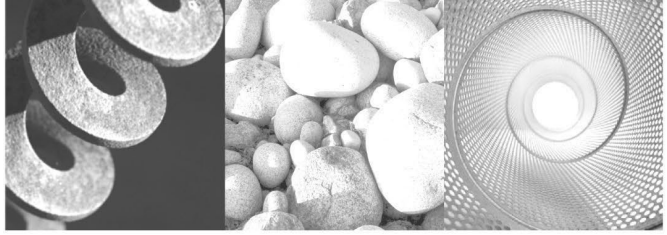

GEI Consultants

Stormwater Management Report

36 Unit Apartment Building

1115 10th Street East, Owen Sound

Owen Sound, Ontario

Submitted to:
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3580 East Bayshore Road
Owen Sound, ON N4K 5N3

Submitted by:
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1260 2nd Avenue East
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March 31, 2025
Project No. 2408466

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Certification

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Record of Revisions

Identification	Date	Description of Issued and/or Revision
SWM Report	March 31, 2025	Issued for Zoning By-law Amendment Application

Statement of Conditions

This report has been prepared at the request of Paaji Inc, and for the exclusive use of GEI Consultants Canada Ltd. (GEI), the Client, its affiliates and the approval agencies (City of Owen Sound); (the "Intended Users"). No one other than the intended user has the right to use and rely on the work without first obtaining the written authorization of GEI and the Client. GEI expressly excludes liability to any party except the intended user for any use of, and/or reliance upon, the work. Neither possession of the work, nor a copy of it, carries the right of publication. All copyright in the work is reserved to GEI. The work shall not be disclosed, produced or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of GEI, or the Client.

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1. Introduction

1.1. Background

GEI Consultants Canada Ltd. (formerly GM BluePlan Engineering Limited.) has been retained by Paaji Inc. to provide engineering services in support of the development of a 36 unit apartment building located at 1115 10th Street East Owen Sound. The existing lot was previously a long-term care home with a 979.9m^2 one story building. The site will be serviced by the storm, water and sanitary sewers along 10th Street East. This report was prepared in support of a Zoning Bylaw Amendment Application.

1.2. Site Description

The site consists of a single-story former long-term care facility located at 1115 10th Street East, with associated parking and landscaped areas. It can be accessed by a driveway from 10th Street East, which is a collector road with a bus stop along the property frontage. The site has a total area of 7,899 m^2 (1.95 acres) with a depth of approximately 124 m. Residential, commercial, institutional, employment, and vacant residential lands surround the property.

The site is currently serviced with a 100mmØ ductile iron potable water service and a 150mmØ A.C. sanitary service extending out of the Northwest corner of the site. The site is also serviced by a 250mmØ concrete storm pipe per Gamsby and Mannerow Ltd. 10th Street East Plans and Profiles dated March 1975. Figure 1.0 enclosed shows the site location for reference (Appendix A).

1.3. Purpose and Scope

The proposed development seeks to convert the existing single-storey former long-term care facility located at 1115 10th Street East, Owen Sound to a 36-dwelling apartment building complete with a building addition and rehabilitation parking and landscaped areas. The completion of this project will involve the following:

- Conversion of the existing single storey building to contain eleven dwelling units,
- A three-storey addition at the north end of the existing building with:
    - Seven units on the lower floor,
    - Nine units on the ground floor, and
    - Nine units on the second floor
- A surface parking area containing approximately 45 parking stalls, including two barrier-free stalls, and a loading space. All of which is to be accessed from 10th Street East; and
- Site landscaping

This report and associated hydrological modelling have been prepared to estimate and summarize the existing peak runoff flow rates within the site area discharging to 10th Street East storm conveyance infrastructure and regional drainage corridor directed ultimately to Georgian Bay.

Further, post-development peak runoff flow rate modelling estimations have been completed based upon the construction of the 36-dwelling unit apartment building to validate the 5-Year to 100-Year post-development peak flow rates will be attenuated to the 5-Year existing levels entering the Municipal storm infrastructure upon the completion of the apartment building.

1.4. Stormwater Management Design Criteria

The Stormwater Management Design Criteria established for the site have been established considering such factors as:

- Historic drainage issues around the site-specific area in Owen Sound, including the Right-of-Ways of 10th Street East
- The existing site topography and existing Municipal infrastructure along 10th Street East.
- City of Owen Sound Engineering comments
- City of Owen Sound Site Plan Engineering Standards

Taking into consideration the information noted above, the following SWM Criteria has been developed for the site:

1) The SWM Strategy for the site must attenuate the post-development peak runoff flow rates to 5-year existing conditions for the 5-year through 100-year design storms for the 3 to 4-hour Chicago-Owen Sound Site Development Engineering Standards (2021); and
2) Mitigate the Total Suspended Solids (TSS) transportation of sediment & deleterious materials offsite pre-construction, during construction and post-construction.
3) Per phone conversations with Owen Sound Engineering staff, we have been instructed to attempt to reduce the post-development conditions to 5-year pre-development green field conditions. With the expectation that per Owen Sound Site Development Engineering Standards for infill lots, post-development peak flow levels are not to exceed the 5-year design storm level. This is due to the current surcharging storm system downstream of the subject site.

2. Background Review

2.1. Standards and Guidelines

This report has been prepared recognizing the following Government Guidelines, Provincial and Municipal Standard and Publications:

- Stormwater Management Planning and Design Manual, The Ministry of The Environment, Conservation & Parks (March 2017), (www.ontario.ca)
- MTO Drainage Management Manual, The Ministry of Transportation Ontario, (www.library.mto.gov.on.ca), (October 1997)
- Site Development Engineering Standards, The Owen Sound Engineering Standards, (www.owensound.ca), (February 2021)
- Gery Sauble Conservation Authority (GSCA) General Policies, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses, (May 2009, rev. January 2010), (www.greysauble.on.ca)
- Zoning By-Law (2010-078), Owen Sound Zoning by-law, (www.owensound.ca), (December 2023); and
- 17th Street East Stormwater Management Study, Gamsby and Mannerow Limited, (May 2013)
- 10th Street East Plan & Profiles, Gamsby and Mannerow Limited, (March 1975)

2.2. Municipal Zoning & By-Law Considerations

The applicant is proposing to develop a 36-dwelling unit apartment building while renovating the existing long-term care home into eleven-dwelling units. The lot will be serviced via 10th Street East with municipal sanitary, water and storm. The site will have access from 10th Street East through the existing driveway.

A Zoning By-Law Amendment (ZBA) is required to change the lands currently zoned Institutional (I) to General Residential (R5), to permit “Dwellings, Apartments”. This designation relates to the runoff coefficients used to model the proposed site conditions.

2.3. Existing Stormwater Drainage and Storm Sewer Infrastructure

The existing drainage patterns of 1115 10th Street East flow generally from south to north with a site area of approximately 0.79 ha. There are two existing catch basins on-site which ultimately outlet into the City’s infrastructure noted as CB-2 on Gamsby & Mannerow’s Plan & Profiles dated (1975) centered with the existing driveway along the curbline.

The existing CB has been identified as the primary Municipal outlet for the 36-dwelling unit apartment building. This outlet has been identified by GEI Consultants Ltd. as the primary outlet for post-development peak runoff flow rates.

CB-2 is connected to the existing (+/-) 450mmØ concrete storm sewer on the north side of 10th Street East via a (+/-) 250mmØ concrete storm pipe. This (+/-) 250mmØ storm pipe originates from CB-2 and connects to CBMH-B-1 per Gamsby and Mannerow's Plan and Profiles dated March 1975.

It should be noted at this time that per Gamsby and Mannerow's 17th Street East Stormwater Management Study revised May 2013. The city currently has two undersized storm sewer reaches along 10th Street East downstream of 1115 10th Street East. Reaches between 9th Ave E and 10th Ave E (east leg) both of which are over 200% capacity as shown in Table 1 below.

Table 1: Simplified Table 4-1 from 17th Street Stormwater Management Study

Location			% Capacity
Street	**From**	**To**	
10th Street East	9th Ave East	10th Ave E (west leg)	284.6%
10th Street East	10th Ave E (west leg)	10th Ave E (east leg)	238.7%

Due to the lack of capacity in the city's infrastructure downstream of the subject site GEI will propose to match the 5-Year design storm under existing condition peak flow for post-development storm events from 5-Year through to 100-Year. With the goal to attenuate the flow to the 5-Year green field condition. We note that per Owen Sound Site Development Engineering Standards for infill lots, post-development peak flow levels are not to exceed the 5-year design storm level.

The full table and catchment area from Gamsby and Mannerow's 17th Street East Stormwater Management Study can be found in Appendix E for reference.

3. Existing Hydrological Conditions

3.1. Hydrological Modelling using Visual OTTHYMO

Existing condition modelling for the site has been completed using the hydrological modelling software Visual OTTHYMO to estimate peak surface water runoff flow rates for the 5-Year through to 100-Year 3 to 4-Hour Chicago Design Storm Event a long with the Regional (Timmins) Storm Events for the development site draining to the existing 10th Street East storm sewer.

Based on a variety of source maps, including OpenSource LIDAR, aerial imagery, and site-specific topographic survey, the catchment area that directs surface water runoff to the city system on 10th Street East is approximately 0.79 ha.

3.2. Existing Land Use

The drainage catchment area (CA100) contains the abandoned single story long-term care home, with associated parking and landscaped areas. Under existing conditions, catchment 100 generally directs surface runoff from south to north at an average grade 7.7% and a Total imperviousness of approximately 37%. Table 2 below highlights the modelling parameters used.

The existing conditions impervious calculations are enclosed in Appendix B for reference.

Table 2: Existing Catchment Modelling Parameters

Catchment Parameter:	CA100
Catchment Area (ha)	0.79
Total Impervious (%)	37.2
Total Impervious – Directly Connected (%)	37.2
Impervious Slope (%)	7.7
Impervious Flow Length (m)	72.57
Impervious Mannings n	0.013
Pervious Slope (%)	7.7
Pervious Flow Length (m)	124
Pervious Mannings n	0.025

Figure 2 – Existing Catchment Area Plan in Appendix A is included for reference.

3.3. Soil Conditions

For the purposes of the report, the following information was used:

- Soil survey of Grey County – Report No. 17, The Ontario Soil Survey; The Canadian Department of Agriculture and the Ontario Agricultural Collage (1954) (https://sis.agr.gc.ca);
- Ontario Agricultural al Maps (AGMaps), Ministry of Agricultural, Food & Ruhl Affairs (2024), (www.lioapplications.lrc.gov.on.ca)

The on-site soil is classified as Vincent Silty Clay Loam and is characterized as having a Hydrological Soil Group BC.

The drainage of the Vincent Silty Clay Loam is moderate to good. The loam consists of fine-textured limestone till which is slightly stoney. As the proposed storm water management strategy is to install

a stone retention gallery that is capable to contain up to the 100-Year 4-Hour Chicago Design storm event, the percolation time will not affect the overall function of the SWM facility.

3.4. Rainfall Data

The site-specific rainfall data has been established based on the 3 to 4-Hour Chicago Distribution. The pre-development peak runoff flow rate for CA100 has been derived from the Owen Sound Site Development Standards revised (February 2021). A copy of the Owen Sound Site Development Standards (Storm Water Modelling Parameters) is enclosed in Appendix B for reference.

The rainfall intensity for the Otthymo Model was calculated based on the data from the Owen Sound Site Development Standards using the following formula:

$$I = At^B$$

3.5. Existing Peak Runoff Flow Rate Modelling Results

Developing the OTTHYMO model for the existing peak runoff flow rate estimations is based on the criteria established in the previous sections.

Utilizing the current Owen Sound Engineering Development Standards and the catchment characteristics determined, the estimated existing conditions peak runoff flow rates directed to 10th Street East CB-2 are summarized in Table 3 below:

Table 3: Existing Peak Runoff Flow Rates

Storm Event	Peak Runoff Flow Rate (m^3/s)
2-Year	0.068
5-Year	**0.097**
25-Year	0.149
100-Year	0.192
Regional (Timmins) Storm	0.086

Detailed modelling results and the existing conditions catchment area schematic are enclosed in Appendix C.

Under Pre-Development “Green Field” Conditions the 5-year design storm peak runoff for the site is 0.029 (m^3/s). As stated previously, attenuated post-development conditions meet the 5-year existing conditions peak runoff with the goal to reduce peak runoff to the 5-year green field conditions per City of Owen Sound Engineering Staff comments.

4. Strategic Storm Management (SWM) Strategy

4.1. Post-Development

The proposed stormwater management (SWM) strategy employed to attenuate the post-development peak runoff flow rates will be completed through a private subsurface stone retention gallery system. The peak runoff will be attenuated and released to 10th Street East through a 150mmØ orifice restriction cap on the outlet of CBMH-1. By using the stone retention gallery in the parking lot of the proposed development the flows will be attenuated before being released through an EFO4 Stormceptor to meet the target of 80% of Total Suspended Solids are removed prior to entering the city's storm sewer. Further details relating to the design of the subsurface stone retention gallery is provided in Section 4.4.

4.2. Post-Development Land Use Parameters

Developing the OTTHYMO model for the post-development peak runoff flow rate estimations is based on the criteria established in the previous sections. To estimate the post-development peak runoff flow rates the site was broken down into four (4) catchment areas. Catchment 201 presents the uncontrolled front yard drainage to 10th Street East. As the existing topography of the front yard of the site does not lend itself to practical stormwater management control devices. Catchment 202 represents the front yard parking lot along with catchment 203 representing the rear yard parking lot. With the final catchment 204 representing the backyard drainage swale. The post development impervious calculations are in Appendix B and Figure 3 shows the Post-Development Catchment Area Plan in Appendix A.

Utilizing the Owen Sound Engineering Standards and the catchment characteristics determined, the estimated post-development catchment parameters directed to 10th Street East CB-2 are summarized in Table 4 below.

Table 4: Post-Development Catchment Modelling Parameters

Catchment Parameter:	CA201	CA202	CA203	CA204
Catchment Area (ha)	0.16	0.32	0.06	0.25
Total Impervious (%)	32.3	82.7	81.8	23.7
Total Impervious – Directly Connected (%)	21.2	82.7	81.8	1.0
Impervious Slope (%)	10	5	5	2
Impervious Flow Length (m)	32.7	46.2	20.0	40.8
Impervious Mannings n	0.013	0.013	0.013	0.013
Pervious Slope (%)	15	2	2	2
Pervious Flow Length (m)	20	3	3	40
Pervious Mannings n	0.025	0.025	0.025	0.025

4.3. Post-Development Surface Water Modelling Results

Utilizing the Owen Sound Development Engineering Standards and the catchment characteristics determined, the estimated post-development peak runoff flow rates directed to the 10th Street East storm inlet are summarized in Table 5 below.

Table 5: Post-Development Peak Runoff Flow Rates

Storm Event	Peak Runoff Flow Rate (m^3/s)		
	CA201 (uncontrolled)	PD206 (storm facility)	Total Site
2-Year	0.014	0.036	0.046 (0.097)
5-Year	0.021	0.045	0.060 (0.097)
25-Year	0.034	0.058	0.080 (0.097)
100-Year	0.045	0.072	**0.097 (0.097)**
Regional (Timmins) Storm	0.018	0.058	0.075 (0.097)

*(0.097) – 5-Year 3-Hour Chicago Design Storm (Existing Hydrological Conditions)

Detailed modelling results and the post-development catchment area schematic are enclosed in Appendix D for reference.

4.4. Sub-Surface Stone Retention Gallery

The stone retention gallery will be constructed in the proposed parking lot of the apartment building and will be privately owned and maintained.

The construction of the gallery will provide a volume of 136 m³ to adequately attenuate the post-development peak runoff flow rates to existing levels.

The proposed stone retention gallery consists of the following parameters:

- Be constructed in a trench with dimensions of 10 m x 2 m (W x D);
- Include a 525 mmØ perforated HDPE pipe with a manufacturer installed filter sock at a slope of 0.5%;
- Include washed clear stone fill with a uniform diameter between 25mm & 52mm and a void ratio of 0.4;
- The bottom and sides of the retention gallery trench is to be wrapped in TeraFix 270R Fabric or approved equivalent with an impermeable membrane across the top to prevent fines from the parking lot entering the retention gallery;
- The north outlet of CBMH-1 will be fitted with a 150 mmØ orifice at an elevation of 232.80 MASL.
- Include an ADS StormTech retention chamber or equivalent to allow for increased storm retention capabilities and access for cleanout.

- The driveway aisle will act as a broad-crested weir (8 m long) running the full width of the driveway entrance at an elevation of 235.35 MASL. This is to act as the spill point under regional storm events. With maximum ponding occurring in the parking lot of 0.05m before over toping the weir under a regional storm event.

The post-development function of the stone retention gallery is demonstrated in Table 6 below.

Table 6: Stone Gallery Function

Design Storm	Storage Used (m^3)	Depth Used (m)
2-Year	41	0.59
5-Year	62	0.91
25-Year	101	1.49
100-Year	134	1.97
Regional (Timmins) Storm	136	2.0

It can be noted, the available storage volume provided for the post-to-existing development peak runoff flow is adequate to attenuate post-development conditions up to the 100-year storm event. As the proposed stone storage is 136 m^3, while the 100-Year retention volume of 134 m^3 as noted in Table 6 above.

The Stage-Storage-Discharge information and design details are included in Appendix B for reference.

4.5. Site Grading and Drainage

Upon completion of the construction and lot grading for the lot, it is anticipated that the overland drainage from the existing rear year will be directed from west to east into the proposed DICB with a swale grade of 0.5%. This will act as a temporary stormwater management area to further attenuate flows from the rear yard. Under a regional storm event, ponding in the rear yard would eventually overtop into the parking lot and travel north through the parking lot. Runoff would ultimately overtop the weir at the top driveway at 235.35 MASL. Surface water runoff from all storm events including the regional storm will continue flowing from south-to-north to 10th Street East as it does under existing conditions.

It is estimated that under a regional storm event the depth of water accumulated in the parking lot of 1115 10th Street East will be 0.05m before overtopping the weir at the top of the driveway. Flow will continue to 10th Street East and head West which ultimately outlets into Georgian Bay.

The preliminary storm sewer design for 1115 10th Street East and have included it in Appendix B for reference.

4.6. Stormwater Quality Objectives

The water quality for the site has been reviewed in accordance with the Cities Site Development Engineering Standards section 3.1.2. and in the Stormwater Management Criteria established for the site.

The current preliminary design for this lot intends to use an EFO4 Stormceptor located midway up the driveway prior to entering the city's storm sewer. This unit meets the cities quality control requirement of a minimum of 80% TSS removal.

5. Recommendations and Conclusions

The SWM Strategy for the site is to attenuate the post-development peak runoff flow rates to the 5-year existing condition for the post-development 5-year through 100-year design storms.

The removal of 80% TSS per The City of Owen Sounds Development Engineering Standards

The proposed stormwater management (SWM) strategy employed to attenuate the post-development peak runoff flow rate manages the stormwater runoff from the site as a sub-surface stone retention gallery. With approximately 0.16 ha of uncontrolled drainage occurring in the front yard.

The storm retention gallery will be constructed under the proposed parking lot and will be privately owned and maintained. The construction of the gallery will provide a retention volume to adequately attenuate the post-development peak runoff flow rates to existing flow rates.

The current preliminary design for the lot intends to utilize a EFO4 Stormceptor to remove 85% of the TSS which exceeds the minimum requirement of 80% of the TSS to meet the requirements set in the City of Owen Sounds Development Engineering Standards.

Per the city's recommendation GEI has improved upon the existing peak flow rates under post-development conditions.

With both the quantity and water quality criteria being met, the proposed site configuration (and zoning) is appropriate and can accommodate the stormwater management requirements.

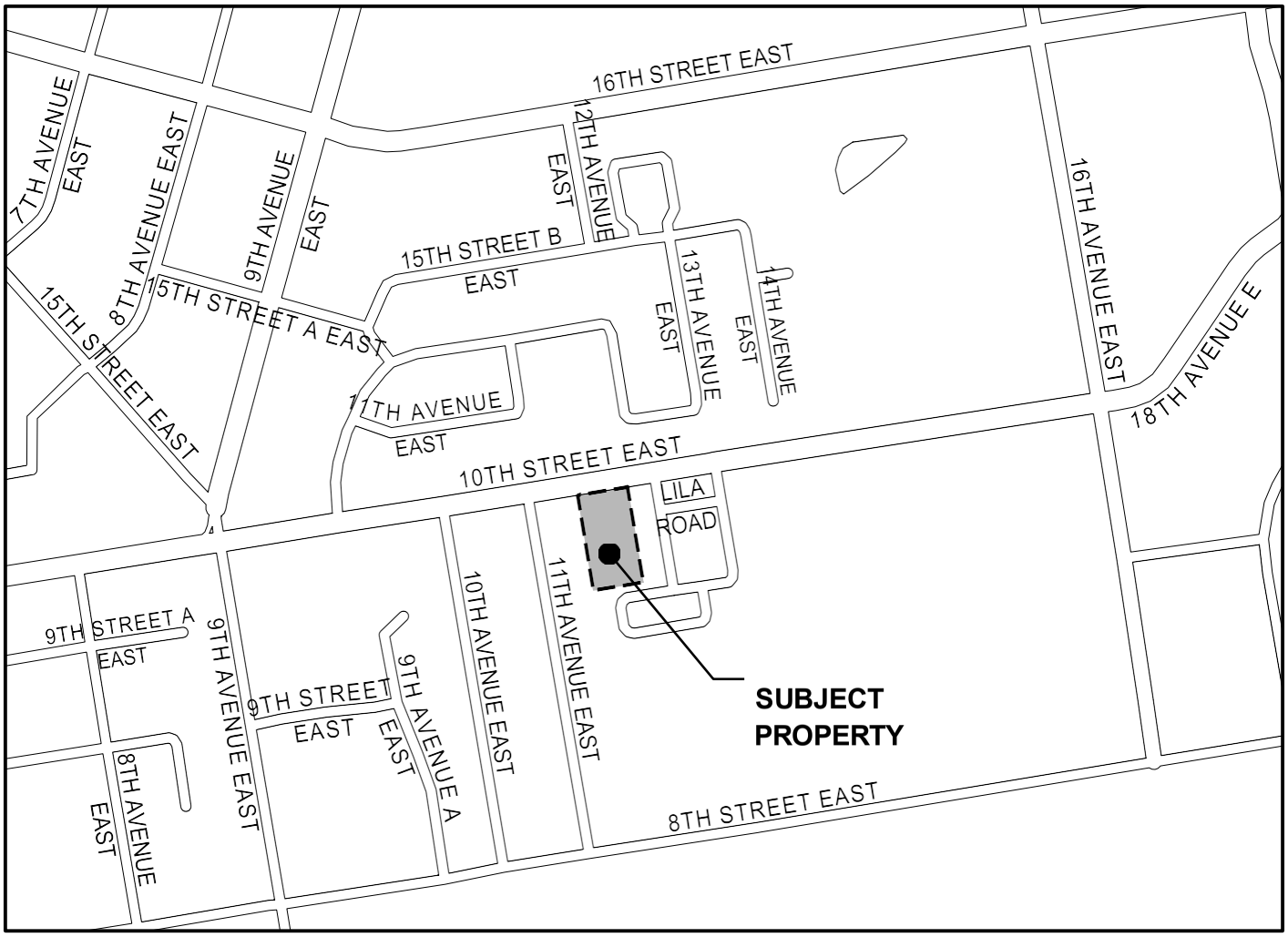
The recommendations and design elements included in this report should be incorporated into the Site Plan development of the site.

Appendix A GEI Figures

A.1. Site Location Map

A.2. Existing Catchment Area Plan

A.3. Post-Development Catchment Area Plan



NOT TO SCALE

MARCH 2025

SITE LOCATION MAP

2408466
PAAJI HEIGHTS

1115 10th St E,
Owen Sound, ON

Figure No. 1

GEI Consultants
GEI CONSULTANTS CANADA LTD.
1260-2ND AVENUE EAST
OWEN SOUND, ONTARIO N4K 2J3
(519)376-1805

SCALE = 1:500

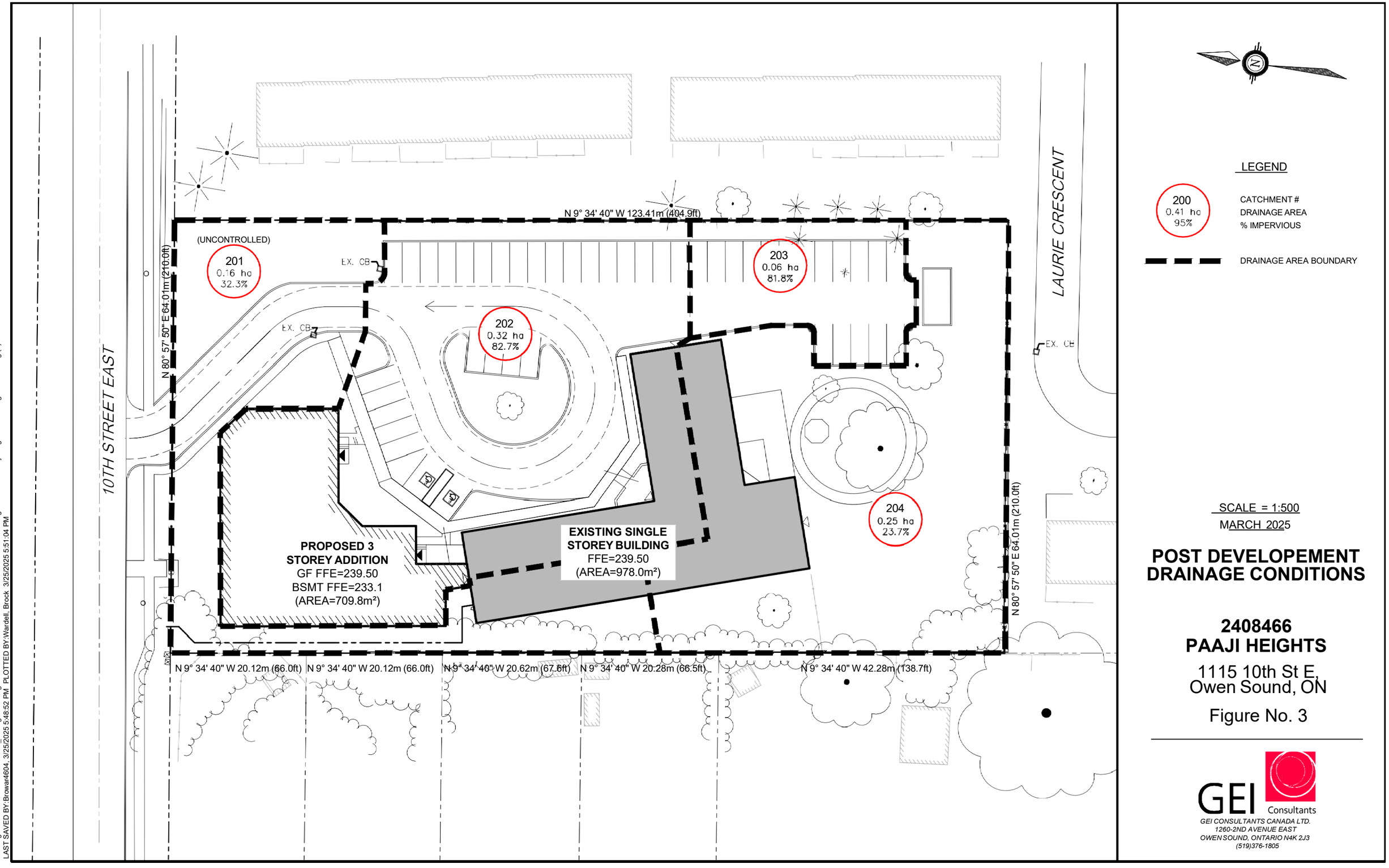
MARCH 2025

EXISTING DRAINAGE CONDITIONS

2408466
PAAJI HEIGHTS
1115 10th St E,
Owen Sound, ON

Figure No. 2

GEI Consultants
GEI CONSULTANTS CANADA LTD.
1260-2ND AVENUE EAST
OWEN SOUND, ONTARIO N4K 2J3
(519)376-1805



LEGEND

200
0.41 ha
95%

CATCHMENT #
DRAINAGE AREA
% IMPERVIOUS

DRAINAGE AREA BOUNDARY

SCALE = 1:500

MARCH 2025

POST DEVELOPEMENT DRAINAGE CONDITIONS

2408466
PAAJI HEIGHTS

1115 10th St E,
Owen Sound, ON

Figure No. 3

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1260-2ND AVENUE EAST
OWEN SOUND, ONTARIO N4K 2J3
(519)376-1805

Appendix B Design Calculations

B.1. Owen Sound Site Development Engineering Standards – Storm Water Modelling Parameters

B.2. Existing Impervious Calculations

B.3. Post-Development Impervious Calculations

B.4. SSD Information and Design Details

B.5. GEI Storm Sewer Design Sheet

3.2 STORM WATER MODELLING PARAMETERS

To aid in the design of SWM facilities, the following information is to be used when calculating surface water volumes for the design of SWM systems.

For Rational Method Calculations:

$\boldsymbol{Q} = 0.00278 \times \boldsymbol{C} \times \boldsymbol{i} \times \boldsymbol{A}$

where: $\boldsymbol{Q}$ = runoff volume in m^3/s
$\boldsymbol{C}$ = runoff coefficient (see below)
$\boldsymbol{i}$ = rainfall intensity in mm/hour
(for 5yr design storm use 109.68 mm/hr with 10 minute entry time for parks and residential; use 110 mm/hr with a 5 minute entry time for all other land uses)
$\boldsymbol{A}$ = area in hectares

Runoff Coefficients:

LAND USE	"C" VALUE	% IMPERVIOUS	ENTRY TIME
Green Field, Parks	0.2	0	10 minutes
Unimproved	0.3	14	10 minutes
Single Family	0.6	57	10 minutes
Semi-detached	0.7	71	10 minutes
Townhouses	0.75	79	10 minutes
Apartments, schools, churches	0.75	79	5 minutes
Industrial	0.9	85	5 minutes
Commercial	0.9	85	5 minutes

Intensity – Duration – Frequency Curves

IDF Curves for the Owen Sound area are attached as Appendix 'C' to this document. The curves are derived using the following variables and formula:

$$\boldsymbol{I}_{mm/hr} = \boldsymbol{A} \times \boldsymbol{T}^{\boldsymbol{B}}$$

Where $\boldsymbol{I}$ = intensity
$\boldsymbol{A}$ = coefficient from chart
$\boldsymbol{T}$ = time in hours
$\boldsymbol{B}$ = coefficient from chart

Design Storm	A	B
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	47.7	-0.738

Chicago Storm Parameters

Most computer modelling programs use the "Chicago Storm" as the default method of simulating rainfall events. For the Owen Sound area, the parameters for modelling using the Chicago storm are as follows:

CHICAGO DESIGN STORM	2 yr	5 yr	25 yr	100 yr
Max. storm duration (min.)	180	180	210	210
Max. hydrograph length (min.)	360	360	360	360
Time step (min.)	5	5	5	5
Coefficient a	854.100	1234.576	1750.276	2171.754
Constant b	7.781	8.297	8.303	8.303
Exponent c	0.830	0.851	0.862	0.867
Fraction r	0.375	0.375	0.375	0.375
Duration t_d (min.)	180	180	210	210
Maximum Intensity (mm/hr)	101.673	134.692	165.718	202.862
Total Depth (mm)	33.228	42.929	59.007	71.271

3.3 STORM WATER MANAGEMENT REPORT

3.3.1 The owner shall have a Professional Engineer prepare a report detailing the modeling, design and features of the proposed SWM system. The SWM Report is to provide system performance data for the 5yr and 100yr design storms and must include scale drawings showing delineated drainage catchment areas, delineated surface pond limits for the 5-year and 100 year design storms (where applicable), overland flow route and a schematic diagram reflecting the model (complex models).

3.4 STORM WATER MANAGEMENT CERTIFICATION

3.4.1 The Professional Engineer who designed the SWM system must certify to the City that he/she supervised the construction of the storm water management system, that it was constructed as approved by the Manager of Engineering Services and that it is functioning properly.

3.5 MAINTENANCE NOTE

The following note is to appear on the SWM design drawing:

> It is the owner's responsibility to conduct routine inspection and maintenance of any oil and grit interception devices or storm water management systems installed or constructed on the owner's property.

3.6 REFERENCE DOCUMENTS

Ontario Ministry Of The Environment Stormwater Management Planning and Design Manual (March 2003) ISBN 0-7794-2969-9

Stormwater Pollution Prevention Handbook (December 2001)
Internet ISBN 0-7794-2553-7
Print ISBN 0-7794-2552-9

GEI Consultants	Project:	1115 10th Street East OS	Date:	07-03-2025
	File No.:	2408466	Designed:	CS
	Subject:	Existing Conditions Impervious Calculations	Checked:	AF

CATCHMENT AREA 100

Total Catchment Area	=	7899.00	m^2		
				%XIMP =	37.2%
Building Area/Driveway Area	=	2940.66	m^2		
Road Area	=	0.00	m^2		
Total Impervious Area (Estimate)	=	2940.66	m^2		
Percent Impervious (%)	=	37.2			

GEI Consultants	Project:	1115 10th Street East OS	Date:	25-03-2025
	File No.:	2408466	Designed:	CS
	Subject:	Post- Development Site Development Impervious Calculations	Checked:	AF

CATCHMENT AREA 201 (FRONT YARD DRAINAGE)

Total Catchment Area	=	1586.26	m^2			
				%XIMP	=	21.2%
Building Area	=	175.84	m^2			
Driveway and Sidewalk Area	=	336.22	m^2			
Total Impervious Area (Estimate)	=	512.06	m^2			
Percent Impervious (%)	=	32.3				

CATCHMENT AREA 202 (POST-DEVELOPMENT) - FRONT PARKING LOT

Total Catchment Area	=	3226.28	m^2	%XIMP	=	82.7%
Building Area	=	1177.40	m^2			
Parking and Sidewalk Area	=	1491.94	m^2			
Total Impervious Area (Estimate)	=	2669.34	m^2			
Percent Impervious (%)	=	82.7				

CATCHMENT AREA 203 (POST-DEVELOPMENT) - SIDE YARD PARKING LOT

Total Catchment Area	=	601.48	m^2	%XIMP	=	81.8%
Building Area	=	0.00	m^2			
Parking and Sidewalk Area	=	492.06	m^2			
Total Impervious Area (Estimate)	=	492.06	m^2			
Percent Impervious (%)	=	81.8				

CATCHMENT AREA 204 (POST-DEVELOPMENT) - REAR YARD

Total Catchment Area	=	2484.69	m^2	%XIMP	=	1.0%
Building Area	=	408.59	m^2			
Other Hardscape Areas	=	179.77	m^2			
Total Impervious Area (Estimate)	=	588.36	m^2			
Percent Impervious (%)	=	23.7				

Project:	1115 10th Street East, Owen Sound	Date:	24-25-2025
File No.:	2408466	Designed:	CS
Subject:	Stage-Storage-Discharge Curve	Checked:	AF

Stone Retention Gallery

Equivalent Length = 17 m
Equivalent Width = 10 m
Equivalent Depth = 2 m
Stone Void Ratio = 0.4
Total Storage Vol. 136 m³
Botton Elevation Elev. = 232.800 m
Top of Stone Elev. = 234.800 m
Stage = 0.125 m

Pipe Dia. = 0.525 m
Pipe Inv. = 232.800 masl

Weir Calculations

H = 0.15 m
L = 8 m
width = 0.5 m

Elevation (m)	Incremental Depth (m)	Surface Area (sq.m)	Incremental Volume (cu.m)	Stone Storage (cu.m)	Pipe Storage (cu.m)	Total Storage Vol. (cu.m)	Description
232.800	0	170	0	0	0.000	0.000	Bottom of Stone
232.925	0.125	170	8.5	8.5	0.209	8.709	
233.050	0.125	170	8.5	17	0.834	17.834	
233.175	0.125	170	8.5	25.5	1.878	27.378	
233.300	0.125	170	8.5	34	3.338	37.338	
233.425	0.125	170	8.5	42.5	0.000	42.500	
233.550	0.125	170	8.5	51	0.000	51.000	
233.675	0.125	170	8.5	59.5	0.000	59.500	
233.800	0.125	170	8.5	68	0.000	68.000	
233.925	0.125	170	8.5	76.5	0.000	76.500	
234.050	0.125	170	8.5	85	0.000	85.000	
234.175	0.125	170	8.5	93.5	0.000	93.500	
234.300	0.125	170	8.5	102	0.000	102.000	
234.425	0.125	170	8.5	110.5	0.000	110.500	
234.550	0.125	170	8.5	119	0.000	119.000	
234.675	0.125	170	8.5	127.5	0.000	127.500	
234.800	0.125	170	8.5	136	0.000	136.000	Top of Stone
235.300	0.50	1.1	0.6	136.57	0.000	136.565	Top of Grate
235.350	0.05	64	1.07	137.63	0.000	137.632	Bottom of Weir
235.500	0.15	0	0	137.63	0.000	137.632	Top of Weir

Orfifice Details

Diametre: = 0.150 m
Area: = 0.0177 m²
Coeficient: = 0.62 (0.62 - Plate, 0.8 - Tube Orfice
Invert Elev. = 232.80 masl

Elevation (m)	Total Storage Vol. (cu.m)	Orifice Flow (cu.m/s)	Weir Flow (cu.m/s)
232.800	0.000	#NUM!	0
232.925	8.709	0.01534352	0
233.050	17.834	0.02301528	0
233.175	27.378	0.0287051	0
233.300	37.338	0.03344043	0
233.425	42.500	0.0375838	0
233.550	51.000	0.04131369	0
233.675	59.500	0.04473367	0
233.800	68.000	0.04791013	0
233.925	76.500	0.0508887	0
234.050	85.000	0.05370232	0
234.175	93.500	0.0563757	0
234.300	102.000	0.05892791	0
234.425	110.500	0.06137408	0
234.550	119.000	0.06372643	0
234.675	127.500	0.06599498	0
234.800	136.000	0.07438048	0
235.300	136.565	0.07516759	0
235.350	137.632	0.07748098	0
235.500	137.632	0.07935731	0.79241239

Discharge (cu.m/s)	Total Storge (ha.m)
0.000	0.000
0.015	0.001
0.023	0.002
0.029	0.003
0.033	0.004
0.038	0.004
0.041	0.005
0.045	0.006
0.048	0.007
0.051	0.008
0.054	0.009
0.056	0.009
0.059	0.010
0.061	0.011
0.064	0.012
0.066	0.013
0.074	0.014
0.075	0.014
0.077	0.014
0.872	0.014

2-Year	41	233.39
5-Year	62	233.71
25-Year	101	234.29
100-Year	134	234.77
Regional	N/A	N/A

Project:	1115 10th Street East, Owen Sound	Date:	24-25-2025
File No.:	2408466	Designed:	CS
Subject:	Stage-Storage-Discharge Curve	Checked:	AF

Existing Conditions		Post-Development			
Design Storm	CA100	CA201	ADD205	PD206	Cumulative
2-Year	0.068	0.014	0.085	0.036	0.046
5-Year	**0.097**	0.021	0.119	0.045	0.060
25-Year	0.149	0.034	0.176	0.058	0.080
100-Year	0.192	0.045	0.224	0.072	**0.097**
Regional	0.086	0.018	0.072	0.058	0.075

Stone Gallery		
Design Storm	Storage Used (cu.m)	Elevation (m)
2-Year	41	233.39
5-Year	62	233.71
25-Year	101	234.29
100-Year	134	234.77
Regional	N/A	N/A

Note: Pre-Development "Green Field Conditions" 5-year Peak Design flow is 0.029 m^3/s

GEI Consultants	Project:	1115 10th Street East, Owen Sound	Date:	24-25-2025
	File No.:	2408466	Designed:	CS
	Subject:	Stage-Storage-Discharge Curve	Checked:	AF

OS Site Dev. Eng. Stds (2021)		
Design Storm	A	B
2 yr	22.3	-0.714
5 yr	29.1	-0.724
10 yr	33.6	-0.729
25 yr	39.3	-0.734
50 yr	43.5	-0.736
100 yr	**47.7**	**-0.738**

Where Q = 2.78 AIC and I = A x Tc^B (where Tc in hours)
Q = peak flow in litres per second (L/s)
A = area in hectares (ha)
I = rainfall intensity in millimetres per hour (mm/h)
C = runoff coefficient
A, B = design storm coefficients
Tc = time of concentration in minutes (MIN. 10.0 minutes)

1115 10th Street East
STORM SEWER DESIGN SHEET

DESIGN: C.S.
GEI Consultants Canada Ltd.

PROJECT: 1115 Paaji Heights

SHEET NO. 1 of 1

DATE: March 2025

Project No: 2408466

LOCATION			AREA (ha)							SEWER DATA								
STREET	FROM	TO	C = 0.20	C = 0.75	C = 0.90	Individual 2.78 AC	Cumulative 2.78 AC	Time of Concentration Tc (minutes)	Rainfall Intensity I (mm/h)	Peak Flow Q (L/s)	Type of Pipe	Roughness Coefficient (n)	Diameter (mm)	Slope (%)	Length (m)	Capacity (L/s)	Full Flow Velocity (m/s)	Time of Flow (minutes)	Percent of Capacity Used (%)
	DICB	CBMH-1		0.27		0.57	0.57	5.00	299	171	PVC	0.013	375	2.00	20	248	2.25	0.15	68.8%
	CBMH-1	CBMH-2		0.38		0.79	1.36	5.15	292	398	HDPE	0.013	525	1.00	60	430	1.99	0.50	92.6%
	CBMH-2	Outlet								11	PVC	0.013	200	5.00	28	73	2.33	0.20	14.7%

Oriface Calculation

Mannings 'n'	0.013	
Pipe diameter	150	**mm**
Pipe Slope	0.005	m/m
Area	0.018	m^2
Wetted Perimeter	0.471	**m**
Hydraulic	0.038	**m**
Pipe Flow (Q)	**0.011**	m^3/s

Note: CBMH-1 is to have a 150mm oriface on the north outlet, discharge is calculated based on 150mm oriface flowing full

Appendix C Existing Conditions

C.1. Existing OTTHYMO Schematic

C.2. Existing OTTHYMO Output

Project:	1115 Paaji Heights
File No.:	2408466
Date:	Mar-25
Designed	CS
Checked:	AF
Subject:	OTTHYMO Schematic

100

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION:25yr 4hr 5min Chicago **
****

CHICAGO STORM
Ptotal= 60.35 mm

IDF curve parameters: A=1750.276
B= 8.303
C= 0.862
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.69	1.00	10.22	2.00	11.84	3.00	3.99
0.08	2.86	1.08	13.31	2.08	10.19	3.08	3.78
0.17	3.05	1.17	18.82	2.17	8.94	3.17	3.60
0.25	3.28	1.25	30.89	2.25	7.95	3.25	3.43
0.33	3.54	1.33	71.60	2.33	7.16	3.33	3.28
0.42	3.85	1.42	188.05	2.42	6.51	3.42	3.14
0.50	4.23	1.50	86.10	2.50	5.97	3.50	3.01
0.58	4.68	1.58	46.26	2.58	5.51	3.58	2.89
0.67	5.25	1.67	30.37	2.67	5.12	3.67	2.79
0.75	5.98	1.75	22.17	2.75	4.78	3.75	2.69
0.83	6.94	1.83	17.28	2.83	4.49	3.83	2.59
0.92	8.27	1.92	14.08	2.92	4.22	3.92	2.51

CALIB
STANDHYD (0201)
ID= 1 DT=10.0 min

Area (ha)= 0.16
Total Imp(%)= 32.30 Dir. Conn.(%)= 21.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.11
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	10.00	15.00
Length	(m)=	32.66	20.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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

```
**************************************
** SIMULATION:100yr 4hr 5min Chicago **
**************************************
```

CHICAGO STORM	Ptotal= 72.84 mm

IDF curve parameters: A=2171.754
B= 8.303
C= 0.867
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.15	1.00	12.18	2.00	14.13	3.00	4.70
0.08	3.35	1.08	15.91	2.08	12.15	3.08	4.46
0.17	3.59	1.17	22.59	2.17	10.64	3.17	4.23
0.25	3.85	1.25	37.28	2.25	9.45	3.25	4.03
0.33	4.17	1.33	87.10	2.33	8.50	3.33	3.85
0.42	4.54	1.42	230.33	2.42	7.72	3.42	3.69
0.50	4.98	1.50	104.88	2.50	7.07	3.50	3.54
0.58	5.53	1.58	56.05	2.58	6.52	3.58	3.40
0.67	6.21	1.67	36.64	2.67	6.05	3.67	3.27
0.75	7.08	1.75	26.66	2.75	5.65	3.75	3.15
0.83	8.23	1.83	20.72	2.83	5.29	3.83	3.04
0.92	9.83	1.92	16.84	2.92	4.98	3.92	2.94

CALIB STANDHYD (0100) ID= 1 DT= 5.0 min	Area (ha)= 0.79 Total Imp(%)= 37.20 Dir. Conn.(%)= 37.20

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.29	0.50	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	7.70	7.70	
Length	(m)=	72.57	124.00	
Mannings n	=	0.130	0.250	
Max.Eff.Inten.(mm/hr)=		230.33	109.27	
over (min)		5.00	15.00	
Storage Coeff. (min)=		3.26 (ii)	12.22 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.27	0.09	
				TOTALS
PEAK FLOW	(cms)=	0.16	0.08	0.192 (iii)
TIME TO PEAK	(hrs)=	1.50	1.67	1.50
RUNOFF VOLUME	(mm)=	71.84	43.82	54.23

```
     TOTAL RAINFALL   (mm)=      72.84        72.84          72.84
     RUNOFF COEFFICIENT   =       0.99         0.60           0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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************************************
** SIMULATION:25yr 4hr 5min Chicago **
************************************
---------------------------------
| CHICAGO STORM    |    IDF curve parameters: A=1750.276
| Ptotal= 60.35 mm |                          B=   8.303
--------------------                          C=   0.862
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.38

                TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                 hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                0.00     2.69 |  1.00    10.22 |  2.00    11.84 |  3.00     3.99
                0.08     2.86 |  1.08    13.31 |  2.08    10.19 |  3.08     3.78
                0.17     3.05 |  1.17    18.82 |  2.17     8.94 |  3.17     3.60
                0.25     3.28 |  1.25    30.89 |  2.25     7.95 |  3.25     3.43
                0.33     3.54 |  1.33    71.60 |  2.33     7.16 |  3.33     3.28
                0.42     3.85 |  1.42   188.05 |  2.42     6.51 |  3.42     3.14
                0.50     4.23 |  1.50    86.10 |  2.50     5.97 |  3.50     3.01
                0.58     4.68 |  1.58    46.26 |  2.58     5.51 |  3.58     2.89
                0.67     5.25 |  1.67    30.37 |  2.67     5.12 |  3.67     2.79
                0.75     5.98 |  1.75    22.17 |  2.75     4.78 |  3.75     2.69
                0.83     6.94 |  1.83    17.28 |  2.83     4.49 |  3.83     2.59
                0.92     8.27 |  1.92    14.08 |  2.92     4.22 |  3.92     2.51


--------------------------------------------------------------------------------------------------------------------------
-
------------------------
| CALIB                |
| STANDHYD (  0100)|   Area    (ha)=   0.79
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  37.20
------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29          0.50
     Dep. Storage     (mm)=       1.00          1.50
```

Average Slope	(%)=	7.70	7.70	
Length	(m)=	72.57	124.00	
Mannings n	=	0.130	0.250	
Max.Eff.Inten.(mm/hr)=		188.05	65.49	
over (min)		5.00	15.00	
Storage Coeff. (min)=		3.53 (ii)	14.53 (ii)	
Unit Hyd. Tpeak (min)=		5.00	15.00	
Unit Hyd. peak (cms)=		0.26	0.08	
				TOTALS
PEAK FLOW	(cms)=	0.13	0.06	0.149 (iii)
TIME TO PEAK	(hrs)=	1.50	1.75	1.50
RUNOFF VOLUME	(mm)=	59.35	33.40	43.05
TOTAL RAINFALL	(mm)=	60.35	60.35	60.35
RUNOFF COEFFICIENT	=	0.98	0.55	0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION:2yr 3hr 5min Chicago **
****

CHICAGO STORM
Ptotal= 33.23 mm

IDF curve parameters: A= 854.100
B= 7.781
C= 0.830
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.37	0.75	8.07	1.50	10.29	2.25	3.57
0.08	2.56	0.83	11.14	1.58	8.50	2.33	3.34
0.17	2.79	0.92	17.74	1.67	7.24	2.42	3.13
0.25	3.07	1.00	39.66	1.75	6.30	2.50	2.95
0.33	3.41	1.08	103.05	1.83	5.58	2.58	2.79
0.42	3.85	1.17	47.46	1.92	5.01	2.67	2.65
0.50	4.42	1.25	26.04	2.00	4.55	2.75	2.52
0.58	5.20	1.33	17.46	2.08	4.17	2.83	2.41
0.67	6.32	1.42	12.99	2.17	3.85	2.92	2.30

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-----------------------
| CALIB             |
| STANDHYD (  0100)|   Area    (ha)=   0.79
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  37.20
-----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.50
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       7.70         7.70
     Length            (m)=      72.57       124.00
     Mannings n           =      0.130        0.250

     Max.Eff.Inten.(mm/hr)=     103.05        21.51
               over (min)          5.00        25.00
     Storage Coeff.  (min)=       4.49 (ii)   21.67 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.23         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.02          0.068 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.58           1.17
     RUNOFF VOLUME    (mm)=      32.23        13.15          20.23
     TOTAL RAINFALL   (mm)=      33.23        33.23          33.23
     RUNOFF COEFFICIENT   =       0.97         0.40           0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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**********************************
** SIMULATION:5yr 3hr 5min Chicago **
**********************************
--------------------------------
| CHICAGO STORM    |    IDF curve parameters: A=1234.576
| Ptotal= 42.93 mm |                          B=   8.297
--------------------                          C=   0.851
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.38

                  TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                   hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                  0.00     2.80 |  0.75    10.17 |  1.50    13.13 |  2.25     4.31
```

0.08	3.04	0.83	14.27	1.58	10.75	2.33	4.01
0.17	3.33	0.92	23.16	1.67	9.08	2.42	3.75
0.25	3.68	1.00	52.75	1.75	7.85	2.50	3.53
0.33	4.11	1.08	136.52	1.83	6.91	2.58	3.33
0.42	4.67	1.17	63.26	1.92	6.16	2.67	3.15
0.50	5.40	1.25	34.39	2.00	5.57	2.75	2.99
0.58	6.40	1.33	22.78	2.08	5.07	2.83	2.84
0.67	7.87	1.42	16.75	2.17	4.66	2.92	2.71

CALIB STANDHYD (0100) ID= 1 DT= 5.0 min	Area (ha)= 0.79 Total Imp(%)= 37.20 Dir. Conn.(%)= 37.20

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.29	0.50	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	7.70	7.70	
Length	(m)=	72.57	124.00	
Mannings n	=	0.130	0.250	
Max.Eff.Inten.(mm/hr)	=	136.52	39.94	
over (min)		5.00	20.00	
Storage Coeff.	(min)=	4.02 (ii)	17.42 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	20.00	
Unit Hyd. peak	(cms)=	0.24	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.09	0.03	0.097 (iii)
TIME TO PEAK	(hrs)=	1.17	1.50	1.17
RUNOFF VOLUME	(mm)=	41.93	19.90	28.08
TOTAL RAINFALL	(mm)=	42.93	42.93	42.93
RUNOFF COEFFICIENT	=	0.98	0.46	0.65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION:Timmins Storm **
****

READ STORM	Filename: C:\Users\cslocombe\AppD

| | ata\Local\Temp\

| |
9abd5862-7733-4c36-baad-389983f9706a\d56d26b0
| Ptotal=193.00 mm | Comments: Timmins Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	15.00	3.00	3.00	6.00	43.00	9.00	13.00
1.00	20.00	4.00	5.00	7.00	20.00	10.00	13.00
2.00	10.00	5.00	20.00	8.00	23.00	11.00	8.00

| CALIB |
| STANDHYD (0100) | Area (ha)= 0.79
| ID= 1 DT= 5.0 min | Total Imp(%)= 37.20 Dir. Conn.(%)= 37.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.29	0.50
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	7.70	7.70
Length	(m)=	72.57	124.00
Mannings n	=	0.130	0.250

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	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00

1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	39.35	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.37 (ii)	19.86 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.18	0.06	
			TOTALS
PEAK FLOW (cms)=	0.04	0.05	0.086 (iii)
TIME TO PEAK (hrs)=	7.00	7.00	7.00
RUNOFF VOLUME (mm)=	192.00	155.18	168.86
TOTAL RAINFALL (mm)=	193.00	193.00	193.00
RUNOFF COEFFICIENT =	0.99	0.80	0.87

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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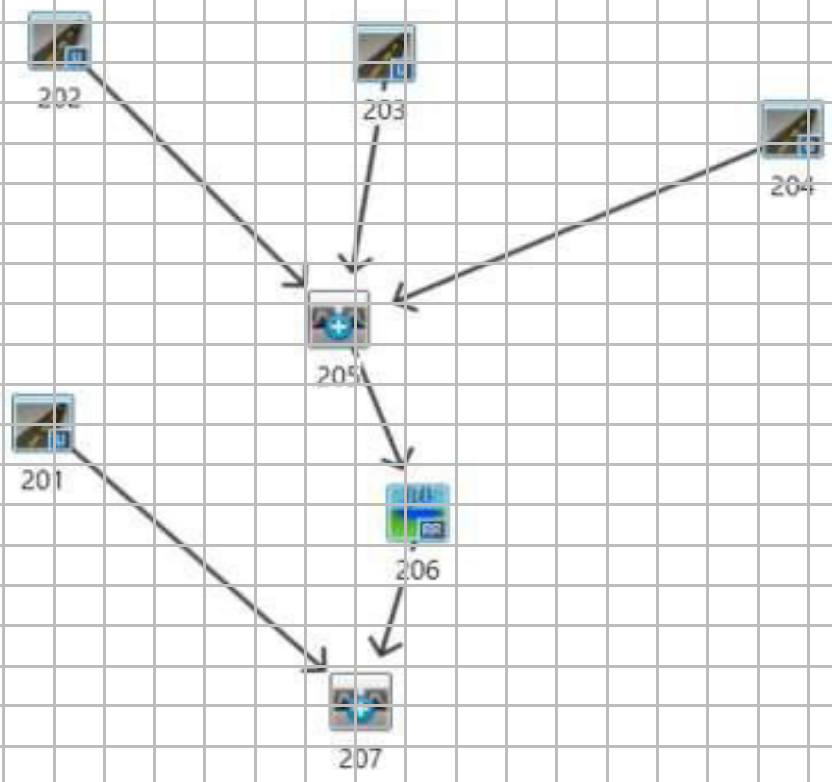
Appendix D Post-Development Conditions

D.1. Post-Development OTTHYMO Schematic

D.2. Post-Development OTTHYMO Output

Project:	1115 Paaji Heights
File No.:	2408466
Date:	Mar-25
Designed	CS
Checked:	AF
Subject:	OTTHYMO Schematic



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**************************************
** SIMULATION:100yr 4hr 5min Chicago **
**************************************
```

CHICAGO STORM	Ptotal= 72.84 mm

IDF curve parameters: A=2171.754
B= 8.303
C= 0.867
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.15	1.00	12.18	2.00	14.13	3.00	4.70
0.08	3.35	1.08	15.91	2.08	12.15	3.08	4.46
0.17	3.59	1.17	22.59	2.17	10.64	3.17	4.23
0.25	3.85	1.25	37.28	2.25	9.45	3.25	4.03
0.33	4.17	1.33	87.10	2.33	8.50	3.33	3.85
0.42	4.54	1.42	230.33	2.42	7.72	3.42	3.69
0.50	4.98	1.50	104.88	2.50	7.07	3.50	3.54
0.58	5.53	1.58	56.05	2.58	6.52	3.58	3.40
0.67	6.21	1.67	36.64	2.67	6.05	3.67	3.27
0.75	7.08	1.75	26.66	2.75	5.65	3.75	3.15
0.83	8.23	1.83	20.72	2.83	5.29	3.83	3.04
0.92	9.83	1.92	16.84	2.92	4.98	3.92	2.94

CALIB STANDHYD (0201) ID= 1 DT=10.0 min	Area (ha)= 0.16 Total Imp(%)= 32.30 Dir. Conn.(%)= 21.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.11
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	10.00	15.00
Length	(m)=	32.66	20.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	3.25	1.167	14.04	2.167	13.14	3.17	4.58
0.333	3.72	1.333	29.93	2.333	10.04	3.33	4.13

```
                0.500    4.35 | 1.500  158.71 | 2.500    8.11 |  3.50    3.77
                0.667    5.25 | 1.667   80.46 | 2.667    6.80 |  3.67    3.47
                0.833    6.64 | 1.833   31.65 | 2.833    5.85 |  3.83    3.21
                1.000    9.03 | 2.000   18.78 | 3.000    5.14 |  4.00    2.99

     Max.Eff.Inten.(mm/hr)=     158.71       112.89
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       2.17 (ii)    4.59 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.17         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.03          0.045 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      72.04        46.52          51.93
     TOTAL RAINFALL   (mm)=      72.84        72.84          72.84
     RUNOFF COEFFICIENT   =       0.99         0.64           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------------
-----------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   0.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  82.70   Dir. Conn.(%)=  82.70
-----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.26         0.06
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       5.00         2.00
     Length            (m)=      46.19         3.00
     Mannings n           =      0.130        0.250

     Max.Eff.Inten.(mm/hr)=     230.33       109.27
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.83 (ii)    3.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.28         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.02          0.168 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      71.84        43.82          66.99
     TOTAL RAINFALL   (mm)=      72.84        72.84          72.84
     RUNOFF COEFFICIENT   =       0.99         0.60           0.92
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
STANDHYD (0203)	Area (ha)=	0.06			
ID= 1 DT= 5.0 min	Total Imp(%)=	81.80	Dir. Conn.(%)=	81.80	
		IMPERVIOUS	PERVIOUS (i)		
Surface Area	(ha)=	0.05	0.01		
Dep. Storage	(mm)=	1.00	1.50		
Average Slope	(%)=	5.00	2.00		
Length	(m)=	20.00	3.00		
Mannings n	=	0.130	0.250		
Max.Eff.Inten.(mm/hr)=		230.33	109.27		
over (min)		5.00	5.00		
Storage Coeff. (min)=		1.71 (ii)	2.30 (ii)		
Unit Hyd. Tpeak (min)=		5.00	5.00		
Unit Hyd. peak (cms)=		0.32	0.30		
				TOTALS	
PEAK FLOW	(cms)=	0.03	0.00	0.034 (iii)	
TIME TO PEAK	(hrs)=	1.50	1.50	1.50	
RUNOFF VOLUME	(mm)=	71.84	43.82	66.73	
TOTAL RAINFALL	(mm)=	72.84	72.84	72.84	
RUNOFF COEFFICIENT	=	0.99	0.60	0.92	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB				
STANDHYD (0204)	Area (ha)=	0.25		
ID= 1 DT=10.0 min	Total Imp(%)=	23.70	Dir. Conn.(%)=	1.00
		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.06	0.19	
Dep. Storage	(mm)=	0.80	1.50	

Average Slope	(%)=	2.00	2.00
Length	(m)=	40.82	40.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	3.25	1.167	14.04	2.167	13.14	3.17	4.58
0.333	3.72	1.333	29.93	2.333	10.04	3.33	4.13
0.500	4.35	1.500	158.71	2.500	8.11	3.50	3.77
0.667	5.25	1.667	80.46	2.667	6.80	3.67	3.47
0.833	6.64	1.833	31.65	2.833	5.85	3.83	3.21
1.000	9.03	2.000	18.78	3.000	5.14	4.00	2.99

Max.Eff.Inten.(mm/hr)=	158.71	132.44		
over (min)	10.00	20.00		
Storage Coeff. (min)=	4.01 (ii)	10.32 (ii)		
Unit Hyd. Tpeak (min)=	10.00	20.00		
Unit Hyd. peak (cms)=	0.16	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.00	0.05	0.046 (iii)	
TIME TO PEAK (hrs)=	1.50	1.67	1.67	
RUNOFF VOLUME (mm)=	72.04	48.38	48.58	
TOTAL RAINFALL (mm)=	72.84	72.84	72.84	
RUNOFF COEFFICIENT =	0.99	0.66	0.67	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0205)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0202):	0.32	0.168	1.50	66.99
+	ID2= 2 (0203):	0.06	0.034	1.50	66.73
	ID = 3 (0205):	0.38	0.202	1.50	66.94

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0205)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0205):	0.38	0.202	1.50	66.94
	+ ID2= 2 (0204):	0.25	0.046	1.67	48.58
	ID = 1 (0205):	0.63	0.224	1.50	59.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0206)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0537	0.0085
	0.0153	0.0009	0.0564	0.0094
	0.0230	0.0018	0.0589	0.0102
	0.0287	0.0027	0.0614	0.0111
	0.0334	0.0037	0.0637	0.0119
	0.0376	0.0043	0.0660	0.0128
	0.0413	0.0051	0.0744	0.0136
	0.0447	0.0060	0.0752	0.0137
	0.0479	0.0068	0.0775	0.0138
	0.0509	0.0077	0.8718	0.0138

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0205)	0.630	0.224	1.50	59.65
OUTFLOW: ID= 1 (0206)	0.630	0.072	1.83	59.64

PEAK FLOW REDUCTION [Qout/Qin](%)= 32.15
TIME SHIFT OF PEAK FLOW (min)= 20.00
MAXIMUM STORAGE USED (ha.m.)= 0.0134

ADD HYD (0207)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0201):	0.16	0.045	1.50	51.93
	+ ID2= 2 (0206):	0.63	0.072	1.83	59.64
	ID = 3 (0207):	0.79	0.097	1.58	58.07

0.167	2.77	1.167	11.76	2.167	11.02	3.17	3.89
0.333	3.17	1.333	24.86	2.333	8.45	3.33	3.51
0.500	3.70	1.500	129.82	2.500	6.84	3.50	3.21
0.667	4.45	1.667	66.18	2.667	5.74	3.67	2.95
0.833	5.61	1.833	26.27	2.833	4.95	3.83	2.74
1.000	7.61	2.000	15.68	3.000	4.35	4.00	2.55

Max.Eff.Inten.(mm/hr)=	129.82	83.77	
over (min)	10.00	10.00	
Storage Coeff. (min)=	2.35 (ii)	5.08 (ii)	
Unit Hyd. Tpeak (min)=	10.00	10.00	
Unit Hyd. peak (cms)=	0.17	0.15	
			TOTALS
PEAK FLOW (cms)=	0.01	0.02	0.034 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	59.55	35.75	40.79
TOTAL RAINFALL (mm)=	60.35	60.35	60.35
RUNOFF COEFFICIENT =	0.99	0.59	0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
STANDHYD (0202)	Area (ha)=	0.32			
ID= 1 DT= 5.0 min	Total Imp(%)=	82.70	Dir. Conn.(%)=	82.70	

		IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=		0.26	0.06	
Dep. Storage (mm)=		1.00	1.50	
Average Slope (%)=		5.00	2.00	
Length (m)=		46.19	3.00	
Mannings n =		0.130	0.250	
Max.Eff.Inten.(mm/hr)=		188.05	81.58	
over (min)		5.00	5.00	
Storage Coeff. (min)=		3.07 (ii)	3.69 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.27	0.25	
				TOTALS
PEAK FLOW (cms)=		0.12	0.01	0.133 (iii)
TIME TO PEAK (hrs)=		1.50	1.50	1.50
RUNOFF VOLUME (mm)=		59.35	33.40	54.85
TOTAL RAINFALL (mm)=		60.35	60.35	60.35

```
     RUNOFF COEFFICIENT   =       0.98         0.55           0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------
-------------------------
| CALIB             |
| STANDHYD (  0203)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  81.80   Dir. Conn.(%)=  81.80
-------------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       5.00         2.00
     Length            (m)=      20.00         3.00
     Mannings n           =      0.130        0.250

     Max.Eff.Inten.(mm/hr)=     188.05        81.58
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       1.86 (ii)    2.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.29
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.027 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      59.35        33.40          54.61
     TOTAL RAINFALL   (mm)=      60.35        60.35          60.35
     RUNOFF COEFFICIENT   =       0.98         0.55           0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------
---------------------------------
| CALIB             |
| STANDHYD (  0204)|   Area    (ha)=   0.25
|ID= 1 DT=10.0 min |   Total Imp(%)=  23.70   Dir. Conn.(%)=   1.00
---------------------------------
                              IMPERVIOUS    PERVIOUS (i)
```

Surface Area	(ha)=	0.06	0.19
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	2.00	2.00
Length	(m)=	40.82	40.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	2.77	1.167	11.76	2.167	11.02	3.17	3.89
0.333	3.17	1.333	24.86	2.333	8.45	3.33	3.51
0.500	3.70	1.500	129.82	2.500	6.84	3.50	3.21
0.667	4.45	1.667	66.18	2.667	5.74	3.67	2.95
0.833	5.61	1.833	26.27	2.833	4.95	3.83	2.74
1.000	7.61	2.000	15.68	3.000	4.35	4.00	2.55

Max.Eff.Inten.(mm/hr)=	129.82	98.96		
over (min)	10.00	20.00		
Storage Coeff. (min)=	4.35 (ii)	11.43 (ii)		
Unit Hyd. Tpeak (min)=	10.00	20.00		
Unit Hyd. peak (cms)=	0.15	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.00	0.03	0.033 (iii)	
TIME TO PEAK (hrs)=	1.50	1.67	1.67	
RUNOFF VOLUME (mm)=	59.55	37.38	37.56	
TOTAL RAINFALL (mm)=	60.35	60.35	60.35	
RUNOFF COEFFICIENT =	0.99	0.62	0.62	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0205)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	0.32	0.133	1.50	54.85
+ ID2= 2 (0203):	0.06	0.027	1.50	54.61

```
        ID = 3 (  0205):     0.38   0.160     1.50     54.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
| ADD HYD  (  0205)|
|   3 +  2 =  1    |          AREA     QPEAK     TPEAK      R.V.
-------------------           (ha)     (cms)     (hrs)      (mm)
        ID1= 3 (  0205):     0.38   0.160     1.50     54.81
      + ID2= 2 (  0204):     0.25   0.033     1.67     37.56
        ================================================
        ID = 1 (  0205):     0.63   0.176     1.50     47.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
| RESERVOIR(  0206)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
-------------------         (cms)     (ha.m.)   |    (cms)     (ha.m.)
                            0.0000      0.0000   |    0.0537      0.0085
                            0.0153      0.0009   |    0.0564      0.0094
                            0.0230      0.0018   |    0.0589      0.0102
                            0.0287      0.0027   |    0.0614      0.0111
                            0.0334      0.0037   |    0.0637      0.0119
                            0.0376      0.0043   |    0.0660      0.0128
                            0.0413      0.0051   |    0.0744      0.0136
                            0.0447      0.0060   |    0.0752      0.0137
                            0.0479      0.0068   |    0.0775      0.0138
                            0.0509      0.0077   |    0.8718      0.0138

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0205)      0.630      0.176      1.50      47.96
   OUTFLOW: ID= 1 (  0206)      0.630      0.058      1.83      47.95

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 33.11
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0101
```

```
| ADD HYD  (  0207)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
-------------------           (ha)     (cms)     (hrs)      (mm)
        ID1= 1 (  0201):     0.16   0.034     1.50
                             40.79
      + ID2= 2 (  0206):     0.63   0.058     1.83     47.95
        ================================================
```

ID = 3 (0207): 0.79 0.080 1.67 46.50

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION:2yr 3hr 5min Chicago **
****

| CHICAGO STORM |
| Ptotal= 33.23 mm |

IDF curve parameters: A= 854.100
B= 7.781
C= 0.830
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.37	0.75	8.07	1.50	10.29	2.25	3.57
0.08	2.56	0.83	11.14	1.58	8.50	2.33	3.34
0.17	2.79	0.92	17.74	1.67	7.24	2.42	3.13
0.25	3.07	1.00	39.66	1.75	6.30	2.50	2.95
0.33	3.41	1.08	103.05	1.83	5.58	2.58	2.79
0.42	3.85	1.17	47.46	1.92	5.01	2.67	2.65
0.50	4.42	1.25	26.04	2.00	4.55	2.75	2.52
0.58	5.20	1.33	17.46	2.08	4.17	2.83	2.41
0.67	6.32	1.42	12.99	2.17	3.85	2.92	2.30

| CALIB |
| STANDHYD (0201) |
| ID= 1 DT=10.0 min |

Area (ha)= 0.16
Total Imp(%)= 32.30 Dir. Conn.(%)= 21.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.11
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	10.00	15.00
Length	(m)=	32.66	20.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	2.47	1.000	14.44	1.833	6.77	2.67	2.87

```
                0.333    2.93 | 1.167   71.36 | 2.000    5.30 |  2.83    2.58
                0.500    3.63 | 1.333   36.75 | 2.167    4.36 |  3.00    2.35
                0.667    4.81 | 1.500   15.22 | 2.333    3.71 |
                0.833    7.19 | 1.667    9.40 | 2.500    3.23 |

     Max.Eff.Inten.(mm/hr)=      71.36        31.16
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       2.98 (ii)    7.04 (ii)
     Unit Hyd. Tpeak (min)=      10.00        10.00
     Unit Hyd. peak  (cms)=       0.16         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.01          0.014 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17           1.17
     RUNOFF VOLUME    (mm)=      32.43        14.48          18.27
     TOTAL RAINFALL   (mm)=      33.23        33.23          33.23
     RUNOFF COEFFICIENT   =       0.98         0.44           0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------------
-----------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   0.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  82.70   Dir. Conn.(%)=  82.70
-----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.26         0.06
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       5.00         2.00
     Length            (m)=      46.19         3.00
     Mannings n           =      0.130        0.250

     Max.Eff.Inten.(mm/hr)=     103.05        31.04
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       3.90 (ii)    4.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.25         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.00          0.066 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17           1.17
     RUNOFF VOLUME    (mm)=      32.23        13.15          28.92
     TOTAL RAINFALL   (mm)=      33.23        33.23          33.23
     RUNOFF COEFFICIENT   =       0.97         0.40           0.87
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0203)	Area (ha)= 0.06
ID= 1 DT= 5.0 min	Total Imp(%)= 81.80 Dir. Conn.(%)= 81.80

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.05	0.01	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	5.00	2.00	
Length	(m)=	20.00	3.00	
Mannings n	=	0.130	0.250	
Max.Eff.Inten.(mm/hr)=		103.05	31.04	
over (min)		5.00	5.00	
Storage Coeff. (min)=		2.36 (ii)	3.17 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.30	0.27	
				TOTALS
PEAK FLOW	(cms)=	0.01	0.00	0.014 (iii)
TIME TO PEAK	(hrs)=	1.17	1.17	1.17
RUNOFF VOLUME	(mm)=	32.23	13.15	28.73
TOTAL RAINFALL	(mm)=	33.23	33.23	33.23
RUNOFF COEFFICIENT	=	0.97	0.40	0.86

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0204)	Area (ha)= 0.25
ID= 1 DT=10.0 min	Total Imp(%)= 23.70 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.06	0.19
Dep. Storage	(mm)=	0.80	1.50

Average Slope	(%)=	2.00	2.00
Length	(m)=	40.82	40.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	2.47	1.000	14.44	1.833	6.77	2.67	2.87
0.333	2.93	1.167	71.36	2.000	5.30	2.83	2.58
0.500	3.63	1.333	36.75	2.167	4.36	3.00	2.35
0.667	4.81	1.500	15.22	2.333	3.71		
0.833	7.19	1.667	9.40	2.500	3.23		

Max.Eff.Inten.(mm/hr)=		71.36	32.98	
	over (min)	10.00	20.00	
Storage Coeff. (min)=		5.52 (ii)	16.52 (ii)	
Unit Hyd. Tpeak (min)=		10.00	20.00	
Unit Hyd. peak (cms)=		0.14	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.00	0.01	0.011 (iii)
TIME TO PEAK	(hrs)=	1.17	1.50	1.50
RUNOFF VOLUME	(mm)=	32.43	15.44	15.58
TOTAL RAINFALL	(mm)=	33.23	33.23	33.23
RUNOFF COEFFICIENT	=	0.98	0.46	0.47

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0205)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0202):	0.32	0.066	1.17	28.92
+	ID2= 2 (0203):	0.06	0.014	1.17	28.73
	ID = 3 (0205):	0.38	0.080	1.17	28.89

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| ADD HYD  (  0205)|
|   3 +  2 =  1    |          AREA     QPEAK     TPEAK      R.V.
-------------------           (ha)     (cms)     (hrs)      (mm)
        ID1= 3 (  0205):      0.38    0.080      1.17
                              28.89
      + ID2= 2 (  0204):      0.25    0.011      1.50     15.58
        ================================================
        ID = 1 (  0205):      0.63    0.085      1.17     23.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
| RESERVOIR(  0206)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
-------------------         (cms)     (ha.m.)   |    (cms)     (ha.m.)
                            0.0000      0.0000   |    0.0537      0.0085
                            0.0153      0.0009   |    0.0564      0.0094
                            0.0230      0.0018   |    0.0589      0.0102
                            0.0287      0.0027   |    0.0614      0.0111
                            0.0334      0.0037   |    0.0637      0.0119
                            0.0376      0.0043   |    0.0660      0.0128
                            0.0413      0.0051   |    0.0744      0.0136
                            0.0447      0.0060   |    0.0752      0.0137
                            0.0479      0.0068   |    0.0775      0.0138
                            0.0509      0.0077   |    0.8718      0.0138

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0205)      0.630      0.085      1.17       23.61
   OUTFLOW: ID= 1 (  0206)      0.630      0.036      1.42       23.60

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 42.37
                  TIME SHIFT OF PEAK FLOW         (min)= 15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0041
```

```
| ADD HYD  (  0207)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
-------------------           (ha)     (cms)     (hrs)      (mm)
        ID1= 1 (  0201):      0.16    0.014      1.17
                              18.27
      + ID2= 2 (  0206):      0.63    0.036      1.42     23.60
        ================================================
        ID = 3 (  0207):      0.79    0.046      1.33     22.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

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************************************
** SIMULATION:5yr 3hr 5min Chicago **
************************************
```

CHICAGO STORM	Ptotal= 42.93 mm

IDF curve parameters: A=1234.576
B= 8.297
C= 0.851
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.38

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.80	0.75	10.17	1.50	13.13	2.25	4.31
0.08	3.04	0.83	14.27	1.58	10.75	2.33	4.01
0.17	3.33	0.92	23.16	1.67	9.08	2.42	3.75
0.25	3.68	1.00	52.75	1.75	7.85	2.50	3.53
0.33	4.11	1.08	136.52	1.83	6.91	2.58	3.33
0.42	4.67	1.17	63.26	1.92	6.16	2.67	3.15
0.50	5.40	1.25	34.39	2.00	5.57	2.75	2.99
0.58	6.40	1.33	22.78	2.08	5.07	2.83	2.84
0.67	7.87	1.42	16.75	2.17	4.66	2.92	2.71

CALIB STANDHYD (0201) ID= 1 DT=10.0 min

Area (ha)= 0.16
Total Imp(%)= 32.30 Dir. Conn.(%)= 21.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.11
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	10.00	15.00
Length	(m)=	32.66	20.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	2.92	1.000	18.71	1.833	8.46	2.67	3.43
0.333	3.50	1.167	94.64	2.000	6.53	2.83	3.07
0.500	4.39	1.333	48.82	2.167	5.32	3.00	2.78
0.667	5.90	1.500	19.76	2.333	4.49		

```
                0.833    9.02 | 1.667   11.94 | 2.500    3.88 |

     Max.Eff.Inten.(mm/hr)=       94.64         49.55
               over (min)        10.00         10.00
     Storage Coeff.  (min)=       2.66 (ii)     6.03 (ii)
     Unit Hyd. Tpeak (min)=      10.00         10.00
     Unit Hyd. peak  (cms)=       0.17          0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01          0.01          0.021 (iii)
     TIME TO PEAK    (hrs)=       1.17          1.17           1.17
     RUNOFF VOLUME    (mm)=      42.13         21.63          25.96
     TOTAL RAINFALL   (mm)=      42.93         42.93          42.93
     RUNOFF COEFFICIENT   =       0.98          0.50           0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------------------------------------
---------------------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   0.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  82.70   Dir. Conn.(%)=  82.70
---------------------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.26          0.06
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       5.00          2.00
     Length            (m)=      46.19          3.00
     Mannings n           =      0.130         0.250

     Max.Eff.Inten.(mm/hr)=      136.52         49.17
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       3.49 (ii)     4.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.26          0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08          0.01          0.091 (iii)
     TIME TO PEAK    (hrs)=       1.17          1.17           1.17
     RUNOFF VOLUME    (mm)=      41.93         19.90          38.11
     TOTAL RAINFALL   (mm)=      42.93         42.93          42.93
     RUNOFF COEFFICIENT   =       0.98          0.46           0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------
------------------------
| CALIB              |
| STANDHYD (  0203)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  81.80   Dir. Conn.(%)=  81.80
------------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       5.00         2.00
     Length            (m)=      20.00         3.00
     Mannings n             =    0.130        0.250

     Max.Eff.Inten.(mm/hr)=     136.52        49.17
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       2.11 (ii)    2.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.019 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17           1.17
     RUNOFF VOLUME    (mm)=      41.93        19.90          37.89
     TOTAL RAINFALL   (mm)=      42.93        42.93          42.93
     RUNOFF COEFFICIENT   =       0.98         0.46           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------------------------
------------------------
| CALIB              |
| STANDHYD (  0204)|   Area    (ha)=   0.25
|ID= 1 DT=10.0 min |   Total Imp(%)=  23.70   Dir. Conn.(%)=   1.00
------------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.06         0.19
     Dep. Storage     (mm)=       0.80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.82        40.00
     Mannings n             =    0.130        0.250
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	2.92	1.000	18.71	1.833	8.46	2.67	3.43
0.333	3.50	1.167	94.64	2.000	6.53	2.83	3.07
0.500	4.39	1.333	48.82	2.167	5.32	3.00	2.78
0.667	5.90	1.500	19.76	2.333	4.49		
0.833	9.02	1.667	11.94	2.500	3.88		

			TOTALS
Max.Eff.Inten.(mm/hr)=	94.64	59.30	
over (min)	10.00	20.00	
Storage Coeff. (min)=	4.93 (ii)	13.63 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.15	0.07	
PEAK FLOW (cms)=	0.00	0.02	0.019 (iii)
TIME TO PEAK (hrs)=	1.17	1.33	1.33
RUNOFF VOLUME (mm)=	42.13	22.86	23.02
TOTAL RAINFALL (mm)=	42.93	42.93	42.93
RUNOFF COEFFICIENT =	0.98	0.53	0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0   Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0205)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0202):	0.32	0.091	1.17	38.11
	+ ID2= 2 (0203):	0.06	0.019	1.17	37.89
	ID = 3 (0205):	0.38	0.111	1.17	38.08

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| ADD HYD  (  0205)|
|   3 +  2 =  1    |          AREA     QPEAK     TPEAK      R.V.
-------------------          (ha)     (cms)     (hrs)      (mm)
        ID1= 3 (  0205):      0.38    0.111      1.17
                              38.08
      + ID2= 2 (  0204):      0.25    0.019      1.33     23.02
        ================================================
        ID = 1 (  0205):      0.63    0.119      1.17     32.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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-------------------------
| RESERVOIR( 0206)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW     STORAGE    |  OUTFLOW     STORAGE
-------------------         (cms)     (ha.m.)    |    (cms)     (ha.m.)
                             0.0000      0.0000   |     0.0537      0.0085
                             0.0153      0.0009   |     0.0564      0.0094
                             0.0230      0.0018   |     0.0589      0.0102
                             0.0287      0.0027   |     0.0614      0.0111
                             0.0334      0.0037   |     0.0637      0.0119
                             0.0376      0.0043   |     0.0660      0.0128
                             0.0413      0.0051   |     0.0744      0.0136
                             0.0447      0.0060   |     0.0752      0.0137
                             0.0479      0.0068   |     0.0775      0.0138
                             0.0509      0.0077   |     0.8718      0.0138

                                  AREA      QPEAK      TPEAK        R.V.
                                  (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0205)       0.630       0.119       1.17       32.10
   OUTFLOW: ID= 1 (  0206)       0.630       0.045       1.42       32.09

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.15
                  TIME SHIFT OF PEAK FLOW         (min)= 15.00
                  MAXIMUM  STORAGE    USED       (ha.m.)=  0.0062

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---------------------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
-------------------          (ha)     (cms)     (hrs)      (mm)
        ID1= 1 (  0201):      0.16    0.021      1.17     25.96
      + ID2= 2 (  0206):      0.63    0.045      1.42     32.09
        ================================================
        ID = 3 (  0207):      0.79    0.060      1.33     30.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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******************************
** SIMULATION:Timmins Storm    **
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****

READ STORM	Filename: C:\Users\cslocombe\AppData\Local\Temp\b27be8bb-5b62-4d85-b50f-b14cc96021e9\d56d26b0
Ptotal=193.00 mm	Comments: Timmins Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	15.00	3.00	3.00	6.00	43.00	9.00	13.00
1.00	20.00	4.00	5.00	7.00	20.00	10.00	13.00
2.00	10.00	5.00	20.00	8.00	23.00	11.00	8.00

CALIB STANDHYD (0201)	Area (ha)= 0.16
ID= 1 DT=10.0 min	Total Imp(%)= 32.30 Dir. Conn.(%)= 21.20

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.11
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	10.00	15.00
Length	(m)=	32.66	20.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00

2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	46.73	
over (min)	10.00	10.00	
Storage Coeff. (min)=	3.65 (ii)	7.10 (ii)	
Unit Hyd. Tpeak (min)=	10.00	10.00	
Unit Hyd. peak (cms)=	0.16	0.13	
			TOTALS
PEAK FLOW (cms)=	0.00	0.01	0.018 (iii)
TIME TO PEAK (hrs)=	6.83	7.00	7.00
RUNOFF VOLUME (mm)=	192.20	159.64	166.53
TOTAL RAINFALL (mm)=	193.00	193.00	193.00
RUNOFF COEFFICIENT =	1.00	0.83	0.86

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
STANDHYD (0202)	Area (ha)=	0.32	
ID= 1 DT= 5.0 min	Total Imp(%)=	82.70	Dir. Conn.(%)= 82.70

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.26	0.06
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	5.00	2.00
Length	(m)=	46.19	3.00
Mannings n	=	0.130	0.250

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	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00

0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	39.44	
over (min)	5.00	10.00	
Storage Coeff. (min)=	5.53 (ii)	6.65 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.20	0.14	
			TOTALS
PEAK FLOW (cms)=	0.03	0.01	0.038 (iii)
TIME TO PEAK (hrs)=	7.00	7.00	7.00
RUNOFF VOLUME (mm)=	192.00	155.18	185.62
TOTAL RAINFALL (mm)=	193.00	193.00	193.00
RUNOFF COEFFICIENT =	0.99	0.80	0.96

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0203)	Area (ha)= 0.06
ID= 1 DT= 5.0 min	Total Imp(%)= 81.80 Dir. Conn.(%)= 81.80

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.05	0.01
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	5.00	2.00
Length	(m)=	20.00	3.00
Mannings n	=	0.130	0.250

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	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00

2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	39.44	
over (min)	5.00	5.00	
Storage Coeff. (min)=	3.35 (ii)	4.49 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.26	0.23	
			TOTALS
PEAK FLOW (cms)=	0.01	0.00	0.007 (iii)
TIME TO PEAK (hrs)=	6.67	7.00	7.00
RUNOFF VOLUME (mm)=	192.00	155.18	185.24
TOTAL RAINFALL (mm)=	193.00	193.00	193.00
RUNOFF COEFFICIENT =	0.99	0.80	0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0204)
ID= 1 DT=10.0 min

Area (ha)= 0.25
Total Imp(%)= 23.70 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.06	0.19
Dep. Storage	(mm)=	0.80	1.50
Average Slope	(%)=	2.00	2.00
Length	(m)=	40.82	40.00
Mannings n	=	0.130	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 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
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00

1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	52.66	
over (min)	10.00	20.00	
Storage Coeff. (min)=	6.76 (ii)	15.89 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.13	0.06	
			TOTALS
PEAK FLOW (cms)=	0.00	0.03	0.027 (iii)
TIME TO PEAK (hrs)=	7.00	7.00	7.00
RUNOFF VOLUME (mm)=	192.20	162.57	162.84
TOTAL RAINFALL (mm)=	193.00	193.00	193.00
RUNOFF COEFFICIENT =	1.00	0.84	0.84

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0205)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	0.32	0.038	7.00	185.62
+ ID2= 2 (0203):	0.06	0.007	7.00	185.24
ID = 3 (0205):	0.38	0.045	7.00	185.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0205)

```
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK      R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 3 (  0205):      0.38   0.045     7.00   185.56
      + ID2= 2 (  0204):      0.25   0.027     7.00   162.84
        ================================================
        ID = 1 (  0205):      0.63   0.072     7.00   176.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
| RESERVOIR(  0206)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |    (cms)     (ha.m.)
                            0.0000      0.0000   |    0.0537      0.0085
                            0.0153      0.0009   |    0.0564      0.0094
                            0.0230      0.0018   |    0.0589      0.0102
                            0.0287      0.0027   |    0.0614      0.0111
                            0.0334      0.0037   |    0.0637      0.0119
                            0.0376      0.0043   |    0.0660      0.0128
                            0.0413      0.0051   |    0.0744      0.0136
                            0.0447      0.0060   |    0.0752      0.0137
                            0.0479      0.0068   |    0.0775      0.0138
                            0.0509      0.0077   |    0.8718      0.0138

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0205)      0.630      0.072      7.00     176.54
   OUTFLOW: ID= 1 (  0206)      0.630      0.058      7.08     176.53

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 80.32
                  TIME SHIFT OF PEAK FLOW        (min)= 5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)= 0.0099
```

```
| ADD HYD  (  0207)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK      R.V.
--------------------          (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0201):      0.16   0.018     7.00   166.53
      + ID2= 2 (  0206):      0.63   0.058     7.08   176.53
        ================================================
        ID = 3 (  0207):      0.79   0.075     7.00   174.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

Appendix E Additional Information

E.1. Gamsby & Mannerow Limited 17th Street East SWM Study – 10th Street Undersized Pipes.

Table 4-1 - Catchment 100's Deficient Storm Sewers

Sub-Catchment #	Location			Existing Sewer Data			Existing Capacity (m^3/sec)	Design Peak Flow (m^3/sec)	% Capacity
	Street	From	To	Diameter (mm)	Slope (%)	Length (m)			
103	10TH Ave E	8th st E	12m N of 8th St E	250	1.6	12	0.075	0.153 (49.1%)	204.0%
103	10TH Ave E	62mN of 8th St E	94m N of 8th St E	375	0.3	32	0.096	0.186 (59.6%)	193.8%
103	10TH Ave E	94m N of 8th St E	152m N of 8th st E	375	0.5	58	0.124	0.218 (70.2%)	175.8%
103	10TH Ave E	152m N of 8th St E	244m N of 8th St E	375	2.1	92	0.254	0.273 (87.7%)	107.5%
103	10TH Ave E	12m S of 10th St E	10111StE	375	0.8	12	0.157	0.311 (100%)	198.1%
104	10TH STE	lOrn Ave E (east leg)	10111Ave E (west leg)	600	0.4	123	0.388	0.926	238.7%
105	10TH STE	10th Ave E (west leg)	9th Ave E	675	0.2	143	0.376	1.070	284.6%
110	9TH Ave E	15'11StAE	16th St E	1050	0.2	193	1.221	1.935	158.5%

4.1.3 Recommended Replacement Pipe Sizes

We recommend that the following storm sewer improvements be incorporated into road improvements planned within Catchment 100. These improvements are summarized in the following Table 4-2:

Table 4-2 - Catchment 100's Recommended Improvements

Sub-Catchment #	Location			Proposed Sewer Data			Proposed Sewer Capacity (m^3/sec)	Design Peak Flow (m3 /sec)	% Capacity
	Street	From	To	Diameter (mm)	Slope (%)	Length (m)			
103	10TH Ave E	8th St E	12m N of gth St E	525	1.6	12	0.544	0.153	28.1%
103	10TH Ave E	62m N of 8th St E	94m N of 8th St E	525	0.3	32	0.236	0.186	78.8%
103	10TH Ave E	94m N of 8th St E	152mN of 8th St E	525	0.5	58	0.304	0.218	71.7%
103	!Orn Ave E	152m N of 8th St E	244mN of 8th St E	450	2.1	92	0.413	0.273	66.1%
103	10TH Ave E	12m S of IOthStE	101h st E	525	0.8	12	0.385	0.311	80.8%
104	10TH STE	10th Ave E (east leg)	10th Ave E (west leg)	900	0.4	123	1.145	0.926	80.9%
105	10TH STE	IOrn Ave E (west leg)	9th Ave E	1050	0.2	143	1.221	1.070	87.6%
110	9TH Ave E	15th St A E	16th St E	1350	0.2	193	2.387	1.935	81.1%