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Engineers, Planners & Landscape Architects

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Development

Municipal  
Infrastructure

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## 5494-5510 Boundary Road Day and Ross

### SERVICEABILITY REPORT

Engineering excellence.

Planning progress.

Liveable landscapes.

**5494-5510 BOUNDARY ROAD  
DAY AND ROSS  
OTTAWA, ONTARIO**

**SERVICEABILITY REPORT**

Prepared by:

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

April 27, 2021

Ref: R-2021-040  
Novatech File: 118168

April 27, 2021

BY COURIER

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

**Attention: Anissa McAlpine MCIP, RPP – Planner I**

**Reference: 5494-5510 Boundary Road  
Serviceability Report  
Our File No.: 118168**

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Please find enclosed the 'Serviceability Report' for the above noted project. This report has been prepared in support of a Zoning By-law and Official Plan Amendment and is hereby submitted for review and approval.

If you have any questions, please contact the undersigned.

Yours truly,

**NOVATECH**



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

## TABLE OF CONTENTS

1.0.	INTRODUCTION .....	1
2.0.	EXISTING CONDITIONS .....	1
3.0.	PROPOSED DEVELOPMENT .....	1
4.0.	SITE CONSTRAINTS .....	1
5.0.	WATER SERVICING.....	3
6.0.	SANITARY SERVICING .....	3
7.0.	STORM SERVICING & STORMWATER MANAGEMENT .....	4
8.0.	EROSION AND SEDIMENT CONTROL MEASURES .....	5
9.0.	CONCLUSIONS AND RECOMMENDATIONS .....	6

### List of Figures

- Figure 1 Key Plan
- Figure 2 Existing Conditions
- Figure 3 Proposed Site Plan
- Figure 4 Conceptual Servicing Plan
- Figure 5 Pre-Development Drainage Area Plan
- Figure 6 Post-Development Drainage Area Plan

### List of Appendices

- Appendix A Water Servicing
- Appendix B Sanitary Servicing
- Appendix C Storm Servicing and Stormwater Management

## 1.0. INTRODUCTION

Novatech has been retained to prepare a Serviceability Report to outline the servicing options for the proposed development located at 5494-5510 Boundary Road within the City of Ottawa. This report has been prepared in support of a Zoning By-law and Official Plan Amendment for the subject site. **Figure 1** is a Key Plan showing the site location.

## 2.0. EXISTING CONDITIONS

The subject site is approximately 8.46 hectares in size and is currently undeveloped. The site is generally covered with areas of tall grass and bare soil, bordered by wooded areas. There are two existing gravel entrances to the site from Boundary Rd. The topography of the site is relatively flat with general drainage to perimeter watercourse. There is ponding water along the north property line which is a result of extensive grade changes on the site over the past approximately 20 years. It is our understanding that the site was previously used as a pit where the native sand material was removed and replaced with miscellaneous fill material. The grade changes on site have trapped water on site from out-letting to the roadside ditch on Boundary Road. **Figure 2** shows the existing site conditions

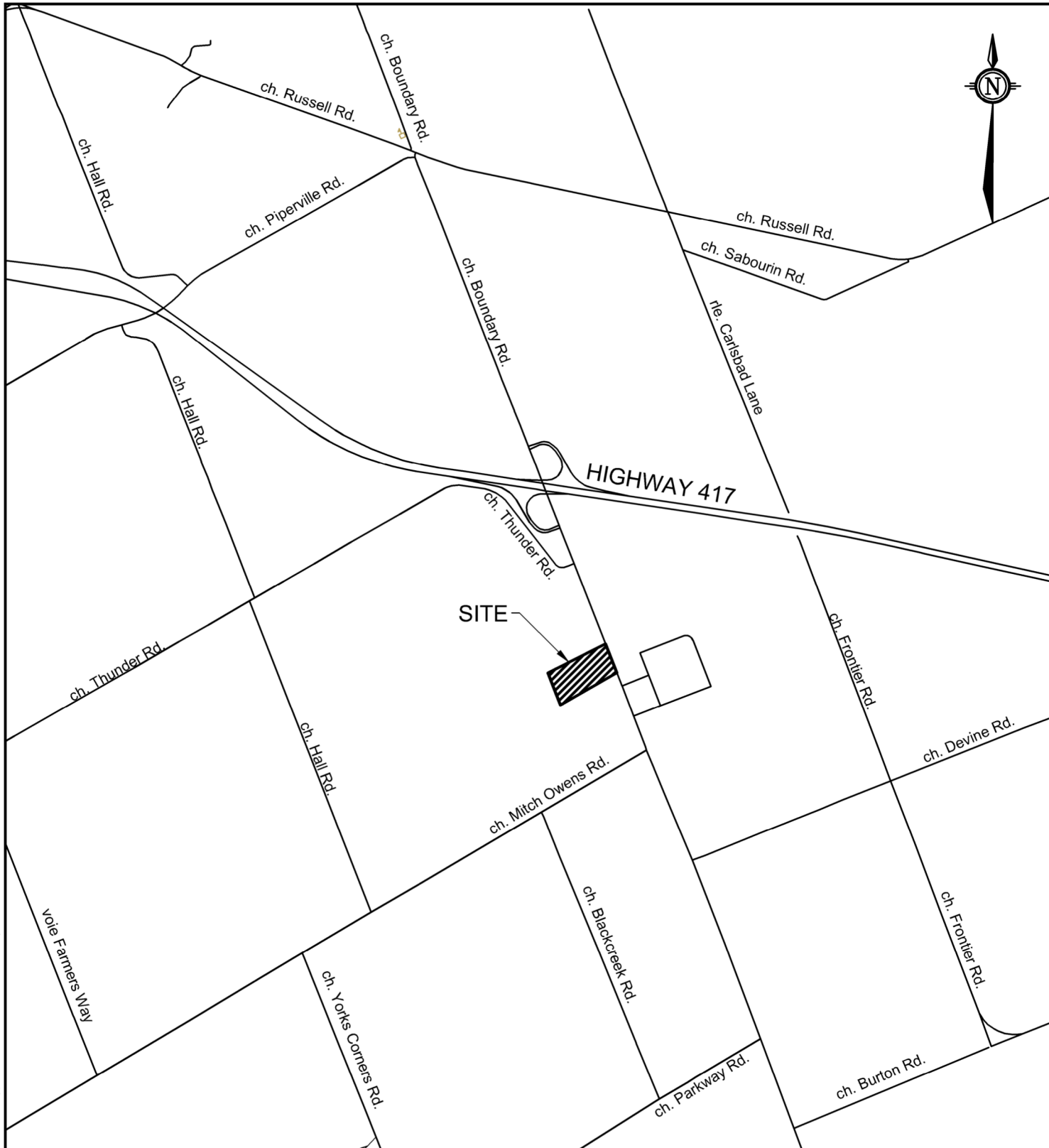
## 3.0. PROPOSED DEVELOPMENT

It is proposed to develop the site with a cross dock warehouse facility with approximately 5000m<sup>2</sup> of warehouse floor space and 650m<sup>2</sup> of office floor space. The warehouse component will consist of 96 loading bays and will include associated secured truck and trailer parking. The office component will include associated car parking lots fronting the development. It is proposed to access the development from two paved entrances from Boundary Road. **Figure 3** shows the proposed development site plan.

## 4.0. SITE CONSTRAINTS

A geotechnical investigation was completed for the subject development and a report provided entitled 'Geotechnical Investigation Proposed Warehouse Complex – 5510 Boundary Road Ottawa, Ontario' prepared by Paterson Group dated September 10, 2018. The following is a summary of the findings of this report:

- From available geological mapping the bedrock is shale and at depth of 25-35m below ground surface.
- Groundwater levels are expected to be 2-3m below existing ground surface.
- A category 3 permit to take water (PTTW) may be required during construction if more than 400,000 L/day of surface and/ or ground water is to be pumped during the construction phase. A time allowance of 4-5 months is required to obtain a permit from the Ministry of Environment Conservation and Parks MECP.
- For typical ground and/ or surface water pumping (50,000-400,000 L/day) during construction a MECP permit to take water (PTTW) and registry with the Environmental Activity and Sector Registry (EASR) is required. A time allowance of 2-4 weeks should be allocated to complete the EASR registry and PTTW discharge plan.
- Due to the presence of a silty clay deposit, the site will be subject to a permissible grade raise restriction. It is anticipated that due to time constraints a surcharge program is not realistic and lightweight fill and granular material will be required on site to manage long-term settlement.
  - A permissible grade raise of 1.0-1.2m is recommended for slab-on-grade using 400mm EPS geofoam blocks to compensate for sustained slab on grade loading.



M:\2018\118168\CAD\Design\118168-KP.dwg, Sheet 8x11 Keyplan, Mar 16, 2021 - 11:16am, jkaloudas



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

**KEY PLAN**

**5510 BOUNDARY ROAD  
 CITY OF OTTAWA**






**5510 BOUNDARY ROAD**

DATE	JOB	FIGURE
MAR 2021	118168	1

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**LEGEND**

-  PROPERTY LINE
-  EXISTING TOP OF BANK
-  EXISTING DITCH
-  EXISTING CULVERT
-  CONTOUR LINES




Engineers, Planners & Landscape Architects  
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Ottawa, Ontario, Canada K2M 1P6

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

**5510 BOUNDARY ROAD**

**EXISTING CONDITIONS**

SCALE 1 : 1250 

DATE APR 2021 JOB 118168 FIGURE 2

General notes / Notes générales

REFERENCE:  
 A - DETAIL NUMBER  
 B - DETAIL LOCATION  
 C - SHEET NUMBER - WHERE DETAILED

THIS DRAWING IS THE PROPERTY OF HATCHARD ENGINEERING LTD. AND HAS BEEN PREPARED SOLELY FOR THIS PROJECT. THIS DRAWING IS NOT TO BE USED BY ANY PARTIES ON OTHER PROJECTS OR EXTENSIONS TO THIS PROJECT EXCEPT BY AGREEMENT AND APPROPRIATE COMPENSATION TO HATCHARD ENGINEERING LTD.

Revisions / Révisions	No/N°	Date

Project Title / Titre du projet

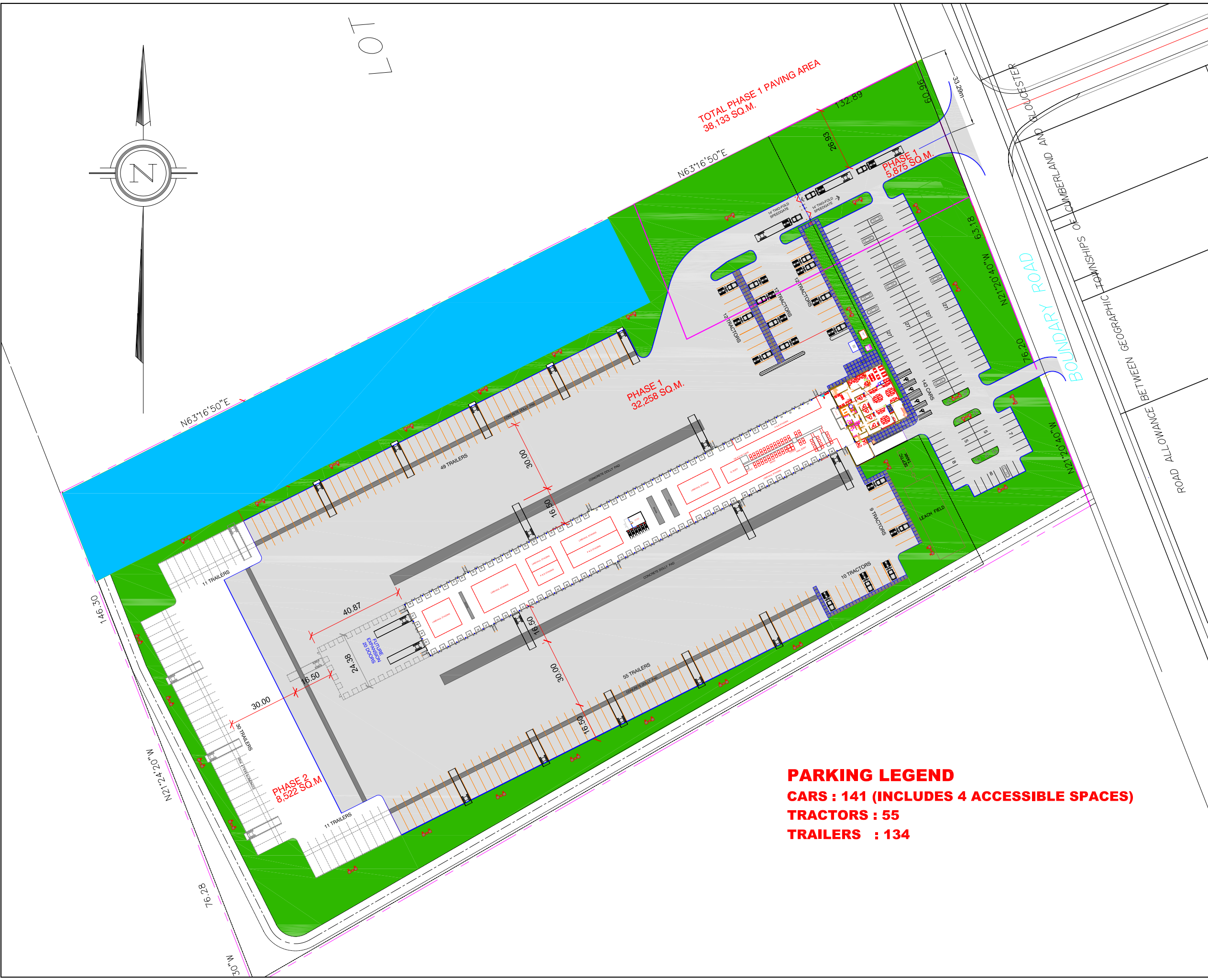
DAY AND ROSS  
 OTTAWA, ON

Sheet Title / Titre de la feuille

SITE PLAN  
 ENTRANCE OPTION 2

Date 19 DEC, 2019	Date	Stamp	Sceau
Scale 1:500	Échelle		
Drawn by BAP	Dessiné par		
Approved by	Approuvé par		

**FIGURE 3**



**PARKING LEGEND**  
**CARS : 141 (INCLUDES 4 ACCESSIBLE SPACES)**  
**TRACTORS : 55**  
**TRAILERS : 134**



- A permissible grade raise of 1.4m is recommended for parking and loading areas away from the building foundations.
- It is recommended to limit plantings around structures and provide clay dikes on service trenches to reduce long term ground water lowering.
- Catchbasins are to be equipped with subdrains extending in four orthogonal directions and longitudinally when placed along curbs. Subdrains are to be placed 300mm below the subgrade level. Subgrade is to be shaped to promote water flow to the subdrains.

An environmental impact study was completed for the subject development and a report provided entitled 'Environmental Impact Statement and Tree Conservation Report (EIS/TCR) – 5494-5510 Boundary Road Ottawa, Ontario' prepared by Holly Bickerton, BAsC, MES. dated February 15, 2021. The subject site is designated as a Rural Natural Feature Area in the Official Plan. The EIS/TCR was required to determine that no negative impacts will occur to any natural heritage features on or within 120m of the property. The following is a summary of the findings of this report:

- There are no provincially significant or local wetlands on the subject site however, local wetlands exist to the north and south. Mitigating setbacks of 45m will be employed adjacent to wetlands.
- There are no species at risk observed within 120m of the site. Two regulated species the Bank Swallow and Barn Swallow were observed on site.
- The permanent headwater drainage features around the perimeter of the site are considered significant wildlife habitat as snapping turtle were observed on site.
- Fish habitats were observed on site and will be maintained in the proposed development. A proposed 15m setback will be maintained from limits of the fish habitat to the proposed development.
- Significant woodlands are present to the north and south of the site which are to be protected by restored naturalized setbacks.
- Any tree clearing on site is to occur outside the bird breeding season (April 15 – August 15) unless authorized by a qualified biologist.
- By implementing the mitigation measures identified in the EIS/TCR, the proposed development will have no negative impacts on the ecological features and functions of the applicable natural heritage features.

An Environmental Impact Statement Fisheries Component was prepared by Bowfin Environmental Consulting Inc. dated April 2021. Several potential fish habitats were identified on site, generally confined to the perimeter and were likely a result of the fill brought to site by the previous owner. These features are part of the Upper Bear Brook sub watershed which is tributary to the South Nation River. The Fisheries Impact Statement outlines the potential impacts to fish and fish habitat and the required mitigation measures. The following is a summary of the findings of this report:

- Eight different features were identified on site plus the roadside ditch. Of these features only feature 5 along the north property line and the roadside ditch will be directly impacted by the proposed development.
- The roadside ditch will need to be piped and filled in for a portion of the ditch fronting the site. The culvert will need to be designed and installed to promote fish passage.
- Feature 5 will need to be realigned out of the development area, the total area of the fish habitat will be maintained in the proposed development.
- A minimum 15m buffer will be provided from the proposed development to the existing and realigned features.

- To maintain water quantity and quality reaching all features on site and infiltration berm will be constructed in the proposed conveyance ditches to promote filtration of water to the existing features.
- All in water works are required to be completed outside fish spawning periods (work between July 1 and March 14).

## 5.0. WATER SERVICING

There is an existing 100mm dia. municipal watermain in Boundary Road which terminates in front of the proposed site. This existing watermain infrastructure is part of the Carlsbad Springs Trickle Feed Water System which was recently extended to service the Amazon distribution facility to the north of the site. This municipal water system would provide potable water for domestic use only at the proposed warehouse facility. Fire suppression requirements will not be provided by the trickle feed connection.

It is proposed to service the site by connecting into the existing 100mm dia. watermain in Boundary road and extending a 50mm dia. private watermain into the site. A water meter will be housed in a concrete underground chamber at the north entrance to the site from Boundary Road, located within the City of Ottawa right of way. The meter chamber will be owned and operated by the City of Ottawa.

### Domestic Demands

There is no flow criteria for warehouse cross dock facilities provided under the City of Ottawa guidelines or the Ontario Building Code. The septic system has been designed for a flow of 3,500 L/day based on metered data from similar facilities. Therefore, the domestic water demands are based on a daily flow of 3,500 L/day plus a hose bib allowance of 3,600 L/day which equates to a total peak flow of 7,100 L/day.

The supply to the facility will be 3 Equivalent connections:  $2,700\text{L/Day} \times 3 = 8,100\text{ Liters/day}$  [0.09 L/s continuous flow]. The water meter chamber will be designed to accommodate this continuous flow rate while not exceeding it. Refer to **Figure 4** for the conceptual servicing details. Details on the water meter chamber will be determined during detailed design.

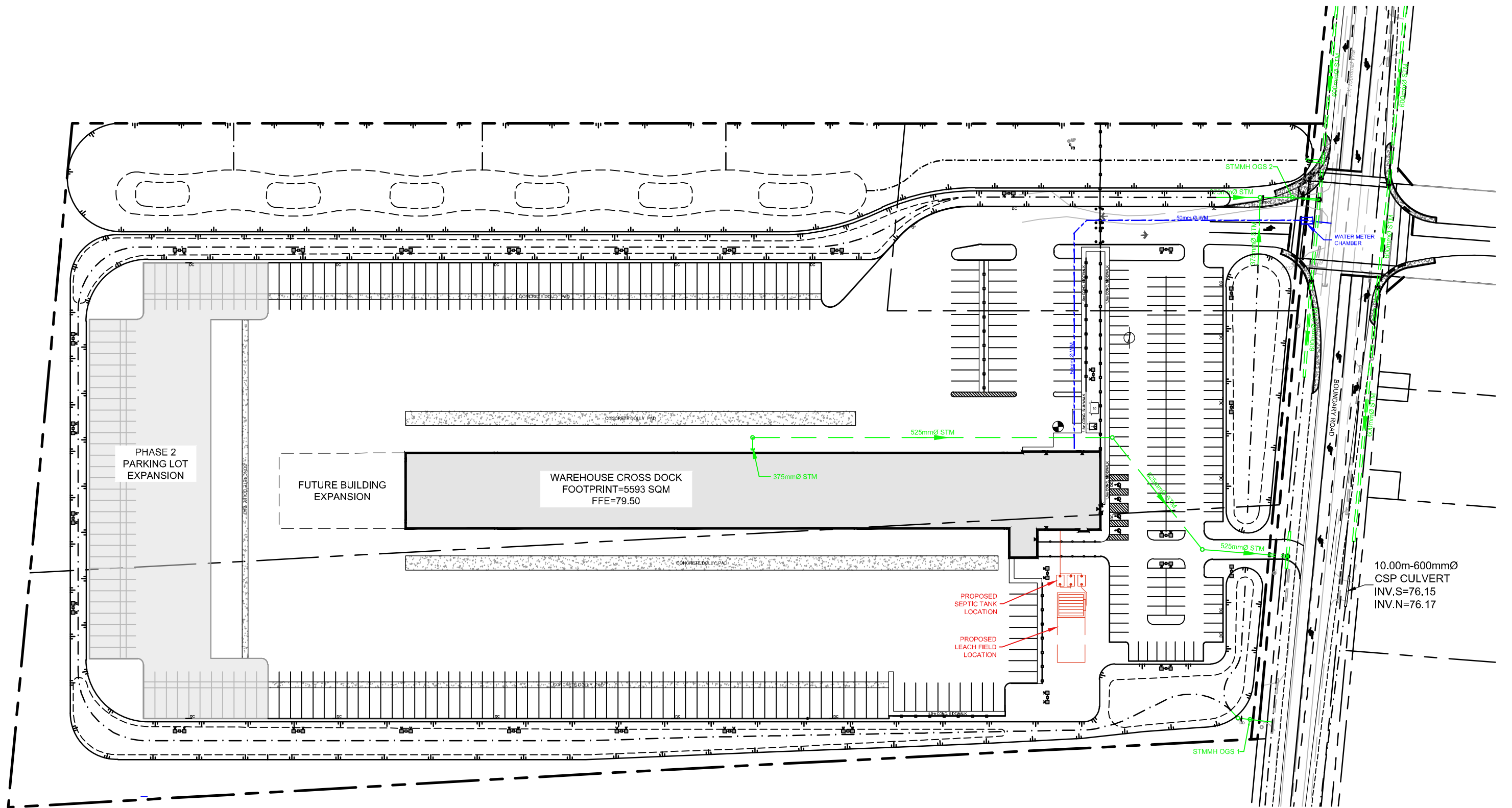
### Fire Suppression

Fire suppression water will be provided by way of underground storage tanks. A preliminary total storage volume of 270m<sup>3</sup> of water will be required to supply the proposed fire suppression system. The required fire flows for the development were calculated to be 150L/s using criteria from Appendix A-3.2.5.7 of the Ontario Building Code. The fire suppression system will be a private system, owned and maintained by the property owner. Fire flow requirements and water storage volumes will need to be confirmed by the fire consultant during detailed design. Refer to **Appendix A** for detailed fire flow calculations.




## 6.0. SANITARY SERVICING

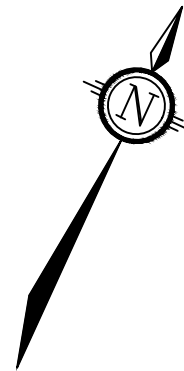
There is currently no existing municipal sanitary sewer fronting the development in Boundary Road as the site is not located within the City of Ottawa sanitary service area. A private onsite septic system with associated tank and leaching bed is proposed. The septic system will be designed Paterson Group for a total peak flow of 3,500 L/day. A preliminary septic design has been completed and is provided in **Appendix B** for reference.

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**LEGEND**

-  PROPERTY LINE
-  PROPOSED STORM SEWER & MANHOLE
-  PROPOSED WATERMAIN



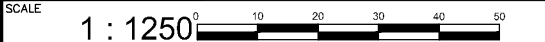
**NOVATECH**

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 Ottawa, Ontario, Canada K2M 1P6

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**5510 BOUNDARY ROAD**

**CONCEPTUAL SERVICING PLAN**

SCALE 1 : 1250 

DATE APR 2021 JOB 118168 FIGURE 4

## 7.0. STORM SERVICING & STORMWATER MANAGEMENT

There is no municipal storm sewer fronting the development, the site currently drains to the existing roadside ditch. It is proposed to service the development with a combination of a private storm sewer system and ditches that will outlet to the Boundary Road ditch. The private storm sewer system will be sized to convey the uncontrolled 2-year flows from the roof drains for the proposed cross-dock facility. The remainder of the site will sheet drain to a perimeter ditch system which will convey stormwater flows to the roadside ditch. The ditch drainage system has been sized to ensure no surface ponding occurs in the parking area during the 2-year event.

The stormwater management criteria and objectives for the site are as follows, per the City of Ottawa's requirements:

For storm flows being directed to the Boundary Road ditch:

- Control post-development storm flows, up to an including the 100-year design event, to the pre-development levels.
- Provide a dual drainage system (i.e. minor and major system flows);
- Ensure that no surface ponding will occur on the paved surfaces during the 2-year storm event;
- Provide on-site water quality control equivalent to an 'Enhanced' Level of Protection (i.e., minimum 80% long-term TSS removal), as required by the Conservation Authority; and,
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

As previously stated, the site in its current condition is relatively flat with general drainage to perimeter swales at the property limits. There is currently no municipal storm sewer fronting the development in Boundary Road. Boundary Road is a rural cross section which includes roadside ditches on both sides of the road. Most of the site currently drains to the existing roadside ditch on Boundary Road. Refer to the existing stormwater management drainage area plan **Figure 5**, in **Appendix C**, which shows the existing site drainage.

A technical memorandum was prepared by Novatech titled Proposed Warehouse Complex, 5510 Boundary Road, Supplemental SWM Modeling Information, dated October 5, 2020. This memo provides detailed hydrologic modeling of the existing site conditions and the pre-development/allowable release rates for the proposed site. The memo is provided in **Appendix C** for reference. A summary of the pre-development flows is provided below in **Table 1**.

**Table 1: Pre-development Release Rate Summary**

Area ID	Drainage Area (ha)	Peak Flow (L/s)		
		2-year	5-year	100-year
PRE	6.94	129.0	221.0	519.0

To control the post-development flows from the site to pre-development levels it is proposed to implement flow control roof drains and inlet control devices in the stormwater management design. The use of flow control devices will require stormwater to back up and be stored on site. It is anticipated that stormwater storage could be provided on building roofs, and in the perimeter ditch system. Preliminary stormwater calculations were completed for site based on the current site plan. Stormwater storage requirements for each of the proposed drainage areas is summarized below in **Table 2** and detailed calculations are included in **Appendix C** for reference.

This relates to a per hectare storage of approximately 270 m<sup>3</sup>/ha which is a reasonable quantity of storage to provide given the type of development.

**Table 2: Stormwater Storage Summary**

Area ID	Area (ha)	Outlet Location	2 Year Required Storage (m <sup>3</sup> )	5 Year Required Storage (m <sup>3</sup> )	100 Year Required Storage (m <sup>3</sup> )
A-01	0.027	Boundary Rd.	N/A	N/A	N/A
A-02	0.559	Boundary Rd.	81.9	113.0	237.6
A-03	3.033	Boundary Rd.	329.0	439.6	724.6
A-04	3.316	Boundary Rd.	403.8	520.1	904.0
Total	6.94		814.6	1072.7	1866.2

It should be noted that the proposed storm sewer outlets to a shallow roadside ditch. The storm sewer will have minimal cover and will require insulation over the pipe to provide frost protection for the pipe bedding.

During storms events in excess of the 100-year storm event, site grading will provide an overland flow route from the site directly to the Boundary Road ditch.

Quality control of stormwater shall be provided to an *Enhanced* level of treatment or 80% removal of total suspended solids. Quality control for stormwater from parking and paved surfaces will be provided through the installation of two oil grit separator units. The proposed OGS units will be located at the outlets to the Boundary Road ditch from the onsite storage ditches. The OGS units will provide enhanced levels of water quality prior to discharging into the roadside ditch system. The target level of protection for long term removal of TSS is 80% with an overall treatment of 100% of the total runoff. The roof area will outlet directly to the roadside ditch via the private storm sewer system. Quality control is not required for roof drainage as it is considered clean.

In summary, the Boundary Road ditch system can service the proposed development and appropriate stormwater management methods can be used to meet the allowable release rates. Refer to **Appendix C** for preliminary stormwater management calculations and pre and post development drainage area figures.

## **8.0. EROSION AND SEDIMENT CONTROL MEASURES**

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 will be placed in existing catchbasins and 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;
- 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;

The erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be undertaken

## 9.0. CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this report are as follows:

- The existing 100mm diameter dead end watermain fronting the development can service the proposed development for domestic use. A water storage tank and private fire suppression system will be required to provide adequate volumes and flow to meet the fire demands for the proposed development.
- The site can be serviced by a private septic system. The septic detailed design will be provided by others.
- The existing Boundary Road ditch can service the proposed development. Storage of stormwater will be provided on the building roof and in the perimeter ditch system. The stormflows will be controlled through the implementation of flow control roof drains and inlet control devices.
- Quality control for the site can be provided through the implementation of Oil Grit Separator units to achieve 80% TSS removal or enhanced level treatment.
- The overland flow route to the Boundary Road ditch is to be maintained.
- Erosion and sediment control measures will be implemented during construction.

## NOVATECH

Prepared by:



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

Reviewed by:

A handwritten signature in black ink, appearing to read "J. Lee Sheets".

J. Lee Sheets, C.E.T.  
Director  
Land Development & Public Sector  
Infrastructure

**APPENDIX A**  
**Water Servicing**

# OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: [Ontario Fire Marshal - OBC Fire Fighting Water Supply](#)  
[Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7](#)



**Novatech Project #:** 118168  
**Project Name:** 5510 Boundary Rd  
**Date:** 3/10/2021  
**Input By:** Matt Hrehoriak  
**Reviewed By:** Lee Sheets

Legend  
 Input by User  
 No Input Required

**Building Description:** Single Storey Warehouse Fire Protection Provided by Underground Tank

Unsprinklered

Step	Calculation Inputs	Calculation Notes	Value
<b>Minimum Fire Protection Water Supply Volume</b>			
1	<b>Water Supply Coefficient</b>		
	Building Classification = <b>Water Supply Coefficient - K =</b>	F-3 From Table 3.1.2.1 From Table 1 (A3.2.5.7)	19
2	<b>Total Building Volume</b>		
	Building Width - W	N/A m	
	Building Length - L	N/A m	Area (W * L) = 6590 m <sup>2</sup>
	Building Height - H	10 m	
	<b>Total Building Volume - V =</b>	W * L * H	65900 m <sup>3</sup>
3	<b>Spatial Coefficient Value</b>		
	<b>Exposure Distances:</b> (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)	<b>Spatial Coefficients:</b> From Figure 1 (Spatial Coefficient vs Exposure Distance)	
	North	10.00 m	Sside 1 = 0.00
	East	10.00 m	Sside 2 = 0.00
	South	10.00 m	Sside 3 = 0.00
	West	10.00 m	Sside 4 = 0.00
	<b>Total of Spacial Coefficient Values - S-Tot</b> as obtained from the formula =	1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)	1.00
4	<b>Minimum Fire Protection Water Supply Volume</b>		
	<b>Q =</b>	$K * V * S_{Tot}$	1,252,100 L
<b>Required Minimum Water Supply Flow Rate</b>			
5	<b>Minimum Water Supply Flow Rate</b> =	From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)	9,000 L/min or 150 L/s
<b>Minimum Fire Protection Water Supply Volume for 30 minutes</b>			
6	<b>Q =</b>	= Minimum Water Supply Flow Rate (L/min) * 30 minutes	270,000 L
<b>Required Fire Protection Water Supply Volume</b>			
7	<b>Q =</b>	Highest volume out of (4) and (6)	1,252,100 L
Notes			





CITY OF MONCTON  
**WATER AND  
 WASTEWATER  
 INVOICE**

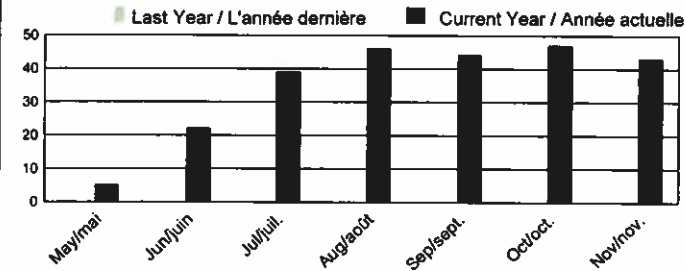
VILLE DE MONCTON  
**FACTURE D'EAU  
 ET D'EAUX  
 USÉES**

14752

Account # / N° de compte	524990
Customer # / N° de client	002117
Address / Adresse	651 FRENETTE AVE
Statement # / N° de relevé	2287927
Bill Date / Date de facturation	12/01/2020
Total due / Total dû	\$228.95
Due date / Date d'échéance	01/05/2021

Meter / Compteur	Size / Taille	Service From / Du	Service To / Au	Present read / Relevé actuel	Previous read / Relevé précédent	Consumption * / Consommation *	Days / Jours	Avg m³ per day / Moyenne par jour en m³
524990	1-1/2"	11/01/2020	12/01/2020	246	203	43	30	1.43
				Actual / Actuel	Actual / Actuel	*Usage in cubic meters / Utilisation en mètres cubes (m³)		

**Billed consumption / Consommation facturée (m³)**



**Previous activity / Activité antérieure**

Last Bill / Dernière facture	\$240.93
Payment Received - Thank You / Paiement reçu - merci	-\$240.93
Late Fees / Frais de retard	\$0.00
Adjustments / ajustement	\$0.00
Balance Forward / Solde impayé	\$0.00

**Current activity / Activité actuelle**

Meter / Compteur 524990	(670175 / 1.00)
Consumption - Water/Eau - consommation	\$65.96
Fixed Charge - Wastewater/Eaux usées - Frais fixe	\$38.17
Fixed Charge - Water/Eau - Frais fixe	\$62.13
Usage - Wastewater/Eaux usées - Utilisation	\$21.84
Usage - TransAqua - Utilisation	\$40.85
<b>Current Charges / Charges actuelles</b>	<b>\$228.95</b>

1.5% interest per month charged after due date.  
 Des intérêts de 1,5% par mois seront facturés après la date d'échéance.

<b>Total due / Total dû</b> (Balance forward + current charges / Solde du compte + charges actuelles)	<b>\$228.95</b>
--	-----------------

**Important**

Sign up for paperless billing and water use tracking at: [myaccount.moncton.ca](http://myaccount.moncton.ca) / Inscrivez-vous pour la facturation électronique et surveillez consommation d'eau à : [Moncompte.moncton.ca](http://Moncompte.moncton.ca)

10111 50  
 20111 10  
 61032 33  
 61031 34  
 61004 33

PLEASE DETACH AND RETURN BOTTOM PORTION WITH PAYMENT IF PAYING BY MAIL / SI VOUS PAYEZ PAR COURRIER, DÉTACHEZ ET RETOURNEZ LA PARTIE INFÉRIEURE



CITY OF MONCTON  
**WATER AND  
 WASTEWATER  
 INVOICE**

VILLE DE MONCTON  
**FACTURE D'EAU  
 ET D'EAUX  
 USÉES**

Account # / N° de compte	Customer # / N° du client	Bill Date / Date de facturation	Due date / Date d'échéance	Total due / Total dû
524990	002117	12/01/2020	01/05/2021	\$ 228.95
<b>Address / Adresse</b>			<b>Statement # / N° de relevé</b>	
651 FRENETTE AVE			2287927	

**Methods of payment**

online [moncton.ca](http://moncton.ca) or  
 at your financial institution.



**Options de paiement**

en ligne [moncton.ca](http://moncton.ca) ou à  
 votre institution financière.

**Phone / Pre-authorized payment**

City of Moncton's Revenue Office  
 506-853-3588



**Téléphone / Paiement préautorisé**

Bureau du Revenu, Ville de Moncton  
 506-853-3588

**Cheque**

payable to City of Moncton



**Chèque**  
 libellé à l'ordre de la Ville de Moncton

**In person**

Mon. to Fri. 8:30 am - 4:30 pm



**En personne**  
 lun. au ven., de 8 h 30 à 16 h 30

**DAY & ROSS INC.**  
 SHERYL BELYEA  
 398 MAIN ST  
 HARTLAND, NB E7P 1C6  
 CANADA

655, rue Main St., Moncton NB, E1C 1E8

☎ 743 7900 ☎

96

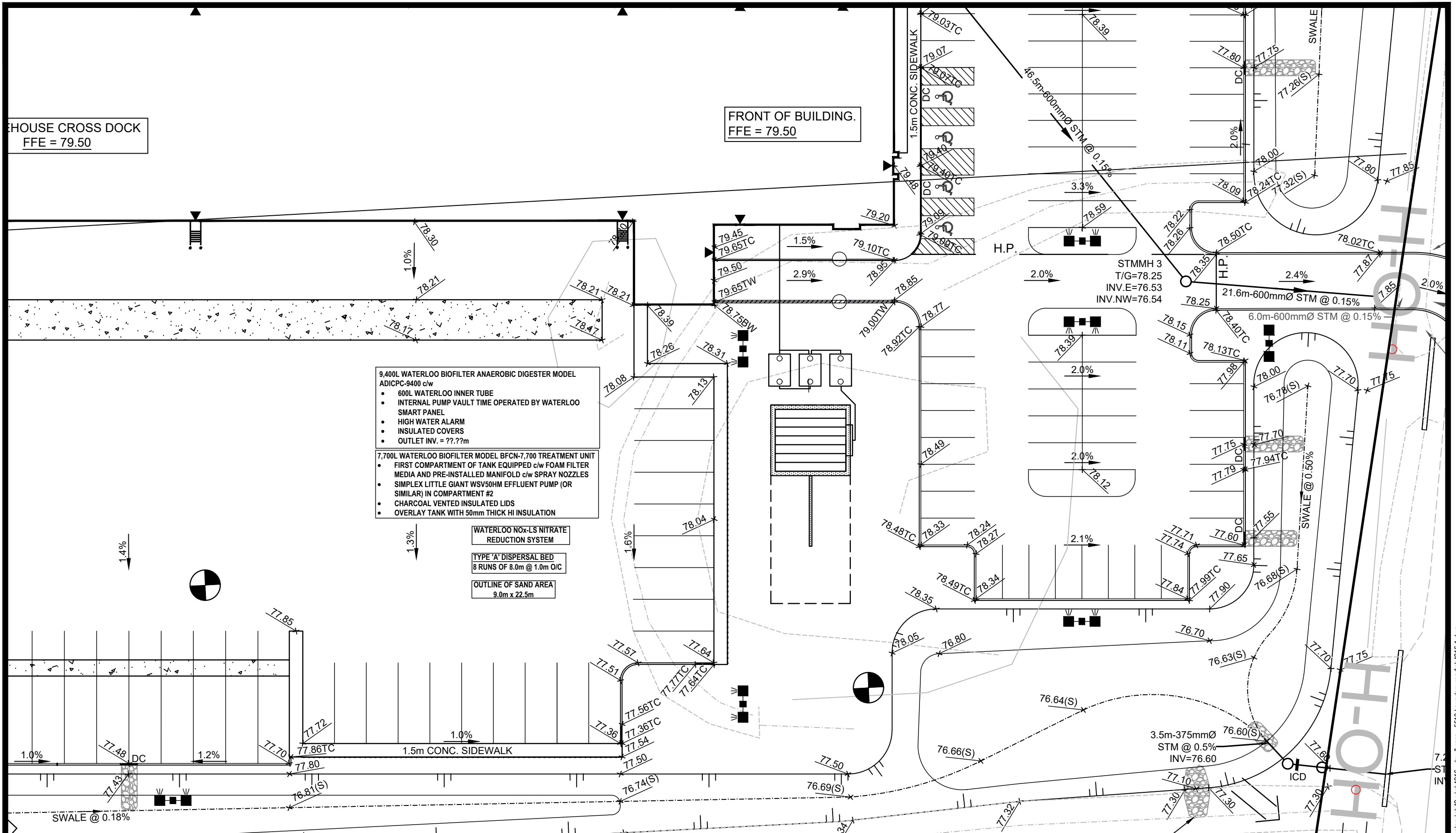
**APPENDIX B**  
**Sanitary Servicing**

HOUSE CROSS DOCK  
FFE = 79.50

FRONT OF BUILDING.  
FFE = 79.50

- 9,400L WATERLOO BIOFILTER ANAEROBIC DIGESTER MODEL ADICPC-9400 c/w**
- 600L WATERLOO INNER TUBE
  - INTERNAL PUMP VAULT TIME OPERATED BY WATERLOO SMART PANEL
  - HIGH WATER ALARM
  - INSULATED COVERS
  - OUTLET INV. = ???.??m
- 7,700L WATERLOO BIOFILTER MODEL BFCN-7,700 TREATMENT UNIT**
- FIRST COMPARTMENT OF TANK EQUIPPED c/w FOAM FILTER MEDIA AND PRE-INSTALLED MANIFOLD c/w SPRAY NOZZLES
  - SIMPLEX LITTLE GIANT WSV50HM EFFLUENT PUMP (OR SIMILAR) IN COMPARTMENT #2
  - CHARCOAL VENTED INSULATED LIDS
  - OVERLAY TANK WITH 50mm THICK HI INSULATION

- WATERLOO NOx-LS NITRATE REDUCTION SYSTEM**
- TYPE 'A' DISPERSAL BED**  
8 RUNS OF 8.0m @ 1.0m O/C
- OUTLINE OF SAND AREA**  
9.0m x 22.5m



**patersongroup**  
consulting engineers  
154 Colonnade Road, Ottawa, Ontario K2E 7J5

DD/MM/YY	Description	Rev.

Client: **DAY AND ROSS**

Project: **PROPOSED CROSS DOCK BUILDING**  
5510 BOUNDARY ROAD  
OTTAWA (CARLSBAD SPRINGS), ONTARIO

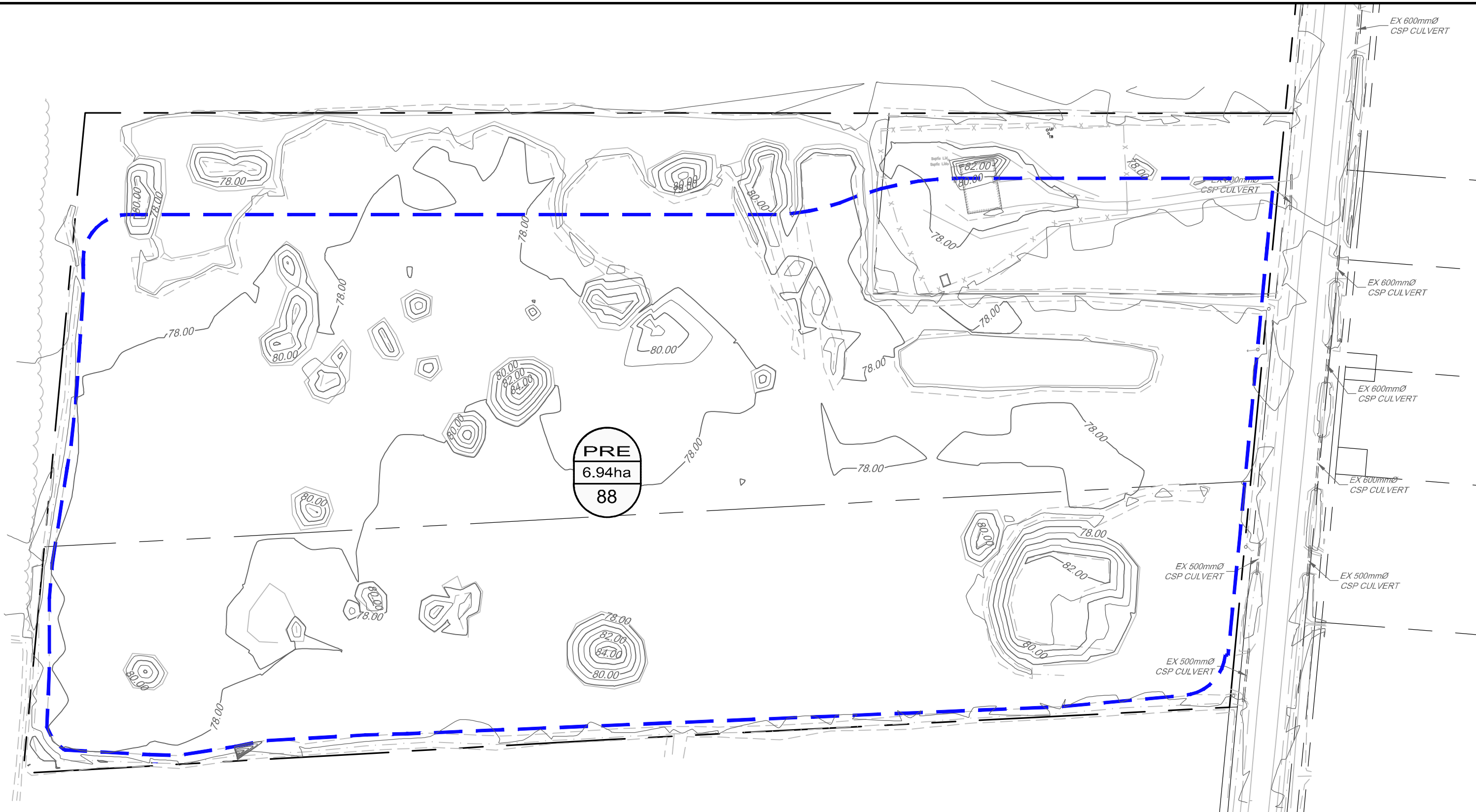
Drawing: **PRELIMINARY SEWAGE SYSTEM LAYOUT PLAN**

Scale: 1:400  
Date: 03/2021  
Drawing no.: **PH4216-1**

Drawn by: HV  
Checked by: MK


**APPENDIX C**  
**Storm Servicing and Stormwater Management**

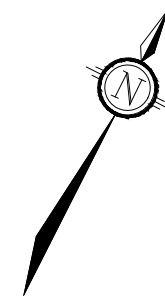
M:\2018\118168\CAD\Design\Figures\118168-EX-SWM.dwg, EX SWM, Mar 15, 2021 - 12:17pm, mthrehorak



**LEGEND**

 EXISTING STORM DRAINAGE AREA

 DRAINAGE AREA ID  
 DRAINAGE AREA (ha)  
 SCS CURVE NUMBER



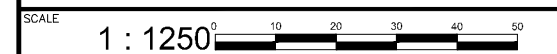
**NOVATECH**  
 Engineers, Planners & Landscape Architects

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

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

**5510 BOUNDARY ROAD**

**PRE-DEVELOPMENT DRAINAGE AREA PLAN**



DATE **MAR 2021** JOB **118168** FIGURE **5**

# MEMORANDUM

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**DATE:** OCTOBER 5, 2020  
**TO:** MATT HREHORIAK  
**FROM:** CONRAD STANG  
**RE:** PROPOSED WAREHOUSE COMPLEX  
5510 BOUNDARY ROAD (OTTAWA, ON)  
SUPPLEMENTAL SWM MODELLING INFORMATION

**PROJECT NO:** 118168

---

This memorandum provides the supplemental stormwater management (SWM) modelling information for the proposed warehouse complex at 5510 Boundary Road (Ottawa, Ontario) in support of the detailed design report, prepared by Novatech.

The Visual Otthymo hydrologic model was used to estimate pre-development peak flows (quantity control targets) for the site. The pre-development drainage area is based on the proposed development area. Refer to the Pre-Development Storm Drainage Area Plan provided in the detailed design report.

### Design Storms

The design storms are based on the IDF parameters presented in the City of Ottawa Sewer Design Guidelines (October 2012). Storm distributions include the 3-hour Chicago and 12-hour SCS Type II storm distributions. Design storms were created for the 2, 5, and 100-year return periods (i.e. storm events).

### Model Parameters

Pre-development conditions were established using data collected through the latest aerial photography (current site conditions), latest topographic mapping and geotechnical investigations.

The pre-development catchments were modelled using the CALIB NASHYD routine with the following parameters:

- The “standard” CN values were estimated based on area weighting the CN values for each associated land cover and soil types (extracted from reference TR-55 CN values).
- The surficial soil type is primarily fill material consisting of silty clay with sand, gravel and cobbles overlying thin layer of very loose to compact silty sand (estimated hydrologic soil group (HSG) ‘C’). The geotechnical investigation was performed by Paterson Group; report dated September 10, 2018 (Report No. PG4592-1).
- The Ia values were estimated based on CN values using  $0.10 * S$ .

- The number of linear reservoirs (N) was estimated to be  $N = 3.0$ , which is typical for catchments within Ontario.
- Time-to-peak ( $T_p$ ) values were calculated using Airport Method, with a minimum 10-minute time-of-concentration ( $T_c$ ).  $T_p = 0.67 * T_c$ .

A summary of the pre-development model parameters, model schematic and detailed model output for the 2-year, 5-year, and 100-year storm events are attached.

### Peak Flows

The estimated pre-development peak flows are presented in Table 1 below.

**Table 1: Summary of Pre-development Peak Flows**

Area ID	Drainage Area (ha)	Peak Flow (m <sup>3</sup> /s)					
		3-hour Chicago Storm			12-hour SCS Type II Storm		
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr
<b>Area 'A'</b>							
PRE	6.94	0.129	0.221	0.519	0.168	0.270	0.574

As the 3-hour Chicago storm distribution results in lower peak flows, the post-development quantity control requirements and release rates will need to adhere to these peak flows.

### **ATTACHMENTS:**

- Visual Otthymo Model Parameters
- Visual Otthymo Detailed Model Output (3-hour Chicago & 12-hour SCS storm distributions)

**Proposed Warehouse Complex - 5510 Boundary Road (Ottawa, ON)**  
**Visual Otthymo Model Parameters (118168)**



<b>NASHYD's (Pre-Development)</b>				
<b>Land Cover</b>	<b>Hydrologic Soil Group (HSG)</b>	<b>Area (ha)</b>	<b>SCS Curve Number (CN)</b>	<b>Initial Abstraction (Ia)* (mm)</b>
Open Water	HSG 'C'	0.29	50	25.4
Meadow	HSG 'C'	0.50	71	10.4
Fallow Field (Bare Soil)	HSG 'C'	6.15	91	2.5
<b>TOTAL (PRE)</b>	-	<b>6.94</b>	<b>88</b>	<b>5.0</b>

\*Initial Abstraction based on  $0.10 * S$ .  $S = 25400 / CN - 254$

<b>Time-to-Peak (Tp) Calculations (Airport Method) (NASHYD's)</b>				
<b>Runoff Coefficient (C)</b>	<b>Average Slope (%)</b>	<b>Flow Path Length (m)</b>	<b>Time-of-Concentration (Tc) (min)</b>	<b>Time-to-Peak (Tp)* (hours)</b>
0.20	0.25	150	57	0.63

\* $Tp = 0.67 * Tc$



Visual Otthymo Model Schematic



Storm Distributions:

- Run 01: 2-year, 3-hour Chicago Storm
- Run 02: 5-year, 3-hour Chicago Storm
- Run 03: 100-year, 3-hour Chicago Storm
  
- Run 04: 2-year, 12-hour SCS Storm
- Run 05: 5-year, 12-hour SCS Storm
- Run 06: 100-year, 12-hour SCS Storm

=====

```
V  V  I  SSSSS U  U  A  L                               (v 5.1.2000)
V  V  I  SS   U  U  A  A  L
V  V  I  SS   U  U  AAAAA L
V  V  I  SS   U  U  A  A  L
V V   I  SSSSS UUUUU A  A  LLLLL
```

```
   OOO   TTTT   TTTT   H  H  Y  Y  M  M   OOO   TM
O  O   T     T   H  H  Y  Y   MM MM  O  O
O  O   T     T   H  H   Y  M  M  O  O
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\*\*\*\*\* D E T A I L E D O U T P U T \*\*\*\*\*

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DATE: 10/05/2020                      TIME: 12:46:55

USER:

COMMENTS: \_\_\_\_\_

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



\*\*\*\*\*  
\*\* SIMULATION : Run 01 \*\*  
\*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData Local\Temp\ 3423a1c4-1884-4f21-baad-4d458bc37917\d23ad515
Ptotal= 31.86 mm	Comments: C3-2

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	2.81	1.00	76.81	1.83	5.09	2.67	2.68
0.33	3.50	1.17	24.08	2.00	4.29	2.83	2.46
0.50	4.69	1.33	12.36	2.17	3.72	3.00	2.28
0.67	7.30	1.50	8.32	2.33	3.29		
0.83	18.21	1.67	6.30	2.50	2.95		

CALIB			
NASHYD ( 0001)	Area (ha)= 6.94	Curve Number (CN)= 88.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res. (N)= 3.00	
	U.H. Tp(hrs)= 0.63		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.81	0.833	18.21	1.583	6.30	2.33	3.29
0.167	2.81	0.917	76.81	1.667	6.30	2.42	2.95
0.250	3.50	1.000	76.81	1.750	5.09	2.50	2.95
0.333	3.50	1.083	24.08	1.833	5.09	2.58	2.68
0.417	4.69	1.167	24.08	1.917	4.29	2.67	2.68
0.500	4.69	1.250	12.36	2.000	4.29	2.75	2.46
0.583	7.30	1.333	12.36	2.083	3.72	2.83	2.46
0.667	7.30	1.417	8.32	2.167	3.72	2.92	2.28
0.750	18.21	1.500	8.32	2.250	3.29	3.00	2.28

Unit Hyd Qpeak (cms)= 0.421

PEAK FLOW (cms)= 0.129 (i)  
 TIME TO PEAK (hrs)= 1.750  
 RUNOFF VOLUME (mm)= 11.729  
 TOTAL RAINFALL (mm)= 31.857  
 RUNOFF COEFFICIENT = 0.368

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



\*\*\*\*\*  
\*\* SIMULATION : Run 02 \*\*  
\*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData\Local\Temp\3423a1c4-1884-4f21-baad-4d458bc37917\b96d6d94
Ptotal= 42.51 mm	Comments: C3-5

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	3.68	1.00	104.19	1.83	6.69	2.67	3.51
0.33	4.58	1.17	32.04	2.00	5.63	2.83	3.22
0.50	6.15	1.33	16.34	2.17	4.87	3.00	2.98
0.67	9.61	1.50	10.96	2.33	4.30		
0.83	24.17	1.67	8.29	2.50	3.86		

CALIB	Area (ha)= 6.94	Curve Number (CN)= 88.0
NASHYD ( 0001)	Ia (mm)= 5.00	# of Linear Res. (N)= 3.00
ID= 1 DT= 5.0 min	U.H. Tp(hrs)= 0.63	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	3.68	0.833	24.17	1.583	8.29	2.33	4.30
0.167	3.68	0.917	104.19	1.667	8.29	2.42	3.86
0.250	4.58	1.000	104.19	1.750	6.69	2.50	3.86
0.333	4.58	1.083	32.04	1.833	6.69	2.58	3.51
0.417	6.15	1.167	32.04	1.917	5.63	2.67	3.51
0.500	6.15	1.250	16.34	2.000	5.63	2.75	3.22
0.583	9.61	1.333	16.34	2.083	4.87	2.83	3.22
0.667	9.61	1.417	10.96	2.167	4.87	2.92	2.98
0.750	24.17	1.500	10.96	2.250	4.30	3.00	2.98

Unit Hyd Qpeak (cms)= 0.421

PEAK FLOW (cms)= 0.221 (i)  
 TIME TO PEAK (hrs)= 1.750  
 RUNOFF VOLUME (mm)= 19.503  
 TOTAL RAINFALL (mm)= 42.512  
 RUNOFF COEFFICIENT = 0.459

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



\*\*\*\*\*  
\*\* SIMULATION : Run 03 \*\*  
\*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData\Local\Temp\3423a1c4-1884-4f21-baad-4d458bc37917\el438c1c
Ptotal= 71.67 mm	Comments: C3-100

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	6.05	1.00	178.56	1.83	11.06	2.67	5.76
0.33	7.54	1.17	54.05	2.00	9.29	2.83	5.28
0.50	10.16	1.33	27.32	2.17	8.02	3.00	4.88
0.67	15.97	1.50	18.24	2.33	7.08		
0.83	40.65	1.67	13.74	2.50	6.35		

CALIB	Area (ha)= 6.94	Curve Number (CN)= 88.0
NASHYD ( 0001)	Ia (mm)= 5.00	# of Linear Res. (N)= 3.00
ID= 1 DT= 5.0 min	U.H. Tp(hrs)= 0.63	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.05	0.833	40.65	1.583	13.74	2.33	7.08
0.167	6.05	0.917	178.56	1.667	13.74	2.42	6.35
0.250	7.54	1.000	178.56	1.750	11.06	2.50	6.35
0.333	7.54	1.083	54.05	1.833	11.06	2.58	5.76
0.417	10.16	1.167	54.05	1.917	9.29	2.67	5.76
0.500	10.16	1.250	27.32	2.000	9.29	2.75	5.28
0.583	15.97	1.333	27.32	2.083	8.02	2.83	5.28
0.667	15.97	1.417	18.24	2.167	8.02	2.92	4.88
0.750	40.65	1.500	18.24	2.250	7.08	3.00	4.88

Unit Hyd Qpeak (cms)= 0.421

PEAK FLOW (cms)= 0.519 (i)  
 TIME TO PEAK (hrs)= 1.667  
 RUNOFF VOLUME (mm)= 43.872  
 TOTAL RAINFALL (mm)= 71.667  
 RUNOFF COEFFICIENT = 0.612

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



\*\*\*\*\*  
\*\* SIMULATION : Run 04 \*\*  
\*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData Local\Temp\ 3423a1c4-1884-4f21-baad-4d458bc37917\fceefce
Ptotal= 42.34 mm	Comments: S12-2

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.50	1.27	3.50	1.69	6.50	9.23	9.50	1.27
1.00	0.59	4.00	1.69	7.00	4.06	10.00	1.02
1.50	1.10	4.50	2.29	7.50	2.71	10.50	1.44
2.00	1.10	5.00	2.88	8.00	2.37	11.00	0.93
2.50	1.44	5.50	4.57	8.50	1.86	11.50	0.85
3.00	1.27	6.00	36.24	9.00	1.95	12.00	0.85

CALIB	Area (ha)= 6.94	Curve Number (CN)= 88.0
NASHYD ( 0001)	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
ID= 1 DT= 5.0 min	U.H. Tp(hrs)= 0.63	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.27	3.083	1.69	6.083	9.23	9.08	1.27
0.167	1.27	3.167	1.69	6.167	9.23	9.17	1.27
0.250	1.27	3.250	1.69	6.250	9.23	9.25	1.27
0.333	1.27	3.333	1.69	6.333	9.23	9.33	1.27
0.417	1.27	3.417	1.69	6.417	9.23	9.42	1.27
0.500	1.27	3.500	1.69	6.500	9.23	9.50	1.27
0.583	0.59	3.583	1.69	6.583	4.06	9.58	1.02
0.667	0.59	3.667	1.69	6.667	4.06	9.67	1.02
0.750	0.59	3.750	1.69	6.750	4.06	9.75	1.02
0.833	0.59	3.833	1.69	6.833	4.06	9.83	1.02
0.917	0.59	3.917	1.69	6.917	4.06	9.92	1.02
1.000	0.59	4.000	1.69	7.000	4.06	10.00	1.02
1.083	1.10	4.083	2.29	7.083	2.71	10.08	1.44
1.167	1.10	4.167	2.29	7.167	2.71	10.17	1.44
1.250	1.10	4.250	2.29	7.250	2.71	10.25	1.44
1.333	1.10	4.333	2.29	7.333	2.71	10.33	1.44
1.417	1.10	4.417	2.29	7.417	2.71	10.42	1.44
1.500	1.10	4.500	2.29	7.500	2.71	10.50	1.44
1.583	1.10	4.583	2.88	7.583	2.37	10.58	0.93
1.667	1.10	4.667	2.88	7.667	2.37	10.67	0.93
1.750	1.10	4.750	2.88	7.750	2.37	10.75	0.93
1.833	1.10	4.833	2.88	7.833	2.37	10.83	0.93
1.917	1.10	4.917	2.88	7.917	2.37	10.92	0.93
2.000	1.10	5.000	2.88	8.000	2.37	11.00	0.93
2.083	1.44	5.083	4.57	8.083	1.86	11.08	0.85
2.167	1.44	5.167	4.57	8.167	1.86	11.17	0.85
2.250	1.44	5.250	4.57	8.250	1.86	11.25	0.85
2.333	1.44	5.333	4.57	8.333	1.86	11.33	0.85
2.417	1.44	5.417	4.57	8.417	1.86	11.42	0.85
2.500	1.44	5.500	4.57	8.500	1.86	11.50	0.85
2.583	1.27	5.583	36.24	8.583	1.95	11.58	0.85
2.667	1.27	5.667	36.24	8.667	1.95	11.67	0.85

# Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON) Visual OTTHYMO Model Output (118168)



2.750	1.27	5.750	36.24	8.750	1.95	11.75	0.85
2.833	1.27	5.833	36.24	8.833	1.95	11.83	0.85
2.917	1.27	5.917	36.24	8.917	1.95	11.92	0.85
3.000	1.27	6.000	36.24	9.000	1.95	12.00	0.85

Unit Hyd Qpeak (cms)= 0.421

PEAK FLOW (cms)= 0.168 (i)  
 TIME TO PEAK (hrs)= 6.583  
 RUNOFF VOLUME (mm)= 19.367  
 TOTAL RAINFALL (mm)= 42.335  
 RUNOFF COEFFICIENT = 0.457

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION : Run 05 \*\*  
 \*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData ata\Local\Temp\ 3423a1c4-1884-4f21-baad-4d458bc37917\8f07cf7d
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TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.50	1.69	3.50	2.25	6.50	12.25	9.50	1.69
1.00	0.79	4.00	2.25	7.00	5.39	10.00	1.35
1.50	1.46	4.50	3.03	7.50	3.60	10.50	1.91
2.00	1.46	5.00	3.82	8.00	3.15	11.00	1.24
2.50	1.91	5.50	6.07	8.50	2.47	11.50	1.12
3.00	1.69	6.00	48.08	9.00	2.58	12.00	1.12

CALIB			
NASHYD ( 0001)	Area (ha)= 6.94	Curve Number (CN)= 88.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res. (N)= 3.00	
	U.H. Tp (hrs)= 0.63		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.69	3.083	2.25	6.083	12.25	9.08	1.69
0.167	1.69	3.167	2.25	6.167	12.25	9.17	1.69
0.250	1.69	3.250	2.25	6.250	12.25	9.25	1.69
0.333	1.69	3.333	2.25	6.333	12.25	9.33	1.69
0.417	1.69	3.417	2.25	6.417	12.25	9.42	1.69
0.500	1.69	3.500	2.25	6.500	12.25	9.50	1.69
0.583	0.79	3.583	2.25	6.583	5.39	9.58	1.35
0.667	0.79	3.667	2.25	6.667	5.39	9.67	1.35
0.750	0.79	3.750	2.25	6.750	5.39	9.75	1.35
0.833	0.79	3.833	2.25	6.833	5.39	9.83	1.35
0.917	0.79	3.917	2.25	6.917	5.39	9.92	1.35
1.000	0.79	4.000	2.25	7.000	5.39	10.00	1.35
1.083	1.46	4.083	3.03	7.083	3.60	10.08	1.91
1.167	1.46	4.167	3.03	7.167	3.60	10.17	1.91
1.250	1.46	4.250	3.03	7.250	3.60	10.25	1.91
1.333	1.46	4.333	3.03	7.333	3.60	10.33	1.91
1.417	1.46	4.417	3.03	7.417	3.60	10.42	1.91

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



1.500	1.46	4.500	3.03	7.500	3.60	10.50	1.91
1.583	1.46	4.583	3.82	7.583	3.15	10.58	1.24
1.667	1.46	4.667	3.82	7.667	3.15	10.67	1.24
1.750	1.46	4.750	3.82	7.750	3.15	10.75	1.24
1.833	1.46	4.833	3.82	7.833	3.15	10.83	1.24
1.917	1.46	4.917	3.82	7.917	3.15	10.92	1.24
2.000	1.46	5.000	3.82	8.000	3.15	11.00	1.24
2.083	1.91	5.083	6.07	8.083	2.47	11.08	1.12
2.167	1.91	5.167	6.07	8.167	2.47	11.17	1.12
2.250	1.91	5.250	6.07	8.250	2.47	11.25	1.12
2.333	1.91	5.333	6.07	8.333	2.47	11.33	1.12
2.417	1.91	5.417	6.07	8.417	2.47	11.42	1.12
2.500	1.91	5.500	6.07	8.500	2.47	11.50	1.12
2.583	1.69	5.583	48.08	8.583	2.58	11.58	1.12
2.667	1.69	5.667	48.08	8.667	2.58	11.67	1.12
2.750	1.69	5.750	48.08	8.750	2.58	11.75	1.12
2.833	1.69	5.833	48.08	8.833	2.58	11.83	1.12
2.917	1.69	5.917	48.08	8.917	2.58	11.92	1.12
3.000	1.69	6.000	48.08	9.000	2.58	12.00	1.12

Unit Hyd Qpeak (cms)= 0.421

PEAK FLOW (cms)= 0.270 (i)  
 TIME TO PEAK (hrs)= 6.583  
 RUNOFF VOLUME (mm)= 30.527  
 TOTAL RAINFALL (mm)= 56.185  
 RUNOFF COEFFICIENT = 0.543

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

\*\*\*\*\*  
 \*\* SIMULATION : Run 06 \*\*  
 \*\*\*\*\*

READ STORM	Filename: C:\Users\cstang\AppData\Local\Temp\3423a1c4-1884-4f21-baad-4d458bc37917\4c999c78
Ptotal= 93.91 mm	Comments: S12-100

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.50	2.82	3.50	3.76	6.50	20.47	9.50	2.82
1.00	1.31	4.00	3.76	7.00	9.02	10.00	2.25
1.50	2.44	4.50	5.07	7.50	6.01	10.50	3.19
2.00	2.44	5.00	6.39	8.00	5.26	11.00	2.07
2.50	3.19	5.50	10.14	8.50	4.13	11.50	1.88
3.00	2.82	6.00	80.38	9.00	4.32	12.00	1.88

CALIB	Area (ha)= 6.94	Curve Number (CN)= 88.0
NASHYD ( 0001)	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
ID= 1 DT= 5.0 min	U.H. Tp (hrs)= 0.63	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.82	3.083	3.76	6.083	20.47	9.08	2.82
0.167	2.82	3.167	3.76	6.167	20.47	9.17	2.82

**Proposed Warehouse Complex – 5510 Boundary Road (Ottawa, ON)  
Visual OTTHYMO Model Output (118168)**



0.250	2.82	3.250	3.76	6.250	20.47	9.25	2.82
0.333	2.82	3.333	3.76	6.333	20.47	9.33	2.82
0.417	2.82	3.417	3.76	6.417	20.47	9.42	2.82
0.500	2.82	3.500	3.76	6.500	20.47	9.50	2.82
0.583	1.31	3.583	3.76	6.583	9.02	9.58	2.25
0.667	1.31	3.667	3.76	6.667	9.02	9.67	2.25
0.750	1.31	3.750	3.76	6.750	9.02	9.75	2.25
0.833	1.31	3.833	3.76	6.833	9.02	9.83	2.25
0.917	1.31	3.917	3.76	6.917	9.02	9.92	2.25
1.000	1.31	4.000	3.76	7.000	9.02	10.00	2.25
1.083	2.44	4.083	5.07	7.083	6.01	10.08	3.19
1.167	2.44	4.167	5.07	7.167	6.01	10.17	3.19
1.250	2.44	4.250	5.07	7.250	6.01	10.25	3.19
1.333	2.44	4.333	5.07	7.333	6.01	10.33	3.19
1.417	2.44	4.417	5.07	7.417	6.01	10.42	3.19
1.500	2.44	4.500	5.07	7.500	6.01	10.50	3.19
1.583	2.44	4.583	6.39	7.583	5.26	10.58	2.07
1.667	2.44	4.667	6.39	7.667	5.26	10.67	2.07
1.750	2.44	4.750	6.39	7.750	5.26	10.75	2.07
1.833	2.44	4.833	6.39	7.833	5.26	10.83	2.07
1.917	2.44	4.917	6.39	7.917	5.26	10.92	2.07
2.000	2.44	5.000	6.39	8.000	5.26	11.00	2.07
2.083	3.19	5.083	10.14	8.083	4.13	11.08	1.88
2.167	3.19	5.167	10.14	8.167	4.13	11.17	1.88
2.250	3.19	5.250	10.14	8.250	4.13	11.25	1.88
2.333	3.19	5.333	10.14	8.333	4.13	11.33	1.88
2.417	3.19	5.417	10.14	8.417	4.13	11.42	1.88
2.500	3.19	5.500	10.14	8.500	4.13	11.50	1.88
2.583	2.82	5.583	80.38	8.583	4.32	11.58	1.88
2.667	2.82	5.667	80.38	8.667	4.32	11.67	1.88
2.750	2.82	5.750	80.38	8.750	4.32	11.75	1.88
2.833	2.82	5.833	80.38	8.833	4.32	11.83	1.88
2.917	2.82	5.917	80.38	8.917	4.32	11.92	1.88
3.000	2.82	6.000	80.38	9.000	4.32	12.00	1.88

Unit Hyd Qpeak (cms)= 0.421

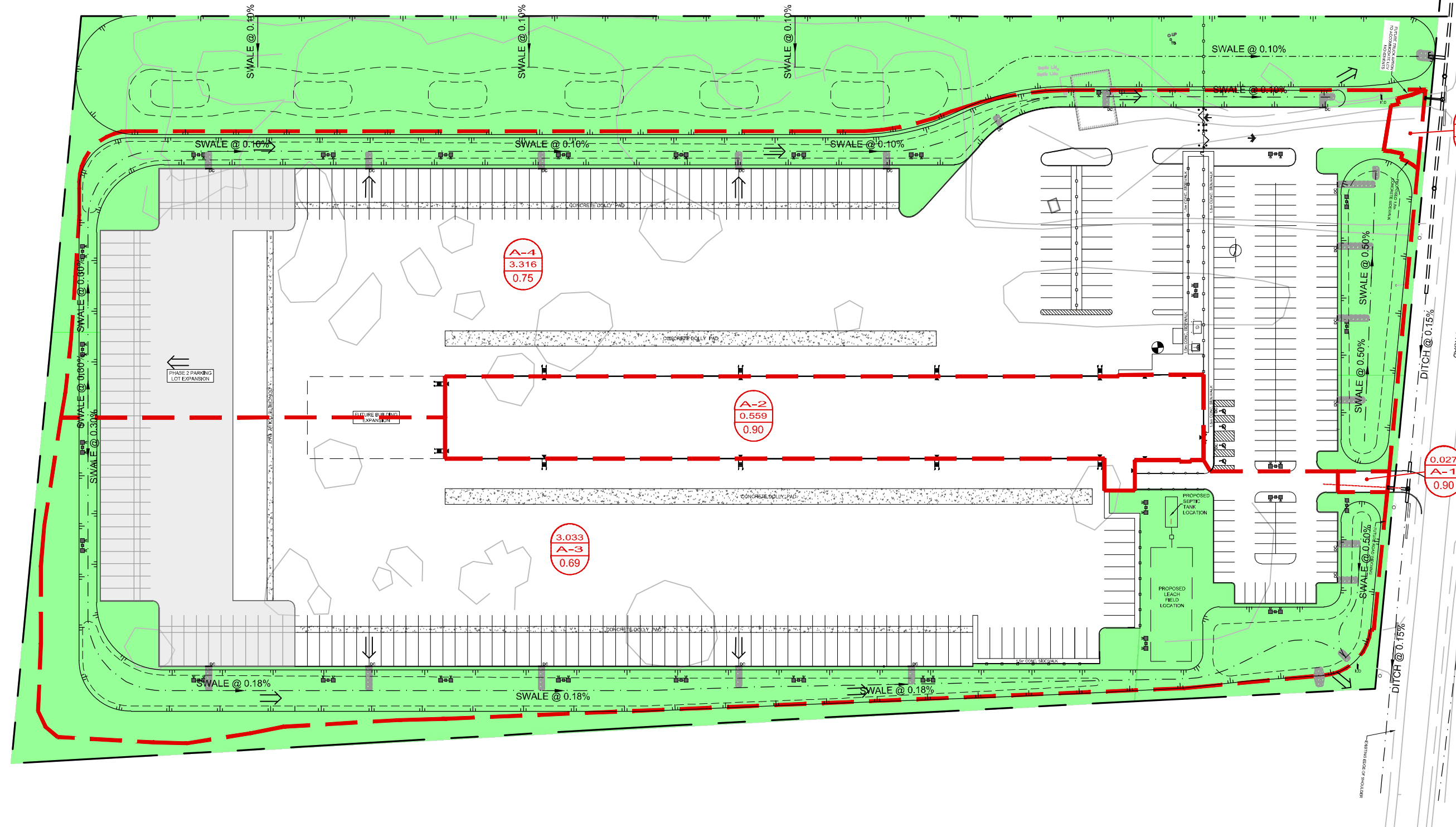
PEAK FLOW (cms)= 0.574 (i)  
 TIME TO PEAK (hrs)= 6.500  
 RUNOFF VOLUME (mm)= 63.982  
 TOTAL RAINFALL (mm)= 93.910  
 RUNOFF COEFFICIENT = 0.681

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----  
 FINISH  
 =====

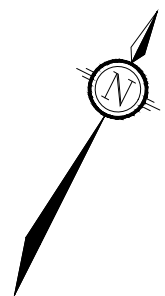


M:\2018\118188\CAD\Design\118188-SWM.dwg, SWM, Mar 16, 2021 - 3:46pm, mhrehorak



**LEGEND**

- POST STORM DRAINAGE AREA
- A-2  
0.559  
0.90 DRAINAGE AREA ID
- A-1  
3.316  
0.75 DRAINAGE AREA (ha)
- A-3  
3.033  
0.69 RUNOFF COEFFICIENT



<b>NOVATECH</b>		<b>5110 BOUNDARY ROAD</b>	
Engineers, Planners & Landscape Architects		POST-DEVELOPMENT DRAINAGE AREA PLAN	
Suite 200, 240 Michael Cowpland Drive Ottawa, Ontario, Canada K2M 1P6		SCALE 1 : 1250	
Telephone (613) 254-9643	Facsimile (613) 254-5867	DATE <b>MAR 2021</b> JOB <b>118188</b> FIGURE <b>6</b>	
Website www.novatech-eng.com			

**TABLE 1: Pre-Development EX-1 Flows**

Outlet Options	Area (ha)	SCS CN	Tc (min)	3-hour Chicago Storm		
				Q <sub>2</sub> Year (L/s)	Q <sub>5</sub> Year (L/s)	Q <sub>100</sub> Year (L/s)
Boundary Road	6.94	88	57	129.0	221.0	519.0

\*Pre-development flows taken from Supplemental SWM Modelling Information Memorandum

**Direct Runoff Areas**

**TABLE 2A: Post-Development Runoff Coefficient "C" - A-1**

Area	Surface	Ha	"C"	C <sub>avg</sub>	*C <sub>100</sub>	Runoff Coefficient Equation
Total	Hard	0.027	0.90	0.90	1.00	C = (A <sub>hard</sub> x 0.9 + A <sub>soft</sub> x 0.2)/A <sub>Tot</sub>
0.027	Soft	0.000	0.20			

\* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

**TABLE 2B: Post-Development A-1 Flows**

Outlet Options	Area (ha)	C <sub>avg</sub>	Tc (min)	Q <sub>2 Year</sub> (L/s)	Q <sub>5 Year</sub> (L/s)	Q <sub>100 Year</sub> (L/s)
Boundary Road	0.027	0.90	10	5.2	7.0	13.4

Time of Concentration T<sub>C</sub>= 10 min  
 Intensity (2 Year Event) I<sub>2</sub>= 77.37 mm/hr  
 Intensity (5 Year Event) I<sub>5</sub>= 104.19 mm/hr  
 Intensity (100 Year Event) I<sub>100</sub>= 178.56 mm/hr

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

100 year Intensity = 1735.688 / (Time in min + 6.014)<sup>0.820</sup>  
 5 year Intensity = 998.071 / (Time in min + 6.053)<sup>0.814</sup>  
 2 year Intensity = 732.951 / (Time in min + 6.199)<sup>0.810</sup>

**Controlled Roof Areas**

**TABLE 3A: Post-Development Runoff Coefficient "C" - A-2**

Area	0.4	Ha	5 Year Event		100 Year Event	
			"C"	C <sub>avg</sub>	"C" + 25%	*C <sub>avg</sub>
Total	Hard	0.000	0.90	0.90	1.00	1.00
0.559	Roof	0.559	0.90			
	Soft	0.000	0.20			

**TABLE 3B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-2**

0.559 =Area (ha)  
 0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
2 YEAR	35	36.06	50.43	12.0	38.46	80.77
	40	32.86	45.96	12.0	33.99	81.59
	<b>45</b>	<b>30.24</b>	<b>42.29</b>	<b>12.0</b>	<b>30.32</b>	<b>81.87</b>
	50	28.04	39.22	12.0	27.25	81.75
	55	26.17	36.60	12.0	24.63	81.29

**TABLE 3C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-2**

0.559 =Area (ha)  
 0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
5 YEAR	40	44.18	61.80	15.0	46.79	112.29
	45	40.63	56.82	15.0	41.81	112.90
	<b>50</b>	<b>37.65</b>	<b>52.66</b>	<b>15.0</b>	<b>37.65</b>	<b>112.96</b>
	55	35.12	49.12	15.0	34.11	112.58
	60	32.94	46.08	15.0	31.07	111.84

**TABLE 3D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-2**

0.559 =Area (ha)  
 1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
100 YEAR	55	59.62	92.66	20.9	71.76	236.80
	60	55.89	86.86	20.9	65.96	237.46
	<b>65</b>	<b>52.65</b>	<b>81.81</b>	<b>20.9</b>	<b>60.91</b>	<b>237.56</b>
	70	49.79	77.37	20.9	56.47	237.19
	75	47.26	73.44	20.9	52.54	236.41

Equations:

Flow Equation

$$Q = 2.78 \times C \times I \times A$$

Where:

C is the runoff coefficient

I is the rainfall intensity, City of Ottawa IDF

A is the total drainage area

Runoff Coefficient Equation

$$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2) / A_{Tot}$$

$$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25) / A_{Tot}$$

**Table 3E: Roof Drain Flows**

Roof Drains		
Roof Area	5590	m <sup>2</sup>
Qty	19	
Type	Accutrol RD-100-A-ADJ	
Setting	1/2 Open	
Design Head	0.05-0.15	m
Design Flow 1" of head	0.32	L/s (ea)
Design Flow 2" of head	0.63	L/s (ea)
Design Flow 3" of head	0.79	L/s (ea)
Design Flow 4" of head	0.95	L/s (ea)
Design Flow 5" of head	1.10	L/s (ea)
Design Flow 6" of head	1.26	L/s (ea)

**Table 3F: Total Roof Storage**

Storm Event	# Roof Drains	Avg Area Per Roof Drain (m <sup>2</sup> )	Avg Ponding Depth Per Roof Drain (m)	*Total Volume (m <sup>3</sup> )	Total Volume (m <sup>3</sup> ) Required
2 Year	19	294.2	0.0508	94.66	81.87
5 Year	19	294.2	0.0762	141.99	112.96
100 Year	19	294.2	0.1270	236.64	237.56
Max Storage	19	294.2	0.1524	283.97	

\*NOTE: Ponding volumes for A-2 calculated using cone equation:

$$V = \frac{Area \times Depth}{3}$$

**TABLE 4A: Post-Development Runoff Coefficient "C" - A-3**

Area	0.4	Ha	5 Year Event		100 Year Event	
			"C"	C <sub>avg</sub>	"C" + 25%	C <sub>avg</sub>
Total	Hard	2.113	0.90	0.69	1.00	0.77
3.033	Roof	0.000	0.90		1.00	
	Soft	0.920	0.20		0.25	

**TABLE 4B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3**

3.033 =Area (ha)  
 0.69 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
2 YEAR	35	36.06	209.08	53.5	155.58	326.72
	40	32.86	190.55	53.5	137.05	328.93
	<b>45</b>	<b>30.24</b>	<b>175.34</b>	<b>53.5</b>	<b>121.84</b>	<b>328.96</b>
	50	28.04	162.59	53.5	109.09	327.27
	55	26.17	151.74	53.5	98.24	324.20

**TABLE 4C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3**

3.033 =Area (ha)  
 0.69 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
5 YEAR	30	53.93	312.69	73.0	239.66	431.38
	35	48.52	281.32	73.0	208.29	437.40
	<b>40</b>	<b>44.18</b>	<b>256.19</b>	<b>73.0</b>	<b>183.16</b>	<b>439.59</b>
	45	40.63	235.57	73.0	162.55	438.87
	50	37.65	218.32	73.0	145.29	435.88

**TABLE 4D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3**

3.033 =Area (ha)  
 0.77 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
100 YEAR	20	119.95	781.30	195.8	585.45	702.54
	25	103.85	676.41	195.8	480.56	720.84
	<b>30</b>	<b>91.87</b>	<b>598.39</b>	<b>195.8</b>	<b>402.54</b>	<b>724.57</b>
	35	82.58	537.88	195.8	342.03	718.26
	40	75.15	489.46	195.8	293.61	704.67

Equations:

Flow Equation

$$Q = 2.78 \times C \times I \times A$$

Where:

C is the runoff coefficient

I is the rainfall intensity, City of Ottawa IDF

A is the total drainage area

Runoff Coefficient Equation

$$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2) / A_{Tot}$$

$$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25) / A_{Tot}$$

**TABLE 4E: Storage Provided - A-3**

Elevation (m)	System Depth (m)	Surface Ponding Volume (m <sup>3</sup> )
76.600	0.00	0.00
76.650	0.05	5.79
76.700	0.10	26.76
76.750	0.15	61.60
76.800	0.20	108.00
76.850	0.25	162.67
76.900	0.30	226.65
76.950	0.35	302.05
77.000	0.40	390.65
77.050	0.45	494.22
77.100	0.50	614.02
77.150	0.55	750.69
77.200	0.60	905.40

Notes: Surface ponding volumes taken from Civil 3D surface information

Orifice Control Sizing

$$Q = 0.62 \times A \times (2gh) \times 0.5$$

Q is the release rate in m<sup>3</sup>/s

A is the orifice area in m<sup>2</sup>

g is the acceleration due to gravity, 9.81 m/s<sup>2</sup>

h is the head of water above the orifice centre in m

d is the diameter of the orifice in m

**TABLE 4F: Orifice Sizing information - A-3**

Control Device							
Round Plate Orifice		214 mm					
Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m <sup>3</sup> )	Area (m <sup>2</sup> )	Dia. (mm)
1:2 Year	53.5	0.29	76.97	375.00	329.0	0.0360	214.0
1:5 Year	58.7	0.35	77.03	375.00	439.6	0.0360	214.0
1:100 Year	66.5	0.45	77.13	375.00	724.6	0.0360	214.0

\*\*The design Head is calculated based on the centre of the orifice at the bottom of the pipe

**TABLE 4G: Cipolletti Weir 100-year Flow Calculations**

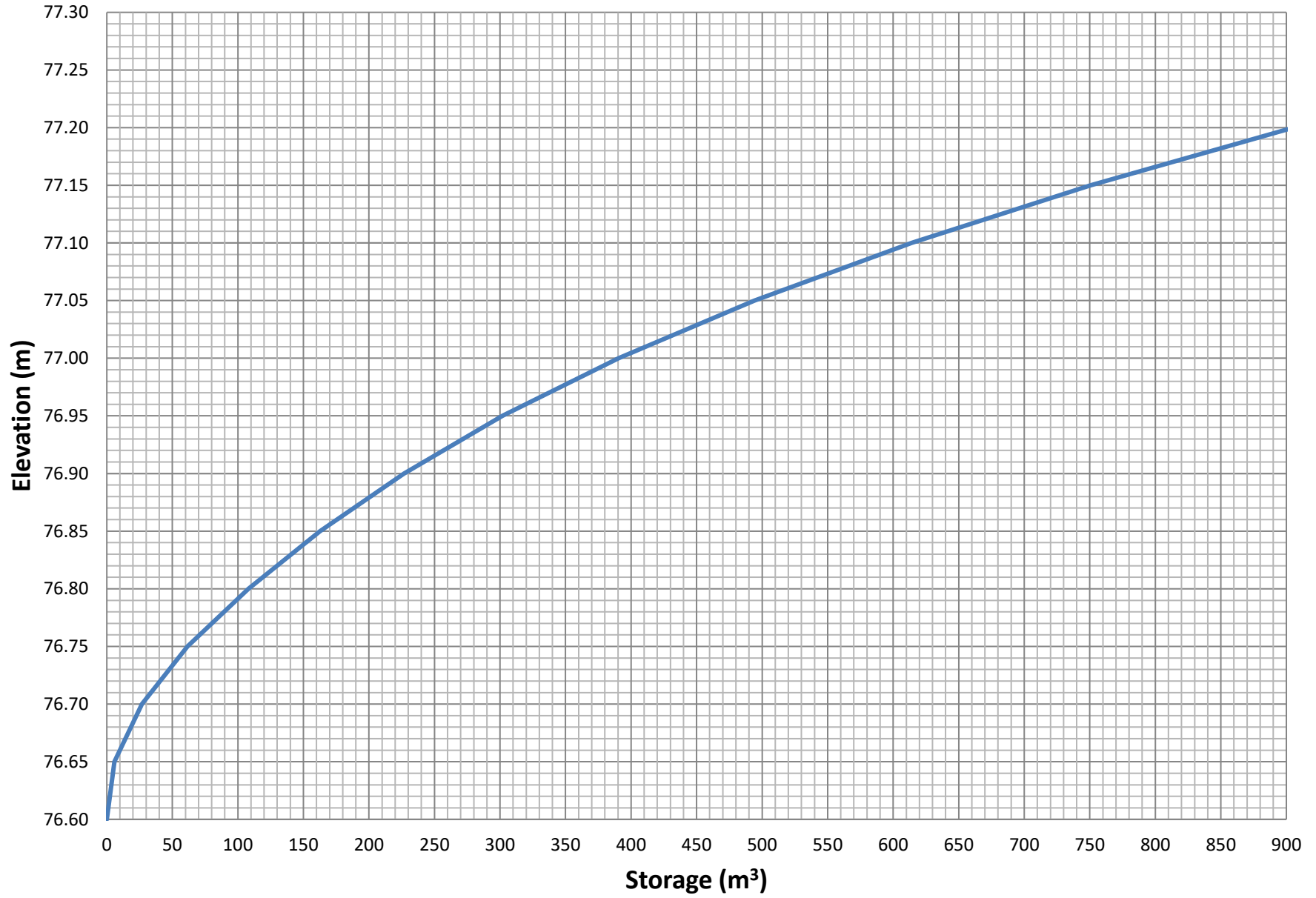
Weir Coefficient (C)	1.84
Bottom Width (m)	1.5
Weir Bottom Elevation (m)	77.00

Cipolletti Weir Equation

$$Q \text{ (m}^3\text{/s)} = C \times L \times H^{(3/2)}$$

Water Level Elevation (m)	Flow Rate Over Weir	
	(m <sup>3</sup> /s)	(L/s)
77.00	0.000	0.0
77.02	0.008	7.8
<b>77.03</b>	<b>0.014</b>	<b>14.3</b>
77.04	0.022	22.1
77.06	0.041	40.6
77.08	0.062	62.5
77.10	0.087	87.3
77.12	0.115	114.7
<b>77.13</b>	<b>0.129</b>	<b>129.4</b>
77.14	0.145	144.6
77.16	0.177	176.6
77.18	0.211	210.8
77.20	0.247	246.9

Stage Storage Curve Area A-3



**TABLE 5A: Post-Development Runoff Coefficient "C" - A-4**

Area	0.4	Ha	5 Year Event		100 Year Event	
			"C"	C <sub>avg</sub>	"C" + 25%	C <sub>avg</sub>
Total	Hard	2.583	0.90	0.75	1.00	0.83
3.316	Roof	0.000	0.90		1.00	
	Soft	0.733	0.20		0.25	

**TABLE 5B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4**

3.316 =Area (ha)  
 0.75 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
2 YEAR	35	36.06	247.73	58.2	189.53	398.02
	40	32.86	225.78	58.2	167.58	402.20
	<b>45</b>	<b>30.24</b>	<b>207.75</b>	<b>58.2</b>	<b>149.55</b>	<b>403.79</b>
	50	28.04	192.65	58.2	134.45	403.34
	55	26.17	179.80	58.2	121.60	401.27

**TABLE 5C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4**

3.316 =Area (ha)  
 0.75 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
5 YEAR	30	53.93	370.49	86.8	283.66	510.59
	35	48.52	333.33	86.8	246.49	517.63
	<b>40</b>	<b>44.18</b>	<b>303.56</b>	<b>86.8</b>	<b>216.72</b>	<b>520.13</b>
	45	40.63	279.13	86.8	192.29	519.19
	50	37.65	258.69	86.8	171.85	515.55

**TABLE 5D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4**

3.316 =Area (ha)  
 0.83 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m <sup>3</sup> )
100 YEAR	25	103.85	798.60	204.6	594.05	891.07
	30	91.87	706.48	204.6	501.93	903.47
	<b>35</b>	<b>82.58</b>	<b>635.04</b>	<b>204.6</b>	<b>430.49</b>	<b>904.03</b>
	40	75.15	577.88	204.6	373.33	895.98
	45	69.05	531.01	204.6	326.46	881.43

Equations:

Flow Equation

$$Q = 2.78 \times C \times I \times A$$

Where:

C is the runoff coefficient

I is the rainfall intensity, City of Ottawa IDF

A is the total drainage area

Runoff Coefficient Equation

$$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2) / A_{Tot}$$

$$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25) / A_{Tot}$$



**TABLE 5E: Storage Provided - A-4**

Elevation (m)	System Depth (m)	Surface Ponding Volume (m <sup>3</sup> )
76.880	0.00	0.00
76.930	0.05	1.17
76.980	0.10	20.54
77.030	0.15	68.36
77.080	0.20	146.32
77.130	0.25	248.28
77.180	0.30	372.63
77.230	0.35	522.01
77.280	0.40	695.88
77.330	0.45	893.05
77.380	0.50	1116.90
77.430	0.55	1385.22
77.480	0.60	1710.04

Notes: Surface ponding volumes taken from Civil 3D surface information

Orifice Control Sizing  
 $Q = 0.62 \times A \times (2gh) \times 0.5$   
 Q is the release rate in m<sup>3</sup>/s  
 A is the orifice area in m<sup>2</sup>

**TABLE 5F: Orifice Sizing information - A-4**

Control Device		243 mm					
Round Plate Orifice							
Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m <sup>3</sup> )	Area (m <sup>2</sup> )	Dia. (mm)
1:2 Year	58.2	0.21	77.19	375.00	403.8	0.0464	243.0
1:5 Year	64.8	0.26	77.24	375.00	520.1	0.0464	243.0
1:100 Year	75.2	0.35	77.33	375.00	904.0	0.0464	243.0

\*\*The design Head is calculated based on the centre of the orifice at the bottom of the pipe

g is the acceleration due to gravity, 9.81 m/s<sup>2</sup>  
 h is the head of water above the orifice centre in m  
 d is the diameter of the orifice in m

**TABLE 5G: Cipolletti Weir 100-year Flow Calculations**

Weir Coefficient (C)	1.84
Bottom Width (m)	1.5
Weir Bottom Elevation (m)	77.20

Cipolletti Weir Equation  
 $Q \text{ (m}^3\text{/s)} = C \times L \times H^{(3/2)}$

Water Level Elevation (m)	Flow Rate Over Weir	
	(m <sup>3</sup> /s)	(L/s)
77.20	0.000	0.0
77.22	0.008	7.8
<b>77.24</b>	<b>0.022</b>	<b>22.1</b>
77.26	0.041	40.6
77.28	0.062	62.5
77.30	0.087	87.3
77.32	0.115	114.7
<b>77.33</b>	<b>0.129</b>	<b>129.4</b>
77.34	0.145	144.6
77.36	0.177	176.6
77.38	0.211	210.8
77.40	0.247	246.9
77.42	0.285	284.8
77.44	0.325	324.5
77.46	0.366	365.9
77.48	0.409	408.9
77.50	0.454	453.5

Stage Storage Curve Area A-4

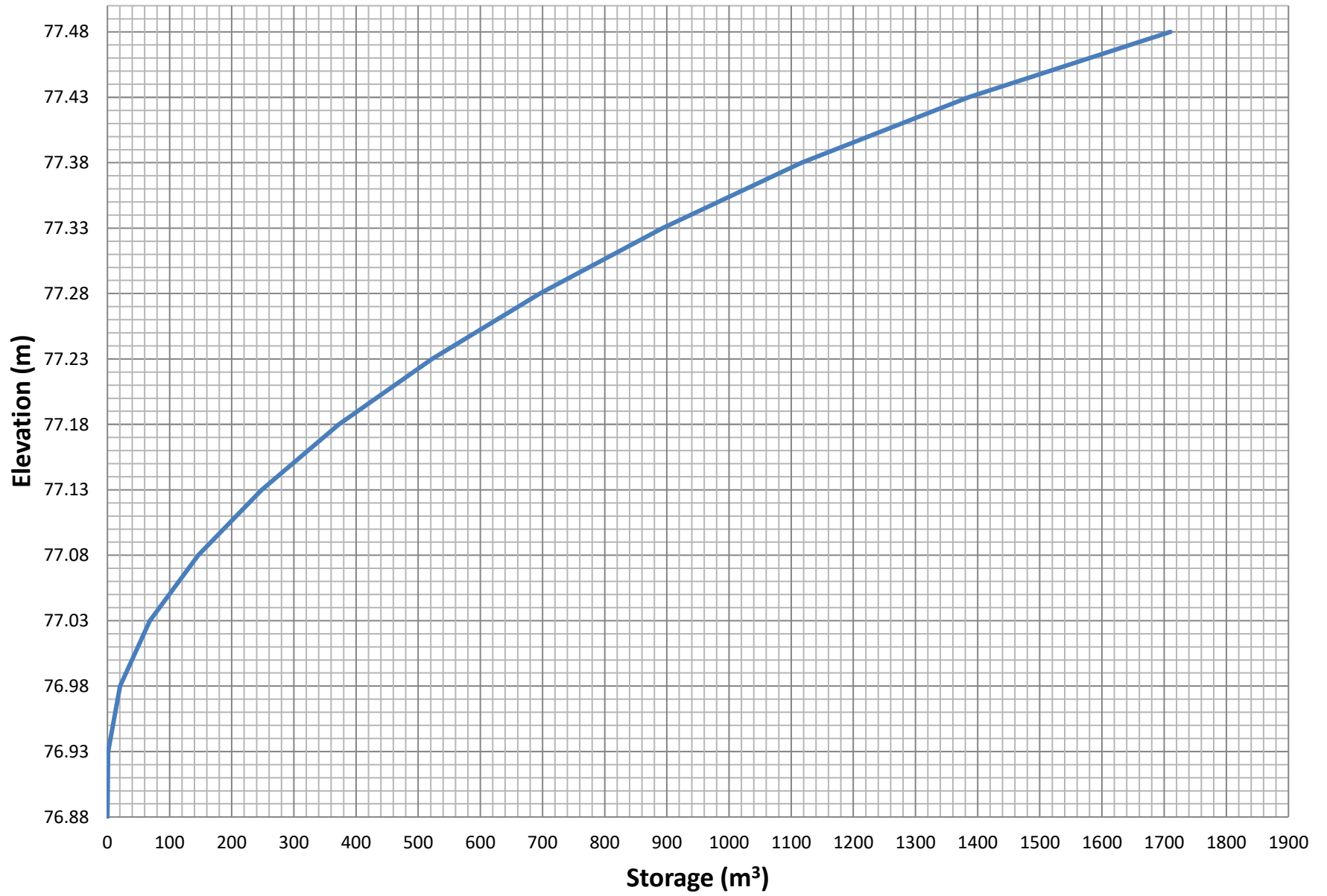


Table 6: Post-Development Stormwater Mangement Summary

Area ID	Area (ha)	1:5 Year Weighted Cw	Outlet Location	Orifice	2 Year Storm Event				5 Year Storm Event				100 Year Storm Event			
					Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)
A-1	0.027	0.90	Boundary Road	N/A	5.2	N/A	N/A	N/A	7.0	N/A	N/A	N/A	13.4	N/A	N/A	N/A
A-2	0.559	0.90	Boundary Road	RD ADJ	12.0	0.05	81.9	284.0	15.0	0.08	113.0	284.0	20.9	0.13	237.6	284.0
A-3	3.033	0.69	Boundary Road	214	53.5	0.37	329.0	905.4	73.0	0.43	439.59	905.4	195.8	0.53	724.6	905.4
A-4	3.316	0.75	Boundary Road	243	58.2	0.31	403.8	1710.0	86.8	0.36	520.13	1710.0	204.6	0.45	904.0	1710.0
<b>Total Post Development</b>					<b>128.9</b>				<b>181.9</b>				<b>434.7</b>			
<b>Total Pre Development</b>					<b>129.0</b>				<b>221.0</b>				<b>519.0</b>			