servicing the South Merivale Business Park includes a downstream stormwater management facility and storm sewers with sizes ranging from 525mm to 2400mm in diameter. There is an existing 675mm dia. storm sewer in Bill Leathem Drive, a 1200mm dia. storm sewer in Paragon Avenue, and a 750mm dia. storm sewer in Leikin Drive which are the proposed storm sewer outlets for the development. The stormwater management facility is located to the south of Bill Leatham Dr and provides quality control of stormwater prior to out letting to Barrhaven Creek. Refer to **Figure 4** for details on the existing storm servicing network.

4.2 Stormwater Management Criteria

4.2.1 Stormwater Quality Control

The existing downstream stormwater management facility was sized to provide quality control for the development. No further lot level quality control measures are required. Refer to the 1991 SMBP SWM Report contained in **Appendix D**, for details.

4.2.2 Stormwater Quantity Control – Allowable Release Rate

The 1991 SMBP SWM Report included the following stormwater management criteria for the future development blocks that drain to the downstream SWM Facility:

- All storm sewers within the development area have been sized to transmit flows of 54.5 L/s/ha, based on a total allowable release rate into the existing SWM facility of 4600 L/s and a total tributary area of 84.4 ha;
- Ensure no overland flow for all storms up-to and including the 100-year event.

The proposed development will outlet to storm maintenance holes EX.STMH 139 in Bill Leathem Drive, EX.STMH 159-160 in Paragon Avenue, and EX.STMH 105-106 in Leikin Drive. The allowable release rate to these manholes were calculated using the criteria of 54.5 L/s/ha and are summarized below in **Table 4.1** below.

Table 4.1: Storm Sewer Design Parameters

Outlet Structure/ Roadway	Tributary Area (ha)	Allowable Release Rate (L/s)
Paragon Ave. EXSTMH 158-135	19.51	1,063
Leikin Dr. EXSTMH 105	3.46	188
Bill Leathem Dr. EXSTMH 139	2.76	150

Note that the off-site storm sewer was designed to convey the 5-year peak flow and surcharge during larger storm events. The storm sewer can surcharge as there are no basement connections.

4.3 Proposed On-Site Storm Infrastructure

The on-site storm sewer and stormwater management system will include storm sewers ranging in size from 300mm to 1800mm in diameter. On-site storage will be provided underground in the storm sewer system and on the surface in dry ponds. Peak flows will be attenuated to the allowable release rates specified using orifices. The inlet controls at each flow control structures are as follows:

Table 4.2: Inlet Control Devices

Location	Structure	Diameter (mm)	5-year		100-year	
			Head (m)	Flow Rate (L/s)	Head (m)	Flow Rate (L/s)
Pond A Outlet	HW03	630	1.23	818	1.95	1053
Leikin Dr Outlet	STMMH221	260	0.59	107	1.90	178
Pond C Outlet	STMMH220	270	1.12	145	1.25	150

No surface storage in the parking areas or on the building roofs are accounted for in the storm servicing design. The 100-year peak flow will be attenuated to the allowable release rate via the underground storm sewer system and dry ponds (at the request of the client).

Refer to the General Plan of Services (124123-GP) for details.

4.3.1 Storm Sewer Sizing Criteria

The storm drainage design is based on the principals of dual drainage (i.e. minor and major system). The on-site storm sewers (i.e. minor system) have been designed based on the criteria outlined in the City of Ottawa Sewer Design Guidelines (October 2012) and associated technical bulletins. The design criteria used in sizing the storm sewers are summarized below in **Table 4.3**.

Table 4.3: Storm Sewer Design Parameters

Parameter	Design Criteria
Private Roads	10 Year Return Period
Storm Sewer Design	Rational Method
IDF Rainfall Data	Ottawa Sewer Design Guidelines
Initial Time of Concentration (Tc)	10 min
Minimum Velocity	0.8 m/s
Maximum Velocity	3.0 m/s
Minimum Diameter	250 mm

Refer to the storm sewer design sheets provided in **Appendix C** and Storm Drainage Area Plan (Drawing 124123-STM).

4.3.2 Overland Flow Sizing Criteria

As previously indicated all flows will be contained underground and in the dry ponds for all storm events up-to and including the 100-year storm event. Storm events that exceed the 100-year storm will pond on the surface and be conveyed through major system flow pathways. The grading design includes a maximum 0.35m of surface ponding before 'spilling' over a high-point. Extended ponding will only occur during very rare events that exceed the 100-year storm.

Refer to the Grading Plan (Drawing 124123-GR).

The inlet capacity of the catchbasin grates and leads have been generally confirmed to convey the 100-year flows so that ponding will not be exceeded. Refer to the Catchbasin Grate and Lead Inlet Capacity Calculation spreadsheet provided in **Appendix D**. Note that in the spreadsheet, there are some grates that will limit the peak flow, generally due to available ponding depth. However, the spreadsheet shows that the catchbasin leads will not restrict flow into the storm sewers.

4.4 Stormwater Management Modeling

The *City of Ottawa Sewer Design Guidelines* (October 2012) requires hydrologic / hydraulic modeling for all dual drainage systems. The performance of the proposed storm drainage system for the site was evaluated using the PCSWMM hydrologic / hydraulic model.

The PCSWMM model schematics and 100-year model output data are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

4.4.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms:

- 3-hour Chicago storm distribution
- 24-hour SCS Type II storm distribution

The return periods analyzed include the 2,5 & 100-year storm events. The IDF parameters used to generate the design storms were taken from the *City of Ottawa Sewer Design Guidelines* (October 2012).
The 3-hour Chicago distribution generated the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system was also 'stress tested' using a 100-year (+20%) 3-hour Chicago design storm. This design storm has a 20% higher intensity and total volume compared to the 100-year event.

4.4.2 Model Development

The PCSWMM model includes the subcatchment areas for the proposed development, delineated based on grading and proposed land use. Individual drainage areas to each inlet have been lumped together to determine the total area to each pipe run. The purpose of the model is to ensure that the proposed storm drainage and stormwater management system adheres to the allowable release rates specified and that there is no surface ponding during the 100-year storm event.

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values as specified in the City of Ottawa Sewer Design Guidelines were used for all catchments.

Horton's Equation:	Initial infiltration rate: $f_o = 76.2$ mm/hr
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$	Final infiltration rate: $f_c = 13.2$ mm/hr
	Decay Coefficient: $k = 4.14$/hr

Depression Storage

The default values for depression storage in the City of Ottawa were used for all subcatchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

The rooftops assumed to provide no depression storage (zero-impervious parameter).

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter (Table 5.1) is calculated as described in Section 5.4.5.6 of the City of Ottawa Sewer Design Guidelines. The flow path lengths are shown on the Flow Length and Ponding Plan provided in **Appendix D**.

Impervious Values

Runoff coefficients for each subcatchment area were determined based on the proposed site plan. Refer to the Storm Drainage Area Plan (124123-SWM) for details. Percent impervious values were calculated using:

%imp = (C – 0.20) / 0.70

Storm Drainage Areas

For modeling purposes, the site has been divided into subcatchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The subcatchment areas are shown on the Storm Drainage Area Plan (124123-STM).

The hydrologic modeling parameters for each subcatchment were developed based on the Site Plan (**Figure 3**) and Storm Drainage Area Plan specified above. Subcatchment parameters are provided in **Table 4.4**.

Table 4.4: Subcatchment Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A01	0.443	0.90	100%	0%	54.72	80.95	2%
A02	0.428	0.90	100%	0%	34.42	124.34	2%
A03	0.457	0.90	100%	0%	35.20	129.83	2%
A04	0.447	0.90	100%	0%	38.94	114.78	2%
A05	0.251	0.90	100%	0%	36.10	69.52	2%
A06	0.297	0.90	100%	0%	42.83	69.35	2%
A07	0.707	0.90	100%	0%	69.94	101.08	2%
A08	0.175	0.90	100%	0%	40.48	43.23	2%
A09	0.338	0.90	100%	0%	49.67	68.04	2%
A10	0.228	0.90	100%	0%	31.29	72.86	2%
A11	0.068	0.90	100%	0%	13.84	49.13	2%
A12	0.523	0.90	100%	0%	36.49	143.32	2%
A13	0.663	0.90	100%	0%	39.93	166.06	2%
A14_1	0.306	0.25	7%	0%	175.36	17.45	2%
A14_2	0.589	0.90	100%	0%	40.69	144.75	2%
A15	0.429	0.90	100%	0%	41.73	102.79	2%
A16	0.391	0.90	100%	0%	39.20	99.75	2%
A18	0.491	0.86	94%	0%	47.34	103.71	2%
A19	0.663	0.90	100%	0%	38.47	172.33	2%
A20	0.150	0.90	100%	0%	29.55	50.76	2%
A21	0.344	0.90	100%	0%	35.32	97.39	2%
A22	1.309	0.90	100%	0%	54.38	240.73	2%
A23	0.258	0.87	96%	0%	55.67	46.35	2%
A24	1.160	0.25	7%	0%	74.13	156.49	2%
B01	0.550	0.90	100%	0%	66.59	82.59	2%

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
B02	0.459	0.90	100%	0%	57.73	79.50	2%
B03	0.207	0.90	100%	0%	25.49	81.20	2%
B04	0.547	0.90	100%	0%	65.37	83.68	2%
B05	0.468	0.90	100%	0%	52.83	88.58	2%
B06	0.206	0.90	100%	0%	27.14	75.92	2%
B07	0.499	0.90	100%	0%	71.23	70.06	2%
B08	0.341	0.90	100%	0%	38.80	87.88	2%
B09	0.213	0.90	100%	0%	25.06	85.01	2%
B10	1.413	0.69	70%	0%	43.15	327.49	2%
B11	2.457	0.25	7%	0%	162.75	150.97	2%
C01	0.466	0.90	100%	0%	36.82	126.55	2%
C02	0.175	0.57	53%	0%	38.41	45.57	2%
C03	0.398	0.90	100%	0%	34.78	114.44	2%
C04	0.204	0.58	54%	0%	35.56	57.36	2%
C05	0.283	0.71	73%	0%	33.51	84.46	2%
C06_1	0.251	0.25	7%	0%	189.45	13.25	2%
C06_2	0.459	0.42	31%	0%	31.52	145.62	2%
C07	0.200	0.64	63%	0%	13.38	149.53	2%
C08_1	0.144	0.41	30%	0%	15.44	93.25	2%
C08_2	0.159	0.25	7%	0%	166.27	9.56	2%
C09	1.207	0.61	59%	0%	52.93	228.02	2%
C10	1.456	0.25	7%	0%	95.93	151.78	2%
DR02	0.642	0.25	7%	0%	27.72	231.57	2%
R01	0.119	0.90	100%	100%	23.56	50.51	2%
R02	0.421	0.90	100%	100%	54.34	77.48	2%
R03	0.116	0.90	100%	100%	30.08	38.57	2%
R04	0.253	0.90	100%	100%	38.10	66.40	2%
R05	0.679	0.90	100%	100%	86.24	78.74	2%
R06	1.078	0.90	100%	100%	105.78	101.91	2%
R07	0.419	0.90	100%	100%	60.57	69.17	2%
R08	0.603	0.90	100%	100%	77.28	78.03	2%
R09	1.007	0.90	100%	100%	87.46	115.14	2%
R10	0.575	0.90	100%	100%	75.43	76.23	2%
R11	0.120	0.90	100%	100%	27.70	43.32	2%
R12	0.339	0.90	100%	100%	44.25	76.61	2%
R13	0.329	0.90	100%	100%	46.16	71.28	2%

4.4.3 Model Results

The on-site storage and conveyance system requirements were refined using the PCSWMM model. The model was used to ensure that peak flows are controlled to the allowable release rates and ensure that the 100-year hydraulic grade line is contained on-site within the storm sewer system.

Storage Requirements

Per the client request, the 100-year storm event is to be confined underground in the proposed storm sewer and dry pond stormwater management system. The PCSWMM model provided the storage volume requirements for the system. The storage required and storage provided in the storm sewers and stormwater management system is shown in **Table 4.5** below.

Table 4.5: Required (100-year) and Provided Storage Volumes

Storage Node	Drainage Area (ha)	Inlet Control Device	Required 100-yr Storage Volume* (m^3)	Provided Storage Volume (m^3)
POND A	16.94	630mm dia. Plate ICD	5,642	11,563
POND B	5.95	260mm dia. Plate ICD (in MH221)	2,511	5,855
POND C	5.64	270mm dia. Plate ICD	1,697	6,063
TOTAL	**28.54**	**-**	**9,850**	**23,481**

**Based on PCSWMM Model Results for a 100-year, 3-hour Chicago Storm.*
***Required and Provided Storage Volumes are for the Dry Pond Only*

Peak Flows

As shown in **Table 4.6**, the overall release rates from the site will adhere to the allowable release rates specified in **Section 4.2.2**. Peak flows from the site are release at a controlled rate to storm MH's 139, 159 & 160. The uncontrolled drainage areas are not tributary to the SMBP storm sewer and generate negligible flows and have therefore, been excluded from the results.

Table 4.6: Summary of Peak Flows

Outfall	Allowable Release Rate (L/s)	Peak Flow (L/s)		
		5 Year	100 Year	100 Year +20%
STMMH222 (Paragon Ave)	1,063	818	1,053	1,151
EX STMMH 105 (Leikin Drive)	188	145	178	195
EX STMMH 139 (Bill Leathem Drive)	150	107	150	168

**Based on PCSWMM Model Results for a 3-hour Chicago Storm; outfall results account for hydrograph timing.*

Hydraulic Grade Line (HGL)

The PCSWMM model was used to estimate the hydraulic grade line (HGL) elevation of the storm sewer system during the 100-year storm event. **Table 4.7** provides a summary of the 100-year HGL elevation at each storm manhole within the proposed development. The model results indicate that the 100-year HGL elevations will be confined within the storm sewer system. Refer to the dry pond cross sections on the Notes and Details Ponds Plan (124123-NDPND) for ponding elevations during the different storm events.

Table 4.7: Hydraulic Grade Line (HGL) Elevations

Manhole ID	MH Invert Elevation (m)	T/G Elevation (m)	HGL Elevation - 100yr4hr (m)	HGL Elevation - 100yr4hr+20% (m)	Clearance from T/G - 100yr (m)	Clearance from T/G - 100yr+20% (m)
CB028	89.55	91.35	89.59	89.59	1.76	1.76
CB097	88.12	89.50	88.75	88.99	0.75	0.51
CB098	88.26	89.60	88.82	89.16	0.78	0.44
CB099	88.22	89.80	89.04	89.53	0.76	0.27
CB309	88.18	91.35	88.97	89.43	2.38	1.92
CB324	87.97	90.37	88.75	88.99	1.62	1.38
CBMH215	87.29	90.11	88.35	88.65	1.76	1.46
CBMH218	87.87	90.56	89.06	89.46	1.50	1.10
CBMH223	87.83	90.00	88.75	88.99	1.25	1.01
CBMH224	87.77	90.30	88.75	88.99	1.55	1.31
CBMH300	88.69	90.65	89.66	90.15	0.99	0.50
CBMH301	88.62	90.70	89.51	89.96	1.19	0.74
CBMH302	88.18	90.67	89.41	89.71	1.26	0.96
CBMH303	88.63	90.64	89.46	89.87	1.18	0.77
CBMH305	88.40	90.62	89.44	89.85	1.18	0.77
CBMH306	88.03	90.72	89.41	89.71	1.31	1.01
CBMH307	87.89	90.52	90.01	90.87	0.51	-0.35
CBMH310	88.56	90.75	89.41	89.71	1.34	1.04
CBMH311	88.19	90.41	88.75	88.99	1.66	1.42
CBMH312	87.74	90.37	88.75	88.99	1.62	1.38
CBMH313	88.48	90.65	89.21	89.73	1.44	0.92
CBMH315	88.85	91.45	89.23	89.29	2.22	2.16
CBMH316	88.48	90.49	89.17	89.77	1.32	0.72
CBMH318	88.39	90.00	89.65	90.29	0.35	-0.29
CBMH319	88.44	90.05	89.97	90.40	0.08	-0.35
CBMH320	88.70	90.59	89.59	90.06	1.00	0.53
CBMH321	88.56	90.69	89.41	89.71	1.28	0.98
CBMH322	88.41	91.05	89.15	89.63	1.90	1.42
CBMH323	87.95	89.96	88.80	89.36	1.16	0.60
MH200	88.27	90.79	89.15	89.69	1.64	1.10
MH201	88.17	90.71	89.17	89.69	1.54	1.02
MH202	88.01	90.70	89.16	89.68	1.54	1.02
MH203	87.76	91.18	89.06	89.55	2.12	1.63
MH204	87.58	91.48	89.00	89.46	2.48	2.02
MH205	87.36	91.57	88.89	89.31	2.68	2.26

Manhole ID	MH Invert Elevation (m)	T/G Elevation (m)	HGL Elevation - 100yr4hr (m)	HGL Elevation - 100yr4hr+20% (m)	Clearance from T/G - 100yr (m)	Clearance from T/G - 100yr+20% (m)
MH206	87.23	91.56	88.71	89.08	2.85	2.48
MH207	86.80	90.97	88.37	88.67	2.60	2.30
MH208	86.67	90.33	88.36	88.65	1.97	1.68
MH209	87.91	90.70	89.10	89.62	1.60	1.08
MH210	87.70	90.68	89.03	89.51	1.65	1.17
MH211	87.61	90.67	88.92	89.37	1.75	1.30
MH212	87.39	90.59	88.64	88.98	1.95	1.61
MH213	87.24	91.59	88.47	88.76	3.12	2.83
MH214	87.44	90.28	88.52	88.95	1.76	1.33
MH216	88.20	90.30	89.43	89.89	0.87	0.41
MH217	88.01	90.30	89.26	89.71	1.04	0.59
MH219	87.77	90.82	88.81	89.16	2.01	1.66
MH221	87.50	90.07	89.40	89.71	0.67	0.36
MH225	88.23	91.01	89.58	90.28	1.43	0.73

**Based on PCSWMM Model Results for a 3-hour Chicago Storm.*

Boundary Condition

A downstream boundary condition was applied to each of the outlets during the 100-year storm event, to ensure the model was conservative in its determination of the 100-year HGL elevations. The HGL in each of the outlet pipes was assumed to be at the outlet pipe obvert.

Stress Test

Table 4.7 also provides the estimated HGL elevations for the ‘stress test’ event. The stress test event represents a 20% increase (rainfall intensity and total precipitation) in the 100-year design event. The ‘stress test’ event will not be confined within the storm sewer system. Ponding will occur within the parking lot sags and may cascade off-site. The major system overland flow will be diverted through overland pathways and spill off-site to Bill Leathem Drive and Paragon Avenue; ultimately discharging to Barrhaven Creek.

Foundation Drains

The proposed building will be slab-on-grade, as such, there are no concerns with the surcharged HGL elevations. The general grade of the site will allow water to pond in the parking lot and overflow downstream before impacting the building. Refer to the Grading Plan (drawing 124123-GR).

5.0 EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter socks (catchbasin inserts) will be placed in existing and proposed catchbasins and catchbasin manholes, and will remain in place until vegetation has been established and construction is completed;
- Silt fencing will be placed along the surrounding construction limits;
- Mud mats will be installed at the site entrances;
- Strawbale or rock check dams will be installed in swales and ditches;
- The contractor will be required to perform regular street sweeping and cleaning as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site;

Erosion and sediment control measures should be inspected daily and after every rain event to determine maintenance, repair or replacement requirements. Sediments or granulars that enter site sewers shall be removed immediately by the contractor. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been established. Refer to the Erosion and Sediment Control Plan (124123-ESC) for additional information.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Watermain

The analysis of the proposed watermain network confirms the following:

- The proposed development will be serviced by extending a private 300mm/150mm diameter watermain from the existing 300mm dia. watermain in Bill Leathem Drive and Paragon Avenue.
- There are adequate pressures in the existing watermain infrastructure to meet the required domestic demands for the development.
- There is adequate flow to service the proposed fire protection system.

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- The proposed development will require a realignment of the existing Barhaven Sanitary trunk sewer.
- The proposed development will be serviced by a private 250mm diameter sanitary sewer that will connect to the realigned Barhaven Trunk Sewer.
- There is adequate capacity within the existing sanitary infrastructure to service the proposed development.

Stormwater Management

The following provides a summary of the storm sewer and stormwater management system:

- Proposed storm sewer system is to connect with the existing storm sewer system on Bill Leathem Drive, Paragon Avenue, and Leikin Drive.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 10-year peak flow using the Rational Method.

  - Underground storage is to be provided within the storm sewer system and surface storage is provided in dry ponds.
  - There will be no surface ponding in the parking lot or truck court area during the 100-year storm event as the 100-year hydraulic grade line (HGL) is contained within the storm sewer system.
- Parking lot graded to ensure that static ponding depths do not exceed 0.35m.
  - Surface ponding would only office for storm events greater than the 100-year event.

A major overland flow route is provided to Bill Leathem Drive, Paragon Avenue, and Leikin Drive, and ultimately to the down stream stormwater management facility.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, catchbasin inserts, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.

7.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Matt Hrehoriak, P.Eng.
Project Manager
Land Development Engineering

Reviewed by:

J. Lee Sheets, C.E.T.
Director
Land Development Engineering

Kallie Auld, P.Eng.
Project Manager
Water Resources Engineering

Appendix A
Water Servicing Information

Detailed Building Use Domestic Water Demands

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial Building:	150	L/day/loading bay
	950	L/day/bathroom
Commercial Office:	75	L/day/9.3m² Floor area

Commercial / Industrial Peaking Factors City of Ottawa Water Distrubution Guidelines

Conditions	Peaking Factor	
Maximum Day	1.5	x avg day
Peak Hour	1.8	x max day

Proposed Development Conditions

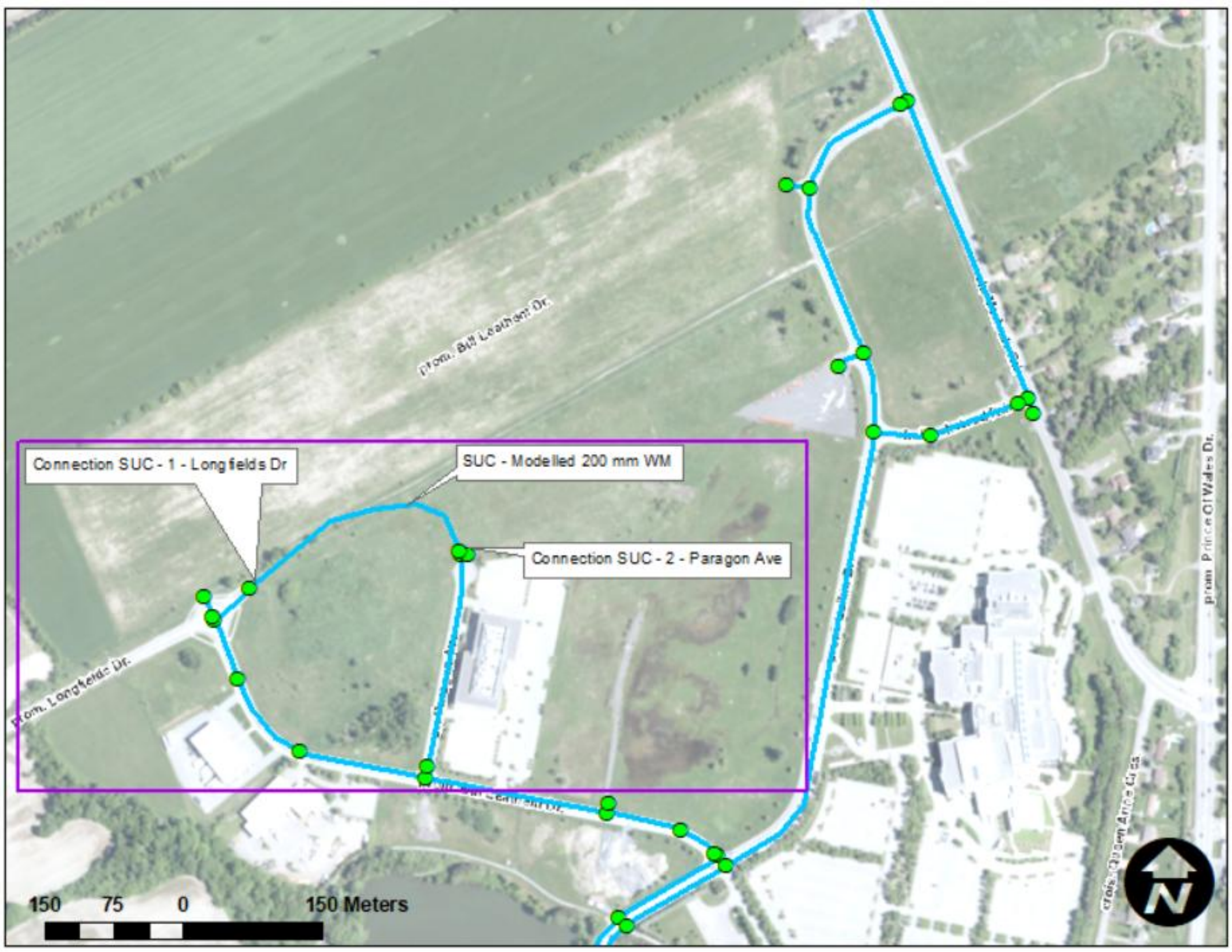
	Commercial Office	Industrial Building	Primary Guard House	Secondary Guard House	Totals
Floor Area	3900	N/A	25.77	13.75	
No. Bathrooms (Warehouse Only)	N/A	100	N/A	N/A	
No. Loading Bays	N/A	59	N/A	N/A	
Total Daily Volume (Liters)	31451.6	103850.0	207.8	110.9	135301.6
Avg Day Demand (L/s)	0.364	1.202	0.002	0.001	**1.57**
Max Day Demand (L/s)	0.546	1.803	0.004	0.002	**2.35**
Peak Hour Demand (L/s)	0.983	3.245	0.006	0.003	**4.24**

Boundary Conditions
SUC Pressure Zone – 99 Bill Leathem Drive

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	94	1.57
Maximum Daily Demand	141	2.35
Peak Hour	254	4.24
Fire Flow Demand #1	7,572	126.20
Fire Flow Demand #2	10,000	166.67
Fire Flow Demand #3	15,000	250.00

Location



Results

Existing Condition (Pre- SUC Pressure Zone Reconfiguration)

Connection SUC - 1 - Longfields Dr

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.8	60.2
Peak Hour	125.0	49.2
Max Day plus Fire Flow #1	122.7	45.9
Max Day plus Fire Flow #2	118.6	39.9
Max Day plus Fire Flow #3	107.2	23.7
[1] Ground Elevation =	90.5	m

Connection SUC - 2 - Paragon Ave

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.8	60.2
Peak Hour	125.0	49.2
Max Day plus Fire Flow #1	123.3	46.7
Max Day plus Fire Flow #2	119.4	41.3
Max Day plus Fire Flow #3	109.0	26.4
[1] Ground Elevation =	90.4	m

Future Condition (Post- SUC Pressure Zone Reconfiguration)

Connection SUC - 1 - Longfields Dr

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	80.1
Peak Hour	144.0	76.1
Max Day plus Fire Flow #1	138.9	68.8
Max Day plus Fire Flow #2	134.5	62.6
Max Day plus Fire Flow #3	122.6	45.6
[1] Ground Elevation =	90.5	m

Connection SUC - 2 - Paragon Ave

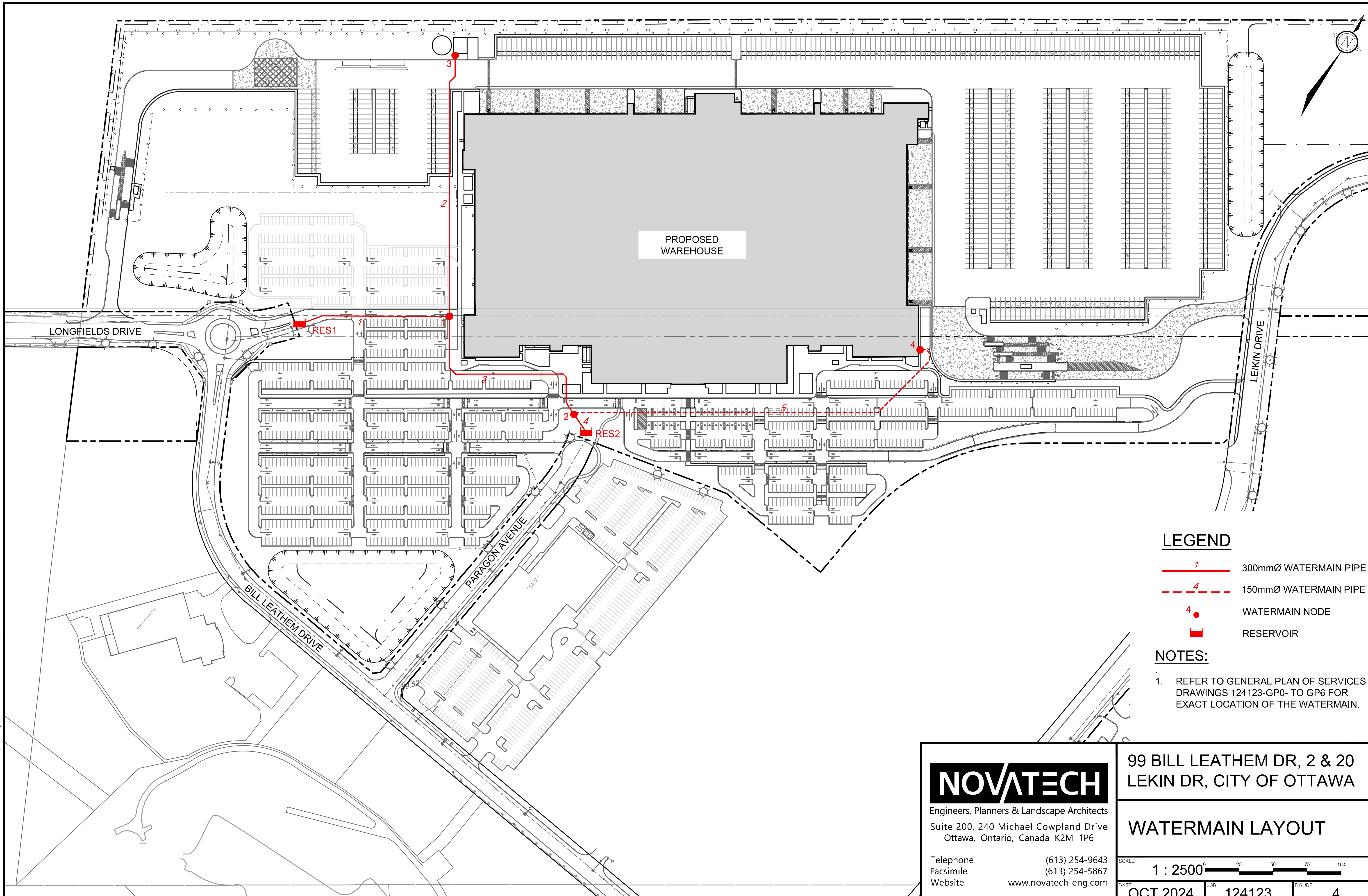
Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	80.2
Peak Hour	144.0	76.2
Max Day plus Fire Flow #1	139.4	69.7
Max Day plus Fire Flow #2	135.4	64.0
Max Day plus Fire Flow #3	124.4	48.4
[1] Ground Elevation =	90.4	m

Notes

1. The presented results in this boundary condition represent results for the SUC pressure zone connection.
2. A 203 mm PVC WM was added to the model, bridging Connection SUC – 1 – Longfields Dr and Connection SUC – 2 – Paragon Ave to avoid dead-end WM boundary condition results. The engineer must model designed private looped watermains.
3. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.



LEGEND

- 300mmØ WATERMAIN PIPE
- 150mmØ WATERMAIN PIPE
- WATERMAIN NODE
- RESERVOIR

NOTES:

1. REFER TO GENERAL PLAN OF SERVICES DRAWINGS 124123-GP0- TO GP6 FOR EXACT LOCATION OF THE WATERMAIN.

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

99 BILL LEATHEM DR, 2 & 20 LEKIN DR, CITY OF OTTAWA

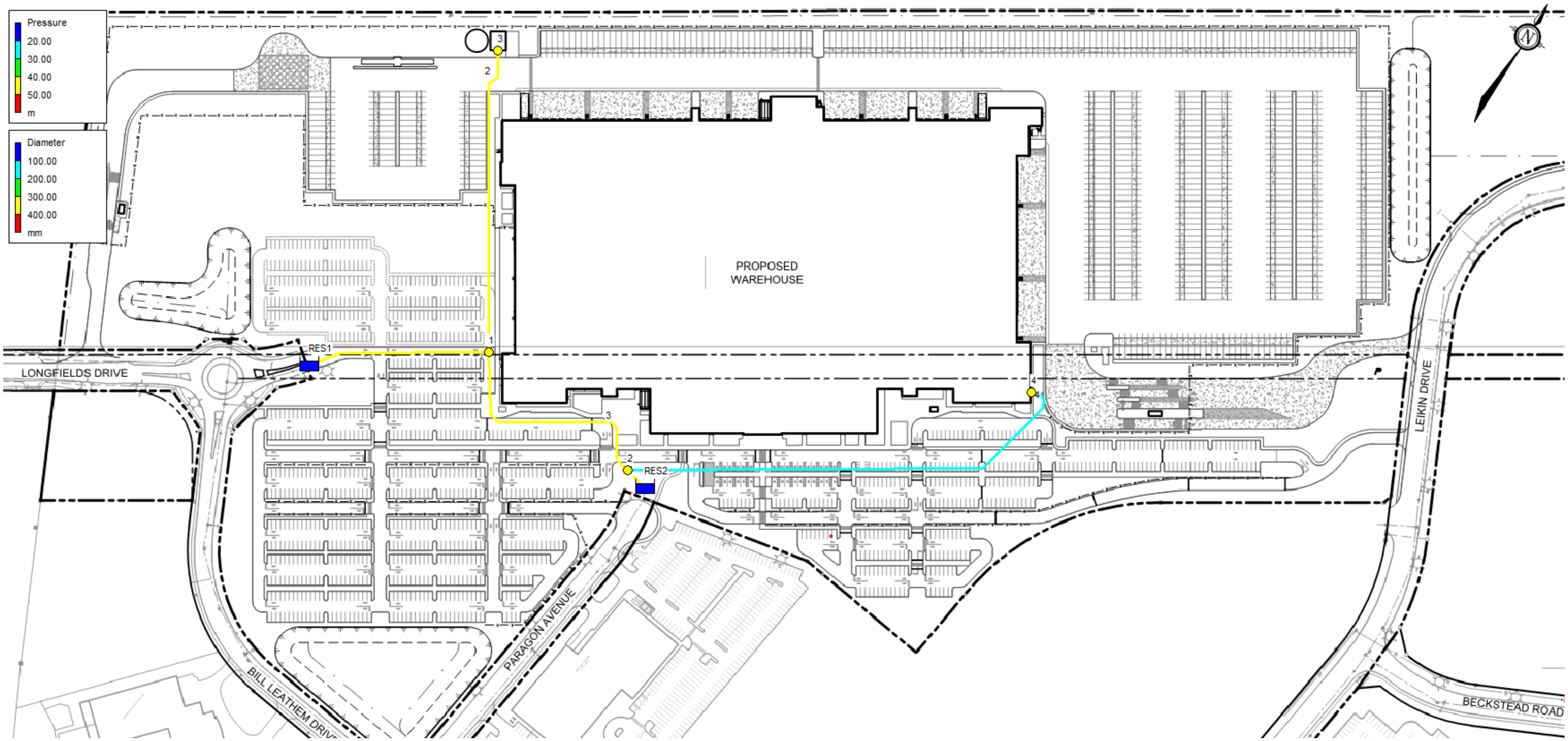
WATERMAIN LAYOUT

SCALE	DATE	JOB	FIGURE
1 : 2500	OCT 2024	124123	4

M:\2024\124123\CAD\Civil\WATER\124123-WATER.dwg, Water, Oct 27, 2024 - 2:34pm, mhrehoriak

SHT11X17.DWG - 279mmX432mm

Maximum HGL EPANET Hydraulic Analysis



```
******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 2.2                             *
******************************************************************
```

Input File: (AD) Max HGL.net

Existing Conditions

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	132.80	41.74	0.00	
4	1.57	132.76	40.82	0.00	
1	0.00	132.80	41.14	0.00	
3	0.00	132.80	42.39	0.00	Max Pressure = 60.3psi
RES1	-0.28	132.80	0.00	0.00	Reservoir
RES2	-1.29	132.80	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	0.28	0.00	0.00	Open
5	1.29	0.02	0.00	Open
2	0.00	0.00	0.00	Open
3	-0.28	0.00	0.00	Open
4	-1.57	0.09	0.14	Open

```
******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 2.2                             *
******************************************************************
```

Input File: (AD) Max HGL.net

Future SUC Zone Reconfiguration

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

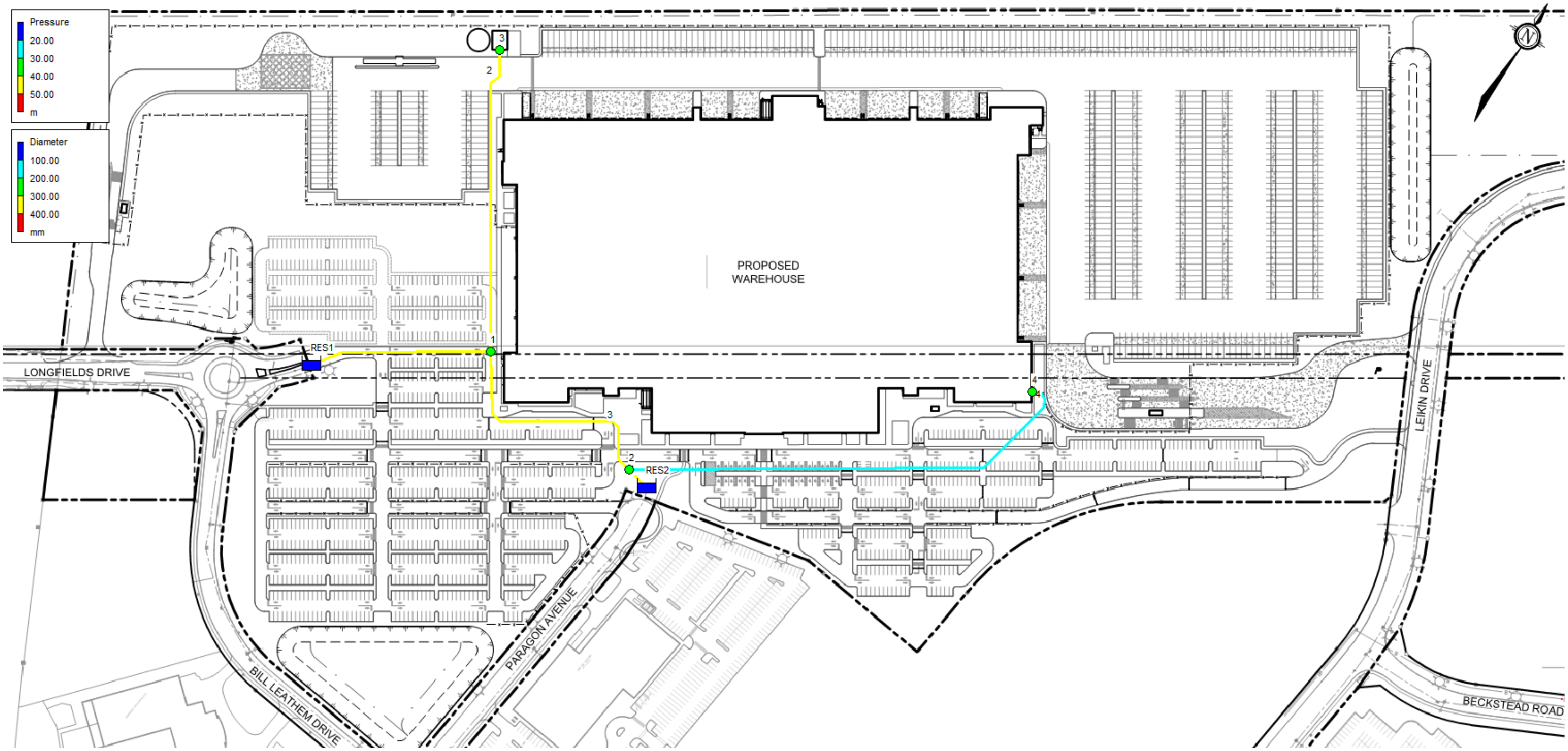
Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	146.90	55.84	0.00	
4	1.57	146.86	54.92	0.00	
1	0.00	146.90	55.24	0.00	
3	0.00	146.90	56.49	0.00	Max Pressure = 80.4psi
RES1	-0.28	146.90	0.00	0.00	Reservoir
RES2	-1.29	146.90	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	0.28	0.00	0.00	Open
5	1.29	0.02	0.00	Open
2	0.00	0.00	0.00	Open
3	-0.28	0.00	0.00	Open
4	-1.57	0.09	0.14	Open

Peak Hour Minimum HGL EPANET Hydraulic Analysis



```
****************************************************************
*                          E P A N E T                         *
*                  Hydraulic and Water Quality                 *
*                  Analysis for Pipe Networks                  *
*                         Version 2.2                          *
****************************************************************
```

Input File: (PH) Min HGL.net

Existing Conditions

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	125.00	33.94	0.00	
4	4.24	124.74	32.80	0.00	Min Pressure = 46.7psi
1	0.00	125.00	33.34	0.00	
3	0.00	125.00	34.59	0.00	
RES1	-0.76	125.00	0.00	0.00	Reservoir
RES2	-3.48	125.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	0.76	0.01	0.00	Open
5	3.48	0.05	0.01	Open
2	0.00	0.00	0.00	Open
3	-0.76	0.01	0.00	Open
4	-4.24	0.24	0.88	Open

```
**********************************************************************
*                           E P A N E T                              *
*                   Hydraulic and Water Quality                      *
*                   Analysis for Pipe Networks                       *
*                         Version 2.2                                *
**********************************************************************
```

Input File: (PH) Min HGL.net

Future SUC Zone Reconfiguration

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

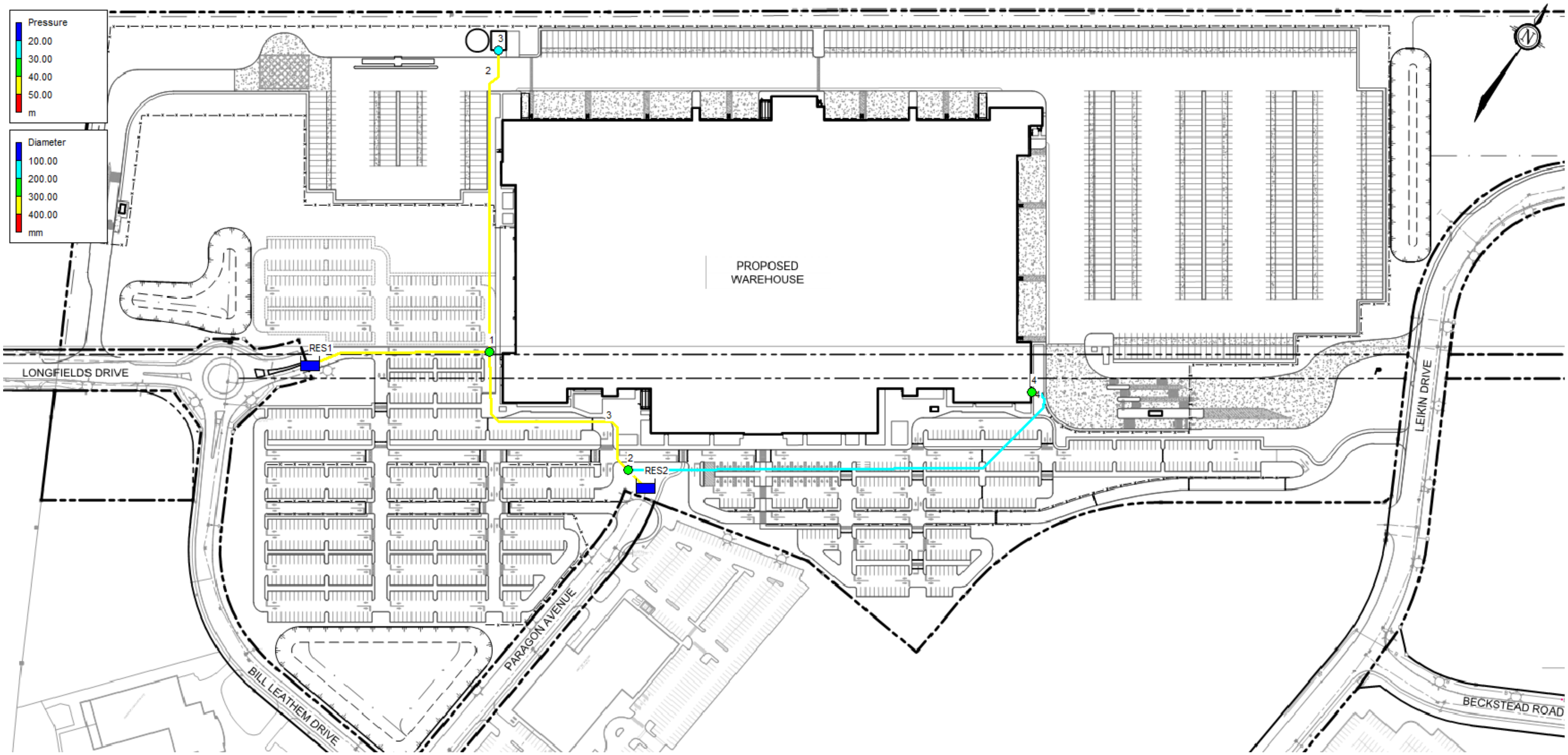
Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	144.00	52.94	0.00	
4	4.24	143.74	51.80	0.00	Min Pressure = 73.7psi
1	0.00	144.00	52.34	0.00	
3	0.00	144.00	53.59	0.00	
RES1	-0.76	144.00	0.00	0.00	Reservoir
RES2	-3.48	144.00	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	0.76	0.01	0.00	Open
5	3.48	0.05	0.02	Open
2	0.00	0.00	0.00	Open
3	-0.76	0.01	0.00	Open
4	-4.24	0.24	0.88	Open

Maximum Day + Fire Flow HGL EPANET Hydraulic Analysis



```
******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 2.2                             *
******************************************************************
```

Input File: Max Day + FF.net
Existing Conditions

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	123.22	32.16	0.00	
4	2.35	123.13	31.19	0.00	
1	0.00	122.49	30.83	0.00	
3	126.20	120.27	29.86	0.00	Min Pressure = 42.5psi
RES1	-48.08	122.70	0.00	0.00	Reservoir
RES2	-80.47	123.30	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	48.08	0.68	1.92	Open
5	80.47	1.14	4.98	Open
2	-126.20	1.79	11.47	Open
3	78.12	1.11	4.72	Open
4	-2.35	0.13	0.29	Open

```
****************************************************************
*                         E P A N E T                          *
*                 Hydraulic and Water Quality                  *
*                 Analysis for Pipe Networks                   *
*                        Version 2.2                           *
****************************************************************
```

Input File: Max Day + FF.net

Future SUC Zone Reconfiguration

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	RES1	1	111.4	300
5	RES2	2	16.1	300
2	3	1	193.3	300
3	2	1	155.5	300
4	4	2	290.5	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
2	0.00	139.33	48.27	0.00	
4	2.35	139.24	47.30	0.00	
1	0.00	138.66	47.00	0.00	
3	126.20	136.44	46.03	0.00	Min Pressure = 65.5psi
RES1	-51.73	138.90	0.00	0.00	Reservoir
RES2	-76.82	139.40	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	51.73	0.73	2.20	Open
5	76.82	1.09	4.57	Open
2	-126.20	1.79	11.47	Open
3	74.47	1.05	4.32	Open
4	-2.35	0.13	0.29	Open

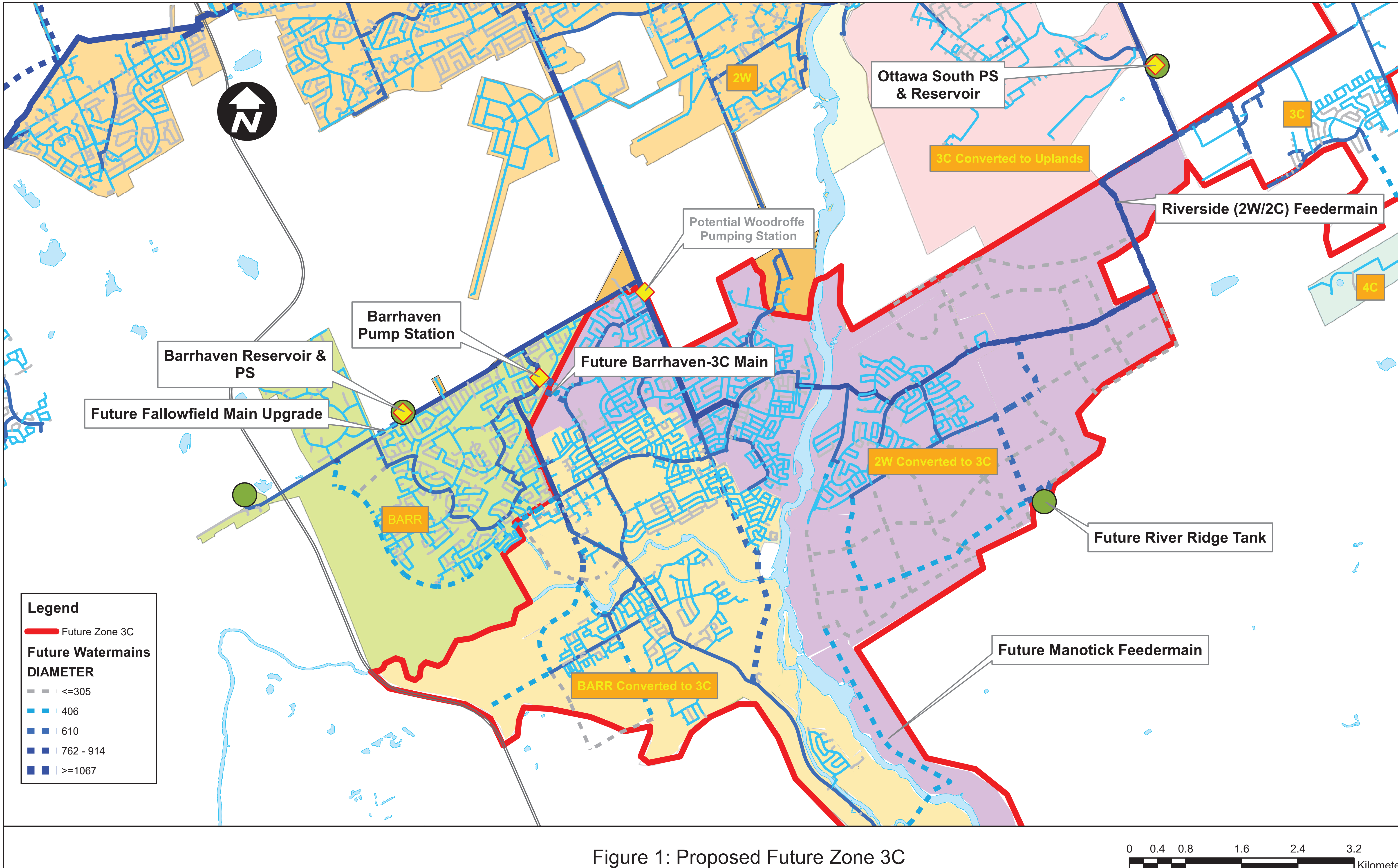


Figure 1: Proposed Future Zone 3C

Appendix B
Sanitary Servicing Information

Detailed Building Use Sanitary Flows

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial Building:	150	L/day/loading bay
	950	L/day/bathroom
Commercial Office:	75	L/day/9.3m² Floor area

Commercial / Industrial Peaking Factors City of Ottawa Sewer Design Guidelines

Building Use	Peaking Factor	
Commercial	1.5	
Industrial	3.1	Sewer Design Guidelines Appendix 4B

Proposed Building Sanitary Flows

	Commercial Office	Industrial Building	Primary Guard House	Secondary Guard House	Totals
Floor Area	3900	N/A	25.77	13.75	
No. Bathrooms	N/A	100	N/A	N/A	
No. Loading Bays	N/A	59	N/A	N/A	
Total Daily Volume (Liters)	31451.6	103850.0	207.8	110.9	135620.3
Peak Building Sanitary Flow (L/s)	0.546	3.726	0.004	0.002	**4.28**

Extraneous Flows

*Total Area (ha)	Extraneous Flow Alottment (L/s/ha)	Total Extraneous Flows (L/s)
30.0	0.33	**9.90**

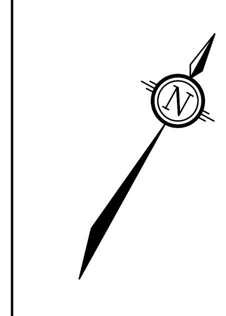
*Total Area - Developed area only

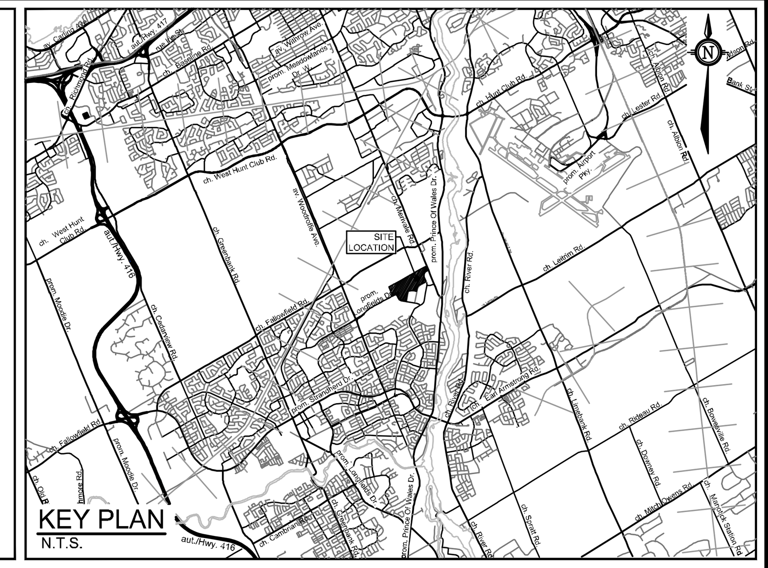
Total Site Peak Sanitary Flows

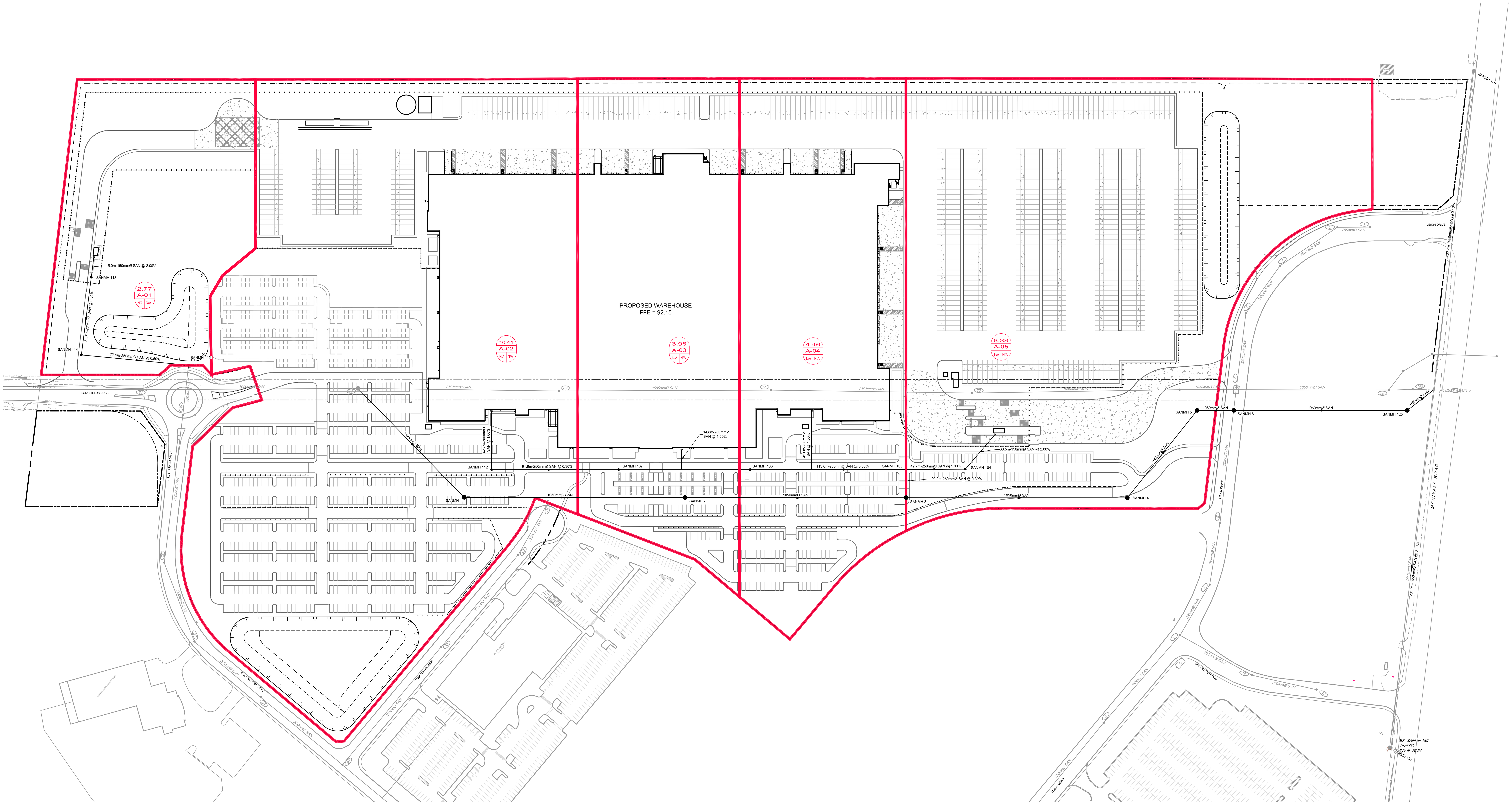
Total Peak Building Sanitary Flows (L/s)	Total Extraneous Flows (L/s)	Total Site Peak Flows (L/s)
4.28	9.90	**14.18**

LEGEND

- PROPERTY LINE
- PROPOSED SANITARY SEWER AND MANHOLE
- DIRECTION OF FLOW
- SAN MH — EXISTING SANITARY MANHOLE & SEWER
- SANITARY SEWER DRAINAGE AREA BOUNDARY
- 6.388 / A-01 / N/A N/A — DRAINAGE AREA (ha) / SAN SEWER PIPE RUN / POPULATION / NO. UNITS







REFER TO 124123-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
1	ISSUED FOR SPA	OCT 29/2024	MJH

SCALE 1:1250

1:1250
0 10 20 30 40 50

DESIGN MJH / LSC
CHECKED MJH
DRAWN LSC
CHECKED MJH
APPROVED MJH

LICENSED PROFESSIONAL ENGINEER
M.J. HREHORIAK
100211256
OCT 29/2024
PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
99 BILL LEATHEM, 2 & 20 LEIKEN DRIVE

DRAWING NAME
SANITARY DRAINAGE AREA PLAN

PROJECT No. 124123
REV REV # 1
DRAWING No. 124123-SAN

Project No. 124123
Project Name: Project X
Project Location: 99 Bill Leathem Dr. 2 20 Leikin Dr

NOVATECH
Engineers, Planners & Landscape Architects

Date: October 2024

Sanitary Sewer Design Sheet

LOCATION			COMMERCIAL / INDUTRIAL FLOW						TOTAL	PIPE					
AREA ID	FROM	TO	AREA (ha)	ACCUM AREA (ha)	PEAK FACTOR	PEAK FLOW (l/s)	ACCUM PEAK FLOW (l/s)	INFIL. FLOW (l/s)	PEAK FLOW (l/s)	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	Q/Qfull
West System															
A-01	CAP	113	2.77	2.77	1.5	0.002	0.002	0.91	0.92	150	2.00	15.0	21.5	1.2	4.3%
	113	114		2.77	0.0	0.000	0.002	0.91	0.92	250	0.50	56.7	42.0	0.9	2.2%
	114	115		2.77	0.0	0.000	0.002	0.91	0.92	250	0.50	77.9	42.0	0.9	2.2%
East System (Trunk Sewer Connection)															
A-02	112	107	10.41	10.41	*Varies	1.242	1.24	3.44	4.68	250	0.30	91.9	32.5	0.7	14.4%
A-03	107	106	3.98	14.39	3.1	1.788	3.03	4.75	7.78	250	0.30	95.2	32.5	0.7	23.9%
A-04	106	105	4.46	18.85	3.1	1.242	4.27	6.22	10.49	250	0.30	113.0	32.5	0.7	32.2%
A-05	104	105	8.38	8.38	1.5	0.004	0.004	2.77	2.77	250	1.00	42.7	59.4	1.2	4.7%
	105	3		27.23		0.000	4.28	8.99	13.26	250	0.30	20.2	32.5	0.7	40.8%
							4.28	**9.90**	**14.18**						

* Area A-02 contains commercial and industrial land uses with peaking factors of 1.5 and 3.1 respectively. Refer to the detailed building use sanitary flows for a comprehensive breakdown.

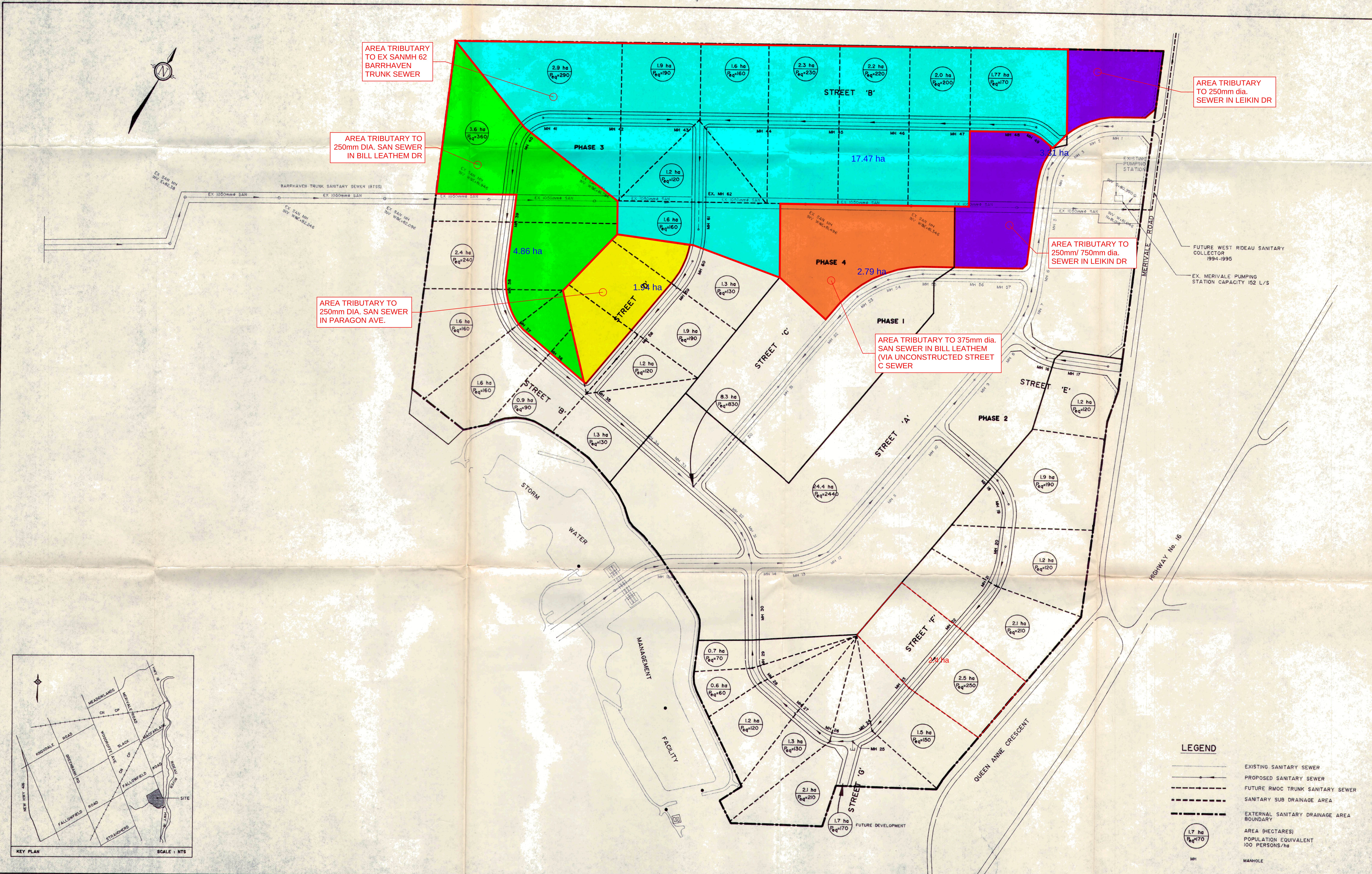
** The Industrial portion of the building was divided evenly between the 3 proposed building services (areas A-02, A-03, and A-04).

Design Parameters:

City of Ottawa Sewer Design Guidelines (Appendix 4-A)
- Extraneous Flows 0.33 l/s/ha
- Commercial Peaking Factor 1.5

City of Ottawa Sewer Design Guidelines (Appendix 4-B)

Industrial Peaking factor 3.1



NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1	REVISED PER R.M.O.C. COMMENTS	01.06.92	JFB

LICENSED PROFESSIONAL ENGINEER UDO BOEHME PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER R.S. CEBRYK PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
OTTAWA, ONTARIO

DESIGN	UB/JFB
CHECKED	UB
DRAWN	JFB
CHECKED	UB
APPROVED	RSC

SCALE 1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK - PHASE 2 & 3

SANITARY DRAINAGE AREA PLAN

CONTRACT No. 92019
DATE JULY 1992
DRAWING No. 92019-SAN

Sanitary Flow Allotment Calculations

Sewer Outlet Location	Area (ha)	Equivalent Population	Peak Flow (L/s)	Extraneous Flow (L/s)	Total Peak Sanitary Flow Allotment (L/s)
250mm dia. Bill Leathem Dr.	4.9	490	7.15	0.54	7.68
250mm dia. Paragon Ave.	2.0	200	2.92	0.22	3.14
1050mm dia. Trunk Sewer EX SANMH 62	17.4	1740	25.38	1.91	27.29
250mm/750mm dia. Leikin Dr.	3.4	340	4.96	0.37	5.33
375mm dia. Bill Leathem Dr Via Street C	2.8	280	4.08	0.31	4.39
Total	30.5	3050	44.48	3.36	47.83

Design Criteria From SMB Ph II & III Services Design Report :

Equivalent Population =	100	People/ha
Design Flow =	450	L/day/person
Peaking Factor =	2.8	
Extraneous Flows=	0.11	L/s/ha

SANITARY SEWER DESIGN SHEET

PROJECT: **SOUTH MERIVALE BUSINESS PARK Phases II and III** PAGE: 1 of 5

DESIGNED BY : LJ DEVELOPER: **CITY OF NEPEAN** DATE: June 22, 1992

CHECKED BY : ENGINEERS: **NOVATECH ENGINEERING CONSULTANTS LTD.** Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'F'	19	10	190	1.9	190	1.9	2.80	2.77	0.21	2.98	154.0	250	PVC	0.30	33.98	0.67
'F'	20	21	120	1.2	120	1.2	2.80	1.75	0.13	1.88	58.0	250	PVC	0.30	33.98	0.67
'F'	21	22	210	2.1	330	3.3	2.80	4.81	0.36	5.18	80.0	250	PVC	0.30	33.98	0.67
'F'	22	23	250	2.5	580	5.8	2.80	8.46	0.64	9.10	111.0	250	PVC	0.30	33.98	0.67
'F'	23	24	150	1.5	730	7.3	2.80	10.65	0.80	11.45	80.0	250	PVC	0.30	33.98	0.67
Flow From Future Development Into Manhole																
			170	1.7												
'F'	24	26	210	2.1	1110	11.1	2.80	16.19	1.22	17.41	64.0	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 L/ha/s)

M = peaking factor =2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

SANITARY SEWER DESIGN SHEET

PROJECT: **SOUTH MERIVALE BUSINESS PARK Phases II and III** Page: 2 of 5

DESIGNED BY : LJ   DEVELOPER: **CITY OF NEPEAN**   DATE: SEPTEMBER 6, 1990

CHECKED BY :   ENGINEERS: **NOVATECH ENGINEERING CONSULTANTS LTD.**   Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'F'	26	27	130	1.3	1240.0	12.4	2.80	18.08	1.36	19.45	64.0	250	PVC	0.30	33.98	0.67
'F'	27	28	120	1.2	1360	13.6	2.80	19.83	1.50	21.33	66.0	250	PVC	0.30	33.98	0.67
'F'	28	29	60	0.6	1420	14.2	2.80	20.71	1.56	22.27	24.0	250	PVC	0.30	33.98	0.67
'F'	29	14	70	0.7	1490	14.9	2.80	21.73	1.64	23.37	150.0	250	PVC	0.30	33.98	0.67
'D'	62	59	130	1.3	130	1.3	2.80	1.90	0.14	2.04	44.0	250	PVC	0.30	33.98	0.67
'D'	59	58	190	1.9	320	3.2	2.80	4.67	0.35	5.02	87.0	250	PVC	0.30	33.98	0.67
'D'	58	35	120	1.2	440	4.4	2.80	6.42	0.48	6.90	110.0	250	PVC	0.31	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8

Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)   n = 0.013
Q (i) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (i) (L/s)

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK Phases II and III
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: June 22, 1992
Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'B'	40	39	360	3.6	360	3.6	2.80	5.25	0.40	5.65	113.0	250	PVC	0.30	33.98	0.67
'B'	39	38	240	2.4	600	6.0	2.80	8.75	0.66	9.41	95.0	250	PVC	0.30	33.98	0.67
'B'	38	37	160	1.6	760	7.6	2.80	11.08	0.84	11.92	61.0	250	PVC	0.30	33.98	0.67
'B'	37	36	160	1.6	920	9.2	2.80	13.42	1.01	14.43	60.8	250	PVC	0.30	33.98	0.67
'B'	36	35	90	0.9	1010	10.1	2.80	14.73	1.11	15.84	75.0	250	PVC	0.30	33.98	0.67
'B'	35	34	130	1.3	1580	15.8	2.80	23.04	1.74	24.78	106.0	250	PVC	0.30	33.98	0.67
'B'	41	42	290	2.9	290	2.9	2.80	4.23	0.32	4.55	110.0	250	PVC	0.30	33.98	0.67
'B'	42	43	190	1.9	480	4.8	2.80	7.00	0.53	7.53	113.0	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (p) = (P*q*M)/(86,400) (L/s)
Q (i) = I*A (L/s), A in hectares
n = 0.013

SANITARY SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK Phases II and III

DESIGNED BY : LJ

DEVELOPER: CITY OF NEPEAN

DATE: SEPTEMBER 6, 1990

CHECKED BY :

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'B'	49	47	170	1.7	170	1.7	2.80	2.48	0.19	2.67	105.0	250	PVC	0.30	33.98	0.67
'B'	47	46	200	2.0	370	3.7	2.80	5.40	0.41	5.80	86.0	250	PVC	0.30	33.98	0.67
'B'	46	45	220	2.2	590	5.9	2.80	8.60	0.65	9.25	99.0	250	PVC	0.30	33.98	0.67
'B'	45	44	230	2.3	820	8.2	2.80	11.96	0.90	12.86	101.0	250	PVC	0.30	33.98	0.67
'B'	44	43	160	1.6	980	9.8	2.80	14.29	1.08	15.37	97.0	250	PVC	0.30	33.98	0.67
'D'	43	62	120	1.2	1580	15.8	2.80	23.04	1.74	24.78	118.0	250	PVC	0.30	33.98	0.67
'D'	61	62	160	1.6	160	1.6	2.80	2.33	0.18	2.51	38.0	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

total flow to EX SAN MH 62

SANITARY SEWER DESIGN SHEET

PROJECT: **SOUTH MERIVALE BUSINESS PARK Phases II and III** PAGE: 5 of 5

DESIGNED BY : LJ

DEVELOPER: **CITY OF NEPEAN** DATE: June 22, 1992

CHECKED BY :

ENGINEERS: **NOVATECH ENGINEERING CONSULTANTS LTD.** Revision:

LOCATION			INDIVIDUAL		CUMMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'E'	17	8	120	1.2	120	1.2	2.80	1.75	0.13	1.88	211.3	250	PVC	0.30	33.98	0.67

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s) n = 0.013

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

SANITARY SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 5, 1991
Revision: Dec. 31/91

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (I) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'A'	EXT.	15A	Constant Flow from Longfield-Davidson Heights = 249.45 L/s*							249.45		750	CONC	0.15	449.81	0.99
	15A	15								249.45	18.0	750	CONC	0.15	449.81	0.99
	15	14	200	2.0	200	2.0	2.80	2.92	0.22	252.59	105.0	750	CONC	0.15	449.81	0.99
Flow from Street 'B' into MH 34:			1580	15.8												
'B'	34	33	170	1.7	1750	17.5	2.80	25.52	1.93	27.45	94.0	375	CONC	0.18	77.60	0.68
Flow from Street 'C' into MH 33:			830	8.3												
'B'	33	32	110	1.1	2690	26.9	2.80	39.23	2.96	42.19	79.0	375	CONC	0.18	77.60	0.68
	32	31			2690	26.9	2.80	39.23	2.96	42.19	27.5	375	CONC	0.18	77.60	0.68
	31	14			2690	26.9	2.80	39.23	2.96	42.19	34.0	375	CONC	0.18	77.60	0.68

* Constant flow from external area = 249.45 L/s per Delcan Design Sheet dated 91.10.21

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8 for Light Industrial land use

Q (p) = peak population flow (L/s)
Q (I) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)
Q (I) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (I) (L/s)

n = 0.013

SANITARY SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 4, 1991
Revision: Dec. 31/91

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	FACTOR M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'F' into MH 14:			1540	15.4												
'A'	14	13	120	1.2	4550	45.5	2.80	66.35	5.01	320.81	72.0	750	CONC	0.14	434.56	0.95
	13	12	120	1.2	4670	46.7	2.80	68.10	5.14	322.69	40.5	750	CONC	0.14	434.56	0.95
	12	11	220	2.2	4890	48.9	2.80	71.31	5.38	326.14	119.0	750	CONC	0.15	449.81	0.99
	11	10	260	2.6	5150	51.5	2.80	75.10	5.67	330.22	115.0	750	CONC	0.15	449.81	0.99
Flow from Street 'F' into MH 10:			190	1.9												
'A'	10	9	180	1.8	5520	55.2	2.80	80.50	6.07	336.02	86.5	750	CONC	0.15	449.81	0.99
	9	8	140	1.4	5660	56.6	2.80	82.54	6.23	338.22	86.0	750	CONC.	0.15	449.81	0.99

q = average daily per cap. flow (450 L/cap. d)
I = unit of peak extraneous flow (0.11 l/ha/s)
M = peaking factor = 2.8 for Light Industrial land use

Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)
Q (i) = I*A (L/s), A in hectares
Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

SANITARY SEWER DESIGN SHEET

DATE: NOV.4, 1991

Revision: Dec. 31/91

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1

DEVELOPER: CITY OF NEPEAN

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DESIGNED BY : SG

CHECKED BY : LJ

LOCATION			INDIVIDUAL		CUMULATIVE		PEAKING FACTOR	POP FLOW	PEAK EXTRAN.	PEAK DESIGN	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	POP	AREA (ha)	POP	AREA (ha)	M	Q (p) (L/s)	FLOW Q (i) (L/s)	FLOW Q (d) (L/s)	LENGTH (m)	PIPE SIZE (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'E' into MH 8:			-120	1.2												
'A'	8	7	250	2.5	6030	60.3	2.80	87.94	6.63	344.02	44.0	750	CONC	0.16	464.57	1.02
	7	6			6030	60.3	2.80	87.94	6.63	344.02	44.0	750	CONC	0.16	464.57	1.02
	6	5	250	2.5	6280	62.8	2.80	91.58	6.91	347.94	96.0	750	CONC	0.16	464.57	1.02
'A'	1	2	230	2.3	230	2.3	2.80	3.35	0.25	3.61	23.5	250	PVC	0.30	33.98	0.67
	2	3			230	2.3	2.80	3.35	0.25	3.61	49.0	250	PVC	0.30	33.98	0.67
	3	4	190	1.9	420	4.2	2.80	6.13	0.46	6.59	43.0	250	PVC	0.30	33.98	0.67
	4	5			420	4.2	2.80	6.13	0.46	6.59	56.0	250	PVC	0.30	33.98	0.67
'A'	* Service Connections:															
		S9			290	2.9	2.80	4.23	0.32	4.55		250	PVC	1.00	62.04	1.22

q = average daily per cap. flow (450 L/cap. d)

I = unit of peak extraneous flow (0.11 l/ha/s)

M = peaking factor = 2.8 for Light Industrial land use

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q (d) = peak design flow (L/s)

Q (p) = (P*q*M)/(86,400) (L/s)

Q (i) = I*A (L/s), A in hectares

Q (d) = Q (p) + Q (i) (L/s)

n = 0.013

* Note: 10 service connections - worst case @ manhole S9

Matthew Hrehoriak

From: Sharif, Golam <sharif.sharif@ottawa.ca>
Sent: Friday, July 30, 2021 2:34 PM
To: Matthew Hrehoriak
Subject: RE: 99 Bill Leathem Dr, 2 & 20 Leikin Dr Sanitary Capacity Confirmation

Hi Matthew,

We have sufficient capacity for the proposed sanitary flows. Thanks.

Sharif

From: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Sent: July 28, 2021 11:15 AM
To: Sharif, Golam <sharif.sharif@ottawa.ca>
Subject: 99 Bill Leathem Dr, 2 & 20 Leikin Dr Sanitary Capacity Confirmation

Hi Sharif,

In response to comments 2.38 can you please confirm the downstream capacity of the sanitary sewer for the proposed South Merivale Business Park development.

The proposed flows are as follows:

Connection #1 (Bill Leatham Round-a-bout connection): Peak flow 0.018 L/s, Infiltration 1.07 1.07 L/s, **Total Flow = 1.08 L/s**

Connection #2 (Paragon Avenue Connection_: Peak flow 1.03 L/s, Infiltration 3.56 L/s, **Total Flow = 4.59 L/s**

Connection #3 (Leikin Drive Connection): Peak flow 1.5 L/s, Infiltration = 0.51 L/s, **Total Flow = 2.01 L/s**

A figure is attached depicted the proposed connection locations.

Please let me know if you require any further information.

Regards,

Matthew Hrehoriak, P.Eng., Project Engineer | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 273 | Fax: 613.254.5867

'

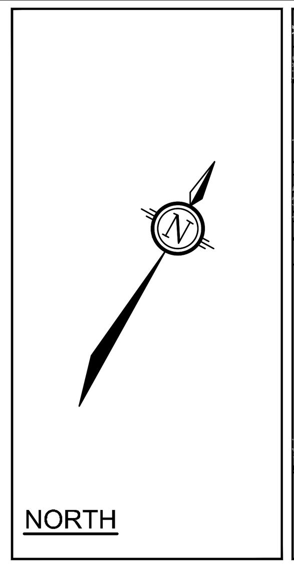
'

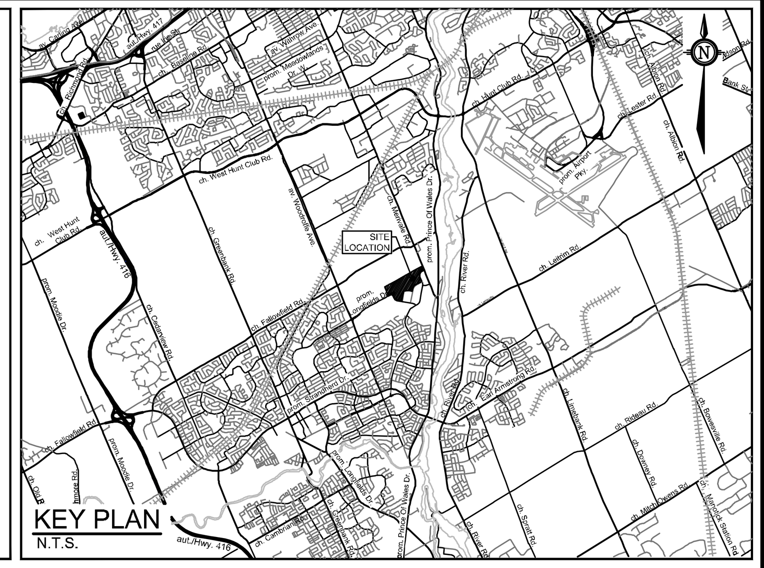
Appendix C

Storm Servicing Information

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- STM MH — EXISTING STORM MANHOLE & SEWER
- CB 1 — EXISTING CATCHBASIN
- STORM SEWER DRAINAGE AREA BOUNDARY
- 0.512 / A-16 / 0.90 — DRAINAGE AREA (ha) / DRAINAGE AREA ID / RUNOFF COEFFICIENT





REFER TO 124123-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	REVISED PER CITY COMMENTS	DEC 11/2024	MJH
1.	ISSUED FOR SPA	OCT 29/2024	MJH

SCALE: 1:1250

DESIGN: MJH / LSC
CHECKED: MJH
DRAWN: LSC
CHECKED: MJH
APPROVED: MJH

LICENSED PROFESSIONAL ENGINEER
M.J. HREHORIAK
100211256
DEC 11/24
PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
99 BILL LEATHEM, 2 & 20 LEIKEN DRIVE

DRAWING NAME
STORM SEWER DRAINAGE AREA PLAN

PROJECT No. 124123
REV: REV # 2
DRAWING No. 124123-STM

STORM SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 124123
Project Name: 99 Bill Leathem Dr. 2 & 20 Leikin Dr
Date: 11/28/2024
Input By: Ryan Kargus
Reviewed By: Matt Hrehoriak
Drawing Reference: 124123-STM

Legend:
- Design Input by User
- As-Built Input by User
- Cumulative Cell
- Calculated Design Cell Output
- Calculated Uncontrolled Peak Flow Cell Output
- Design Input Restricted Peak Flow Cell

Reference: City of Ottawa - Sewer Design Guidelines (2012 and TBs)
MOE - Design Guidelines for Sewage Works (2008)

Location				Demand													Design Capacity								
				Area				Flow									Proposed Sewer Pipe Sizing / Design								
Street	Area ID	From MH	To MH	Impervious 0.90	Pervious 0.20	Total Area A (ha.)	Weighted Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity (mm/hr) I 2-yr	5-yr	10-yr	100-yr	Peak Flow (L/s)	Total Uncontrolled Peak Flow Q (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
PARAGON AVE STORM SEWER OUTLET																									
SITE	A1	200	201	0.000	0.000	0.000		0.00	0.00	10.00					0.00	146.5	71.4	525 CONC	0.5334	0.013	0.12	155.4	0.70	1.71	94.3%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.562	0.000	0.562	0.90	1.41	1.41	10.00		104.19			146.51										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A2	201	202	0.000	0.000	0.000		0.00	0.00	11.71					0.00	338.7	75.9	750 CONC	0.762	0.013	0.12	402.3	0.88	1.43	84.2%
				0.000	0.000	0.000		0.00	0.00	11.71					0.00										
				0.849	0.000	0.849	0.90	2.12	3.53	11.71		95.95			338.73										
				0.000	0.000	0.000		0.00	0.00	11.71					0.00										
SITE	A3	202	203	0.000	0.000	0.000		0.00	0.00	13.14					0.00	447.3	84.2	825 CONC	0.8382	0.013	0.12	518.7	0.94	1.49	86.2%
				0.000	0.000	0.000		0.00	0.00	13.14					0.00										
				0.574	0.000	0.574	0.90	1.44	4.97	13.14		90.07			447.34										
				0.000	0.000	0.000		0.00	0.00	13.14					0.00										
SITE	A4	CBMH313	203	0.000	0.000	0.000		0.00	0.00	10.00					0.00	116.5	29.6	450 CONC	0.4572	0.013	0.50	210.3	1.28	0.39	55.4%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.447	0.000	0.447	0.90	1.12	1.12	10.00		104.19			116.53										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A5	CBMH322	MAIN	0.000	0.000	0.000		0.00	0.00	10.00					0.00	65.4	10.5	375 PVC	0.381	0.013	0.50	129.3	1.13	0.15	50.6%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.251	0.000	0.251	0.90	0.63	0.63	10.00		104.19			65.43										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A6	203	204	0.000	0.000	0.000		0.00	0.00	14.64					0.00	685.3	85.8	975 CONC	0.9906	0.013	0.12	809.9	1.05	1.36	84.6%
				0.000	0.000	0.000		0.00	0.00	14.64					0.00										
				0.549	0.000	0.549	0.90	1.37	8.09	14.64		84.75			685.30										
				0.000	0.000	0.000		0.00	0.00	14.64					0.00										
SITE	A7	225	204	0.000	0.000	0.000		0.00	0.00	10.00					0.00	184.3	77.6	525 CONC	0.5334	0.013	0.20	200.6	0.90	1.44	91.9%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.707	0.000	0.707	0.90	1.77	1.77	10.00		104.19			184.31										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A8	204	205	0.000	0.000	0.000		0.00	0.00	16.00					0.00	964.9	59.4	1050 CONC	1.0668	0.013	0.12	986.9	1.10	0.90	97.8%
				0.000	0.000	0.000		0.00	0.00	16.00					0.00										
				0.854	0.000	0.854	0.90	2.14	11.99	16.00		80.46			964.94										
				0.000	0.000	0.000		0.00	0.00	16.00					0.00										
SITE	A9	CBMH309	205	0.000	0.000	0.000		0.00	0.00	10.00					0.00	88.4	11.2	450 CONC	0.4572	0.013	0.30	162.9	0.99	0.19	54.2%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.339	0.000	0.339	0.90	0.85	0.85	10.00		104.19			88.37										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A10	CBMH315	MAIN	0.000	0.000	0.000		0.00	0.00	10.00					0.00	59.4	10.9	375 PVC	0.381	0.013	0.50	129.3	1.13	0.16	46.0%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.228	0.000	0.228	0.90	0.57	0.57	10.00		104.19			59.44										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A11	205	206	0.000	0.000	0.000		0.00	0.00	16.90					0.00	1268.0	111.8	1200 CONC	1.2192	0.013	0.12	1409.0	1.21	1.54	90.0%
				0.000	0.000	0.000		0.00	0.00	16.90					0.00										
				1.146	0.000	1.146	0.90	2.87	16.28	16.90		77.90			1267.99										
				0.000	0.000	0.000		0.00	0.00	16.90					0.00										
SITE	A12	206	207	0.000	0.000	0.000		0.00	0.00	18.44					0.00	1376.6	103.0	1200 CONC	1.2192	0.013	0.12	1409.0	1.21	1.42	97.7%
				0.000	0.000	0.000		0.00	0.00	18.44					0.00										
				0.942	0.000	0.942	0.90	2.36	18.63	18.44		73.87			1376.65										
				0.000	0.000	0.000		0.00	0.00	18.44					0.00										

STORM SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Location				Demand													Design Capacity								
				Area				Flow									Proposed Sewer Pipe Sizing / Design								
Street	Area ID	From MH	To MH	Impervious 0.90	Pervious 0.20	Total Area A (ha.)	Weighted Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity (mm/hr) I 2-yr	5-yr	10-yr	100-yr	Peak Flow (L/s)	Total Uncontrolled Peak Flow Q (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A13	200	209	1.266	0.000	1.266	0.90	3.17	3.17	10.00		104.19			330.03	330.0	109.4	750 CONC	0.762	0.013	0.12	402.3	0.88	2.07	82.0%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	12.07					0.00										
				0.000	0.000	0.000		0.00	0.00	12.07					0.00										
SITE	A14	209	210	1.588	0.319	1.907	0.78	4.15	7.32	12.07		94.41			690.91	690.9	112.7	975 CONC	0.9906	0.013	0.12	809.9	1.05	1.79	85.3%
				0.000	0.000	0.000		0.00	0.00	12.07					0.00										
				0.000	0.000	0.000		0.00	0.00	13.85					0.00										
				0.000	0.000	0.000		0.00	0.00	13.85					0.00										
SITE	A15	210	211	0.998	0.000	0.998	0.90	2.50	9.82	13.85		87.45			858.34	858.3	73.8	1050 CONC	1.0668	0.013	0.12	986.9	1.10	1.11	87.0%
				0.000	0.000	0.000		0.00	0.00	13.85					0.00										
				0.000	0.000	0.000		0.00	0.00	14.97					0.00										
				0.000	0.000	0.000		0.00	0.00	14.97					0.00										
SITE	A16	211	212	0.512	0.000	0.512	0.90	1.28	11.10	14.97		83.66			928.30	928.3	64.0	1050 CONC	1.0668	0.013	0.12	986.9	1.10	0.97	94.1%
				0.000	0.000	0.000		0.00	0.00	14.97					0.00										
				0.000	0.000	0.000		0.00	0.00	15.93					0.00										
				0.000	0.000	0.000		0.00	0.00	15.93					0.00										
SITE	A17	212	213	0.339	0.000	0.339	0.90	0.85	11.94	15.93		80.66			963.37	963.4	114.2	1200 CONC	1.2192	0.013	0.12	1409.0	1.21	1.58	68.4%
				0.000	0.000	0.000		0.00	0.00	15.93					0.00										
				0.000	0.000	0.000		0.00	0.00	17.51					0.00										
				0.000	0.000	0.000		0.00	0.00	17.51					0.00										
SITE	A18	213	207	0.773	0.047	0.820	0.86	1.96	13.90	17.51		76.23			1059.98	1060.0	117.3	1200 CONC	1.2192	0.013	0.12	1409.0	1.21	1.62	75.2%
				0.000	0.000	0.000		0.00	0.00	17.51					0.00										
				0.000	0.000	0.000		0.00	0.00	19.86					0.00										
				0.000	0.000	0.000		0.00	0.00	19.86					0.00										
SITE	A19	207	208	0.663	0.000	0.663	0.90	1.66	34.20	19.86		70.56			2412.91	2412.9	103.2	1500 CONC	1.524	0.013	0.12	2554.6	1.40	1.23	94.5%
				0.000	0.000	0.000		0.00	0.00	19.86					0.00										
				0.000	0.000	0.000		0.00	0.00	21.09					0.00										
				0.000	0.000	0.000		0.00	0.00	21.09					0.00										
SITE	A20	208	HW1	0.150	0.000	0.150	0.90	0.38	34.57	21.09		67.95			2349.15	2349.2	42.8	1500 CONC	1.524	0.013	0.12	2554.6	1.40	0.51	92.0%
				0.000	0.000	0.000		0.00	0.00	21.09					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	A21	CBMH323	214	0.198	0.146	0.344	0.60	0.58	0.58	10.00		104.19			60.07	60.1	27.5	375 PVC	0.381	0.013	0.50	129.3	1.13	0.40	46.4%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.40					0.00										
				0.000	0.000	0.000		0.00	0.00	10.40					0.00										
SITE	A22	214	215	1.309	0.000	1.309	0.90	3.28	3.28	10.40		102.11			334.41	334.4	117.2	750 CONC	0.762	0.013	0.12	402.3	0.88	2.21	83.1%
				0.000	0.000	0.000		0.00	0.00	10.40					0.00										
				0.000	0.000	0.000		0.00	0.00	12.62					0.00										
				0.000	0.000	0.000		0.00	0.00	12.62					0.00										
SITE	A23	215	HW2	0.258	0.000	0.258	0.90	0.65	3.92	12.62		92.14			361.23	361.2	21.5	750 CONC	0.762	0.013	0.12	402.3	0.88	0.41	89.8%
				0.000	0.000	0.000		0.00	0.00	12.62					0.00										
LEIKIN AVE STORM SEWER OUTLET																									
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B1	300	305	0.550	0.000	0.550	0.90	1.38	1.38	10.00		104.19			143.38	143.4	36.0	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.67	71.5%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B2	320	305	0.459	0.000	0.459	0.90	1.15	1.15	10.00		104.19			119.66	119.7	37.1	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.69	59.6%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.67					0.00										
				0.000	0.000	0.000		0.00	0.00	10.67					0.00										
SITE	B3	305	302	0.207	0.000	0.207	0.90	0.52	3.04	10.67		100.79			306.65	306.6	57.5	750 CONC	0.762	0.013	0.12	402.3	0.88	1.09	76.2%
				0.000	0.000	0.000		0.00	0.00	10.67					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B4	301	302	0.547	0.000	0.547	0.90	1.37	1.37	10.00		104.19			142.60	142.6	35.9	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.67	71.1%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										

STORM SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Location				Demand													Design Capacity								
				Area				Flow									Proposed Sewer Pipe Sizing / Design								
Street	Area ID	From MH	To MH	Impervious 0.90	Pervious 0.20	Total Area A (ha.)	Weighted Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity (mm/hr) I 2-yr	5-yr	10-yr	100-yr	Peak Flow (L/s)	Total Uncontrolled Peak Flow Q (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
SITE	B5	303	302	0.000	0.000	0.000		0.00	0.00	10.00					0.00	122.0	37.1	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.69	60.8%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.468	0.000	0.468	0.90	1.17	1.17	10.00		104.19			122.00										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B6	302	306	0.000	0.000	0.000		0.00	0.00	11.75					0.00	583.9	57.2	900 CONC	0.9144	0.013	0.12	654.2	1.00	0.96	89.2%
				0.000	0.000	0.000		0.00	0.00	11.75					0.00										
				0.206	0.000	0.206	0.90	0.52	6.10	11.75		95.76			583.87										
				0.000	0.000	0.000		0.00	0.00	11.75					0.00										
SITE	B7	310	306	0.000	0.000	0.000		0.00	0.00	10.00					0.00	130.1	36.0	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.67	64.8%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.499	0.000	0.499	0.90	1.25	1.25	10.00		104.19			130.08										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B8	321	306	0.000	0.000	0.000		0.00	0.00	10.00					0.00	88.9	37.1	525 CONC	0.5334	0.013	0.20	200.6	0.90	0.69	44.3%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.341	0.000	0.341	0.90	0.85	0.85	10.00		104.19			88.90										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B9	306	HW4	0.000	0.000	0.000		0.00	0.00	12.71					0.00	801.3	46.1	975 CONC	0.9906	0.013	0.15	905.5	1.17	0.65	88.5%
				0.000	0.000	0.000		0.00	0.00	12.71					0.00										
				0.213	0.000	0.213	0.90	0.53	8.73	12.71		91.76			801.27										
				0.000	0.000	0.000		0.00	0.00	12.71					0.00										
SITE	B10	307	221	0.000	0.000	0.000		0.00	0.00	10.00					0.00	280.8	119.9	600 CONC	0.6096	0.013	0.30	350.8	1.20	1.66	80.0%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.981	0.432	1.413	0.69	2.69	2.69	10.00		104.19			280.76										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	B11	HW 6	221	0.000	0.000	0.000		0.00	0.00	10.00					0.00	932.8	89.1	1050 CONC	1.0668	0.013	0.12	986.9	1.10	1.35	94.5%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.182	2.275	2.457	0.25	1.72	10.45	13.37		89.24			932.75										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
BILL LEATHEM DR STORM SEWER OUTLET																									
SITE	C1	CBMH319	216	0.000	0.000	0.000		0.00	0.00	10.00					0.00	121.5	17.3	375 PVC	0.381	0.013	0.50	129.3	1.13	0.25	93.9%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.466	0.000	0.466	0.90	1.17	1.17	10.00		104.19			121.48										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	C2	216	217	0.000	0.000	0.000		0.00	0.00	10.25					0.00	28.4	41.1	525 CONC	0.5334	0.013	0.12	155.4	0.70	0.98	18.3%
				0.000	0.000	0.000		0.00	0.00	10.25					0.00										
				0.092	0.083	0.175	0.57	0.28	0.28	10.25		102.87			28.45										
				0.000	0.000	0.000		0.00	0.00	10.25					0.00										
SITE	C3	CBMH318	217	0.000	0.000	0.000		0.00	0.00	10.00					0.00	103.8	17.2	375 PVC	0.381	0.013	0.50	129.3	1.13	0.25	80.2%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.398	0.000	0.398	0.90	1.00	1.00	10.00		104.19			103.76										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	C4	217	218	0.000	0.000	0.000		0.00	0.00	11.24					0.00	59.4	51.9	675 CONC	0.6858	0.013	0.12	303.8	0.82	1.05	19.6%
				0.000	0.000	0.000		0.00	0.00	11.24					0.00										
				0.111	0.093	0.204	0.58	0.33	0.61	11.24		98.07			59.41										
				0.000	0.000	0.000		0.00	0.00	11.24					0.00										
SITE	C5	218	219	0.000	0.000	0.000		0.00	0.00	12.29					0.00	108.9	33.7	750 CONC	0.762	0.013	0.12	402.3	0.88	0.64	27.1%
				0.000	0.000	0.000		0.00	0.00	12.29					0.00										
				0.207	0.077	0.283	0.71	0.56	1.16	12.29		93.47			108.89										
				0.000	0.000	0.000		0.00	0.00	12.29					0.00										
SITE	C6	219	HW7	0.000	0.000	0.000		0.00	0.00	12.93					0.00	167.3	85.6	750 CONC	0.762	0.013	0.12	402.3	0.88	1.62	41.6%
				0.000	0.000	0.000		0.00	0.00	12.93					0.00										
				0.144	0.565	0.709	0.34	0.68	1.84	12.93		90.91			167.27										
				0.000	0.000	0.000		0.00	0.00	12.93					0.00										
SITE	C7	311	312	0.000	0.000	0.000		0.00	0.00	10.00					0.00	37.4	75.8	375 PVC	0.381	0.013	0.50	129.3	1.13	1.11	28.9%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.127	0.073	0.200	0.64	0.36	0.36	10.00		104.19			37.36										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE	C8	312	HW8	0.000	0.000	0.000		0.00	0.00	11.11					0.00	69.3	15.0	450 CONC	0.4572	0.013	0.30	162.9	0.99	0.25	42.6%
				0.000	0.000	0.000		0.00	0.00	11.11					0.00										
				0.090	0.213	0.303	0.41	0.34	0.70	11.11		98.66			69.33										
				0.000	0.000	0.000		0.00	0.00	11.11					0.00										

STORM SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Location				Demand													Design Capacity								
				Area				Flow									Proposed Sewer Pipe Sizing / Design								
Street	Area ID	From MH	To MH	Impervious	Pervious	Total Area A (ha.)	Weighted Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity (mm/hr) I				Peak Flow (L/s)	Total Uncontrolled Peak Flow Q (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
				0.90	0.20						2-yr	5-yr	10-yr	100-yr											
SITE	C9	223	224	0.000	0.000	0.000		0.00	0.00	10.00					0.00	212.9	39.7	675 CONC	0.6858	0.013	0.12	303.8	0.82	0.80	70.1%
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
				0.705	0.502	1.207	0.61	2.04	2.04	10.00		104.19			212.87										
				0.000	0.000	0.000		0.00	0.00	10.00					0.00										
SITE		224	HW10	0.000	0.000	0.000		0.00	0.00	10.80					0.00	204.6	51.5	675 CONC	0.6858	0.013	0.12	303.8	0.82	1.04	67.3%
				0.000	0.000	0.000		0.00	0.00	10.80					0.00										
				0.000	0.000	0.000		0.00	2.04	10.80		100.13			204.56										
				0.000	0.000	0.000		0.00	0.00	10.80					0.00										
Totals				22.50	4.82	27.32	0.78										2772.6								

Demand Equation / Parameters

1. Q = 2.78 ACI

Definitions

Q = Peak flow in litres per second (L/s)
A = Area in hectares (ha)
C = Weighted runoff coefficient (increased by 25% for 100-year)
I = Rainfall intensity in millimeters per hour (mm/hr)

Rainfall intensity is based on City of Ottawa IDF data presented in the City of Ottawa - Sewer Design Guidelines

Capacity Equation

Q full = $1000*(1/n)*A_p*R^{2/3}*So^{0.5}$

Definitions

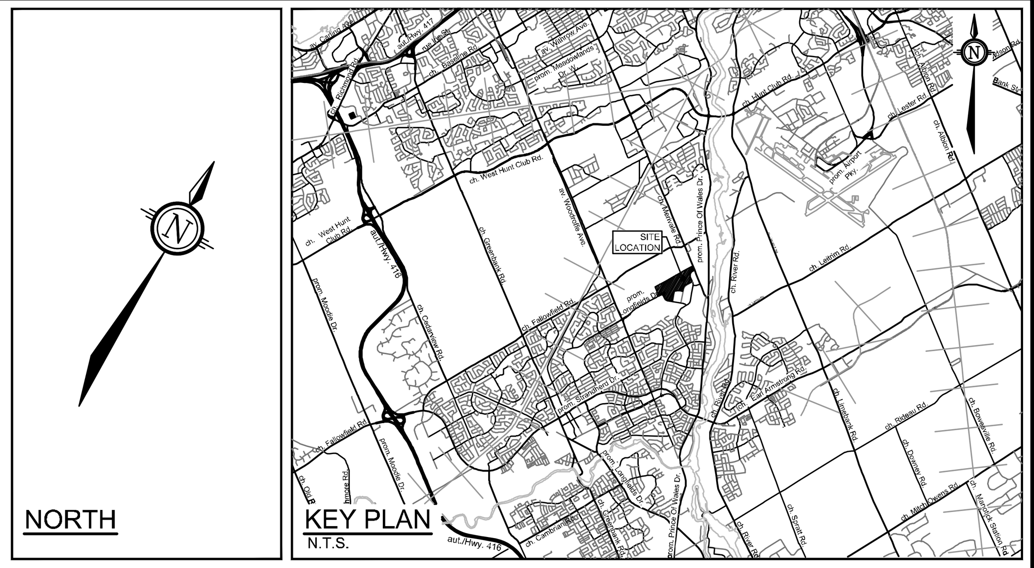
Q full = Capacity (L/s)
n = Manning coefficient of roughness (0.013)
A_p = Pipe flow area (m^2)
R = Hydraulic Radius of wetted area (dia./4 for full pipes)
So = Pipe slope/gradient

Appendix D

Stormwater Management Modeling

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- STM MH — EXISTING STORM MANHOLE & SEWER
- CB 1 — EXISTING CATCHBASIN
- STORM SEWER DRAINAGE AREA BOUNDARY
- 19.51 — DRAINAGE AREA (ha)
- EX-02 — DRAINAGE AREA ID
- 0.24 — RUNOFF COEFFICIENT



REFER TO 124123-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
1	ISSUED FOR SPA	OCT 29/2024	MJH

SCALE: 1:1250

1:1250 — 0 10 20 30 40 50

DESIGN	MJH / LSC
CHECKED	MJH
DRAWN	LSC
CHECKED	MJH
APPROVED	MJH

LICENSED PROFESSIONAL ENGINEER — M. J. HREHORIAK — 100211256 — OCT 29/2024 — PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
99 BILL LEATHEM, 2 & 20 LEIKEN DRIVE

DRAWING NAME
EXISTING STORM DRAINAGE AREA PLAN

PROJECT No. 124123
REV: REV # 1
DRAWING No. 124123-XSTM

No.	REVISION	DATE	BY
1.	ROAD PATTERN REVISED	AUG 16/91	SMG

LICENSED PROFESSIONAL ENGINEER — UDO BOEHME — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — S. M. GORDON — PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD. OTTAWA, ONTARIO

DESIGN: JMD
CHECKED: UB
DRAWN: MGB
CHECKED: UB
APPROVED: MJH

SCALE 1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK

STORM DRAINAGE AREAS

CONTRACT No. 90041
DATE SEPT. 1990
DRAWING No. STM-002

No.	REVISION	DATE	BY
1.	ROAD PATTERN REVISED	AUG 16/91	SMG

LICENSED PROFESSIONAL ENGINEER — UDO BOEHME — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — S.M. GORDON — PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
OTTAWA, ONTARIO

DESIGN	JMD
CHECKED	UB
DRAWN	MGB
CHECKED	UB
APPROVED	MJH

SCALE
1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK

STORM SEWER

CONTRACT No. 90041
DATE SEPT. 1990
DRAWING No. STM-001

Table 1: Allowable Release Rates - Bill Leathem Drive (EX. STMMH 139)

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}	54.5 L/s/ha
EX-01	2.76	0.24	83.56	**153.9**	**150.4**

Table 2: Allowable Release Rates - Paragon Avenue (EX STMMH 158 -135)

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}	54.5 L/s/ha
EX-02	19.51	0.24	83.56	**1087.7**	**1063.3**

Table 3: Allowable Release Rates - Leikin Drive (EX STMH 105-106)

Area ID	Area (ha)	C_{Allow}	I_{5Year}	Q_{Allow}	54.5 L/s/ha
EX-03	3.46	0.24	83.56	**192.9**	**188.6**

Time of Concentration Tc= 15.0 min
Intensity (5 Year Event) I_5= 83.56 mm/hr
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

Equations:
Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- *EXISTING STORM MANHOLE & SEWER*
- *EXISTING CATCHBASIN*
- STORM SEWER DRAINAGE AREA BOUNDARY
- 0.085 / A-16 / 0.78 — DRAINAGE AREA (ha), DRAINAGE AREA ID, RUNOFF COEFFICIENT

REFER TO 124123-ND FOR ADDITIONAL NOTES

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2	REVISED PER CITY COMMENTS	DEC 11/2024	MJH
1	ISSUED FOR SPA	OCT 29/2024	MJH

SCALE 1:1250

DESIGN	MJH / LSC
CHECKED	MJH
DRAWN	LSC
CHECKED	MJH
APPROVED	MJH

LICENSED PROFESSIONAL ENGINEER M.J. HREHORIAK 100211256 DEC 11/2024 PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

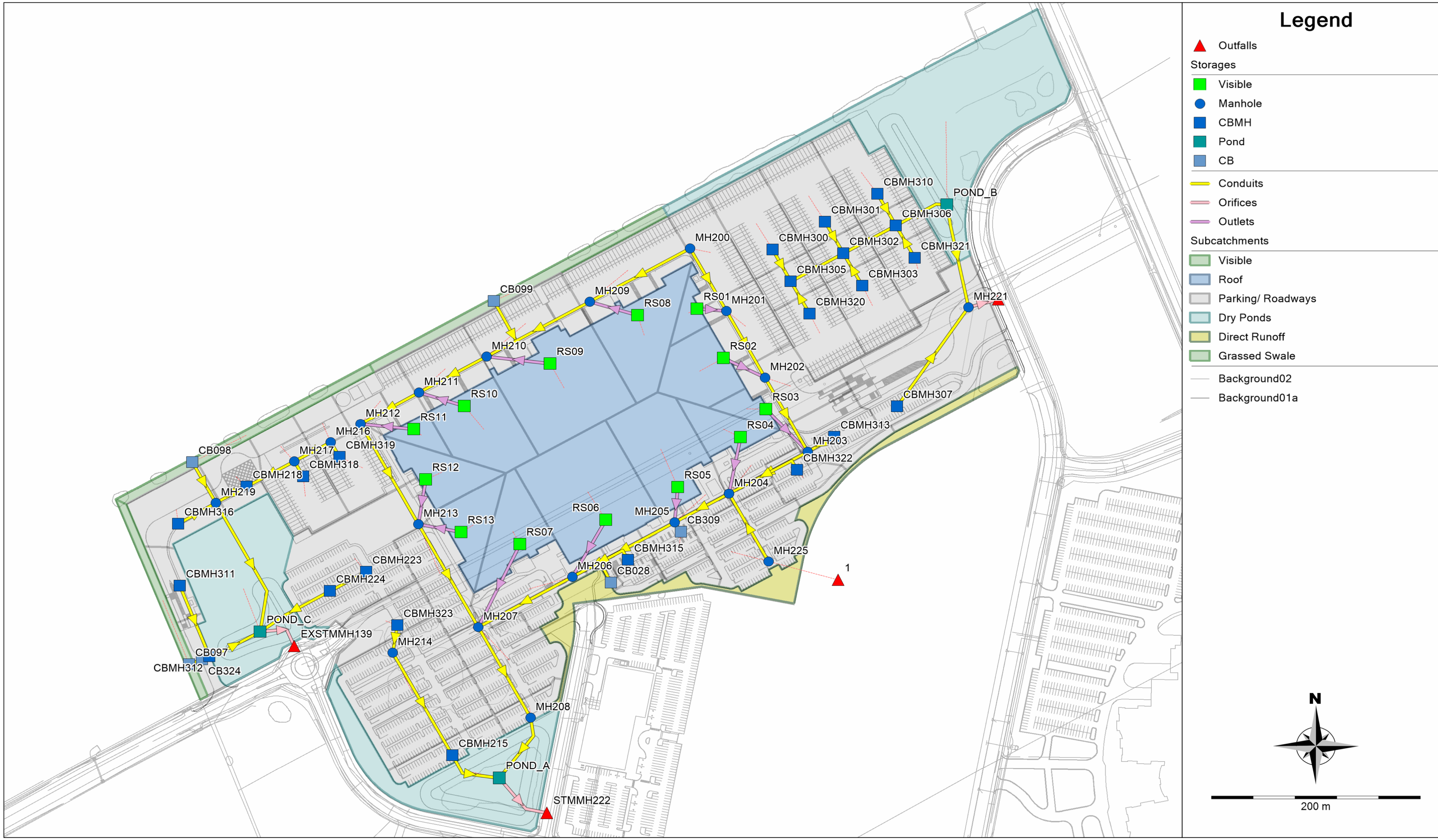
LOCATION
CITY OF OTTAWA
99 BILL LEATHEM, 2 & 20 LEIKEN DRIVE

DRAWING NAME
STORMWATER MANAGEMENT PLAN

PROJECT No. 124123
REV: REV # 1
DRAWING No. 124123-SWM

South Nepean Business Park Warehouse (124123)
Post-Development Model Schematic

NOVATECH
Engineers, Planners & Landscape Architects



12/11/2024
PREPARED BY: NOVATECH

M:\2024\124123\DATA\Calculations\SWM\PCSWMM\124123-ModelParams_r1.xlsx

South Nepean Business Park Warehouse (124123)
Roof Storage Drain Flow Rates

Roof ID	Area (ha)	Surface Area (m^2)	Available for Ponding[1] (m^2)	Volume[2] (m^3)	Equivalent Area for Storage Curve[3] (m^2)	Total Drain Flow Rate (L/s)
R01	0.119	1190	952	48	635	38
R02	0.421	4210	3368	168	2245	120
R03	0.116	1160	928	46	619	32
R04	0.253	2530	2024	101	1349	43
R05	0.679	6790	5432	272	3621	206
R06	1.078	10780	8624	431	5749	300
R07	0.419	4190	3352	168	2235	104
R08	0.603	6030	4824	241	3216	162
R09	1.007	10070	8056	403	5371	244
R10	0.575	5750	4600	230	3067	153
R11	0.12	1200	960	48	640	34
R12	0.339	3390	2712	136	1808	90
R13	0.329	3290	2632	132	1755	115

[1] *Assume 80% of Roof Area available for Ponding*

[2] *Ponding volume on roof with 0.15m of ponding depth using cone equation*

[3] *Equivalent area for 0.15m of depth in stage-area curve for roof storage assuming an area if 0 m^2 at depth of 0m*

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****

Number of rain gages 1
Number of subcatchments ... 61
Number of nodes 69
Number of links 66
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Raingage	06-C100yr-3hr	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A01	0.44	80.95	100.00	2.0000	Raingage	MH200
A02	0.43	124.34	100.00	2.0000	Raingage	MH201
A03	0.46	129.83	100.00	2.0000	Raingage	MH202
A04	0.45	114.78	100.00	2.0000	Raingage	CBMH313
A05	0.25	69.52	100.00	2.0000	Raingage	CBMH322
A06	0.30	69.35	100.00	2.0000	Raingage	MH204
A07	0.71	101.08	100.00	2.0000	Raingage	MH225
A08	0.17	43.23	100.00	2.0000	Raingage	MH205
A09	0.34	68.04	100.00	2.0000	Raingage	CB309
A10	0.23	72.86	100.00	2.0000	Raingage	CBMH315
A11	0.07	49.13	100.00	2.0000	Raingage	CB028
A12	0.52	143.32	100.00	2.0000	Raingage	MH206
A13	0.66	166.06	100.00	2.0000	Raingage	MH209
A14_1	0.31	17.45	7.00	0.3000	Raingage	
A14_2	0.59	144.75	100.00	2.0000	Raingage	MH210
A15	0.43	102.79	100.00	2.0000	Raingage	MH211
A16	0.39	99.75	100.00	2.0000	Raingage	MH212
A18	0.49	103.71	94.00	2.0000	Raingage	MH213
A19	0.66	172.33	100.00	2.0000	Raingage	MH207
A20	0.15	50.76	100.00	2.0000	Raingage	MH208
A21	0.34	97.39	100.00	2.0000	Raingage	CBMH323
A22	1.31	240.73	100.00	2.0000	Raingage	MH214
A23	0.26	46.35	96.00	2.0000	Raingage	CBMH215
A24	1.16	156.49	7.00	2.0000	Raingage	POND_A
B01	0.55	82.59	100.00	2.0000	Raingage	CBMH300
B02	0.46	79.50	100.00	2.0000	Raingage	CBMH320
B03	0.21	81.20	100.00	2.0000	Raingage	CBMH305
B04	0.55	83.68	100.00	2.0000	Raingage	CBMH301
B05	0.47	88.58	100.00	2.0000	Raingage	CBMH303
B06	0.21	75.92	100.00	2.0000	Raingage	CBMH302
B07	0.50	70.06	100.00	2.0000	Raingage	CBMH310
B08	0.34	87.88	100.00	2.0000	Raingage	CBMH321
B09	0.21	85.01	100.00	2.0000	Raingage	CBMH306
B10	1.41	327.49	70.00	2.0000	Raingage	CBMH307
B11	2.46	150.97	7.00	2.0000	Raingage	POND_B
C01	0.47	126.55	100.00	2.0000	Raingage	CBMH319
C02	0.17	45.56	53.00	2.0000	Raingage	MH216
C03	0.40	114.44	100.00	2.0000	Raingage	CBMH318
C04	0.20	57.36	54.00	2.0000	Raingage	MH217
C05	0.28	84.46	73.00	2.0000	Raingage	CBMH218
C06_1	0.25	13.25	7.00	0.5000	Raingage	CB098
C06_2	0.46	145.62	32.00	2.0000	Raingage	CBMH316
C07	0.20	149.53	63.00	2.0000	Raingage	CBMH311
C08_1	0.14	93.25	30.00	2.0000	Raingage	CB324

```
  C08_2                    0.16      9.56      7.00    1.0000 Raingage
CB097
  C09                      1.21    228.02     59.00    2.0000 Raingage
CBMH223
  C10                      1.46    151.78      7.00    2.0000 Raingage
POND_C
  DR02                     0.64    231.57      7.00    2.0000 Raingage
1
  R01                      0.12     50.51    100.00    2.0000 Raingage
RS01
  R02                      0.42     77.48    100.00    2.0000 Raingage
RS02
  R03                      0.12     38.57    100.00    2.0000 Raingage
RS03
  R04                      0.25     66.40    100.00    2.0000 Raingage
RS04
  R05                      0.68     78.74    100.00    2.0000 Raingage
RS05
  R06                      1.08    101.91    100.00    2.0000 Raingage
RS06
  R07                      0.42     69.17    100.00    2.0000 Raingage
RS07
  R08                      0.60     78.03    100.00    2.0000 Raingage
RS08
  R09                      1.01    115.14    100.00    2.0000 Raingage
RS09
  R10                      0.57     76.23    100.00    2.0000 Raingage
RS10
  R11                      0.12     43.32    100.00    2.0000 Raingage
RS11
  R12                      0.34     76.61    100.00    2.0000 Raingage
RS12
  R13                      0.33     71.28    100.00    2.0000 Raingage
RS13


  ************
  Node Summary
  ************
                                         Invert      Max.    Ponded   External
  Name                 Type               Elev.     Depth      Area   Inflow
  -------------------------------------------------------------------------------
  1                    OUTFALL             0.00      0.00       0.0
  EXSTMMH105           OUTFALL            87.45      0.00       0.0
  EXSTMMH139           OUTFALL            87.21      0.00       0.0
  STMMH222             OUTFALL            86.30      0.00       0.0
  CB028                STORAGE            89.55      1.80       0.0
  CB097                STORAGE            88.12      1.38       0.0
  CB098                STORAGE            88.26      1.34       0.0
  CB099                STORAGE            88.22      1.58       0.0
  CB309                STORAGE            88.18      3.17       0.0
  CB324                STORAGE            87.97      2.40       0.0
  CBMH215              STORAGE            87.29      2.82       0.0
  CBMH218              STORAGE            87.87      2.69       0.0
  CBMH223              STORAGE            87.83      2.17       0.0
  CBMH224              STORAGE            87.77      2.53       0.0
  CBMH300              STORAGE            88.69      1.96       0.0
  CBMH301              STORAGE            88.62      2.08       0.0
  CBMH302              STORAGE            88.18      2.49       0.0
  CBMH303              STORAGE            88.63      2.01       0.0
  CBMH305              STORAGE            88.40      2.22       0.0
  CBMH306              STORAGE            88.03      2.69       0.0
  CBMH307              STORAGE            87.89      2.63       0.0
  CBMH310              STORAGE            88.56      2.19       0.0
  CBMH311              STORAGE            88.19      2.22       0.0
  CBMH312              STORAGE            87.74      2.63       0.0
  CBMH313              STORAGE            88.48      2.17       0.0
  CBMH315              STORAGE            88.85      2.60       0.0
  CBMH316              STORAGE            88.48      2.01       0.0
  CBMH318              STORAGE            88.39      1.61       0.0
  CBMH319              STORAGE            88.44      1.61       0.0
  CBMH320              STORAGE            88.70      1.89       0.0
  CBMH321              STORAGE            88.56      2.13       0.0
  CBMH322              STORAGE            88.41      2.64       0.0
  CBMH323              STORAGE            87.95      2.01       0.0
  MH200                STORAGE            88.27      2.52       0.0
  MH201                STORAGE            88.17      2.54       0.0
  MH202                STORAGE            88.01      2.69       0.0
  MH203                STORAGE            87.76      3.42       0.0
  MH204                STORAGE            87.58      3.90       0.0
  MH205                STORAGE            87.36      4.21       0.0
  MH206                STORAGE            87.23      4.33       0.0
  MH207                STORAGE            86.80      4.17       0.0
  MH208                STORAGE            86.67      3.66       0.0
  MH209                STORAGE            87.91      2.79       0.0
  MH210                STORAGE            87.70      2.98       0.0
  MH211                STORAGE            87.61      3.06       0.0
  MH212                STORAGE            87.39      3.20       0.0
  MH213                STORAGE            87.24      4.35       0.0
  MH214                STORAGE            87.44      2.84       0.0
  MH216                STORAGE            88.20      2.10       0.0
  MH217                STORAGE            88.01      2.29       0.0
  MH219                STORAGE            87.77      3.05       0.0
  MH221                STORAGE            87.50      2.57       0.0
  MH225                STORAGE            88.23      2.78       0.0
  POND_A               STORAGE            86.40      3.60       0.0
  POND_B               STORAGE            87.60      3.14       0.0
  POND_C               STORAGE            87.50      3.00       0.0
  RS01                 STORAGE            95.00      0.15       0.0
  RS02                 STORAGE            95.00      0.15       0.0
  RS03                 STORAGE            95.00      0.15       0.0
  RS04                 STORAGE            95.00      0.15       0.0
  RS05                 STORAGE            95.00      0.15       0.0
  RS06                 STORAGE            95.00      0.15       0.0
  RS07                 STORAGE            95.00      0.15       0.0
  RS08                 STORAGE            95.00      0.15       0.0
  RS09                 STORAGE            95.00      0.15       0.0
  RS10                 STORAGE            95.00      0.15       0.0
  RS11                 STORAGE            95.00      0.15       0.0
  RS12                 STORAGE            95.00      0.15       0.0
  RS13                 STORAGE            95.00      0.15       0.0


  ************
  Link Summary
  ************
```

Name	From Node	To Node	Type	Length	% Slope	Roughness
028-206	CB028	MH206	CONDUIT	21.6	1.0186	0.0130
097-324	CB097	CB324	CONDUIT	13.5	1.0376	0.0130
098-219	CB098	MH219	CONDUIT	46.5	0.2581	0.0130
099-210	CB099	MH210	CONDUIT	45.1	0.2441	0.0130
200-201	MH200	MH201	CONDUIT	71.4	0.1120	0.0130
200-209	MH200	MH209	CONDUIT	109.4	0.1189	0.0130
201-202	MH201	MH202	CONDUIT	75.9	0.1186	0.0130
202-203	MH202	MH203	CONDUIT	84.2	0.1307	0.0130
203-204	MH203	MH204	CONDUIT	85.8	0.1166	0.0130
204-205	MH204	MH205	CONDUIT	59.4	0.1179	0.0130
205-206	MH205	MH206	CONDUIT	111.8	0.1163	0.0130
206-207	MH206	MH207	CONDUIT	103.0	0.1263	0.0130
207-208	MH207	MH208	CONDUIT	103.2	0.1162	0.0130
208-PONDA	MH208	POND_A	CONDUIT	18.3	0.1636	0.0130
209-210	MH209	MH210	CONDUIT	112.7	0.1153	0.0130
210-211	MH210	MH211	CONDUIT	73.8	0.1220	0.0130
211-212	MH211	MH212	CONDUIT	64.0	0.1094	0.0130
212-213	MH212	MH213	CONDUIT	114.2	0.1226	0.0130
213-207	MH213	MH207	CONDUIT	117.3	0.1194	0.0130
214-2115	MH214	CBMH215	CONDUIT	117.2	0.1195	0.0130
215-PONDA	CBMH215	POND_A	CONDUIT	20.0	0.1995	0.0130
216-217	MH216	MH217	CONDUIT	39.6	0.1011	0.0130
217-218	MH217	CBMH218	CONDUIT	51.9	0.1348	0.0130
218-219	CBMH218	MH219	CONDUIT	33.7	0.1188	0.0130
219-PONDC	MH219	POND_C	CONDUIT	100.4	0.0996	0.0130
223-224	CBMH223	CBMH224	CONDUIT	39.7	0.1259	0.0130
224-PONDC	CBMH224	POND_C	CONDUIT	48.6	0.1234	0.0130
225-204	MH225	MH204	CONDUIT	77.6	0.1933	0.0130
300-305	CBMH300	CBMH305	CONDUIT	36.0	0.1942	0.0130
301-302	CBMH301	CBMH302	CONDUIT	35.9	0.1950	0.0130
302-306	CBMH302	CBMH306	CONDUIT	57.2	0.1224	0.0130
303-302	CBMH303	CBMH302	CONDUIT	37.1	0.2159	0.0130
305-302	CBMH305	CBMH302	CONDUIT	57.5	0.1218	0.0130
306-PONDB	CBMH306	POND_B	CONDUIT	44.0	0.1365	0.0130
307-221	CBMH307	MH221	CONDUIT	119.9	0.3002	0.0130
309-205	CB309	MH205	CONDUIT	11.2	0.3585	0.0130
310-306	CBMH310	CBMH306	CONDUIT	36.0	0.2220	0.0130
311-312	CBMH311	CBMH312	CONDUIT	75.8	0.4882	0.0130
312-PONDC	CBMH312	POND_C	CONDUIT	17.5	0.2292	0.0130
313-203	CBMH313	MH203	CONDUIT	29.6	0.5073	0.0130
315-206	CBMH315	MH206	CONDUIT	10.9	0.4575	0.0130
316-219	CBMH316	MH219	CONDUIT	41.7	0.7909	0.0130
318-217	CBMH318	MH217	CONDUIT	17.2	0.4641	0.0130
319-216	CBMH319	MH216	CONDUIT	17.2	0.4641	0.0130
320-305	CBMH320	CBMH305	CONDUIT	37.1	0.2155	0.0130
321-306	CBMH321	CBMH306	CONDUIT	37.1	0.2155	0.0130
322-204	CBMH322	MH204	CONDUIT	10.5	0.4753	0.0130
323-214	CBMH323	MH214	CONDUIT	27.5	0.4724	0.0130
324-312	CB324	CBMH312	CONDUIT	7.6	1.0502	0.0130
PONDB-221	POND_B	MH221	CONDUIT	83.2	0.1202	0.0130
1	POND_C	EXSTMMH139	ORIFICE			
5	MH221	EXSTMMH105	ORIFICE			
STM-53_(STM)	POND_A	STMMH222	ORIFICE			
R01-OUT	RS01	MH201	OUTLET			
R02-OUT	RS02	MH202	OUTLET			
R03-OUT	RS03	MH203	OUTLET			
R04-OUT	RS04	MH204	OUTLET			
R05-OUT	RS05	MH205	OUTLET			
R06-OUT	RS06	MH206	OUTLET			
R07-OUT	RS07	MH207	OUTLET			
R08-OUT	RS08	MH209	OUTLET			
R09-OUT	RS09	MH210	OUTLET			
R10-OUT	RS10	MH211	OUTLET			
R11-OUT	RS11	MH212	OUTLET			
R12-OUT	RS12	MH213	OUTLET			

```
  R13-OUT          RS13             MH213            OUTLET
```

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
028-206	CIRCULAR	0.30	0.07	0.08	0.30	1	102.00
097-324	CIRCULAR	0.30	0.07	0.08	0.30	1	102.94
098-219	CIRCULAR	0.38	0.11	0.10	0.38	1	92.94
099-210	CIRCULAR	0.38	0.11	0.10	0.38	1	90.38
200-201	CIRCULAR	0.53	0.22	0.13	0.53	1	149.89
200-209	CIRCULAR	0.76	0.46	0.19	0.76	1	400.46
201-202	CIRCULAR	0.76	0.46	0.19	0.76	1	400.08
202-203	CIRCULAR	0.84	0.55	0.21	0.84	1	540.99
203-204	CIRCULAR	0.99	0.77	0.25	0.99	1	799.16
204-205	CIRCULAR	1.07	0.89	0.27	1.07	1	978.84
205-206	CIRCULAR	1.22	1.17	0.30	1.22	1	1386.42
206-207	CIRCULAR	1.22	1.17	0.30	1.22	1	1444.72
207-208	CIRCULAR	1.52	1.82	0.38	1.52	1	2514.24
208-PONDA	CIRCULAR	1.52	1.82	0.38	1.52	1	2983.34
209-210	CIRCULAR	0.99	0.77	0.25	0.99	1	794.83
210-211	CIRCULAR	1.07	0.89	0.27	1.07	1	995.73
211-212	CIRCULAR	1.07	0.89	0.27	1.07	1	942.72
212-213	CIRCULAR	1.22	1.17	0.30	1.22	1	1423.84
213-207	CIRCULAR	1.22	1.17	0.30	1.22	1	1404.72
214-2115	CIRCULAR	0.76	0.46	0.19	0.76	1	401.48
215-PONDA	CIRCULAR	0.76	0.46	0.19	0.76	1	518.80
216-217	CIRCULAR	0.53	0.22	0.13	0.53	1	142.35
217-218	CIRCULAR	0.69	0.37	0.17	0.69	1	322.26
218-219	CIRCULAR	0.76	0.46	0.19	0.76	1	400.33
219-PONDC	CIRCULAR	0.76	0.46	0.19	0.76	1	366.48
223-224	CIRCULAR	0.69	0.37	0.17	0.69	1	311.37
224-PONDC	CIRCULAR	0.69	0.37	0.17	0.69	1	308.32
225-204	CIRCULAR	0.53	0.22	0.13	0.53	1	196.88
300-305	CIRCULAR	0.53	0.22	0.13	0.53	1	197.34
301-302	CIRCULAR	0.53	0.22	0.13	0.53	1	197.74
302-306	CIRCULAR	0.91	0.66	0.23	0.91	1	660.00
303-302	CIRCULAR	0.53	0.22	0.13	0.53	1	208.05
305-302	CIRCULAR	0.76	0.46	0.19	0.76	1	405.34
306-PONDB	CIRCULAR	0.99	0.77	0.25	0.99	1	864.62
307-221	CIRCULAR	0.61	0.29	0.15	0.61	1	351.58
309-205	CIRCULAR	0.46	0.16	0.11	0.46	1	177.88
310-306	CIRCULAR	0.53	0.22	0.13	0.53	1	210.97
311-312	CIRCULAR	0.38	0.11	0.10	0.38	1	127.81
312-PONDC	CIRCULAR	0.46	0.16	0.11	0.46	1	142.24
313-203	CIRCULAR	0.46	0.16	0.11	0.46	1	211.60
315-206	CIRCULAR	0.38	0.11	0.10	0.38	1	123.72
316-219	CIRCULAR	0.38	0.11	0.10	0.38	1	162.68
318-217	CIRCULAR	0.38	0.11	0.10	0.38	1	124.61
319-216	CIRCULAR	0.38	0.11	0.10	0.38	1	124.61
320-305	CIRCULAR	0.53	0.22	0.13	0.53	1	207.85
321-306	CIRCULAR	0.53	0.22	0.13	0.53	1	207.87
322-204	CIRCULAR	0.38	0.11	0.10	0.38	1	126.11
323-214	CIRCULAR	0.38	0.11	0.10	0.38	1	125.73
324-312	CIRCULAR	0.30	0.07	0.08	0.30	1	103.57
PONDB-221	CIRCULAR	1.07	0.89	0.27	1.07	1	988.25

****
Analysis Options
****

```
  Flow Units ............... LPS
  Process Models:
```

```
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/08/2024 00:00:00
Ending Date .............. 10/09/2024 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 8
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Initial LID Storage	0.026	0.865
Total Precipitation	2.191	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.382	12.508
Surface Runoff	1.811	59.212
Final Storage	0.026	0.865
Continuity Error (%)	-0.074	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.810	18.104
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.002
External Outflow	1.816	18.162
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.093	0.933
Final Stored Volume	0.094	0.941
Continuity Error (%)	-0.334	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link STM-53_(STM) (59)
Link R06-OUT (20)
Link R09-OUT (6)
Link 5 (2)
Link R05-OUT (1)

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.99 sec
Maximum Time Step	:	2.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
2.000 - 1.516 sec	:	99.08 %
1.516 - 1.149 sec	:	0.29 %
1.149 - 0.871 sec	:	0.26 %
0.871 - 0.660 sec	:	0.22 %
0.660 - 0.500 sec	:	0.15 %

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A01	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.32	219.53	1.001
A02	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.31	212.27	1.001
A03	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.33	226.65	1.001
A04	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.32	221.67	1.001
A05	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.18	124.48	1.001

A06	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.21	147.27	1.001
A07	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.51	349.80	1.001
A08	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.13	86.78	1.001
A09	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.24	167.55	1.001
A10	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.16	113.08	1.001
A11	71.67	0.00	0.00	0.00	71.77	0.00	71.77	0.05	33.73	1.002
A12	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.38	259.38	1.001
A13	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.48	328.78	1.001
A14_1	71.67	0.00	0.00	54.84	5.02	11.81	16.84	0.05	16.36	0.235
A14_2	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.42	292.08	1.001
A15	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.31	212.73	1.001
A16	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.28	193.90	1.001
A18	71.67	0.00	0.00	2.62	67.43	1.68	69.11	0.34	241.27	0.964
A19	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.48	328.79	1.001
A20	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.11	74.40	1.001
A21	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.25	170.61	1.001
A22	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.94	648.69	1.001
A23	71.67	0.00	0.00	1.75	68.86	1.13	69.98	0.18	127.13	0.977
A24	71.67	0.00	0.00	45.37	5.02	21.29	26.32	0.31	155.00	0.367
B01	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.39	272.24	1.001
B02	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.33	227.40	1.001
B03	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.15	102.67	1.001
B04	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.39	270.79	1.001
B05	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.34	231.95	1.001
B06	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.15	102.17	1.001
B07	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.36	246.85	1.001
B08	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.24	169.11	1.001
B09	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.15	105.65	1.001
B10	71.67	0.00	0.00	13.41	50.22	8.11	58.33	0.82	624.17	0.814
B11	71.67	0.00	0.00	48.89	5.02	17.76	22.79	0.56	206.84	0.318
C01	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.33	231.11	1.001
C02	71.67	0.00	0.00	21.22	38.03	12.48	50.51	0.09	68.21	0.705
C03	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.29	197.39	1.001
C04	71.67	0.00	0.00	20.70	38.75	12.29	51.04	0.10	81.26	0.712
C05	71.67	0.00	0.00	11.97	52.38	7.40	59.78	0.17	129.77	0.834
C06_1	71.67	0.00	0.00	53.76	5.02	12.89	17.92	0.04	14.30	0.250
C06_2	71.67	0.00	0.00	30.90	22.97	17.85	40.82	0.19	149.60	0.570
C07	71.67	0.00	0.00	16.25	45.22	10.30	55.52	0.11	92.41	0.775
C08_1	71.67	0.00	0.00	31.14	21.53	19.06	40.59	0.06	55.45	0.566
C08_2	71.67	0.00	0.00	50.92	5.02	15.74	20.76	0.03	11.10	0.290
C09	71.67	0.00	0.00	18.64	42.33	10.76	53.08	0.64	474.02	0.741
C10	71.67	0.00	0.00	46.40	5.02	20.26	25.29	0.37	166.18	0.353
DR02	71.67	0.00	0.00	42.60	5.02	24.07	29.09	0.19	153.73	0.406
R01	71.67	0.00	0.00	0.00	71.76	0.00	71.76	0.09	59.02	1.001
R02	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.30	208.63	1.001
R03	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.08	57.53	1.001
R04	71.67	0.00	0.00	0.00	71.74	0.00	71.74	0.18	125.47	1.001
R05	71.67	0.00	0.00	0.00	71.71	0.00	71.71	0.49	335.03	1.001
R06	71.67	0.00	0.00	0.00	71.71	0.00	71.71	0.77	529.41	1.001
R07	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.30	207.53	1.001
R08	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.43	298.02	1.001
R09	71.67	0.00	0.00	0.00	71.71	0.00	71.71	0.72	496.75	1.001
R10	71.67	0.00	0.00	0.00	71.72	0.00	71.72	0.41	284.27	1.001
R11	71.67	0.00	0.00	0.00	71.75	0.00	71.75	0.09	59.52	1.001
R12	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.24	168.09	1.001
R13	71.67	0.00	0.00	0.00	71.73	0.00	71.73	0.24	163.12	1.001

****

Node Depth Summary

****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
1	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
EXSTMMH105	OUTFALL	0.47	0.47	87.92	0	00:00	0.47
EXSTMMH139	OUTFALL	0.63	0.63	87.84	0	00:00	0.63
STMMH222	OUTFALL	0.54	0.54	86.84	0	00:00	0.54
CB028	STORAGE	0.01	0.04	89.59	0	01:42	0.04
CB097	STORAGE	0.07	0.63	88.75	0	01:52	0.63
CB098	STORAGE	0.05	0.56	88.82	0	01:10	0.56
CB099	STORAGE	0.31	0.82	89.04	0	01:10	0.81
CB309	STORAGE	0.02	0.79	88.97	0	01:10	0.78
CB324	STORAGE	0.10	0.78	88.75	0	01:52	0.78
CBMH215	STORAGE	0.10	1.06	88.35	0	01:49	1.06
CBMH218	STORAGE	0.13	1.19	89.06	0	01:10	1.18
CBMH223	STORAGE	0.15	0.92	88.75	0	01:52	0.92
CBMH224	STORAGE	0.20	0.98	88.75	0	01:51	0.98
CBMH300	STORAGE	0.10	0.97	89.66	0	01:10	0.96
CBMH301	STORAGE	0.11	0.89	89.51	0	01:10	0.89
CBMH302	STORAGE	0.22	1.23	89.41	0	02:04	1.23
CBMH303	STORAGE	0.11	0.83	89.46	0	01:10	0.82
CBMH305	STORAGE	0.16	1.04	89.44	0	01:10	1.03
CBMH306	STORAGE	0.27	1.38	89.41	0	02:03	1.38
CBMH307	STORAGE	0.33	2.12	90.01	0	01:10	2.11
CBMH310	STORAGE	0.12	0.85	89.41	0	02:03	0.85
CBMH311	STORAGE	0.06	0.56	88.75	0	01:52	0.56
CBMH312	STORAGE	0.23	1.01	88.75	0	01:52	1.01
CBMH313	STORAGE	0.02	0.73	89.21	0	01:10	0.72
CBMH315	STORAGE	0.01	0.38	89.23	0	01:10	0.38
CBMH316	STORAGE	0.02	0.69	89.17	0	01:10	0.68
CBMH318	STORAGE	0.04	1.26	89.65	0	01:10	1.26
CBMH319	STORAGE	0.04	1.53	89.97	0	01:10	1.52
CBMH320	STORAGE	0.10	0.89	89.59	0	01:10	0.89
CBMH321	STORAGE	0.12	0.85	89.41	0	02:03	0.85
CBMH322	STORAGE	0.31	0.74	89.15	0	01:09	0.74
CBMH323	STORAGE	0.03	0.85	88.80	0	01:10	0.85
MH200	STORAGE	0.02	0.88	89.15	0	01:10	0.86
MH201	STORAGE	0.03	1.00	89.17	0	01:10	0.99
MH202	STORAGE	0.04	1.15	89.16	0	01:10	1.13
MH203	STORAGE	0.06	1.30	89.06	0	01:10	1.28
MH204	STORAGE	0.08	1.42	89.00	0	01:10	1.39
MH205	STORAGE	0.10	1.53	88.89	0	01:10	1.51
MH206	STORAGE	0.14	1.48	88.71	0	01:10	1.47
MH207	STORAGE	0.21	1.57	88.37	0	01:46	1.57
MH208	STORAGE	0.33	1.69	88.36	0	01:49	1.69
MH209	STORAGE	0.05	1.19	89.10	0	01:10	1.18
MH210	STORAGE	0.07	1.33	89.03	0	01:10	1.31
MH211	STORAGE	0.08	1.31	88.92	0	01:10	1.30
MH212	STORAGE	0.10	1.25	88.64	0	01:10	1.23
MH213	STORAGE	0.12	1.23	88.47	0	01:10	1.22
MH214	STORAGE	0.09	1.08	88.52	0	01:10	1.08
MH216	STORAGE	0.07	1.23	89.43	0	01:10	1.22
MH217	STORAGE	0.10	1.25	89.26	0	01:10	1.25
MH219	STORAGE	0.21	1.04	88.81	0	01:10	1.03
MH221	STORAGE	0.72	1.90	89.40	0	02:05	1.90
MH225	STORAGE	0.03	1.35	89.58	0	01:10	1.34
POND_A	STORAGE	0.60	1.95	88.35	0	01:49	1.95
POND_B	STORAGE	0.62	1.81	89.41	0	02:05	1.81
POND_C	STORAGE	0.47	1.25	88.75	0	01:52	1.25
RS01	STORAGE	0.00	0.11	95.11	0	01:11	0.11
RS02	STORAGE	0.00	0.11	95.11	0	01:13	0.11
RS03	STORAGE	0.00	0.11	95.11	0	01:12	0.11
RS04	STORAGE	0.01	0.13	95.13	0	01:20	0.13
RS05	STORAGE	0.00	0.11	95.11	0	01:13	0.11
RS06	STORAGE	0.00	0.11	95.11	0	01:14	0.11
RS07	STORAGE	0.01	0.11	95.11	0	01:14	0.11
RS08	STORAGE	0.00	0.11	95.11	0	01:14	0.11
RS09	STORAGE	0.01	0.11	95.11	0	01:15	0.11
RS10	STORAGE	0.00	0.11	95.11	0	01:14	0.11
RS11	STORAGE	0.00	0.11	95.11	0	01:12	0.11
RS12	STORAGE	0.00	0.11	95.11	0	01:12	0.11
RS13	STORAGE	0.00	0.10	95.10	0	01:11	0.10

****

Node Inflow Summary

****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
1	OUTFALL	153.73	153.73	0	01:10	0.187	0.187	0.000
EXSTMMH105	OUTFALL	0.00	177.69	0	02:05	0	3.89	0.000
EXSTMMH139	OUTFALL	0.00	149.75	0	01:52	0	2.44	0.000
STMMH222	OUTFALL	0.00	1053.23	0	01:49	0	11.6	0.000
CB028	STORAGE	33.73	33.73	0	01:10	0.0488	0.0498	0.011
CB097	STORAGE	11.10	11.10	0	01:10	0.033	0.033	-0.052
CB098	STORAGE	14.30	28.38	0	01:03	0.045	0.0462	0.316
CB099	STORAGE	16.36	18.72	0	01:06	0.0515	0.0518	-0.072
CB309	STORAGE	167.55	167.55	0	01:10	0.242	0.242	0.354
CB324	STORAGE	55.45	65.33	0	01:10	0.0585	0.0915	0.028
CBMH215	STORAGE	127.13	945.84	0	01:10	0.181	1.37	-0.063
CBMH218	STORAGE	129.77	684.48	0	01:10	0.169	0.979	-0.593
CBMH223	STORAGE	474.02	474.02	0	01:10	0.641	0	

CBMH224	STORAGE	0.00	466.95	0	01:10	0	0.641	-0.353
CBMH300	STORAGE	272.24	272.24	0	01:10	0.394	0.394	0.854
CBMH301	STORAGE	270.79	270.79	0	01:10	0.392	0.392	0.888
CBMH302	STORAGE	102.17	1194.28	0	01:08	0.148	1.74	-0.596
CBMH303	STORAGE	231.95	231.95	0	01:10	0.336	0.336	0.917
CBMH305	STORAGE	102.67	598.33	0	01:08	0.149	0.866	-0.172
CBMH306	STORAGE	105.65	1704.25	0	01:08	0.153	2.5	0.143
CBMH307	STORAGE	624.17	624.17	0	01:10	0.824	0.824	-0.005
CBMH310	STORAGE	246.85	246.85	0	01:10	0.358	0.358	0.990
CBMH311	STORAGE	92.41	92.41	0	01:10	0.111	0.111	-0.066
CBMH312	STORAGE	0.00	144.01	0	01:10	0	0.203	-0.238
CBMH313	STORAGE	221.67	221.67	0	01:10	0.321	0.321	0.396
CBMH315	STORAGE	113.08	113.08	0	01:10	0.164	0.164	-0.001
CBMH316	STORAGE	149.60	149.60	0	01:10	0.187	0.187	0.588
CBMH318	STORAGE	197.39	197.39	0	01:10	0.286	0.286	0.489
CBMH319	STORAGE	231.11	231.11	0	01:10	0.334	0.334	0.473
CBMH320	STORAGE	227.40	227.40	0	01:10	0.329	0.329	0.800
CBMH321	STORAGE	169.11	169.11	0	01:10	0.245	0.245	1.145
CBMH322	STORAGE	124.48	124.48	0	01:10	0.18	0.18	0.164
CBMH323	STORAGE	170.61	170.61	0	01:10	0.247	0.247	0.443
MH200	STORAGE	219.53	357.46	0	01:08	0.318	0.35	0.988
MH201	STORAGE	212.27	239.24	0	01:10	0.307	0.395	0.120
MH202	STORAGE	226.65	483.21	0	01:04	0.328	0.992	0.693
MH203	STORAGE	0.00	678.61	0	01:05	0	1.39	-0.554
MH204	STORAGE	147.27	1247.31	0	01:10	0.213	2.47	-0.199
MH205	STORAGE	86.78	1581.76	0	01:10	0.126	3.32	-0.597
MH206	STORAGE	259.38	2110.17	0	01:10	0.375	4.7	0.716
MH207	STORAGE	328.79	4318.44	0	01:10	0.476	9.78	-0.728
MH208	STORAGE	74.40	4379.97	0	01:10	0.108	9.96	-0.035
MH209	STORAGE	328.78	718.56	0	01:09	0.476	1.25	-0.362
MH210	STORAGE	292.08	1134.30	0	01:09	0.422	2.45	-0.073
MH211	STORAGE	212.73	1389.69	0	01:09	0.308	3.17	0.451
MH212	STORAGE	193.90	1545.52	0	01:09	0.28	3.53	-0.311
MH213	STORAGE	241.27	1880.97	0	01:10	0.339	4.36	0.482
MH214	STORAGE	648.69	819.21	0	01:10	0.939	1.18	-0.044
MH216	STORAGE	68.21	296.89	0	01:10	0.0884	0.421	0.275
MH217	STORAGE	81.26	566.80	0	01:10	0.104	0.808	-0.213
MH219	STORAGE	0.00	832.55	0	01:10	0	1.22	0.593
MH221	STORAGE	0.00	592.77	0	01:10	0	4.14	-0.027
MH225	STORAGE	349.80	349.80	0	01:10	0.507	0.507	2.375
POND_A	STORAGE	155.00	5456.66	0	01:10	0.305	12.1	-0.076
POND_B	STORAGE	206.84	2247.02	0	01:08	0.56	3.44	-0.440
POND_C	STORAGE	166.18	1556.91	0	01:10	0.368	2.68	-0.573
RS01	STORAGE	59.02	59.02	0	01:10	0.0854	0.0854	-0.002
RS02	STORAGE	208.63	208.63	0	01:10	0.302	0.302	-0.004
RS03	STORAGE	57.53	57.53	0	01:10	0.0832	0.0832	-0.002
RS04	STORAGE	125.47	125.47	0	01:10	0.181	0.181	-0.002
RS05	STORAGE	335.03	335.03	0	01:10	0.487	0.487	-0.011
RS06	STORAGE	529.41	529.41	0	01:10	0.773	0.773	-0.018
RS07	STORAGE	207.53	207.53	0	01:10	0.301	0.301	-0.004
RS08	STORAGE	298.02	298.02	0	01:10	0.432	0.432	-0.007
RS09	STORAGE	496.75	496.75	0	01:10	0.722	0.722	-0.011
RS10	STORAGE	284.27	284.27	0	01:10	0.412	0.412	-0.006
RS11	STORAGE	59.52	59.52	0	01:10	0.0861	0.0861	-0.002
RS12	STORAGE	168.09	168.09	0	01:10	0.243	0.243	-0.003
RS13	STORAGE	163.12	163.12	0	01:10	0.236	0.236	-0.004

```
**********************
Node Surcharge Summary
**********************
```

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
CB099	STORAGE	0.05	0.143	0.756
CBMH307	STORAGE	5.38	1.514	0.506
CBMH313	STORAGE	0.08	0.268	1.445
CBMH318	STORAGE	0.20	0.881	0.348
CBMH319	STORAGE	0.20	1.146	0.083
MH200	STORAGE	0.05	0.121	1.637
MH201	STORAGE	0.08	0.241	1.536
MH202	STORAGE	0.10	0.316	1.536
MH209	STORAGE	0.07	0.202	1.596
MH210	STORAGE	0.08	0.240	1.649
MH211	STORAGE	0.10	0.247	1.746
MH225	STORAGE	0.18	0.813	1.434

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CB028	0.013	0.7	0.0	0.0	0.036	2.0	0 01:42	2.83
CB097	0.000	5.0	0.0	0.0	0.000	45.5	0 01:52	10.97
CB098	0.000	3.7	0.0	0.0	0.000	41.6	0 01:10	21.71
CB099	0.000	19.6	0.0	0.0	0.000	52.2	0 01:10	22.62
CB309	0.000	0.7	0.0	0.0	0.001	24.8	0 01:10	165.89
CB324	0.000	4.2	0.0	0.0	0.001	32.4	0 01:52	63.21
CBMH215	0.000	3.5	0.0	0.0	0.001	37.7	0 01:49	945.68
CBMH218	0.000	5.0	0.0	0.0	0.002	44.2	0 01:10	671.92
CBMH223	0.000	6.8	0.0	0.0	0.002	42.3	0 01:52	466.95
CBMH224	0.000	8.1	0.0	0.0	0.002	38.6	0 01:51	452.65
CBMH300	0.000	5.0	0.0	0.0	0.001	49.4	0 01:10	270.05
CBMH301	0.000	5.4	0.0	0.0	0.001	42.9	0 01:10	268.56
CBMH302	0.001	8.9	0.0	0.0	0.006	49.3	0 02:04	1186.09
CBMH303	0.000	5.4	0.0	0.0	0.001	41.1	0 01:10	230.33
CBMH305	0.000	7.3	0.0	0.0	0.003	46.8	0 01:10	593.32
CBMH306	0.001	9.9	0.0	0.0	0.006	51.2	0 02:03	1700.31
CBMH307	0.000	12.7	0.0	0.0	0.002	80.7	0 01:10	592.77
CBMH310	0.000	5.6	0.0	0.0	0.001	38.7	0 02:03	244.40
CBMH311	0.000	2.7	0.0	0.0	0.001	25.2	0 01:52	85.54
CBMH312	0.000	8.8	0.0	0.0	0.001	38.3	0 01:52	137.05
CBMH313	0.000	0.7	0.0	0.0	0.001	33.4	0 01:10	220.30
CBMH315	0.000	0.5	0.0	0.0	0.000	14.6	0 01:10	113.08
CBMH316	0.000	1.2	0.0	0.0	0.000	34.2	0 01:10	144.83
CBMH318	0.000	2.6	0.0	0.0	0.001	78.4	0 01:10	195.33
CBMH319	0.000	2.4	0.0	0.0	0.002	94.8	0 01:10	228.77
CBMH320	0.000	5.1	0.0	0.0	0.001	47.2	0 01:10	225.62
CBMH321	0.000	5.7	0.0	0.0	0.001	39.8	0 02:03	168.33
CBMH322	0.000	11.9	0.0	0.0	0.001	27.9	0 01:09	124.77
CBMH323	0.000	1.5	0.0	0.0	0.001	42.3	0 01:10	170.52
MH200	0.000	0.9	0.0	0.0	0.002	35.0	0 01:10	278.17
MH201	0.000	1.1	0.0	0.0	0.002	39.5	0 01:10	246.02
MH202	0.000	1.6	0.0	0.0	0.002	42.9	0 01:10	443.47
MH203	0.000	1.8	0.0	0.0	0.006	38.1	0 01:10	635.83
MH204	0.000	2.1	0.0	0.0	0.006	36.3	0 01:10	1216.90
MH205	0.000	2.5	0.0	0.0	0.007	36.2	0 01:10	1587.25
MH206	0.001	3.1	0.0	0.0	0.007	34.2	0 01:10	2086.33
MH207	0.001	5.1	0.0	0.0	0.007	37.7	0 01:46	4318.72
MH208	0.000	9.1	0.0	0.0	0.002	46.1	0 01:49	4384.52
MH209	0.000	1.8	0.0	0.0	0.003	42.8	0 01:10	661.02

MH210	0.000	2.3	0.0	0.0	0.003	44.7	0	01:10	1071.12
MH211	0.000	2.7	0.0	0.0	0.003	42.9	0	01:10	1360.56
MH212	0.000	3.0	0.0	0.0	0.006	38.9	0	01:10	1550.22
MH213	0.001	2.7	0.0	0.0	0.006	28.3	0	01:10	1872.63
MH214	0.000	3.0	0.0	0.0	0.001	37.9	0	01:10	818.71
MH216	0.000	3.3	0.0	0.0	0.002	58.6	0	01:10	290.87
MH217	0.000	4.5	0.0	0.0	0.002	54.8	0	01:10	555.56
MH219	0.001	6.8	0.0	0.0	0.003	34.1	0	01:10	806.96
MH221	0.001	27.8	0.0	0.0	0.003	74.1	0	02:05	555.30
MH225	0.000	1.1	0.0	0.0	0.002	48.4	0	01:10	340.04
POND_A	0.993	7.2	0.0	0.0	5.642	40.8	0	01:49	1053.23
POND_B	0.562	8.8	0.0	0.0	2.511	39.5	0	02:05	164.42
POND_C	0.452	7.0	0.0	0.0	1.697	26.4	0	01:52	149.75
RS01	0.001	1.2	0.0	0.0	0.025	52.9	0	01:11	27.65
RS02	0.002	1.4	0.0	0.0	0.092	54.5	0	01:13	88.60
RS03	0.001	1.5	0.0	0.0	0.026	56.7	0	01:12	24.10
RS04	0.003	3.0	0.0	0.0	0.072	71.4	0	01:20	36.34
RS05	0.004	1.3	0.0	0.0	0.139	51.2	0	01:13	147.41
RS06	0.006	1.5	0.0	0.0	0.229	53.1	0	01:14	218.54
RS07	0.003	1.7	0.0	0.0	0.098	58.3	0	01:14	79.43
RS08	0.004	1.5	0.0	0.0	0.133	55.3	0	01:14	120.42
RS09	0.007	1.8	0.0	0.0	0.234	58.0	0	01:15	185.90
RS10	0.004	1.6	0.0	0.0	0.128	55.6	0	01:14	114.10
RS11	0.001	1.4	0.0	0.0	0.027	56.1	0	01:12	25.48
RS12	0.002	1.6	0.0	0.0	0.077	57.1	0	01:12	68.01
RS13	0.001	1.1	0.0	0.0	0.064	48.9	0	01:11	80.45

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
1	13.28	17.74	153.73	0.187
EXSTMMH105	44.07	103.69	177.69	3.894
EXSTMMH139	33.49	85.96	149.75	2.439
STMMH222	98.96	140.41	1053.23	11.644
System	47.45	347.79	1394.50	18.163

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
028-206	CONDUIT	2.83	0	01:42	0.60	0.03	0.12
097-324	CONDUIT	10.97	0	01:10	0.38	0.11	1.00
098-219	CONDUIT	21.71	0	01:06	0.42	0.23	1.00
099-210	CONDUIT	22.62	0	01:13	0.56	0.25	1.00
200-201	CONDUIT	138.58	0	01:08	0.66	0.92	1.00
200-209	CONDUIT	278.17	0	01:09	0.82	0.69	1.00
201-202	CONDUIT	202.64	0	01:04	0.66	0.51	1.00
202-203	CONDUIT	443.47	0	01:05	1.07	0.82	1.00
203-204	CONDUIT	635.83	0	01:11	0.94	0.80	1.00
204-205	CONDUIT	1216.90	0	01:10	1.36	1.24	1.00
205-206	CONDUIT	1587.25	0	01:11	1.36	1.14	1.00
206-207	CONDUIT	2086.33	0	01:10	1.81	1.44	0.98
207-208	CONDUIT	4318.72	0	01:10	2.64	1.72	1.00
208-PONDA	CONDUIT	4384.52	0	01:10	3.07	1.47	1.00
209-210	CONDUIT	661.02	0	01:09	0.86	0.83	1.00
210-211	CONDUIT	1071.12	0	01:09	1.20	1.08	1.00
211-212	CONDUIT	1360.56	0	01:11	1.53	1.44	1.00
212-213	CONDUIT	1550.22	0	01:11	1.34	1.09	1.00
213-207	CONDUIT	1872.63	0	01:10	1.64	1.33	0.97
214-2115	CONDUIT	818.71	0	01:10	1.82	2.04	1.00
215-PONDA	CONDUIT	945.68	0	01:10	2.28	1.82	1.00
216-217	CONDUIT	290.87	0	01:10	1.30	2.04	1.00
217-218	CONDUIT	555.56	0	01:10	1.50	1.72	1.00
218-219	CONDUIT	671.92	0	01:09	1.47	1.68	1.00
219-PONDC	CONDUIT	806.96	0	01:10	1.80	2.20	1.00
223-224	CONDUIT	466.95	0	01:10	1.27	1.50	1.00
224-PONDC	CONDUIT	452.65	0	01:10	1.46	1.47	1.00
225-204	CONDUIT	340.04	0	01:09	1.52	1.73	1.00
300-305	CONDUIT	270.05	0	01:08	1.21	1.37	1.00
301-302	CONDUIT	268.56	0	01:08	1.20	1.36	1.00
302-306	CONDUIT	1186.09	0	01:08	1.81	1.80	1.00
303-302	CONDUIT	230.33	0	01:08	1.04	1.11	1.00
305-302	CONDUIT	593.32	0	01:08	1.30	1.46	1.00
306-PONDB	CONDUIT	1700.31	0	01:08	2.39	1.97	1.00
307-221	CONDUIT	592.77	0	01:10	2.03	1.69	1.00
309-205	CONDUIT	165.89	0	01:09	1.17	0.93	1.00

310-306	CONDUIT	244.40	0	01:08	1.10	1.16	1.00
311-312	CONDUIT	85.54	0	01:07	0.99	0.67	1.00
312-PONDC	CONDUIT	137.05	0	01:10	0.84	0.96	1.00
313-203	CONDUIT	220.30	0	01:09	1.64	1.04	1.00
315-206	CONDUIT	113.08	0	01:10	1.13	0.91	0.82
316-219	CONDUIT	144.83	0	01:10	1.27	0.89	1.00
318-217	CONDUIT	195.33	0	01:10	1.71	1.57	1.00
319-216	CONDUIT	228.77	0	01:09	2.01	1.84	1.00
320-305	CONDUIT	225.62	0	01:08	1.02	1.09	1.00
321-306	CONDUIT	168.33	0	01:08	1.00	0.81	1.00
322-204	CONDUIT	124.77	0	01:09	1.22	0.99	0.94
323-214	CONDUIT	170.52	0	01:10	1.50	1.36	1.00
324-312	CONDUIT	63.21	0	01:10	1.01	0.61	1.00
PONDB-221	CONDUIT	409.06	0	01:10	0.50	0.41	1.00
1	ORIFICE	149.75	0	01:52			1.00
5	ORIFICE	177.69	0	02:05			1.00
STM-53_(STM)	ORIFICE	1053.23	0	01:49			1.00
R01-OUT	DUMMY	27.65	0	01:11			
R02-OUT	DUMMY	88.60	0	01:13			
R03-OUT	DUMMY	24.10	0	01:12			
R04-OUT	DUMMY	36.34	0	01:20			
R05-OUT	DUMMY	147.41	0	01:13			
R06-OUT	DUMMY	218.54	0	01:14			
R07-OUT	DUMMY	79.43	0	01:14			
R08-OUT	DUMMY	120.42	0	01:14			
R09-OUT	DUMMY	185.90	0	01:15			
R10-OUT	DUMMY	114.10	0	01:14			
R11-OUT	DUMMY	25.48	0	01:12			
R12-OUT	DUMMY	68.01	0	01:13			
R13-OUT	DUMMY	80.45	0	01:11			

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm	Inlet
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl
028-206	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
097-324	1.00	0.00	0.00	0.00	0.25	0.00	0.00	0.75	0.82	0.00
098-219	1.00	0.00	0.00	0.00	0.18	0.00	0.00	0.82	0.03	0.00
099-210	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
200-201	1.00	0.96	0.02	0.00	0.02	0.00	0.00	0.00	0.95	0.00
200-209	1.00	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.01	0.00
201-202	1.00	0.00	0.00	0.00	0.11	0.00	0.00	0.89	0.02	0.00
202-203	1.00	0.00	0.00	0.00	0.08	0.00	0.00	0.92	0.00	0.00
203-204	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.01	0.00
204-205	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.01	0.00
205-206	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.86	0.00
206-207	1.00	0.00	0.00	0.00	0.14	0.00	0.00	0.86	0.01	0.00
207-208	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.00
208-PONDA	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.00	0.00
209-210	1.00	0.00	0.00	0.00	0.11	0.00	0.00	0.89	0.01	0.00
210-211	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.88	0.00
211-212	1.00	0.00	0.00	0.00	0.11	0.00	0.00	0.89	0.00	0.00
212-213	1.00	0.00	0.00	0.00	0.37	0.00	0.00	0.63	0.18	0.00
213-207	1.00	0.00	0.00	0.00	0.14	0.00	0.00	0.86	0.01	0.00
214-2115	1.00	0.00	0.00	0.00	0.24	0.00	0.00	0.76	0.01	0.00
215-PONDA	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.00	0.00
216-217	1.00	0.00	0.00	0.00	0.17	0.00	0.00	0.83	0.01	0.00
217-218	1.00	0.00	0.00	0.00	0.24	0.00	0.00	0.76	0.03	0.00
218-219	1.00	0.00	0.01	0.00	0.97	0.00	0.00	0.02	0.71	0.00
219-PONDC	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00
223-224	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
224-PONDC	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
225-204	1.00	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.01	0.00
300-305	1.00	0.00	0.00	0.00	0.20	0.00	0.00	0.80	0.01	0.00
301-302	1.00	0.00	0.00	0.00	0.22	0.00	0.00	0.78	0.01	0.00
302-306	1.00	0.00	0.00	0.00	0.31	0.00	0.00	0.69	0.02	0.00
303-302	1.00	0.00	0.00	0.00	0.22	0.00	0.00	0.78	0.02	0.00
305-302	1.00	0.00	0.00	0.00	0.26	0.00	0.00	0.74	0.02	0.00
306-PONDB	1.00	0.00	0.00	0.00	0.34	0.00	0.00	0.66	0.02	0.00
307-221	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00
309-205	1.00	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.00	0.00

310-306	1.00	0.00	0.00	0.00	0.23	0.00	0.00	0.77	0.02	0.00
311-312	1.00	0.00	0.49	0.00	0.50	0.00	0.00	0.01	0.82	0.00
312-PONDC	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
313-203	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00
315-206	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
316-219	1.00	0.00	0.00	0.00	0.17	0.00	0.00	0.83	0.07	0.00
318-217	1.00	0.00	0.00	0.00	0.14	0.00	0.00	0.86	0.02	0.00
319-216	1.00	0.00	0.00	0.00	0.13	0.00	0.00	0.87	0.02	0.00
320-305	1.00	0.00	0.00	0.00	0.20	0.00	0.00	0.80	0.02	0.00
321-306	1.00	0.00	0.00	0.00	0.23	0.00	0.00	0.77	0.02	0.00
322-204	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
323-214	1.00	0.00	0.00	0.00	0.08	0.00	0.00	0.92	0.01	0.00
324-312	1.00	0.00	0.00	0.00	0.25	0.00	0.00	0.75	0.74	0.00
PONDB-221	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
097-324	2.66	2.66	3.35	0.01	0.01
098-219	1.58	1.58	2.33	0.01	0.01
099-210	0.05	0.05	0.08	0.01	0.01
200-201	0.05	0.05	0.08	0.01	0.01
200-209	0.05	0.05	0.07	0.01	0.01
201-202	0.08	0.08	0.10	0.01	0.01
202-203	0.10	0.10	0.11	0.01	0.01
203-204	0.11	0.11	0.12	0.01	0.01
204-205	0.12	0.12	0.13	0.16	0.12
205-206	0.12	0.12	0.13	0.10	0.10
206-207	0.01	0.13	0.58	0.19	0.01
207-208	0.55	0.55	0.99	0.24	0.01
208-PONDA	1.02	1.02	1.10	0.18	0.01
209-210	0.07	0.07	0.09	0.01	0.01
210-211	0.09	0.09	0.10	0.06	0.07
211-212	0.02	0.10	0.02	0.20	0.02
212-213	0.01	0.02	0.01	0.07	0.01
213-207	0.01	0.01	0.58	0.15	0.01
214-2115	1.01	1.15	1.39	0.18	0.01
215-PONDA	1.42	1.42	1.52	0.16	0.01
216-217	0.77	0.78	1.27	0.20	0.16
217-218	1.22	1.23	1.78	0.18	0.15
218-219	1.70	1.74	1.93	0.17	0.13
219-PONDC	2.17	2.28	2.60	0.20	0.03
223-224	2.23	2.24	2.45	0.15	0.01
224-PONDC	2.51	2.53	2.78	0.14	0.01
225-204	0.13	0.18	0.13	0.17	0.13
300-305	2.32	2.33	2.63	0.15	0.13
301-302	2.63	2.65	2.94	0.15	0.13
302-306	2.81	2.88	3.11	0.17	0.04
303-302	2.59	2.60	2.94	0.11	0.11
305-302	2.59	2.60	2.89	0.15	0.11
306-PONDB	3.08	3.12	3.32	0.17	0.01
307-221	5.38	5.38	7.14	0.17	0.17
309-205	0.11	0.13	0.12	0.01	0.09
310-306	2.83	2.90	3.15	0.12	0.04
311-312	1.91	1.91	3.79	0.01	0.01
312-PONDC	3.82	3.82	4.03	0.01	0.01
313-203	0.08	0.08	0.10	0.09	0.05
316-219	0.08	0.08	2.29	0.01	0.02
318-217	0.17	0.20	1.29	0.16	0.16
319-216	0.18	0.20	0.63	0.18	0.18
320-305	2.24	2.24	2.63	0.10	0.12
321-306	2.79	2.79	3.15	0.01	0.03
322-204	0.01	0.14	0.01	0.01	0.01
323-214	0.55	0.55	1.16	0.15	0.14
324-312	3.40	3.40	3.83	0.01	0.01
PONDB-221	4.59	4.59	5.02	0.01	0.01

Analysis begun on: Wed Dec 11 08:40:28 2024
Analysis ended on: Wed Dec 11 08:40:29 2024
Total elapsed time: 00:00:01

South Nepean Business Park Warehouse (124123)
Design Storm Time Series Data
3-hour Chicago Design Storms

C25mm-3.stm		C2-3.stm		C5-3.stm	
Duration min	Intensity mm/hr	Duration min	Intensity mm/hr	Duration min	Intensity mm/hr
0:00	0	0:00	0	0:00	0
0:10	2.21	0:10	2.81	0:10	3.68
0:20	2.75	0:20	3.5	0:20	4.58
0:30	3.68	0:30	4.69	0:30	6.15
0:40	5.73	0:40	7.3	0:40	9.61
0:50	14.29	0:50	18.21	0:50	24.17
1:00	60.28	1:00	76.81	1:00	104.19
1:10	18.9	1:10	24.08	1:10	32.04
1:20	9.7	1:20	12.36	1:20	16.34
1:30	6.53	1:30	8.32	1:30	10.96
1:40	4.94	1:40	6.3	1:40	8.29
1:50	3.99	1:50	5.09	1:50	6.69
2:00	3.37	2:00	4.29	2:00	5.63
2:10	2.92	2:10	3.72	2:10	4.87
2:20	2.58	2:20	3.29	2:20	4.3
2:30	2.32	2:30	2.95	2:30	3.86
2:40	2.1	2:40	2.68	2:40	3.51
2:50	1.93	2:50	2.46	2:50	3.22
3:00	1.79	3:00	2.28	3:00	2.98

South Nepean Business Park Warehouse (124123)
Design Storm Time Series Data
3-hour Chicago Design Storms

C100-3.stm		C100-3+20%.stm	
Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr
0:00	0	0:00	0
0:10	6.05	0:10	6:14
0:20	7.54	0:20	9.05
0:30	10.16	0:30	12.19
0:40	15.97	0:40	19.16
0:50	40.65	0:50	48.78
1:00	178.56	1:00	214.27
1:10	54.05	1:10	64.86
1:20	27.32	1:20	32.78
1:30	18.24	1:30	21.89
1:40	13.74	1:40	16.49
1:50	11.06	1:50	13.27
2:00	9.29	2:00	11.15
2:10	8.02	2:10	9.62
2:20	7.08	2:20	8.5
2:30	6.35	2:30	7.62
2:40	5.76	2:40	6.91
2:50	5.28	2:50	6.34
3:00	4.88	3:00	5.86

South Nepean Business Park Warehouse (124123)
Design Storm Time Series Data
SCS Design Storms

NOVATECH
Engineers, Planners & Landscape Architects

S2-24.stm		S5-24.stm		S100-24.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0.00	0:00	0	0:00	0
1:00	0.72	1:00	0.44	1:00	0.6
2:00	0.34	2:00	0.44	2:00	0.75
3:00	0.63	3:00	0.81	3:00	1.39
4:00	0.63	4:00	0.81	4:00	1.39
5:00	0.81	5:00	1.06	5:00	1.81
6:00	0.72	6:00	0.94	6:00	1.6
7:00	0.96	7:00	1.25	7:00	2.13
8:00	0.96	8:00	1.25	8:00	2.13
9:00	1.30	9:00	1.68	9:00	2.88
10:00	1.63	10:00	2.12	10:00	3.63
11:00	2.59	11:00	3.37	11:00	5.76
12:00	20.55	12:00	26.71	12:00	45.69
13:00	5.23	13:00	6.8	13:00	11.64
14:00	2.30	14:00	2.99	14:00	5.12
15:00	1.54	15:00	2	15:00	3.42
16:00	1.34	16:00	1.75	16:00	2.99
17:00	1.06	17:00	1.37	17:00	2.35
18:00	1.11	18:00	1.44	18:00	2.46
19:00	0.72	19:00	0.94	19:00	1.6
20:00	0.58	20:00	0.75	20:00	1.28
21:00	0.81	21:00	1.06	21:00	1.81
22:00	0.53	22:00	0.68	22:00	1.17
23:00	0.48	23:00	0.63	23:00	1.07
0:00	0.48	0:00	0.63	0:00	1.07

South Nepean Business Park Warehouse (124123)
Catchbasin Grate and Lead Inlet Capacity Calculations

NOVATECH
Engineers, Planners & Landscape Architects

Tc = 10 min
100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
= 178.6 mm/hr

Notes:
[1] *Maximum Available ponding depth is based on the lowest spill point of each catchbasin (equivalent to the static ponding depth).*
[2] *Grate Inlet Rate taken from MTO Drainage Management Manual Design Chart 4.19. Flow obtained using max. available ponding depth (static ponding depth) on CB inlet curve.*

Drainage Area Information						Sub-Area Information			Catchbasin Information					CB Lead Information							
Area ID	Total Area (ha)	Runoff Coeff.	A hard	100yr Runoff Coeff.	Rational Peak Flow (L/s)	CB / CBMH ID	Sub Area (ha)	Runoff (L/s)	T/G (m)	Spill Elev. (m)	Maximum Available Ponding Depth[1] (m)	Grate Inlet Rate[2] (L/s)	Q_{Peak} / Q_{Grate} (%)	CB lead dia. (mm)	Actual Inner Dia. (mm)	Length (m)	Pipe Slope (%)	HGL Slope (%)	Surcharge Depth at CB (m)	Capacity (L/s)	Q_{Peak} / $Q_{Capacity}$ (%)
A01	0.443	0.900	0.443	1.000	219.9	CB01	0.222	110.0	90.55	90.70	0.15	118	93%	375	381	19.9	0.50	0.36	0.00	129.3	85%
						CB02	0.222	110.0	90.45	90.74	0.29	197	56%	375	381	19.9	0.50	0.36	0.00	129.3	85%
A02	0.428	0.900	0.428	1.000	212.5	CB03	0.214	106.3	90.42	90.66	0.24	177	60%	375	381	19.7	0.50	0.34	0.00	129.3	82%
						CB04	0.214	106.3	90.39	90.61	0.22	167	64%	375	381	19.8	0.50	0.34	0.00	129.3	82%
A03	0.457	0.900	0.457	1.000	226.9	CB05	0.229	113.5	90.36	90.60	0.24	177	64%	375	381	19.9	0.50	0.38	0.00	129.3	88%
						CB06	0.229	113.5	90.27	90.55	0.28	193	59%	375	381	36.3	0.50	0.38	0.00	129.3	88%
A04	0.447	0.900	0.447	1.000	221.9	CB07	0.112	55.5	90.23	90.53	0.30	201	28%	375	381	16.2	0.50	0.09	0.00	129.3	43%
						CB08	0.112	55.5	90.40	90.65	0.25	181	31%	375	381	39.0	0.50	0.09	0.00	129.3	43%
						CB26	0.112	55.5	90.55	90.75	0.20	156	36%	375	381	21.5	0.50	0.09	0.00	129.3	43%
						CBMH313	0.112	55.5	90.65	90.86	0.21	162	34%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A05	0.251	0.900	0.251	1.000	124.6	CB09	0.084	41.5	90.50	90.75	0.25	181	23%	300	304.8	24.3	0.50	0.17	0.00	71.3	58%
						CBMH314	0.084	41.5	90.80	91.10	0.30	201	21%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						CBMH322	0.084	41.5	91.05	91.25	0.20	156	27%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A06	0.297	0.900	0.297	1.000	147.4	CB10	0.074	36.9	91.35	91.60	0.25	181	20%	300	304.8	8.5	1.00	0.13	0.00	100.9	37%
						CB12	0.074	36.9	91.10	91.20	0.10	60	61%	300	304.8	11.7	1.00	0.13	0.00	100.9	37%
						CB13	0.074	36.9	91.35	91.65	0.30	201	18%	300	304.8	8.5	1.00	0.13	0.00	100.9	37%
						CB125	0.074	36.9	91.65	91.65	0.00	0	N/A	375	381	26.8	0.50	0.04	0.00	129.3	28%
A07	0.707	0.900	0.707	1.000	351.0	CB14	0.088	43.9	90.70	90.95	0.25	181	24%	300	304.8	22.6	1.00	0.19	0.00	100.9	43%
						CB15	0.088	43.9	90.80	91.05	0.25	181	24%	300	304.8	19.0	1.00	0.19	0.00	100.9	43%
						CB16	0.088	43.9	90.60	90.90	0.30	201	22%	300	304.8	22.6	1.00	0.19	0.00	100.9	43%
						CB17	0.088	43.9	90.70	90.95	0.25	181	24%	300	304.8	19.1	1.00	0.19	0.00	100.9	43%
						CB18	0.088	43.9	90.59	90.85	0.26	185	24%	300	304.8	28.6	1.00	0.19	0.00	100.9	43%
						CB19	0.088	43.9	90.75	91.00	0.25	181	24%	300	304.8	24.1	1.00	0.19	0.00	100.9	43%
						CB20	0.088	43.9	90.90	91.15	0.25	181	24%	300	304.8	22.5	1.00	0.19	0.00	100.9	43%
						CB21	0.088	43.9	90.95	91.25	0.30	201	22%	300	304.8	19.1	1.00	0.19	0.00	100.9	43%
A08	0.175	0.900	0.175	1.000	86.9	CB22	0.088	43.5	91.15	91.25	0.10	60	72%	300	304.8	11.3	1.00	0.19	0.00	100.9	43%
						CB124	0.088	43.5	91.65	91.65	0.00	0	N/A	375	381	26.9	0.50	0.06	0.00	129.3	34%
A09	0.338	0.900	0.338	1.000	167.8	CB24	0.085	42.0	90.85	91.10	0.25	181	23%	300	304.8	11.7	2.00	0.17	0.00	142.7	29%
						CBMH317	0.085	42.0	90.95	91.10	0.15	118	36%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						CB308	0.085	42.0	91.15	91.40	0.25	181	23%	450	457.2	16.6	0.30	0.02	0.00	162.9	26%
						CB309	0.085	42.0	91.35	91.55	0.20	156	27%	450	457.2	11.2	0.30	0.02	0.00	162.9	26%
A10	0.228	0.900	0.228	1.000	113.2	CB31	0.076	37.7	91.00	91.30	0.30	201	19%	375	381	16.8	1.00	0.04	0.00	182.9	21%
						CBMH304	0.076	37.7	91.25	91.55	0.30	201	19%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						CBMH315	0.076	37.7	91.45	91.60	0.15	118	32%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A11	0.068	0.900	0.068	1.000	33.8	CB28	0.068	33.8	91.35	91.45	0.10	60	56%	300	304.8	21.6	1.00	0.11	0.00	100.9	34%
A12	0.523	0.900	0.523	1.000	259.6	CB46	0.105	51.9	91.35	91.50	0.15	118	44%	375	381	15.5	1.00	0.08	0.00	182.9	28%
						CB58	0.105	51.9	91.35	91.60	0.25	181	29%	375	381	15.5	1.00	0.08	0.00	182.9	28%
						CB59	0.105	51.9	90.75	90.85	0.10	60	87%	375	381	21.6	1.00	0.08	0.00	182.9	28%
						CB123	0.105	51.9	91.60	91.75	0.15	118	44%	375	381	27.0	0.50	0.08	0.00	129.3	40%
						CB68	0.105	51.9	90.95	91.06	0.11	73	71%	375	381	23.2	1.00	0.08	0.00	182.9	28%
A13	0.663	0.900	0.663	1.000	329.1	CB33	0.221	109.7	90.44	90.66	0.22	167	66%	375	381	16.9	0.50	0.36	0.00	129.3	85%
						CB34	0.221	109.7	90.41	90.63	0.22	167	66%	375	381	16.9	0.50	0.36	0.00	129.3	85%
						CB35	0.221	109.7	90.37	90.59	0.22	167	66%	375	381	16.9	0.50	0.36	0.00	129.3	85%
A14	0.894	0.900	0.894	1.000	443.8	CB36	0.224	111.0	90.34	90.56	0.22	167	66%	375	381	16.9	0.50	0.37	0.00	129.3	86%
						CB37	0.224	111.0	90.30	90.52	0.22	167	66%	375	381	16.9	0.50	0.37	0.00	129.3	86%
						CB38	0.224	111.0	90.27	90.48	0.21	162	68%	375	381	16.9	0.50	0.37	0.00	129.3	86%
						CB99	0.224	111.0	89.80	90.54	0.74	-	-	375	381	45.1	0.25	0.37	0.05	91.5	121%

South Nepean Business Park Warehouse (124123)
Catchbasin Grate and Lead Inlet Capacity Calculations

NOVATECH
Engineers, Planners & Landscape Architects

Tc = 10 min
100 year Intensity = $1735.688 / (\text{Time in min} + 6.014)^{0.820}$
= 178.6 mm/hr

Notes:
[1] *Maximum Available ponding depth is based on the lowest spill point of each catchbasin (equivalent to the static ponding depth).*
[2] *Grate Inlet Rate taken from MTO Drainage Management Manual Design Chart 4.19. Flow obtained using max. available ponding depth (static ponding depth) on CB inlet curve.*

Drainage Area Information						Sub-Area Information			Catchbasin Information					CB Lead Information							
Area ID	Total Area (ha)	Runoff Coeff.	A hard	100yr Runoff Coeff.	Rational Peak Flow (L/s)	CB / CBMH ID	Sub Area (ha)	Runoff (L/s)	T/G (m)	Spill Elev. (m)	Maximum Available Ponding Depth[1] (m)	Grate Inlet Rate[2] (L/s)	Q_{Peak} / Q_{Grate} (%)	CB lead dia. (mm)	Actual Inner Dia. (mm)	Length (m)	Pipe Slope (%)	HGL Slope (%)	Surcharge Depth at CB (m)	Capacity (L/s)	Q_{Peak} / $Q_{Capacity}$ (%)
A15	0.429	0.900	0.429	1.000	213.0	CB39	0.215	106.5	90.23	90.45	0.22	167	64%	375	381	16.9	0.50	0.34	0.00	129.3	82%
						CB40	0.215	106.5	90.19	90.41	0.22	167	64%	375	381	16.9	0.50	0.34	0.00	129.3	82%
A16	0.391	0.900	0.391	1.000	194.1	CB41	0.196	97.1	90.16	90.38	0.22	167	58%	375	381	16.9	0.50	0.28	0.00	129.3	75%
						CB42	0.196	97.1	90.12	90.36	0.24	177	55%	375	381	18.0	0.50	0.28	0.00	129.3	75%
A18	0.491	0.860	0.463	0.960	234.0	CB43	0.098	46.8	90.95	91.05	0.10	60	78%	375	381	23.6	1.00	0.07	0.00	182.9	26%
						CB44	0.098	46.8	90.90	90.99	0.09	47	100%	375	381	23.6	1.00	0.07	0.00	182.9	26%
						CB45	0.098	46.8	90.85	90.95	0.10	60	78%	375	381	23.6	1.00	0.07	0.00	182.9	26%
						CB116	0.098	46.8	91.00	91.05	0.05	12	390%	375	381	23.1	0.50	0.07	0.00	129.3	36%
						CB118	0.098	46.8	90.95	91.00	0.05	12	390%	375	381	23.0	0.50	0.07	0.00	129.3	36%
A19	0.663	0.900	0.663	1.000	329.1	CB47	0.074	36.6	90.50	90.60	0.10	60	61%	375	381	21.0	1.00	0.04	0.00	182.9	20%
						CB48	0.074	36.6	90.35	90.50	0.15	118	31%	375	381	23.2	1.00	0.04	0.00	182.9	20%
						CB49	0.074	36.6	90.65	90.85	0.20	156	23%	375	381	21.0	1.00	0.04	0.00	182.9	20%
						CB50	0.074	36.6	90.50	90.70	0.20	156	23%	375	381	23.2	1.00	0.04	0.00	182.9	20%
						CB51	0.074	36.6	90.30	90.40	0.10	60	61%	375	381	21.0	1.00	0.04	0.00	182.9	20%
						CB52	0.074	36.6	90.40	90.55	0.15	118	31%	375	381	23.2	1.00	0.04	0.00	182.9	20%
						CB53	0.074	36.6	90.10	90.20	0.10	60	61%	375	381	20.9	1.00	0.04	0.00	182.9	20%
						CB54	0.074	36.6	90.35	90.55	0.20	156	23%	375	381	23.2	1.00	0.04	0.00	182.9	20%
						CB55	0.074	36.6	90.05	90.10	0.05	12	305%	375	381	20.9	1.00	0.04	0.00	182.9	20%
A20	0.500	0.900	0.500	1.000	248.2	CB56	0.250	124.1	90.30	90.50	0.20	156	80%	375	381	23.2	1.00	0.46	0.00	182.9	68%
						CB57	0.250	124.1	90.00	90.10	0.10	60	207%	375	381	20.9	1.00	0.46	0.00	182.9	68%
A21	0.344	0.600	0.197	0.680	116.1	CB11	0.172	58.1	90.00	90.09	0.09	47	124%	375	381	18.4	1.00	0.10	0.00	182.9	32%
						CBMH323	0.172	58.1	89.96	90.07	0.11	73	80%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A22	1.309	0.900	1.309	1.000	649.8	CB27	0.119	59.1	90.50	90.60	0.10	60	98%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB29	0.119	59.1	89.92	90.05	0.13	98	60%	375	381	17.0	1.00	0.10	0.00	182.9	32%
						CB60	0.119	59.1	89.90	89.97	0.07	25	236%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB61	0.119	59.1	90.50	90.60	0.10	60	98%	375	381	22.7	1.00	0.10	0.00	182.9	32%
						CB62	0.119	59.1	89.90	89.97	0.07	25	236%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB63	0.119	59.1	90.45	90.60	0.15	118	50%	375	381	22.6	1.00	0.10	0.00	182.9	32%
						CB64	0.119	59.1	90.40	90.50	0.10	60	98%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB65	0.119	59.1	89.75	89.98	0.23	172	34%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB70	0.119	59.1	90.35	90.50	0.15	118	50%	375	381	22.6	1.00	0.10	0.00	182.9	32%
						CB71	0.119	59.1	89.70	89.85	0.15	118	50%	375	381	22.8	1.00	0.10	0.00	182.9	32%
						CB72	0.119	59.1	90.30	90.45	0.15	118	50%	375	381	22.6	1.00	0.10	0.00	182.9	32%
A23	0.258	0.900	0.258	1.000	128.1	CB73	0.129	64.1	89.65	89.85	0.20	156	41%	375	381	22.8	1.00	0.12	0.00	182.9	35%
						CB74	0.129	64.1	90.25	90.40	0.15	118	54%	375	381	22.7	1.00	0.12	0.00	182.9	35%
B01	0.550	0.900	0.550	1.000	273.0	CB83	0.275	136.5	90.70	91.00	0.30	201	68%	375	381	37.3	0.70	0.56	0.00	153.0	89%
						CBMH300	0.275	136.5	90.65	90.95	0.30	201	68%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B02	0.459	0.900	0.459	1.000	227.8	CB90	0.230	113.9	90.56	90.86	0.30	201	57%	375	381	34.8	0.50	0.39	0.00	129.3	88%
						CBMH320	0.230	113.9	90.59	90.86	0.27	189	60%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B04	0.547	0.900	0.547	1.000	271.5	CB85	0.274	135.8	90.75	91.05	0.30	201	68%	375	381	37.5	0.70	0.55	0.00	153.0	89%
						CBMH301	0.274	135.8	90.70	91.00	0.30	201	68%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B05	0.468	0.900	0.468	1.000	232.3	CB66	0.234	116.2	90.61	90.91	0.30	201	58%	375	381	34.8	0.50	0.40	0.00	129.3	90%
						CBMH303	0.234	116.2	90.64	90.91	0.27	189	61%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B07	0.499	0.900	0.499	1.000	247.7	CB82	0.250	123.9	90.80	91.10	0.30	201	62%	375	381	37.4	0.50	0.46	0.00	129.3	96%
						CBMH310	0.250	123.9	90.75	91.05	0.30	201	62%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B08	0.341	0.900	0.341	1.000	169.3	CB67	0.171	84.7	90.66	90.96	0.30	201	42%	375	381	34.8	0.50	0.21	0.00	129.3	65%
						CBMH321	0.171	84.7	90.69	90.98	0.29	197	43%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

South Nepean Business Park Warehouse (124123)
Catchbasin Grate and Lead Inlet Capacity Calculations

NOVATECH
Engineers, Planners & Landscape Architects

Tc = 10 min
100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
= 178.6 mm/hr

Notes:
[1] *Maximum Available ponding depth is based on the lowest spill point of each catchbasin (equivalent to the static ponding depth).*
[2] *Grate Inlet Rate taken from MTO Drainage Management Manual Design Chart 4.19. Flow obtained using max. available ponding depth (static ponding depth) on CB inlet curve.*

Drainage Area Information						Sub-Area Information			Catchbasin Information					CB Lead Information							
Area ID	Total Area (ha)	Runoff Coeff.	A hard	100yr Runoff Coeff.	Rational Peak Flow (L/s)	CB / CBMH ID	Sub Area (ha)	Runoff (L/s)	T/G (m)	Spill Elev. (m)	Maximum Available Ponding Depth[1] (m)	Grate Inlet Rate[2] (L/s)	Q_{Peak} / Q_{Grate} (%)	CB lead dia. (mm)	Actual Inner Dia. (mm)	Length (m)	Pipe Slope (%)	HGL Slope (%)	Surcharge Depth at CB (m)	Capacity (L/s)	Q_{Peak} / $Q_{Capacity}$ (%)
B10	1.413	0.690	0.989	0.780	547.1	CB23	0.109	42.1	90.35	90.55	0.20	156	27%	375	381	11.1	0.50	0.05	0.00	129.3	33%
						CB25	0.109	42.1	90.45	90.65	0.20	156	27%	375	381	4.7	1.00	0.05	0.00	182.9	23%
						CB84	0.109	42.1	90.45	90.60	0.15	118	36%	375	381	11.2	0.50	0.05	0.00	129.3	33%
						CB86	0.109	42.1	90.26	90.45	0.19	150	28%	375	381	10.7	0.50	0.05	0.00	129.3	33%
						CB87	0.109	42.1	90.15	90.30	0.15	118	36%	375	381	46.3	0.50	0.05	0.00	129.3	33%
						CB88	0.109	42.1	90.22	90.51	0.29	197	21%	375	381	23.3	0.50	0.05	0.00	129.3	33%
						CB89	0.109	42.1	90.23	90.40	0.17	136	31%	375	381	16.2	0.50	0.05	0.00	129.3	33%
						CB91	0.109	42.1	90.16	90.32	0.16	128	33%	375	381	7.4	0.50	0.05	0.00	129.3	33%
						CB92	0.109	42.1	90.26	90.45	0.19	150	28%	375	381	25.3	0.50	0.05	0.00	129.3	33%
						CB93	0.109	42.1	90.28	90.51	0.23	172	24%	375	381	43.5	0.50	0.05	0.00	129.3	33%
						CB94	0.109	42.1	90.15	90.40	0.25	181	23%	375	381	40.4	0.50	0.05	0.00	129.3	33%
						CB95	0.109	42.1	90.30	90.55	0.25	181	23%	375	381	26.8	0.50	0.05	0.00	129.3	33%
						CB96	0.109	42.1	90.30	90.45	0.15	118	36%	375	381	20.1	0.50	0.05	0.00	129.3	33%
C01	0.466	0.900	0.341	0.800	185.1	CB76	0.233	92.6	90.05	90.27	0.22	167	55%	375	381	32.4	0.50	0.26	0.00	129.3	72%
						CBMH319	0.233	92.6	90.05	90.27	0.22	167	55%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C02	0.175	0.570	0.093	0.650	56.5	CB75	0.175	56.5	90.00	90.30	0.30	201	28%	375	381	20.6	0.50	0.10	0.00	129.3	44%
C03	0.398	0.900	0.398	1.000	197.6	CB77	0.199	98.8	90.00	90.24	0.24	177	56%	375	381	32.4	0.50	0.29	0.00	129.3	76%
						CBMH318	0.199	98.8	90.00	90.24	0.24	177	56%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C04	0.204	0.580	0.111	0.660	66.8	CB78	0.204	66.8	90.00	90.27	0.27	189	35%	375	381	20.2	0.50	0.13	0.00	129.3	52%
C05	0.283	0.710	0.206	0.800	112.4	CBMH218	0.283	112.4	90.56	90.73	0.17	136	83%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C06	0.709	0.340	0.142	0.400	140.8	CB79	0.236	46.9	90.49	90.62	0.13	98	48%	300	304.8	13.4	1.00	0.22	0.00	100.9	47%
						CB98	0.236	46.9	89.60	90.66	1.06	-	-	375	381	46.5	0.25	0.07	0.00	91.5	51%
						CBMH316	0.236	46.9	90.49	90.62	0.13	98	48%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C07	0.200	0.640	0.126	0.720	71.5	CB80	0.100	35.8	90.41	90.54	0.13	98	36%	300	304.8	12.7	1.00	0.13	0.00	100.9	35%
						CBMH311	0.100	35.8	90.41	90.54	0.13	98	36%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C08	0.303	0.410	0.091	0.480	72.2	CB97	0.101	24.1	89.50	90.46	0.96	-	-	300	304.8	13.5	1.00	0.06	0.00	100.9	24%
						CB324	0.101	24.1	90.37	90.46	0.09	47	51%	300	304.8	7.6	1.00	0.06	0.00	100.9	24%
						CBMH312	0.101	24.1	90.37	90.46	0.09	47	51%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C09	1.207	0.610	0.707	0.690	413.400	CB119	0.201	68.9	90.05	90.17	0.12	86	80%	375	381	23.7	0.50	0.14	0.00	129.3	53%
						CB120	0.201	68.9	90.00	90.15	0.15	118	58%	375	381	21.9	0.50	0.14	0.00	129.3	53%
						CB121	0.201	68.9	90.40	90.55	0.15	118	58%	375	381	23.7	0.50	0.14	0.00	129.3	53%
						CB122	0.201	68.9	90.30	90.50	0.20	156	44%	375	381	21.9	0.50	0.14	0.00	129.3	53%
						CBMH223	0.201	68.9	90.00	90.15	0.15	118	58%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						CBMH224	0.201	68.9	90.30	90.45	0.15	118	58%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Catchbasins within perimeter ditches - there will be ponding here during larger storm events
Catchbasins on-grade (no ponding) - grate inlet equation not applicable
Catchbasin Manholes along sewer run, no CB lead

100% Flow rate is higer than the grate capacity, generally due to limited ponding depth. Runoff will spill to adjacent low-points.

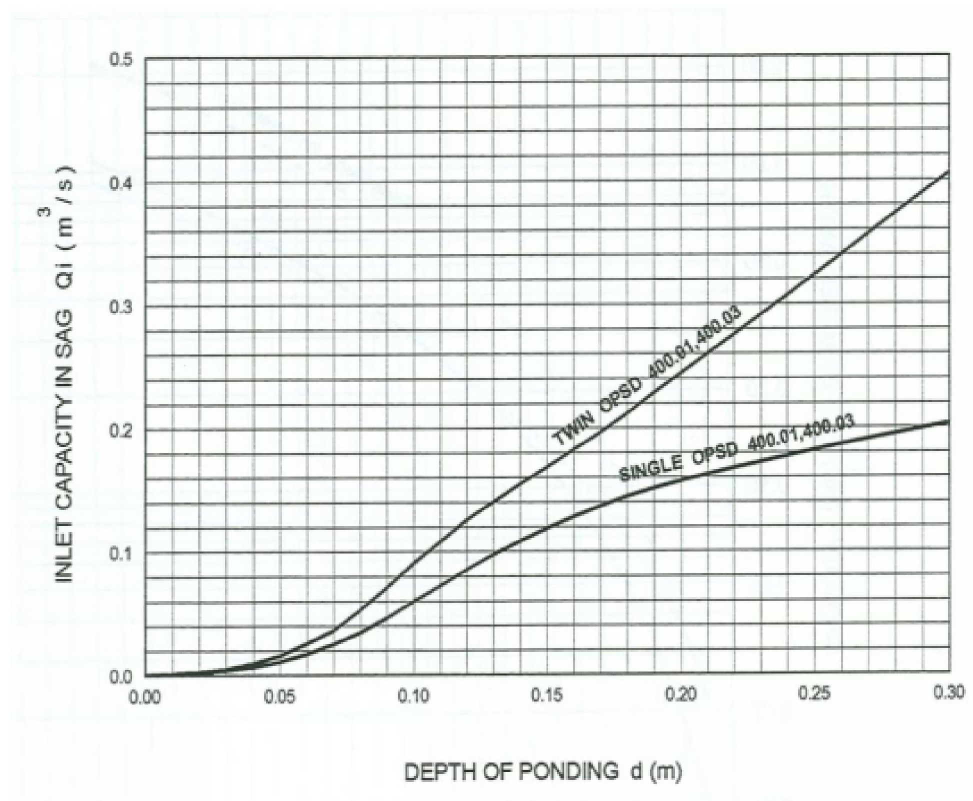
South Nepean Business Park Warehouse (124123)
Catchbasin In-Sag Inlet Capacity

NOVATECH
Engineers, Planners & Landscape Architects

Refer to MTO Drainage Management Manual
Design Chart 4.19 - Inlet Capacity at Road Sag

d (m)	Qc (L/s)	
	Single	Twin
0.00	0	0
0.01	1	1
0.02	3	3
0.03	5	5
0.04	8	10
0.05	12	17
0.06	18	26
0.07	25	38
0.08	35	53
0.09	47	71
0.10	60	89
0.11	73	107
0.12	86	125
0.13	98	140
0.14	108	154
0.15	118	168
0.16	128	182
0.17	136	196
0.18	144	212
0.19	150	228
0.20	156	244
0.21	162	260
0.22	167	276
0.23	172	292
0.24	177	308
0.25	181	324
0.26	185	340
0.27	189	356
0.28	193	372
0.29	197	388
0.30	201	404

Design Chart 4.19: Inlet Capacity at Road Sag



CITY OF NEPEAN
SOUTH MERIVALE BUSINESS PARK
STORMWATER MANAGEMENT REPORT

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.

November 1, 1991

Revised December 3, 1991

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

1.0 INTRODUCTION

The South Merivale Business Park (SMBP) is located at the south end of Merivale Road and is bounded on the north and northwest by National Capital Commission (NCC) Greenbelt, on the south and southwest by Barrhaven Creek and the Longfield/Davidson Stormwater Management Facility (LDSWMF) and on the east by Merivale Road and Queen Anne Crescent. This area has been redesignated for industrial development. The total site area is 84.4 hectares.

The subdivision is to consist of full urban road cross sections including a storm sewer system. Stormwater drainage currently drains toward Barrhaven Creek with the exception of a portion east of Street A which enters a minor watercourse and then flows east into the Rideau. Proposed stormwater flows will outlet into the (LDSWMF), a stormwater treatment area on Barrhaven Creek.

The LDSWMF currently operates as a water quality detention area for storm runoff from Barrhaven and will also serve the future Longfield and Davidson Heights Communities. It is being upgraded and reconstructed to provide detention for a greater development area with the addition of ultra-violet disinfection. This facility is being designed to detain and treat frequent rainfalls with more severe rainfalls bypassing the treatment facility. The facility has been designed to include stormwater runoff from the business park.

2.0 DESIGN GUIDELINES

Stormwater runoff from the development area must conform to the criteria and parameters established in the LDSWMF Report by Delcan and the South Urban Community Drainage Study by UMA Engineering. Only the former report directly affects the design criteria.

The following summarizes the design criteria to be utilized for stormwater management.

1. A maximum stormwater flow of 4600 L/s will be permitted into the LDSWMF from the SMBP.

2. The following upper basin pond levels and storm events are to be used for design purposes.

POND EVENT	ELEVATION (m)
Normal Dry Weather	83.50
1:2 Year	85.60
1:5 Year	86.20
1:100 Year	86.80

Appendices A and B confirm these design criteria.

The City of Nepean has also established standards to be utilized in conjunction with the above criteria.

These standards are as follows:

1. Outlet control when utilized to be installed at catchbasin only.

2. Inlet flow control devices to be Scepter type A and B, plug version (see Appendix E).

3. Maximum depth of ponding in streets to be 0.25 m.

3.0 MINOR DRAINAGE SYSTEM

3.1 Flow Rates

All storm sewers within the development area have been sized to transmit flows of 54.5 L/s/ha. This average area release rate has been obtained as follows:

$$\text{Area Release Rate} = \frac{\text{Permissable Pond Inflow}}{\text{Total Area}}$$

$$= \frac{4600 \text{ L/s}}{84.4 \text{ ha}}$$

$$= 54.5 \text{ L/s/ha}$$

This release rate approximates to pre-development flows from the area. By using the rational method an overall runoff coefficient, "R", can be calculated applying the 4600 L/s discharge, 84.4 ha area and a rainfall intensity of 83 mm/hr based upon a time of concentration of 15 minutes for a 1:5 year storm event.

$$Q = 2.78 \text{ RIA}$$

$$R = \frac{Q}{2.78 \text{ IA}}$$

$$= \frac{4600}{(2.78)(83)(84.4)}$$

$$= 0.24$$

Typical runoff coefficient for the business park is estimated at R = 0.75. In this regard, on-site stormwater management will be required to achieve the design release rate. It is proposed that inlet control devices ICD's be installed in all catchbasins and property leads.

Because an average area release rate is used, allowable release rates can be calculated for each identified drainage basin. Table 1 summarizes flow rates from each drainage area. The location of each drainage area is presented on Plan 90041-STM in Appendix E. Column C presents the flow which may be transmitted from each area. It is calculated by proportioning the total flow to each drainage area. Area A1, to be developed in Phase I construction, a total stormwater flow of 1293 L/s is permissable. This flow is generated from both road right-of-ways and from the industrial sites.

TABLE 1: Summary of SMBP Area R.O.W. and Site Stormwater Flows

Area (ha) (a)	% SMBP (%) a x 100/84.4 (b)	Allowable Flows (b) x 4600 (L/s) (c)	R.O.W. Area (Ha) (d)	Site Area (Ha) (e)	R.O.W.[1] Flows L/s (f)	Site Flows (c-f) (g)	Site Release Rate (L/s/ha) (g)/(e)
A_1 = 23.7	28.1	1293	2.7	21.0	500	793	38.8
A_2 = 1.2	1.4	64	To be designed in detail at a later stage	To be designed in detail at a later stage	To be designed in detail at a later stage	To be designed in detail at a later stage	To be designed in detail at a later stage
A_3 = 2.4	2.8	129					
A_4 = 15.3	18.1	833					
A_5 = 8.5	10.1	465					
A_6 = 33.3	39.5	1816					
84.4	00	4600					

NOTES

1. R.O.W. flows calculated as follow

15 pairs catchbasins @ 30 L/s release rate	=	450	L/s
3 catchbasins @ 30 L/s combined release rate	=	30	L/s
single catchbasin @ 20 L/s release rate	=	20	L/s
		500	L/s

3.2 System Design

The storm sewers in the SMBP have been designed using the inlet method and an area release rate of 54.5 L/s/ha. Inlet control devices will be used to restrict the stormwater flow from all roadway catchbasins and properties to the above noted levels. Storm sewer design sheets have been prepared for Phase I using this method and are presented in Appendix C.

Peak flows have been calculated individually by multiplying the catchment area from manhole to manhole by 54.5 L/s. These flows are then added cumulatively to calculate total flows in the system. Proposed sewers have been sized based upon these flows.

To support the use of this design philosophy, design sheets are also included for Phase I construction by applying the rational method in conjunction with the City of Nepean's standard 1 in 5 year IDF curve. Comparing the two sets of design sheets the following differences are noted:

1) The rational method results in total peak flows of 3000 L/s from the entire site whereas the inlet method results in flows of 4600 L/s.

2) A consequence of the rational method would result in the undersizing of storm sewers at the lower end of the system.

The difference in peak design flows is explained by underlying assumptions of each method. Peak flows are a function of the travel time from the upper most end of the system to the outlet. As stormwater travels through the system, flow being added along the way is reduced because the storm's intensity has diminished. The inlet method assumes drainage areas upstream of each catchbasin and property inlet control device are surcharged during infrequent storm events and a constant flow is added to the entire system.

Since the inlet method models the system as it is intended to operate, it is recommended that the storm sewers be designed using this method even though pipe sizes are somewhat conservatively designed.

3.3 Storage

Storage of rainfall from infrequent storm events is necessary in order to achieve the required release rate. Storage can be provided in two locations, as follows:

a) within the road right-of-way
b) on the subdivision sites

Storage volumes for runoff exceeding the allowable release rates is provided in the road right-of-way by virtue of a saw-tooth grading design of the roadway profile. In general, the elevations of successive downstream summits of the saw-tooth design are lower providing, as a minimum, a 0.1% overall major system grade.

Subdivision site storage will be provided in parking areas and is described in detail in section 5.0.

The road right-of-way catchment areas varies in size from 0.13 to 0.25 ha and the typical area is 0.18 ha. Each catchment area will be served by a pair of catchbasins and the flow from each pair will be restricted to 30 L/s. In order to establish this flow a head of 1.4 m is necessary. (See flow curves for the Scepter inlet control device, Type B presented in Appendix E). In area "A1", 34 catchbasins will have a combined flow of 500 L/s as detailed on Table 1. Fifteen catchbasins will be paired together and a single ICD will be installed for every two catchbasins. In one location three catchbasins will be interconnected utilizing one inlet control. A single catchbasin will require a Type "A" ICD in order to achieve the required release rate at this location (catchbasin 32 on drawing 90041-STM).

The total head of 1.4 m can be broken down into two components, the elevation from the centre of the ICD to the top of the catchbasin inlet and from the top of the inlet to the maximum ponding elevation. The maximum ponding elevation has been taken as the pavement grade at the curb located at the downstream summit elevation on the roadway. This typically corresponds to .15 m ponding depth. The centre line of the ICD will be 1.25 m below this point. A maximum ponding elevation of 0.2 m will occur at catchbasin's #24 and 25. Consequently the centre line of this ICD will be 0.05 m higher. Inverts for the 200 mm catchbasin lead will be 100 mm below this elevation. See Appendix G for typical catchbasin and grate details. Catchbasin connections have been shown on the storm drainage area plan.

Type B Scepter ICD was selected because of the larger opening than the Type A which typically results in less maintenance. Furthermore a single ICD will be located in two catchbasins which again will require less maintenance compared to an ICD in every catchbasin. The two catchbasins will be connected by a 200 mm lead at 1.0%. The connection to the storm sewer will be made from the catchbasin closest to the storm sewer for cost reduction.

4.0 MAJOR SYSTEM

The major system has been designed to store flows resulting from the 1:100 year event. Only storms less frequent than this will flood the downstream roadway into the next catchment area.

For the typical catchment area the amount of storage required has been calculated using the modified rational method. At catchbasin's 5 and 6, the following detention volume was calculated.

1:100 Year Storm Event

CB #	Time	Intensity	Area R=0.58 (ha)	Inflow Rate (L/s)	Allowable Release Rate (L/s)	Storage Rate (L/s)	Detention (m^3)
5 & 6	10	174	0.18	50.5	30	20.5	12.3 $<15m^3$
	20	116	0.18	33.7	30	3.7	4.4
	30	89	0.18	25.8	30		
	40	70	0.18	20.3	30		

The storage available in the right-of-way catchment area for catchbasins 5 and 6 is 15 m^3. Since a volume of 12.3 m^3 must be stored, sufficient volume is available to provide storage for the 100 year event. Although a ponding level of 150 mm is available in this particular catchment, this depth will not be reached during the 1:100 year design storm event.

5.0 SITE STORMWATER MANAGEMENT

5.1 Typical Phase I Site Release Rate

A summary of recommended release rates for Phase I construction is presented on Table 1. Release rates for Phase I subdivision sites are calculated by subtracting the total allowable stormwater flow from Area 1 right-of-way flows and dividing by the area for the sites. Allowable flows from subdivision sites for Phase I are 38.8 L/s/ha.

Subdivision site release rates for additional phase construction will approximate this flow but must be verified when detail designs are complete.

5.2 On-Site Storage

Site storage is required to control stormwater for rainfalls as infrequent as the 1:100 year storm event. Storage may be provided in two locations.

1. Parking Lot
2. Roof Tops

Figure 1 details a typical site grading plan with the local catchment areas. Parking area grades vary from 1.3% to 4% from the high points to the top of the grates. The highest point in the parking area is set at the road entrance to dam all stormwater from the 1:100 year event from entering the road right-of-way. All other high points have been set to match this elevation.

By using the modified rational method a total detention volume of 206.4 m^3 will be required in the parking area for the 1:100 year storm event. It is assumed roof top storage will be provided on all buildings and the release rate will be limited to approximately 8.0 L/s. The maximum depth of ponding will be approximately 0.3 m at each of the catchbasins for the 100 year storm event.

Figure 1 demonstrates the feasibility of on-site storage. It will be the responsibility of the owners at the site development stage to provide a design for grading and drainage suitable for their particular site with the following criteria:

- Phase I Site Release Rates 38.8 L/s/ha max.
- 100 Year Design Storm

6.0 CONCLUSION

The following summarizes conclusions for the stormwater management for the SMBP.

1. An overall area release rate of 54.8 L/s/ha is permitted to the Longfield/Davidson Stormwater Management Facility.

2. Phase I stormwater flows are to be limited to 1293 L/s.

3. Phase I site stormwater flows are to be limited to 38.8 L/s/ha.

4. The minor stormwater system has been designed to transmit inlet flows equivalent to 54.8 L/s/ha.

5. Release rates in the road right-of-way can be limited to 30 L/s by utilizing a Scepter Type B inlet control device installed to a pair of catchbasins with 1.4 m of head.

6. Saw-tooth road grades have been set to contain the 1:100 year storm event on the road.

7. Sites can be provided with roof top and parking area storage to contain the 1:100 year storm event.

Prepared by:
(Sign + Stamp)

Reviewed by:
(Sign + Stamp)

APPENDIX A

DELCAN LETTER

100.11

DELCAN

ENGINEERS
PLANNERS
ARCHITECTS

35 YEARS

1991 08 15 **BY HAND**

Our Ref: 04-1917-A-00

Mr. Udo Boehme, P.Eng.
Novatech Engineering Consultants Ltd.
Suite 17
77 Auriga Drive
Nepean, Ontario
K2E 7Z7

REÇU/RECEIVED
AUG 21 1991

Dear Mr. Boehme:

RE: Longfields/Davidson Stormwater Facility
City of Nepean

With reference to your letter of August 1, 1991, we are enclosing the following tender issue drawings for your information at this time:

Drawing No.	Description
4	Plan of Facility
5	Horizontal and Vertical Control
7	Collector Road Plan and Profile
9	Existing and Business Park Storm Sewers, Monitoring Station, Site Plans, Access Roads and Details
DA-1	Area Drainage Plan Collector Road Sanitary Sewer

Please note that in some respects, these plans are not final, for example, the watermains will be 406 mm diameter and are under review by the Region. We are also providing copies of design sheets for the sanitary sewer in the collector road, and the storm sewer outlet from the Business Park.

DELCAN CORPORATION

2001 THURSTON DRIVE, P.O. BOX 8004, OTTAWA, ONTARIO, K1G 3H6 • (613) 738-4160 TELEX 06-9666-89
FAX: (613) 739-7105

ST JOHNS, TORONTO, MONTREAL, HAMILTON, NIAGARA FALLS, LONDON, THUNDER BAY, WINNIPEG, REGINA, SASKATOON, CALGARY, VICTORIA, VANCOUVER, NANAIMO

DELCAN

Drawings 4 and 7 show the location and elevation of the sanitary sewer you refer to in your letter. Drawing 5 provides the horizontal location control. Please note that the curved collector road alignment within the boundary of the Facility as shown on your plan does not agree with the straight alignment shown on our plan.

With regard to the Business Park storm sewer outlet, in addition to the design sheets, the plan and profile (drawing 9) and location plans enclosed, we are providing the following water levels in the upper basin per your request.

Pond Level	Elevation
Normal Dry Weather	83.50
1 in 2 Year	85.60
1 in 5 Year	86.20
1 in 100 Year	86.80

We trust this is satisfactory.

Regards.

John R. Allen, P.Eng.
Project Manager

JRA:lmb

Encl.

cc: Mr. Fel Petti, P.Eng.

STORM SEWER DESIGN SHEET

Q = 2.78 AIR
Where Q = peak flow in litres per second (L/s)
A = area in hectares (ha)
I = rainfall intensity in millimetres per hour (mm/h)
R = runoff coefficient

LOCATION			AREAS (ha)			Indiv. 2.78 AR.	Accum. 2.78 AR.	Time of Conc.	Rainfall Intensity I	Peak Flow Q (L/s)	SEWER DATA							COMMENTS
STREET	FROM	TO	R =	R =	R =						Type of Pipe	Diameter (mm)	Slope (%)	Length (m)	Capacity (L/s) n=	Velocity (m/s)	Time of Flow (min)	
* Outlet to Facility										11,867	Conc	2400	0.25%	46 m	12,914	2.765		

*See Novatech Design Sheets Dated Sept. 9, 1990

DelCan DE LEUW CATHER CANADA LTD
CONSULTING ENGINEERS AND PLANNERS

DESIGN J.R. Allen
CHECKED P.J. Hunt
DATE 91.05.22

PROJECT Longfields/Davidson Stormwater Management Facility - South Merivale Business Park Storm Sewer Outlet

SHEET No. 1 of 1

SANITARY SEWER DESIGN SHEET

q = average daily per capita flow (454 L/cap.d)
I = unit of peak extraneous flow (0.11 L/ha.s)
M = peaking factor
Q(p) = peak population flow (L/s)
Q(i) = peak extraneous flow (L/s)
Q(d) = peak design flow

$M = 1 + \frac{14}{4 + P^{0.5}}$ where P = population in 1000's

$Q(p) = \frac{PqM}{86.4}$ (L/s)

Q(i) = IA (L/s) where A = area in hectares
Q(d) = Q(p) + Q(i) (L/s)

LOCATION			INDIVIDUAL		CUMULATIVE		Peaking factor M	Pop. flow Q(p) (L/s)	Peak extraneous flow Q(i) (L/s)	Peak design flow Q(d) (L/s)	PROPOSED SEWER						
STREET	FROM	TO	Pop.	Area A (hectares)	Pop.	Area A (hectares)					Length (m)	Pipe size (mm)	Type of pipe	Grade %	Capacity (L/s) n = ___	Full flow velocity (m/s)	Actual vel. at Q(d)
*Collector Rd	South P.L.	NorthP.L.	-	-	8623	193.31	3.02	136.84	21.26	158.10							
						65.19	2.70	91.67	7.17	98.84							
										256.94*	171	675	Conc	0.15%	339.52	0.95	
											28	2-450	Conc	0.35%	352.4	1.073	

*See Oliver Mangione McCalla Design Sheets Dated June, 1991

DelCan DE LEUW CATHER CANADA LTD
CONSULTING ENGINEERS AND PLANNERS

DESIGN	J.R. Allen	PROJECT	Longfields/Davidson
CHECKED	P.J. Hunt		Stormwater Management Facility
DATE	91/06/16		

SHEET No. 1 of 1

APPENDIX B

STORMWATER MANAGEMENT MEETING MINUTES

MINUTES OF MEETING NO. 1

PROJECT:	South Merivale Business Park	**PROJECT NO: 90041**
DATE:		
LOCATION:	City of Nepean	
PRESENT:	Mr. Gary Craig, P.Eng. - Director of Engineering	City of Nepean
	Mr. John Allen, P.Eng. -	Delcan
	Mr. M. Hawdur, P.Eng. -	Novatech Engineering
	Mr. U. Boehme, P.Eng. -	Novatech Engineering
DISTRIBUTION:	All present File No. 90041	

The following represent major points and issues discussed:

- The storm outlet for the business park is the Longfields/Davidson Stormwater Management Facility.

- An outlet structure has been provided for in Delcan's contract.

- The pond has been designed to accept controlled flows of 0.05 m^3/sec/ha or a total flow of 4.6 m^3/sec from the business park.

- Delcan is finalizing the twin 400 mm diameter watermain crossing. Present design calls for two watermains approximately 1.0 meter off of curb. Delcan to confirm upon receipt of approval from R.M.O.C.

- The priority of placement of fill resulting from pond excavation will be the berm along Merivale and lots/blocks along Phase I construction for the S.M.B.P. recognizing the suitability of the fill material.

- It was agreed that connecting invert to invert the proposed 625 diameter sanitary sewer to the existing 1050 diameter Barrhaven trunk would not pose a problem.

  - flows may not materialize to the extent causing surcharge.
  - timing for construction of the Merivale Road trunk is on schedule and quite possibly may be advanced.

. . . /2

- The discrepancy between the legal plan and Delcan's design drawing at the northerly limit of the crossing should pose no problems and Delcan will make any necessary adjustments.

- The reference plan should be adjusted to provide a 100 metre centreline radius and be tangential at either end of the curve with respect to the most northerly curve of the business park.

- Depending on the timing of construction for Phase I of the business park and Delcan's contract, proper coordination between the two contracts may be required.

Mr. John Allen left the meeting and the following items/issues were discussed:

- Streetlighting on internal streets would be consistent with City of Nepean criteria.

- Novatech to examine alternatives and make recommendations for Street No. 1 (4 lane facility) with respect to lighting design.

- Nepean to confirm luminaire and pole type.

- Novatech to contact Hydro regarding additional premium to provide underground hydro at all road crossings.

- Novatech to confirm with Park and Recreation location of bike and walkways.

- Novatech to confirm with O.C. Transpo regarding bus lay-by requirements.

PLEASE REPORT ANY ERRORS AND/OR OMISSIONS
TO THE UNDERSIGNED

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.

Udo Boehme, P.Eng.

APPENDIX C

STORMWATER DRAINAGE AREA DESIGN SHEETS Q = 54.5 L/s/ha

STORM SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1

DEVELOPER: CITY OF NEPEAN

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 1, 1991

Revision:

DESIGNED BY : SG

CHECKED BY : LJ

LOCATION			AREA	INDIV	PEAK FLOW	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	(ha)	54.5 A (L/s)	Q (L/s)	TYPE OF PIPE	NOMINAL PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
'A'	101	102	2.4	130.8	130.8	CONC.	525	0.17	49.0	184.99	0.83
	102	103			130.8	CONC.	525	0.17	51.0	184.99	0.83
	103	104	1.8	98.1	228.9	CONC.	600	0.17	41.0	264.11	0.90
	104	105			228.9	CONC.	600	0.17	59.5	264.11	0.90
	105	106	2.5	136.3	365.2	CONC.	750	0.15	96.0	449.81	0.99
	106	107	2.4	130.8	496.0	CONC.	825	0.15	43.5	579.98	1.05
	107	108			496.0	CONC.	825	0.15	41.0	579.98	1.05
Flow from Street 'E' into MH 108:			1.2	65.4							
'A'	108	109	1.2	65.4	626.8	CONC.	825	0.18	86.0	635.34	1.15
	109	110	1.7	92.7	719.4	CONC.	900	0.15	86.5	731.45	1.11

Q = 54.5 * A (L/s) where: Post Development Flow Restricted to 54.5 L/s/ha n = 0.013

A = Area in hectares

STORM SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1

DEVELOPER: CITY OF NEPEAN

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 1, 1991

Revision:

DESIGNED BY : SG

CHECKED BY : LJ

LOCATION			AREA	INDIV	PEAK FLOW	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	(ha)	54.5 A (L/s)	Q (L/s)	TYPE OF PIPE	PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'F' into MH 110:			2.4	130.8							
'A'	110	111	2.5	136.3	986.5	CONC.	1050	0.15	120.0	1,103.34	1.23
	111	112	2.4	130.8	1117.3	CONC.	1050	0.16	114.0	1,139.52	1.27
	112	113	1.1	60.0	1177.2	CONC.	1050	0.18	43.5	1,208.64	1.35
	113	114	1.2	65.4	1242.6	CONC.	1050	0.2	72.5	1,274.02	1.43
'A'	115	114	1.7	92.7	92.7	CONC.	525	0.17	55.5	184.99	0.83
Flow from Street 'F' into MH 114:			15.3	833.9							
'B'	114	131			2169.1	CONC.	1350	0.16	30.5	2,227.28	1.51
	131	132			2169.1	CONC.	1350	0.16	29.5	2,227.28	1.51
	132	133	1.1	60.0	2229.1	CONC.	1350	0.17	79.0	2,295.82	1.55

Q = 54.5 * A (L/s) where: Post Development Flow Restricted to 54.50 L/s/ha n = 0.013

A = Area in hectares

STORM SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 1, 1991
Revision:

DESIGNED BY : SG
CHECKED BY : LJ

LOCATION			AREA	INDIV	PEAK FLOW	PROPOSED SEWER					
STREET	FROM M.H.	TO M.H.	(ha)	54.5 A (L/s)	Q (L/s)	TYPE OF PIPE	NOMINAL PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)
Flow from Street 'C' into MH 133:			8.5	463.3							
'B'	133	134	1.7	92.7	2785.0	CONC.	1500	0.15	94.0	2,856.14	1.57
Flow from Street 'B' into MH 134:			33.3	1814.9							
	134	163			4599.8	CONC.	1650	0.20	54.0	4,252.36	1.93
	163	outlet			4599.8	CONC.	2400	0.25	46.0	12,912.91	2.77

Q = 54.5 * A (L/s) where: Post Development Flow Restricted to 54.5 L/s/ha n = 0.013

A = Area in hectares

APPENDIX D

STORMWATER DRAINAGE AREA DESIGN SHEETS R = 0.24

STORM SEWER DESIGN SHEET

DESIGNED BY : SG
CHECKED BY : LJ

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1
DEVELOPER: CITY OF NEPEAN
ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

DATE: NOV. 1, 1991
Revision:

LOCATION			AREA	RUNOFF	INDIV	ACCUM	TIME OF	RAINFALL	PEAK FLOW	PROPOSED SEWER							
STREET	FROM M.H.	TO M.H.	(ha)	COEFF. R	2.78 AR (L/s)	2.78 AR (L/s)	CONC. (MIN)	INTENSITY (MM/HR)	Q (L/s)	TYPE OF PIPE	NOMINAL PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (MIN)
'A'	101	102	2.4	0.24	1.6	1.6	15.0	83	132.4	CONC.	525	0.17	49.0	184.99	0.83	1.0
	102	103							132.4	CONC.	525	0.17	51.0	184.99	0.83	1.0
	103	104	1.8	0.24	1.2	2.8	17.0	77	215.7	CONC.	600	0.17	41.0	264.11	0.90	0.8
	104	105							215.7	CONC.	600	0.17	59.5	264.11	0.90	1.1
	105	106	2.5	0.24	1.7	4.5	18.9	72	323.5	CONC.	750	0.15	96.0	449.81	0.99	1.8
	106	107	2.4	0.24	1.6	6.1	20.7	69	416.8	CONC.	825	0.15	43.0	579.98	1.05	0.7
	107	108							416.8	CONC.	825	0.15	40.0	579.98	1.05	1.4
Flow from Street 'E' into MH 108:			1.2	0.24	0.8	0.8										
'A'	108	109	1.2	0.24	0.8	7.7	22.1	66	507.1	CONC.	825	0.18	86.0	635.34	1.15	1.2
	109	110	1.7	0.24	1.1	8.8	23.3	64	563.1	CONC.	900	0.15	86.5	731.45	1.11	1.3

Q = 2.78 AIR (L/s) where: Post Development Flow Restricted to 54.5 L/s/ha
A = Area in hectares,ha
I = Rainfall Intensity in mm/hr.

n = 0.013

R = Runoff Coefficient

STORM SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1

DEVELOPER: CITY OF NEPEAN

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

PAGE: 2 of 3

DATE: NOV. 1, 1991

Revision:

DESIGNED BY : SG

CHECKED BY : LJ

LOCATION			AREA	RUNOFF	INDIV	ACCUM	TIME OF	RAINFALL	PEAK FLOW	PROPOSED SEWER						
STREET	FROM M.H.	TO M.H.	(ha)	COEFF. R	2.78 AR (L/s)	2.78 AR (L/s)	CONC. (MIN)	INTENSITY (MM/HR)	Q (L/s)	TYPE OF PIPE	NOMINAL PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (MIN)
Flow from Street 'F' into MH 110:			2.4	0.24	1.6	1.6										
'A'	110	111	2.5	0.24	1.7	12.1	24.6	62	747.2	CONC.	1050	0.15	120.0	1,103.34	1.23	1.6
	111	112	2.4	0.24	1.6	13.7	26.2	60	813.8	CONC.	1050	0.16	113.5	1,139.52	1.27	1.5
	112	113	1.1	0.24	0.7	14.4	27.7	58	828.8	CONC.	1050	0.18	42.5	1,208.64	1.35	0.5
	113	114	1.2	0.24	0.8	15.2	28.2	57	864.7	CONC.	1050	0.2	73.5	1,274.02	1.43	0.9
'A'	115	114	1.7	0.24	1.1	1.1	10.0	103	116.5	CONC.	525	0.17	54.0	184.99	0.83	1.1
Flow from Street 'F' into MH 114:			13.6	0.24	9.1	9.1										
'B'	114	131				25.4	29.1	56	1418.2	CONC.	1350	0.16	28.5	2,227.28	1.51	0.3
	131	132							1418.2	CONC.	1350	0.16	29.0	2,227.28	1.51	0.3
	132	133	1.1	0.24	0.7	26.2	29.7	55	1439.6	CONC.	1350	0.17	60.0	2,295.82	1.55	0.9

Q = 2.78 AIR (L/s) where: Post Development Flow Restricted to 50 L/s/ha

A = Area in hectares

I = Rainfall Intensity in mm/hr.

n = 0.013

R = Runoff Coefficient

STORM SEWER DESIGN SHEET

PROJECT: SOUTH MERIVALE BUSINESS PARK - PHASE 1

DEVELOPER: CITY OF NEPEAN

ENGINEERS: NOVATECH ENGINEERING CONSULTANTS LTD.

PAGE: 3 of 3

DATE: OCT. 11, 1991

Revision:

DESIGNED BY : SG

CHECKED BY : LJ

LOCATION			AREA	RUNOFF	INDIV	ACCUM	TIME OF	RAINFALL	PEAK FLOW	PROPOSED SEWER						
STREET	FROM M.H.	TO M.H.	(ha)	COEFF. R	2.78 AR (L/s)	2.78 AR (L/s)	CONC. (MIN)	INTENSITY (MM/HR)	Q (L/s)	TYPE OF PIPE	NOMINAL PIPE SIZE (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (MIN)
Flow from Street 'C' into MH 133:			8.5	0.24	5.7	5.7										
'B'	133	134	1.7	0.24	1.1	33.0	30.6	54	1782.0	CONC.	1500	0.15	93.0	2,856.14	1.57	1.0
Flow from Street 'B' into MH 134:			33.3	0.24	22.2											
	134	162				55.2	31.6	53	2923.9	CONC.	1650	0.20	52.5	4,252.36	1.93	0.5
	162	outlet							2923.9	CONC.	2400	0.25	46.0	12,912.91	2.77	0.3

Q = 2.78 AIR (L/s) where: Post Development Flow Restricted to 50 L/s/ha

A = Area in hectares

I = Rainfall Intensity in mm/hr.

R = Runoff Coefficient

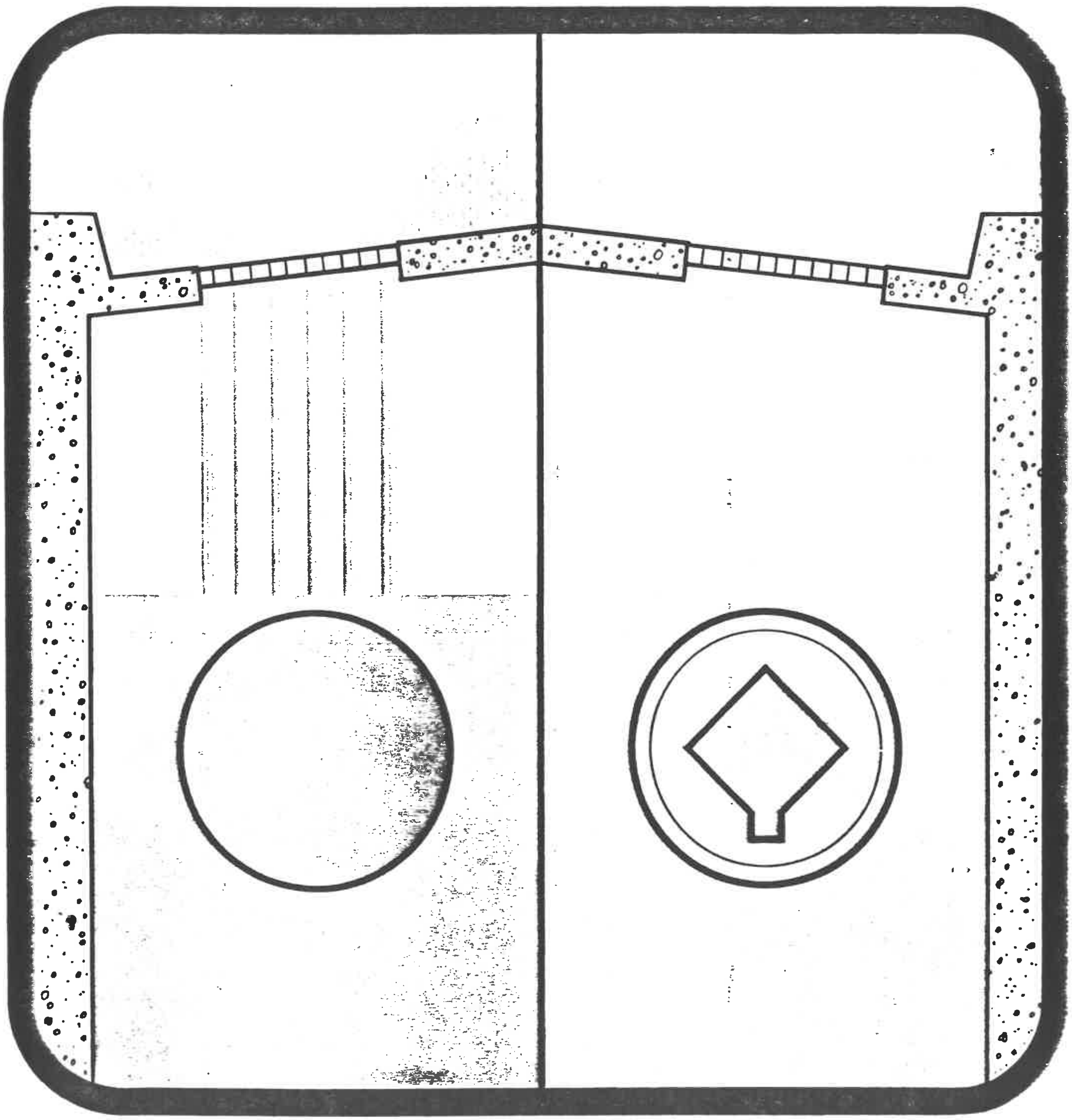
n = 0.013

APPENDIX E

INLET CONTROL DEVICE INFORMATION

ICD - Inlet Control Device

A SIMPLE ADDITION TO NEW OR EXISTING STORM SEWER SYSTEMS TO ELIMINATE FLOODED BASEMENTS BY TEMPORARILY DIVERTING EXCESS RAINFALL TO THE SURFACE



SCEPTER ICD
Controls storm water

DESCRIPTION

The Scepter Inlet Control Device (ICD) is a fabricated or injection molded PVC flow orifice. Developed in the Department of Civil Engineering, University of Ottawa, the ICD is available in two standard versions to restrict the flow of storm water.

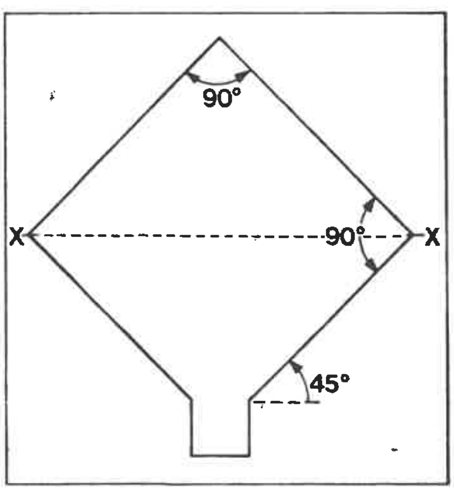
The ratings are:

ICD TYPE	FLOW cfs (l/s)	HEAD ft. (m)
A	0.7 (19.8)	4 (1.22)
B	1.0 (28.3)	4 (1.22)
C	1.3 (36.8)	4 (1.22)
D	3.0 (84.9)	10 (3.05)
F	4.0 (113.2)	10 (3.05)

DESIGN FACTORS

The unique compound orifice shape promotes self-cleaning action in debris-laden flows, especially important in the critical early stages of flow capture. When submerged, the sharp corners of the orifice contract the flow, which helps to "centre" the debris as it traverses the plane of the orifice.

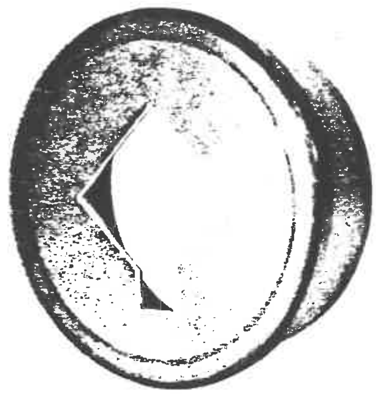
HYDRAULICS



The head is measured from the centreline of the triangle (X-X) to the catchbasin inlet (flood level). Calibration curves for the five standard orifice sizes under various heads are shown on the right.

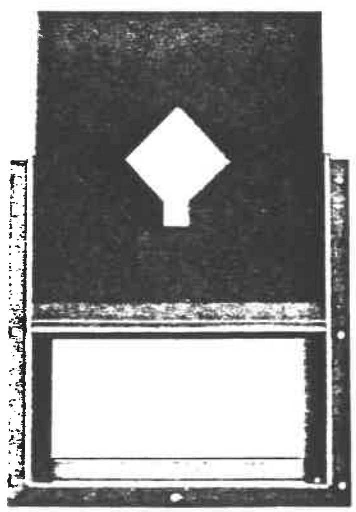
ADAPTABILITY

The Scepter ICD is available in two versions:



PLUG ICD

A short, slightly-tapered plug for insertion in the outlet pipe from the catchbasin (the catchbasin lead). It is held in place by friction and hydrostatic pressure. Made to fit 8", 10" or 12" pipe in any material (clay, A-C, concrete, PVC, etc.). The orifice plate is flush with the end of the plug.



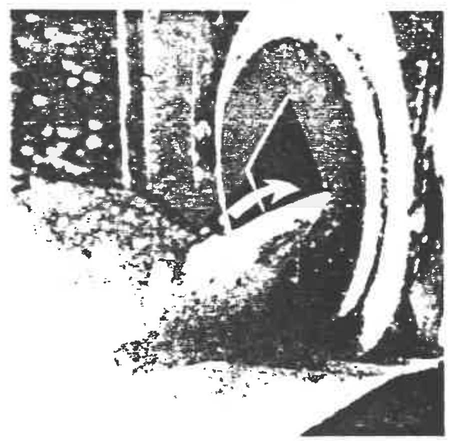
FRAMED ICD

A plate containing the orifice is held in channels in a metal frame. The framed ICD is installed over the outlet pipe from the catchbasin. Both versions of the ICD can be removed for inspection. As installed, they do not limit access to the catchbasin.

ELIMINATES BASEMENT FLOODING AND FOUNDATION SEEPAGE

The patented* function of the ICD is to control surcharging of storm sewers by restricting the flow into the sewer pipe. In the normal course of events drainage system surcharging is unavoidable. During major storms a surcharged sewer may back up into foundation drains (or basement drains in combined systems) and the result is a public outcry against "inadequate" sewer systems. Designing for "100-year storms" or even "five-year storms" can be a costly alternative to simply diverting excessive rainfall to temporary surface storage, and away from the community's basements.

SUMP SCOURING ACTION

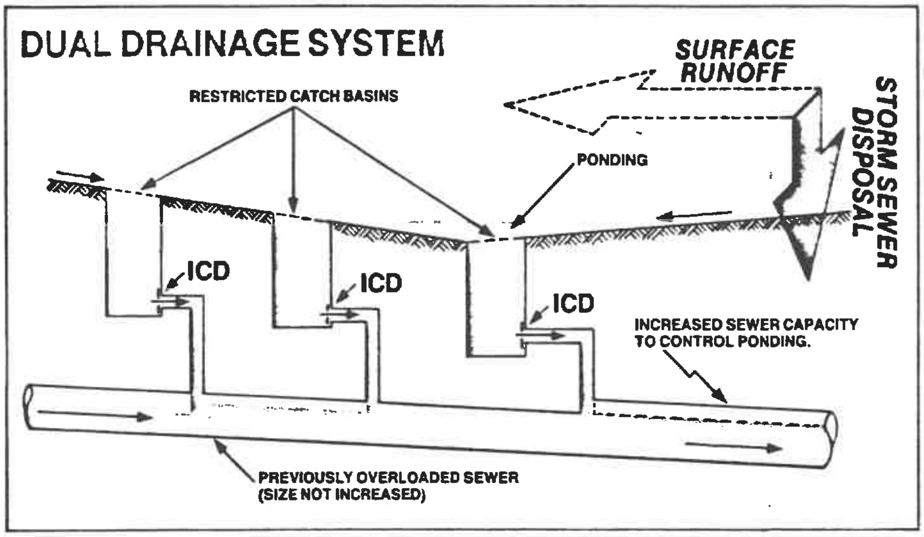


The rectangular slot at the bottom of the orifice works effectively in two ways. First, during dry periods it draws the water level below the main orifice area keeping it clear of floating debris. Second, it generates strong vortex action in the approach flow during heavy rainfalls, which vigorously scours sediment from the sump of the catchbasin and away from the orifice. Field trials and laboratory testing prove this action.

*CANADIAN PATENT 1165207 U.S. PATENT 4522533 MEXICO PATENT PENDING.

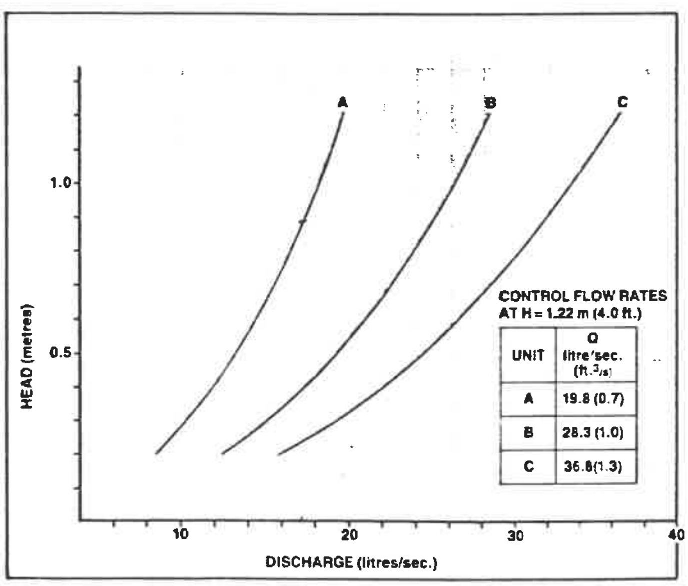
SCEPTER ICD
Preserves storm sewer capacity

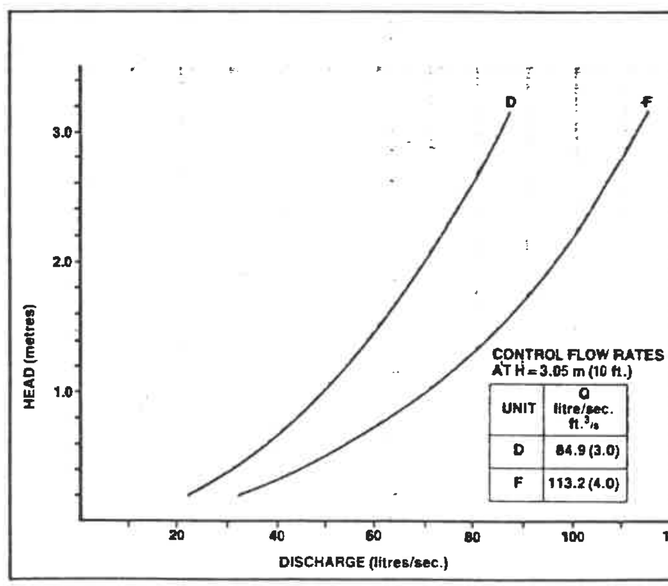
THE SCEPTER ICD ROLE IN THE "DUAL DRAINAGE SYSTEM"



Typically the disposal of storm water is via overland flow and an underground pipe system. A rational design of storm sewer systems will consider not just the capacity of the storm sewer itself, but also the hydraulic characteristics of the sewer inlets and the potential for overland flow via streets and other surface drainage features. A community's storm water disposal system can be modelled on computer. (Your Scepter Representative can suggest a contact for this service.) From such an analysis will emerge an optimum design of pipe size, location of Scepter ICD's, depth of ponding, and the duration and spread of ponding. Together with the strategic location of parkland and proper street grading, the use of Scepter ICD's plays a key role in the elimination of flooding by controlling sewer inlets. Studies in a number of communities show that systems designed with the "dual drainage" principle using Scepter ICD's can avoid surcharging during flows having return periods up to 100 years. Existing systems can make use of this principle if suitable temporary storage facilities are introduced. Relief sewer projects for existing systems can also use the ICD's. In the above figure only the lower conduit has an increased capacity. Without ICD's, the entire system would have required changes.

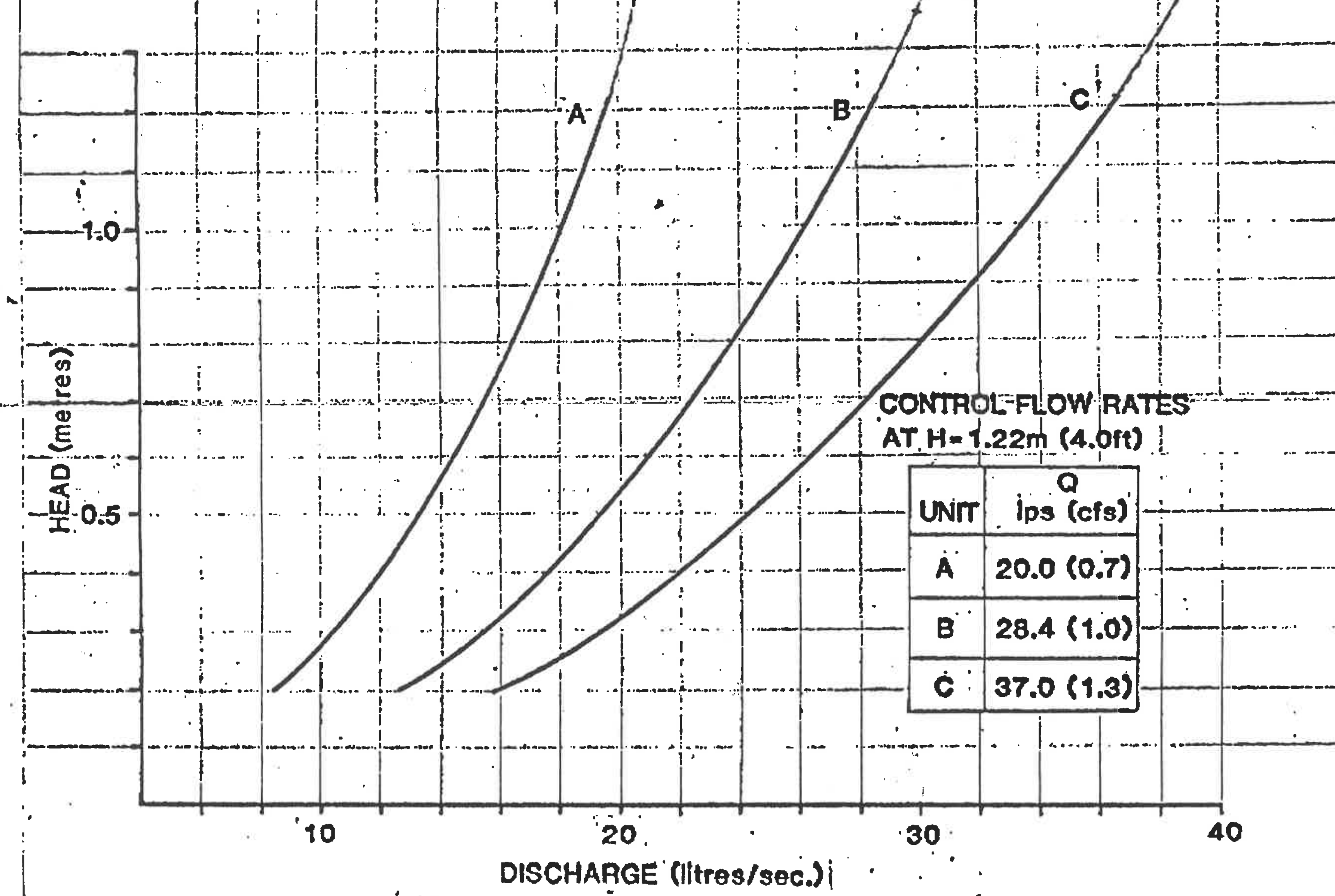
CALIBRATION CURVES FOR STANDARD ORIFICE SIZES





Note: Units D and F can be adapted to minimum 10-inch size pipes.

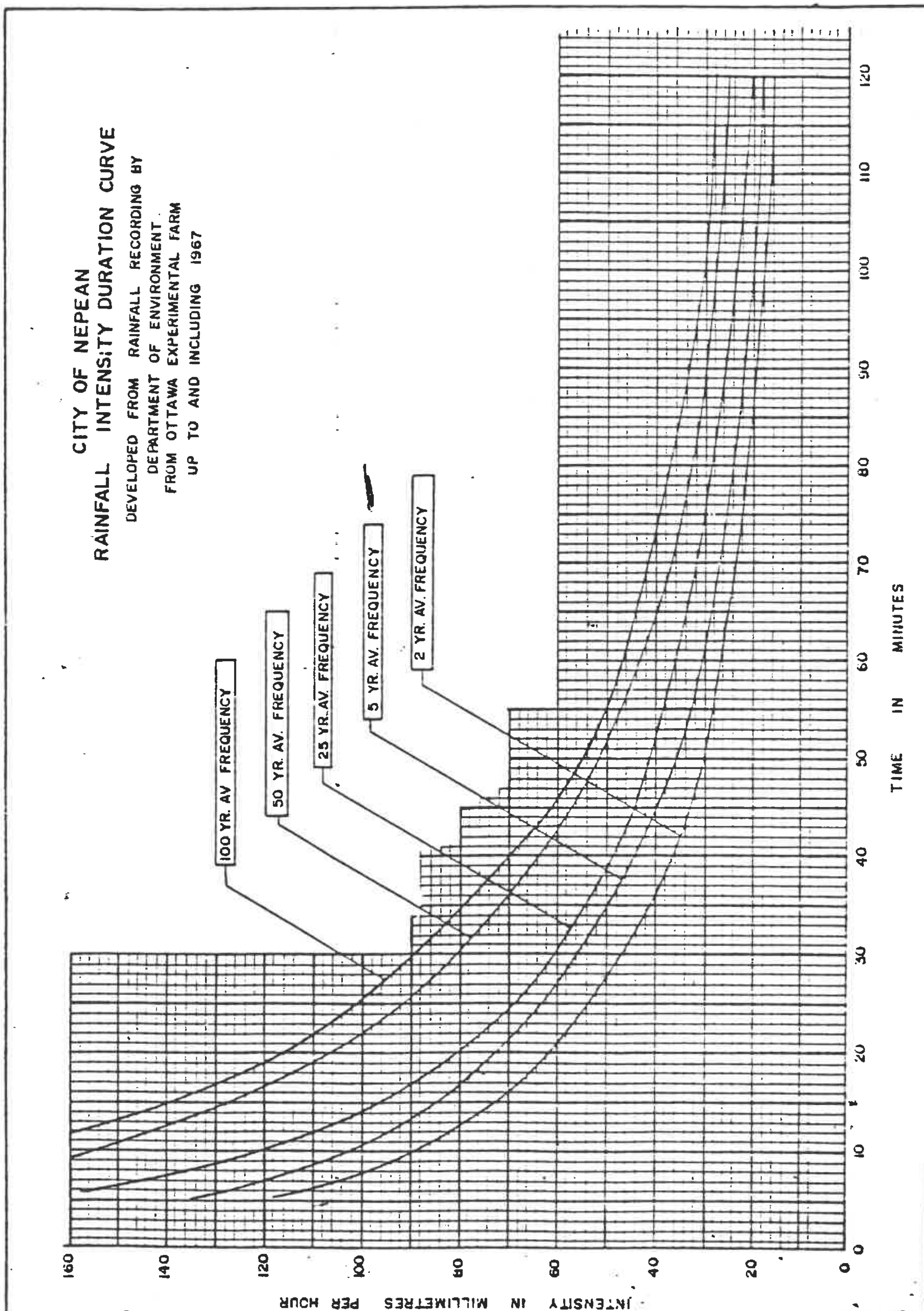
CALIBRATION CURVES FOR 3 STANDARD ORIFICE SIZES



UNIT	Q lps (cfs)
A	20.0 (0.7)
B	28.4 (1.0)
C	37.0 (1.3)

APPENDIX F

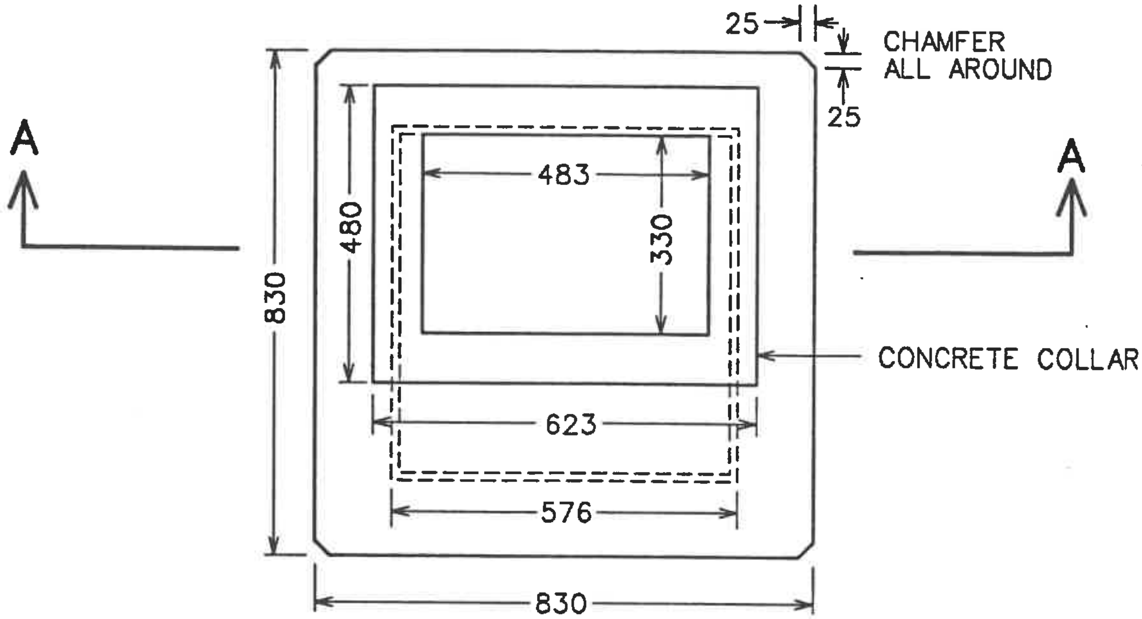
CITY OF NEPEAN IDF CURVES



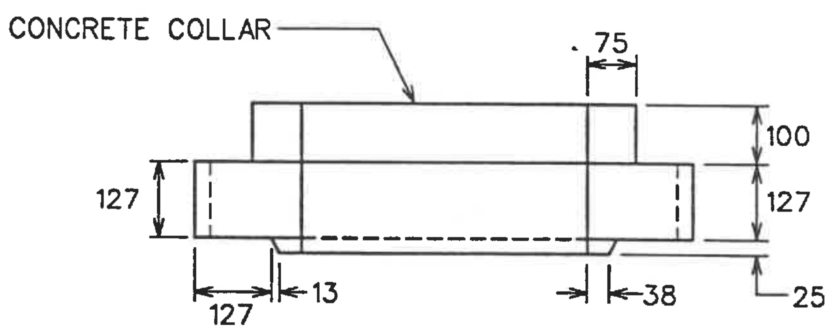
DRAWN BY C.B.	CITY OF NEPEAN	SCALE N.T.S.
CHECKED BY		DATE 82 09 24
APPROVED BY	RAINFALL INTENSITY DURATION CURVE	DRAWING No. MM-1

APPENDIX G

TYPICAL CATCHBASIN AND GRATE DETAIL



PLAN VIEW

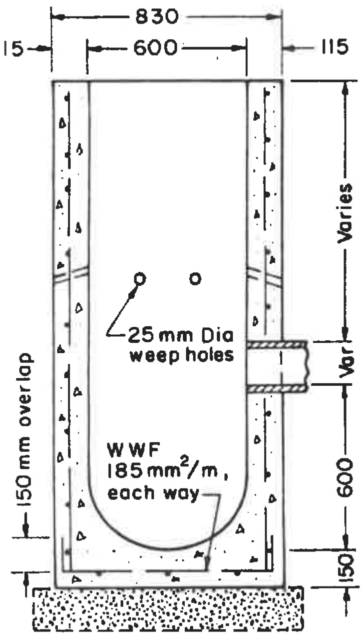


SECTION A-A

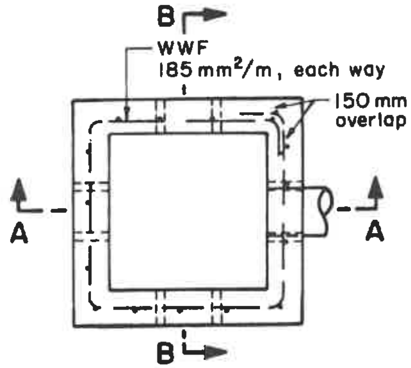
NOTES:

1. TOP TO BE USED ON ALL CATCH BASINS - O.P.S.D. 705.02
2. NS-400 FRAME AND COVER TO BE SET ON COLLAR AND SECURED - SEE NS-700
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

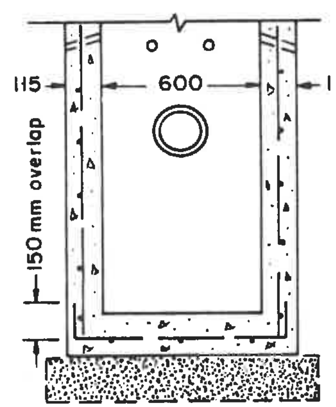
SCALE: N.T.S.	**CITY OF NEPEAN** PUBLIC WORKS DEPARTMENT		REV: 1
DRAWN: M.F.M.			DATE: SEPT. 1991
APPR.: W.R.N.	CONCRETE CATCH BASIN TOP		DRAWING NO.: NS-703



SECTION A-A

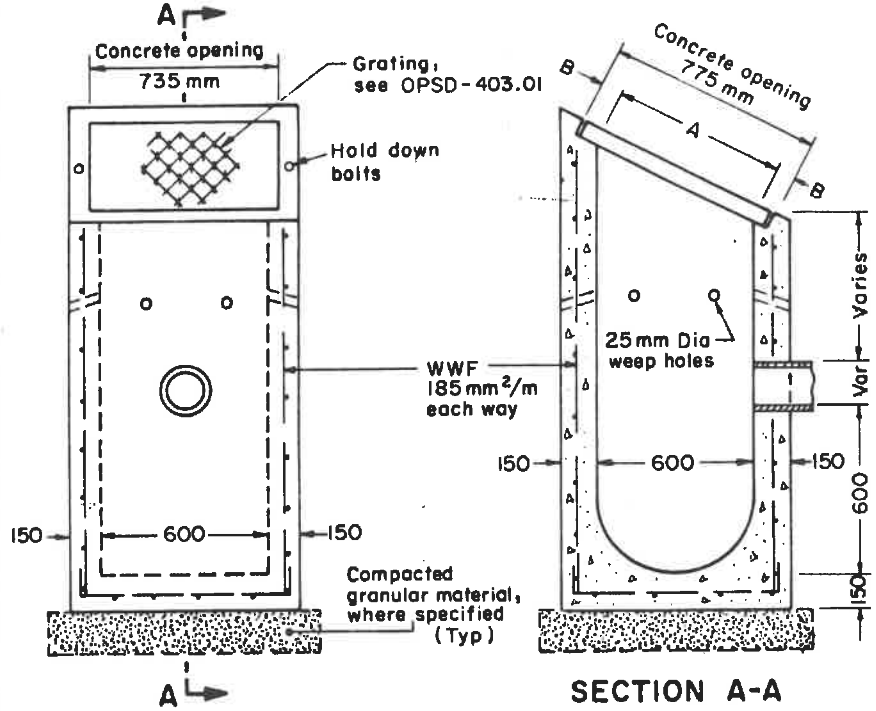


PLAN



SECTION B-B

CATCH BASIN TYPE A



FRONT VIEW

SECTION A-A

DITCH INLET TYPE B

SLOPE OF GRATING	DIMENSIONS A	DIMENSIONS B
2:1	675	50
3:1	645	65
4:1	625	75
6:1	605	85
8:1	605	85
10:1	605	85

NOTES:

A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope is to be 6:1 or flatter.

B All reinforcing steel shall have 25 mm min cover.

C Weep holes, where required, shall be placed so that the bottom of the weeper on the inside and the top of the weeper on the outside are level.

D Granular backfill to be placed to a min thickness of 300 mm on all sides.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

600 x 600 mm PRECAST CONCRETE CATCH BASIN AND DITCH INLET

DEPTH 4.0 m MAX

Date	1983 12 01	Rev
Date		

OPSD-705.02

APPENDIX H

MAJOR SYSTEM PLANS

DRAINAGE AREA SCHEDULE	
AREA No.	AREA (ha)
1	23.7
2	1.2
3	2.4
4	15.3
5	8.5
6	33.3
TOTAL	84.4

LEGEND

- PROPOSED STORM SEWER
- SUB CATCHMENT AREA
- STORM DRAINAGE AREA - PHASE I
- EXTERNAL STORM DRAINAGE AREA BOUNDARY
- 2.4 ha — STORM DRAINAGE AREA (HECTARES)
- MH — MANHOLE

NOTE

RUNOFF COEFFICIENTS FOR ALL DRAINAGE AREAS : C=0.25
(FLOWS TO BE RESRICTED TO PREDEVELOPMENT LEVEL)

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3	ISSUED FOR TENDER	JAN.15/92	SG
2	REVISED AS PER RMOC COMMENTS	DEC 9/91	SG
1	REVISED AS PER NEPEAN COMMENTS	NOV.28/91	SG

LICENSED PROFESSIONAL ENGINEER — UDO BOEHME — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — S.M. GORDON — PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
OTTAWA, ONTARIO

DESIGN SG
CHECKED UB
DRAWN JFB
CHECKED UB
APPROVED MJH

SCALE
1 : 2500 HORIZONTAL
VERTICAL

CITY OF NEPEAN

NEPEAN

SOUTH MERIVALE BUSINESS PARK

STORM DRAINAGE AREA PLAN
PHASE I

CONTRACT No. 90041
DATE OCT. 1991
DRAWING No. 90041-STM

Appendix E
Development Servicing Checklist

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- N/A ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☐ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

N/A ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

N/A ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

N/A ☐ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

N/A ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ Address reliability requirements such as appropriate location of shut-off valves

N/A ☐ Check on the necessity of a pressure zone boundary modification.

- [X] Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

- [X] Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

- N/A [ ] Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

- [X] Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

- [X] Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- [X] Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

- [X] Confirm consistency with Master Servicing Study and/or justifications for deviations.

- N/A [ ] Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

- [X] Description of existing sanitary sewer available for discharge of wastewater from proposed development.

- [X] Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

- [X] Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix ‘C’) format.

- [X] Description of proposed sewer network including sewers, pumping stations, and forcemains.

N/A ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

N/A ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

N/A ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

N/A ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

N/A ☐ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

N/A ☐ Set-back from private sewage disposal systems.

N/A ☐ Watercourse and hazard lands setbacks.

N/A ☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

- [X] Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- [X] Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- [X] Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
- N/A [ ] Any proposed diversion of drainage catchment areas from one outlet to another.
- [X] Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- N/A [ ] If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.
- [ ] Identification of potential impacts to receiving watercourses
- [ ] Identification of municipal drains and related approval requirements.
- [X] Descriptions of how the conveyance and storage capacity will be achieved for the development.
- [ ] 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.
- [X] Inclusion of hydraulic analysis including hydraulic grade line elevations.
- [X] Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- N/A [ ] Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- N/A [ ] Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

- [X] Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.
- [ ] Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- N/A [ ] Changes to Municipal Drains.
- N/A [ ] Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- [X] Clearly stated conclusions and recommendations
- N/A [ ] Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.
- [X] All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Appendix F
Drawings