NOVATECH

Engineers, Planners & Landscape Architects

Engineering

- Land/Site Development
- Municipal Infrastructure
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- Traffic/ Transportation
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Planning

- Land/Site Development
- Planning Application Management
- Municipal Planning
- Urban Design
- Expert Witness (LPAT)
- Wireless Industry

Landscape Architecture

- Streetscapes & Public Amenities
- Open Space, Parks & Recreation
- Community & Residential
- Commercial & Institutional
- Environmental Restoration

39 Years

5494-5510 Boundary Road
Day and Ross

SERVICEABILITY REPORT

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

NOVATECH
Engineers, Planners & Landscape Architects

April 27, 2021 BY COURIER

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

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

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

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

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 Figures

List of Appendices

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

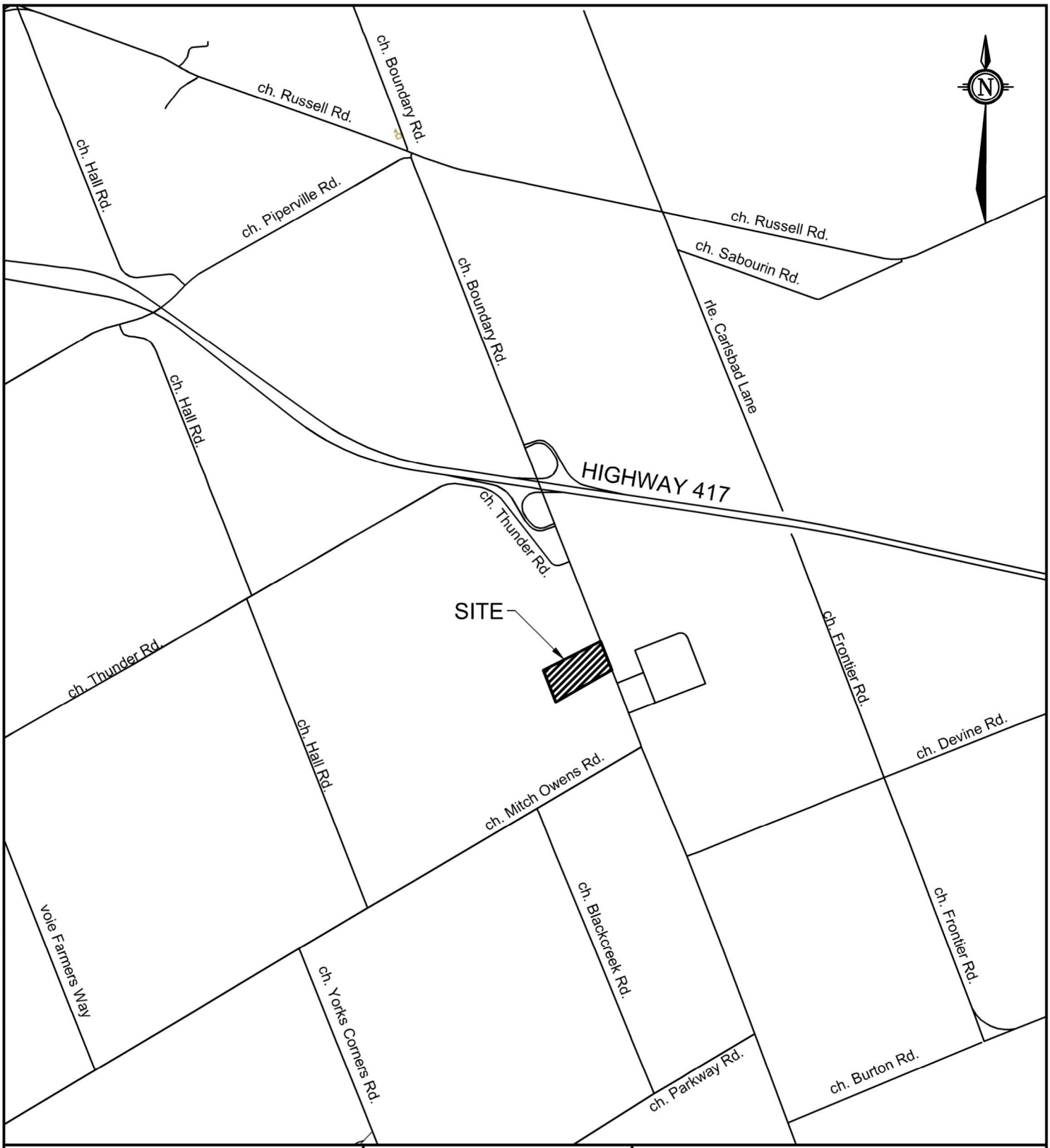
3.0. PROPOSED DEVELOPMENT

It is proposed to develop the site with a cross dock warehouse facility with approximately 5000m² of warehouse floor space and 650m² 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 CONTRAINTS

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.



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

KEY PLAN

5510 BOUNDARY ROAD
CITY OF OTTAWA

5510 BOUNDARY ROAD

DATE	JOB	FIGURE
MAR 2021	118168	1

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

SHT8X11.DWG - 216mmx279mm

LEGEND

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

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Website www.novatech-eng.com

5510 BOUNDARY ROAD

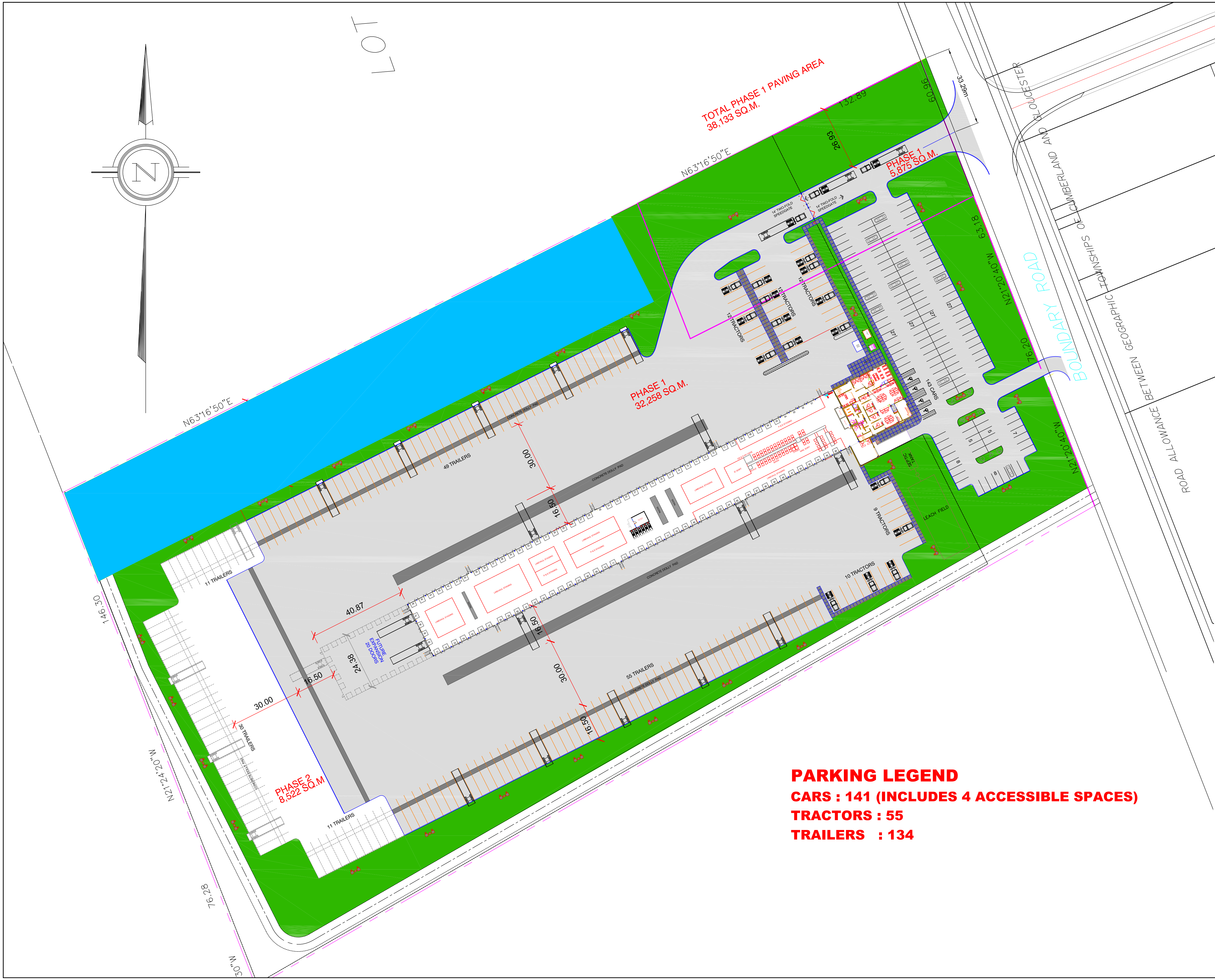
EXISTING CONDITIONS

SCALE 1 : 1250 (0 10 20 30 40 50)

DATE	JOB	FIGURE
APR 2021	118168	2

SHT11X17.DWG - 279mmX432mm

M:\2018\118168\CAD\Design\Figures\118168-XCON.dwg, EX, Mar 19, 2021 - 3:58pm, mhrehoriak



Consultant — Expert-conseil

HATCHARD ENGINEERING
728 Perth Main Street, Suite B Perth-Andover, N.B. E7H 2W7
Phone: 506-273-6640 Fax: 506-273-4305
Email: bhatchard@hatchard.ca www.hatchardgoguen.ca

General notes — Notes générales

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

Revisions / Révisions	No/N°	Date
Issued for tender/lancement de l'appel d'offres	-	-

Project Title — Titre du projet

DAY AND ROSS

OTTAWA, ON

Sheet Title — Titre de la feuille

SITE PLAN
ENTRANCE OPTION 2

Date / Date	19 DEC. 2019
Scale / Échelle	1:600
Drawn by / Dessiné par	BAP
Approved by / Approuvé par	

Stamp — Sceau

FIGURE 3

    - 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.

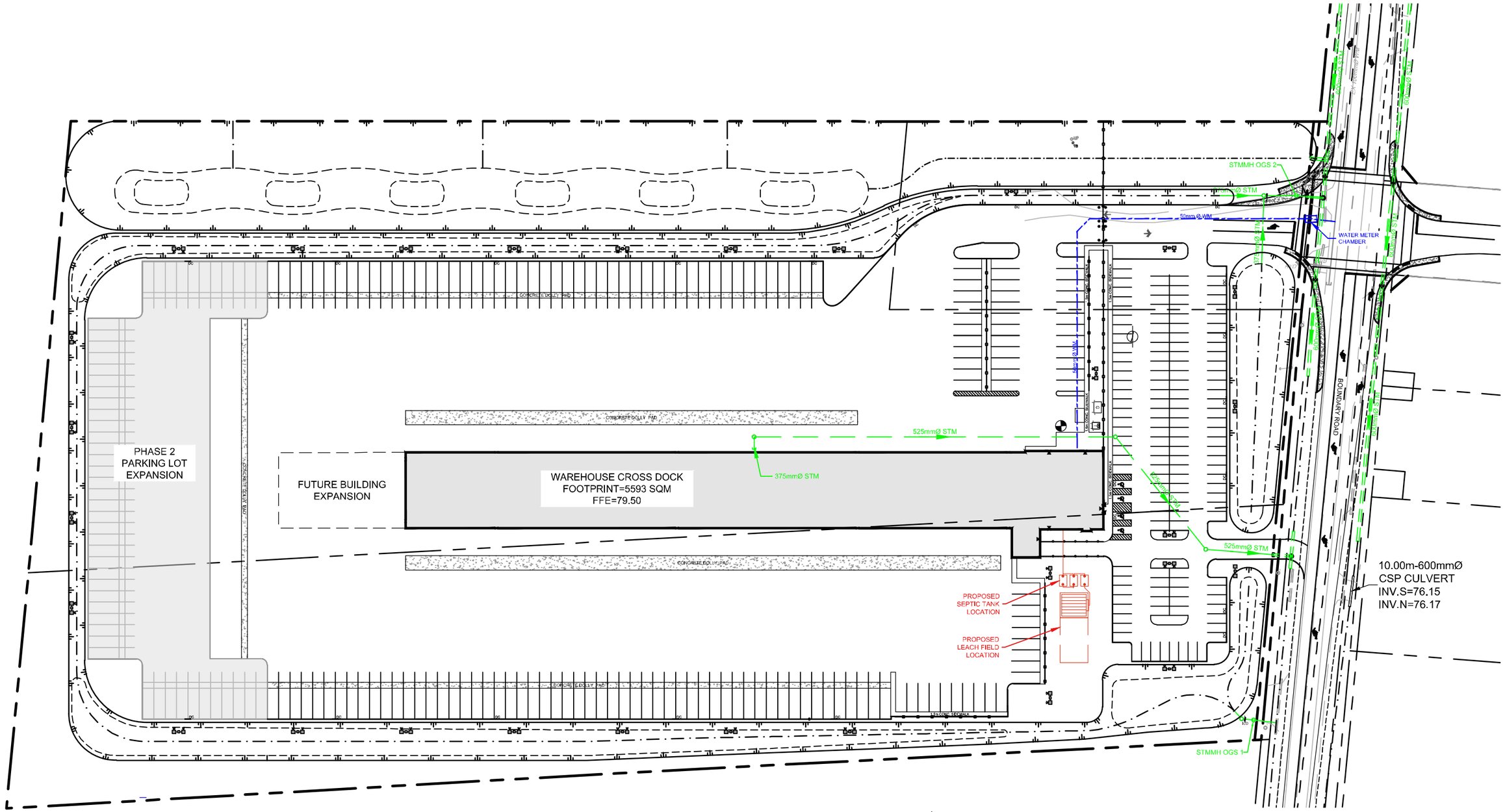
The supply to the facility will be 3 Equivalent connections: 2,700L/Day x 3 = 8,100 Liters/day [0.09 L/s continuous flow]. The water meter chamber will be designed to accommodate this continuous flow rate while not exceeding it. Refer to **Figure 4** for the conceptual servicing details. Details on the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



LEGEND

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

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Website www.novatech-eng.com

5510 BOUNDARY ROAD

CONCEPTUAL SERVICING PLAN

SCALE 1 : 1250 (0 10 20 30 40 50)
DATE APR 2021
JOB 118168
FIGURE 4

M:\2018\118168\CAD\Design\Figures\118168-CONCEPT SERV.dwg, PR, Mar 19, 2021 - 4:46pm, mhrehoriak

SHT11X17.DWG 279mmX432mm

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^3/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^3)	5 Year Required Storage (m^3)	100 Year Required Storage (m^3)
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:

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
Minimum Fire Protection Water Supply Volume					
1	**Water Supply Coefficient**				
	Building Classification =	F-3		From Table 3.1.2.1	
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)	**19**
2	**Total Building Volume**				
	Building Width - W	N/A	m		
	Building Length - L	N/A	m	Area (W * L) = 6590 m2	
	Building Height - H	10	m		
	Total Building Volume - V =			W * L * H	**65900 m³**
3	**Spatial Coefficient Value**				
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** 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**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)	**1.00**
4	**Minimum Fire Protection Water Supply Volume**				
	Q =			$K * V * S_{Tot}$	**1,252,100 L**
Required Minimum Water Supply Flow Rate					
5	**Minimum Water Supply Flow Rate =**			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**
Minimum Fire Protection Water Supply Volume for 30 minutes					
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes	**270,000 L**
Required Fire Protection Water Supply Volume					
7	**Q =**			Highest volume out of (4) and (6)	**1,252,100 L**
Notes					

MONCTON

CITY OF MONCTON
WATER AND WASTEWATER INVOICE

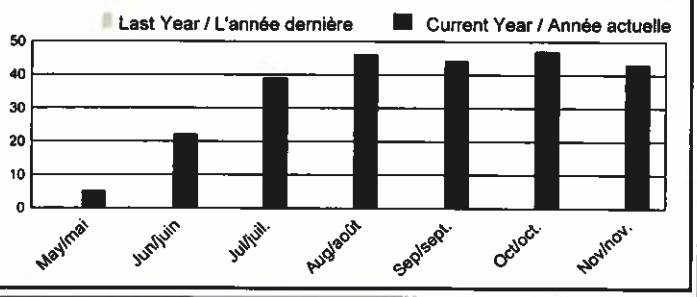
VILLE DE MONCTON
FACTURE D'EAU ET D'EAUX USÉES

14352

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 Actual / Actuel	203 Actual / Actuel	43 *Usage in cubic meters / Utilisation en mètres cubes (m³)	30	1.43

Billed consumption / Consommation facturée (m³)



Important

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

So
10111
20111 c/o

61032 33
61034
61031
61004 33

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
Current Charges / Charges actuelles	$228.95

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

Total due / Total dû *(Balance forward + current charges / Solde du compte + charges actuelles)*	**$228.95**

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

MONCTON

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

Address / Adresse	Statement # / N° de relevé
651 FRENETTE AVE	2287927

Methods of payment

online moncton.ca or at your financial institution.

Phone / Pre-authorized payment
City of Moncton's Revenue Office
506-853-3588

Cheque
payable to City of Moncton

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

Options de paiement

en ligne moncton.ca ou à votre institution financière.

Téléphone / Paiement préautorisé
Bureau du Revenu, Ville de Moncton
506-853-3588

Chèque
libellé à l'ordre de la Ville de Moncton

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

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

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

⑆74379⑈900⑆

96

APPENDIX B
Sanitary Servicing

EHOUSE 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

1.5m CONC. SIDEWALK

46.5m-600mmØ STM @ 0.15%

STMMH 3
T/G=78.25
INV.E=76.53
INV.NW=76.54

21.6m-600mmØ STM @ 0.15%

6.0m-600mmØ STM @ 0.15%

3.5m-375mmØ
STM @ 0.5%
INV=76.60

SWALE @ 0.18%

SWALE @ 0.50%

ICD

H.P.

DC

1.5m CONC. SIDEWALK

HI-OH

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

DD/MM/YY	Description	Rev.

Client: **DAY AND ROSS**

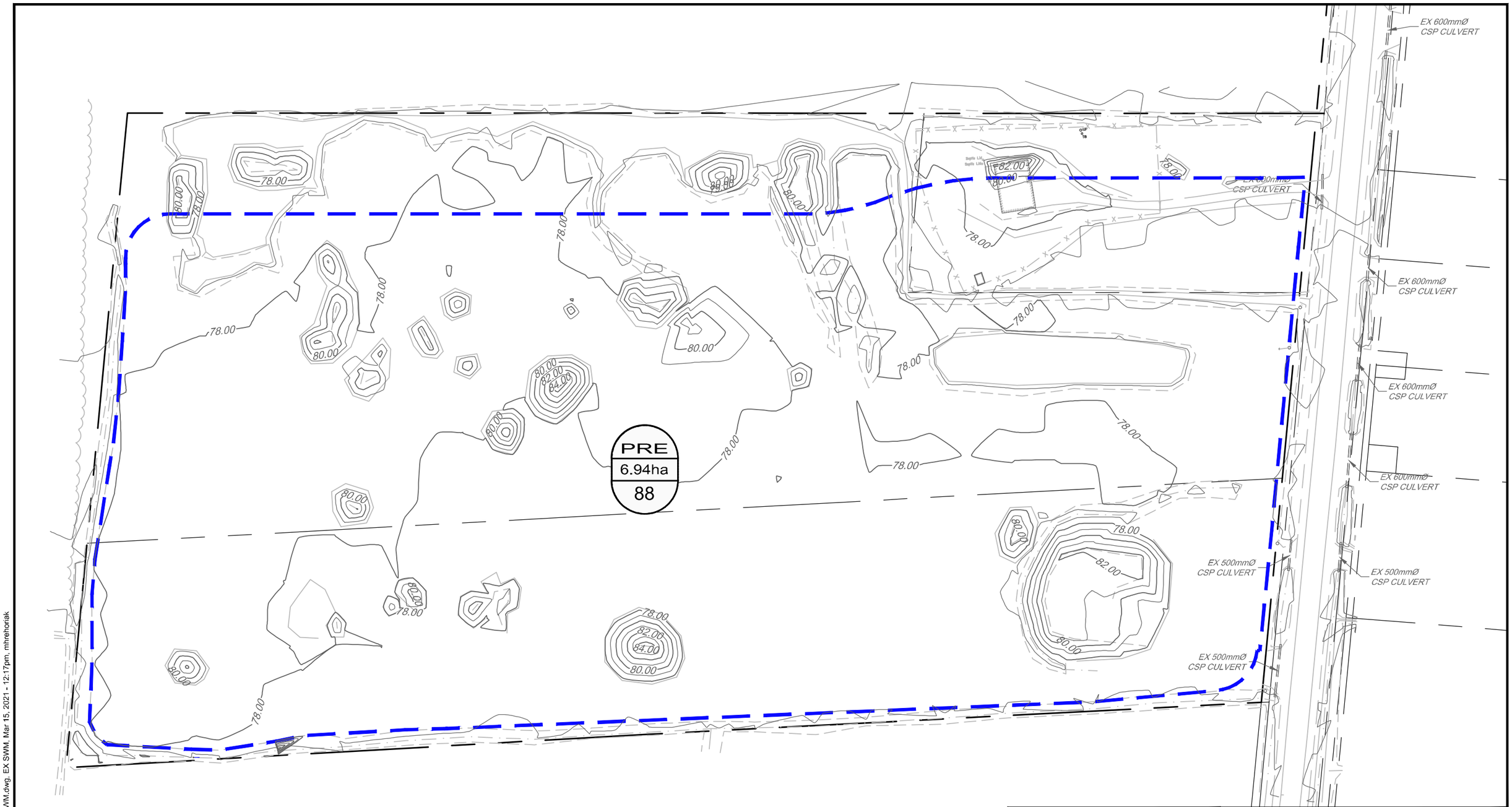
Project: **PROPOSED CROSS DOCK BUILDING**
5510 BOUNDARY ROAD
OTTAWA (CARLSBAD SPRINGS), ONTARIO

Drawing: **PRELIMINARY SEWAGE SYSTEM LAYOUT PLAN**

Scale: 1:400	Drawn by: HV
Date: 03/2021	Checked by: MK
Drawing no.: **PH4216-1**	

p:\autocad drawings\hydrogeology\ph4\2xx\ph4216 - day & ross - 5510 boundary road\ph4216-1.dwg

APPENDIX C
Storm Servicing and Stormwater Management



LEGEND

EXISTING STORM DRAINAGE AREA

PRE
6.94ha
88

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

SCALE 1 : 1250 (0 10 20 30 40 50)
DATE MAR 2021
JOB 118168
FIGURE 5

SHT11X17.DWG - 279mmX432mm

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

NOVATECH
Engineers, Planners & Landscape Architects

M E M O R A N D U M

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.

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

- 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^3/s)					
		3-hour Chicago Storm			*12-hour SCS Type II Storm*		
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr
Area 'A'							
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)

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

NOVATECH
Engineers, Planners & Landscape Architects

NASHYD's (Pre-Development)				
Land Cover	**Hydrologic Soil Group (HSG)**	**Area (ha)**	**SCS Curve Number (CN)**	**Initial Abstraction (Ia)* (mm)**
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
TOTAL (PRE)	**-**	**6.94**	**88**	**5.0**

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

Time-to-Peak (Tp) Calculations (Airport Method) (NASHYD's)				
Runoff Coefficient (C)	**Average Slope (%)**	**Flow Path Length (m)**	**Time-of-Concentration (Tc) (min)**	**Time-to-Peak (Tp)* (hours)**
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
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  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
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.1\VO2\voin.dat
  Output  filename: C:\Users\cstang\AppData\Local\Civica\VH5\6c732c44-3f8e-4d1e-b713-5e03d621a144\0a3a2f80-fc19-
4e8b-a3a4-fca80fbc9b41\scena
  Summary filename: C:\Users\cstang\AppData\Local\Civica\VH5\6c732c44-3f8e-4d1e-b713-5e03d621a144\0a3a2f80-fc19-
4e8b-a3a4-fca80fbc9b41\scena


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

USER:


COMMENTS: _____________________________________________________________
```

```
  ********************************************
  ** SIMULATION : Run 01                     **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\cstang\AppD
|                  |              ata\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.

--------------------------------------------------------------------------------
```

```
  ********************************************
  ** SIMULATION : Run 02                     **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\cstang\AppD
|                  |              ata\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            |
| 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    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.

--------------------------------------------------------------------------------
```

```
  **********************************************
  ** SIMULATION : Run 03                       **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\cstang\AppD
|                  |              ata\Local\Temp\
|                  |              3423a1c4-1884-4f21-baad-4d458bc37917\e1438c1c
| Ptotal= 71.67 mm |    Comments: C3-100
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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            |
| 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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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.
```

```
  **********************************************
  ** SIMULATION : Run 04                      **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\cstang\AppD
|                  |              ata\Local\Temp\
|                  |              3423a1c4-1884-4f21-baad-4d458bc37917\fceeafce
| Ptotal= 42.34 mm |    Comments: S12-2
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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            |
| 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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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

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\Local\Temp\3423a1c4-1884-4f21-baad-4d458bc37917\8f07cf7d
Ptotal= 56.19 mm | Comments: S12-5

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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

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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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
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 hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN 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

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
===========================================================================================================
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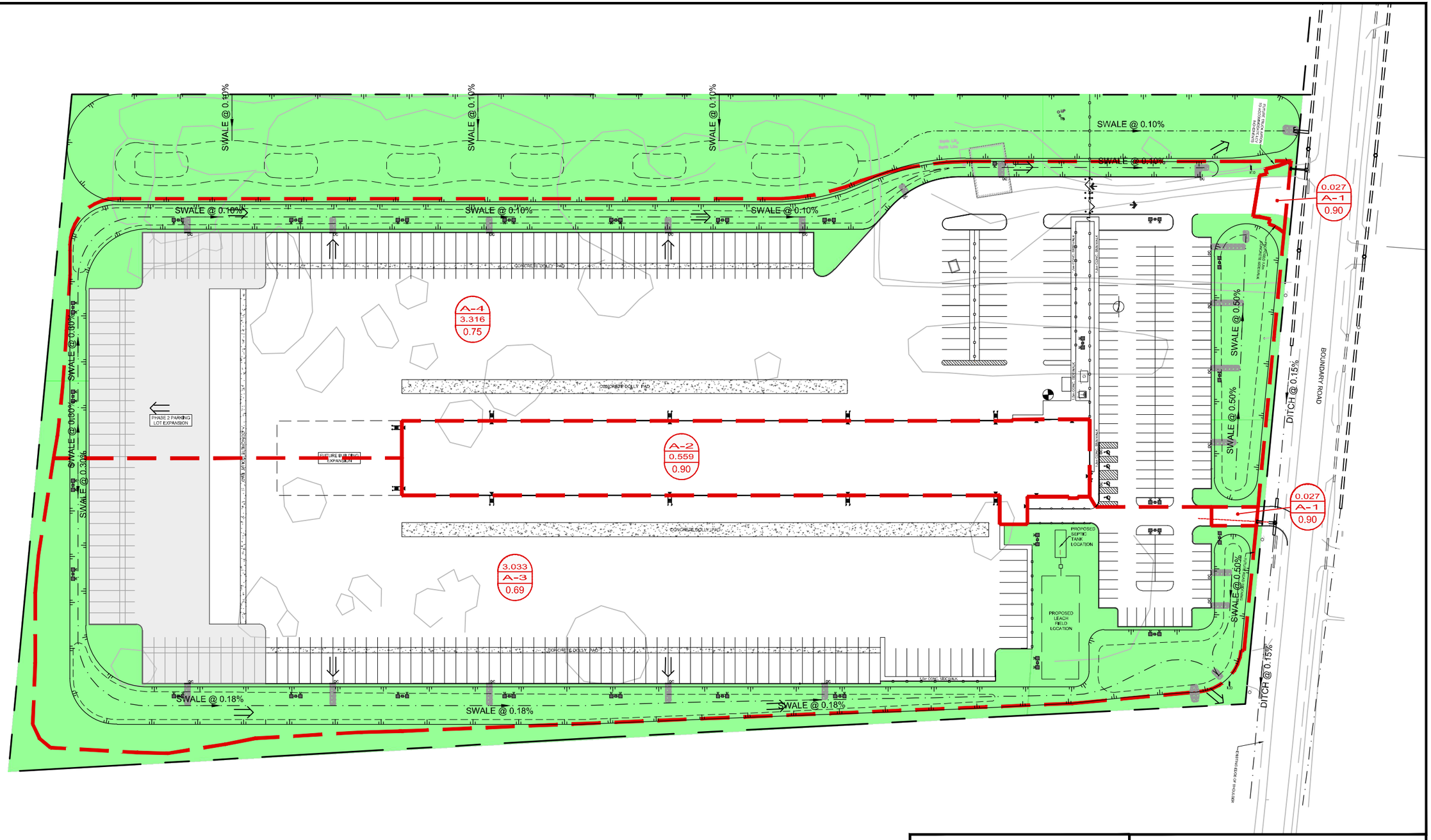

LEGEND

POST STORM DRAINAGE AREA

A-2 / 0.559 / 0.90 — DRAINAGE AREA ID / DRAINAGE AREA (ha) / RUNOFF COEFFICIENT

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

5110 BOUNDARY ROAD

POST-DEVELOPMENT DRAINAGE AREA PLAN

SCALE 1 : 1250 (0 10 20 30 40 50)
DATE MAR 2021 | JOB 118168 | FIGURE 6

SHT11X17.DWG - 279mmX432mm

M:\2018\118168\CAD\Design\118168-SWM.dwg, SWM, Mar 16, 2021 - 3:46pm, mhrehoriak

TABLE 1: Pre-Development EX-1 Flows

				3-hour Chicago Storm		
Outlet Options	**Area (ha)**	**SCS CN**	**Tc (min)**	**$Q_{2\ Year}$ (L/s)**	**$Q_{5\ Year}$ (L/s)**	**$Q_{100\ Year}$ (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_{avg}	$*C_{100}$
Total	Hard	0.027	0.90	0.90	1.00
0.027	Soft	0.000	0.20		

Runoff Coefficient Equation

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

* 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_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Boundary Road	0.027	0.90	10	**5.2**	**7.0**	**13.4**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	77.37	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

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

Controlled Roof Areas

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

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$^*C_{avg}$
Total	Hard	0.000	0.90		1.00	
0.559	Roof	0.559	0.90	0.90	1.00	1.00
	Soft	0.000	0.20		0.25	

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^3)
2 YEAR	35	36.06	50.43	12.0	38.46	80.77
	40	32.86	45.96	12.0	33.99	81.59
	45	**30.24**	**42.29**	**12.0**	**30.32**	**81.87**
	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^3)
5 YEAR	40	44.18	61.80	15.0	46.79	112.29
	45	40.63	56.82	15.0	41.81	112.90
	50	**37.65**	**52.66**	**15.0**	**37.65**	**112.96**
	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^3)
100 YEAR	55	59.62	92.66	20.9	71.76	236.80
	60	55.89	86.86	20.9	65.96	237.46
	65	**52.65**	**81.81**	**20.9**	**60.91**	**237.56**
	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
$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

Table 3E: Roof Drain Flows

Roof Drains		
Roof Area	5590	m²
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 (m²)	Avg Ponding Depth Per Roof Drain (m)	*Total Volume (m³)	Total Volume (m³) 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: $V = \frac{Area\ X\ Depth}{3}$

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

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$^{*}C_{avg}$
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^3)
2 YEAR	35	36.06	209.08	53.5	155.58	326.72
	40	32.86	190.55	53.5	137.05	328.93
	45	30.24	**175.34**	**53.5**	**121.84**	**328.96**
	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^3)
5 YEAR	30	53.93	312.69	73.0	239.66	431.38
	35	48.52	281.32	73.0	208.29	437.40
	40	**44.18**	**256.19**	**73.0**	**183.16**	**439.59**
	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^3)
100 YEAR	20	119.95	781.30	195.8	585.45	702.54
	25	103.85	676.41	195.8	480.56	720.84
	30	**91.87**	**598.39**	**195.8**	**402.54**	**724.57**
	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

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

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

TABLE 4E: Storage Provided - A-3

Elevation (m)	System Depth (m)	Surface Ponding Volume (m^3)
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 x A x (2gh) x 0.5
Q is the release rate in m^3/s
A is the orifice area in m^2

g is the acceleration due to gravity, 9.81 m/s^2
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^3)	Area (m^2)	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 Coefficeint (C)	1.84
Bottom Width (m)	1.5
Weir Bottom Elevation (m)	77.00

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

Water Level Elevation	Flow Rate Over Weir	
(m)	(m^3/s)	(L/s)
77.00	0.000	0.0
77.02	0.008	7.8
77.03	**0.014**	**14.3**
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
77.13	**0.129**	**129.4**
77.14	0.145	144.6
77.16	0.177	176.6
77.18	0.211	210.8
77.20	0.247	246.9

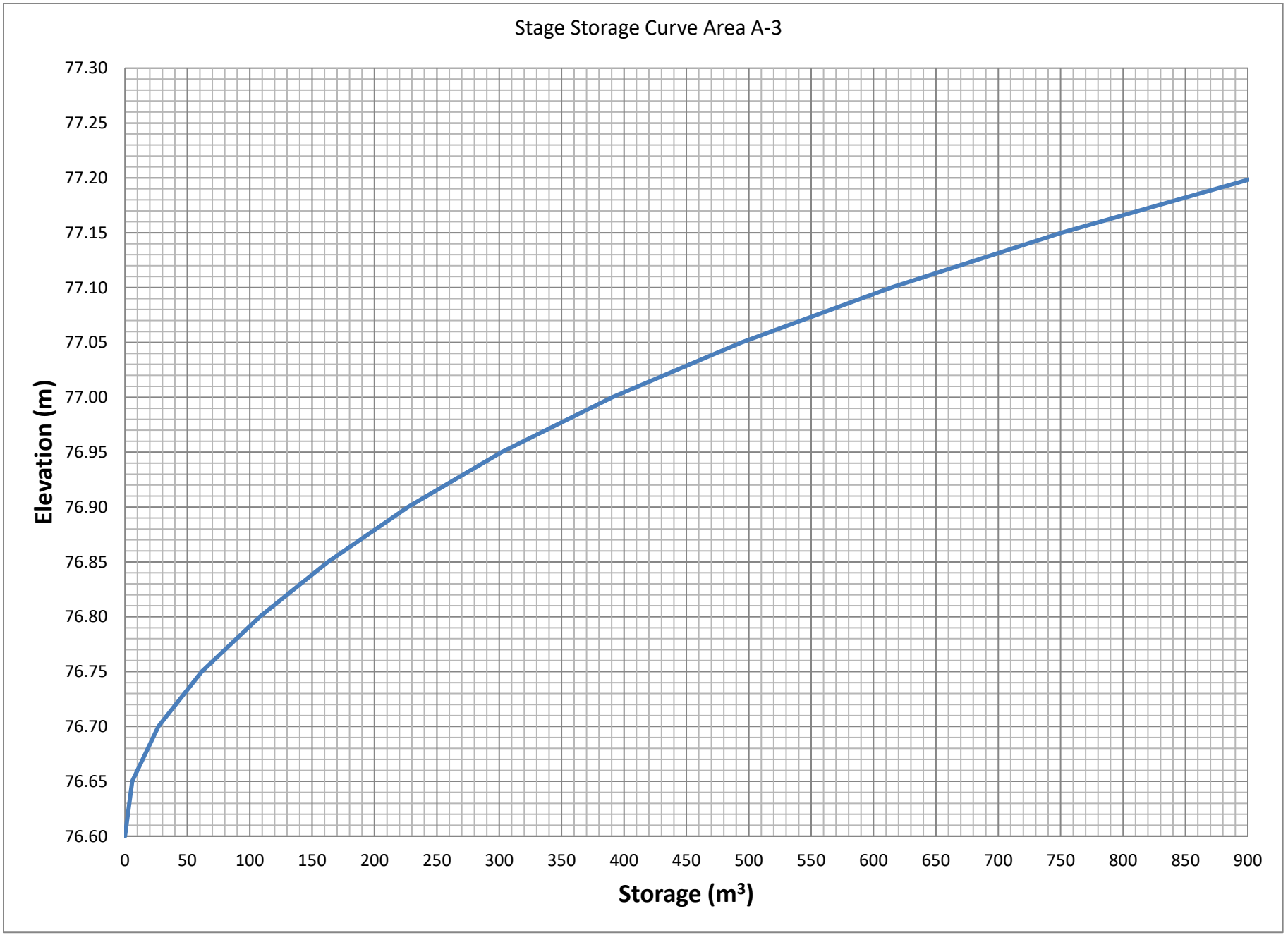
Stage Storage Curve Area A-3
Elevation (m)
77.30
77.25
77.20
77.15
77.10
77.05
77.00
76.95
76.90
76.85
76.80
76.75
76.70
76.65
76.60
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
Storage (m³)

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

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$^{*}C_{avg}$
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^3)
2 YEAR	35	36.06	247.73	58.2	189.53	398.02
	40	32.86	225.78	58.2	167.58	402.20
	45	30.24	**207.75**	**58.2**	**149.55**	**403.79**
	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^3)
5 YEAR	30	53.93	370.49	86.8	283.66	510.59
	35	48.52	333.33	86.8	246.49	517.63
	40	**44.18**	**303.56**	**86.8**	**216.72**	**520.13**
	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^3)
100 YEAR	25	103.85	798.60	204.6	594.05	891.07
	30	91.87	706.48	204.6	501.93	903.47
	35	**82.58**	**635.04**	**204.6**	**430.49**	**904.03**
	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

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

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

TABLE 5E: Storage Provided - A-4

Elevation (m)	System Depth (m)	Surface Ponding Volume (m^3)
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^3/s
A is the orifice area in m^2

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

TABLE 5F: Orifice Sizing information - A-4

Control Device
Round Plate Orifice 243 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)	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

TABLE 5G: Cipolletti Weir 100-year Flow Calculations

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

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

Water Level Elevation	Flow Rate Over Weir	
(m)	(m^3/s)	(L/s)
77.20	0.000	0.0
77.22	0.008	7.8
77.24	**0.022**	**22.1**
77.26	0.041	40.6
77.28	0.062	62.5
77.30	0.087	87.3
77.32	0.115	114.7
77.33	**0.129**	**129.4**
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

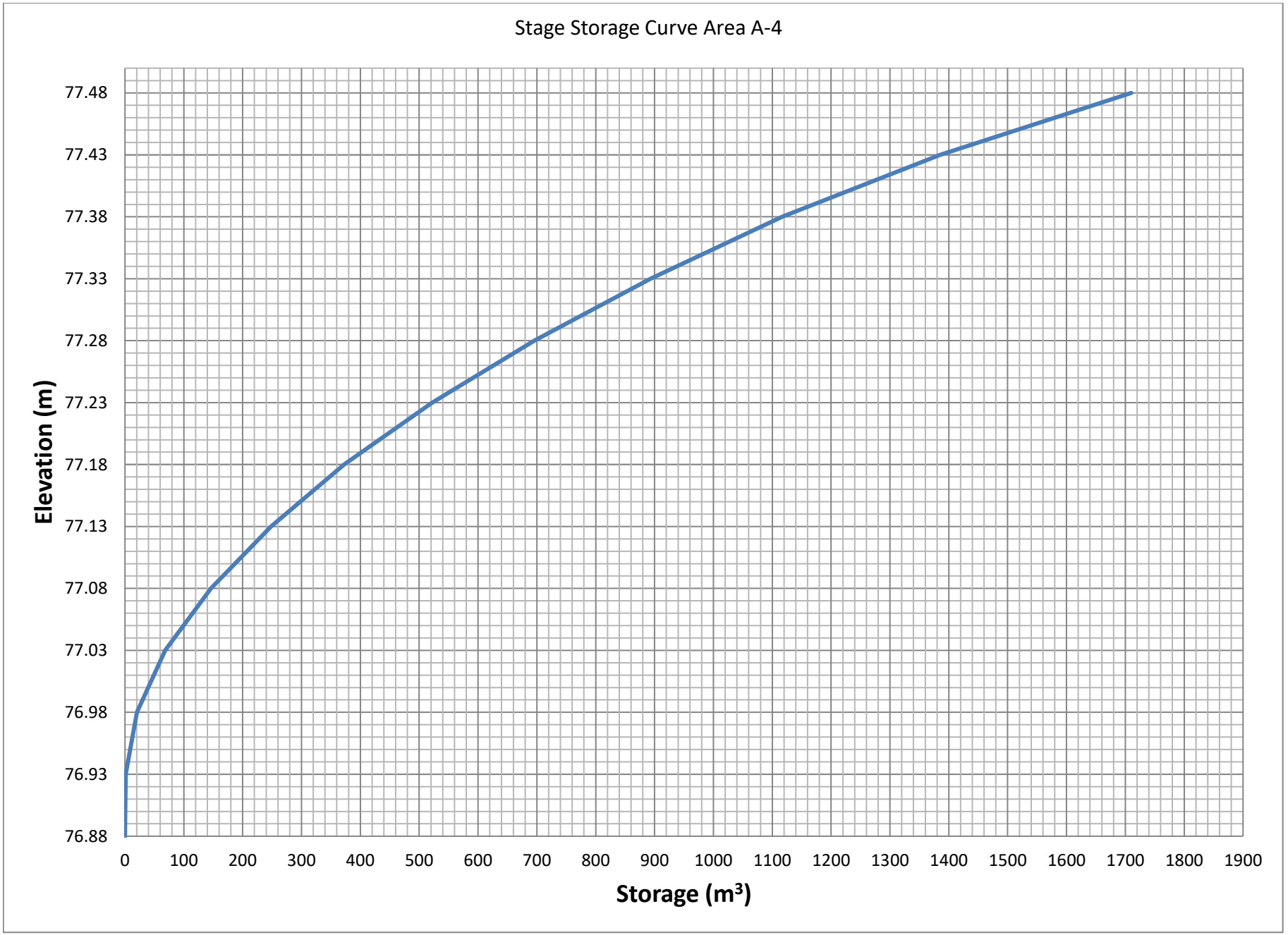
Stage Storage Curve Area A-4
Elevation (m)
77.48
77.43
77.38
77.33
77.28
77.23
77.18
77.13
77.08
77.03
76.98
76.93
76.88
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
Storage (m³)

Table 6: Post-Development Stormwater Mangement Summary

Area ID	Area (ha)	1:5 Year Weighted Cw	Oulet 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)	Pondind 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
Total Post Development					**128.9**				**181.9**				**434.7**			
Total Pre Development					**129.0**				**221.0**				**519.0**			