BRAMPTON
Flower City
brampton.ca

Public Notice

Committee of Adjustment

APPLICATION # *A-2021-0227*
WARD #3

APPLICATION FOR MINOR VARIANCE

WHEREAS an application for minor variance has been made by **UMRIA DEVELOPERS INC.**, under Section 45 of the Planning Act, (R.S.O. 1990 c.P.13) for relief from **By-law 270-2004**;

AND WHEREAS the property involved in this application is described as Part of Lot 5, Concession 1 WHS, Parts 1, 2, 7 and 8, Plan 43R-17885 municipally known as **12 HENDERSON AVENUE,** Brampton;

AND WHEREAS the applicant is requesting the following variance(s):

1. To permit a maximum of 441 dwelling units whereas the by-law permits a maximum of 402 dwelling units;

2. To permit a maximum floor space index of 1.3 whereas the by-law permits a maximum floor space index of 1.2.

OTHER PLANNING APPLICATIONS:

The land which is subject of this application is the subject of an application under the Planning Act for:

Plan of Subdivision: NO File Number: _____
Application for Consent: NO File Number: _____

The Committee of Adjustment has appointed **TUESDAY, October 26, 2021 at 9:00 A.M. by electronic meeting broadcast from the Council Chambers, 4th Floor, City Hall, 2 Wellington Street West, Brampton,** for the purpose of hearing all parties interested in supporting or opposing these applications.

This notice is sent to you because you are either the applicant, a representative/agent of the applicant, a person having an interest in the property or an owner of a neighbouring property. **OWNERS ARE REQUESTED TO ENSURE THAT THEIR TENANTS ARE NOTIFIED OF THIS APPLICATION. THIS NOTICE IS TO BE POSTED BY THE OWNER OF ANY LAND THAT CONTAINS SEVEN OR MORE RESIDENTIAL UNITS IN A LOCATION THAT IS VISIBLE TO ALL OF THE RESIDENTS.** If you are not the applicant and you do not participate in the hearing, the Committee may proceed in your absence, and you will not be entitled to any further notice in the proceedings. **WRITTEN SUBMISSIONS MAY BE SENT TO THE SECRETARY-TREASURER AT THE ADDRESS OR FAX NUMBER LISTED BELOW.**

IF YOU WISH TO BE NOTIFIED OF THE DECISION OF THE COMMITTEE OF ADJUSTMENT IN RESPECT OF THIS APPLICATION, YOU MUST SUBMIT A WRITTEN REQUEST TO THE COMMITTEE OF ADJUSTMENT. This will also entitle you to be advised of a Local Planning Appeal Tribunal hearing. Even if you are the successful party, you should request a copy of the decision since the Committee of Adjustment decision may be appealed to the Local Planning Appeal Tribunal by the applicant or another member of the public.

RULES OF PROCEDURE OF THIS COMMITTEE REQUIRE REPRESENTATION OF THE APPLICATION AT THE HEARING, OTHERWISE THE APPLICATION SHALL BE DEFERRED.

PLEASE SEE ATTACHED PARTICIPATION PROCEDURES REQUIRED DURING THE COVID-19 PANDEMIC

DATED at Brampton Ontario, this 14th Day of October, 2021.

Comments may be sent to and more information about this matter may be obtained between 8:30 a.m. to 4:30 p.m. Monday - Friday from:

Jeanie Myers, Secretary-Treasurer
Committee of Adjustment, City Clerk's Office,
Brampton City Hall, 2 Wellington Street West,
Brampton, Ontario L6Y 4R2
Phone: (905)874-2117
Fax: (905)874-2119
jeanie.myers@brampton.ca

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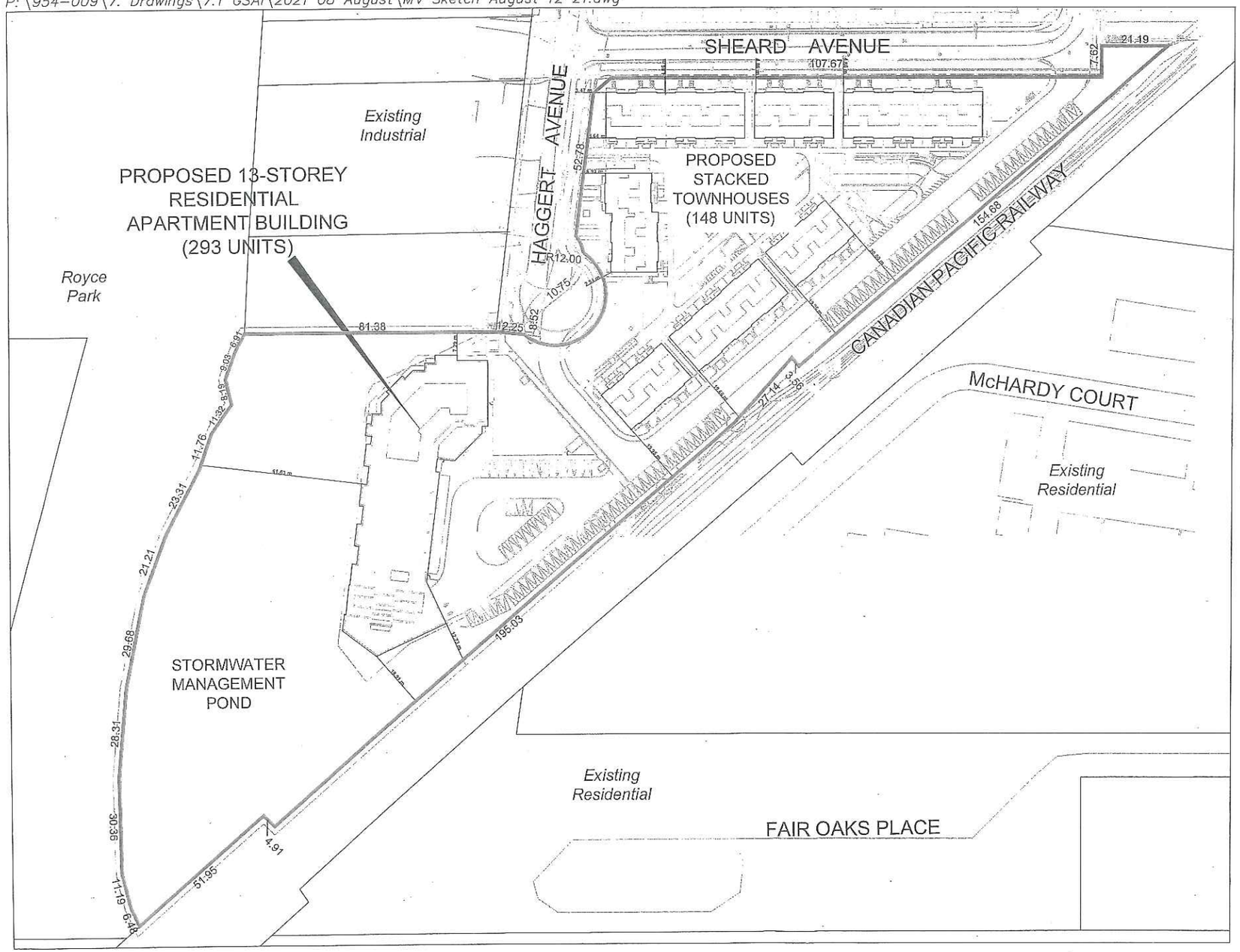

MINOR VARIANCE SKETCH

12 HENDERSON AVENUE
CITY OF BRAMPTON
REGIONAL MUNICIPALITY OF PEEL

SUBJECT PROPERTY: ± 3.04ha (± 7.51ac)

REQUIRED VARIANCES:

1. TO PERMIT A MAXIMUM OF 441 DWELLING UNITS WHEREAS A MAXIMUM OF 402 UNITS ARE PERMITTED.
2. TO PERMIT A MAXIMUM FLOOR SPACE INDEX OF 1.3 WHEREAS A MAXIMUM FLOOR SPACE INDEX OF 1.2 IS PERMITTED

Note:
-Variances not shown on plan

SCALE 1:1500
August 12, 2021

GSAI
Glen Schnarr & Associates Inc.

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Under the authority of the Emergency *Management and Civil Protection Act* and the *Municipal Act, 2001*, City Council approved Committee Meetings to be held electronically during the COVID-19 Emergency

Electronic Hearing Procedures
How to get involved in the Virtual Hearing

Brampton City Hall is temporarily closed to help stop the spread of COVID-19. In-person Committee of Adjustment Hearings have been cancelled since mid-March 2020. Brampton City Council and some of its Committees are now meeting electronically during the Emergency. The Committee of Adjustment will conduct its meeting electronically until further notice.

How to Participate in the Hearing:

- All written comments (by mail or email) must be received by the Secretary-Treasurer no later than **4:30 pm, Thursday, October 21, 2021.**
- Advance registration for applicants, agents and other interested persons is required to participate in the electronic hearing using a computer, smartphone or tablet by emailing the Secretary–Treasurer at cityclerksoffice@brampton.ca or jeanie.myers@brampton.ca by **4:30 pm Friday, October 22, 2021.**
    - Persons without access to a computer, smartphone or tablet can participate in a meeting via telephone. You can register by calling 905-874-2117 and leave a message with your name, phone number and the application you wish to speak to by **Friday, October 22, 2021.** City staff will contact you and provide you with further details.
- All Hearings will be livestreamed on the City of Brampton YouTube account at: **https://www.brampton.ca/EN/City-Hall/meetings-agendas/Pages/Welcome.aspx** or **http://video.isilive.ca/brampton/live.html .**

If holding an electronic rather than an oral hearing is likely to cause a party significant prejudice a written request may be made to have the Committee consider holding an oral hearing on an application at some future date. The request must include your name, address, contact information, and the reasons for prejudice and must be received no later than 4:30 pm the Friday prior to the hearing to cityclerksoffice@brampton.ca or jeanie.myers@brampton.ca. If a party does not submit a request and does not participate in the hearing, the Committee may proceed without a party's participation and the party will not be entitled to any further notice regarding the proceeding.

NOTE Personal information as defined in the *Municipal Freedom of Information and Protection of Privacy Act (MFIPPA)*, collected and recorded or submitted in writing or electronically as related to this planning application is collected under the authority of the *Planning Act*, and will be used by members of the Committee and City of Brampton staff in their review of this matter. Please be advised that your submissions will be part of the public record and will be made available to the public, including posting on the City's website, www.brampton.ca. By providing your information, you acknowledge that all personal information such as the telephone numbers, email addresses and signatures of individuals will be redacted by the Secretary-Treasurer on the on-line posting only. Questions regarding the collection, use and disclosure of personal information may be directed to the Secretary-Treasurer at 905-874-2117.

GLEN SCHNARR & ASSOCIATES INC.
URBAN & REGIONAL PLANNERS, LAND DEVELOPMENT CONSULTANTS

PARTNERS:
GLEN SCHNARR, MCIP, RPP
GLEN BROLL, MCIP, RPP
COLIN CHUNG, MCIP, RPP
JIM LEVAC, MCIP, RPP

September 27, 2021. Our File: 954-009

City of Brampton
Committee of Adjustment
2 Wellington Street West
Brampton, Ontario
L6Y 4R2

Attention: Ms. Jeanie Myers,
Secretary-Treasurer of the Committee of Adjustment

Re: Minor Variance Application
Umbria Developers Inc.
12 Henderson Avenue
City of Brampton

A-2021-0227

Glen Schnarr and Associates Inc. is pleased to submit this application for a Minor Variance at 12 Henderson Avenue (herein referred to as the 'subject property') on behalf of Umbria Developers Inc. The property is generally located south of Queen Street West, east of McLaughlin Road.

The subject property has a site area of approximately 3.0 hectares (7.4 acres) and is currently vacant. The property is designated "Medium High / High Density Residential" in the Downtown Brampton Secondary Plan allowing for a range of townhouse and apartment uses up to a density of 241 units per net residential hectare. The property was recently subject to an approved Zoning By-law Amendment Application (C01W05.044) to rezone the lands from "Industrial One" (M1) to "Residential Apartment A – Section 2997" (R4A-2997) allowing for up to 402 stacked townhouses and/or apartment dwellings.

The subject property is currently subject to a Site Plan Approval Application (City file #: SPA-2021-0047) for Phase 1 of the proposed development, comprising of 148 stacked townhouses with associated parking and amenity space. Umbria Developers Inc. is proposing to develop Phase 2 with a 13-storey residential apartment building with 293 units, bringing the total proposed unit count to 441. While an additional 39 units are proposed over the current maximum, only a slight increase in total floor space index (FSI) – from 1.2 to 1.3 – is generated as a result of proposing smaller units and more efficient floor plan. In support of the proposed increase in unit count and FSI, the following variances are requested:

10 KINGSBRIDGE GARDEN CIRCLE
SUITE 700
MISSISSAUGA, ONTARIO
L5R 3K6
TEL (905) 568-8888
FAX (905) 568-8894
www.gsai.ca

1. To permit a maximum of 441 dwelling units whereas a maximum of 402 units are permitted; and

2. To permit a maximum floor space index of 1.3 whereas a maximum floor space index of 1.2 is permitted.

Given the proposed increase in unit count, Umbria has undertaken an updated Traffic Impact Study and Functional Servicing and Stormwater Management Report to confirm that the proposed increase in density can be technically supported. The Traffic Impact Study concludes that the additional density is supportable on the subject property, subject to a number of operational improvements in the area including signal timing adjustments, turning restrictions, and turn lane reconfigurations. In addition, the Functional Servicing and Stormwater Management Report determines that the subject property can be serviced with the upgrade of the existing 150 mm diameter municipal watermain along Haggart Avenue with a 300 mm watermain and continue to be serviced with an extension to the existing sanitary sewer on Haggert Avenue. Thus, from a traffic and servicing perspective, the additional density and floor space index is supportable.

In our opinion, the proposed variances meet the prescribed criteria to authorize a minor variance under Section 45 of the Planning Act:

1. The proposed variances conform to the Official Plan as the property is designated "Medium High / High Density Residential" in the Downtown Brampton Secondary Plan which allows for a density of up to 241 units per net hectare. Based on the net site area of approximately 3 hectares, the permitted density would allow for a maximum of 723 units on site. As such, the proposed 441 units are within the density permission of the Official Plan;

2. The proposed variances meet the intent of the Zoning By-law as the lands are zoned "R4A-2997" which permits stacked townhouses and apartment dwellings up to 13 storeys. The proposed variances will continue to implement the housing form permitted by the Zoning By-law;

3. The proposed variances are minor in nature as the total gross floor area permitted by the Zoning By-law (by way of FSI) is generally maintained with no increase in building height; and

4. The proposed variances are appropriate and desirable as the proposed development continues to be supportable by the existing surrounding road network and servicing infrastructure with minor improvements.

The following are enclosed in support of this application:

- One (1) completed Application Form for a Minor Variance;
- One (1) Functional Servicing and Stormwater Management Report prepared by Crozier dated July 22, 2021;
- One (1) Traffic Impact Study Update prepared by Stantec dated August 23, 2021; and
- One (1) Minor Variance Sketch prepared by Glen Schnarr & Associates Inc. August 12, 2021.

We trust this completes the Application for Minor Variance and look forward to appearing before the Committee of Adjustment on the October 26, 2021 hearing date. Please do not hesitate to contact the undersigned if you have any questions or require any additional information.

Yours very truly,

GLEN SCHNARR & ASSOCIATES INC.

Taranjeet Grewal
Planner

Flower City

brampton.ca

For Office Use Only
(to be inserted by the Secretary-Treasurer
after application is deemed complete)

FILE NUMBER: A-2021-0027

The Personal Information collected on this form is collected pursuant to section 45 of the Planning Act and will be used in the processing of this application. Applicants are advised that the Committee of Adjustment is a public process and the information contained in the Committee of Adjustment files is considered public information and is available to anyone upon request and will be published on the City's website. Questions about the collection of personal information should be directed to the Secretary-Treasurer, Committee of Adjustment, City of Brampton.

APPLICATION
Minor Variance or Special Permission
(Please read Instructions)

NOTE: It is required that this application be filed with the Secretary-Treasurer of the Committee of Adjustment and be accompanied by the applicable fee.

The undersigned hereby applies to the Committee of Adjustment for the City of Brampton under section 45 of the Planning Act, 1990, for relief as described in this application from By-Law **270-2004.**

1. **Name of Owner(s)** Umbria Developers Inc.
Address 37 Hawkridge Trail, Brampton, ON L6P 2T4
Phone # 647 220 9355 **Fax #**
Email s.kamal@umbriadevelopers.com

2. **Name of Agent** Glen Schnarr and Associates Inc.
Address 10 Kingsbridge Garden Circle, Mississauga ON L5R 3K6
Suite 700
Phone # 416-315-3284 **Fax #**
Email jasona@gsai.ca

3. **Nature and extent of relief applied for (variances requested):**

1. To permit a maximum of 441 dwelling units whereas a maximum of 402 units are permitted.

2. To permit a maximum floor space index of 1.3 whereas a maximum floor space index of 1.2 is permitted.

4. **Why is it not possible to comply with the provisions of the by-law?**

1. The number of units proposed exceeds the maximum number permitted in the Zoning By-law ;
2. The proposed Floor Space Index exceeds the maximum permitted.

5. **Legal Description of the subject land:**
Lot Number 5
Plan Number/Concession Number CON 1 WHS PT LOT 5 AND RP 43R17885 PARTS 1 2 7 AND 8
Municipal Address 12 Henderson Avenue

6. **Dimension of subject land (in metric units)**
Frontage Approx 252.0 meters
Depth 64.0 meters
Area 3.11 hectares (7.68 acres)

7. **Access to the subject land is by:**

Provincial Highway	☐	**Seasonal Road**	☐
Municipal Road Maintained All Year	☑	**Other Public Road**	☐
Private Right-of-Way	☐	**Water**	☐

8. **Particulars of all buildings and structures on or proposed for the subject land: (specify in metric units ground floor area, gross floor area, number of storeys, width, length, height, etc., where possible)**

EXISTING BUILDINGS/STRUCTURES on the subject land: List all structures (dwelling, shed, gazebo, etc.)

None

PROPOSED BUILDINGS/STRUCTURES on the subject land:

A 13 storey residential apartment building and 148 units of stacked townhouses are proposed on the subject lands with a GFA of 39,074 square meters.

9. **Location of all buildings and structures on or proposed for the subject lands: (specify distance from side, rear and front lot lines in metric units)**

EXISTING

Front yard setback	N/A
Rear yard setback	N/A
Side yard setback	N/A
Side yard setback	N/A

PROPOSED

Front yard setback	4.86 meters
Rear yard setback	19.66 meters
Side yard setback	2.94 meters
Side yard setback	N/A

10. **Date of Acquisition of subject land:** May 31, 2021

11. **Existing uses of subject property:** Residential Apartment

12. **Proposed uses of subject property:** Residential

13. **Existing uses of abutting properties:** Residential

14. **Date of construction of all buildings & structures on subject land:** 2022

15. **Length of time the existing uses of the subject property have been continued:** Use currently not established

16. (a) **What water supply is existing/proposed?**

Municipal ☑ **Other (specify)** _____
Well ☐

(b) **What sewage disposal is/will be provided?**

Municipal ☑ **Other (specify)** _____
Septic ☐

(c) **What storm drainage system is existing/proposed?**

Sewers ☑
Ditches ☐ **Other (specify)** _____
Swales ☐

17. **Is the subject property the subject of an application under the Planning Act, for approval of a plan of subdivision or consent?**

Yes ☐ **No** ☑

If answer is yes, provide details: **File #** _____ **Status** _____

18. **Has a pre-consultation application been filed?**

Yes ☒ **No** ☐

19. **Has the subject property ever been the subject of an application for minor variance?**

Yes ☐ **No** ☑ **Unknown** ☐

If answer is yes, provide details:

File # _____ **Decision** _____ **Relief** _____
File # _____ **Decision** _____ **Relief** _____
File # _____ **Decision** _____ **Relief** _____

J. Gus
Signature of Applicant(s) or Authorized Agent

DATED AT THE Region OF Peel

THIS 16 DAY OF September, 2021.

IF THIS APPLICATION IS SIGNED BY AN AGENT, SOLICITOR OR ANY PERSON OTHER THAN THE OWNER OF THE SUBJECT LANDS, WRITTEN AUTHORIZATION OF THE OWNER MUST ACCOMPANY THE APPLICATION. IF THE APPLICANT IS A CORPORATION, THE APPLICATION SHALL BE SIGNED BY AN OFFICER OF THE CORPORATION AND THE CORPORATION'S SEAL SHALL BE AFFIXED.

I, Glen Schnarr and Associates Inc (c/o Jason Afonso), OF THE Region OF Peel

IN THE City OF Mississauga SOLEMNLY DECLARE THAT:

ALL OF THE ABOVE STATEMENTS ARE TRUE AND I MAKE THIS SOLEMN DECLARATION CONSCIENTIOUSLY BELIEVING IT TO BE TRUE AND KNOWING THAT IT IS OF THE SAME FORCE AND EFFECT AS IF MADE UNDER OATH.

DECLARED BEFORE ME AT THE
City OF Mississauga
IN THE Region OF
Peel THIS 16th DAY OF
September, 2021.

Laura Kim Amorim, a Commissioner etc.
Province of Ontario, for
Glen Schnarr & Associates Inc.
Expires March 3, 2023.

J. Gus
Signature of Applicant or Authorized Agent

Submit by Email

FOR OFFICE USE ONLY

Present Official Plan Designation: _____

Present Zoning By-law Classification: _____

This application has been reviewed with respect to the variances required and the results of the said review are outlined on the attached checklist.

_____ Zoning Officer

_____ Date

DATE RECEIVED September 29, 2021

Date Application Deemed Complete by the Municipality _____

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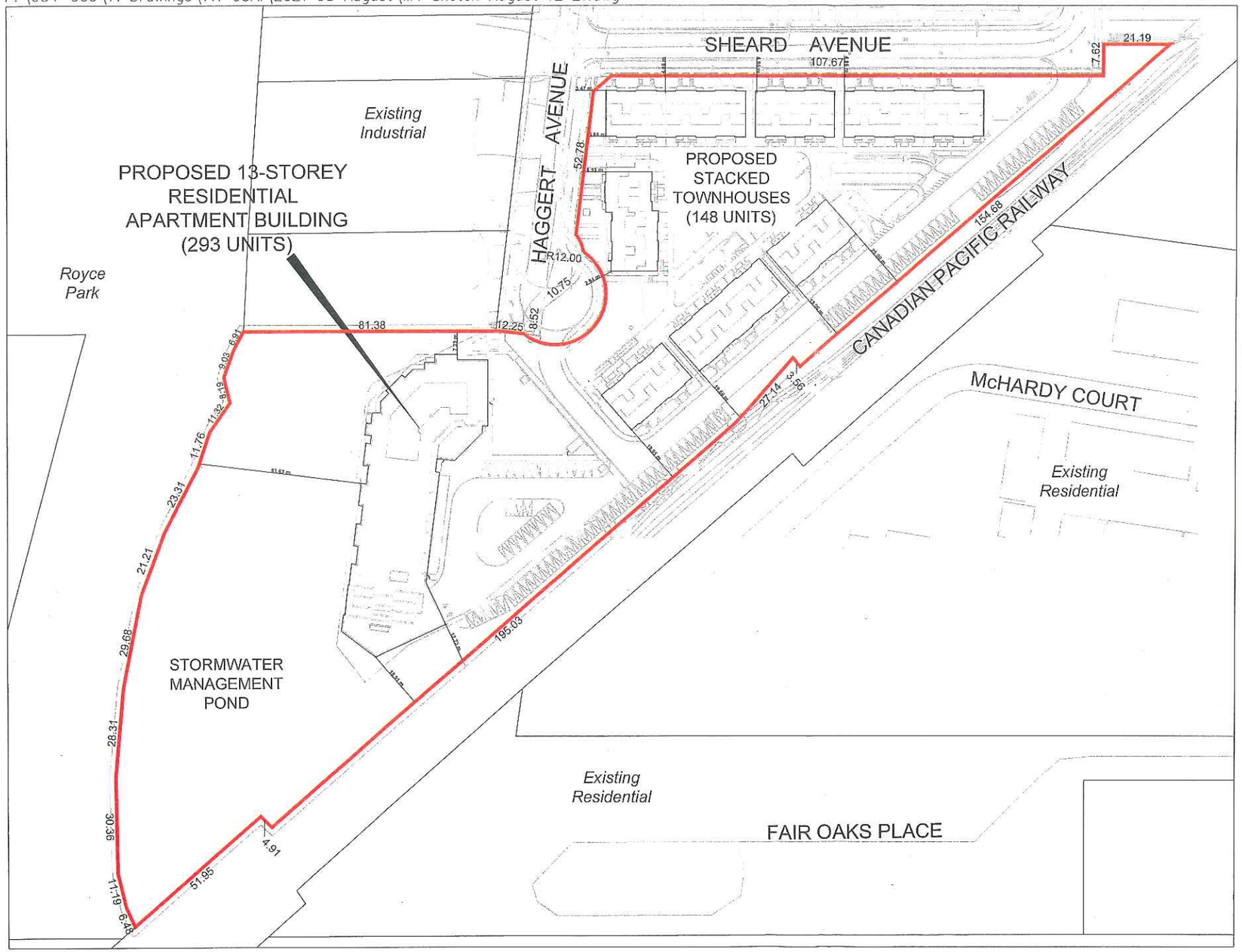

MINOR VARIANCE SKETCH

12 HENDERSON AVENUE
CITY OF BRAMPTON
REGIONAL MUNICIPALITY OF PEEL

SUBJECT PROPERTY: ± 3.04ha (± 7.51ac)

REQUIRED VARIANCES:

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2. TO PERMIT A MAXIMUM FLOOR SPACE INDEX OF 1.3 WHEREAS A MAXIMUM FLOOR SPACE INDEX OF 1.2 IS PERMITTED

Note:
-Variances not shown on plan

SCALE 1:1500
August 12, 2021

GSAI
Glen Schnarr & Associates Inc.

Stantec

Report

A- 2021- 0227

To:	Syed Sarwar Shakeb Habibi 1030 Queen Street West, Brampton, ON L6X 0B2	From:	Ahmed Abdelnaby Mohammed Al Hasoo 400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
File:	160500014	Date:	August 23, 2021

Reference: 12 Henderson Avenue Traffic Impact Study Update – Full Build-Out

BACKGROUND

Stantec was retained by Umbria Developments Inc. to prepare an update to the Traffic Impact Study conducted for a proposed development located at 12 Henderson Avenue in the City of Brampton. The previous study, *12 Henderson Avenue Traffic Impact Assessment – Full Build-Out* investigated the impacts of 250 apartment units and 152 stacked townhouses. Umbria Developments Inc. is planning to change to the proposed unit count to 148 townhouses and 293 apartment units, resulting in an overall increase of 39 dwelling units. This traffic impact study provides an update to the previously submitted study, and in particular, provides an update to the 2025 Total Future Conditions analyses.

The *12 Henderson Avenue Traffic Impact Assessment – Full Build-Out,* can be found in **Attachment I**.

Since the completion of the study, it was identified that another development proposal located at 10 Henderson Avenue is currently under the pre-consultation phase. As per discussion with the City of Brampton staff the proposal includes 282 condo units and is anticipated to have significant impacts on traffic operations in the general area.

SCOPE

The scope of the traffic analysis includes:

- Updating the traffic forecast for the total future conditions of the year 2025 at the development's full buildout;
- Assessing the transportation impacts and requirements to accommodate the increase in the proposed unit counts; and
- Conducting sensitivity analysis to identify the potential impacts and required improvements due to the inclusion of the proposed residential development at 10 Henderson Avenue. The 2025 background analyses have been retained from the 2020 TIS findings for comparison purposes.

The study area intersections include:

1. Queen Street West / Haggert Avenue (unsignalized),
2. Queen Street West / McMurchy Avenue (signalized),
3. Royce Avenue / Henderson Avenue (unsignalized),
4. Royce Avenue / McMurchy Avenue (signalized), and
5. Haggert Avenue / Sheard Avenue (unsignalized).

The study area intersections and location of the proposed development is shown in **Figure 2**

As this study is an update to the future scenarios, it was agreed to update the analyses for the recommended scenario as per the *12 Henderson Avenue Traffic Impact Assessment – Full Build-Out* study recommended scenarios, which include:

- Signal timing cycle increase to from 135s to 140s cycle with optimized splits at the intersection of Queen Street West at McMurchy Avenue;
- The extension of the northbound left turn storage lane at the intersection of Queen Street West at McMurchy Avenue from 60m to 120m. Through a later memorandum "*12 Henderson Avenue | Justification for the length of Northbound left-turn storage lane at the intersection of Queen Street / McMurchy Avenue, January 2021*," it was identified that only 80m is constructable due to intersection spacing between Queen Street and Jessie Street. The analyses were updated to include an 80m storage lane; accordingly, and

The *12 Henderson Avenue | Justification for the length of Northbound left-turn storage lane at the intersection of Queen Street / McMurchy Avenue, January 2021* can be found in **Attachment II**.

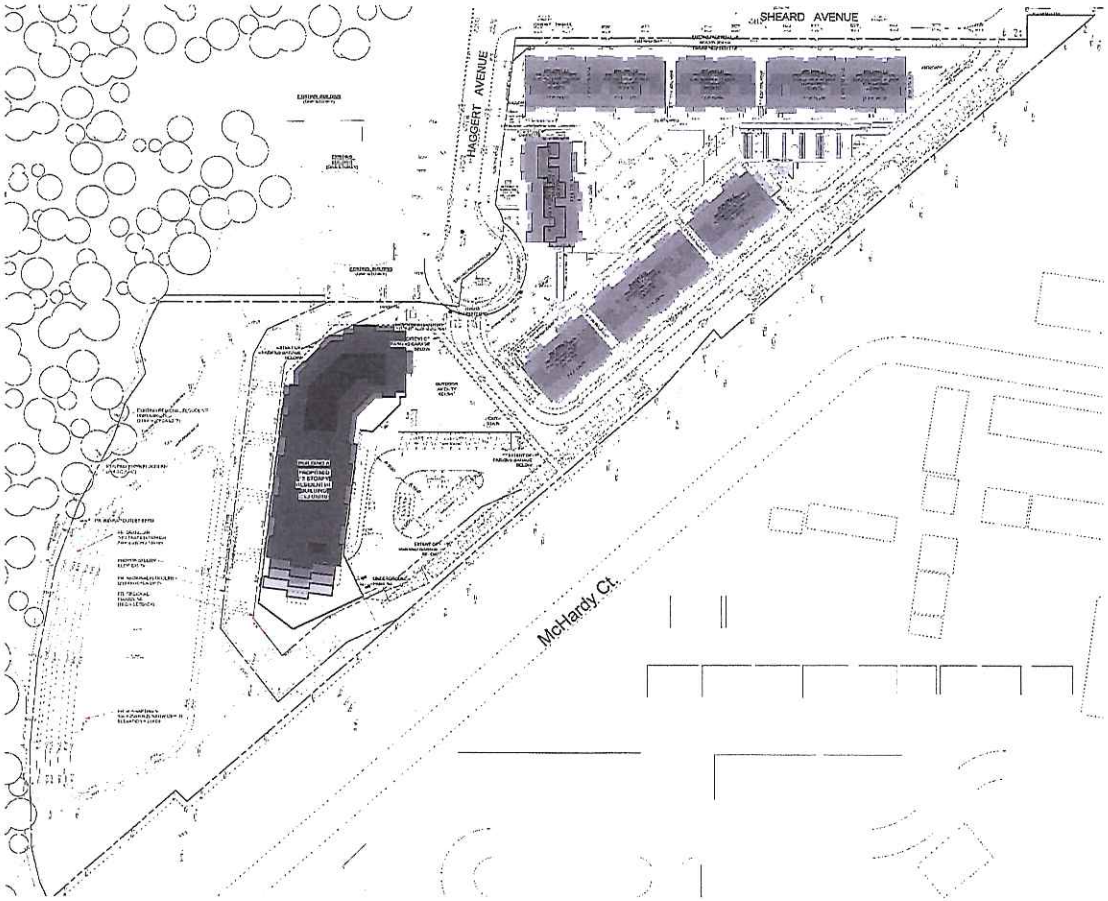
PROPOSED DEVELOPMENT

The proposed development is planned to have a total of 148 townhouses and 293 apartment units; access to the site is anticipated to be provided through the extensions of Haggert Avenue and Henderson Avenue.

The proposed development's site plan is shown in **Figure 1** and a full resolution version is provided within **Attachment III**.

Reference: 12 Henderson Avenue Traffic Impact Study Update – Full Build-Out

Figure 1 – Proposed Site Plan



Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Figure 2 - Study Area

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

TRAFFIC DATA AND OBSERVATIONS

The turning movement volumes from the previously submitted 2020 TIS were utilized. These traffic counts are dated to the year 2016 and were grown to 2025 levels using a 1.5% growth rate. Stantec was provided with more recent counts dated to June of 2021 at the intersection of Queen Street West / McMurchy Avenue and to October of 2020 at the intersection of Queen Street / Haggert Avenue. Comparisons between the grown 2020 volumes used in the previous study and the most recent counts indicate significant traffic reductions, which are likely attributed to the ongoing pandemic. The comparison indicates that:

- At Queen Street West / MucMurchy Avenue:
    - AM Peak: Grown 2019/2020 traffic volumes show a total of 2506 veh/h as compared to the 2021 June count which shows a total of 1365 veh/h (a 45% reduction).
    - PM Peak: Grown 2019/2020 traffic volumes show a total of 3027 veh/h as compared to the 2021 June count which shows a total of 2506 veh/h (a 17% reduction).
- At Queen Street West / Haggert Avenue:
    - AM Peak: Grown 2019/2020 traffic volumes show a total of 2144 veh/h as compared to the 2021 June count which shows a total of 1484 veh/h (a 31% reduction).
    - PM Peak: Grown 2019/2020 traffic volumes show a total of 2601 veh/h as compared to the 2021 June count which shows a total of 1851 veh/h (a 29% reduction).

Attachment IV contains the 2020 and 2021 requested Turning Movement Counts (TMCs) for reference.

It is anticipated that the pandemic has significantly contributed to the reductions in traffic demands and therefore, the previous 2016 traffic counts grown to 2025 levels were retained as basis for the analyses. Although demands may not fully reach pre-pandemic levels in the immediate future, this conservative approach is used as traffic demands are anticipated to increase overtime towards pre-pandemic thresholds.

The same growth rate of 1.5% was retained for the purposes of the analyses.

The 2019/2020 grown demands used for the 2020 study for the AM and PM peak hour volumes are shown in **Figure 3** and **Figure 4,** respectively.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

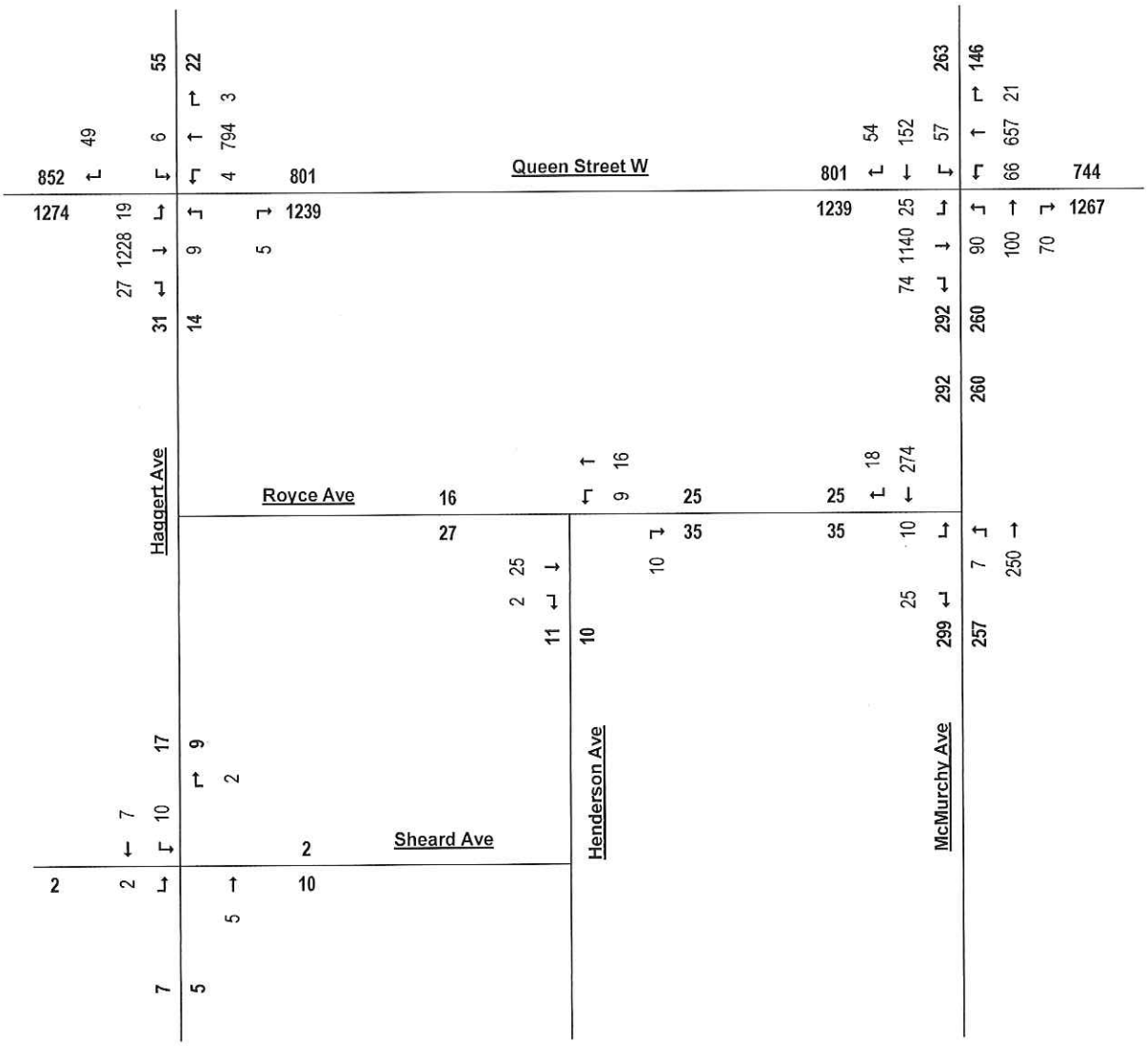


Figure 3 - Grown (2019/2020) Volumes | AM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

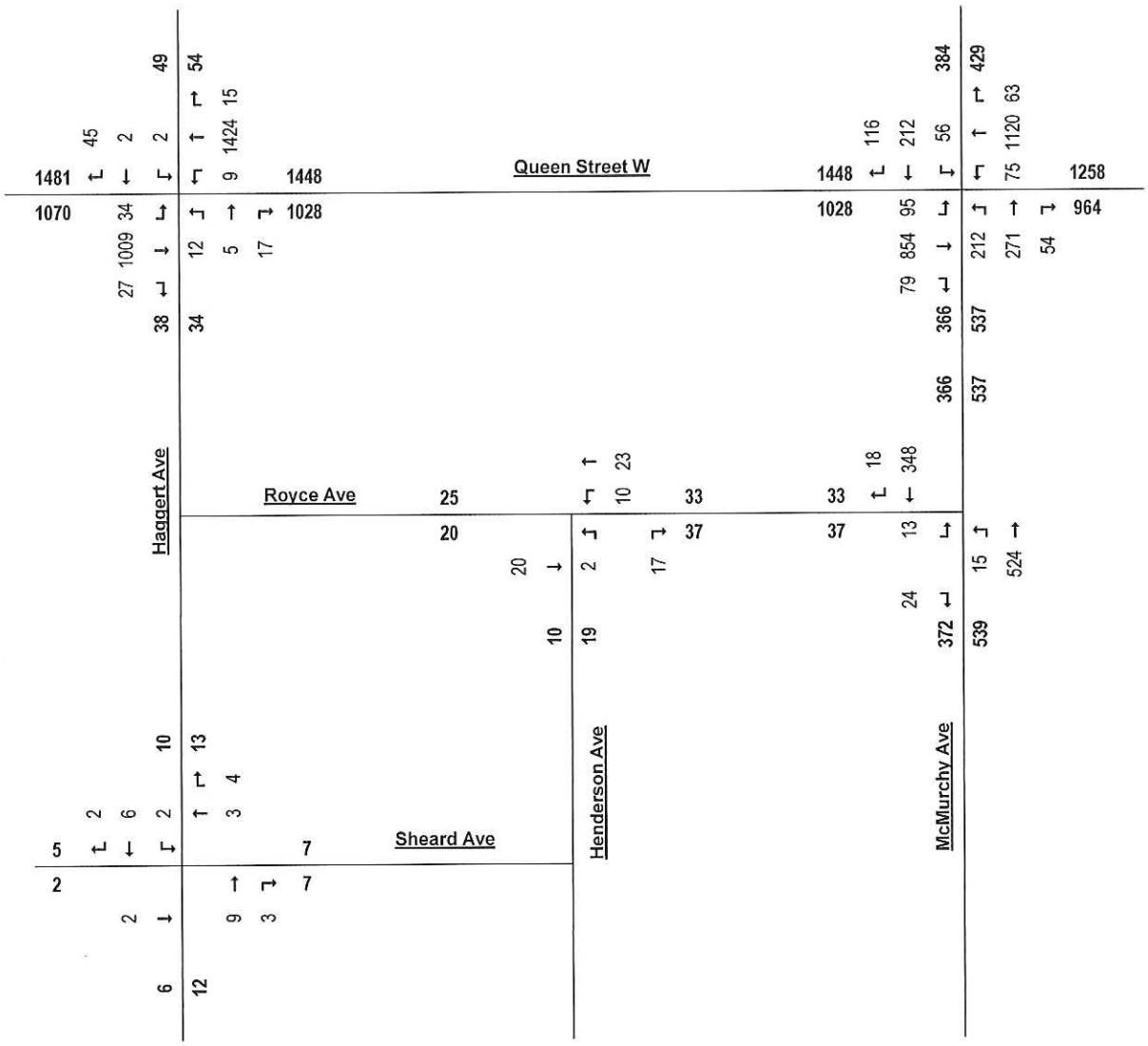


Figure 4 - Grown (2019/2020) Volumes | PM Peak Hour

FUTURE BACKGROUND CONDITIONS

2025 BACKGROUND TRAFFIC VOLUMES

The 2025 horizon year represents future forecasted operating conditions prior to the build out of the development and excludes the development's generated traffic. A growth rate of 1.5% per annum is applied to the base 2016 traffic volumes and the growth rate is used to estimate the future increase in traffic demand due to natural growth sources such as population and employment growth.

There are no planned network improvements identified by 2025 within the study area.

It is worth noting that an Initial Business Case (IBC) has been conducted for the implementation of bus rapid transit services along Queen Street, between Mississauga Road and the Highway 7 Viva BRT in York Region[1]. However, based on our review of the project page on the City of Brampton website and news, no further updates on the IBC are available related to funding and timelines. The project timeframe for implementation is subject to funding and approvals. It has been assumed that the Queen Street BRT will not be implemented by this study's 2025 horizon year.

The future background traffic forecasts are shown in **Figure 5** and **Figure 6.**

[1] *Brampton Queen Street – York Region Highway 7 BRT Initial Business Case; October 2020.*

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

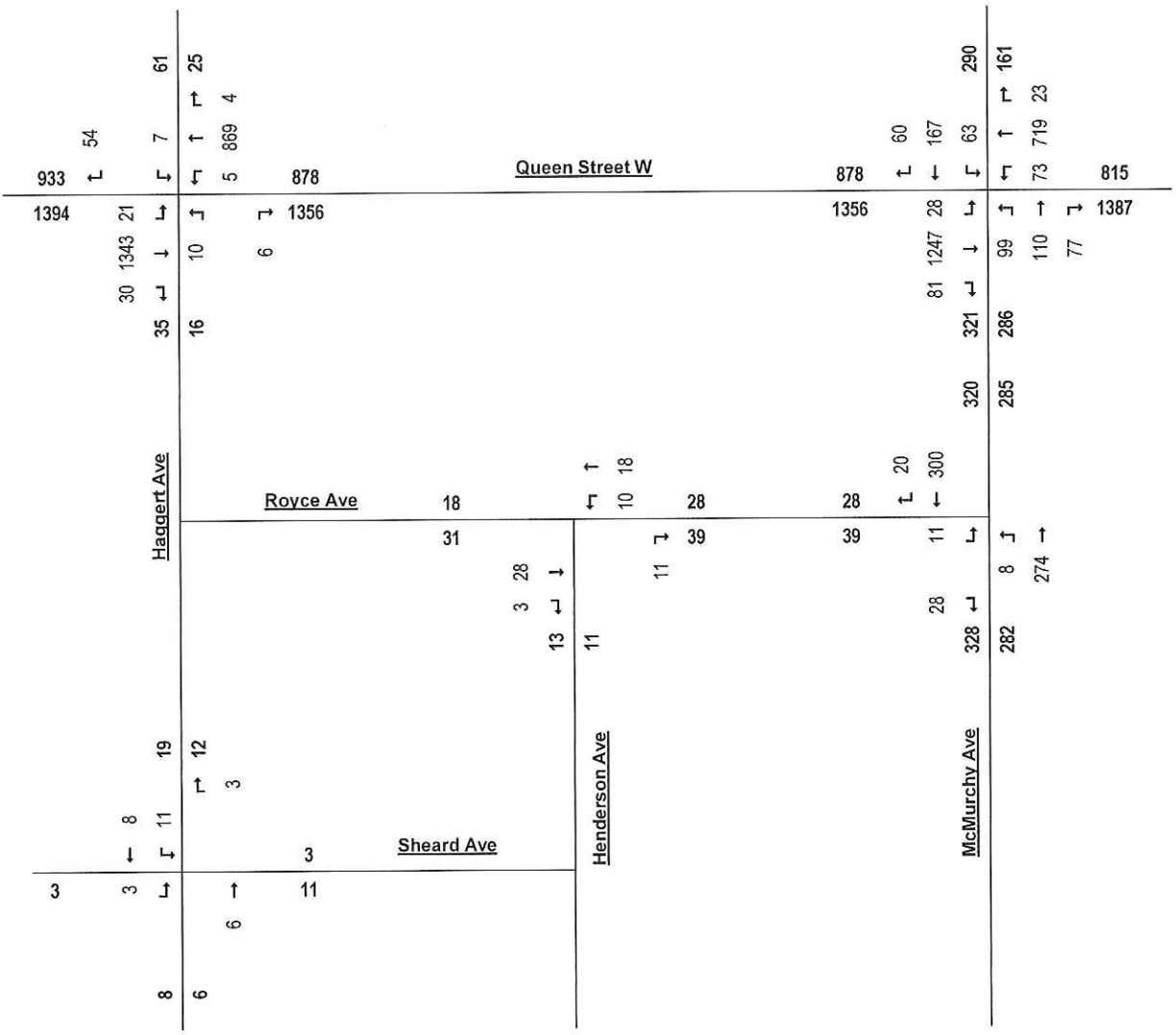


Figure 5 - Future Background (2025) Volumes | AM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

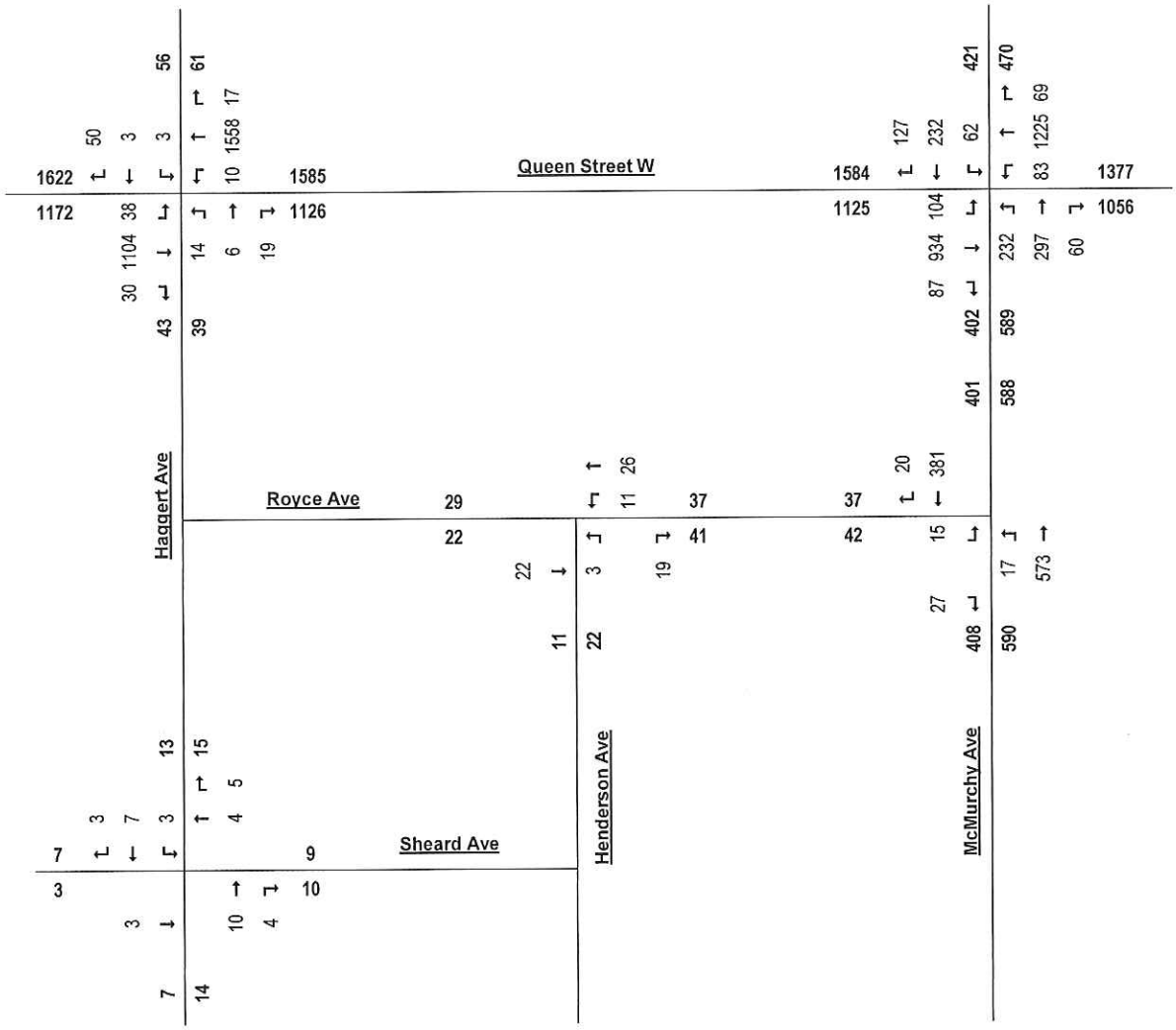


Figure 6 - Future Background (2025) Volumes | PM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

2025 BACKGROUND TRAFFIC OPERATIONS

A level of service analysis was performed to assess the operational conditions for the future weekday AM and PM peak hour background traffic forecasts.

The results of the operational analysis for the 2025 future background conditions are presented in **Table 1**. The SimTraffic and Synchro analysis outputs are provided for reference in **Attachment V** and **Attachment VI**, respectively.

The following impacts to the study area road network have been identified by 2025 as a result of background traffic growth and include:

- Overall, the study area intersections are projected to operate at satisfactory levels of operation at LOS E or better during the AM peak hour.
- During the PM peak hour, at the intersection of Queen Street West and McMurchy Avenue, the eastbound left movement operates at LOS "F" with a v/c ratio of 1.13 and an anticipated delay of 235s, thus requiring improvements. The westbound left movement operates at LOS "F" with a v/c ratio less than 1.0 and an anticipated delay of 122s. The southbound left and through / right movements are found to operate at LOS "F" with an anticipated 187s and 184s of travel time delays. The southbound through / right movement is also expected to experience significant vehicular queueing reaching 349m.
- During the PM peak hour, the northbound and southbound approaches at the intersection of Queen Street West and Haggert Avenue operate at LOS "F" with significant delays and have reached their theoretical capacities. The westbound approach, due to queuing at the downstream intersection, is anticipated to operate at LOS "F" with an expected 53s of delay due to westbound queueing and operations at the intersection of Queen Street / McLauglin Road.

The future background conditions and the associated anticipated levels of operations are summarized in **Table 1.**

Table 1 - Future Background (2025) Operational Conditions

Intersection	Approach/Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	Delay[1]	v/c[2]	Q[1]	LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	C	24	0.08	24	F	235	1.13	46
		Thru/Right	B	17	0.58	138	D	40	0.58	216
	WB	Left	D	44	0.42	35	F	122	0.49	45
		Thru/Right	A	10	0.33	53	D	46	0.73	243
	NB	Left	D	50	0.92	47	E	70	1.05	78
		Thru/Right	D	36	0.57	65	D	38	0.61	148
	SB	Left	D	45	0.44	44	F	187	0.31	87
		Thru/Right	D	42	0.75	80	F	184	0.99	349
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	A	8	0.45	2	B	11	0.37	73
	WB	Thru-Thru/Right	A	2	0.28	6	F	53	0.51	294
	NB	Left/Thru/Right	D	34	0.4	14	F	415	1.83	84
	SB	Left/Thru/Right	E	37	0.23	20	F	463	1.54	128
	EB	Left/Right	A	7	0.07	14	B	10	0.11	15

McMurchy Ave S / Royce Avenue *Unsignalized*	NB	Left/Thru	A	4	0.01	8	A	4	0.02	19
	SB	Thru/Right	A	2	0.2	3	A	2	0.26	1
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	A	0	0.02	--	A	0	0.01	--
	WB	Left/Thru	A	2	0.01	--	A	2	0.01	--
	NB	Left/Right	A	0	0.01	11	A	3	0.02	12
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	A	4	0	--	A	5	0	4
	WB	Left/Thru/Right	A	2	0	--	A	4	0.01	9
	NB	Left/Thru/Right	A	0	0	--	A	0	0	--
	SB	Left/Thru/Right	A	1	0.01	--	A	1	0	--

1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres

As a result of the above findings, the following improvement measures were investigated to improve PM peak hour traffic operations:

- Increasing the cycle length at the intersection of Queen Street West and McMurchy Avenue to 135s in addition to optimizing the cycle offset, limiting the westbound through split to 51s, and introducing a 24 second eastbound left phase to segment upstream traffic,
- Restricting the northbound and southbound left turn and through movements at the stop-controlled intersection of Queen Street W and Haggert Avenue during the PM peak hour only. This operational measure resulted in rerouting 20 northbound vehicles and 6 southbound vehicles to use Queen Street / McMurchy Avenue. Rerouted Traffic was reassigned to the internal network; accordingly, and
- Increasing the eastbound and westbound through split phase timings by 4 seconds at the intersection of Queen Street West and McLaughlin Road.

The results of these improvements for the PM peak hour are summarised in **Table 2**.

Table 2 - Future Background (2025) – PM Peak Hour Improvements

Intersection	Approach/Movement		Improvement	PM Peak Hour			
				LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	*Increasing the cycle length to 135s* *westbound through split at 51s introducing an eastbound left protected-permissive 24s*	D	52	0.61	37
		Thru/Right		A	10	0.61	48
	WB	Left		E	76	0.56	41
		Thru/Right		D	42	0.95	177
	NB	Left		E	68	0.92	81
		Thru/Right		D	42	0.56	167
	SB	Left		F	91	0.30	76
		Thru/Right		F	87	0.93	201
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	*Restricting northbound and southbound left / through movements during the PM peak period*	A	6	0.37	30
	WB	Thru-Thru/Right		A	7	0.51	62
	NB	Left/Thru/Right		A	9	0.05	13
	SB	Left/Thru/Right		E	46	0.08	35
McMurchy Ave S / Royce Avenue	EB	Left/Right	*Not Applicable*	B	28	0.21	34
	NB	Left/Thru		A	5	0.02	64

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Unsignalized	SB	Thru/Right		A	2	0.26	0
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	*Not Applicable*	A	0	0.01	--
	WB	Left/Thru		A	2	0.01	--
	NB	Left/Right		A	4	0.04	15
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	*Not Applicable*	A	5	0	5
	WB	Left/Thru/Right		A	4	0.01	9
	NB	Left/Thru/Right		A	0	0	--
	SB	Left/Thru/Right		A	1	0	--
Other off-site Improvements			*Increasing the eastbound and westbound through split phase timings by 5 seconds at the intersection of Queen Street W and McLaughlin.*	NA			

1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres

With the improvements implemented, no movements in the study area are anticipated to have their theoretical capacity (v/c) exceeded. The optimization exercise along with the implementation of protected-permissive eastbound left phase at the intersection of Queen Street at McMurchy Avenue significantly improves the intersection performance during the PM peak hour, as shown in **Table 2**.

The eastbound left movement is found to operate at LOS "E" with a travel time delay of 52s. The northbound left movement is found to operate at LOS "E" with an anticipated delay of 68s. The southbound approach is anticipated to operate at delays reaching 1.5 minutes. The westbound left turn movement is anticipated to operate at delays of 76s resulting in a LOE "E", however the delays are lower than the intersection cycle length indicating that all trips at the movement will be able to proceed within one cycle. It is worth noting that the westbound left turn queues are not expected to block westbound through traffic's movement, the delay is mainly due to the westbound through movement queuing delays, followed by the control delay at the westbound left turn signal head. The southbound approach's delay is found to be an acceptable compromise to improving the overall intersection operations without the need for potential significant coordination changes along the corridor.

Although high delays are initially observed for the northbound and southbound approaches to the intersection of Queen Street W / Haggert Avenue during the PM peak hour, it is worth noting that relatively low traffic demand is forecasted at this intersection by 2025. Without implementing through and left turn restrictions, a total of 39 vehicles are forecast on the northbound approach, and 56 vehicles on the southbound approach, indicating that the delay incurred at this intersection is largely due to insufficient gaps within traffic moving eastbound and westbound along Queen Street W. Restricting, northbound and southbound through / left turn movements during the PM peak is anticipated to result in significant operational improvements with the northbound approach operating at LOS A. The southbound right movement was found to experience delays despite the improvements due to high westbound traffic volumes and queueing. However, the delay is relatively minor at 46 seconds.

DEVELOPMENT SITE TRAFFIC

The number of vehicular trips generated by the proposed development is estimated using information contained in the Institute of Transportation Engineers (ITE) publication, "Trip Generation, 10th Edition". Specifically, the AM and PM peak hour trips are estimated using the trip generation rates/formulae for "Mid-Rise Apartments" (ITE Multi-family housing/mid-rise land use, code #221) for the apartment units while (ITE Multifamily housing

low rise, code#220) was used for the townhomes. The proposed Phase 2 of the development consists of 293 apartment units and 148 townhouse.

An 8% trip reduction is applied to the total number of estimated trips to represent the reduction in automobile trips due to transit usage, as recommended by City of Brampton staff in their September 20, 2018, comments.

The site generated trips are summarized below in **Table 3**.

Table 3 - Site Trip Generation

Land Use	Units	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
Townhouses (Phase 1): Multifamily Housing (Low-Rise) LUC #220	148	16	52	68	52	31	83
Mid-rise Apartments (Phase 2): Multifamily Housing (Mid-Rise) LUC #221	293	27	78	105	79	50	129
Total Trips		43	130	173	131	81	212
8% Reduction		3	10	13	10	6	16
Total Auto Trips		40	120	160	121	75	196

GENERATED TRIPS DISTRIBUTION AND ASSIGNMENT

The distribution of site generated trips for the proposed development is consistent with the methodology applied in the 2020 TIS and is the same methodology of the TIS prepared by Paradigm Transportation Solutions Ltd., dated December 2018. Trips are distributed across the study area road network based on the 2011 TTS origin-destination data for Zone #3490. The trip distribution is summarized in **Table 4**. Assigned trip volumes are summarized in **Figure 7** and **Figure 8**. The trip distribution during the PM peak hour took into account the implemented turn restrictions at Queen Street W / Haggert Avenue N.

Table 4 - Site Trip Distribution

To / From	Roadway	Proportion	
		Inbound	Outbound
East	Queen Street W	20%	20%
West	Queen Street W	40%	30%
North	McMurchy Avenue N	15%	15%
	Haggert Avenue N	1%	1%
South	McMurchy Avenue S	24%	34%
Total		**100%**	**100%**

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

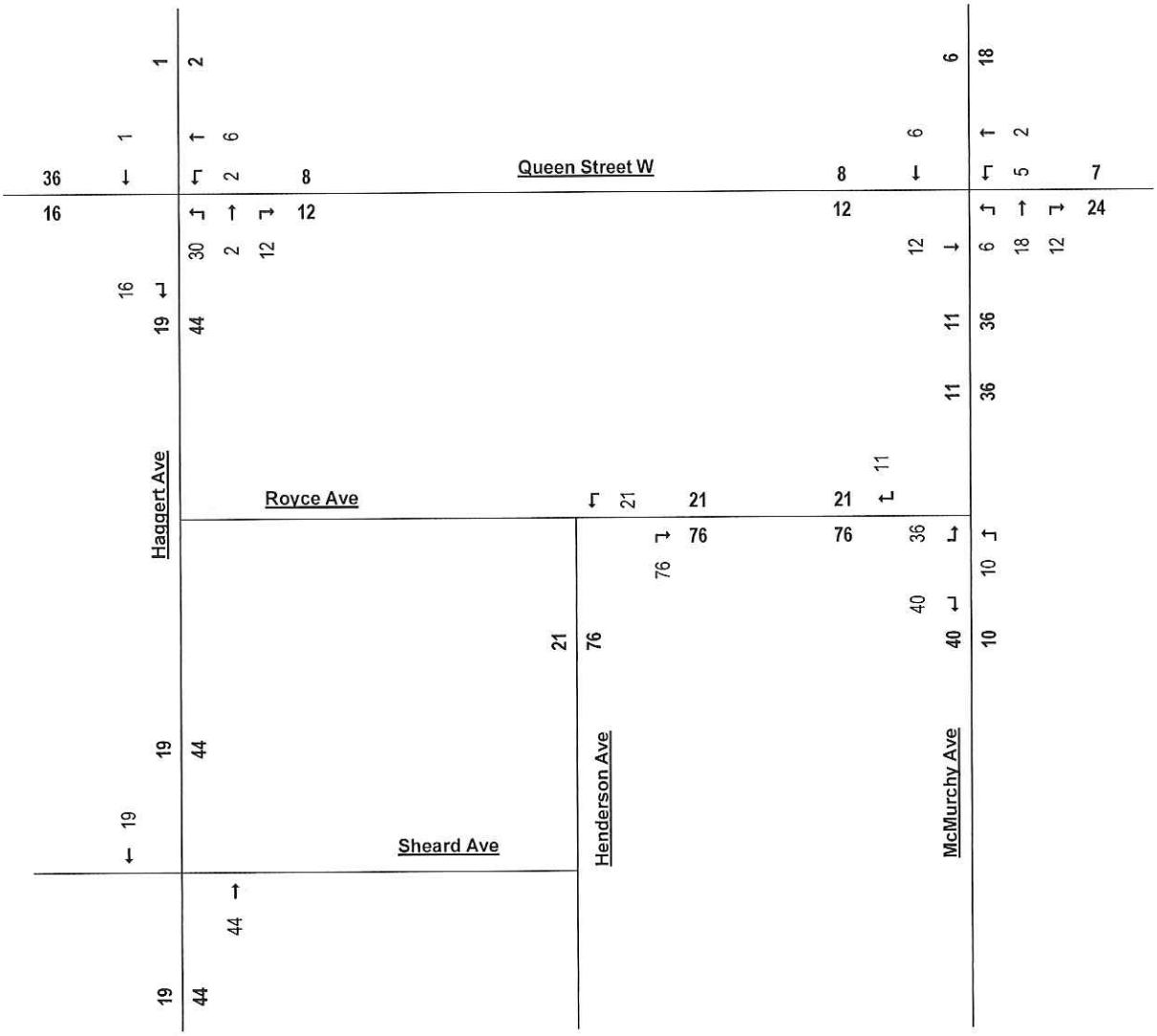


Figure 7 - Site Trips | AM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

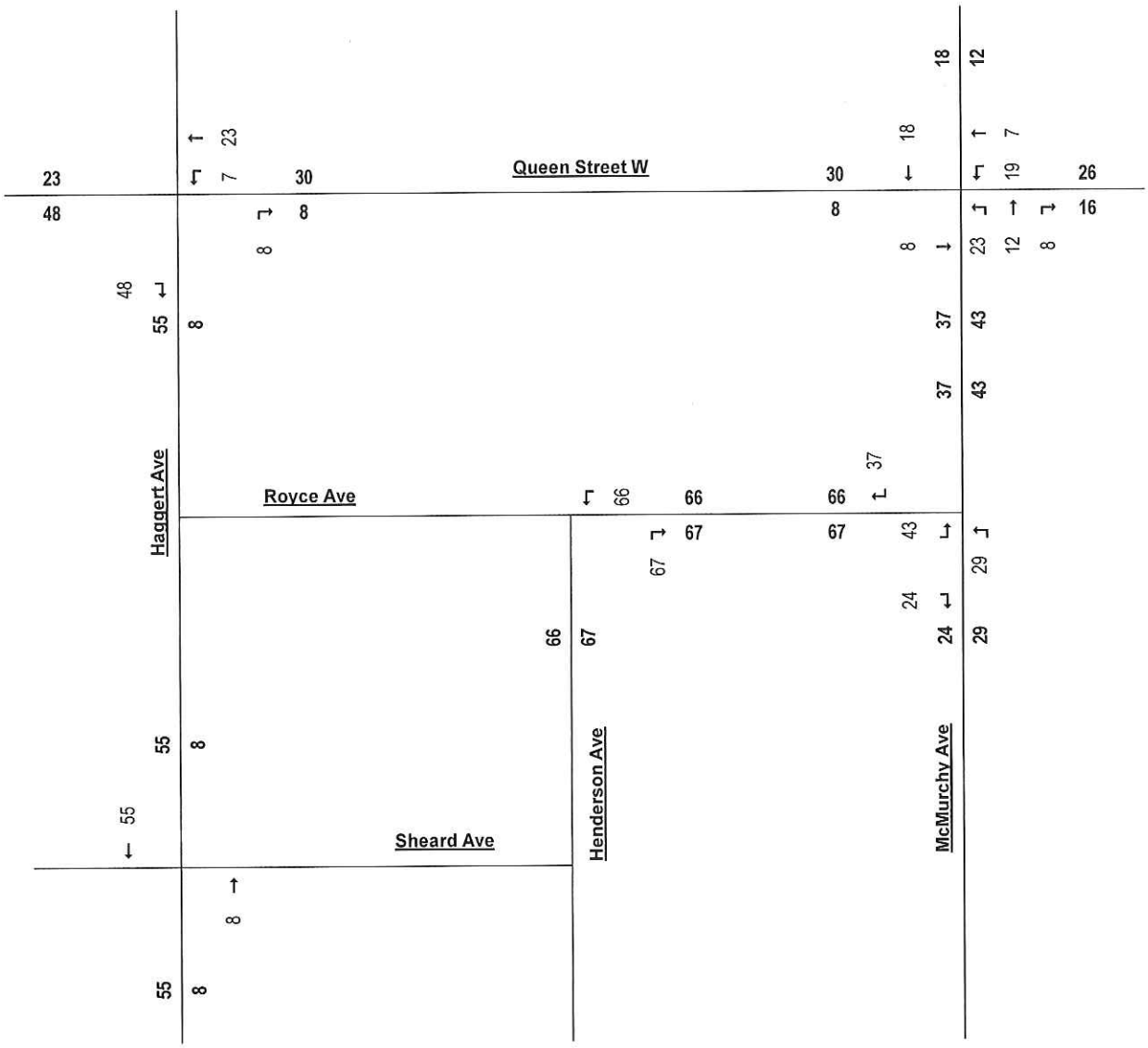


Figure 8 - Site Trips | PM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

FUTURE TOTAL TRAFFIC CONDITIONS

FUTURE TOTAL TRAFFIC VOLUMES

The weekday AM and PM peak hour total traffic forecasts are the combination of the background and site traffic forecasts. The proposed development will not introduce new driveways to the road network; all traffic will use the existing local roads to access Queen Street W and McMurchy Avenue S. The future total traffic volumes are illustrated in **Figure 9** and **Figure 10**.

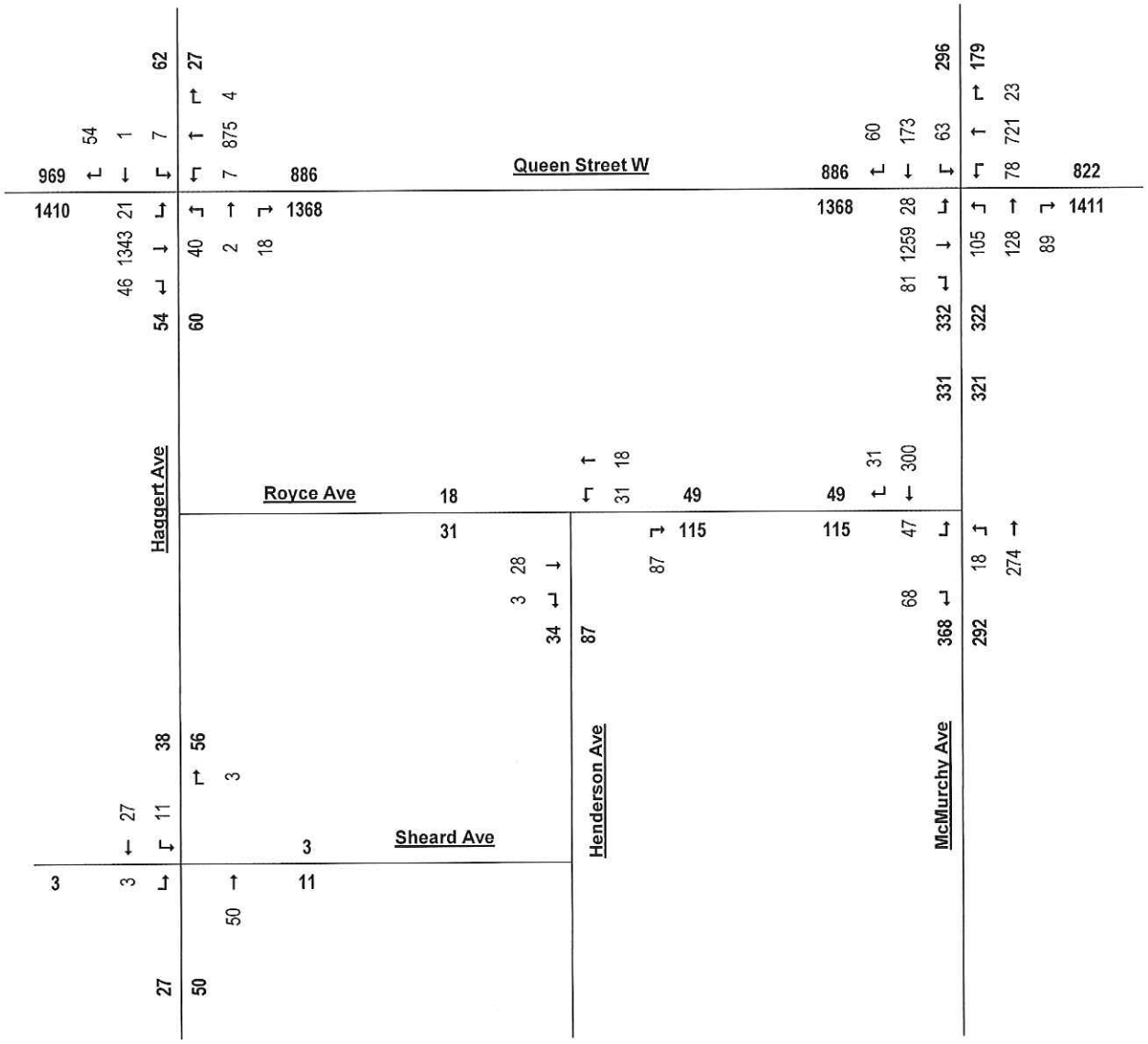


Figure 9 - Future Total Traffic Volumes | AM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

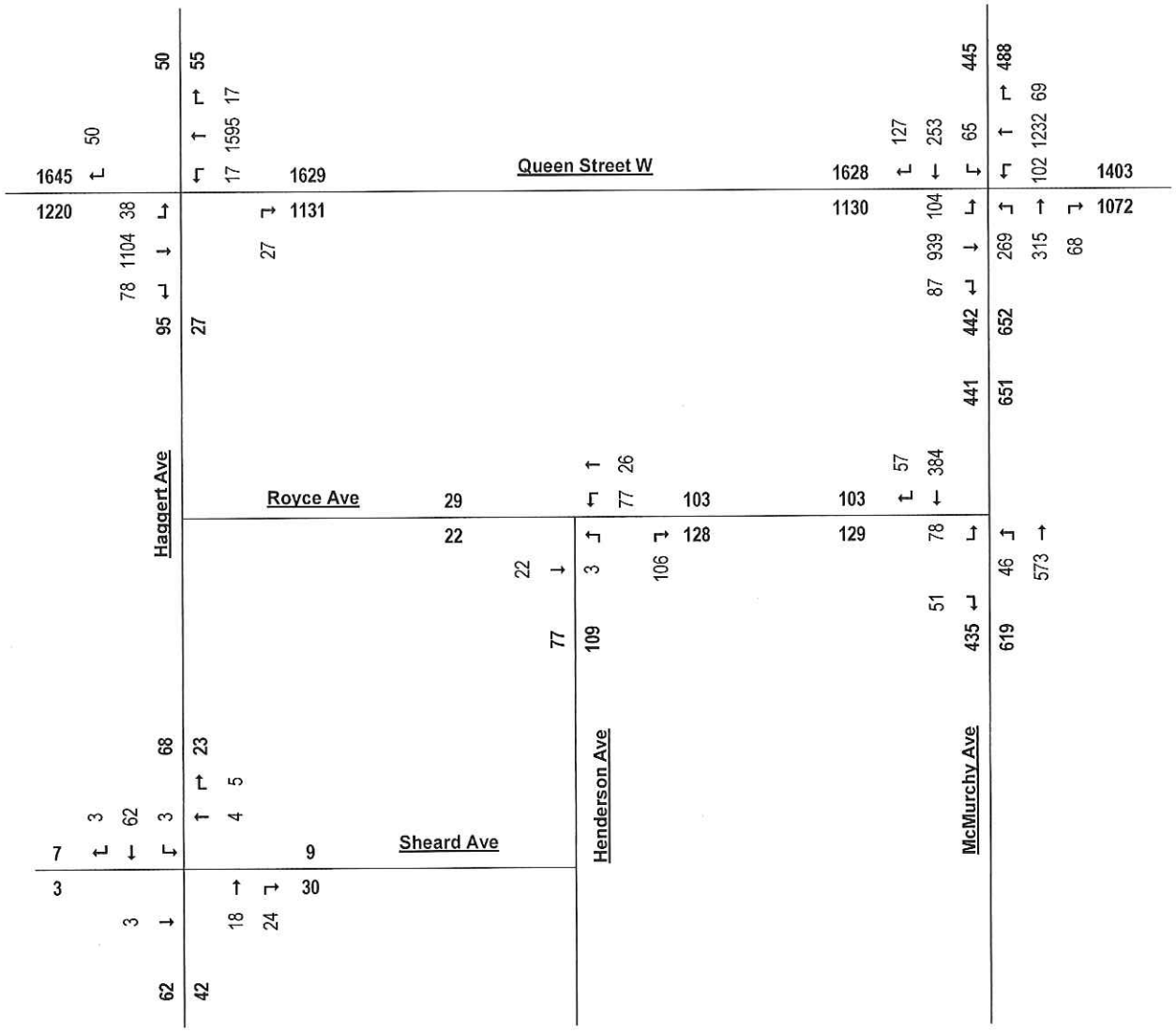


Figure 10 - Future Total Traffic Volumes | PM Peak Hour

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

FUTURE TOTAL TRAFFIC OPERATIONS

Future Total traffic forecasts were analyzed using the same methodology, parameters, lane arrangements, and traffic control devices as used in the analysis of future background traffic conditions, with the:

- Addition of site generated trips;
- Implementation of the recommended signal timing improvements at Queen Street W / McMurchy Avenue for the Background Traffic assessment; and
- Implementation of the recommended northbound and southbound through/left turn movement restrictions during the PM peak hour at the intersection of Queen Street West and Haggert Avenue.

The results of the operational analysis for the 2025 future total conditions are presented in **Table 5**. The SimTraffic and Synchro analysis outputs are provided for reference in **Attachment V** and **Attachment VI**.

The following impacts to the study area road network have been identified by 2025 Future Total Conditions:

- During the AM peak hour, the northbound approach to Queen Street W / Haggert Avenue is anticipated to exceed the theoretical capacity due to the significant delay forecasted through the HCM methodology. However, when evaluated through SimTraffic, considering the impact of platooning and coordination, delays at this movement are not anticipated to be significant and the movement is anticipated to operate at LOS "D with delays forecasted at 34 seconds. Only 60 veh/h are forecasted to arrive at the northbound approach during the AM peak hour. All other movements in the study area are forecast to operate acceptably at LOS "D" or better.
- During the PM peak hour, at the intersection of Queen Street West and McMurchy Avenue, the northbound left movement was found to exceed the theoretical capacity with a v/c ratio of 1.02 and a delay of 99s resulting in LOS "F". The northbound approach queues are forecast to spill back 226m and in instances, the northbound left queues are anticipated to reach a length of 99m on a 60m storage lane. This impacts the through traffic's progression and affects the eastbound left movement at the McMurchy Avenue and Royce Avenue intersection. This results in delays for the eastbound approach at the intersection of McMurchy Avenue / Royce Avenue reaching 43s and resulting in a LOS "E". The southbound approach is anticipated to operate at LOS "F" with delays nearing 167s. The westbound left movement is anticipated to operate at LOS "F" with delays of 157s while the westbound through / right movement is anticipated to operate at LOS "F" with delays of 90s.

The future total conditions anticipated levels of operations are summarized in **Table 5**.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Table 5 - Future Total (2025) Operational Conditions

Intersection	Approach/Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	Delay[1]	v/c[2]	Q[1]	LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	C	26	0.08	20	E	60	0.61	39
		Thru/Right	B	18	0.59	148	B	11	0.62	56
	WB	Left	D	52	0.46	35	F	157	0.73	46
		Thru/Right	B	10	0.33	55	F	90	0.97	326
	NB	Left	D	53	0.97	50	F	99	1.02	79
		Thru/Right	C	32	0.66	75	D	50	0.58	226
	SB	Left	D	45	0.51	43	F	167	0.30	81
		Thru/Right	D	35	0.76	80	F	127	0.96	394
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	A	9	0.46	60	A	8	0.40	40
	WB	Thru-Thru/Right	A	2	0.28	17	A	10	0.52	85
	NB	Left/Thru/Right	D	34	1.71	27	B	9	0.07	16
	SB	Left/Thru/Right	B	13	0.29	18	F	54	0.08	34
McMurchy Ave S / Royce Avenue *Unsignalized*	EB	Left/Right	A	7	0.23	21	E	43	0.54	61
	NB	Left/Thru	A	1	0.02	14	A	6	0.05	70
	SB	Thru/Right	A	2	0.21	1	A	2	0.28	1
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	A	0	0.02	0	A	0	0.01	1
	WB	Left/Thru	A	1	0.02	4	A	2	0.05	5
	NB	Left/Right	A	3	0.10	11	A	3	0.11	19
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	A	4	0	5	A	4	0	5
	WB	Left/Thru/Right	A	3	0	6	A	4	0.01	9
	NB	Left/Thru/Right	A	0	0	--	A	0	0	--
	SB	Left/Thru/Right	A	0	0.01	1	A	0	0	2

1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres

As a result of the findings above, the following mitigation measures were implemented:

- Increasing the cycle length to 140s at the intersection of Queen Street W and McMurchy Avenue;
- Increasing the northbound left storage length from 60m to 80m at the intersection of Queen Street West and McMurchy Avenue. It is important to note that the previous study modelled a longer length; however, subsequent reviews as presented in **Attachment II**, indicate that only 80m is constructable and therefore the SimTraffic Modelling was updated accordingly;
- Introducing a westbound left protected split of 15s at the intersection of Queen Street West / McMurchy Avenue; and
- Increasing the cycle length at the intersection of Queen Street West and McLaughlin Avenue to 140s to improve coordination with the intersection of Queen Street West and McMurchy Avenue.

The PM peak hour traffic operations with these improvements implemented are presented in **Table 6**.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Table 6 - Future Total (2025) – PM Peak Hour Improvements

Intersection	Approach/Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	Delay[1]	v/c[2]	Q[1]	LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	*Increasing the cycle length to 140 seconds, optimizing phase splits and offsets, increasing the northbound left storage lane from 60m to 80m (constructable), and adding a 15s protected westbound left split.*				E	65	0.61	43
		Thru/Right					B	19	0.77	103
	WB	Left					F	94	0.54	43
		Thru/Right					E	71	0.98	270
	NB	Left					E	63	0.99	105
		Thru/Right					C	36	0.65	140
	SB	Left					E	68	0.29	72
		Thru/Right					F	87	0.90	216
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	*Not Applicable*				A	8	0.40	31
	WB	Thru-Thru/Right					A	4	0.52	14
	NB	Left/Thru/Right					B	9	0.07	15
	SB	Left/Thru/Right					C	20	0.08	20
McMurchy Ave S / Royce Avenue *Unsignalized*	EB	Left/Right	*Not Applicable*				C	15	0.54	28
	NB	Left/Thru					A	2	0.05	24
	SB	Thru/Right					A	1	0.28	1
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	*Not Applicable*				A	0	0.01	0
	WB	Left/Thru					A	2	0.05	4
	NB	Left/Right					A	3	0.11	17
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	*Not Applicable*				A	4	0	5
	WB	Left/Thru/Right					A	3	0.01	10
	NB	Left/Thru/Right					A	0	0	--
	SB	Left/Thru/Right					A	0	0	--
Other off-site Improvements			*Increasing the cycle length from 135s to 140s; the added 5 seconds is assigned to the eastbound and westbound through split phases*				NA			

1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres

As shown in **Table 6** above, adjusting the cycle length and modifying the northbound left storage length at the intersection of Queen Street West and McMurchy Avenue had positive impacts on traffic operations. During the PM peak hour, the operations at the northbound left movement are improved and theoretical capacity is no longer exceeded. The delay associated with the movement has been reduced by to 36s while the northbound through movement queues have been reduced to 140m and no longer impact the eastbound left operations at the intersection of McMurchy Avenue and Royce Avenue.

The southbound left turn movement is anticipated to operate at LOS "E" and the delays have been substantially reduced to 68s. The southbound through movement is anticipated to operate at LOS "F" at a delay of 87s. A similar pattern is observed for the westbound approach, as the 15s protected westbound left split has improved operations. The westbound left movement is forecast to operate at LOS "F" with a delay of 94s while the westbound through movement is anticipated to operate at LOS "E" with a delay of 71s. Overall, these operations are considered as acceptable due to the congested nature of Queen Street during the peak hours. All other study area intersections and movements are forecasted to operate at LOS "D or better.

SENSITIVITY ANALYSIS OF 10 HENDERSON AVENUE

Following discussion with the City of Brampton staff, it was identified that there is currently a proposal to introduce 282 condominium units; however, the development proposal is currently at the pre-consultation stage and no detailed study or information is available yet. Therefore, high-level sensitivity analyses were performed to identify the likely impact of both development proposals at 12 Henderson Avenue (the subject site) and 10 Henderson Avenue being fully built by the year 2025.

TRAFFIC GENERATION AND ASSIGNMENT

Information available at BramPlanOnline indicate that the third to twenty second floor would contain 1 to 2 residential units. Due to the reduced number of units per level, compared to typical high-rise buildings, the traffic generation utilized mid-rise multi-family units (LUC 221) representing slightly conservative traffic generation assumptions.

Table 7 below summarizes the combined traffic generation for both proposed developments at 10 and 12 Henderson Avenue.

Table 7 - Site Trip Generation | Both Development Proposals at 10 and 12 Henderson Avenue

	Revised Higher-Density Plan					
	AM In	AM Out	AM Total	PM In	PM Out	PM Total
Townhouses (148 units)	16	52	68	52	31	83
Apartments (293 units at 12 Henderson and 282 units at 10 Henderson)	54	153	207	154	99	253
Total	70	205	275	206	130	336
8% Reduction	5	16	22	16	10	26
Total	**65**	**189**	**253**	**190**	**120**	**310**

Traffic distribution and assignment followed the same methodology presented earlier for 12 Henderson trip generation presented in **Table 4**.

Figure 11 and **Figure 12** summarize the total traffic assignment of both developments' site trips.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

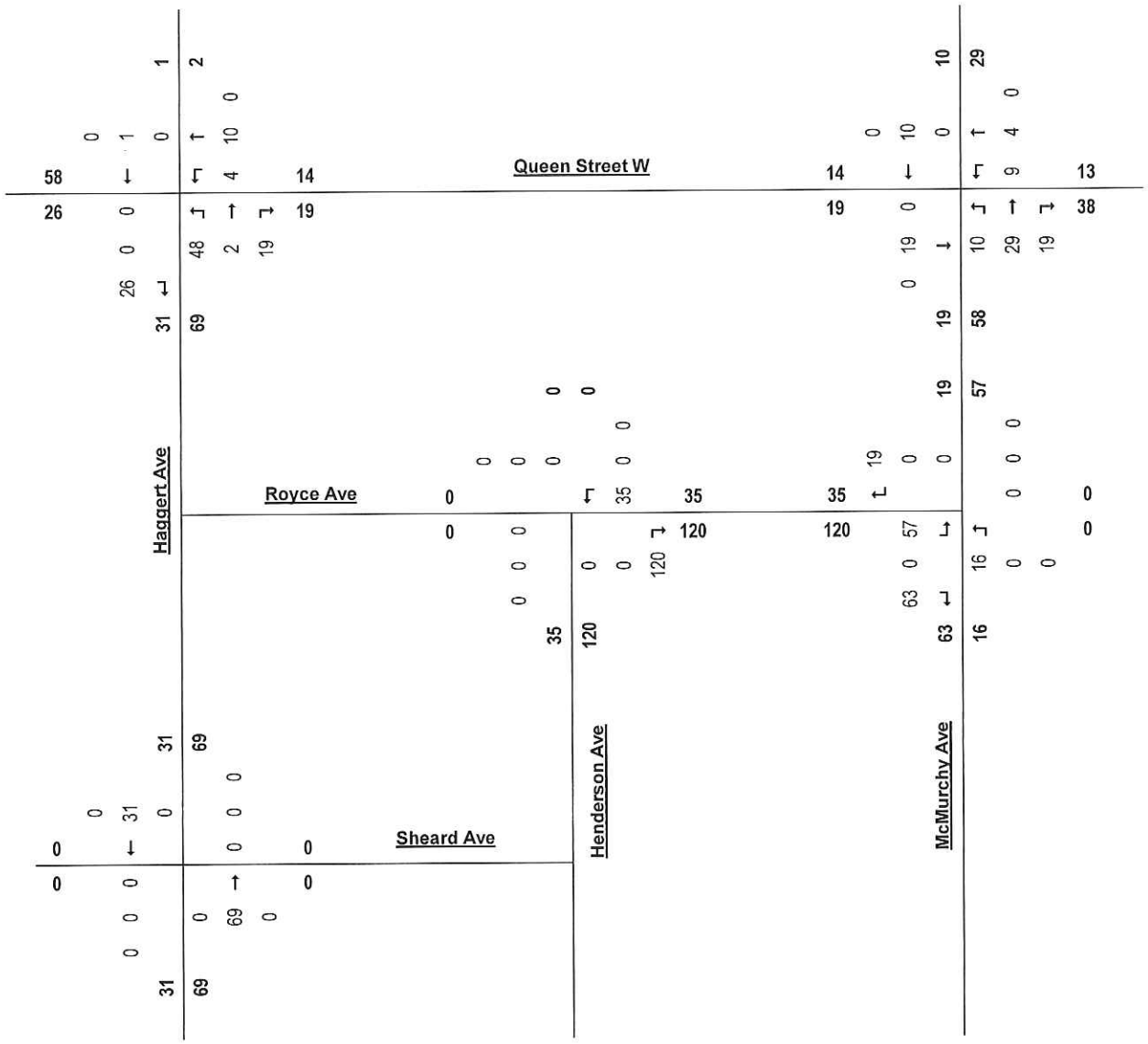


Figure 11 – Site Trips | AM Peak Hour – Sensitivity

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

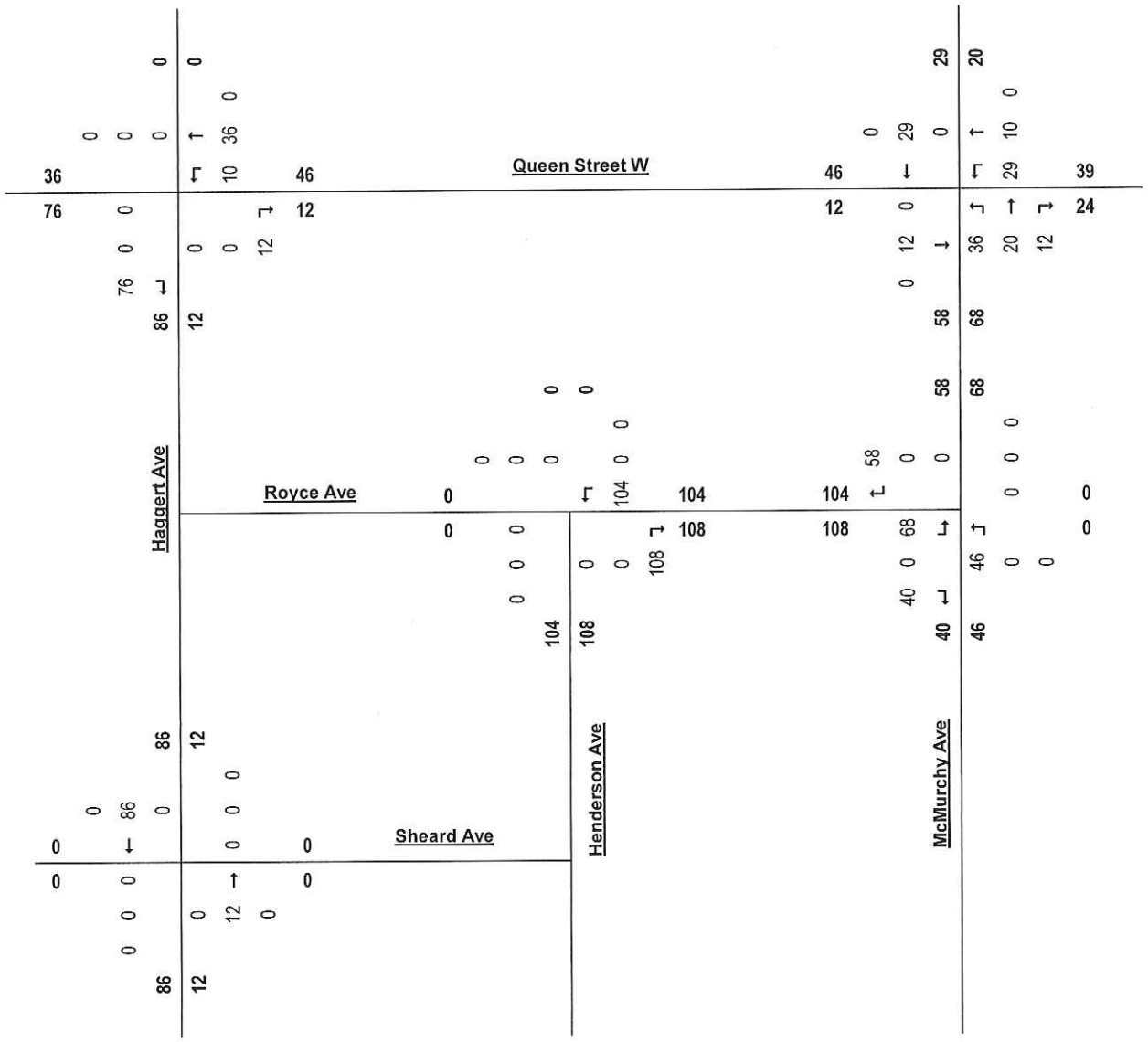


Figure 12 – Site Trips | PM Peak Hour – Sensitivity

FUTURE TOTAL TRAFFIC VOLUMES

The weekday AM and PM peak hour total traffic forecasts are the combination of the background and site traffic forecasts. The future total traffic volumes are illustrated in **Figure 13** and **Figure 14**.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

FUTURE TOTAL TRAFFIC OPERATIONS

Future Total traffic forecasts are analyzed using the same methodology, parameters, lane arrangements, and traffic control devices that were used for the analyses presented earlier, with the:

- Addition of the combined site generated trips (10 and 12 Henderson Avenue developments) to the 2025 background traffic volumes;
- Carrying the recommended signal timing improvements of the future total conditions at Queen Street W / McMurchy Avenue as well as the 80m northbound left turn lane storage lane; and
- Retaining the northbound and southbound through/left turn movement restrictions during the PM peak hour at the intersection of Queen Street West and Haggert Avenue.

Signalization warrants have also been performed, but assuming that the left/through PM peak turning movement restrictions are not in place. It was found that signalization is not warranted; Signal warrants can be found in **Attachment VII**.

The future total traffic volumes under this sensitivity scenario are summarized in **Figure 13** and **Figure 14** for the AM and PM peak hours, respectively.

The results of the operational analysis for the 2025 future total conditions are presented in **Table 8**. The SimTraffic and Synchro analysis outputs are provided for reference in **Attachment V** and **Attachment VI**.

Reference: 12 Henderson Avenue Traffic Impact Study Update – Full Build-Out

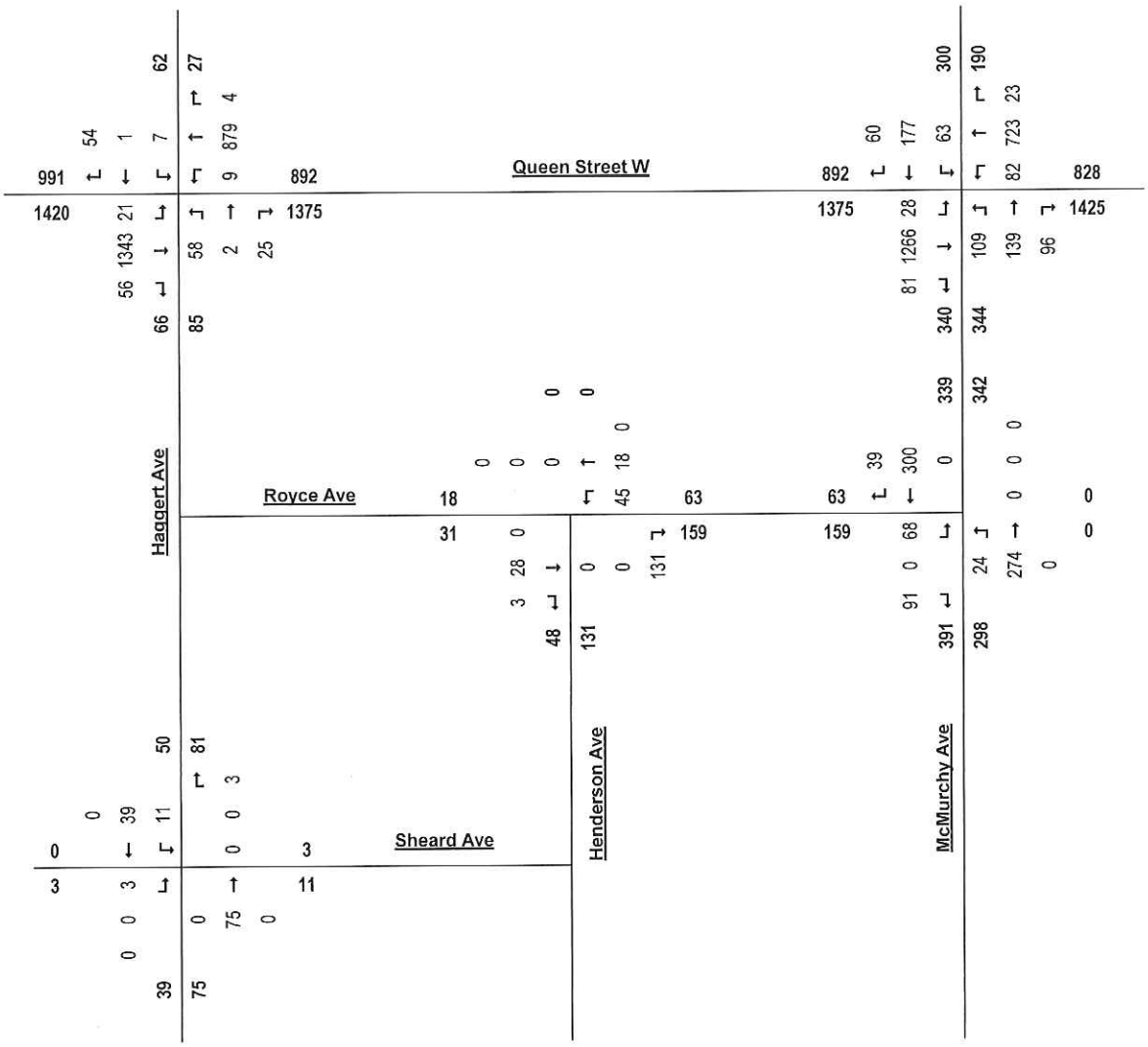


Figure 13 - Future Total Traffic Volumes | AM Peak Hour - Sensitivity

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

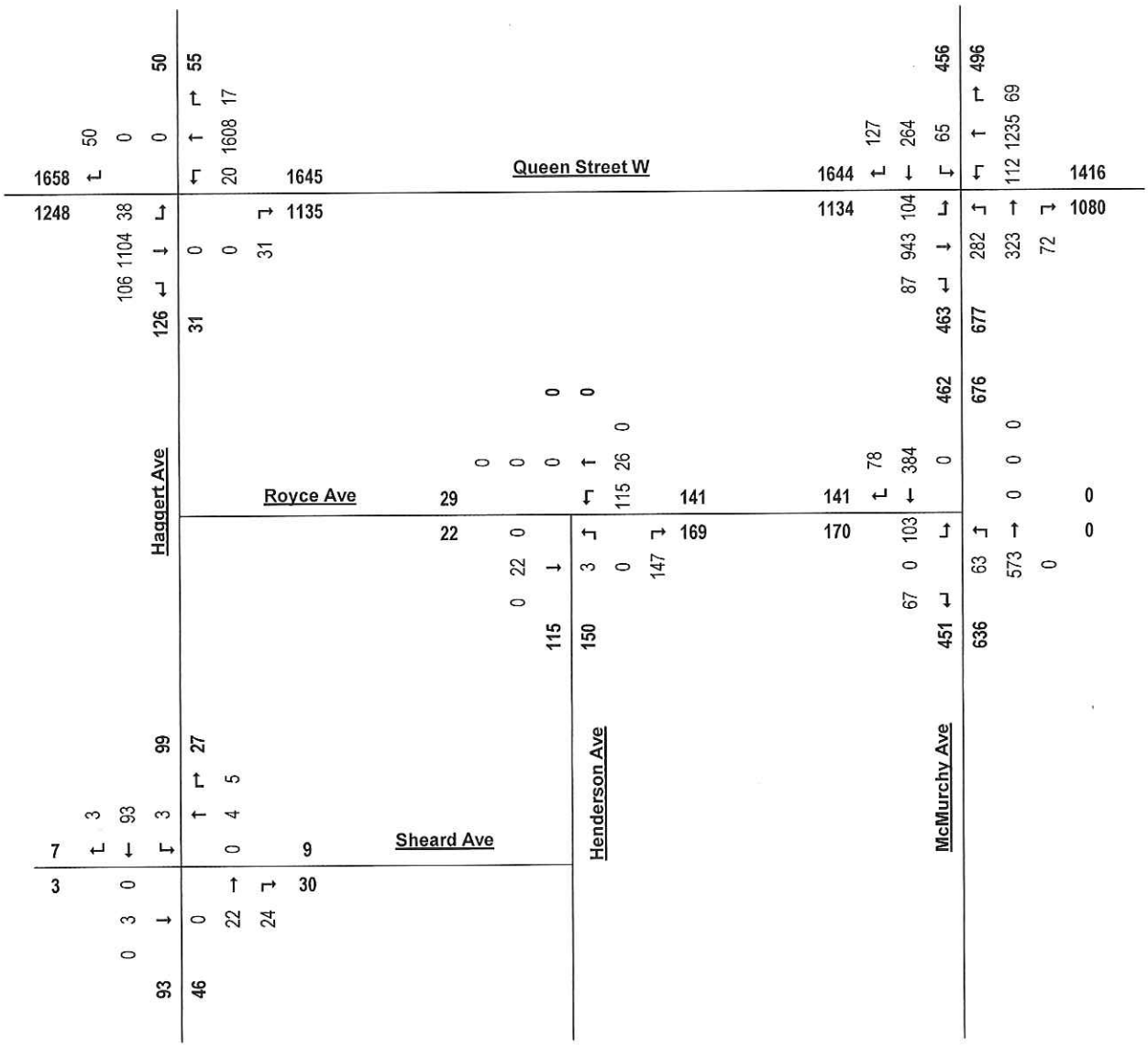


Figure 14 - Future Total Traffic Volumes | PM Peak Hour - Sensitivity

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Table 8 - Future Total (2025) Operational Sensitivity

Intersection	Approach/Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	Delay[1]	v/c[2]	Q[1]	LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	C	24	0.08	25	E	60	0.61	43
		Thru/Right	B	18	0.60	144	B	20	0.79	104
	WB	Left	E	56	0.50	37	F	111	0.59	44
		Thru/Right	B	11	0.34	59	F	89	0.99	318
	NB	Left	D	50	1.00	52	F	131	1.05	116
		Thru/Right	C	33	0.71	74	E	58	0.66	253
	SB	Left	D	47	0.56	32	F	115	0.29	77
		Thru/Right	D	37	0.76	78	F	128	0.91	335
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	A	9	0.47	24	A	8	0.42	26
	WB	Thru-Thru/Right	A	2	0.28	19	A	4	0.52	14
	NB	Left/Thru/Right	E	36	2.52	39	B	9	0.09	18
	SB	Left/Thru/Right	B	6	0.30	22	C	19	0.08	20
McMurchy Ave S / Royce Avenue *Unsignalized*	EB	Left/Right	A	7	0.23	24	F	143	0.78	118
	NB	Left/Thru	A	1	0.02	16	C	20	0.06	159
	SB	Thru/Right	A	2	0.21	2	A	3	0.30	3
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	A	0	0.02	0	F	76	0.01	22
	WB	Left/Thru	A	1	0.02	4	A	2	0.08	5
	NB	Left/Right	A	3	0.10	23	E	50*	0.16	44
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	A	4	0	5	A	6	0.10	5
	WB	Left/Thru/Right	A	3	0	6	A	4	0.30	9
	NB	Left/Thru/Right	A	0	0	--	A	0	0	--
	SB	Left/Thru/Right	A	1	0.01	3	A	0	0	1

*1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres, * delay can be longer due to denied 10veh that were denied entry due to congestion*

The following impacts to the study area road network have been identified by 2025 Future Total Conditions:

- During the AM peak hour, the northbound approach to Queen Street W / Haggert Avenue is anticipated to exceed the theoretical capacity due to the significant delay forecasted through the HCM methodology. However, when evaluated through SimTraffic, considering the impact of platooning and coordination, delays at this movement are not anticipated to be significant and the movement is anticipated to operate at LOS "D with delays forecasted at 36 seconds. Only 85 veh/h are forecasted to arrive at the northbound approach during the AM peak hour. In addition, the westbound left turn at Queen Street West / McMurchy Avenue is forecasted to operate at a delay of 56 seconds LOS "E". The northbound left turn movement is anticipated to operate at its theoretical capacity thresholds with a v/c ration of 1.0, and a delay of 50s representing LOS "D." All other movements in the study area are forecasted to operate acceptably at LOS "D" or better.
- During the PM peak hour, at the intersection of Queen Street West and McMurchy Avenue, the northbound left movement was found to exceed the theoretical capacity with a v/c ratio of 1.05 and a

delay of 131s resulting in LOS "F". The northbound approach queues are forecast to spill back 253m and in instances, the northbound left queues are anticipated to reach a length of 116m on an 80m storage lane. This impacts the through traffic's progression and affects the eastbound left movement at the McMurchy Avenue and Royce Avenue intersection. This results in delays for the eastbound approach at the intersection of McMurchy Avenue / Royce Avenue of 76s resulting in a LOS "F". The southbound approach is anticipated to operate at LOS "F" with delays nearing 128s. The westbound left movement is anticipated to operate at LOS "F" with delays of 111s while the westbound through / right movement is anticipated to operate at LOS "F" with delays of 89s.

As a result of the findings above, the following mitigation measures were implemented:

- Increasing the cycle length to 145s at the intersection of Queen Street W and McMurchy Avenue;
- Retaining the westbound left protected/permissive operations with a protected split of 15s at the intersection of Queen Street West and McMurchy Avenue;
- Reducing the eastbound left turn protected split from 22s to 18s. The movement is envisioned to continue operating as a protected/permissive phase;
- Increasing the east-west through splits by 3s (to 63s and 60s for the eastbound through and westbound through movements, respectively);
- Increasing the northbound left turn phase's protected portion of the split by 3s to 23s;
- Increasing the northbound through phase by 2s to 59s while reducing the southbound through phase split by 1s to 44s; and finally
- Increasing the cycle length at the intersection of Queen Street West and McLaughlin Avenue to 145s to improve coordination with the intersection of Queen Street West and McMurchy Avenue.

The PM peak hour traffic operations with these improvements implemented are presented in **Table 9**.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Table 9 - Future Total (2025) Operational Conditions

Intersection	Approach/Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	Delay[1]	v/c[2]	Q[1]	LOS[1]	Delay[1]	v/c[2]	Q[1]
Queen Street W / McMurchy Avenue *Signalized*	EB	Left	*Increasing the cycle length to 145 seconds, optimizing phase splits and offsets,*				F	82	0.62	44
		Thru/Right					B	37	0.79	162
	WB	Left					F	122	0.61	44
		Thru/Right					F	100	1.01	355
	NB	Left					F	96	0.98	111
		Thru/Right					D	43	0.64	196
	SB	Left					F	121	0.28	76
		Thru/Right					F	134	0.94	299
Queen Street W / Haggert Avenue *Unsignalized*	EB	Thru-Thru/Right	*Not Applicable*				A	8	0.42	39
	WB	Thru-Thru/Right					A	5	0.52	22
	NB	Left/Thru/Right					B	9	0.09	16
	SB	Left/Thru/Right					C	18	0.08	21
McMurchy Ave S / Royce Avenue *Unsignalized*	EB	Left/Right	*Not Applicable*				D	29	0.78	50
	NB	Left/Thru					A	3	0.06	44
	SB	Thru/Right					A	2	0.30	2
Henderson Ave / Royce Avenue *Unsignalized*	EB	Thru/Right	*Not Applicable*				A	0	0.01	0
	WB	Left/Thru					A	2	0.08	5
	NB	Left/Right					A	3	0.16	21
Haggert Ave S / Sheard Avenue *Unsignalized*	EB	Left/Thru/Right	*Not Applicable*				A	5	0.10	5
	WB	Left/Thru/Right					A	2	0.30	9
	NB	Left/Thru/Right					A	0	0	--
	SB	Left/Thru/Right					A	0	0	--
Other off-site Improvements			*Increasing the cycle length from 140s to 145s with phase splits optimization.*				NA			

1 – Calculated with SimTraffic; 2 – Calculated with Synchro HCM methodology; v/c equal to or greater than 1.0 for any movement, LOS E/F are highlighted (if any); Delay in seconds; Queue = 95th Percentile Queue in metres

As shown in **Table 9** above, adjusting the cycle length and phase splits at the intersection of Queen Street West and McMurchy Avenue had positive impacts on the network's traffic operations. During the PM peak hour, the operations at the northbound left movement are improved and theoretical capacity is no longer exceeded. The delay associated with the movement has been reduced by to 35s while the northbound through movement queues have been reduced to 196m.

The southbound left turn movement is anticipated to operate at LOS "F", the delays have increased by 6s and the movement delays are anticipated to reach up to 134s (~2.25mins). The westbound left movement is forecast to operate at LOS "F" with a delay of 122s while the westbound through movement is anticipated to operate at LOS "F" with a delay of 100s. The eastbound left movement is also forecasted to operate at LOS "F" with delays reaching 82s. Generally, at the intersection, the delays are lower than the cycle length of 145s and are considered acceptable given the congested conditions of Queen Street.

All other study area movements are anticipated to operate acceptably at LOS "D" or better.

SUMMARY AND CONCLUSIONS

Stantec was retained by Umbria Developments Inc. to prepare an update to the Traffic Impact Study conducted for a proposed development located at 12 Henderson Avenue in the City of Brampton. The previous study, *12 Henderson Avenue Traffic Impact Assessment – Full Build-Out* investigated the impacts of 250 apartment units and 152 stacked townhouses. Umbria Developments Inc. is planning a change to the proposed unit count to 148 townhouses and 293 apartment units resulting in an overall increase of 39 dwelling units. This traffic impact study provides an update to the previously submitted study and provides additional sensitivity analyses by incorporating the development proposal of 282 condominium units at 10 Henderson Avenue.

The conducted analyses conclude that this development can be supported from a traffic operations perspective; however, a number of operational improvements are required during the PM peak hour at the intersections of Queen Street at McMurchy Avenue (signal timing adjustments), Haggert Avenue (left/through movements turn restrictions during the PM peak hour), and McLaughlin Road (signal timing adjustments). Furthermore, increasing the northbound left turn storage to 80m at the intersection of Queen Street / McMurchy Avenue is recommended. As the development proposal located at 10 Henderson Avenue is currently under the pre-consultation with no completed traffic studies yet, a sensitivity scenario was developed to identify the impacts of its inclusion. Below is a summary of the operating conditions for all analyzed scenarios and the required improvements.

Under 2025 Background Conditions:

- During the AM peak hour, all intersections and movements are anticipated to operate at satisfactory levels with LOS "E" or better.
- During the PM peak hour, multiple movements are anticipated to operate at a LOS "F", delays exceeding 2 minutes, and v/c ratios exceeding 1.0 at the intersection of Queen Street West / McMurchy Avenue. The northbound and southbound approaches at the intersection of Queen Street West / Haggert Avenue is also anticipated to operate under similar operating conditions due to the lack of insufficient gaps for through/left turn movements between eastbound and westbound traffic at the intersection.

Background Conditions Improvements (PM Peak Hour Only):

To improve the background PM peak hour operating conditions, the signal cycle length at the intersection of Queen Street W and McMurchy Avenue was increased to 135s (with 51s for the westbound through split) and an eastbound left protected phase of 24s was introduced to improve traffic flow. At the stop-controlled intersection of Queen Street West and Haggert Avenue, a restriction on northbound and southbound left / through movements is recommended during the PM peak period (4-6 PM).

The improvement measures are anticipated to improve future background operations in the study area significantly. At the intersection of Queen Street West and McMurchy Avenue, no movements are expected to exceed theoretical capacities. For the most delayed movements, travel time delays are anticipated to be reduced to 71 seconds as compared to over 7.5 minutes of delay without improvements.

2025 Future Total Conditions

- During the AM peak period, the northbound approach at the intersection of Queen Street West and Haggert Avenue is anticipated to exceed its theoretical capacity with a v/c ratio of 1.71 despite the low traffic volumes. However, after taking into account the impacts of traffic platooning and queueing, it is anticipated that delays will average 34 seconds. Therefore, no improvements are required for the AM peak hour.
- During the PM peak period, at the intersection of Queen Street West and McMurchy Avenue, the northbound left movement was found to exceed theoretical capacity and operate at LOS "F" with a delay of 99s. The northbound through movement is anticipated to generate vehicular queues in excess of 226m which will spill back and affect the eastbound left operation at the intersection with Royce Avenue. The westbound approach is anticipated to operate at LOS "F" with 157s and 90s of delay for the left and through movements, respectively. The southbound approach movements are also anticipated to operate at LOS "F" with up to 167s of delay.

2025 Future Total Conditions Improvements (PM Peak Hour Only):

To improve the 2025 future total PM peak hour operating conditions, the signal cycle length at the intersection of Queen Street W and McMurchy Avenue was increased to 140s with reoptimized splits. Resulting in significant improvements to operations. with this improvement, all turning movements are anticipated to operate below or at their theoretical capacities.

With the recommended improvements, the northbound left movement was found operate below its theoretical capacity and operates at LOS "E" with a delay of 63s. The northbound through movement queues are anticipated to be reduced to 140m avoiding negative impacts to the eastbound left operations at the intersection with Royce Avenue. The westbound approach is anticipated to operate at LOS "F" with 94s and 71ss of delay for the left and through movements, respectively. The southbound approach movements are also anticipated to operate at LOS "F" with up to 87s of delay.

2025 Future Total Conditions | Sensitivity Analyses of 10 Henderson Avenue

To identify the impacts of the combined demands of both proposed developments at 10 and 12 Henderson Avenue, the analyses were revisted using the recommended improvements to support 12 Henderson Avenue as a baseline. It was found that without improvements in the PM peak hour the network is anticipated to experience deteriorated operations. Generally, the following was identified:

- During the AM peak hour, the northbound approach at the intersection of Queen Street West and Haggert Avenue is anticipated to exceed its theoretical capacity with a v/c ratio of 2.52 despite the low traffic volumes. However, taking into account the impacts of traffic platooning and queueing, it is anticipated that delays will average 36 seconds. Furthermore, the westbound left turn movement is anticipated to operate at LOS "E"; however, the delay is relatively low at 56s. The northbound left turn movement is anticipated to operate at its theoretical capacity thresholds; however, delay is forecasted at 50s representing LOS "D". Therefore, no improvements are required for the AM peak hour.
- During the PM peak hour, at the intersection of Queen Street West and McMurchy Avenue, the northbound left movement was found to exceed theoretical capacity and operate at LOS "F" with a delay of 131s. The northbound through movement is anticipated to generate vehicular queues in excess of 253m which will spill back and affect the eastbound left operation and northbound through operations at the intersection with Royce Avenue. The westbound approach is anticipated to operate at LOS "F" with 111s and 89s of delay for the left and through movements, respectively. The southbound approach movements are also anticipated to operate at LOS "F" with up to 128s of delay.

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

2025 Future Total Conditions | Sensitivity Analyses of 10 Henderson Avenue Improvements (PM Peak Hour Only):

To improve the future total PM peak hour operating conditions under the sensitivity scenario, the signal cycle length at the intersection of Queen Street W and McMurchy Avenue was increased to 145s with reoptimized splits. Resulting in significant improvements to operations at the intersection and overall network. With this improvement, all turning movements except for the westbound through movement are anticipated to operate below or at their theoretical capacities. The westbound through movement is anticipated to operate at v/c of 1.01 and a delay of 100s. The westbound segment along Queen Street between Haggert Avenue and McMurchy Avenue, is anticipated to be the operating under moving queues (stop-go conditions). However, the modelling indicates that this form operation is limited to this segment and is not anticipated to impact westbound traffic's through progression operations at Mills Street.

With the recommended improvements, the northbound left movement was found operate below its theoretical capacity and operates at LOS "F" with a delay of 96s. The northbound through movement queues are anticipated to be reduced to 196m avoiding negative impacts to the eastbound left and northbound through operations at the intersection with Royce Avenue. The westbound approach is anticipated to operate at LOS "F" with 122s and 100s of delay for the left and through movements, respectively. The southbound approach movements are also anticipated to operate at LOS "F" with up to 134s of delay.

Under both scenarios, with and without the inclusion of the development proposal at 10 Henderson Avenue, it was concluded that the subject development located at 12 Henderson, can be supported from a transportation perspective. However, a number of improvements is recommended as summarized below in **Table 10**.

Table 10: Recommended Improvements by Horizon Year

Horizon Year	Improvements
Existing Conditions ***(As per the 2020 TIS)***	For the PM Peak hour at: 1. Queen Street / McMurchy Avenue: • *Introduction of a 15s northbound left split;* • *Changing E-W coordination offsets from 104s to 72s* • *Maintain a cycle length of 120s*
2025 Background Conditions ***(As per the 2020 TIS)***	For the PM Peak hour at: 1. Queen Street / McMurchy Avenue: • *Increasing the cycle length to 135s* • *westbound through split at 51s introducing an eastbound left protected-permissive 24s* 2. Queen Street / Haggert Avenue: • *Restricting northbound and southbound left / through movements during the PM peak period* 3. Queen Street / McLaughlin Road: • *Increasing the eastbound and westbound through split phase timings by 5 seconds at the intersection of Queen Street W and McLaughlin.*
2025 Future Total Conditions ***(Considers the 12 Henderson Avenue development only)***	For the PM Peak hour at: 1. Queen Street / McMurchy Avenue:

Reference: **12 Henderson Avenue Traffic Impact Study Update – Full Build-Out**

Horizon Year	Improvements
	• *Increasing the cycle length to 140 seconds,* • *optimizing phase splits and offsets,* • *increasing the northbound left storage lane from 60m to 80m, and* • *adding a 15s protected westbound left split.* 2. Queen Street / McLaughlin Road: • *Increasing the cycle length from 135s to 140s; the added 5 seconds is assigned to the eastbound and westbound through split phases*
2025 Future Total Conditions - Sensitivity ***(Considers both the 12 Henderson Avenue and 10 Henderson Avenue developments)***	For the PM Peak hour at: 1. Queen Street / McMurchy Avenue: • *Increasing the cycle length to 145 seconds,* • *optimizing phase splits and offsets,* • *maintaining the introduction of protected/permissive operations for the westbound left movement, and* • *Maintaining the increase of storage length of the northbound left turn movement from 60m to 80m.* 2. Queen Street / McLaughlin Road: • *Increasing the cycle length from 140s to 145s; the added 5 seconds is assigned to the eastbound and westbound through split phases.*

We trust that this study provides the City of Brampton and Region of Peel with the necessary information and improvements required to accommodate the development. For any clarifications or comments, please contact the undersigned.

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Attachment:
I- 12 Henderson Avenue Traffic Impact Assessment – Full Build-Out, 2020
II- 12 Henderson Avenue | Justification for the length of Northbound left-turn storage lane at the intersection of Queen Street / McMurchy Avenue, 2021
III- Proposed Development Site Plan
IV- 2020 and 2021 collected TMCs (for reference only)
V- SimTraffic Outputs
VI- Synchro Outputs
VII- Intersection Signalization Warrants – 10 and 12 Henderson Avenue Developments

A-2021-0227

SERVICING & STORMWATER MANAGEMENT REPORT

12 HENDERSON AVENUE

CITY OF BRAMPTON
REGION OF PEEL

PREPARED FOR:

UMBRIA DEVELOPERS INC.

PREPARED BY:

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JULY 2021

CFCA FILE NO. 1259-6076

CITY FILE NO. C02W05.044 &

CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
Rev.0	November 2017	Issued for ZBA
Rev.1	May 2019	Issued for ZBA
Rev.2	November 2019	Issued for ZBA
Rev.3	March 5, 2021	Issued for SPA
Rev.3A	July 22, 2021	Issued for Minor Variance (Phase 2)

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1.0 INTRODUCTION

Umbria Developers Inc. (Owner) retained C.F. Crozier & Associates Inc. (Crozier) to prepare a Servicing and Stormwater Management Report and accompanying drawings in support of Minor Variance Application for the proposed Phase 2 of the residential development located at 12 Henderson Avenue in the City of Brampton (City), Region of Peel (Region).

This report outlines the proposed servicing and stormwater management plan for the site according to the requirements of the City of Brampton, Region of Peel, and Credit Valley Conservation (CVC).

The following reports and design standards were referenced during the preparation of this report:

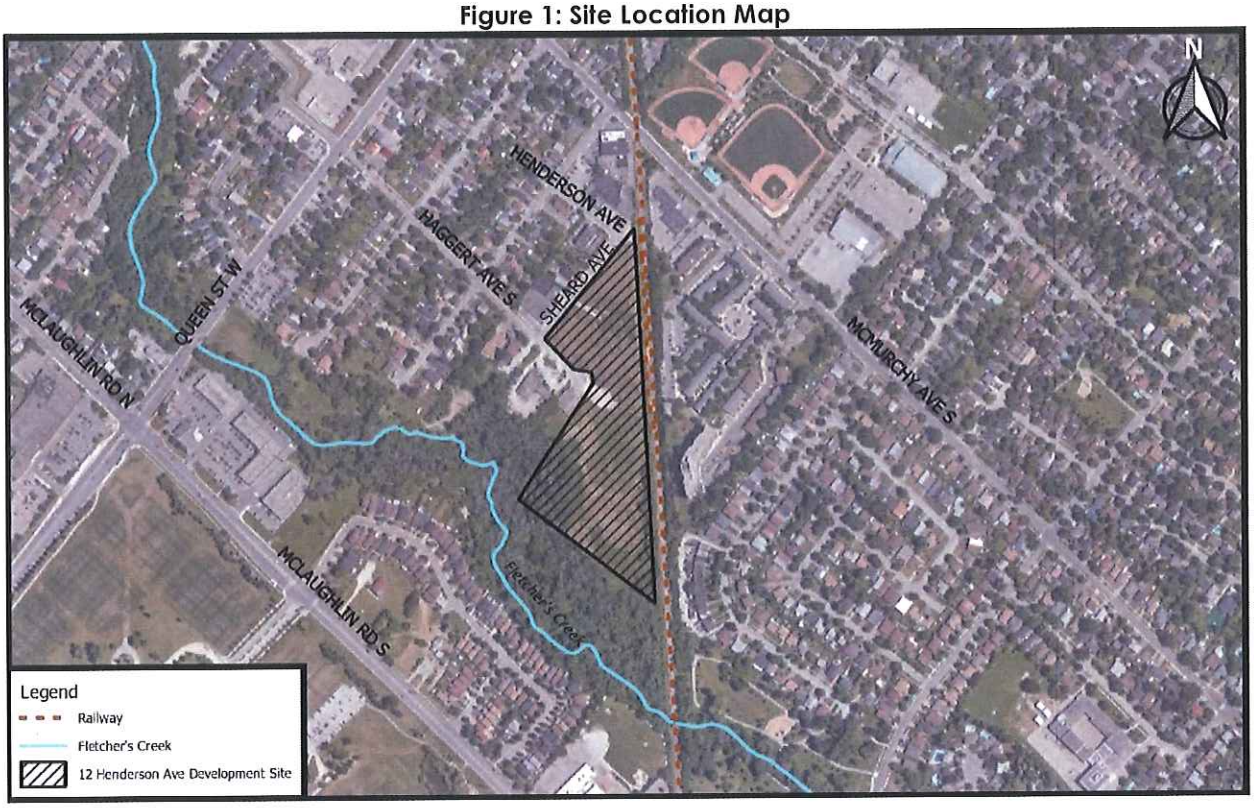
- Region of Peel Public Works Design, Specifications & Procedures Manual – Sanitary Sewer Design Criteria dated July 2009, Modified March 2017;
- Region of Peel Public Works Design, Specifications & Procedures Manual – Watermain Design Criteria dated June 2010;
- Region of Peel Public Works Design, Specifications & Procedures Manual – Storm Sewer Design Criteria dated July 2009;
- City of Brampton Site Plan Approval Manual dated 2011;
- City of Brampton Site Plan Review User Guide dated February 2018;
- City of Brampton Design Standards Drawings;
- Credit Valley Conservation Stormwater Management Criteria date August 2012;
- Ministry of Environment Stormwater Management Planning and Design Manual dated March 2003;
- Guidance for Development Activities in Redside Dace Protected Habitat by Ministry of Natural Resources and Forestry dates March 2016.

2.0 SITE DESCRIPTION

The subject land covers an area of approximately 3.12 ha, 0.06 ha of which is part of the proposed road widening of Sheard Ave. The site currently consists of an open vacant lot with fallow vegetation. The property is located in a mixed commercial and residential neighbourhood, and is bounded by a commercial lot to the north, Haggert Avenue and Fletcher's Creek to the south, an Orangeville Railway Development Corporation railway to the east, and Sheard Avenue to the west. See **Figure 1** below for site location.

The site slopes gradually north to south, the current drainage is uncontrolled sheet flow to Sheard Avenue and Haggert Avenue, and south towards Fletcher's Creek. There is existing water, sanitary and storm infrastructure located within Sheard Avenue and Haggert Avenue.
A review of historical air imaging provided by Beacon Environmental Ltd. and Region of Peel as-built drawings indicate that prior to the site becoming a vacant lot (circa 2008), multiple industrial buildings existed within the site. The buildings occupied the lot area between Haggert Avenue and Henderson Avenue, with the remaining southern portion of the lot as an open vacant field.

Figure 1: Site Location Map



3.0 PROPOSED DEVELOPMENT

The proposed development concept plan (Kirkor Architects, dated July 2021) consists of:

Phase 1

- Buildings B-H – 3 storeys stacked back-to-back townhouses with 148 units, complete with above ground parking and one level of below ground parking;
- Outdoor courtyard amenity space approximately 1,360 m^2;
- Dry pond facility;
- Internal road ways.

Phase 2

- Building A – Residential condominium with 293 units, complete with above ground parking and two levels of below ground parking;
- Outdoor amenity space.

Site entrances are proposed at the end of the proposed Haggert Street cul-de-sac, and the intersection of Henderson Avenue and Sheard Avenue.

3.1 Population Estimates

The expected population for the proposed development was calculated using the residential unit information obtained from the proposed concept plan provided by Kirkor Architects, and equivalent population factors from Region of Peel Public Works Department in addition to the Linear Infrastructure Design Criteria Manual (July 2009). **Table 1** below summarizes the proposed population for the subject property.

Table 1: Estimated Population Density

Land Use	Number of Units	Area (ha)	Equivalent Population Density (Persons/unit)	Population
Residential Townhouses (Buildings B-H)	148	1.28	3.5	518
Phase 2 Residential Condominiums	293	0.94	2.7	791
			Total	**1,309**

The total estimated residential population for the proposed development is 1,309 persons.

4.0 WATER SERVICING

The Region of Peel is responsible for the operation and maintenance of the public water system in the City of Brampton, and any local system connecting to this public system. The following sections outline the existing and proposed design of water servicing for the proposed development.

4.1 Existing Conditions

Review of Region of Peel Drawing 2628-D (as-built drawing for Haggert Avenue dated April 29, 2000), and City of Brampton as-builts for Haggert Avenue, as provided in **Appendix A**, confirm that there is an existing 300 mm diameter watermain along Sheard Avenue, with a 150 mm diameter watermain along Haggert Avenue, as shown on the Site Servicing Plan (**Drawing C02**). During a site visit, Crozier confirmed the existence of municipal fire hydrants located on the north side of Sheard Avenue across from the site and at the intersection of Sheard Avenue and Haggert Avenue.

4.2 Design Water Demand

The water demands for the site were calculated with reference to the Region of Peel standards. The residential average daily water demand of 280 L/capita/day was used with an occupancy density of 3.5 persons/unit for the Phase 1 townhouses and 2.7 persons/unit for the Phase 2 condominium, as shown in **Table 1**. **Table 2** summarizes the estimated water demand for the site based on Region of Peel requirements. The Region of Peel Connection Demand Table has been completed with available information and is provided in **Appendix B**.

Table 2: Estimated Domestic Water Demand

Method	Phase	Average Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
Region of Peel	Phase 1 (Buildings B-H)	1.68	3.36	5.04
	Phase 2 (Condominium)	2.56	5.13	7.69

4.3 Fire Flow Demand

The Fire Underwriters Survey method was used to estimate the fire flow requirements for the proposed development. This calculation estimates the preliminary watermain size required to service the development. **Table 3** summarizes the required fire flow and duration to meet fire protection requirements for the proposed development.

Table 3: Estimated Fire Demand Flows

Method	Demand Flow (L/s)	Duration (h)
Fire Underwriters Survey	183	2.5

The proposed fire service is required to convey a fire flow demand of approximately 183 L/s (2,906 USGPM) for a duration of 2.5 hours. Flow requirements were calculated based on the preliminary footprint and gross floor area of 12 units with vertical fire separation every 3 units, ordinary building construction, and the proposed installation of automated sprinklers. Please refer to **Appendix B** for detailed domestic water supply and fire flow calculations.

Note that the Fire Underwriters Survey value is a conservative estimate for comparison purposes only. The mechanical engineer for this development will complete the required analyses for fire protection and the architect will design fire separation methods per the determined fire flow rate, in order to meet municipally available flows and pressures.

A hydrant flow test was performed by Watermark on April 27th, 2021, on the existing 300 mm diameter municipal watermain on Sheard Avenue and the 150 mm diameter watermain on Haggert Avenue. The results note that at 20 psi residual pressure in the municipal watermains, a maximum of 691 L/s (10,950 USGPM) projected flow is to be available within the water system on Sheard Avenue and 775 L/s (12,280 USGPM) is to be available within the municipal water system on Haggert Avenue. Detailed results of the hydrant flow test are provided in **Appendix B**.

Based on the proposed water demand and hydrant flow test results, it is anticipated that the existing municipal water supply can support the proposed development without the need for external upgrades or retrofit.

4.4 Proposed Water Servicing

As part of the design for the site, the existing 150 mm diameter municipal watermain along Haggert Avenue South is proposed to be removed and replaced with a 300 mm diameter watermain. This upgrade is proposed along Haggert Avenue South from the intersection of Haggert Avenue South and Sheard Avenue to the end of the cul-de-sac where the site connections are proposed.

The site is proposed to be serviced by a dual looped watermain (domestic and fire) connecting to the existing 300 mm diameter watermain along Sheard Avenue and the proposed 300 mm diameter watermain along Haggert Avenue South via tapping sleeves and valve in boxes per Regional Standard 1-6-4. All water service connections to the municipal infrastructure require a check valve in chamber (Regional Standard 1-1-5 and 1-3-1) for the 200 mm fire line within the property line and a 100 mm diameter PVC domestic lateral is proposed to extend from the 200 mm fire line 1.2 m outside of the property line.

For Phase 1, domestic water supply is provided through the proposed 100 mm diameter watermain and a fire connection is also required to support the proposed sprinkler system within the underground parking garage. The services for Phase 1 will enter the underground on the east side of

the Site (between Buildings E and F) with a proposed water meter and back flow preventor per Regional Standard 1-4-1 located within the P1 fire room. Domestic water supply will be distributed to each unit internal to the building and will be designed by the mechanical engineer.

Water servicing for Phase 2 is proposed to be extended from Haggert Avenue South. A 100 mm diameter domestic lateral extended from the proposed 200 mm fire line approximately 1.2 m outside of the property line is proposed. The services will be plugged within the property line with a check valve and chamber immediately south of the proposed Haggert Avenue South cul-de-sac until the development of Phase 2.

Refer to **Drawing C02** for more details on the proposed water servicing for the site.

5.0 SANITARY SERVICING

The City of Brampton is serviced by a network of local and trunk sanitary sewers and sewage pumping stations. The Region of Peel is responsible for the operation and maintenance of the public sewage collection and treatment systems in the City of Brampton, and any local sewage system that connects to this public system.

5.1 Existing Conditions

Upon review of City of Brampton and the Electronic Peel Asset Locator (EPAL) Drawing 26284-D (as-built drawing for Haggert Avenue, dated April 29, 2000), there is an existing 250 mm diameter gravity sanitary sewer located on Sheard Avenue which drains northwest to a manhole at the intersection of Sheard Avenue and Haggert Avenue. A 250 mm diameter gravity sanitary sewer conveys flows south towards the existing 1,200 mm diameter sanitary trunk sewer near Fletcher's Creek. Copies of the as-built drawings for the existing sanitary sewers are found in **Appendix A**.

5.2 Design Sanitary Flow

To estimate the sanitary design flows from the proposed development, the Region of Peel Design Standards were referenced. The calculated design flows are based on the unit count and development area provided on the concept plan prepared by Kirkor Architects, dated February 5, 2021. A summary of the calculated design flows is found in **Table 4**, with detailed calculations are provided in **Appendix C**.

Table 4: Estimated Sanitary Design Flow

Method	Phase	Peaking Factor	Average Day (L/s)	Peak Flow (L/s)	Infiltration (L/s)	Total Sanitary Flow (Peak Flow + Infiltration) (L/s)
Region of Peel	Phase 1 (Buildings B-H)	3.97	1.87	7.41	0.26	7.66
	Phase 2 (Condominium)	3.86	2.85	11.02	0.19	11.21

The sanitary demands in **Table 4** were calculated based on Region of Peel population density for residential townhouses at 3.5 persons/unit and condominiums at 2.7 persons/unit, as shown in **Table 1**. The results show that the total sanitary flow demand for Phase 1 following development is 7.66 L/s and 11.21 L/s for Phase 2. The internal sanitary system including pipe sizing, manhole spacing, cleanouts, etc., will be designed in accordance with the Ontario Building Code and Region of Peel requirements.

5.3 Proposed Conditions

A municipal sanitary sewer extension consisting of a 250 mm diameter PVC gravity sewer at a minimum slope of 0.9% is proposed to extend from the existing sanitary manhole at the Sheard Avenue and Haggert Avenue intersection internally to the site. The extension is proposed to service both the Phase 1 and Phase 2 development. The existing sanitary manhole at the sanitary junction will be benched per Regional Standard 2-5-20.

For Phase 1, a 250 mm diameter sanitary sewer connection at a slope of 2.0% is proposed to convey wastewater from an underground connection at the P1 level of the townhouse blocks near Building C to the proposed municipal sanitary sewer extension on Haggert Avenue. The mechanical engineer will design the sanitary system within the buildings.

A 250 mm diameter PVC sanitary sewer at 2.0% has a capacity of 84.1 L/s, which is sufficient to accommodate the estimated sanitary flow of 7.66 L/s for Phase 1. The proposed outlet from the site is immediately upstream of an existing 1,200 mm diameter sanitary trunk near Fletcher's Creek, therefore downstream capacity of the receiving sanitary sewer is anticipated be sufficient to accommodate the proposed development.

For Phase 2, a 250 mm diameter sanitary sewer connection at 2.0% is proposed to connect to the municipal sanitary sewer extension on Haggert Avenue. A series of two (2) sanitary manholes (MH 3 and 4) and associated 250 mm sanitary sewers at a slope of 2.0% are proposed to accommodate the estimated wastewater flow of 11.06 L/s from the future Phase 2 development. Sanitary MH 4 will serve as a property line manhole and as a sanitary plug for Phase 2 and will only accept wastewater from the future Phase 2 development.

Refer to **Drawing C02** for more details on the proposed sanitary servicing for the site.

6.0 DRAINAGE CONDITIONS

6.1 Existing Drainage Conditions

Existing Stormwater Infrastructure

Review of Region of Peel Drawing 2628-D (as-built drawing for Haggert Avenue dated April 29, 2000), and City of Brampton as-builts for Haggert Avenue, as provided in **Appendix A**, indicate that there is an existing 450 mm diameter storm sewer along Sheard Avenue and a 525 mm diameter storm sewer along Haggert Avenue. The 450 mm diameter storm sewer joins the 525 mm diameter storm sewer at the intersection of Sheard Avenue and Haggert Avenue. This system conveys flows north along Haggert Avenue, and eventually discharges to Fletcher's Creek through an existing storm sewer located along Royce Avenue (City of Brampton As-Built Drawing F4-93-A). No known stormwater infrastructure currently exists within the site.

Existing Overland Flow Routes

As described in **Section 2.0**, the subject property is currently an open vacant lot consisting of fallow vegetation. Site runoff drains to the existing municipal streets and to Fletcher's Creek via uncontrolled sheet flow. The site is divided into 3 individual sub-catchments to calculate the respective peak stormwater flows reaching each outlet. Approximately 0.64 ha drain to Sheard and Haggert Avenue, with the remaining 2.48 ha draining from north to south towards Fletcher's Creek, as shown on the Pre-Development Drainage Plan (**Figure 2**).

Although there is an existing drainage divide, stormwater discharging from the site under pre-development conditions eventually discharge to Fletcher's Creek by either direct sheet flow, or through storm sewers within the City roads. There are no known stormwater control measures currently installed on the subject property.

Fletcher's Creek flows from west to east and is located approximately 150 m south of the site's property line. A preliminary hydraulic analysis was completed to determine the extents of the existing and proposed Regional flood elevation at the site and was included with the first submission under separate cover. A cut and fill analysis was also prepared under separate cover to establish a proposed Regional floodline for the site. The existing and proposed Regional and 100-year floodlines are shown on the Grading Plan (**Drawing C03A**) and were used to determine the proposed development limit.

6.2 Proposed Drainage Conditions

The development is proposed in two phases:

- Phase 1 includes construction of Buildings B to H, underground parking structure, the proposed internal condo roadway and all stormwater infrastructure.
- Phase 2 will include a residential building and associated underground parking structure.

The proposed stormwater management design considers both the full build out scenario (Phase 1 and Phase 2) and the interim condition where only Phase 1 is constructed, to demonstrate the complete development is feasible from a stormwater management perspective. The proposed storm sewer network and stormwater management dry pond will be constructed during Phase 1. The proposed storm sewer network and dry pond is situated such that an outlet from the future residential tower to be constructed as part of Phase 2 can be accommodated.

The site was subdivided into three individual drainage catchments to calculate the respective site peak stormwater flows (**Figure 3**) and are described below.

Catchment 201UC

Catchment 201UC (0.22 ha) fronts Sheard Avenue and Haggert Avenue South and consists of the front yards and associated sidewalk of the proposed development (Buildings B, C, D & E). Due to site grading constraints, stormwater from this catchment will flow overland uncontrolled to the Sheard Avenue and Haggert Avenue South right-of-way, consistent with existing conditions. Roof leaders from the three buildings along Sheard Avenue (Buildings C, D & E) and the building along Haggert Avenue South (Building B) are proposed to discharge to grade onto Catchment 202 in an effort to limit the quantity of stormwater discharging to the municipal right-of-way.

No storm sewer connections are proposed to the existing 450 mm diameter storm sewer along Sheard Avenue or to the existing 525 mm storm sewer on Haggert Avenue South from the site under proposed conditions. Stormwater from Catchment 201UC will discharge to the existing catchbasins along Sheard Avenue and Haggert Avenue South, consistent with existing conditions.

In an effort to reduce flows sent uncontrolled towards the municipal ROWs, permeable pavers are proposed on all walkways within the site. Permeable pavers allow for filtration and infiltration of runoff, reducing peak flows when compared to traditional impervious paving surfaces.

Catchment 202

Catchment 202 (1.70 ha) consists of the majority of the proposed development. An internal storm sewer network is proposed to collect and convey minor storm events through the site and discharge to the proposed dry pond at the south limits.

Major storm events will be safely conveyed overland within the condo road towards the south end of the site where it is directed either towards the south swale or the west property line swale. Overland flow that will be captured by the proposed south swale will enter the storm sewer through the proposed ditch inlet catchbasin (STM DICB 9) located at the downstream end of the proposed conveyance swale. The proposed conveyance swale and catchbasin (STM DICB 9) have been sized to convey the 100-year storm event from the entire site, with the exception of the courtyard area, to remain conservative. See **Section 6.3** for more information on the sizing of the swale and catchbasin.

Under the ultimate condition (full build out of Phase 1 and 2), major storm events will also be safely conveyed overland within the condo road towards a swale proposed along the west property line, directly west of future Building A. Overland flows will enter the storm sewer through either the catchbasin manhole located on the road just east of the Haggert Avenue South cul-de-sac (STM CBMH 4) or the one located immediately downstream of the proposed OGS (STM DCBMH 10). See **Section 6.4** for more information on the sizing of the swale and STM CBMH 10. The stretch of the proposed storm sewer located between the internal road (STM CBMH 4) and the pond outlet has been sized to convey the 100-year storm event. Rooftop runoff resulting from future Building A will be conveyed through a direct connection into the proposed internal storm sewer, ultimately reaching the proposed dry pond. The future connection can be implemented using the pipe that will be installed to connect STM DICB 9 to the storm sewer as part of Phase 1.

Roof leaders from the proposed townhouse blocks will discharge to grade and be collected by the proposed storm sewer network within the proposed lower courtyard outdoor amenity area. Stormwater runoff captured within the proposed lower courtyard amenity area for all storm events, up to and including the 100-year storm event, will discharge to the underground parking garage. Stormwater will be conveyed by the internal storm pipe network suspended from the ceiling of the underground parking structure, and outlet to the provided external storm sewer on the south side of the underground parking garage near Building H. The storm sewers from this point to the pond outlet are sized for the 100-year storm. Refer to the mechanical engineer's details and specification for the complete design of the storm pipe network within the underground parking structure.

No storm sewer connections are proposed to the existing 525 mm diameter storm sewer along Haggert Avenue or the 450 mm diameter storm sewer along Sheard Avenue.

Catchment 203

Catchment 203 (1.20 ha) consists of the proposed dry pond and open space. Rainfall on the majority of Catchment 203 will enter the proposed dry pond via overland drainage. A small portion of this catchment will flow overland uncontrolled towards Fletcher's Creek, as under existing conditions.

6.3 South Conveyance Swale and Catchbasin Analysis

As discussed in **Section 6.2**, there is a swale proposed along the top of slope on the south side of the site to support Phase 1 of the project. A catchbasin completed with a honeycomb grate is also proposed at the downstream end of the swale to capture runoff and convey it to its ultimate outlet. The honeycomb grate is proposed to provide capture of the 100-year storm event from the entire

site, with the exception of the courtyard area, to remain conservative. Refer to **Drawings C03A** for more details on the proposed swale and catchbasin.

Runoff generated from Catchment 202, with the exception of the internal courtyard, is conveyed through the swale located along the catchment's south boundary. SWMHYMO was used to determine the total peak flow for the 100-year storm event that will ultimately be conveyed through the swale and captured by the catchbasin. Given that the courtyard is not directed towards the swale, a new catchment was created to represents the flows that are directed to the swale during the 100-year storm event. This catchment has been named Catchment 202_S. Refer to **Appendix D** for the SWMHYMO model results.

FlowMaster was used to determine whether the flows can be properly conveyed within the proposed swale. Calculations were also completed to determine the capacity of the proposed catchbasin. To provide functionality of the proposed catchbasin, calculations were completed to ensure the catchbasins have the capacity to capture the 100-year storm event with a safety factor of 50%. The FlowMaster results for the swale are summarized in **Table 5** and the catchbasin capacity results are summarized in **Table 6**. Refer to **Appendix D** for the FlowMaster analysis results and the catchbasin capacity calculations.

Table 5: South Swale FlowMaster Results

100-Year Storm Flow (m^3/s)	Normal Depth (m)	Minimum Depth of Swale Provided (m)	Swale Slope Provided (%)
0.284	0.22	0.25	1.9

Table 6: Catchbasin DICB 9 Capacity Results

Inlet ID	DICB T/G	Max Ponding Depth (m)	Inlet Capacity (m^3/s)	50% Clogged (m^3/s)	100-Year Peak Flow (m^3/s)
DICB 9	217.00	0.45	0.6310	0.3155	0.284

Based on the FlowMaster results (**Table 5**), the proposed swale is sufficiently sized to accommodate the 100-year peak flows. As per the results presented in **Table 6**, the proposed catchbasin completed with a honeycomb grate is also sufficient to accommodate the 100-year peak flow.

6.4 West Property Line Conveyance Swale and Catchbasin Analysis

As discussed in **Section 6.2**, there is a swale proposed along the west property line on site. This swale will be constructed as part of Phase 1 but will only be fully utilized following the full build out of the site, and the removal of the swale discussed in the previous section. A double catchbasin completed with a honeycomb grate is also proposed at the downstream end of the swale (DCBMH 10) to capture runoff and convey it to its ultimate outlet. The honeycomb grate is proposed to provide capture of the 100-year storm event. Refer to **Drawings C03A** for more details on the proposed swale and catchbasin.

Runoff generated from Catchment 202, with the exception of the internal courtyard, is conveyed through the swale located along the west property line following the construction of Phase 2. SWMHYMO was used to determine the total peak flow for the 100-year storm event that will ultimately be conveyed through the swale and captured by the catchbasin. Given that the courtyard is not directed towards the swale, a new catchment was created to represents the flows that are directed to the swale during the 100-year storm event. This catchment has been named Catchment 202_S. Refer to **Appendix D** for the SWMHYMO model results.

FlowMaster was used to determine whether the flows can be properly conveyed within the proposed swale. Calculations were also completed to determine the capacity of the proposed catchbasin. To provide functionality of the proposed catchbasin, calculations were completed to ensure the catchbasins have the capacity to capture the 100-year storm event with a safety factor of 50%. The FlowMaster results for the swale are summarized in **Table 7** and the catchbasin capacity results are summarized in **Table 8**. Refer to **Appendix D** for the FlowMaster analysis results and the catchbasin capacity calculations.

Table 7: West Property Line Swale FlowMaster Results

100-Year Storm Flow (m^3/s)	Normal Depth (m)	Minimum Depth of Swale Provided (m)	Swale Slope Provided (%)
0.284	0.32	0.35	1.3

Table 8: Catchbasin DCBMH 10 Capacity Results

Inlet ID	DICB T/G	Max Ponding Depth (m)	Inlet Capacity (m^3/s)	50% Clogged (m^3/s)	100-Year Peak Flow (m^3/s)
CBMH 10	216.80	0.20	0.6414	0.3207	0.284

Based on the FlowMaster results (**Table 7**), the proposed swale is sufficiently sized to accommodate the 100-year peak flows. As per the results presented in **Table 8**, the proposed catchbasin completed with a double honeycomb grate is also sufficient to accommodate the 100-year peak flow.

Given that the swale is proposed to convey the major storm event on site, rip-rap is proposed within the swale to reduce erosion. Based a maximum velocity through the swale of 0.92 m/s, the proposed rip-rap shall have a stone size of 20 mm (D_{50}) installed at a minimum depth of 40 mm. Refer to Detail B on **Drawing C03A** for more details of the proposed west property line swale and **Appendix D** for the rip-rap sizing calculations.

6.5 Proposed Dry Pond

6.5.1 Dry Pond Description

A dry pond is proposed for both quantity and quality controls for the overall development. The dry pond is sized to contain and release the post-development peak flows from the 24-hour Chicago design storm to pre-development peak flows. Stormwater flows will enter the proposed dry pond primarily through the proposed storm sewer network with areas immediately surrounding the pond entering the facility by overland flow. Major overland flow is also proposed to be captured by the proposed storm sewer system on site to reduce the erosion potential around the pond inlet. Rip-rap is proposed within the pond at the inlet location to reduce erosion. Based a maximum velocity through the storm sewer of 1.75 m/s, the proposed rip-rap shall have a stone size of 78 mm (D_{50}) installed at a minimum depth of 150 mm. Refer to **Appendix D** for the rip-rap sizing calculations.

Under Phase 1, major overland flow will be safely conveyed towards the south end of the site where it is directed either towards the south swale or the west property line swale as described in **Section 6.3**. These flows will then be captured by STM DICB 9 and conveyed through the proposed storm sewer to the dry pond.

During Phase 2, a rip-rap channel is proposed downstream of STM CBMH 4 along the west property line to safely convey overland flow to STM CBMH 10, as described in **Section 6.4**. This swale and

catchbasin will be installed as part of Phase 1 of the project but will only be fully utilized following the construction of Phase 2. The flows captured by CBMH 10 will then be conveyed through the proposed storm sewer to the dry pond.

The proposed dry pond is located between the Regional and 100-year flood elevations. Therefore, the dry pond has been designed to minimize the required earthworks (i.e. berms) to ensure no negative impacts to the Regional flood storage are encountered. The bottom elevation of the pond is located above the 100-year flood elevation of 214.07 m to ensure the 100-year flood event does not enter the proposed dry pond when flooding within Fletcher's Creek occurs. Refer to **Drawing C03A** for the size, location and details regarding the proposed dry pond.

6.5.2 Outlet Structure

Three orifice and weir combination control structures are proposed to control the post-development peak flows to the pre-development targets. A 75 mm diameter orifice sleeve is proposed for the outlet structure located at the east end of the dry pond (weir 1). A 0.30 m deep rip-rap basin is proposed at the inlet of the pond outlet to allow stormwater to pond in front of the orifice sleeve to mitigate potential clogging. In addition to the rip-rap basin, a perforated riser pipe with stone jacket is also proposed to mitigate clogging. The 75 mm diameter orifice is proposed at the pond bottom elevation to retain and release the 25 mm water quality event over a period of 48-hours.

A 150 mm diameter orifice sleeve is proposed in each of the three control structures to control the 2-year to 100-year design storms. Perforated riser pipes with stone jackets are proposed at each outlet to mitigate clogging. An emergency weir is proposed above the 150 mm diameter orifice sleeve to safely convey storms greater than the 100-year design storm. Refer to **Table 9** for a summary of the proposed dry pond characteristics.

Table 9: Dry Pond Operating Characteristics

Bottom Elevation (m)	214.30
Top of Berm Elevation (m)	214.95
Depth (m)	0.65
Extended Detention Orifice Elevation[1] (75 mm diameter orifice sleeve) (m)	214.30
Control Orifice Elevation (150 mm diameter orifice sleeve) (m)	214.45
Emergency Weir Elevation[2] (m)	214.75

Notes: 1) Extended detention orifice only located on control structure #1 to maintain required drawdown time.
2) Emergency weir elevation located at the 100-year high water level to convey flows greater than the 100-year design storm.

Controlled stormwater from the three proposed outlet structures will be released to the proposed infiltration trench and flow spreader system along the south property line of the site. The infiltration trench is sized to retain and infiltrate the runoff from 5 mm of rainfall over the impervious area of the site. The remainder of the berm is proposed as rip-rap to spread out the controlled flows as it flows overland towards Fletcher's Creek, consistent with existing conditions. Refer to **Drawing C03A** for additional dry pond design details and **Appendix D** for the stage-storage-discharge design sheet for the dry pond and rip-rap sizing calculations for the outlet.

7.0 STORMWATER MANAGEMENT

Stormwater management and site drawings for the proposed development are designed based on the policies and standards of the City of Brampton, Credit Valley Conservation and Ministry of

Environment, Conservation and Parks (MECP). The following criteria are applicable for the subject property:

- Quantity Control: Post-development to pre-development flows for the 2-year up to and including the 100-year design storm events
- Quality Control: MECP Enhanced Level of Protection (80% TSS Removal)
- Erosion Control: 48-hour detention of the 25 mm event and provided during construction
- Water Balance: Minimum 5 mm on site retention for site impervious area

7.1 Stormwater Quantity Control

Two individual outlets from the site were reviewed and analyzed from a stormwater management perspective under both pre-development and post-development conditions. The primary outlet for site stormwater runoff is Fletcher's Creek and the secondary outlet is the existing municipal right-of-way.

A SWMHYMO model was created using City of Brampton rainfall intensities and the 24-hour Chicago design storm, individual catchment areas and associated design parameters to determine the pre-development and post-development peak flows from the site to both outlets. The model was also used to determine the quantity storage volumes required to reduce post-development peak flows to pre-development peak levels (targets).

The pre- and post-development peak stormwater flows to the municipal right-of-way outlet are provided in **Table 10** and the SWMHYMO model results can be found in **Appendix D.** In an effort to reduce the peak flows to the municipal roads, Low Impact Development (LID) measures are proposed on site. The proposed LIDs consist of permeable pavers, which are proposed on all walkways within the site. A comparison of peak flows post-development with and without the implementation of the proposed LID measure is also included in **Table 10**.

Table 10: Pre- and Post-Development Peak Flows to Municipal Right-of-Way (Sheard Avenue and Haggert Avenue)

Storm (year)	**Pre-Development** (0.64 ha) **Peak Flow** (L/s)	**Post-Development**[1] (0.22 ha) **Peak Flow** (L/s)	**Post-Development with LID Measure**[2] (0.22 ha) **Peak Flow** (L/s)
2	13	18	12
5	26	29	21
10	36	38	28
25	50	50	37
50	61	59	44
100	71	67	51

1) Represented by "201_UC2" in the SWMHYMO mode input/output.
2) Represented by "201_UC" in the SWMHYMO model input/output.

The post-development peak flows are all below the pre-development peak flows contributing to the municipal right-of-way and storm sewers within Haggert Avenue South and Sheard Avenue. Permeable pavers are proposed on all walkways within the site to allow for infiltration of runoff, reducing peak flows when compared to traditional impervious paving surfaces. As shown in **Table 10**, the permeable pavers are successful in reducing peak flows under post-development conditions, providing a reduction of 16 L/s during the 100-year storm event.

The post-development target flow rates for stormwater discharging to Fletcher's Creek are derived from the pre-development peak flows and are shown in **Table 11**. Note that the calculations for the

post-development conditions were completed assuming full build out of the site to ensure the dry pond is size appropriately. An impervious level of 68% for Catchment 202 was assumed for the entire site build out to account for Phase 2 based on a concept previously prepared for Building A.

Table 11: Pre- and Post-Development Peak Flows to Fletcher's Creek

Storm (yr)	**Pre-Development** (2.45 ha) **Peak Flow** (L/s)	**Post-Development** (2.93 ha) **Uncontrolled Peak Flow** (L/s)	**Post-Development Controlled Peak Flows** (L/s)	**Required Storage** [1] (m^3)	**Provided Storage** [2] (m^3)
2	38	389	17	633	2,232
5	75	537	34	836	
10	105	638	48	989	
25	145	774	61	1,200	
50	177	875	71	1,367	
100	209	975	83	1,522	

Notes: 1) Required storage volume calculated using the ROUTE RESERVOIR command in SWMHYMO.
2) Provided storage calculated by average end-area method for the proposed facility.

Per the results presented in **Table 11**, the proposed outlet structures and dry pond control the post-development peak flows to lower than pre-development peak flows. The proposed configuration provides an overall net-benefit to the receiving Fletcher's Creek.

The proposed storm sewers on site have been sized to convey at a minimum the minor storm event (10-year storm) per City criteria. All storm sewers downstream of STM MH 3 have been sized to also convey the 100-year storm runoff resulting from the courtyard and the sewers downstream of STM CBMH 4 have been designed to convey the 100-year storm from the entire Catchment 202. Refer to **Appendix D** for the storm sewer design sheet. Two scenarios were created to ensure the system can convey flows not only for Phase 1, but also the anticipated flows for the full build out of the site.

7.2 Stormwater Quality Control

It will be necessary to implement stormwater management practices to address the water quality control for the developed portions of the site. All stormwater management practices proposed on site will be implemented as part of Phase 1.

Water quality controls for the site must incorporate measures to provide "Enhanced Protection" per the MECP (2003) guidelines. "Enhanced" water quality protection involves the removal of at least 80% of the total suspended solids (TSS) from 90% of the annual runoff volume. It is proposed to incorporate a treatment train approach into the site's stormwater management strategy, including an OGS, a dry pond and an infiltration trench.

A Stormceptor EF6 is proposed upstream of the proposed dry pond to provide pre-treatment, providing 81% TSS removal. It is our understanding that the CVC have adopted a policy that considers the TSS removal efficiency of a standalone oil-grit separator to be 50%, regardless of manufacturer. Therefore, the proposed Stormceptor EF6 meets both the Credit Valley Conservation requirement (50% TSS removal) and the City of Brampton's requirement (80% TSS removal).
The dry pond and extended detention orifice (75 mm diameter orifice sleeve) are designed to retain the water quality runoff volume per MECP Table 5.2, which is larger than the runoff resulting from the 25 mm rainfall event. The stormwater runoff volume from the site is retained for a minimum of 57-hours, exceeding the 48-hour retention time required by Credit Valley Conservation. Therefore, the proposed dry pond is sized to provide a minimum of 60% TSS removal and satisfies the long-term erosion and sediment control requirements.

The proposed infiltration trench is the last step in the treatment train and is sized to retain and infiltrate a volume of 91 m^3. This is equivalent to the required water quality volume for an infiltration feature providing 80% TSS removal based on Table 3.2 of the MECP Stormwater Management Planning and Design Manual, using an impervious level of 60% and an associated required storage volume of 32 m^3/ha.

The proposed OGS is sized to meet the City requirement for 80% TSS removal but is only credited for 50% TSS removal based on CVC policy. The proposed dry pond was designed to achieve 60% TSS removal, and the infiltration trench was designed to achieve 80% TSS removal. Therefore, the proposed treatment train approach achieves a total 96% TSS removal, exceeding the minimum 80% TSS removal requirement. Supporting calculations are provided in **Appendix D**.

Further details including a native planting plan will be provided by Beacon Environmental for the proposed dry pond to reduce erosive energy and improve thermal mitigation of the treated water prior to discharging to Fletcher's Creek.

7.3 Water Balance

The water balance criteria for the site based on CVC objectives is to retain the first 3 mm of runoff on site for infiltration or reuse. Erosion control measures include detaining the first 5 mm of rainfall and releasing it at a reduced flow rate. However, CVC allows for erosion control and water balance requirements to be satisfied by retaining and infiltrating 5 mm of rainfall over the impervious area, therefore this value of 5 mm was used for the water balance target. As generally accepted, the grassed and landscaped areas are credited with an initial abstraction of minimum 5 mm and do not require retention measures. As such, the 5 mm criterion is only applied to the impervious site area within the development limits. A total impervious area of 1.74 ha was used to account for additional impervious area that will result from Phase 2.

The water balance volume requirement for the site is listed in **Table 12**.

Table 12: Site Water Balance Summary

Site Total Area (ha)	**Site Impervious Area** (ha)	**Water Balance Criteria**	**Water Balance Volume Requirements** (m^3)
3.12	1.74	Retain first 5 mm	87

An infiltration trench has been sized according to the preliminary water balance requirement of 87 m^3, as shown on **Drawing C03A/C03B** with detailed design calculations provided in **Appendix D**. The proposed infiltration trench has a total footprint area of 319.2 m^2 and will provide 91.3 m^3 of storage, greater than the 87 m^3 required to meet water balance objective. A Geotechnical Investigation and Hydrogeological Study prepared by GeoPro Consulting Limited, dated January 7, 2015, determined the soil on site has an infiltration rate of 15 mm/hr (design infiltration rate of 6 mm/hr). The infiltration trench has a total depth of 0.34 m and drains the total storage volume of 91.3 m^3 within 48 hours. The bottom of the infiltration trench is located 1.79 m above the high groundwater level.
Treated stormwater from the proposed dry pond will outlet to the proposed infiltration trench, prior to discharging to Fletcher's Creek. A berm is proposed along the property line of the site and the infiltration gallery to allow stormwater to pond and infiltrate into the granular subsurface material. Stormwater velocities will also be decreased if stormwater overtops the berm during high flow events.

Infiltrating stormwater after the proposed dry pond allows clean, treated stormwater to infiltrate, while providing additional quality treatment by further removing suspended solids and allowing stormwater to reduce in temperature prior to discharging to Fletcher's Creek.

7.4 Stormwater Management Operation and Maintenance

Proper long-term maintenance will be required for the proposed stormwater management system, consisting of the storm sewer network, Oil/Grit Separator, dry pond and infiltration gallery to ensure proper function. The condo development will be responsible for maintaining the stormwater management system proposed on site. Generally, the proponent should follow the Maintenance and Monitoring details provided in Section 6 of the Ministry of Environment Stormwater Management Planning and Design Manual.

For more information, refer to the Operation and Maintenance Manual prepared by Crozier under separate cover.

8.0 FLOODPLAIN HYDRAULIC ANALYSIS

In collaboration with CVC, Crozier prepared a preliminary hydraulic assessment dated May 23, 2017 and has been provided under separate cover.

9.0 ENVIRONMENTAL IMPACTS AND MITIGATION

Beacon Environmental Ltd. completed a Meander Belt Width Assessment and an Environmental Impact Study (EIS) dated November 2019. Crozier has reviewed this report and incorporated the relevant environmental set-backs within the proposed site design and are shown on **Drawings C03A**.

The environmental set-backs exist outside of the site's property line, however Beacon's report indicates that Fletcher's Creek is considered a partially confined system inhabiting Redside Dace. Therefore, Crozier will work closely with Beacon during the detailed design phase to ensure the proper Ministry of Natural Resources and Forestry (MNRF) requirements are satisfied regarding the proposed dry pond system and outlet to Fletcher's Creek.

10.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

Erosion and sediment controls will be installed prior to the commencement of any construction activities and will be maintained until the site is stabilized or as directed by the Site Engineer and/or the City of Brampton. The Removals and Erosion & Sediment Control Plans (**Drawing C01/C01A**) identifies the location of the recommended control features. Controls will be inspected after each significant rainfall event and maintained in proper working condition.

The following sediment and erosion controls will be included during construction on the site:

Silt Fencing

Silt fence as per the latest City of Brampton Standard will be installed surrounding the perimeter of the site to intercept sheet flow. Additional silt fence may be added based on field decisions by the Site Engineer and Owner, prior to, during and following construction.

Double silt fencing with straw bales will be used along the south property line to control sediment from reaching Fletcher's Creek to address concerns regarding the Redside Dace regulated habitat.

Rock Mud Mat

A rock mud mat will be installed at the construction entrance to prevent mud tracking from the site onto the surrounding lands and perimeter roadway network. All construction traffic will be restricted to this access only.

Silt Sacks

Silt sacks shall be installed in the existing catchbasins along Sheard Avenue and Haggert Avenue.

Temporary Sediment Basin or Sediment Trap

Prior to construction and earthworks activities, a temporary sediment basin will be incorporated at the location of the permanent dry pond. This temporary sediment basin accepts flows from the site, reduces overall stormwater velocities and promotes settlement of suspended solids.

11.0 CONCLUSIONS AND RECOMMENDATIONS

We conclude that the proposed development of the subject property can be readily serviced and meet the objectives of the regulatory agencies with the proposed servicing outlined in this report and accompanying drawings and figures. Based on the information contained in this report, we offer the following conclusions:

1. The existing 150 mm diameter municipal watermain along Haggert Avenue is proposed to be removed and replaced with a 300 mm diameter watermain. This upgrade is proposed along Haggert Avenue from Sheard Avenue to the end of the cul-de-sac.

2. The peak hour domestic water demand is 5.04 L/s for Phase 1 and 7.59 L/s for Phase 2, with an estimated fire flow demand of 183 L/s at 2.5 hours. Phase 1 is proposed to connect into the existing 300 mm diameter watermain on Sheard Avenue and Phase 2 is proposed to connect into the proposed 300 mm diameter upgraded watermain on Haggert Avenue. Both connections will consist of a 100 mm diameter PVC watermain, with a separate 200 mm diameter PVC watermain to supply fire flows.

3. The sanitary design flow for Phase 1 and Phase 2 is 7.66 L/s and 11.06 L/s, respectively. The sanitary flows will discharge from the site to a proposed municipal sanitary sewer extension consisting of a 250 mm diameter PVC gravity sewer.

4. Stormwater quantity control criteria is satisfied by the proposed dry pond located within Catchment 203 by overcontrolling post-development peak flows to pre-development peak flows for all design storms.

5. Stormwater quality control criteria is satisfied by use of a treatment train approach consisting of a proposed Stormceptor EF6 Oil/Grit Separator unit and extended detention within the proposed dry pond.

6. Long term erosion and sediment control is met by retaining the water quality volume runoff volume (>25 mm event runoff) for 48 hours.

7. Site water balance is satisfied by the proposed downstream infiltration gallery. Additional Low Impact Development (LID) techniques may be evaluated during detailed design for Phase 2.

8. Site environmental constraints as outlined by Beacon Environmental Ltd. have been respected under the proposed design. Additional coordination with Beacon will be completed during the detailed design phase to ensure proper design regarding the regulated Redside Dace habitat.

9. Erosion and sediment control measures during construction will be used to mitigate impacts of construction on the neighbouring infrastructure and Fletcher's Creek.

Therefore, we recommend approval of the Site Plan Application for the development of the subject lands from the perspective of site servicing and stormwater management requirements.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

Isabelle Cléroux, E.I.T.
Land Development

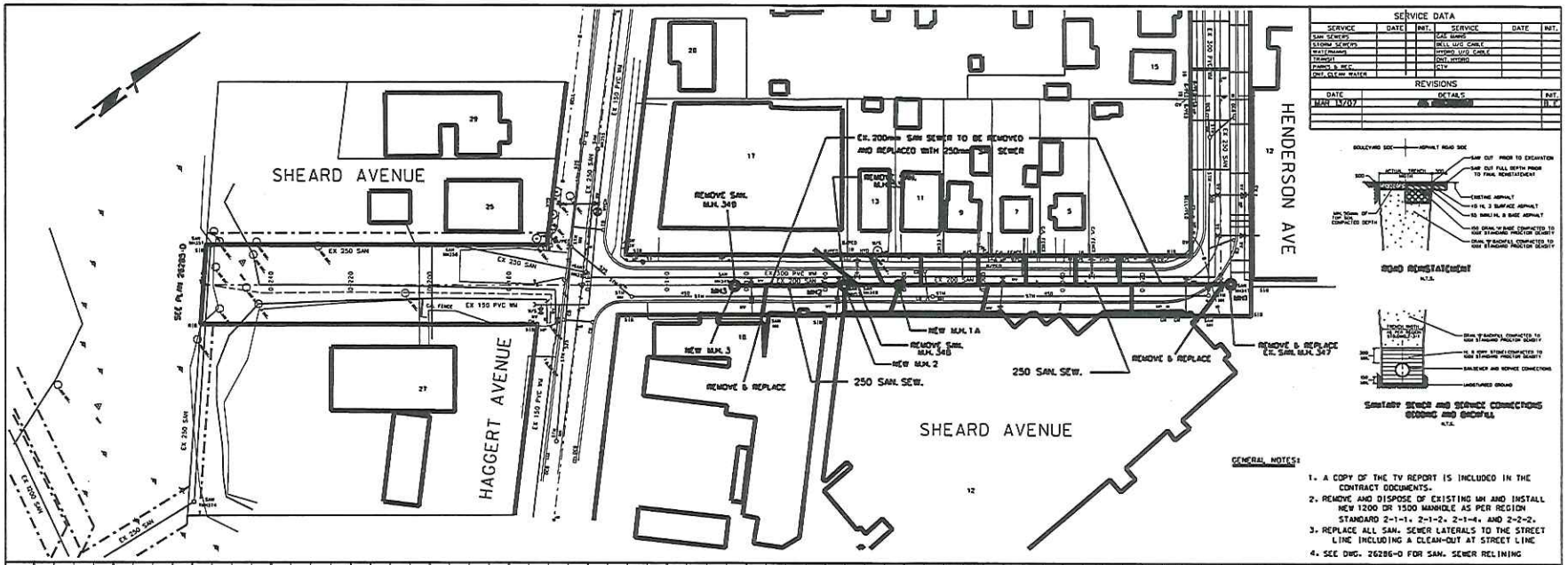
C.F. CROZIER & ASSOCIATES INC.

Ashish Shukla, P.Eng.
Associate

I:\1200\1241-NYX Capital Corp\4515-12 Henderson Ave_Archive\2021.07.16_Rev 3A (Minor Variance Report)\4515_FSRSWM.docx

APPENDIX A

Background Information



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F4-93-A

PR 119
Sheet # 4

STORM SEWER LOCAL IMP.
ROYCE, JESSIE, HAGGART, HENDERSON, McMURCHY AVE. S.
Scale: as noted

Office of the Commissioner of Works
Town of Brampton
Designed - A
Drawn - KS

F4-93-J

E D C B A A B C D E

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Geotechnical Investigation and Hydrogeological Study

Proposed Townhouse Development

12 Henderson Avenue, Brampton, Ontario

Prepared For:

Noval Development Group

GeoPro Project No.: 15-1186-01

Report Date: January 7, 2015

from 14 to more than 100 blows per 300 mm penetration indicated a compact to very dense relative density. The natural moisture contents measured in the soil samples ranged from approximately 8% to 21%.

Sandy Silt Till and Silty Sand Till

Till deposit was encountered below the fill materials, sandy silt and silty sand in all the boreholes and extended to the depths ranging from about 2.1 m to 11.1 m below the existing ground surface. Boreholes BH2 to BH3 and BH5 to BH10 were terminated in these deposits. SPT N value of 14 blows to more than 100 blows per 300 mm penetration indicated a compact to very dense relative density. The natural moisture contents measured in the soil samples ranged from approximately 6% to 14%.

3.2 Groundwater Conditions

Groundwater was encountered in all of the boreholes except Boreholes BH2 and BH10 during the drilling. The groundwater observations are summarized in the following table:

BH No.	Depth of Drilling (mBGS)	Cave in depth (mBGS)	Water level at the time of drilling (mBGS)	Water Level at the time of completion (mBGS)
BH1	6.6	6.1	4.6	5.6
BH2	6.6	open	dry	dry
BH3	6.6	open	3.0	5.6
BH4	5.0	4.6	4.6	4.3
BH5	11.1	9.4	3.8	7.6
BH6	9.6	open	6.1	dry
BH7	8.1	open	6.1	dry
BH8	8.1	open	4.6	7.9
BH9	8.1	open	4.6	7.9
BH10	8.1	open	dry	dry

Note: mBGS = meter below ground surface

After installation of the monitoring wells, hydrostatic groundwater levels were measured in the monitoring well on three (3) events. The measured groundwater levels are presented in the following table.

Monitoring Well ID	Screen Interval (mBGS)	Date of Monitoring: November 11, 2015	Date of Monitoring: November 15, 2015	Date of Monitoring: November 16, 2015
		Water Level (mBGS)	Water Level (mBGS)	Water Level (mBGS)
BH4	3.5 ~ 5.0	1.06	1.03	1.04
BH5	3.6 ~ 6.7	5.63	3.58	3.63
BH6	6.1 ~ 7.6	3.49	3.45	3.45
BH7	4.6 ~ 7.6	3.04	2.50	2.52

Note:
mBGS = meter below ground surface

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to weather conditions.

Based on the data measured of groundwater level, the shallow groundwater flow direction was generally inferred to be southeastward.

3.3 Hydraulic Conductivity

The hydraulic conductivities (K_s and K_{fs} values) were estimated based on the results obtained from in-situ borehole permeability tests (slug tests), infiltration tests, and grain size analysis.

3.3.1 Slug Tests

The in-situ slug tests were conducted in four (4) monitoring wells on November 11, 2015 using either the rising head or falling head method. During the test, a certain volume of water was removed or added, and the change in head (i.e., water level) was recorded using a datalogger or measured manually using an electronic water level finder. The recorded data was plotted on a semi-logarithmic scale using Hvorslev's method to estimate the saturated hydraulic conductivity (K_s) values.

The saturated hydraulic conductivity (K_s) estimated from the slug tests carried out in four (4) monitoring wells (BH4, BH5, BH6, and BH7) are shown in the following table.

Monitoring Well ID	Screen Interval (mBGS)	Soil Type	Hydraulic Conductivity, K_s (cm/s)
BH4	3.5 ~ 5.0	Sandy Silt	8.3E-05
BH5	3.6 ~ 6.7	Sandy Silt/Sandy Silt Till	2.1E-05

BH6	6.1 ~ 7.6	Sandy Silt Till	3.6E-05
BH7	6.1 ~ 7.6	Sandy Silt	5.1E-06

3.3.2 Infiltration Testing

The infiltration testing methodology, data calculations and assessment are in accordance with the Stormwater Management Criteria (SWMC), Version 1.0, dated August 2012, issued by the Toronto and Region Conservation Authority (TRCA).

In-situ infiltration testing was carried out by GeoPro staff on November 11 and 15, 2015 using a Guelph Permeameter. The infiltration testing was completed at six (6) locations at a depth of approximately 0.6 m below the existing ground surface.

Based on the results of the infiltration tests, the field saturated hydraulic conductivity (K_{fs}) values were estimated to range from 5.4 x 10^{-7} to 7.5 x 10^{-6} cm/s. The records of the infiltration tests and the data processing are presented in Appendix A.

3.3.3 Grain Size Analysis

Grain size analyses (sieve and hydrometer) were conducted on three (3) selected samples, and the results of the particle size distribution were used to estimate the hydraulic conductivity of the soil samples analyzed. The K-values were estimated using the Hazen method for the native cohesionless sandy silt soils, and the Kozeny-Carman equation for the native sandy silt tills. The calculated K-values are presented in the following table.

Borehole No/ Sample No.	Soil Depth (mBGS)	Primary Soil	Hydraulic Conductivity (cm/s)
BH4/SS6	1.5 – 2.1	Sandy Silt	6.2E-07
BH5/SS6B	6.1 – 6.7	Sandy Silt Till	6.0E-07
BH7/SS7	3.8 – 4.4	Sandy Silt	4.3E-07

Based on the above estimations or calculations, the hydraulic conductivity values for the soils at the site were in the order of 10^{-7} to 10^{-5} cm/s.

3.4 Infiltration Rate Assessment

Following the TRCA's Stormwater Management Criteria (SWMC) V.1.0 (2012), the soil infiltration rates were calculated based on the field saturated hydraulic conductivity (K_{fs}) values obtained from the Guelph Permeameter testing. The estimated infiltration rates are presented in the following tables.

Location	Depth (mBGS)	K_{fs} (cm/s)	Infiltration Rate (mm/hr)
G1	0.6	7.45E-06	23
G2	0.6	9.68E-07	13
G3	0.6	2.91E-06	18
G4	0.6	5.40E-07	11
G5	0.6	2.13E-06	17
G6	0.6	2.91E-06	18

It should be noted that the infiltration rate used to design an infiltration facility should incorporate a safety correction factor of between 2.5 and 3.5 when less permeable soil horizons exist within 1.5 m below the proposed bottom elevation of the proposed infiltration facility. The recommended design infiltration rates were calculated to be from 5 mm/hour to 6 mm/hour for the soils at the Site. The details of the infiltration rate estimation are included in Appendix B.

TRCA's SWMC states that for the purposes of site suitability for low impact development (LID), where tested soil infiltration rate is low (i.e. less than 15 mm/hour), LID infiltration facilities may still be feasible. The MOE Stormwater Management and Planning Design Manual (2003) recommends applying conveyance controls (such as pervious catchbasins) to areas with infiltration rates of less than 15 mm/hour (soils with hydraulic conductivity as low as 10^{-6} cm/s).

4. DISCUSSION AND RECOMMENDATION

This report contains the findings of GeoPro's geotechnical investigation, together with the geotechnical engineering recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes and monitoring wells may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express GeoPro's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect on the construction.

The design drawings of the project are not available at the time of preparing this report. Once the design drawings and detail site plan are available, this report should be reviewed by GeoPro and further recommendations be provided as appropriate.

BH1 Borehole Location BH4 Monitoring Well Location G1 Guelph Permeameter Test Location	Client: Noval Development Group		15-1186-01	Drawing No.: 1
	Drawn: GC	Approved: DL	Borehole, Monitoring Well and Guelph Permeameter Testing Location Plan	
	Date: January, 2015	Scale: As Shown	Geotechinical Investigation and Hydrogeological Study for Proposed Townhouse Development 12 Henderson Avenue, Brampton, Ontario	
	Original Size: Letter	Rev: DL	GeoPro Consulting Limited	

LOG OF BOREHOLE BH5

PROJECT: Geotechnical Investigation for Proposed Townhouse Development

CLIENT: Noval Development Group

PROJECT LOCATION: 12 Henderson Avenue, Brampton, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger Auto Hammer

Diameter: 155 mm REF. NO.: 15-1186-01

Date: Nov-10-2015 ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m	ELEVATION
215.6					
0.0 / 215.4	**TOPSOIL** (250 mm)				
0.3	**FILL:** sandy silt, trace clay, trace organic, trace rootlets, brown, moist, loose	1	SS	8	215
1		2	SS	13	
214.3					
1.4	**SANDY SILT TILL:** trace clay, trace gravel, brown, moist, compact	3	SS	24	214
2 / 213.5					
2.1 / 213.2	**SILTY SAND:** trace gravel, brown, moist, compact				
2.4	**SANDY SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, copmact	4	SS	26	213
3		5	SS	18	
212.0					
3.7 / 211.7	**SANDY SILT:** trace clay, trace gravel, brown, moist to wet,				
4 3.9	compact	6	SS	22	
	SANDY SILT TILL TO SILTY SAND TILL: trace clay, trace gravel, containing cobbles and boulders, grey, moist, dense to very dense	7	SS	36	211
5	---auger grinding				
6		8	SS	50/152 mm	209
7	---auger grinding				
		9	SS	50/140 mm	208
9		10	SS	76	207
10					206

GROUND WATER CONDITIONS: W. L. 212.0 m Nov 16, 2015; Sand; Screen; W. L. 210.0 m Nov 11, 2015; Bentonite; Natural Pack

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
O UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity; O ε_f=3% Strain at Failure

LOG OF BOREHOLE BH5

PROJECT: Geotechnical Investigation for Proposed Townhouse Development

CLIENT: Noval Development Group

PROJECT LOCATION: 12 Henderson Avenue, Brampton, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger Auto Hammer

Diameter: 155 mm

REF. NO.: 15-1186-01

Date: Nov-10-2015

ENCL NO.: 6

SOIL PROFILE			SAMPLES														
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w_L	WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kNm³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	---auger grinding **SANDY SILT TILL TO SILTY SAND TILL:** trace clay, trace gravel, containing cobbles and boulders, grey, moist, dense to very dense(Continued)						Bentonite									
11 204.5			11	SS	60		205						○			
11.1	**END OF THE BOREHOLE** Notes: 1) Water encountered at a depth of 3.8 m below ground surface (BGS) during drilling. 2) Water was at a depth of 7.6 mBGS upon completion of drilling. 3) Borehole caved at a depth of 9.4 mBGS upon completion of drilling. 4) 51 mm dia. Monitoring Well was installed in borehole upon completion of drilling. Water Level Readings Date W.L. Depth (mBGS) November 11, 2015 5.63 November 15, 2015 3.58 November 16, 2015 3.63															

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

LOG OF BOREHOLE BH6

PROJECT: Geotechnical Investigation for Proposed Townhouse Development

CLIENT: Noval Development Group

PROJECT LOCATION: 12 Henderson Avenue, Brampton, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger Auto Hammer

Diameter: 155 mm

REF. NO.: 15-1186-01

Date: Nov-10-2015

ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m	ELEVATION
215.5					
0.0 / 215.2	**TOPSOIL** (250 mm)				
0.3	**FILL:** sandy silt, trace clay, trace organic, trace rootlets, trace gravel, brown, moist, dense	1	SS	6	
		2	SS	33	
213.8					
1.7	**SANDY SILT TILL:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, dense to compact	3	SS	31	
		4	SS	27	
212.6					
2.9	**SILT:** trace gravel, trace sand, brown, moist, compact	5	SS	26	
211.6					
3.8	**SANDY SILT:** trace gravel, grey, moist, dense	6	SS	33	
211.0					
4.4	**SILTY SAND TILL:** trace clay, trace gravel, containing cobbles and boulders, grey, moist, dense	7	SS	36	
	---auger grinding	8	SS	94	
	---auger grinding	9	SS	100/25 mm	
	---auger grinding	10	SS	52	
205.9					
9.6	**END OF THE BOREHOLE**				

Notes:
1) Water encountered at a depth of

Continued Next Page

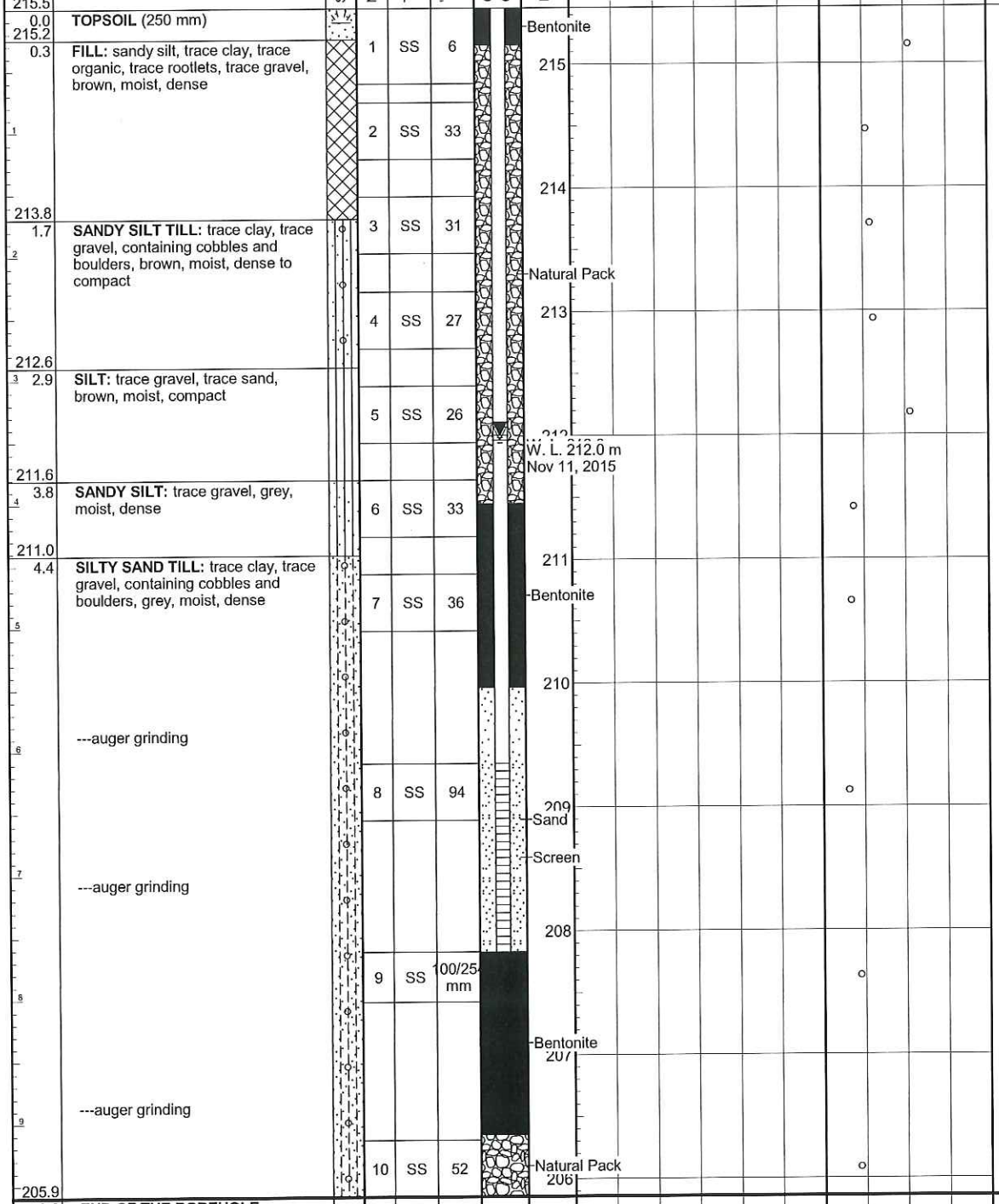
GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ ε=3% Strain at Failure



DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100

SHEAR STRENGTH (kPa)

○ UNCONFINED + FIELD VANE & Sensitivity

● QUICK TRIAXIAL × LAB VANE

20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)

10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

LOG OF BOREHOLE BH6

PROJECT: Geotechnical Investigation for Proposed Townhouse Development

CLIENT: Noval Development Group

PROJECT LOCATION: 12 Henderson Avenue, Brampton, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger Auto Hammer

Diameter: 155 mm REF. NO.: 15-1186-01

Date: Nov-10-2015 ENCL NO.: 7

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kNm³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
	6.1 m below ground surface (BGS) during drilling. 2) Borehole was open and dry upon completion of drilling 3) 51 mm dia. Monitoring Well was installed in borehole upon completion of drilling. Water Level Readings Date W.L. Depth (mBGS) November 11, 2015 3.49 November 15, 2015 3.45 November 16, 2015 3.45											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

APPENDIX B

Water Demand Calculations

CROZIER CONSULTING ENGINEERS

PROJECT: 12 Henderson Avenue
PROJECT NO.: 1241-4515

CREATED BY: IC/JL/MJ
CHECKED BY: AS

DATE: 2019-05-02
UPDATED: 2021-07-22

Water Demand - Proposed Conditions

Site Statistics: Total Site Area: 3.12 ha

Landuse	Number of Units	Area (ha)	Population Density	Units	Population
Phase 1 Residential Townhouses	148	1.28	3.5	Person/unit	518
Phase 2 Residential Condominiums	293	0.94	2.7	Person/unit	791
Pond and Natural Area	-	0.84	-	-	-
Road Widening	-	0.06	-	-	-

Total Residential Population: **1309**

Design Parameters:

Average Demand (L/capita/day)
280

Water Demand:

Phase 1 - Average Residential Daily Demand = 145,040 L/day
1.68 L/s

Phase 2 - Average Residential Daily Demand = 221,508 L/day
2.56 L/s

Peaking Factors
Max Day = 2
Residential Peak Hour = 3

Summary Table:

Municipality	Phase	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Peel	Phase 1 Buildings	1.68	3.36	5.04
	Phase 2 Condominium	2.56	5.13	7.69

Notes & References

Per Region of Peel Comments from Public Works Department (October 28, 2019)

Region of Peel Public Works Design, Specifications & Procedures Manual - Linear Infrastructure Sanitary Sewer Design Criteria (July, 2009) - 2.1 - Modified March 2017 REV 0.9 (CS)

Region of Peel Public Works Design, Specifications & Procedures Manual - Linear Infrastructure - Watermain Design Criteria (June, 2010) - 2.3 Table #1

Region of Peel Public Works Design, Specifications & Procedures Manual - Linear Infrastructure - Watermain Design Criteria (June, 2010) - 2.3 Table #1

Max Day = Average Day Demand * Max Day
Peak Hour = Average Day Demand * Peak Hour

CROZIER CONSULTING ENGINEERS

12 Henderson Ave.
Fire Protection Volume Calculation (Building D)
CFCA File: 1241-4515

Date: 2019-11-21
Updated: 2021-03-02
Designed By: BW/IC
Checked By: AS

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

F = the required fire flow in litres per minute

C = coefficient related to the type of construction:

=	1.5	for wood frame construction (structure essentially all combustible)
=	1.0	for ordinary construction (brick or other masonry walls, combustible floor and interior)
=	0.8	for non-combustible construction (unprotected metal structural components)
=	0.6	for fire-resistive construction (fully protected frame, floors, roof)

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Proposed Buildings **Structure:** Condo Townhouse - vertical fire separation every 3 rows of units

Height in storeys =	3	
Units per row=	4	
Number of units per fire separation area=	12	
Area per Unit=	181.3 sq.m.	
Total GFA for Fire Separation Area=	2175.6 sq.m.	GFA for Section determined by multplying the area per unit by the number of units
C =	1.0	assume ordinary construction

Therefore F = 10,262 L/min

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	0% (No Change)		

Limited Combustible	-15% reduction

-1,539 L/min reduction
8,722 L/min

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduced by up to 50% for complete automatic sprinkler protection. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards.

Assuming building will have a sprinkler system

4,361 L/min reduction

Water Supply for Public Fire Protection - 1999
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	30.1 to 45 m	5%
10.1 to 20 m	15%		

NOTE:

Exposed buildings

Name		Distance (m)	Charge (%)	Surcharge (L/s)
North	Building E1	3	25%	2180.6
South	Building C2	3	25%	2180.6
East	Building F	20	15%	1308.3
West	Adjacent Property	27	10%	872.2
				6,542 L/min Surcharge

Determine Required Fire Flow

No.1	10,262		
No. 2	-1,539 reduction		
No. 3	4,361 reduction		
No. 4	6,542 surcharge		
Required Flow:	**10,903 L/min**		
Rounded to nearest 1000 L/min:	**11,000 L/min**	or	183.3 L/s
			2,906 USGPM

Required Duration of Fire Flow	
Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	**2.5**
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

NYX Henderson LP
1131A Leslie Street
Suite 400
Toronto, Ontario
M3C 3L8

April 27, 2021

RE: Fire Flow Testing at 12 Henderson Ave, Brampton, ON

Watermark has conducted two fire flow tests in the vicinity of 12 Henderson Ave, Brampton, Ontario. The testing was completed in accordance with NFPA 291. Region of Peel water operations staff were on hand to assist.

Test # 1 - 5 Sheard Avenue

Static pressure prior to the test was observed to be 66.5 PSI. Using 1 x 4" port and 2 x 2.5" ports on one flow hydrant, a maximum flow rate of 2250 USGPM was achieved. This provided a 4% pressure drop, to 64 PSI. As the pressure drop did not acheive the recommended 25% of static, this test should not be used for NFPA purposes, however the high flow rate acheived should provide confidence in the results.

Test # 2 - 25 Haggert Avenue South

Static pressure prior to the test was observed to be 66 PSI. Using 1 x 4" port and 2 x 2.5" ports on one flow hydrant, a maximum flow rate of 2250 USGPM was achieved. This provided a 3% pressure drop, to 64 PSI. As the pressure drop did not acheive the recommended 25% of static, this test should not be used for NFPA purposes, however the high flow rate acheived should provide confidence in the results.

Equipment:

Flow: 1 x 4" HoseMonster with integrated 4" Pitotless Nozzle
Flow: 2 x 2.5" HoseMonster with integrated 2" Pitotless Nozzle
Pressure: 2 x GCR Triton Data Logger w/ 20 bar integrated pressure sensor

We strongly feel that all attempts have been made to ensure that the required data as stipulated will be captured, stored and presented in an accurate, efficient and timely manner for the required period. We are pleased Watermark again as your data provider, and we look forward to working with you in the future.

Kind Regards,

Colin Powell

(519) 217-3439
colin.powell@watermark.ca

Hydrant Flow Test Report

Residual Hydrant Number _____

watermark
water loss management

Operator: Colin Powell

Date: 27-Apr-21 Time: 2:20 PM

Witness: Region of Peel Operations

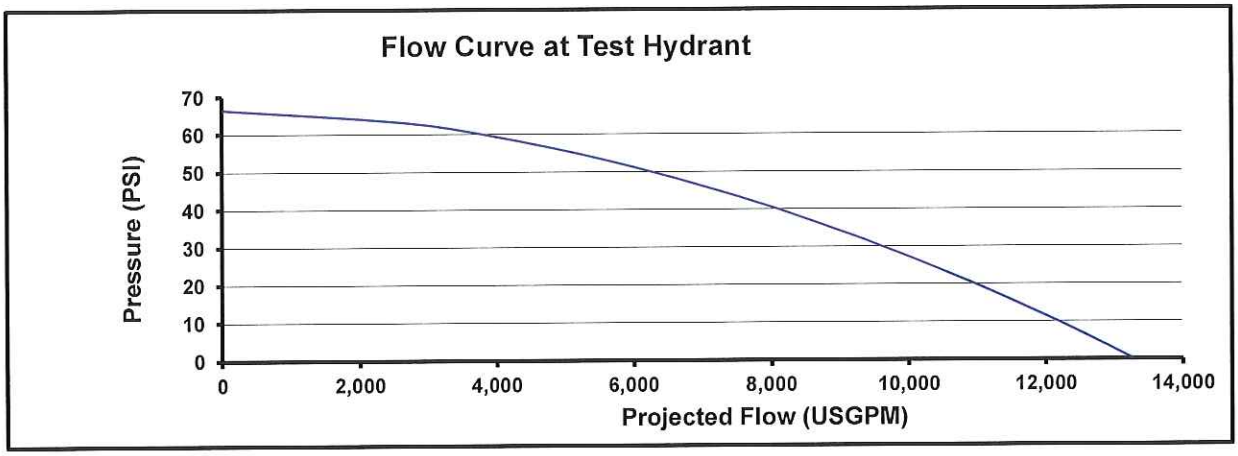
Residual Test Hydrant:	5 Sheard Ave		
Hydrant Number:		NFPA Colour Code:	CLASS AA - BLUE
Owner:	Region of Peel		

STATIC PRESSURE:	66.5 psi	459 kPa	Pressure Drop
RESIDUAL PRESSURE:	64 psi	441 kPa	3.8%

			Hydrant Number
Flow Hydrants:	A	13 Sheard Ave	
	B		
	C		

Hydrant No.	Flow Device	Outlet Dia. (in.)	Coefficient (~0.9)	Pitot Gauge Reading (psi)	Flow (USGPM)
A	Pitot	2.5		12	540
A	Pitot	2.5		10	493
A	HoseMonster	4"			1225
	TSI	2.5			
			Total Flow (USGPM)		2259
			Total Flow (L/second)		143

Available Flow At Test Hydrant at 20 ps	10,950	USGPM
	691	L/second



Comments/Discrepencies/Diagram:

Hydrant Flow Test Report

Residual Hydrant Number 0

watermark
water loss management

Operator: Colin Powell

Date: 27-Apr-21 Time: 2:20 PM

Witness: Region of Peel Operations

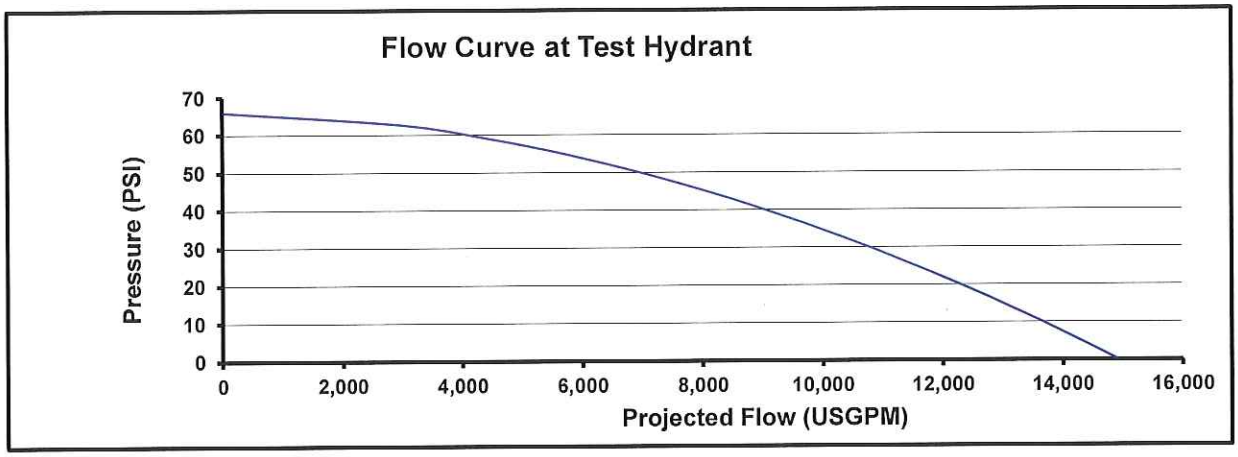
Residual Test Hydrant:	25 Haggert Avenue South		
Hydrant Number:		NFPA Colour Code:	CLASS AA - BLUE
Owner:	Region of Peel		

STATIC PRESSURE:	66 psi	455 kPa	Pressure Drop
RESIDUAL PRESSURE:	64 psi	441 kPa	3.0%

			Hydrant Number
Flow Hydrants:	A	13 Sheard Avenue	
	B		
	C		

Hydrant No.	Flow Device	Outlet Dia. (in.)	Coefficient (~0.9)	Pitot Gauge Reading (psi)	Flow (USGPM)
A	Pitot	2.5		12	540
A	Pitot	2.5		10	493
A	HoseMonster	4"			1225
	TSI	2.5			
			Total Flow (USGPM)		2259
			Total Flow (L/second)		143

Available Flow At Test Hydrant at 20 ps	12,280	USGPM
	775	L/second



Comments/Discrepencies/Diagram:

Watermark Solutions Limited
(705) 250-0368 www.watermark.ca

CROZIER CONSULTING ENGINEERS

PROJECT: 12 Henderson Avenue
PROJECT NO.: 1241-4515
CREATED BY: IC/JL
CHECKED BY: AS
DATE: 2019-05-02
UPDATED: 2021-07-22

Water Demand Table (Region of Peel)

Connection Demand Table - Phase 1				
Water Connection				
Connection point				
Intersection of Henderson Ave. and Sheard Ave.				
Pressure zone of connection point			5	
Total equivalent population to be serviced			518	
Total lands to be serviced			1.28	
Hydrant flow test				
Hydrant flow test location:				
	Test #1 - Sheard Avenue			
		Pressure (kPa)	Flow (in l/s)	Time
Sheard Avenue				
Minimum water pressure		441	143.00	2:20 PM
Maximum water pressure		459	0.00	2:20 PM

No.	Water Demands			
		Demand (in l/s)		
	Demand Type	Domestic	Use 2	Total
1	Average day flow	1.68		1.68
2	Maximum day flow	3.36		3.36
3	Peak hour flow	5.04		5.04
4	Fire flow	183		183
Analysis				
5	Maximum day plus fire flow	186		186
WASTEWATER CONNECTION				**Total**
Connection Point		Haggert Ave. and Sheard Ave.		
Total equivalent population to be serviced		518		518
Total lands to be serviced		1.28		1.28
6	Wastewater sewer effluent (in l/s)	7.66		7.66

1 Please refer to design criteria for population equivalencies
2 Please reference the Fire Underwriters Survey Document
3 Please specify the connection point ID
4 Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent population to be serviced" and the "total lands to be serviced" should reference the connection point. (The FSR should contain one copy of Site Servicing Plan)
5 Please complete as many uses are necessary for the development (Please specify each use)
6 A hydrant flow test will be conducted prior to detailed design

Please include the graphs associated with the hydrant flow test information table.
Please provide Professional Engineer's signature and stamp on the demand table.
All required calculations must be submitted with the demand table submission.

CROZIER CONSULTING ENGINEERS

PROJECT: 12 Henderson Avenue
PROJECT NO.: 1241-4515
CREATED BY: IC/JL
CHECKED BY: AS
DATE: 2019-05-02
UPDATED: 2021-07-22

Water Demand Table (Region of Peel)

Connection Demand Table - Phase 2				
Water Connection				
Connection point				
Haggert Ave.				
Pressure zone of connection point			5	
Total equivalent population to be serviced			791	
Total lands to be serviced			0.94	
Hydrant flow test				
Hydrant flow test location:				
	Test #1 - Sheard Avenue			
		Pressure (kPa)	Flow (in l/s)	Time
Sheard Avenue				
Minimum water pressure		441	143.00	2:20 PM
Maximum water pressure		455	0.00	2:20 PM

No.	Water Demands			
		Demand (in l/s)		
	Demand Type	Domestic	Use 2	Total
1	Average day flow	2.53		2.53
2	Maximum day flow	5.06		5.06
3	Peak hour flow	7.59		7.59
4	Fire flow	183		183
Analysis				
5	Maximum day plus fire flow	188		188

WASTEWATER CONNECTION				
				Total
Connection Point		Haggert Ave. and Sheard Ave.		
Total equivalent population to be serviced		791		791
Total lands to be serviced		0.94		0.94
6	Wastewater sewer effluent (in l/s)	11.06		11.06

1 Please refer to design criteria for population equivalencies
2 Please reference the Fire Underwriters Survey Document
3 Please specify the connection point ID
4 Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent population to be serviced" and the "total lands to be serviced" should reference the connection point. (The FSR should contain one copy of Site Servicing Plan)
5 Please complete as many uses are necessary for the development
(Please specify each use)
6 A hydrant flow test will be conducted prior to detailed design

Please include the graphs associated with the hydrant flow test information table.
Please provide Professional Engineer's signature and stamp on the demand table.
All required calculations must be submitted with the demand table submission.

APPENDIX C

Sanitary Demand Calculations

CROZIER CONSULTING ENGINEERS

PROJECT: 12 Henderson Avenue
PROJECT NO.: 1241-4515

CREATED BY: IC/JL/MJ
CHECKED BY: AS

DATE: 2019-05-02
UPDATED: 2021-07-22

Sanitary Design Flow - Proposed Conditions

Site Statistics: Total Site Area: 3.12 ha

Landuse	Number of Units	Area (ha)	Population Density	Units	Population
Phase 1 Residential Townhouses	148	1.28	3.5	Person/unit	518
Phase 2 Residential Condominiums	293	0.94	2.7	Person/unit	791
Pond and Natural Area	-	0.84	-	-	-
Road Widening	-	0.06	-	-	-

Tota Residential Population: **1309**

Design Parameters:

Type of Development	Average Daily Flow	Units
Residential Apartment	302.8	L/Capita/Day

Sanitary Design Flow - Phase 1:

Average Daily Residential Flow = **1.87** L/s

Harmon Peak Factor: MResi = **3.97**

Peak Resi Flow = **7.41** L/s

Infiltration Flow: Infiltration = 0.20 L/ha/s
Total Infiltration = **0.26** L/s

Total Peak Flow: Total Peak Flow = **7.66** L/s

Sanitary Design Flow - Phase 2:

Average Daily Residential Flow = **2.85** L/s

Harmon Peak Factor: MResi = **3.86**

Peak Resi Flow = **11.02** L/s

Infiltration Flow: Infiltration = 0.20 L/ha/s
Total Infiltration = **0.19** L/s

Total Peak Flow: Total Peak Flow = **11.21** L/s

Summary Table:

Phase	Average Daily Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)
Phase 1 (Townhouses)	1.87	3.97	7.41	0.26	**7.66**
Phase 2 (Residential Condominiums)	2.85	3.86	11.02	0.19	**11.21**

Notes & References

Per Region of Peel Comments from Public Works Department (October 28, 2019)

Region of Peel Public Works Design, Specifications & Procedures Manual - Linear Infrastructure Sanitary Sewer Design Criteria (July, 2009) - 2.1 - Modified March 2017 REV 0.9 (CS)

Region of Peel Public Works Design, Specifications & Procedures Manual - Linear Infrastructure - Sanitary Sewer Design Criteria (July, 2009) - STD. DWG.2-9-2

Average Daily

(p/1000)^.5)

Peak Flow = Average Daily Flow * M

Total Peak Flow = Peak Flows + Total Infiltration

APPENDIX D

Stormwater Management Calculations

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.07.12
By: IC
Check BW

D.A. NAME 101
D.A. AREA 0.30

Hydrologic Parameters: NASHYD Command
Pre-Development Drainage Area: Catchment 101

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	0.30
				0.00
				0
				0
Total Area				0.3

Impervious Landuses Present:												
	Roadway		Sidewalk		Gravel		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL												
Subtotal												

Pervious Landuses Present:												
	Woodland		Pasture		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL			0.30	71							0.30	21.30
											0.00	0.00
Subtotal			0.30	71								

	Composite Area Calculations	Total Pervious Area	0.3
		Total Impervious Area	0
		% Impervious	0.0
		Composite Curve Number	71.0
		Total Area Check	0.30

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Silt Loam		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.0	0.0	0.42	0.00							0.00
Pasture	8	0.3	2.4	0.28	0.30							0.08
Wetland	16	0.0	0.0	0.05	0.00							0.00
Lawn	5	0.0	0.0	0.25	0.00							0.00
Cultivated	7	0.0	0.0	0.60	0.00							0.00
Impervious	2	0.0	0.0	0.95	0.00							0.00
Composite		0.3	8.0	Composite Runoff Coefficient								0.28

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
S1	79	1	1.27%	2.3	0.26	0.08	0.05	0.05	0.08	0.05	0.37	0.25

Appropriate calculated time to	0.25	Appropriate Method:	Airport

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.07.12
By: IC
Check BW

D.A. NAME **102**
D.A. AREA **0.34**

Hydrologic Parameters: NASHYD Command
Pre-Development Drainage Area: Catchment 102

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	0.34
				0.00
				0
				0
Total Area				0.34

Impervious Landuses Present:												
	Roadway		Sidewalk		Gravel		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL												
Subtotal												

Pervious Landuses Present:												
	Woodland		Pasture		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL			0.34	71							0.34	24.14
											0.00	0.00
Subtotal			0.34	71								

	Composite Area Calculations	Total Pervious Area	0.34
		Total Impervious Area	0
		% Impervious	0.0
		Composite Curve Number	71.0
		Total Area Check	0.34

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Silt Loam		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.0	0.0	0.42	0.00							0.00
Pasture	8	0.3	2.7	0.28	0.34							0.10
Wetland	16	0.0	0.0	0.05	0.00							0.00
Lawn	5	0.0	0.0	0.25	0.00							0.00
Cultivated	7	0.0	0.0	0.60	0.00							0.00
Impervious	2	0.0	0.0	0.95	0.00							0.00
Composite		0.3	8.0	Composite Runoff Coefficient								0.28

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
S1	61	0.77	1.26%	2.3	0.26	0.07	0.04	0.04	0.06	0.04	0.32	0.22

Appropriate calculated time to	0.22	Appropriate Method:	Airport

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.07.12
By: IC
Check: BW

D.A. NAME 103
D.A. AREA 2.48

Hydrologic Parameters: NASHYD Command
Pre-Development Drainage Area: Catchment 103

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	2.48
				0.00
				0
				0
Total Area				2.48

Impervious Landuses Present:												
	Roadway		Sidewalk		Gravel Laneway		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL												
Subtotal												

Pervious Landuses Present:												
	Woodland		Pasture		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL			2.48	71							2.48	176.08
Subtotal			2.48	71								

	Composite Area Calculations	Total Pervious Area	2.48
		Total Impervious Area	0
		% Impervious	0.0
		Composite Curve Number	71.0
		Total Area Check	2.48

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Silt Loam		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.0	0.0	0.42	0.00							0.00
Pasture	8	2.5	19.8	0.28	2.48							0.69
Wetland	16	0.0	0.0	0.05	0.00							0.00
Lawn	5	0.0	0.0	0.25	0.00							0.00
Cultivated	7	0.0	0.0	0.60	0.00							0.00
Impervious	2	0.0	0.0	0.95	0.00							0.00
Composite		2.5	8.0	Composite Runoff Coefficient								0.28

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
S1	105	0.96	0.91%	2.3	0.22	0.13	0.08					
S2	28	1.26	4.50%	2.3	0.49	0.02	0.01					
S3	13	0.22	1.69%	2.3	0.30	0.01	0.01	0.13	0.17	0.11	0.54	0.36
S4	38	0.66	1.74%	2.3	0.30	0.03	0.02					
S5	38	1.16	3.05%	2.3	0.40	0.03	0.02					

Appropriate calculated time to	0.36	Appropriate Method:	Airport

```
; C    Metric units
*#*************************************************************************
*# Project Name: [L. Henderson Ave.]    Project Number: [1253-007]
*# Date       : 10/1.07.13
*# Time       : [PM]
*# Company    : C.F. CROZIER & ASSOCIATED INC.
*# License #  :  3737013
*#*************************************************************************
 START          ITEM=[0.0],  RETOUT=[2],  NSTORM=[0],  HNUM=[0]
                [  ] --enter filename, one per line for MAJOR SIM--
*1
*#----------------|-------------------------------------------------------|
*#               | 5 YEAR EVENT                                          |
*#----------------|-------------------------------------------------------|
CHICAGO STORM    IUNITS=[2],  TD=[24.0](hrs), TPEAK=[0.333],  CSDT=[10](min),
                 ICASE=[1],
                  A=[492.56],  B=[0.685], and C=[0.737],
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 101 (TO SHEARD AVE )                        |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[1], NHYD=["101"], DT=[1]min, AREA=[0.30]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 102 (TO HASSERT AVE )                       |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.34]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | TOTAL FLOWS TO CITY ROADS                             |
*#----------------|-------------------------------------------------------|
ADD HYD          ID1=+[3], NHYD=["OUT1"], ID2 to add=[1,2]
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 103 (TO FLETCHERS CREEK )                   |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[3], NHYD=["103"], DT=[1]min, AREA=[2.48]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.36]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | 5 YEAR EVENT                                          |
*#----------------|-------------------------------------------------------|
CHICAGO STORM    IUNITS=[2],  TD=[24.0](hrs), TPEAK=[0.333],  CSDT=[10](min),
                 ICASE=[1],
                  A=[552.56],  B=[0.685], and C=[0.737],
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 101 (TO SHEARD AVE )                        |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[1], NHYD=["101"], DT=[1]min, AREA=[0.30]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 102 (TO HASSERT AVE )                       |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.34]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | TOTAL FLOWS TO CITY ROADS                             |
*#----------------|-------------------------------------------------------|
ADD HYD          ID1=+[3], NHYD=["OUT1"], ID2 to add=[1,2]
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 103 (TO FLETCHERS CREEK )                   |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[3], NHYD=["103"], DT=[1]min, AREA=[2.48]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.36]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | 10 YEAR EVENT                                         |
*#----------------|-------------------------------------------------------|
CHICAGO STORM    IUNITS=[2],  TD=[24.0](hrs), TPEAK=[0.333],  CSDT=[10](min),
                 ICASE=[1],
                  A=[670],  B=[0.69], and C=[0.737],
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 101 (TO SHEARD AVE )                        |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[1], NHYD=["101"], DT=[1]min, AREA=[0.30]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 102 (TO HASSERT AVE )                       |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.34]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.18]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | TOTAL FLOWS TO CITY ROADS                             |
*#----------------|-------------------------------------------------------|
ADD HYD          ID1=+[3], NHYD=["OUT1"], ID2 to add=[1,2]
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 103 (TO FLETCHERS CREEK )                   |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[3], NHYD=["103"], DT=[1]min, AREA=[2.48]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.36]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | 25 YEAR EVENT                                         |
*#----------------|-------------------------------------------------------|
CHICAGO STORM    IUNITS=[2],  TD=[24.0](hrs), TPEAK=[0.333],  CSDT=[10](min),
                 ICASE=[1],
                  A=[711.3],  B=[0.688], and C=[0.691],
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 101 (TO SHEARD AVE )                        |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[1], NHYD=["101"], DT=[1]min, AREA=[0.30]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.2]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 102 (TO HASSERT AVE )                       |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.34]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.22]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | TOTAL FLOWS TO CITY ROADS                             |
*#----------------|-------------------------------------------------------|
ADD HYD          ID1=+[3], NHYD=["OUT1"], ID2 to add=[1,2]
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 103 (TO FLETCHERS CREEK )                   |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[3], NHYD=["103"], DT=[1]min, AREA=[2.48]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.36]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | 50 YEAR EVENT                                         |
*#----------------|-------------------------------------------------------|
CHICAGO STORM    IUNITS=[2],  TD=[24.0](hrs), TPEAK=[0.333],  CSDT=[10](min),
                 ICASE=[1],
                  A=[785.14],  B=[0.657], and C=[0.691],
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 101 (TO SHEARD AVE )                        |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[1], NHYD=["101"], DT=[1]min, AREA=[0.30]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.2]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 102 (TO HASSERT AVE )                       |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.34]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.22]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
*#               | TOTAL FLOWS TO CITY ROADS                             |
*#----------------|-------------------------------------------------------|
ADD HYD          ID1=+[3], NHYD=["OUT1"], ID2 to add=[1,2]
*#----------------|-------------------------------------------------------|
*#               | CATCHMENT 103 (TO FLETCHERS CREEK )                   |
*#----------------|-------------------------------------------------------|
CALIB NASHYD     ID=[3], NHYD=["103"], DT=[1]min, AREA=[2.48]{ha},
                 IWF=[0](c=s),  CN/C=[71], IA=[8](mm),
                 N=[3], TP=[0.36]hrs,
                 RAINFALL=[ ,  ,  ,  , ](mm/hr),  ENDS=-1
*#----------------|-------------------------------------------------------|
FINISH
```

```
                                                                                
                                                                                
 XXXXX   W     W  H     H  H     H  Y     Y  M     M    000          III   000    11   7777777 ---------
 X    X  W     W  H     H  H     H   Y   Y   MM   MM   0   0          I   0   0  1 1   7     7
 XXXXX   W  W  W  HHHHHHH  HHHHHHH    Y Y    M M M M  0   0          I   0   0    1   7     7  Ver4.05.0
 X    X  W W W W  H     H  H     H     Y     M  M  M  0   0          I   0   0    1   7     7  SEP 2017
 XXXXX    W   W   H     H  H     H     Y     M     M   000          III   000   1111  7     7 ---------

        StormWater Management Hydrologic Model                          111   000    11   7     7 ---------

 ************************************************************************************************
 ************************************ SWMHYMO Ver4.05.0 ***************************************
 ****************** A single event and continuous hydrologic simulation model *********************
 ****************** Based on the principles of NASH and SCS unit-theory ***************************
 ****************** OTTHYMO-83 and OTTHYMO-89. *****************************************************
 ************************************************************************************************
 ****************** Distributed by: J.F. Jablonski and Associates Inc. *****************************
 ****************** Ottawa, Ontario (613) 836-3884 *************************************************
 ****************** Gatineau, Quebec (819) 243-6393 ************************************************
 ****************** E-Mail: mail@jfja.com **********************************************************
 ************************************************************************************************

 ************************************************************************************************
 ****************** Licensed under: C.F. Crozier & Associates Inc. *********************************
 ****************** Collingwood ********************** SERIAL#:s17373012 ***************************
 ************************************************************************************************

 ************************************************************************************************
 ****************** ****** PROGRAM ARRAY DIMENSIONS ****** *****************************************
 ****************** Maximum value for ID numbers  :  10 ********************************************
 ****************** Max. number of rainfall points: 105408 *****************************************
 ****************** Max. number of flow points    : 105408 *****************************************
 ************************************************************************************************

 ************************************************************************************************
 ****************** SWMHYMO Ver4.05.0 ***************************************
 ****************** A single event and continuous hydrologic simulation model *********************
 ****************** Based on the principles of NASH and SCS unit-theory ***************************
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 ************************************************************************************************

 ************************************************************************************************
 ****************** ****** PROGRAM ARRAY DIMENSIONS ****** *****************************************
 ****************** Maximum value for ID numbers  :  10 ********************************************
 ****************** Max. number of rainfall points: 105408 *****************************************
 ****************** Max. number of flow points    : 105408 *****************************************
 ************************************************************************************************

                      ************************  D E T A I L E D   O U T P U T  ************************
                      *                  RUN DATE: 2021-07-12     TIME: 15:01:40     RUN COUNTER: 000001                  *
                      ************************************************************************************************
 * Input  filename: C:\1c00\1121-NHK Capital Corp\4515-1 Henderson Ave\Design\2YSCS100.dat                               *
 * Output filename: C:\1c00\1121-NHK Capital Corp\4515-12 Henderson Ave\Design\2YSCS100.out                              *
 * Summary filename: C:\1c00\1121-NHK Capital Corp\4515-12 Henderson Ave\Design\2YSCS100.sum                             *
 * User comment:                                                                                                        *
 * 1:                                                                                                                   *
 * 2:                                                                                                                   *
 * 3:                                                                                                                   *
 ************************************************************************************************************************

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000101----------------------------------------------------------------------------------------------------------
 *# Project Name (12 Henderson Ave.)    Project Number: (1c00-4515)
 *# Date       : 2021.07.12
 *# Modeller   : (CFC)
 *# Company    : C.F. CROZIER & ASSOCIATES INC.
 *# License #  :  3737012
 ----------------------------------------------------------------------------------------------------------------------
 | START            | Project dir.:C:\1c00\1121-NHK Capital Corp\4515-12 Henderson Ave\Design\2YSCS |
 | Rainfall dir.:C:\1c00\1121-NHK Capital Corp\4515-12 Henderson Ave\Design\SCS |
 ----------------------------------------------------------------------------------------------------------------------
 TIMSTP=    [5]min or   0
 METOUT=    2 (output = METRIC)
 NRUN  = 0001
 NSTORM=  0
 ----------------------------------------------------------------------------------------------------------------------
 R0001a000101----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | 2 YEAR EVENT                                                                                             |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CHICAGO STORM |     IDF Curve parameters: A= 414.810
 | Ptotal= 54.93 mm |                       B=   .000
 ----------                                  C=   .719
                                 Used in:  INTENSITY = A / (t + B)^C

                                 Duration of storm   = 24.00 hrs
                                 Storm time step     = 10.00 min
                                 Time to peak ratio  =  .33

      TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN
      hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr
      0:10     .654    4:10    1.109    8:10   14.062   12:10    1.703   16:10    1.053   20:10    .793
      0:20     .674    4:20    1.145    8:20    9.971   12:20    1.654   16:20    1.039   20:20    .785
      0:30     .695    4:30    1.183    8:30    7.548   12:30    1.610   16:30    1.024   20:30    .777
      0:40     .717    4:40    1.223    8:40    6.131   12:40    1.569   16:40    1.009   20:40    .770
      0:50     .740    4:50    1.265    8:50    5.199   12:50    1.530   16:50    .995    20:50    .762
      1:00     .764    5:00    1.311    9:00    4.540   13:00    1.494   17:00    .981    21:00    .754
      1:10     .789    5:10    1.360    9:10    4.052   13:10    1.459   17:10    .967    21:10    .747
      1:20     .816    5:20    1.411    9:20    3.698   13:20    1.427   17:20    .953    21:20    .74
      1:30     .843    5:30    1.470    9:30    3.565   13:30    1.396   17:30    .940    21:30    .732
      1:40     .873    5:40    1.533    9:40    3.548   13:40    1.368   17:40    .934    21:40    .725
      1:50     .904    5:50    1.607    9:50    3.613   13:50    1.433   17:50    .928    21:50    .717
      2:00     .934    6:00    1.694   10:00    3.801   14:00    1.911   18:00    .911    22:00    .717
      2:10     .970    6:10    1.801   10:10    4.170   14:10    1.371   18:10    .894    22:10    .721
      2:20    1.009    6:20    1.941   10:20    4.966   14:20    1.332   18:20    .877    22:20    .725
      2:30    1.052    6:30    2.127   10:30    7.048   14:30    1.296   18:30    .860    22:30    .729
      2:40    1.100    6:40    2.384   10:40   14.062   14:40    1.262   18:40    .843    22:40    .733
      2:50    1.153    6:50    2.781   10:50   11.109   14:50    1.230   18:50    .826    22:50    .737
      3:00    1.213    7:00    3.513   11:00    8.911   15:00    1.200   19:00    .809    23:00    .741
      3:10    1.281    7:10    5.199   11:10    7.548   15:10    1.172   19:10    .792    23:10    .745
      3:20    1.359    7:20   11.109   11:20    6.631   15:20    1.145   19:20    .775    23:20    .749
      3:30    1.450    7:30   14.062   11:30    6.021   15:30    1.119   19:30    .758    23:30    .753
      3:40    1.557    7:40    8.911   11:40    5.671   15:40    1.094   19:40    .741    23:40    .757
      3:50    1.683    7:50    6.631   11:50    5.509   15:50    1.070   19:50    .724    23:50    .761
      4:00    1.829    8:00    5.509   12:00    5.514   16:00    1.047   20:00    .707    24:00    .765

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000103----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 101 (TO SWEARD AVE )                                                                           |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=    .200  Curve Number  (CN)= 71.00
 | 01:101      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .290

      Unit Hyd Qpeak  (cms)=    .014

      PEAK FLOW       (cms)=    .000 (i)
      TIME TO PEAK    (hrs)=   8.333
      DURATION        (hrs)=  25.500, (#####hhrrmm):  1:01:15
      AVERAGE FLOW    (cms)=    .000
      RUNOFF VOLUME     (m)=  14.017
      TOTAL RAINFALL    (m)=  54.930
      RUNOFF COEFFICIENT  =    .255

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

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000102----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 102 (TO HASSELL AVE )                                                                          |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=    .340  Curve Number  (CN)= 71.00
 | 02:102      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .319

      Unit Hyd Qpeak  (cms)=    .017

      PEAK FLOW       (cms)=    .007 (i)
      TIME TO PEAK    (hrs)=   8.333
      DURATION        (hrs)=  25.500, (#####hhrrmm):  1:01:15
      AVERAGE FLOW    (cms)=    .001
      RUNOFF VOLUME     (m)=  23.823
      TOTAL RAINFALL    (m)=  54.930
      RUNOFF COEFFICIENT  =    .434

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

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000103----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 103 (TO FLETCHERS CREEK )                                                                      |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=   1.480  Curve Number  (CN)= 71.00
 | 03:103      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .365

      Unit Hyd Qpeak  (cms)=    .069

      PEAK FLOW       (cms)=    .039 (i)
      TIME TO PEAK    (hrs)=   8.333
      DURATION        (hrs)=  24.167, (#####hhrrmm):  1:01:15
      AVERAGE FLOW    (cms)=    .004
      RUNOFF VOLUME     (m)=  81.017
      TOTAL RAINFALL    (m)=  54.930
      RUNOFF COEFFICIENT  =    .246

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

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000107----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | 5 YEAR EVENT                                                                                             |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CHICAGO STORM |     IDF Curve parameters: A= 572.940
 | Ptotal= 76.98 mm |                       B=   .085
 ----------                                  C=   .782
                                 Used in:  INTENSITY = A / (t + B)^C

                                 Duration of storm   = 24.00 hrs
                                 Storm time step     = 10.00 min
                                 Time to peak ratio  =  .33

      TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN    TIME     RAIN
      hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr   hours    mm/hr
      0:10     .964    4:10    1.605    8:10   21.004   12:10    2.442   16:10    1.525   20:10    1.153
      0:20     .983    4:20    1.656    8:20   13.935   12:20    2.377   16:20    1.504   20:20    1.141
      0:30     .999    4:30    1.711    8:30   10.529   12:30    2.315   16:30    1.483   20:30    1.129
      0:40    1.015    4:40    1.772    8:40    8.459   12:40    2.257   16:40    1.463   20:40    1.118
      0:50    1.031    4:50    1.838    8:50    7.139   12:50    2.202   16:50    1.444   20:50    1.107
      1:00    1.048    5:00    1.910    9:00    6.251   13:00    2.150   17:00    1.425   21:00    1.096
      1:10    1.065    5:10    1.989    9:10    5.718   13:10    2.101   17:10    1.407   21:10    1.085
      1:20    1.085    5:20    2.076    9:20    5.447   13:20    2.055   17:20    1.389   21:20    1.074
      1:30    1.105    5:30    2.171    9:30    5.474   13:30    2.011   17:30    1.371   21:30    1.063
      1:40    1.126    5:40    2.277    9:40    5.864   13:40    1.970   17:40    1.355   21:40    1.053
      1:50    1.149    5:50    2.397    9:50    6.828   13:50    1.931   17:50    1.339   21:50    1.043
      2:00    1.169    6:00    2.539   10:00    9.075   14:00    1.893   18:00    1.323   22:00    1.033
      2:10    1.194    6:10    2.712   10:10   15.854   14:10    1.857   18:10    1.308   22:10    1.023
      2:20    1.217    6:20    2.934   10:20    9.667   14:20    1.823   18:20    1.293   22:20    1.014
      2:30    1.243    6:30    3.230   10:30    8.189   14:30    1.790   18:30    1.279   22:30    1.003
      2:40    1.270    6:40    3.643   10:40    7.335   14:40    1.758   18:40    1.265   22:40    1.012
      2:50    1.300    6:50    4.283   10:50    6.797   14:50    1.728   18:50    1.251   22:50    1.004
      3:00    1.332    7:00    5.347   11:00    6.473   15:00    1.699   19:00    1.238   23:00    .995
      3:10    1.367    7:10    7.548   11:10    6.269   15:10    1.671   19:10    1.225   23:10    .988
      3:20    1.407    7:20   15.854   11:20    6.155   15:20    1.644   19:20    1.213   23:20    .980
      3:30    1.450    7:30    7.014   11:30    6.109   15:30    1.619   19:30    1.201   23:30    .973
      3:40    1.471    7:40    6.811   11:40    6.071   15:40    1.594   19:40    1.189   23:40    .966
      3:50    1.513    7:50    6.473   11:50    5.989   15:50    1.570   19:50    1.178   23:50    .959
      4:00    1.557    8:00   15.854   12:00    5.914   16:00    1.547   20:00    1.167   24:00    .952

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000101----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 101 (TO SWEARD AVE )                                                                           |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=    .200  Curve Number  (CN)= 71.00
 | 01:101      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .290

      Unit Hyd Qpeak  (cms)=    .018

      PEAK FLOW       (cms)=    .001 (i)
      TIME TO PEAK    (hrs)=   8.333
      DURATION        (hrs)=  25.500, (#####hhrrmm):  1:01:15
      AVERAGE FLOW    (cms)=    .000
      RUNOFF VOLUME     (m)=  17.531
      TOTAL RAINFALL    (m)=  76.974
      RUNOFF COEFFICIENT  =    .228

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

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000102----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 102 (TO HASSELL AVE )                                                                          |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=    .340  Curve Number  (CN)= 71.00
 | 02:102      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .319

      Unit Hyd Qpeak  (cms)=    .029

      PEAK FLOW       (cms)=    .011 (i)
      TIME TO PEAK    (hrs)=   8.333
      DURATION        (hrs)=  25.500, (#####hhrrmm):  1:01:15
      AVERAGE FLOW    (cms)=    .001
      RUNOFF VOLUME     (m)=  27.531
      TOTAL RAINFALL    (m)=  76.974
      RUNOFF COEFFICIENT  =    .358

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

 ----------------------------------------------------------------------------------------------------------------------
 R0001a000103----------------------------------------------------------------------------------------------------------
 *+----------|----------------------------------------------------------------------------------------------------------*
 *|          | CATCHMENT 103 (TO FLETCHERS CREEK )                                                                      |
 *+----------|----------------------------------------------------------------------------------------------------------*
 ----------
 | CALIB NASHYD     |  Area   (ha)=   1.480  Curve Number  (CN)= 71.00
 | 03:103      DT= 1.00 |  Ia     (mm)=   8.000  # of Linear Res.(N)=  3.00
 ----------------------  U.H. Tp(hrs)=    .365

      Unit Hyd Qpeak  (cms)=    .069

      PEAK FLOW       (cms)=    .075 (i)
      TIME TO PEAK    (hrs)=   8.167
      DURATION        (hrs)=  24.667, (#####hhrrmm):  1:02:13
      AVERAGE FLOW    (cms)=    .007
      RUNOFF VOLUME     (m)=  27.531
```

```
TOTAL RAINFALL  (mm)=   70.764
RUNOFF COEFFICIENT  =    .054

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

+----------------+
| CHICAGO STORM  |   IDF curve parameters: A= 410.000
| Total= 91.07 mm |                      B=   .000
+----------------+                      C=   .697

                    Used for   INTENSITY = A / (t + B)^C

                    Duration of storm   = 24.00 hrs
                    Storm time step     = 10.00 min
                    Time to peak ratio  =  .33

    TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN
    hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr
    0+10   1.182|  4+10   1.958|  8+10   6.368|  12+10  3.959|  16+10  1.854|  20+10  1.405
    0+20   1.203|  4+20   2.012|  8+20  10.585|  12+20  2.939|  16+20  1.823|  20+20  1.391
    0+30   1.218|  4+30   2.079|  8+30  21.439|  12+30  2.804|  16+30  1.800|  20+30  1.379
    0+40   1.239|  4+40   2.152|  8+40  10.109|  12+40  2.705|  16+40  1.779|  20+40  1.367
    0+50   1.258|  4+50   2.231|  8+50   6.947|  12+50  2.664|  16+50  1.758|  20+50  1.354
    1+00   1.279|  5+00   2.317|  9+00   5.912|  13+00  2.607|  17+00  1.739|  21+00  1.342
    1+10   1.300|  5+10   2.413|  9+10   5.312|  13+10  2.549|  17+10  1.711|  21+10  1.330
    1+20   1.319|  5+20   2.518|  9+20   4.934|  13+20  2.493|  17+20  1.693|  21+20  1.319
    1+30   1.337|  5+30   2.635|  9+30   5.647|  13+30  2.440|  17+30  1.674|  21+30  1.307
    1+40   1.372|  5+40   2.767|  9+40   5.169|  13+40  2.390|  17+40  1.649|  21+40  1.296
    1+50   1.397|  5+50   2.915|  9+50   5.184|  13+50  2.342|  17+50  1.632|  21+50  1.285
    2+00   1.424|  6+00   3.089|  10+00  4.913|  14+00  2.297|  18+00  1.611|  22+00  1.275
    2+10   1.453|  6+10   3.291|  10+10  4.649|  14+10  2.254|  18+10  1.591|  22+10  1.264
    2+20   1.482|  6+20   3.511|  10+20  4.417|  14+20  2.212|  18+20  1.575|  22+20  1.254
    2+30   1.514|  6+30   3.744|  10+30  4.212|  14+30  2.173|  18+30  1.557|  22+30  1.244
    2+40   1.547|  6+40   3.996|  10+40  4.028|  14+40  2.135|  18+40  1.539|  22+40  1.234
    2+50   1.581|  6+50   4.282|  10+50  3.863|  14+50  2.099|  18+50  1.521|  22+50  1.224
    3+00   1.619|  7+00   4.609|  11+00  3.713|  15+00  2.064|  19+00  1.503|  23+00  1.215
    3+10   1.658|  7+10   5.000|  11+10  3.577|  15+10  2.030|  19+10  1.487|  23+10  1.205
    3+20   1.701|  7+20   5.459|  11+20  3.452|  15+20  1.998|  19+20  1.477|  23+20  1.197
    3+30   1.743|  7+30   6.017|  11+30  3.336|  15+30  1.967|  19+30  1.461|  23+30  1.188
    3+40   1.795|  7+40  11.514|  11+40  3.232|  15+40  1.938|  19+40  1.447|  23+40  1.179
    3+50   1.850|  7+50  21.478|  11+50  3.134|  15+50  1.910|  19+50  1.431|  23+50  1.170
    4+00   1.899|  8+00 121.792|  12+00  3.043|  16+00  1.883|  20+00  1.419|  24+00  1.162

+----------------+
| CATCHMENT 101  (TO CHEAPSIDE AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .200  Curve Number  (CN)= 71.00
| 001i02       ID= 1 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .048

    PEAK FLOW     (cms)=    .014 (i)
    TIME TO PEAK  (hrs)=   8.117
    DURATION      (hrs)=  25.796, (4444)hhorrs)=  110145
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  37.034
    TOTAL RAINFALL  (mm)=  70.074
    RUNOFF COEFFICIENT  =    .529

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

+----------------+
| CATCHMENT 102  (TO MARGARET AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .340  Curve Number  (CN)= 71.00
| 001i02       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .068

    PEAK FLOW     (cms)=    .028 (i)
    TIME TO PEAK  (hrs)=   8.183
    DURATION      (hrs)=  25.533, (4444)hhorrs)=  110152
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  37.034
    TOTAL RAINFALL  (mm)=  70.074
    RUNOFF COEFFICIENT  =    .529

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

+----------------+
| ADD HYD        |
| 03+TOTU        |   ID=NHYD            AREA    QPEAK   TPEAK    R.V.    INF
+----------------+                      (ha)    (cms)   (hrs)    (mm)    (mm)
                    ID 1 001i01          .200     .014   8.117   37.034    .000
                   +ID 2 001i02          .340     .028   8.183   37.034    .000
                    ---------------------------------------------------------
                    ID = 03:TOTU         .540     .042   8.150   37.034    .000

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

+----------------+
| CATCHMENT 103  (TO FLETCHERS CREEK)
+----------------+

| CALIB NASHYD         |  Area    (ha)=   2.490  Curve Number  (CN)= 71.00
| 001i03       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .300

    Unit Hyd Qpeak  (cms)=    .288

    PEAK FLOW     (cms)=    .109 (i)
    TIME TO PEAK  (hrs)=   8.267
    DURATION      (hrs)=  24.967, (4444)hhorrs)=  110133
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  37.034
    TOTAL RAINFALL  (mm)=  70.074
    RUNOFF COEFFICIENT  =    .529

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

+----------------+
| CHICAGO STORM  |   IDF curve parameters: A= 711.300
| Total=110.53 mm |                      B=   .091
+----------------+                      C=   .791

                    Used for   INTENSITY = A / (t + B)^C

                    Duration of storm   = 24.00 hrs
                    Storm time step     = 10.00 min
                    Time to peak ratio  =  .33

    TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN
    hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr
    0+10   1.437|  4+10   2.365|  8+10  41.511|  12+10  3.573|  16+10  2.249|  20+10  1.709
    0+20   1.463|  4+20   2.440|  8+20  19.967|  12+20  3.483|  16+20  2.218|  20+20  1.692
    0+30   1.484|  4+30   2.521|  8+30  13.102|  12+30  3.394|  16+30  2.144|  20+30  1.676
    0+40   1.505|  4+40   2.609|  8+40  12.502|  12+40  3.310|  16+40  2.193|  20+40  1.661
    0+50   1.529|  4+50   2.703|  8+50  10.756|  12+50  3.231|  16+50  2.131|  20+50  1.646
    1+00   1.558|  5+00   2.808|  9+00   9.509|  13+00  3.156|  17+00  2.103|  21+00  1.631
    1+10   1.581|  5+10   2.922|  9+10   8.562|  13+10  3.084|  17+10  2.077|  21+10  1.617
    1+20   1.605|  5+20   3.043|  9+20   7.813|  13+20  3.014|  17+20  2.051|  21+20  1.603
    1+30   1.637|  5+30   3.180|  9+30   7.214|  13+30  2.953|  17+30  2.028|  21+30  1.589
    1+40   1.667|  5+40   3.334|  9+40   6.713|  13+40  2.895|  17+40  2.002|  21+40  1.576
    1+50   1.698|  5+50   3.517|  9+50   6.285|  13+50  2.833|  17+50  1.979|  21+50  1.563
    2+00   1.731|  6+00   3.732|  10+00  5.910|  14+00  2.783|  18+00  1.956|  22+00  1.550
    2+10   1.765|  6+10   3.978|  10+10  5.592|  14+10  2.731|  18+10  1.933|  22+10  1.537
    2+20   1.801|  6+20   4.214|  10+20  5.332|  14+20  2.681|  18+20  1.912|  22+20  1.525
    2+30   1.839|  6+30   4.572|  10+30  5.045|  14+30  2.634|  18+30  1.891|  22+30  1.513
    2+40   1.879|  6+40   4.970|  10+40  4.803|  14+40  2.589|  18+40  1.870|  22+40  1.501
    2+50   1.921|  6+50   5.425|  10+50  4.564|  14+50  2.541|  18+50  1.850|  22+50  1.489
    3+00   1.965|  7+00   6.062|  11+00  4.347|  15+00  2.502|  19+00  1.831|  23+00  1.477
    3+10   2.012|  7+10   6.957|  11+10  4.133|  15+10  2.460|  19+10  1.812|  23+10  1.466
    3+20   2.062|  7+20   8.183|  11+20  3.933|  15+20  2.420|  19+20  1.794|  23+20  1.455
    3+30   2.115|  7+30  10.101|  11+30  3.758|  15+30  2.382|  19+30  1.776|  23+30  1.444
    3+40   2.171|  7+40  13.322|  11+40  3.608|  15+40  2.350|  19+40  1.759|  23+40  1.434
    3+50   2.230|  7+50  25.091|  11+50  3.792|  15+50  2.317|  19+50  1.741|  23+50  1.423
    4+00   2.294|  8+00 143.208|  12+00  3.641|  16+00  2.282|  20+00  1.724|  24+00  1.413

+----------------+
| CATCHMENT 101  (TO CHEAPSIDE AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .200  Curve Number  (CN)= 71.00
| 001i01       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .048

    PEAK FLOW     (cms)=    .021 (i)
    TIME TO PEAK  (hrs)=   8.117
    DURATION      (hrs)=  25.796, (4444)hhorrs)=  110145
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  53.944
    TOTAL RAINFALL  (mm)= 110.534
    RUNOFF COEFFICIENT  =    .488

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

+----------------+
| CATCHMENT 102  (TO MARGARET AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .340  Curve Number  (CN)= 71.00
| 001i02       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .068

    PEAK FLOW     (cms)=    .042 (i)
    TIME TO PEAK  (hrs)=   8.117
    DURATION      (hrs)=  25.533, (4444)hhorrs)=  110152
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  91.705
    TOTAL RAINFALL  (mm)= 110.534
    RUNOFF COEFFICIENT  =    .488

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

+----------------+
| ADD HYD        |
| 03+TOTU        |   ID=NHYD            AREA    QPEAK   TPEAK    R.V.    INF
+----------------+                      (ha)    (cms)   (hrs)    (mm)    (mm)
                    ID 1 001i01          .200     .021   8.117   53.944    .000
                   +ID 2 001i02          .340     .042   8.117   91.705    .000
                    ---------------------------------------------------------
                    ID = 03:TOTU         .540     .063   8.117   73.824    .000

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

+----------------+
| CATCHMENT 103  (TO FLETCHERS CREEK)
+----------------+

| CALIB NASHYD         |  Area    (ha)=   2.490  Curve Number  (CN)= 71.00
| 001i03       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .300

    Unit Hyd Qpeak  (cms)=    .288

    PEAK FLOW     (cms)=    .161 (i)
    TIME TO PEAK  (hrs)=   8.267
    DURATION      (hrs)=  24.967, (4444)hhorrs)=  110133
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  91.705
    TOTAL RAINFALL  (mm)= 110.534
    RUNOFF COEFFICIENT  =    .488

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

+----------------+
| CHICAGO STORM  |   IDF curve parameters: A= 789.163
| Total=124.71 mm |                      B=   .097
+----------------+                      C=   .802

                    Used for   INTENSITY = A / (t + B)^C

                    Duration of storm   = 24.00 hrs
                    Storm time step     = 10.00 min
                    Time to peak ratio  =  .33

    TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN|  TIME   RAIN
    hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr|  hours  mm/hr
    0+10   1.633|  4+10   2.678|  8+10  35.410|  12+10  4.061|  16+10  2.559|  20+10  1.941
    0+20   1.663|  4+20   2.770|  8+20  22.370|  12+20  3.957|  16+20  2.521|  20+20  1.922
    0+30   1.688|  4+30   2.864|  8+30  17.006|  12+30  3.855|  16+30  2.486|  20+30  1.904
    0+40   1.711|  4+40   2.963|  8+40  14.164|  12+40  3.757|  16+40  2.453|  20+40  1.886
    0+50   1.742|  4+50   3.071|  8+50  12.115|  12+50  3.667|  16+50  2.423|  20+50  1.870
    1+00   1.770|  5+00   3.189|  9+00  10.710|  13+00  3.583|  17+00  2.395|  21+00  1.857
    1+10   1.800|  5+10   3.319|  9+10   9.677|  13+10  3.503|  17+10  2.369|  21+10  1.841
    1+20   1.831|  5+20   3.462|  9+20   8.840|  13+20  3.427|  17+20  2.343|  21+20  1.825
    1+30   1.871|  5+30   3.624|  9+30   8.164|  13+30  3.354|  17+30  2.320|  21+30  1.810
    1+40   1.897|  5+40   3.810|  9+40   7.596|  13+40  3.288|  17+40  2.297|  21+40  1.794
    1+50   1.933|  5+50   4.003|  9+50   7.113|  13+50  3.220|  17+50  2.275|  21+50  1.779
    2+00   1.973|  6+00   4.252|  10+00  6.709|  14+00  3.161|  18+00  2.255|  22+00  1.765
    2+10   2.009|  6+10   4.503|  10+10  6.359|  14+10  3.101|  18+10  2.236|  22+10  1.750
    2+20   2.050|  6+20   4.811|  10+20  6.059|  14+20  3.044|  18+20  2.216|  22+20  1.736
    2+30   2.094|  6+30   5.194|  10+30  5.721|  14+30  2.991|  18+30  2.197|  22+30  1.723
    2+40   2.139|  6+40   5.631|  10+40  5.417|  14+40  2.941|  18+40  2.178|  22+40  1.709
    2+50   2.189|  6+50   6.193|  10+50  5.149|  14+50  2.891|  18+50  2.160|  22+50  1.696
    3+00   2.235|  7+00   6.907|  11+00  4.924|  15+00  2.844|  19+00  2.144|  23+00  1.683
    3+10   2.289|  7+10   7.871|  11+10  4.723|  15+10  2.799|  19+10  2.126|  23+10  1.670
    3+20   2.345|  7+20   9.150|  11+20  4.731|  15+20  2.756|  19+20  2.041|  23+20  1.658
    3+30   2.405|  7+30  11.431|  11+30  4.576|  15+30  2.715|  19+30  2.041|  23+30  1.646
    3+40   2.469|  7+40  17.599|  11+40  4.435|  15+40  2.676|  19+40  2.041|  23+40  1.633
    3+50   2.537|  7+50  28.837|  11+50  4.300|  15+50  2.639|  19+50  2.041|  23+50  1.621
    4+00   2.610|  8+00 159.309|  12+00  4.174|  16+00  2.604|  20+00  1.962|  24+00  1.610

+----------------+
| CATCHMENT 101  (TO CHEAPSIDE AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .200  Curve Number  (CN)= 71.00
| 001i01       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .048

    PEAK FLOW     (cms)=    .017 (i)
    TIME TO PEAK  (hrs)=   8.117
    DURATION      (hrs)=  25.796, (4444)hhorrs)=  110145
    AVERAGE FLOW  (cms)=    .001
    RUNOFF VOLUME   (m)=  44.795
    TOTAL RAINFALL  (mm)= 124.705
    RUNOFF COEFFICIENT  =    .359

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

+----------------+
| CATCHMENT 102  (TO MARGARET AVE.)
+----------------+

| CALIB NASHYD         |  Area    (ha)=    .340  Curve Number  (CN)= 71.00
| 001i02       ID= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
+--------------------+  U.H. Tp(hrs)=    .150

    Unit Hyd Qpeak  (cms)=    .068
```

```
      PEAK FLOW      (cms)=    .034 (1)
      TIME TO PEAK   (hrs)=   9.183
      DURATION       (hrs)=  25.933, (dddd:hh:mm:ss)=  1:01:55
      AVERAGE FLOW   (cms)=    .002
      RUNOFF VOLUME    (mm)=  71.745
      TOTAL RAINFALL   (mm)= 124.709
      RUNOFF COEFFICIENT   =    .575

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

 | ADD HYD          |
 | 03:ZOUT1         |   ID:NHYD          AREA    QPEAK    TPEAK     R.V.    INF
 ------------------------                (ha)    (cms)    (hrs)     (mm)   (mm)
                       ID 1 01:101          .300     .034    9.17   71.745    .000
                      +ID 2 01:102          .240     .034    9.183  71.745    .000
                       -----------------------------------------------------------
                       SUM  03:ZOUT1         .540     .067    9.183  71.745    .000

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 | CALIB NASHYD     |  Area    (ha)=   1.480  Curve Number  (CN)= 71.00
 | 01:103      DT= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
 ------------------------  U.H. Tp(hrs)=    .389

      Unit Hyd Qpeak  (cms)=    .287

      PEAK FLOW      (cms)=    .177 (1)
      TIME TO PEAK   (hrs)=   9.350
      DURATION       (hrs)=  26.467, (dddd:hh:mm:ss)=  1:01:28
      AVERAGE FLOW   (cms)=    .018
      RUNOFF VOLUME    (mm)=  71.745
      TOTAL RAINFALL   (mm)= 124.709
      RUNOFF COEFFICIENT   =    .575

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

 | CHICAGO STORM    |      ILH curve parameters: A= 858.240
 | Ptotal=137.41 mm |                            B=   .585
 ------------------                            C=   .699
                       Used in:  INTENSITY = A / (t + B)^C

                       Duration of storm   = 24.00 hrs
                       Storm time step     = 10.00 min
                       Time to peak ratio  =  .33

      TIME    RAIN    TIME    RAIN    TIME    RAIN    TIME    RAIN    TIME    RAIN    TIME    RAIN
      hhmm    mm/hr   hhmm    mm/hr   hhmm    mm/hr   hhmm    mm/hr   hhmm    mm/hr   hhmm    mm/hr
      0:10    1.410   4:10    2.970   8:10   38.900   12:10   4.449   16:10   2.826   20:10   2.148
      0:20    1.477   4:20    3.023   8:20   21.932   12:20   4.361   16:20   2.780   20:20   2.14
      0:30    1.545   4:30    3.101   8:30   14.833   12:30   4.253   16:30   2.729   20:30   2.109
      0:40    1.595   4:40    3.173   8:40   10.946   12:40   4.148   16:40   2.712   20:40   2.070
      0:50    1.636   4:50    3.231   8:50   13.380   12:50   4.049   16:50   2.677   20:50   2.071
      1:00    1.677   5:00    3.322   9:00   11.440   13:00   3.964   17:00   2.643   21:00   2.054
      1:10    1.730   5:10    3.405   9:10   10.070   13:10   3.903   17:10   2.610   21:10   2.035
      1:20    2.014   5:20    3.833   9:20    9.048   13:20   3.838   17:20   2.578   21:20   2.017
      1:30    2.050   5:30    3.994   9:30    8.232   13:30   3.780   17:30   2.547   21:30   2.000
      1:40    2.087   5:40    4.129   9:40    7.578   13:40   3.691   17:40   2.518   21:40   1.983
      1:50    2.134   5:50    4.419   9:50    7.053   13:50   3.653   17:50   2.487   21:50   1.967
      2:00    2.177   6:00    4.673   10:00   6.701   14:00   3.591   18:00   2.458   22:00   1.951
      2:10    2.228   6:10    4.947   10:10   6.439   14:10   3.539   18:10   2.431   22:10   1.935
      2:20    2.269   6:20    5.311   10:20   6.203   14:20   3.489   18:20   2.404   22:20   1.919
      2:30    2.312   6:30    5.739   10:30   5.993   14:30   3.205   18:30   2.377   22:30   1.904
      2:40    2.362   6:40    6.314   10:40   5.833   14:40   3.283   18:40   2.352   22:40   1.889
      2:50    2.417   6:50    6.924   10:50   5.932   14:50   3.243   18:50   2.327   22:50   1.875
      3:00    2.479   7:00    7.820   11:00   5.413   15:00   3.241   19:00   2.303   23:00   1.860
      3:10    2.552   7:10    9.291   11:10   5.299   15:10   3.059   19:10   2.279   23:10   1.846
      3:20    2.633   7:20   12.179   11:20   5.215   15:20   3.018   19:20   2.256   23:20   1.832
      3:30    2.727   7:30   12.691   11:30   5.052   15:30   2.945   19:30   2.233   23:30   1.819
      3:40    2.828   7:40   17.179   11:40   4.998   15:40   2.951   19:40   2.211   23:40   1.805
      3:50    2.939   7:50   31.720   11:50   4.748   15:50   2.907   19:50   2.190   23:50   1.792
      4:00    3.061   8:00  171.755   12:00   4.610   16:00   2.860   20:00   2.169   24:00   1.779

 | CALIB NASHYD     |  Area    (ha)=    .300  Curve Number  (CN)= 71.00
 | 01:101      DT= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
 ------------------------  U.H. Tp(hrs)=    .250

      Unit Hyd Qpeak  (cms)=    .046

      PEAK FLOW      (cms)=    .031 (1)
      TIME TO PEAK   (hrs)=   9.217
      DURATION       (hrs)=  25.799, (dddd:hh:mm:ss)=  1:01:48
      AVERAGE FLOW   (cms)=    .001
      RUNOFF VOLUME    (mm)=  71.833
      TOTAL RAINFALL   (mm)= 137.417
      RUNOFF COEFFICIENT   =    .523

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

 | CALIB NASHYD     |  Area    (ha)=    .240  Curve Number  (CN)= 71.00
 | 02:102      DT= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
 ------------------------  U.H. Tp(hrs)=    .229

      Unit Hyd Qpeak  (cms)=    .039

      PEAK FLOW      (cms)=    .028 (1)
      TIME TO PEAK   (hrs)=   9.183
      DURATION       (hrs)=  25.933, (dddd:hh:mm:ss)=  1:01:55
      AVERAGE FLOW   (cms)=    .001
      RUNOFF VOLUME    (mm)=  71.832
      TOTAL RAINFALL   (mm)= 137.417
      RUNOFF COEFFICIENT   =    .523

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

 | ADD HYD          |
 | 03:ZOUT1         |   ID:NHYD          AREA    QPEAK    TPEAK     R.V.    INF
 ------------------------                (ha)    (cms)    (hrs)     (mm)   (mm)
                       ID 1 01:101          .300     .031    9.217  71.833    .000
                      +ID 2 01:102          .240     .028    9.183  71.832    .000
                       -----------------------------------------------------------
                       SUM  03:ZOUT1         .540     .057    9.200  71.833    .000

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 | CALIB NASHYD     |  Area    (ha)=   1.480  Curve Number  (CN)= 71.00
 | 01:103      DT= 1.00 |  Ia      (mm)=   8.000  # of Linear Res.(N)=  3.00
 ------------------------  U.H. Tp(hrs)=    .389

      Unit Hyd Qpeak  (cms)=    .243

      PEAK FLOW      (cms)=    .109 (1)
      TIME TO PEAK   (hrs)=   9.350
      DURATION       (hrs)=  26.467, (dddd:hh:mm:ss)=  1:01:28
      AVERAGE FLOW   (cms)=    .013
      RUNOFF VOLUME    (mm)=  71.832
      TOTAL RAINFALL   (mm)= 137.417
      RUNOFF COEFFICIENT   =    .523

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

 | ENDSIM           |

      SIMULATION ended on 2021-07-11     at 15:01:41
```

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.03.02
By: IC
Check AS

D.A. NAME 201_U
D.A. AREA 0.22

Hydrologic Parameters: NASHYD Command
Post-Development Drainage Area: Catchment 201_UC

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	0.22
				0.00
				0
				0
Total Area				0.22

Impervious Landuses Present:												
	Roadway		Sidewalk		Gravel		Building		SWMF		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL	0.02	98									0.02	2.2736
Subtotal												

Pervious Landuses Present:												
	Woodland		Pasture		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area	CN	Area	CN	Area	CN	Area (ha)	CN	Area	CN	Area	A*CN
SL							0.20	75			0.20	14.76
											0.00	0.00
Subtotal			0.00	0								

	Composite Area Calculations	Total Pervious Area	0.1968
		Total Impervious Area	0.0232
		% Impervious	10.5
		Composite Curve Number	77.4
		Total Area Check	0.22

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Runoff Coefficient								
				Silt Loam		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.0	0.0	0.42	0.00							0.00
Pasture	8	0.0	0.0	0.28	0.00							0.00
Wetland	16	0.0	0.0	0.05	0.00							0.00
Lawn	5	0.2	1.0	0.25	0.20							0.05
Cultivated	7	0.0	0.0	0.60	0.00							0.00
Impervious	2	0.0	0.0	0.95	0.02							0.02
Composite		0.2	4.7	Composite Runoff Coefficient								0.32

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
S1	20	0.4	2.00%	2.3	0.33	0.02	0.01	0.01	0.02	0.01	0.15	0.10

Appropriate calculated time to	0.10	Appropriate Method:	Airport

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.03.02
By: IC
Check: AS

D.A. NAME 201_UC2
D.A. AREA (ha) 0.22

Hydrologic Parameters: STANDHYD Command
Post-Development Drainage Area: Catchment 201_UC2

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	0.22
				0
				0
				0
Total Area Check				0.22

Impervious Landuses Present:												
	Roadway		Sidewalk		Walkway		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL	0.02	98			0.02	98					0.05	4.63
Subtotal Area	0.02	98			0.02	98						

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL							0.17	75			0.17	12.96
Subtotal Area							0.17	75				

	Pervious Area Calculations	Total Pervious Area	0.17
		Composite Pervious Curve Number	75
	Impervious Area Calculations	Total Directly Connected Area	0.22
		Total Indirectly Connected Area	0.05
		Total Impervious Area	0.05
		% X imp	21
		% T imp	21
		Total Area Check	0.22

Initial Abstraction and Hydraulics Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0.00	0.00
Meadow	8	0.00	0.00
Wetland	16	0.00	0.00
Lawn	5	0.17	0.86
Cultivated	7	0.00	0.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	2	10	0.25
Impervious	2.0	2	20	0.013

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.03.02
By: IC
Check: AS

D.A. NAME 202
D.A. AREA (ha) 1.70

Hydrologic Parameters: STANDHYD Command
Post-Development Drainage Area: Catchment 202

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	1.70
				0
				0
				0
Total Area Check				1.7

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway/Roof		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL					1.15	98					1.150	112.7
Subtotal Area					1.15							

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn/Walkways*		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL							0.55	75			0.550	41.25
Subtotal Area							0.55	75				

	Pervious Area Calculations	Total Pervious Area	0.550
		Composite Pervious Curve Number	75
	Impervious Area Calculations	Total Directly Connected Area	1.15
		Total Indirectly Connected Area	0.26
		Total Impervious Area	1.15
		% X imp	68
		% T imp	68
		Total Area Check	1.70

Initial Abstraction and Hydraulics Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0.00	0.00
Meadow	8	0.00	0.00
Wetland	16	0.00	0.00
Lawn/Walkw	5	0.550	2.75
Cultivated	7	0.00	0.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	2	10	0.25
Impervious	2.0	2	100	0.013

*All walkways are proposed as permeable pavers

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.03.02
By: IC
Check: AS

D.A. NAME 203
D.A. AREA (ha) 1.20

Hydrologic Parameters: STANDHYD Command
Post-Development Drainage Area: Catchment 203

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	1.20
				0
				0
				0
Total Area Check				1.2

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway/Roof		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL									0.54		0.540	0.0
Subtotal Area									0.54			

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL							0.660	75			0.660	49.50
Subtotal Area							0.66	75				

	Pervious Area Calculations	Total Pervious Area	0.660
		Composite Pervious Curve Number	75
	Impervious Area Calculations	Total Directly Connected Area	0.54
		Total Indirectly Connected Area	0.18
		Total Impervious Area	0.54
		% X imp	45
		% T imp	45
		Total Area Check	1.20

Initial Abstraction and Hydraulics Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0.00	0.00
Meadow	8	0.00	0.00
Wetland	16	0.00	0.00
Lawn	5	0.660	3.30
Cultivated	7	0.00	0.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	4	145	0.25
Impervious	2.0	2	89	0.013

CROZIER CONSULTING ENGINEERS

Project Name: 12 Henderson Ave.
Project Number: 1241-4515
Date: 2021.03.02
By: IC
Check: AS

D.A. NAME **202_S**
D.A. AREA (ha) **1.16**

Hydrologic Parameters: STANDHYD Command
Post-Development Drainage Area: Catchment 202_S

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic	% Area	Area
Silt Loam	SL	BC	100	1.16
				0
				0
				0
Total Area Check				1.16

Impervious Landuses Present:												
	Roadway		Sidewalk		Driveway/Roof		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL					0.47	98					0.470	46.1
Subtotal Area					0.47							

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn/Walkways*		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
SL							0.69	75			0.690	51.75
Subtotal Area							0.69	75				

	Pervious Area Calculations	Total Pervious Area	0.690
		Composite Pervious Curve Number	75
	Impervious Area Calculations	Total Directly Connected Area	0.47
		Total Indirectly Connected Area	0.17
		Total Impervious Area	0.47
		% X imp	41
		% T imp	41
		Total Area Check	1.16

Initial Abstraction and Hydraulics Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0.00	0.00
Meadow	8	0.00	0.00
Wetland	16	0.00	0.00
Lawn/Walkw	5	0.690	3.45
Cultivated	7	0.00	0.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	2	80	0.25
Impervious	2.0	2	100	0.013

*All walkways are proposed as permeable pavers

```
00001> ;    Metric units
00002> *a*****************************************************************
00003> *a  Project Name: [11 Henderson Ave.]    Project Number: (1259-0074)
00004> *a  Date       : 2021.06.11
00005> *a  Modeller   : [CF]
00006> *a  Company    : C.F. CROZIER & ASSOCIATES INC.
00007> *a  Id-Name #  : 1747012
00008> *a*****************************************************************
00009> *DIMS*              IDEF-[5,0],  NELVUT-[2],  NAUTOUT-[0],  NRUN-[0]
00010> **                   [ ] <enter> filename, (do not file) for MASTER file
00011>
00012> *a----------------| 25 yr EVENT ----------------------------------------|
00013> *a----------------| 25 yr EVENT ----------------------------------------|
00014> *CHICAGO STORM      IUNITF-[2],   TP-[24.0]hrs),  TPEAT-[0.333],  CSPCT-[10]<cls),
00015>                     ICASE=>[1],
00016>                      A-[111.9],   B-[0.695],  and C-[0.715],
00017> *a----------------| ---------------------------------------------------|
00018> *a----------------| ---------------------------------------------------|
00019> *RUNOFF STORM       ICASE=>[1],   NSMOFF-[0],  XFACT-[0.18],
00020> **                  ---------------------------------------------------|
00021>
00022> *a----------------| ---------------------------------------------------|
00023> *a----------------| CATCHMENT 201 [2] (uncontrolled flow to Shoard Ave.) ------|
00024> *a----------------| ---------------------------------------------------|
00025> CALIB NASHYD        ID-[1], NHYD-["201 UC"], DT-[5]min, AREA-[0.22]ha),
00026>                     LNF=[0](m/s),  CN/C-[77.4], IA-[4.7](mm),
00027>                     N-[3], TP-[0.10]hrs,
00028>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00029> *a----------------| ---------------------------------------------------|
00030>
00031> *a----------------| ---------------------------------------------------|
00032> *a----------------| CATCHMENT 201 [2] (uncontrolled flow to Shoard Av.) -----|
00033> *a----------------|-------------------(with no permeable pavers included)------|
00034> CALIB STANDHYD       ID-[5], NHYD-["201 UC2"], DT-[1](min), AREA-[0.22](ha),
00035>                     XIMP-[0.21], TIMP-[0.21], SNF-[0](-), Ia-[2],
00036>                     SCS curve number CN=[75],
00037>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00038>                                          Lp=[100](m), MSK-[0.25], SCF-[0](min),
00039>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00040>                                          L=I-[50](m), MNI-[0.013], SCI-[0](min),
00041>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00042> *a----------------| ---------------------------------------------------|
00043>
00044> *a----------------| ---------------------------------------------------|
00045> *a----------------| CATCHMENT 202 (Internal flow to SWM system) -------------|
00046> *a----------------| ---------------------------------------------------|
00047> CALIB STANDHYD       ID-[2], NHYD-["202"], DT-[1](min), AREA-[1.70]ha),
00048>                     XIMP-[0.68], TIMP-[0.68], SNF-[0](-), Ia-[2],
00049>                     SCS curve number CN=[75],
00050>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00051>                                          Lp=[100](m), MSK-[0.25], SCF-[0](min),
00052>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00053>                                          L=I-[105](m), MNI-[0.013], SCI-[0](min),
00054>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00055> *a----------------| ---------------------------------------------------|
00056>
00057> *a----------------| ---------------------------------------------------|
00058> *a----------------| CATCHMENT 203 (Dry Pond and Vegetated Area) -------------|
00059> *a----------------| ---------------------------------------------------|
00060> CALIB STANDHYD       ID-[3], NHYD-["203"], DT-[1](min), AREA-[1.20]ha),
00061>                     XIMP-[0.45], TIMP-[0.45], SNF-[0](-), Ia-[2],
00062>                     SCS curve number CN=[75],
00063>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00064>                                          L=P-[140](m), MSK-[0.25], SCF-[0](min),
00065>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[2.0](%),
00066>                                          L=I-[120](m), MNI-[0.013], SCI-[0](min),
00067>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00068> *a----------------| ---------------------------------------------------|
00069>
00070> *a----------------| ---------------------------------------------------|
00071> *a----------------| TOTAL FLOWS CONTRIBUTING TO SWM FACILITY ----------------|
00072> *a----------------| ---------------------------------------------------|
00073> ADD HYD             ID1=>[4], HNAM=["TO SWM"], ID2 to add-[1,3]
00074> *a----------------| ---------------------------------------------------|
00075>
00076>
00077> *a----------------| ---------------------------------------------------|
00078> *a----------------| 5-ROUTE RESERVOIR FOR CONTROL SYSTEM --------------------|
00079> *a----------------| ---------------------------------------------------|
00080> ROUTE RESERVOIR     ID-out-[1],   NHYD-["201_C"],  ID1s-[4],
00081>                     RES-[1](cms),
00082>                                TABLE OF ( OUTFLOW-STORAGE ) values
00083>                                          (cms) - (ha-m)
00084>                                        [ 0.0    ,  0.0    ]
00085>                                        [ 0.004  ,  0.049  ]
00086>                                        [ 0.045  ,  0.099  ]
00087>                                        [ 0.081  ,  0.152  ]
00088>                                        [ 0.778  ,  0.219  ]
00089>                                        [  -1    ,  -1     ]  (max twenty pts)
00090>                     ID-out-[3], NHYD-out-["POND_OUT"]
00091> *a----------------| ---------------------------------------------------|
00092>
00093> *a----------------| ---------------------------------------------------|
00094> *a----------------| 2-YEAR EVENT --------------------------------------------|
00095> *a----------------| ---------------------------------------------------|
00096> CHICAGO STORM      IUNITF-[2],   TP-[24.0]hrs),  TPEAT-[0.333],  CSPCT-[10]<cls),
00097>                     ICASE=>[1],
00098>                      A-[414.8],   B-[0.785],  and C-[0.715],
00099> *a----------------| ---------------------------------------------------|
00100> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) ------|
00101> *a----------------| ---------------------------------------------------|
00102> CALIB NASHYD        ID-[1], NHYD-["201 UC"], DT-[1]min, AREA-[0.22]ha),
00103>                     LNF=[0](m/s),  CN/C-[77.4], IA-[4.7](mm),
00104>                     N-[3], TP-[0.10]hrs,
00105>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00106> *a----------------| ---------------------------------------------------|
00107>
00108> *a----------------| ---------------------------------------------------|
00109> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) -----|
00110> *a----------------|-------------------(with no permeable pavers included)------|
00111> CALIB STANDHYD       ID-[5], NHYD-["201 UC2"], DT-[1](min), AREA-[0.22](ha),
00112>                     XIMP-[0.21], TIMP-[0.21], SNF-[0](-), Ia-[2],
00113>                     SCS curve number CN=[75],
00114>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00115>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00116>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00117>                                          L=I-[50](m), MNI-[0.013], SCI-[0](min),
00118>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00119> *a----------------| ---------------------------------------------------|
00120>
00121> *a----------------| ---------------------------------------------------|
00122> *a----------------| CATCHMENT 202 (Internal flow to SWM system) -------------|
00123> *a----------------| ---------------------------------------------------|
00124> CALIB STANDHYD       ID-[2], NHYD-["202"], DT-[1](min), AREA-[1.70](ha),
00125>                     XIMP-[0.68], TIMP-[0.68], SNF-[0](-), Ia-[2],
00126>                     SCS curve number CN=[75],
00127>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00128>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00129>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00130>                                          L=I-[100](m), MNI-[0.013], SCI-[0](min),
00131>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00132> *a----------------| ---------------------------------------------------|
00133>
00134> *a----------------| ---------------------------------------------------|
00135> *a----------------| CATCHMENT 203 (Dry Pond and Vegetated Area) -------------|
00136> *a----------------| ---------------------------------------------------|
00137> CALIB STANDHYD       ID-[3], NHYD-["203"], DT-[1](min), AREA-[1.20](ha),
00138>                     XIMP-[0.45], TIMP-[0.45], SNF-[0](-), Ia-[2],
00139>                     SCS curve number CN=[75],
00140>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00141>                                          L=P-[140](m), MSK-[0.25], SCF-[0](min),
00142>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00143>                                          L=I-[120](m), MNI-[0.013], SCI-[0](min),
00144>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00145> *a----------------| ---------------------------------------------------|
00146>
00147> *a----------------| ---------------------------------------------------|
00148> *a----------------| TOTAL FLOWS CONTRIBUTING TO SWM FACILITY ----------------|
00149> *a----------------| ---------------------------------------------------|
00150> ADD HYD             ID1=>[4], HNAM=["TO SWM"], ID2 to add-[1,3]
00151> *a----------------| ---------------------------------------------------|
00152>
00153>
00154> *a----------------| ---------------------------------------------------|
00155> *a----------------| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
00156> *a----------------| ---------------------------------------------------|
00157> ROUTE RESERVOIR     ID-out-[1],   NHYD-["201_C"],  ID1s-[4],
00158>                     RES-[1](cms),
00159>                                TABLE OF ( OUTFLOW-STORAGE ) values
00160>                                          (cms) - (ha-m)
00161>                                        [ 0.0    ,  0.0    ]
00162>                                        [ 0.004  ,  0.049  ]
00163>                                        [ 0.045  ,  0.099  ]
00164>                                        [ 0.081  ,  0.152  ]
00165>                                        [ 0.778  ,  0.219  ]
00166>                                        [  -1    ,  -1     ]  (max twenty pts)
00167>                     ID-out-[3], NHYD-out-["POND_OUT"]
00168> *a----------------| ---------------------------------------------------|
00169>
00170>
00171> *a----------------| ---------------------------------------------------|
00172> *a----------------| 5 YEAR EVENT --------------------------------------------|
00173> *a----------------| ---------------------------------------------------|
00174> CHICAGO STORM      IUNITF-[2],   TP-[24.0]hrs),  TPEAT-[0.333],  CSPCT-[10]<cls),
00175>                     ICASE=>[1],
00176>                      A-[171.9],   B-[0.695],  and C-[0.703],
00177> *a----------------| ---------------------------------------------------|
00178> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) ------|
00179> *a----------------| ---------------------------------------------------|
00180> CALIB NASHYD        ID-[1], NHYD-["201_UC"], DT-[1]min, AREA-[0.22]ha),
00181>                     LNF=[0](m/s),  CN/C-[77.4], IA-[4.7](mm),
00182>                     N-[3], TP-[0.10]hrs,
00183>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00184> *a----------------| ---------------------------------------------------|
00185>
00186> *a----------------| ---------------------------------------------------|
00187> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) -----|
00188> *a----------------|-------------------(with no permeable pavers included)------|
00189> CALIB STANDHYD       ID-[5], NHYD-["201_UC2"], DT-[1](min), AREA-[0.22](ha),
00190>                     XIMP-[0.21], TIMP-[0.21], SNF-[0](-), Ia-[2],
00191>                     SCS curve number CN=[75],
00192>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00193>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00194>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00195>                                          L=I-[50](m), MNI-[0.013], SCI-[0](min),
00196>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00197> *a----------------| ---------------------------------------------------|
00198>
00199> *a----------------| ---------------------------------------------------|
00200> *a----------------| CATCHMENT 202 (Internal flow to SWM system) -------------|
00201> *a----------------| ---------------------------------------------------|
00202> CALIB STANDHYD       ID-[2], NHYD-["202"], DT-[1](min), AREA-[1.70](ha),
00203>                     XIMP-[0.68], TIMP-[0.68], SNF-[0](-), Ia-[2],
00204>                     SCS curve number CN=[75],
00205>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00206>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00207>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00208>                                          L=I-[105](m), MNI-[0.013], SCI-[0](min),
00209>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00210> *a----------------| ---------------------------------------------------|
00211>
00212> *a----------------| ---------------------------------------------------|
00213> *a----------------| CATCHMENT 203 (Dry Pond and Vegetated Area) -------------|
00214> *a----------------| ---------------------------------------------------|
00215> CALIB STANDHYD       ID-[3], NHYD-["203"], DT-[1](min), AREA-[1.20](ha),
00216>                     XIMP-[0.45], TIMP-[0.45], SNF-[0](-), Ia-[2],
00217>                     SCS curve number CN=[75],
00218>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00219>                                          L=P-[135](m), MSK-[0.5], SCF-[0](min),
00220>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00221>                                          L=I-[85](m), MNI-[0.013], SCI-[0](min),
00222>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00223> *a----------------| ---------------------------------------------------|
00224>
00225> *a----------------| ---------------------------------------------------|
00226> *a----------------| TOTAL FLOWS CONTRIBUTING TO SWM FACILITY ----------------|
00227> *a----------------| ---------------------------------------------------|
00228> ADD HYD             ID1=>[4], HNAM=["TO SWM"], ID2 to add-[1,3]
00229> *a----------------| ---------------------------------------------------|
00230>
00231>
00232> *a----------------| ---------------------------------------------------|
00233> *a----------------| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
00234> *a----------------| ---------------------------------------------------|
00235> ROUTE RESERVOIR     ID-out-[1],   NHYD-["201_C"],  ID1s-[4],
00236>                     RES-[1](cms),
00237>                                TABLE OF ( OUTFLOW-STORAGE ) values
00238>                                          (cms) - (ha-m)
00239>                                        [ 0.0    ,  0.0    ]
00240>                                        [ 0.004  ,  0.049  ]
00241>                                        [ 0.045  ,  0.099  ]
00242>                                        [ 0.081  ,  0.152  ]
00243>                                        [ 0.778  ,  0.219  ]
00244>                                        [  -1    ,  -1     ]  (max twenty pts)
00245>                     ID-out-[3], NHYD-out-["POND_OUT"]
00246> *a----------------| ---------------------------------------------------|
00247>
00248>
00249> *a----------------| ---------------------------------------------------|
00250> *a----------------| 10 YEAR EVENT -------------------------------------------|
00251> *a----------------| ---------------------------------------------------|
00252> CHICAGO STORM      IUNITF-[2],   TP-[24.0]hrs),  TPEAT-[0.333],  CSPCT-[10]<cls),
00253>                     ICASE=>[1],
00254>                      A-[210],   B-[0.803],  and C-[0.697],
00255> *a----------------| ---------------------------------------------------|
00256> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) ------|
00257> *a----------------| ---------------------------------------------------|
00258> CALIB NASHYD        ID-[1], NHYD-["201_UC"], DT-[1]min, AREA-[0.22]ha),
00259>                     LNF=[0](m/s),  CN/C-[77.4], IA-[4.7](mm),
00260>                     N-[3], TP-[0.10]hrs,
00261>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00262> *a----------------| ---------------------------------------------------|
00263>
00264> *a----------------| ---------------------------------------------------|
00265> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) -----|
00266> *a----------------|-------------------(with no permeable pavers included)------|
00267> CALIB STANDHYD       ID-[5], NHYD-["201_UC2"], DT-[1](min), AREA-[0.22](ha),
00268>                     XIMP-[0.21], TIMP-[0.21], SNF-[0](-), Ia-[2],
00269>                     SCS curve number CN=[75],
00270>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00271>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00272>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00273>                                          L=I-[50](m), MNI-[0.013], SCI-[0](min),
00274>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00275> *a----------------| ---------------------------------------------------|
00276>
00277> *a----------------| ---------------------------------------------------|
00278> *a----------------| CATCHMENT 202 (Internal flow to SWM system) -------------|
00279> *a----------------| ---------------------------------------------------|
00280> CALIB STANDHYD       ID-[2], NHYD-["202"], DT-[1](min), AREA-[1.70](ha),
00281>                     XIMP-[0.68], TIMP-[0.68], SNF-[0](-), Ia-[2],
00282>                     SCS curve number CN=[75],
00283>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00284>                                          L=P-[100](m), MSK-[0.25], SCF-[0](min),
00285>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00286>                                          L=I-[105](m), MNI-[0.013], SCI-[0](min),
00287>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00288> *a----------------| ---------------------------------------------------|
00289>
00290> *a----------------| ---------------------------------------------------|
00291> *a----------------| CATCHMENT 203 (Dry Pond and Vegetated Area) -------------|
00292> *a----------------| ---------------------------------------------------|
00293> CALIB STANDHYD       ID-[3], NHYD-["203"], DT-[1](min), AREA-[1.20](ha),
00294>                     XIMP-[0.45], TIMP-[0.45], SNF-[0](-), Ia-[2],
00295>                     SCS curve number CN=[75],
00296>                     Pervious   Sub-area: IAper-[5.0](mm), SLPP-[2.0](%),
00297>                                          L=P-[135](m), MSK-[0.5], SCF-[0](min),
00298>                     Impervious Sub-area: IAimp-[1.0](mm), SLPI-[1.0](%),
00299>                                          L=I-[85](m), MNI-[0.013], SCI-[0](min),
00300>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00301> *a----------------| ---------------------------------------------------|
00302>
00303> *a----------------| ---------------------------------------------------|
00304> *a----------------| TOTAL FLOWS CONTRIBUTING TO SWM FACILITY ----------------|
00305> *a----------------| ---------------------------------------------------|
00306> ADD HYD             ID1=>[4], HNAM=["TO SWM"], ID2 to add-[1,3]
00307> *a----------------| ---------------------------------------------------|
00308>
00309>
00310> *a----------------| ---------------------------------------------------|
00311> *a----------------| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
00312> *a----------------| ---------------------------------------------------|
00313> ROUTE RESERVOIR     ID-out-[1],   NHYD-["201_C"],  ID1s-[4],
00314>                     RES-[1](cms),
00315>                                TABLE OF ( OUTFLOW-STORAGE ) values
00316>                                          (cms) - (ha-m)
00317>                                        [ 0.0    ,  0.0    ]
00318>                                        [ 0.004  ,  0.049  ]
00319>                                        [ 0.045  ,  0.099  ]
00320>                                        [ 0.081  ,  0.152  ]
00321>                                        [ 0.778  ,  0.219  ]
00322>                                        [  -1    ,  -1     ]  (max twenty pts)
00323>                     ID-out-[3], NHYD-out-["POND_OUT"]
00324> *a----------------| ---------------------------------------------------|
00325>
00326>
00327> *a----------------| ---------------------------------------------------|
00328> *a----------------| 25 YEAR EVENT -------------------------------------------|
00329> *a----------------| ---------------------------------------------------|
00330> CHICAGO STORM      IUNITF-[2],   TP-[24.0]hrs),  TPEAT-[0.333],  CSPCT-[10]<cls),
00331>                     ICASE=>[1],
00332>                      A-[211.1],   B-[0.695],  and C-[0.693],
00333> *a----------------| ---------------------------------------------------|
00334> *a----------------| CATCHMENT 201_UC2 (uncontrolled flow to Shoard Ave.) -----|
00335> *a----------------| ---------------------------------------------------|
00336> CALIB NASHYD        ID-[1], NHYD-["201_UC"], DT-[1]min, AREA-[0.22]ha),
00337>                     LNF=[0](m/s),  CN/C-[77.4], IA-[4.7](mm),
00338>                     N-[3], TP-[0.10]hrs,
00339>                     RAINFALL-[ ,  ,  ,  , ](mm/hr),  ENS=-1
00340> *a----------------| ---------------------------------------------------|
```

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*+----------------|-------------------------------------------------------+
*| CATCHMENT 201_U22 (uncontrolled flow to Jheard Ave.) -----|
*+----------------|-----------------(with no permeable pavers included)-----+
CALIB STANDHYD      ID=[5], NHYD=["201_U2C"], DT=[1](min), AREA=[0.12](ha),
                    XIMP=[0.21], TIMP=[0.21], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[120](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 202 (Internal flow to SWM system) -------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[2], NHYD=["202_"], DT=[1](min), AREA=[1.70](ha),
                    XIMP=[0.48], TIMP=[0.48], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[79],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[2.0](%),
                                         LGP=[110](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CALCULATE 203 (Hwy R/W and Vegetated Area) --------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[3], NHYD=["203"], DT=[1](min), AREA=[1.20](ha),
                    XIMP=[0.85], TIMP=[0.85], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[145](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[33](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| TOTAL FLOW CONTRIBUTING TO SWM FACILITY -----------------|
*+----------------|-------------------------------------------------------+
ADD HYD             ID_out=[4], NHYD=["TO_FAC"], IDs to add=[1,3]
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
*+----------------|-------------------------------------------------------+
ROUTE RESERVOIR     ID_out=[4],   NHYD=["SYS_CTL"], ID_in=[4],
                    RTI=[1](min),
                                 TABLE of ( OUTFLOW-STORAGE ) values
                                          (cms) - (ha-m)
                                        [ 0.0  ,   0.0   ]
                                        [ 0.024,   0.049 ]
                                        [ 0.044,   0.099 ]
                                        [ 0.091,   0.15  ]
                                        [ 0.778,   0.223 ]
                                        [   -1  ,   -1   ]  (max twenty pts)
                          ID_ovf=[3], NHYD_ovf=["END_OVF"]
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| 50 YEAR EVENT -------------------------------------------|
*+----------------|-------------------------------------------------------+
CHICAGO STORM       ID=[1], NHYD=["50_EVENT"], DT=[1](min), TDUR=[24.0](hrs),
                    IDIST=[2],  TPEAK=[0.333],  CDIST=[10](min),
                    ITYPE=[1],
                      A=[778.19],  B=[0.687],  and C=[0.699],
*+----------------|-------------------------------------------------------+
*| CATCHMENT 201_U2 (uncontrolled flow to Jheard Ave.) -----|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[5], NHYD=["201_U2C"], DT=[1](min), AREA=[0...](ha),
                    XIMP=[0.21], TIMP=[0.21], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[120](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 201_U22 (uncontrolled flow to Jheard Ave.) -----|
*+----------------|-----------------(with no permeable pavers included)-----+
CALIB STANDHYD      ID=[5], NHYD=["201_U2C"], DT=[1](min), AREA=[0.12](ha),
                    XIMP=[0.21], TIMP=[0.21], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[120](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 201 (Internal flow to SWM system) -------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[1], NHYD=["201_"], DT=[1](min), AREA=[1.70](ha),
                    XIMP=[0.48], TIMP=[0.48], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[79],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[2.0](%),
                                         LGP=[110](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 203 (Hwy R/W and Vegetated Area) --------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[3], NHYD=["203"], DT=[1](min), AREA=[1.20](ha),
                    XIMP=[0.85], TIMP=[0.85], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[145](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[33](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| TOTAL FLOW CONTRIBUTING TO SWM FACILITY -----------------|
*+----------------|-------------------------------------------------------+
ADD HYD             ID_out=[4], NHYD=["TO_FAC"], IDs to add=[1,3]
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
*+----------------|-------------------------------------------------------+
ROUTE RESERVOIR     ID_out=[4],   NHYD=["SYS_CTL"], ID_in=[4],
                    RTI=[1](min),
                                 TABLE of ( OUTFLOW-STORAGE ) values
                                          (cms) - (ha-m)
                                        [ 0.0  ,   0.0   ]
                                        [ 0.024,   0.049 ]
                                        [ 0.044,   0.099 ]
                                        [ 0.091,   0.15  ]
                                        [ 0.778,   0.223 ]
                                        [   -1  ,   -1   ]  (max twenty pts)
                          ID_ovf=[3], NHYD_ovf=["END_OVF"]
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| 100 YEAR EVENT ------------------------------------------|
*+----------------|-------------------------------------------------------+
CHICAGO STORM       ID=[2], NHYD=["100_EVENT"], DT=[1](min), TDUR=[24.0](hrs),
                    IDIST=[2],  TPEAK=[0.333],  CDIST=[10](min),
                    ITYPE=[1],
                      A=[954.94],  B=[0.688],  and C=[0.699],
*+----------------|-------------------------------------------------------+
*| CATCHMENT 201_U2 (uncontrolled flow to Jheard Ave.) -----|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[5], NHYD=["201_U2C"], DT=[1](min), AREA=[0.12](ha),
                    IMP=[0](%),  CN/C=[77.4], IA=[4.7](mm),
                    N=[3], ID=[0.10](hrs),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 201_U22 (uncontrolled flow to Jheard Ave.) -----|
*+----------------|-----------------(with no permeable pavers included)-----+
CALIB STANDHYD      ID=[5], NHYD=["201_U2C"], DT=[1](min), AREA=[0.12](ha),
                    XIMP=[0.21], TIMP=[0.21], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[120](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[120](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+

*+----------------|-------------------------------------------------------+
*| CATCHMENT 201 (Internal flow to SWM system) -------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[1], NHYD=["201_"], DT=[1](min), AREA=[1.70](ha),
                    XIMP=[0.48], TIMP=[0.48], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[79],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[2.0](%),
                                         LGP=[110](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[100](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| CALCULATE 204 (Hwy R/W and Vegetated Area) --------------|
*+----------------|-------------------------------------------------------+
CALIB STANDHYD      ID=[3], NHYD=["204"], DT=[1](min), AREA=[1.20](ha),
                    XIMP=[0.85], TIMP=[0.85], SNP=[0](mm), LGSP=[2],
                    SCS curve number CN=[75],
                    Pervious   surfaces: IAper=[5.0](mm), SLPP=[1.0](%),
                                         LGP=[145](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[33](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr),  ENS=-1
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| TOTAL FLOW CONTRIBUTING TO SWM FACILITY -----------------|
*+----------------|-------------------------------------------------------+
ADD HYD             ID_out=[4], NHYD=["TO_FAC"], IDs to add=[1,3]
*+----------------|-------------------------------------------------------+


*+----------------|-------------------------------------------------------+
*| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------------|
*+----------------|-------------------------------------------------------+
ROUTE RESERVOIR     ID_out=[4],   NHYD=["SYS_CTL"], ID_in=[4],
                    RTI=[1](min),
                                 TABLE of ( OUTFLOW-STORAGE ) values
                                          (cms) - (ha-m)
                                        [ 0.0  ,   0.0   ]
                                        [ 0.024,   0.049 ]
                                        [ 0.044,   0.099 ]
                                        [ 0.091,   0.15  ]
                                        [ 0.778,   0.223 ]
                                        [   -1  ,   -1   ]  (max twenty pts)
                          ID_ovf=[3], NHYD_ovf=["END_OVF"]
*+----------------|-------------------------------------------------------+


FINISH
```

```
                    MAXIMUM STORAGE  USED        (ha.m.)=.XXXXE-01

 ------------------------------------------------------------------------------
 R0001c000010----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| 5-HOUR EVENT ----------------------------------------------------|
 *+----------------+

 | CHICAGO STORM |     IDF curve parameters: A= 414.810
 | Storm= 50.00 mm |                        B=   .000
                                             C=   .715
                       Rainfall Intensity = A / (t + B)^C

                       Duration of storm  = 24.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  .33

     TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN
     hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr
     0:10    .684  4:10   1.109  8:10  16.042  12:10   1.760  16:10   1.053  20:10    .793
     0:20    .674  4:20   1.135  8:20   9.971  12:20   1.691  16:20   1.039  20:20    .769
     0:30    .664  4:30   1.254  8:30   7.514  12:30   1.629  16:30   1.026  20:30    .747
     0:40    .654  4:40   1.527  8:40   6.214  12:40   1.569  16:40   1.013  20:40    .726
     0:50    .707  4:50   1.731  8:50   5.393  12:50   1.513  16:50    .999  20:50    .707
     1:00    .719  5:00   1.541  9:00   4.800  13:00   1.459  17:00    .953  21:00    .689
     1:10    .731  5:10   1.390  9:10   4.343  13:10   1.353  17:10    .870  21:10    .719
     1:20    .743  5:20   1.241  9:20   3.964  13:20   1.427  17:20    .899  21:20    .742
     1:30    .755  5:30   1.110  9:30   3.659  13:30   1.344  17:30    .916  21:30    .726
     1:40    .771  5:40   1.059  9:40   3.341  13:40   1.356  17:40    .934  21:40    .729
     1:50    .788  5:50   1.075  9:50   3.043  13:50   1.339  17:50    .903  21:50    .723
     2:00    .804  6:00   1.774 10:00   2.881  14:00   1.312  18:00    .911  22:00    .717
     2:10    .820  6:10   1.491 10:10   2.704  14:10   1.287  18:10    .901  22:10    .711
     2:20    .837  6:20   1.062 10:20   2.566  14:20   1.262  18:20    .890  22:20    .705
     2:30    .855  6:30   1.189 10:30   2.443  14:30   1.239  18:30    .880  22:30    .699
     2:40    .874  6:40   1.360 10:40   2.334  14:40   1.217  18:40    .870  22:40    .694
     2:50    .893  6:50   1.451 10:50   2.236  14:50   1.196  18:50    .861  22:50    .688
     3:00    .916  7:00   2.914 11:00   2.147  15:00   1.175  19:00    .852  23:00    .683
     3:10    .939  7:10   3.270 11:10   2.065  15:10   1.156  19:10    .843  23:10    .677
     3:20    .963  7:20   3.991 11:20   1.991  15:20   1.137  19:20    .834  23:20    .672
     3:30   1.028  7:30   4.971 11:30   1.924  15:30   1.119  19:30    .826  23:30    .667
     3:40   1.015  7:40   8.853 11:40   1.862  15:40   1.101  19:40    .817  23:40    .662
     3:50   1.048  7:50  10.010 11:50   1.804  15:50   1.084  19:50    .809  23:50    .657
     4:00   1.078  8:00  34.473 12:00   1.750  16:00   1.069  20:00    .800  24:00    .652

 ------------------------------------------------------------------------------
 R0001c000011----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 101_100 (uncontrolled flow to Should Ave) ------------|
 *+----------------+

 | CALIB STANDHYD  |     Area   (ha)=    .220   Curve Number   (NM)= 77.90
 | U01c01_UC  DT= 1.00 |  Ia    (mm)=   4.700   * of Direct Rain(%)=  3.00
                         U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=    .014

     PEAK FLOW     (cms)=    .001 (i)
     TIME TO PEAK  (hrs)=   8.000
     DURATION      (hrs)=  24.750, (#####Abnormal=   1100:41
     AVERAGE FLOW  (cms)=    .000
     RUNOFF VOLUME   (m)=  20.14
     TOTAL RAINFALL  (m)=  54.900
     RUNOFF COEFFICIENT  =    .367

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

 ------------------------------------------------------------------------------
 R0001c000012----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 101_102 (uncontrolled flow to Should Ave) ------------|
 *+----------------+-------------------------------------------------+
 *|                with no permeable gaveis in this sub-basin ------|
 *+----------------+

 | CALIB STANDHYD  |     Area   (ha)=    .220
 | U01c01_UC  DT= 1.00 |  Total Imp(%)=  85.00   Dir. Conn.(%)=  21.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     .187        .033
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     1.00        2.00
     Length          (m)=    20.00       10.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47       20.94
                    over (min)=  5.00        5.00
     Storage Coeff.  (min)=    .17 (ii)    7.72 (ii)
     Unit Hyd. Tpeak (min)=   5.00        5.00
     Unit Hyd. peak  (cms)=    .19         .03                *TOTALS*
     PEAK FLOW       (cms)=    .03         .00          .033 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.00         8.000
     RUNOFF VOLUME     (m)=  187.33       18.82       206.151
     TOTAL RAINFALL    (m)=  194.70       54.90       249.600
     RUNOFF COEFFICIENT  =     .96         .34          .826

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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.

 ------------------------------------------------------------------------------
 R0001c000013----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *|                |-------------------------------------------------|
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 102 (Internal flow to SWM system) --------------------|
 *+----------------+-------------------------------------------------+

 | CALIB STANDHYD  |     Area   (ha)=   1.70
 | U01c02_        DT= 1.00 |  Total Imp(%)=  68.00   Dir. Conn.(%)=  48.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=    1.16         .54
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     2.00        2.00
     Length          (m)=   100.00       10.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47       20.94
                    over (min)=  5.00        5.00
     Storage Coeff.  (min)=    .17 (ii)    7.72 (ii)
     Unit Hyd. Tpeak (min)=   5.00        5.00
     Unit Hyd. peak  (cms)=    .91         .15                *TOTALS*
     PEAK FLOW       (cms)=    .15         .02          .169 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.08         8.000
     RUNOFF VOLUME     (m)=  920.33      169.51      1089.838
     TOTAL RAINFALL    (m)=  941.33      941.33      941.330
     RUNOFF COEFFICIENT  =     .98         .54          .818

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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.

 ------------------------------------------------------------------------------
 R0001c000014----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 201 (Dry Pond and Vegetated Area) --------------------|
 *+----------------+-------------------------------------------------+

 | CALIB STANDHYD  |     Area   (ha)=   1.20
 | U01c03_        DT= 1.00 |  Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     .54         .66
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     1.00        2.00
     Length          (m)=   99.00       145.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47        8.53
                    over (min)=  5.00       47.00
     Storage Coeff.  (min)=    .12 (ii)   43.61 (ii)
     Unit Hyd. Tpeak (min)=   5.00       43.00
     Unit Hyd. peak  (cms)=    .54         .03                *TOTALS*
     PEAK FLOW       (cms)=    .12         .01          .120 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.58         8.000
     RUNOFF VOLUME     (m)=  520.93       19.52       540.454
     TOTAL RAINFALL    (m)=  549.00       549.0       549.000
     RUNOFF COEFFICIENT  =     .95         .04          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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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```

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 R0001c000015----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *|                |-------------------------------------------------|
 *+----------------+-------------------------------------------------+
 *| TOTAL FLOWS CONSIDERING TO SWM FACILITY ------------------------|
 *+----------------+-------------------------------------------------+

 | ADD HYD         |
 | 04+05_END       |  IDs=IDs            AREA    QPEAK    TPEAK      R.V.     TMP
 +-----------------+                      (ha)    (cms)    (hrs)      (mm)    (cms)
                     ID 1 U01c01_        1.700     .169    8.000    41.913     .000
                     +ID 2 U01c02_       1.200     .120    8.000    94.000     .000
                     =================================================================
                     SUM  04+05_END      2.900     .289    8.000    63.045     .000

     NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 R0001c000016----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| ROUTE RESERVOIR ------------------------------------------------|
 *+----------------+-------------------------------------------------+

 | ROUTE RESERVOIR -> |    Requested routing time step =  1.0 min.
 | IN 04+05_END       |
 | ---> U01c02_C      |  ----------------------- OUTFLOW STORAGE TABLE -----------------------
                          (cms)  (ha.m.)   (cms)  (ha.m.)   (cms)  (ha.m.)   (cms)  (ha.m.)
                          .000  .000E+00   .045  .290E-01   .091  .152E-00   .136  .313E-00
                          .023  .145E-01   .068  .221E-00   .113  .235E-00   .000  .000E+00

     ROUTING RESULTS              AREA    QPEAK    TPEAK      R.V.
     ---------------              (ha)    (cms)    (hrs)      (mm)
     INFLOW : 04+05_END          2.900     .289    8.000    63.045
     OUTFLOW : U01c02_C          2.900     .017   10.667    44.464
     OVERFLOW : U01c02_OV        2.900     .000     .000     .000

                 TOTAL NUMBER OF SUBSEQUENT OVERFLOWS :      0
                 CUMULATIVE TIME OF OVERFLOW (hours) =     .00
                 PERCENTAGE OF TIME OVERFLOWING  (%) =     .00

                 PEAK  FLOW  REDUCTION [Qout/Qin](%)=   5.971
                 TIME SHIFT OF PEAK FLOW       (min)=  154.00
                 MAXIMUM STORAGE  USED        (ha.m.)=.XXXXE-01

 ------------------------------------------------------------------------------
 R0001c000017----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| 5 YEAR EVENT ----------------------------------------------------|
 *+----------------+

 | CHICAGO STORM   |     IDF curve parameters: A= 982.543
 | Storm= 76.98 mm |                        B=   .089
                                             C=   .783

                       Rainfall Intensity = A / (t + B)^C

                       Duration of storm  = 24.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  .33

     TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN  TIME    RAIN
     hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr  hours   mm/hr
     0:10    .968  4:10   1.005  8:10  21.004  12:10   2.442  16:10   1.535  20:10   1.152
     0:20    .953  4:20   1.050  8:20  13.910  12:20   2.377  16:20   1.504  20:20   1.142
     0:30    .939  4:30   1.710  8:30  10.969  12:30   2.315  16:30   1.475  20:30   1.132
     0:40   1.015  4:40   1.772  8:40   9.289  12:40   2.257  16:40   1.447  20:40   1.123
     0:50   1.091  4:50   1.839  8:50   7.969  12:50   2.202  16:50   1.419  20:50   1.113
     1:00   1.074  5:00   1.910  8:50   6.951  13:00   2.150  17:00   1.393  21:00   1.104
     1:10   1.066  5:10   1.989  9:10   6.919  13:10   2.102  17:10   1.367  21:10   1.095
     1:20   1.085  5:20   2.076  9:20   5.997  13:20   2.056  17:20   1.343  21:20   1.086
     1:30   1.105  5:30   2.171  9:30   5.971  13:30   2.012  17:30   1.319  21:30   1.077
     1:40   1.125  5:40   2.283  9:40   5.624  13:40   1.970  17:40   1.296  21:40   1.069
     1:50   1.147  5:50   2.407  9:50   5.328  13:50   1.931  17:50   1.273  21:50   1.061
     2:00   1.169  6:00   2.549 10:00   5.075  14:00   1.893  18:00   1.252  22:00   1.045
     2:10   1.193  6:10   2.712 10:10   5.454  14:10   1.857  18:10   1.708  22:10   1.024
     2:20   1.217  6:20   2.904 10:20   3.669  14:20   1.823  18:20   1.295  22:20   1.014
     2:30   1.243  6:30   3.132 10:30   3.389  14:30   1.790  18:30   1.273  22:30   1.004
     2:40   1.270  6:40   3.404 10:40   3.335  14:40   1.758  18:40   1.252  22:40   1.001
     2:50   1.299  6:50   3.753 10:50   3.147  14:50   1.728  18:50   1.231  22:50   1.004
     3:00   1.333  7:00   4.197 11:00   2.977  15:00   1.699  19:00   1.216  23:00   .999
     3:10   1.362  7:10   4.765 11:10   2.969  15:10   1.671  19:10   1.225  23:10   .994
     3:20   1.392  7:20   5.521 11:20   2.655  15:20   1.645  19:20   1.212  23:20   .989
     3:30   1.433  7:30   7.014 11:30   2.759  15:30   1.619  19:30   1.199  23:30   .983
     3:40   1.471  7:40   9.021 11:40   2.671  15:40   1.593  19:40   1.186  23:40   .978
     3:50   1.513  7:50  14.014 11:50   2.589  15:50   1.570  19:50   1.174  23:50   .973
     4:00   1.557  8:00 101.902 12:00   2.511  16:00   1.547  20:00   1.162  24:00   .968

 ------------------------------------------------------------------------------
 R0001c000018----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 101_UC (uncontrolled flow to Should Ave) -------------|
 *+----------------+-------------------------------------------------+

 | CALIB STANDHYD  |     Area   (ha)=    .220   Curve Number   (NM)= 77.90
 | U01c01_UC  DT= 1.00 |  Ia    (mm)=   4.700   * of Direct Rain(%)=  3.00
                         U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=    .044

     PEAK FLOW     (cms)=    .021 (i)
     TIME TO PEAK  (hrs)=   8.000
     DURATION      (hrs)=  24.733, (#####Abnormal=   1100:44
     AVERAGE FLOW  (cms)=    .001
     RUNOFF VOLUME   (m)=  35.055
     TOTAL RAINFALL  (m)=  76.954
     RUNOFF COEFFICIENT  =    .469

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

 ------------------------------------------------------------------------------
 R0001c000019----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *|                |-------------------------------------------------|
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 101_UC2 (uncontrolled flow to Should Ave) -------------|
 *+----------------+-------------------------------------------------+
 *|                with no permeable gaveis in this sub-basin ------|
 *+----------------+

 | CALIB STANDHYD  |     Area   (ha)=    .22
 | U01c01_UC2      DT= 1.00 |  Total Imp(%)=  21.00   Dir. Conn.(%)=  21.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     .05         .17
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     1.00        2.00
     Length          (m)=    20.00       10.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47       16.34
                    over (min)=  5.00        5.00
     Storage Coeff.  (min)=    .17 (ii)    8.93 (ii)
     Unit Hyd. Tpeak (min)=   5.00        5.00
     Unit Hyd. peak  (cms)=    .19         .02                *TOTALS*
     PEAK FLOW       (cms)=    .01         .01          .018 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.00         8.000
     RUNOFF VOLUME     (m)=   36.91       16.82        53.730
     TOTAL RAINFALL    (m)=   54.90       54.90        54.900
     RUNOFF COEFFICIENT  =     .67         .31          .979

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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.

 ------------------------------------------------------------------------------
 R0001c000020----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *|                |-------------------------------------------------|
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 102 (Internal flow to SWM system) --------------------|
 *+----------------+-------------------------------------------------+

 | CALIB STANDHYD  |     Area   (ha)=   1.70
 | U01c02_        DT= 1.00 |  Total Imp(%)=  68.00   Dir. Conn.(%)=  48.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=    1.16         .54
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     2.00        2.00
     Length          (m)=   100.00       10.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47       16.34
                    over (min)=  5.00        5.00
     Storage Coeff.  (min)=    .17 (ii)    8.93 (ii)
     Unit Hyd. Tpeak (min)=   5.00        5.00
     Unit Hyd. peak  (cms)=    .91         .12                *TOTALS*
     PEAK FLOW       (cms)=    .15         .01          .161 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.00         8.000
     RUNOFF VOLUME     (m)=  920.33      168.82      1089.151
     TOTAL RAINFALL    (m)=  941.33      941.33      941.330
     RUNOFF COEFFICIENT  =     .98         .54          .818

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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.

 ------------------------------------------------------------------------------
 R0001c000021----------------------------------------------------------------
 *+----------------+-------------------------------------------------+
 *|                |-------------------------------------------------|
 *+----------------+-------------------------------------------------+
 *| CATCHMENT 201 (Internal flow to SWM system) --------------------|
 *+----------------+-------------------------------------------------+

 | CALIB STANDHYD  |     Area   (ha)=   1.20
 | U01c03_        DT= 1.00 |  Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=     .54         .66
     Dep. Storage    (mm)=    2.00        5.00
     Average Slope   (%)=     1.00        2.00
     Length          (m)=   99.00       145.00
     Mannings n      =        .013        .250

     Max.eff.Inten.(mm/hr)=   79.47        8.53
                    over (min)=  5.00       47.00
     Storage Coeff.  (min)=    .12 (ii)   43.61 (ii)
     Unit Hyd. Tpeak (min)=   5.00       43.00
     Unit Hyd. peak  (cms)=    .54         .03                *TOTALS*
     PEAK FLOW       (cms)=    .12         .01          .120 (iii)
     TIME TO PEAK    (hrs)=   8.00        8.58         8.000
     RUNOFF VOLUME     (m)=  520.93       19.52       540.454
     TOTAL RAINFALL    (m)=  549.00       549.0       549.000
     RUNOFF COEFFICIENT  =     .95         .04          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* = 75.0   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.
```

```
      TOTAL RAINFALL   (in)=     76.95        74.95        74.954
      RUNOFF COEFFICIENT  =      .97          .13          .803

        (i) CN IS COMPUTED DIRECTLY FROM SOIL/COVER INDEXES.
            CN* = 75.0    Ia = Imp. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

*****************************************************************************
R2001c0001i---------------------------------------------------------------------
*4+----------------| CATCHMENT 103 (Hay Road and Vegetated Area) ----------------|
*4+----------------|-------------------------------------------------------------|

 | CALIB STANDHYD          |   Area    (ha)=    1.20
 | 01c103       DT= 1.00 |   Total Imp(%)=   45.00   Dir. Conn.(%)=   45.00
                           ------------------------
                                 IMPERVIOUS     PERVIOUS (i)
      Surface Area     (ha)=        .54          .66
      Dep. Storage     (mm)=       1.00         5.00
      Average Slope    (%)=       2.00         2.00
      Length           (m)=      53.00       145.00
      Mannings n       =          .013         .250

      Max.eff.Inten.(mm/hr)=     106.90        19.54
            over (min)          1.00         3.00
      Storage Coeff.  (min)=    1.50 (ii)    31.49 (ii)
      Unit Hyd. Tpeak (min)=     1.00         3.00
      Unit Hyd. peak  (cms)=      .58          .04
                                                      *TOTALS*
      PEAK FLOW       (cms)=      .16          .01          .161 (iii)
      TIME TO PEAK    (hrs)=     8.00         8.50         8.000
      RUNOFF VOLUME   (mm)=     74.95        32.06        51.910
      TOTAL RAINFALL  (mm)=     76.95        76.95        76.954
      RUNOFF COEFFICIENT  =      .97          .41          .675

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* = 75.0    Ia = Imp. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

*****************************************************************************
R2001c0002i---------------------------------------------------------------------
*4+----------------| TOTAL FLOWS CONTRIBUTING TO ARM FACILITY ----------------|
*4+----------------|-------------------------------------------------------------|

 | ADD HYD         |
 | 04+05 END       |   IDs=NHD          AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------                      (ha)     (cms)    (hrs)      (mm)    (cms)
                          ID 1 01c101     1.700     .374    8.000    51.849     .000
                         +ID 2 03c103     1.200     .161    8.000    51.910     .000
                          ================================================================
                          SUM  04+05 END  2.900     .527    8.000    51.869     .000

      NOTE: PEAK FLOWS do NOT INCLUDE BASEFLOWS IF ANY.

*****************************************************************************
R2001c0003i---------------------------------------------------------------------
*4+----------------| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------|
*4+----------------|-------------------------------------------------------------|

 | ROUTE RESERVOIR -> |   Requested routing time step =  1.0 min.
 | IN=04+05 END       |
 | OUT=01c102 C       | ------------------------ OUTLFOW STORAGE TABLE ------------------------
 ---------------------- OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE
                          (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)
                          .000  .0000E+00    .048  .4920E-01    .581  .1510E+00    .774  .2230E+00
                          .014  .4920E-01    .091  .1070E+00    .774  .1230E+00    .000  .0000E+00

      ROUTING RESULTS              AREA     QPEAK    TPEAK      R.V.
      ---------------              (ha)     (cms)    (hrs)      (mm)
      INFLOW = 04+05 END          2.900     .527    8.000    51.869
      OUTFLOW = 01c102_C          2.900     .024    9.667    50.957
      OVERFLOW = 03SEND_CV        .000      .000     .000     .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS =      0
                    CUMULATIVE TIME OF OVERFLOW (hours) =     .00
                    PERCENTAGE OF TIME OVERFLOWING      (%)=   .00

                    PEAK  FLOW  REDUCTION [Qout/Qin](%)=    4.13
                    TIME SHIFT OF PEAK FLOW            (min)=  100.00
                    MAXIMUM  STORAGE  USED             (ha.m.)=.8308E-01

*****************************************************************************
R2001c0004i---------------------------------------------------------------------
*4+----------------| 10 YEAR EVENT ----------------|
*4+----------------|-------------------------------|

 | CHICAGO STORM          |   IDF curve parameters: A= 810.000
 | Ptotal= 61.07 mm       |                         B=   .000
                          |                         C=   .807

                                 t=(i*100/a)^(1/n) - B / (1 + B) C

                          Duration of storm   = 24.00 hrs
                          Storm time step     = 10.00 min
                          Time to peak ratio  =   .33

      TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN
      hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr
      0:10   1.191  4:10   1.550  8:10  16.383  12:10   2.995  16:10   1.454  20:10   1.105
      0:20   1.009  4:20   1.012  8:20  14.545  12:20   2.179  16:20   1.441  20:20   1.101
      0:30   1.014  4:30   1.079  8:30  12.899  12:30   2.016  16:30   1.403  20:30   1.079
      0:40   1.038  4:40   1.151  8:40  10.199  12:40   1.735  16:40   1.379  20:40   1.067
      0:50   1.058  4:50   1.231  8:50   8.947  12:50   1.668  16:50   1.350  20:50   1.051
      1:00   1.079  5:00   1.317  9:00   7.961  13:00   1.607  17:00   1.334  21:00   1.041
      1:10   1.100  5:10   1.413  9:10   7.111  13:10   1.543  17:10   1.312  21:10   1.030
      1:20   1.123  5:20   1.513  9:20   6.391  13:20   1.493  17:20   1.290  21:20   1.019
      1:30   1.147  5:30   1.635  9:30   5.787  13:30   1.440  17:30   1.269  21:30   1.007
      1:40   1.171  5:40   1.767  9:40   5.280  13:40   1.395  17:40   1.248  21:40   1.296
      1:50   1.197  5:50   1.915  9:50   5.158  13:50   1.341  17:50   1.230  21:50   1.285
      2:00   1.224  6:00   2.045  10:00  4.913  14:00   1.97   18:00   1.211  22:00   1.275
      2:10   1.253  6:10   2.211  10:10  4.649  14:10   1.254  18:10   1.192  22:10   1.264
      2:20   1.283  6:20   2.411  10:20  4.417  14:20   1.212  18:20   1.175  22:20   1.254
      2:30   1.315  6:30   2.734  10:30  4.211  14:30   1.173  18:30   1.157  22:30   1.244
      2:40   1.347  6:40   3.114  10:40  4.025  14:40   1.135  18:40   1.140  22:40   1.234
      2:50   1.382  6:50   3.675  10:50  3.855  14:50   1.099  18:50   1.124  22:50   1.224
      3:00   1.419  7:00   5.059  11:00  3.713  15:00   1.061  19:00   1.108  23:00   1.215
      3:10   1.458  7:10   5.773  11:10  3.577  15:10   1.030  19:10   1.093  23:10   1.206
      3:20   1.500  7:20   9.757  11:20  3.452  15:20   1.000  19:20   1.079  23:20   1.197
      3:30   1.741  7:30   8.317  11:30  3.328  15:30   0.967  19:30   1.065  23:30   1.188
      3:40   1.790  7:40  11.611  11:40  3.231  15:40   0.938  19:40   1.047  23:40   1.179
      3:50   1.840  7:50  21.476  11:50  3.134  15:50   0.909  19:50   1.034  23:50   1.170
      4:00   1.893  8:00 121.794  12:00  3.039  16:00   0.881  20:00   1.019  24:00   1.162

*****************************************************************************
R2001c0005i---------------------------------------------------------------------
*4+----------------| CATCHMENT 201_UC (uncontrolled flow to Sheard Ave.) ------|
*4+----------------|-------------------------------------------------------------|

 | CALIB NASHHYD           |   Area    (ha)=    .210  Curve Number  (CN)= 75.40
 | 01c201_UC    DT= 1.00 |   Ia      (mm)=   4.700   # of Linear Res.(N)=  3.00
 ========================  U.H. Tp(hrs)=    .100

      Unit Hyd Qpeak  (cms)=    .084

      PEAK FLOW       (cms)=    .019 (i)
      TIME TO PEAK    (hrs)=   8.033
      DURATION        (hrs)=  24.333, Time step(hrs)=  1.000(ii)
      AVERAGE FLOW    (cms)=    .001
      RUNOFF VOLUME   (mm)=   47.259
      TOTAL RAINFALL  (mm)=   61.074
      RUNOFF COEFFICIENT  =     .773

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

*****************************************************************************
R2001c0006i---------------------------------------------------------------------
*4+----------------| CATCHMENT 201_UC2 (uncontrolled flow to Sheard Ave.) ------|
*4+----------------|-------------------------------------------------------------|
*4+----------------|-------------(with no permeable paved in this sub)------------|

 | CALIB STANDHYD          |   Area    (ha)=    .22
 | 05c101_UC2   DT= 1.00 |   Total Imp(%)=  21.00   Dir. Conn.(%)=  21.00
                           ------------------------
                                 IMPERVIOUS     PERVIOUS (i)
      Surface Area     (ha)=        .05          .17
      Dep. Storage     (mm)=       2.00         5.00
      Average Slope    (%)=       2.00         2.00
      Length           (m)=      20.00        10.00
      Mannings n       =          .013         .250

      Max.eff.Inten.(mm/hr)=    111.79        27.85
            over (min)          1.00         7.00
      Storage Coeff.  (min)=    1.79 (ii)    27.35 (ii)
      Unit Hyd. Tpeak (min)=     1.00         7.00
      Unit Hyd. peak  (cms)=      .60          .04
                                                      *TOTALS*
      PEAK FLOW       (cms)=      .03          .00          .031 (iii)
      TIME TO PEAK    (hrs)=     8.00         8.10         8.000
      RUNOFF VOLUME   (mm)=     74.95        41.15        51.915
      TOTAL RAINFALL  (mm)=     76.95        76.95        76.954
      RUNOFF COEFFICIENT  =      .98          .54          .675

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* = 75.0    Ia = Imp. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

*****************************************************************************
R2001c0007i---------------------------------------------------------------------
*4+----------------| TOTAL FLOWS CONTRIBUTING TO ARM FACILITY ----------------|
*4+----------------|-------------------------------------------------------------|

 | ADD HYD         |
 | 04+05 END       |   IDs=NHD          AREA     QPEAK    TPEAK      R.V.     DWF
 ------------------                      (ha)     (cms)    (hrs)      (mm)    (cms)
                          ID 1 01c102     2.900     .527    8.000    51.869     .000
                         +ID 2 05c101     .220      .031    8.000    51.915     .000
                          ================================================================
                          SUM  04+05 END  3.120     .558    8.000    51.873     .000

      NOTE: PEAK FLOWS do NOT INCLUDE BASEFLOWS IF ANY.

*****************************************************************************
R2001c0008i---------------------------------------------------------------------
*4+----------------| ROUTE RESERVOIR FOR CONTROL SYSTEM ----------------|
*4+----------------|-------------------------------------------------------------|

 | ROUTE RESERVOIR -> |   Requested routing time step =  1.0 min.
 | IN=04+05 END       |
 | OUT=01c102_C       | ------------------------ OUTLFOW STORAGE TABLE ------------------------
 ---------------------- OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE
                          (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)
                          .000  .0000E+00    .048  .4920E-01    .581  .1510E+00    .774  .2230E+00
                          .014  .4920E-01    .091  .1070E+00    .774  .1230E+00    .000  .0000E+00

      ROUTING RESULTS              AREA     QPEAK    TPEAK      R.V.
      ---------------              (ha)     (cms)    (hrs)      (mm)
      INFLOW = 04+05 END          3.120     .558    8.000    51.873
      OUTFLOW = 01c102_C          3.120     .024    9.333    51.001
      OVERFLOW = 03SEND_CV        .000      .000     .000     .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS =      0
                    CUMULATIVE TIME OF OVERFLOW (hours) =     .00
                    PERCENTAGE OF TIME OVERFLOWING      (%)=   .00

                    PEAK  FLOW  REDUCTION [Qout/Qin](%)=    4.30
                    TIME SHIFT OF PEAK FLOW            (min)=   80.00
                    MAXIMUM  STORAGE  USED             (ha.m.)=.9931E-01

*****************************************************************************
R2001c0009i---------------------------------------------------------------------
*4+----------------| 25 YEAR EVENT ----------------|
*4+----------------|-------------------------------|

 | CHICAGO STORM          |   IDF curve parameters: A= 934.300
 | Ptotal=109.93 mm       |                         B=   .091
                          |                         C=   .843

                                 t=(i*100/a)^(1/n) - B / (1 + B) C

                          Duration of storm   = 24.00 hrs
                          Storm time step     = 10.00 min
                          Time to peak ratio  =   .33

      TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN
      hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr  hh:mm  mm/hr
      0:10   1.137  4:10   1.769  8:10  31.821  12:10   3.579  16:10   1.715  20:10   1.304
      0:20   1.459  4:20   2.110  8:20  19.467  12:20   3.193  16:20   1.688  20:20   1.292
      0:30   1.484  4:30   2.511  8:30  15.146  12:30   2.894  16:30   1.658  20:30   1.276
      0:40   1.509  4:40   3.021  8:40  12.792  12:40   2.661  16:40   1.629  20:40   1.261
      0:50   1.523  4:50   3.701  8:50  10.756  12:50   2.451  16:50   1.601  20:50   1.244
      1:00   1.555  5:00   4.708  9:00   9.506  13:00   2.286  17:00   1.581  21:00   1.232
      1:10   1.591  5:10   6.252  9:10   8.541  13:10   2.148  17:10   1.557  21:10   1.217
      1:20   1.628  5:20   8.914  9:20   7.818  13:20   2.014  17:20   1.534  21:20   1.203
      1:30   1.667  5:30   9.191  9:30   7.214  13:30   1.955  17:30   1.526  21:30   1.199
      1:40   1.707  5:40   9.348  9:40   6.713  13:40   1.895  17:40   1.506  21:40   1.186
      1:50   1.748  5:50   8.827  9:50   6.290  13:50   1.838  17:50   1.479  21:50   1.173
      2:00   1.791  6:00   8.731  10:00  5.926  14:00   1.793  18:00   1.456  22:00   1.160
      2:10   1.705  6:10   9.349  10:10  5.610  14:10   1.731  18:10   1.433  22:10   1.327
      2:20   1.801  6:20   9.214  10:20  5.332  14:20   1.681  18:20   1.412  22:20   1.315
      2:30   1.849  6:30   8.571  10:30  5.085  14:30   1.634  18:30   1.391  22:30   1.303
      2:40   1.873  6:40   7.970  10:40  4.865  14:40   1.588  18:40   1.370  22:40   1.291
      2:50   1.921  6:50   7.495  10:50  4.665  14:50   1.541  18:50   1.350  22:50   1.279
      3:00   1.969  7:00   6.102  11:00  4.487  15:00   1.502  19:00   1.341  23:00   1.277
      3:10   2.011  7:10   6.957  11:10  4.323  15:10   1.462  19:10   1.323  23:10   1.266
      3:20   2.052  7:20   6.714  11:20  4.173  15:20   1.431  19:20   1.304  23:20   1.255
      3:30   2.119  7:30  10.121  11:30  4.035  15:30   1.396  19:30   1.278  23:30   1.244
```

```
01019>      3:40   1.1710    7:10  13.4221  11:40   3.9141  15:10   1.3590  18:40   1.7091  22:40   1.434
01020>      3:50   2.1221    7:20  14.4911  11:50   3.1931  15:20   1.2151  18:50   1.5411  22:50   1.419
01021>      4:00   1.1940    7:30 142.3141  12:00   3.0111  15:30   1.1421  19:00   1.3721  23:00   1.419
01022>
01023> ------------------------------------------------------------------------------------------------------
01024> R0001:C00001----------|-------------------------------------------------------------|
01025> *&----------------|-------------------------------------------------------------|
01026> *&----------------| <CATCHMENT 101_00> (uncontrolled flow to Street Area) ------|
01027> *&----------------|-------------------------------------------------------------|
01028> ------------------------
01029> | CALIB STANDHYD       |   Area    (ha)=    .220   Curve Number  (CN)= 77.40
01030> | 01:101_00            |   Ia      (mm)=   1.000   # of Linear Res.(N)=  3.00
01031> ------------------------   U.H. Tp(hrs)=    .103
01032>
01033>      Unit Hyd Qpeak  (cms)=    .044
01034>
01035>      PEAK FLOW     (cms)=    .007 (1)
01036>      TIME TO PEAK  (hrs)=   8.003
01037>      DURATION      (hrs)=  24.733, (4944)hhmmss)=   100:44
01038>      AVERAGE FLOW  (cms)=    .002
01039>      RUNOFF VOLUME  (mm)=   4.227
01040>      TOTAL RAINFALL (mm)=  110.534
01041>      RUNOFF COEFFICIENT  =    .069
01042>
01043>      (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01044>
01045> ------------------------------------------------------------------------------------------------------
01046> R0001:C00101----------|-------------------------------------------------------------|
01047> *&----------------|-------------------------------------------------------------|
01048> *&----------------| <CATCHMENT 201_00> (uncontrolled flow to Street Area) ------|
01049> *&----------------|-------------------------------------------------------------|
01050> ------------------------
01051> | CALIB STANDHYD       |   Area    (ha)=    .220   Curve Number  (CN)= 77.40
01052> | 01:201_00            |   Ia      (mm)=   1.000   # of Linear Res.(N)=  3.00
01053> ------------------------   U.H. Tp(hrs)=    .103
01054>
01055>      Unit Hyd Qpeak  (cms)=    .044
01056>
01057>      PEAK FLOW     (cms)=    .007 (1)
01058>      TIME TO PEAK  (hrs)=   8.003
01059>      DURATION      (hrs)=  24.733, (4944)hhmmss)=   100:44
01060>      AVERAGE FLOW  (cms)=    .002
01061>      RUNOFF VOLUME  (mm)=   4.227
01062>      TOTAL RAINFALL (mm)=  110.534
01063>      RUNOFF COEFFICIENT  =    .069
01064>
01065>      (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01066>
01067> ------------------------------------------------------------------------------------------------------
01068> R0001:C00201----------|-------------------------------------------------------------|
01069> *&----------------|-------------------------------------------------------------|
01070> *&----------------| <CATCHMENT 202_00> (uncontrolled flow to Street Area) ------|
01071> *&----------------|-------------------------------------------------------------|
01072> ------------------------
01073> | CALIB STANDHYD       |   Area    (ha)=   1.70
01074> | 02:202_00            |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
01075> ------------------------

                             IMPERVIOUS    PERVIOUS (i)
01076>      Surface Area    (ha)=    .76          .94
01077>      Dep. Storage    (mm)=   1.00         5.00
01078>      Average Slope    (%)=   2.00         2.00
01079>      Length           (m)=  100.00       115.00
01080>      Mannings n       =      .013         .250
01081>
01082>      Max.eff.Inten.(mm/hr)=  141.33        33.84
01083>                  over (min)     2.00        21.00
01084>      Storage Coeff.  (min)=   1.68 (i)     23.75 (i)
01085>      Unit Hyd. Tpeak (min)=   2.00        24.00
01086>      Unit Hyd. peak  (cms)=    .92          .05
01087>                                        *TOTALS*
01088>      PEAK FLOW     (cms)=    .21          .01          .220 (i)(i)
01089>      TIME TO PEAK  (hrs)=   8.00         8.35         8.000
01090>      RUNOFF VOLUME  (mm)=  103.53        98.56        81.045
01091>      TOTAL RAINFALL (mm)=  110.53       110.53       110.534
01092>      RUNOFF COEFFICIENT  =    .94          .89          .733
01093>
01094>      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01095>          CN* = 75.0    Ia = Dep. Storage  (Above)
01096>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
01097>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01098>
01099> ------------------------------------------------------------------------------------------------------
01100> R0001:C00301----------|-------------------------------------------------------------|
01101> *&----------------|-------------------------------------------------------------|
01102> *&----------------| <ADJACENT 301 (Fay Park and Vegetated Area)  ---------------|
01103> *&----------------|-------------------------------------------------------------|
01104> ------------------------
01105> | CALIB STANDHYD       |   Area    (ha)=   1.10
01106> | 03:301_00            |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
01107> ------------------------

                             IMPERVIOUS    PERVIOUS (i)
01108>      Surface Area    (ha)=    .54          .56
01109>      Dep. Storage    (mm)=   1.00         5.00
01110>      Average Slope    (%)=   2.00         2.00
01111>      Length           (m)=  100.00       115.00
01112>      Mannings n       =      .013         .250
01113>
01114>      Max.eff.Inten.(mm/hr)=  141.33        33.84
01115>                  over (min)     2.00        21.00
01116>      Storage Coeff.  (min)=   1.68 (i)     23.75 (i)
01117>      Unit Hyd. Tpeak (min)=   2.00        24.00
01118>      Unit Hyd. peak  (cms)=    .92          .05
01119>                                        *TOTALS*
01120>      PEAK FLOW     (cms)=    .11          .05          .159 (i)(i)
01121>      TIME TO PEAK  (hrs)=   8.00         8.35         8.000
01122>      RUNOFF VOLUME  (mm)=  103.53        98.56        81.045
01123>      TOTAL RAINFALL (mm)=  110.53       110.53       110.534
01124>      RUNOFF COEFFICIENT  =    .94          .89          .733
01125>
01126>      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01127>          CN* = 75.0    Ia = Dep. Storage  (Above)
01128>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
01129>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01130>
01131> ------------------------------------------------------------------------------------------------------
01132> R0001:C00401----------|-------------------------------------------------------------|
01133> *&----------------|-------------------------------------------------------------|
01134> *&----------------| TOTAL FLOWS CONTRIBUTING TO POND FACILITY ------------------|
01135> *&----------------|-------------------------------------------------------------|
01136>
01137> | ADD HYD              |
01138> | 04:TO_POND           |   TOTAMTD          AREA    QPEAK    TPEAK      R.V.      TMP
01139> ------------------------   (ha)     (cms)    (hrs)    (mm)    (cms)
01140>                        +ID 1 01:200      1.760     .144    8.000   81.045     .000
01141>                        +ID 1 03:301      1.100     .159    8.000   81.045     .000
01142>                        ---------------------------------------------------------------
01143>                        SUM  04:TO_POND   2.860     .274    8.000   87.735     .000
01144>
01145>      NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01146>
01147> ------------------------------------------------------------------------------------------------------
01148> R0001:C00301----------|-------------------------------------------------------------|
01149> *&----------------|-------------------------------------------------------------|
01150> *&----------------| ROUTE RESERVOIR FOR COMPLE SYSTEM ----------------------------|
01151> *&----------------|-------------------------------------------------------------|
01152>
01153> | ROUTE RESERVOIR      |   Requested routing time-step =  1.0 min.
01154> | IN:04:TO_POND        |
01155> | OUT:05:102_00        |   ---------- OUTFLOW STORAGE TABLE ----------
01156> ------------------------ OUTFLOW  STORAGE  OUTFLOW  STORAGE  OUTFLOW  STORAGE  OUTFLOW  STORAGE
01157>                          (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)   (cms)   (ha.m.)
01158>                          .000  .0000E+00   .049  .5937E-01   .083  .1510E+00   .779  .2138E+00
01159>                          .001  .1490E-01   .081  .1810E+00   .398  .1230E+00   .000  .0000E+00
01160>
01161>      ROUTING RESULTS            AREA     QPEAK     TPEAK      R.V.
01162>      ---------------            (ha)     (cms)     (hrs)      (mm)
01163>        INFLOW : 04:TO_POND      2.860     .274    8.000    87.735
01164>        OUTFLOW : 05:102_00      2.860     .041    9.333    87.735
01165>        OVERFLOW : 03:END_OF     .0000    .0000     .000     .0000
01166>
01167>                    TOTAL NUMBER OF SIMULATED OVERFLOWS =      0
01168>                    CUMULATIVE TIME OF OVERFLOWS (hours)=     .00
01169>                    PERCENTAGE OF TIME OVERFLOWING   (%)=     .00
01170>
01171>
01172>
01173>
01174>
01175>
01176>
01177>
01178>
01179>
01180>
01181>
01182>
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01187>
01188>
01189>
01190>
01191>
01192>
01193>
01194>
01195>                    PEAK FLOW  REDUCTION [Qout/Qin](%)=   7.49
01196>                    TIME SHIFT OF PEAK FLOW      (min)=   8.00
01197>                    MAXIMUM STORAGE USED         (ha.m.)= .1300E+00
01198>
01199> ------------------------------------------------------------------------------------------------------
01200> R0001:C00401----------|-------------------------------------------------------------|
01201> *&----------------|-------------------------------------------------------------|
01202> *&----------------| 50 YEAR EVENT ------------------------------------------------|
01203> *&----------------|-------------------------------------------------------------|
01204> ------------------------
01205> | CHICAGO STORM        |   ILF curve parameters:A= 740.193
01206> | Ptotal=124.71 mm     |                        B=   .067
01207> ------------------------                        C=   .870
01208>                          Used in:   INTENSITY = A / (t + B)^C
01209>
01210>                          Duration of storm =  24.00 hrs
01211>                          Storm time step   = 10.00 min
01212>                          Time to peak ratio=   .33
01213>
01214>      TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN   TIME   RAIN
01215>      hhmm   mm/hr  hhmm   mm/hr  hhmm   mm/hr  hhmm   mm/hr  hhmm   mm/hr  hhmm   mm/hr
01216>      0:10   1.5693   4:10   2.6833   8:10  35.4301  12:10   4.0681  16:10   1.5791  20:10   1.041
01217>      0:20   1.6681   4:20   2.7731   8:20  21.9701  12:20   3.8531  16:20   1.5221  20:20   1.0227
01218>      0:30   1.7884   4:30   2.8821   8:30  17.0961  12:30   3.6581  16:30   1.4681  20:30   1.008
01219>      0:40   1.9311   4:40   3.0161   8:40  14.1081  12:40   3.4971  16:40   1.4251  20:40   1.0041
01220>      0:50   2.0741   4:50   3.0771   8:50  12.1481  12:50   3.3671  16:50   1.3881  20:50   1.0011
01221>      1:00   2.1770   5:00   3.1233   9:00  10.7401  13:00   3.2581  17:00   1.3561  21:00   1.0001
01222>      1:10   2.3001   5:10   3.1814   9:10   9.6771  13:10   3.1631  17:10   1.3261  21:10   1.0041
01223>      1:20   2.4311   5:20   3.2461   9:20   8.8401  13:20   3.0781  17:20   1.2991  21:10   1.0131
01224>      1:30   2.5624   5:30   3.3121   9:30   8.1611  13:30   2.9991  17:30   1.2731  21:30   1.0191
01225>      1:40   2.6971   5:40   3.3801   9:40   7.5994  13:40   2.9281  17:40   1.2491  21:40   1.0241
01226>      1:50   2.8331   5:50   4.0031   9:50   7.1119  13:50   2.8631  17:50   1.2251  21:50   1.0291
01227>      2:00   2.9701   6:00   4.1241  10:00   6.7019  14:00   2.8041  18:00   1.2041  22:00   1.0341
01228>      2:10   3.1079   6:10   4.5051  10:10   6.3531  14:10   2.7501  18:10   1.1831  22:10   1.0381
01229>      2:20   3.2461   6:20   4.8121  10:20   6.0591  14:20   2.6991  18:20   1.1651  22:20   1.0421
01230>      2:30   3.3831   6:30   5.1641  10:30   5.7931  14:30   2.6521  18:30   1.1471  22:30   1.0461
01231>      2:40   3.5191   6:40   5.6831  10:40   5.5631  14:40   2.6081  18:40   1.1301  22:40   1.0491
01232>      2:50   3.6551   6:50   6.1301  10:50   5.3491  14:50   2.5671  18:50   1.1141  22:50   1.0531
01233>      3:00   3.7951   7:00   6.6571  11:00   5.1561  15:00   2.5311  19:00   1.0991  23:00   1.0561
01234>      3:10   3.9391   7:10   7.4771  11:10   4.9731  15:10   2.4981  19:10   1.0851  23:10   1.0601
01235>      3:20   4.0851   7:20   9.2501  11:20   4.7971  15:20   2.4671  19:20   1.0711  23:20   1.0641
01236>      3:30   4.2401   7:30  11.4321  11:30   4.6371  15:30   2.4371  19:30   1.0581  23:30   1.0671
01237>      3:40   4.3991   7:40  15.5291  11:40   4.4831  15:40   2.4071  19:40   1.0451  23:40   1.0711
01238>      3:50   4.5631   7:50  24.8751  11:50   4.3401  15:50   2.3821  19:50   1.0331  23:50   1.0741
01239>      4:00   2.0110   8:00 159.9401  12:00   4.1761  16:00   1.5941  20:00   1.021  24:00   1.0771
01240>
01241> ------------------------------------------------------------------------------------------------------
01242> R0001:C00301----------|-------------------------------------------------------------|
01243> *&----------------|-------------------------------------------------------------|
01244> *&----------------| <ADJACENT 201_00> (uncontrolled flow to Street Area) ------|
01245> *&----------------|-------------------------------------------------------------|
01246> ------------------------
01247> | CALIB STANDHYD       |   Area    (ha)=    .220   Curve Number  (CN)= 77.40
01248> | 01:201_00            |   Ia      (mm)=   1.000   # of Linear Res.(N)=  3.00
01249> ------------------------   U.H. Tp(hrs)=    .103
01250>
01251>      Unit Hyd Qpeak  (cms)=    .044
01252>
01253>      PEAK FLOW     (cms)=    .011 (1)
01254>      TIME TO PEAK  (hrs)=   8.003
01255>      DURATION      (hrs)=  24.733, (4944)hhmmss)=   100:44
01256>      AVERAGE FLOW  (cms)=    .002
01257>      RUNOFF VOLUME  (mm)=  71.170
01258>      TOTAL RAINFALL (mm)=  124.708
01259>      RUNOFF COEFFICIENT  =    .595
01260>
01261>      (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01262>
01263> ------------------------------------------------------------------------------------------------------
01264> R0001:C00401----------|-------------------------------------------------------------|
01265> *&----------------|-------------------------------------------------------------|
01266> *&----------------| <CATCHMENT 101_00> (uncontrolled flow to Street Area) ------|
01267> *&----------------|-------------------------------------------------------------|
01268> ------------------------
01269> | CALIB STANDHYD       |   Area    (ha)=    .22
01270> | 01:101_00            |   Total Imp(%)=  21.00   Dir. Conn.(%)=  21.00
01271> ------------------------

                             IMPERVIOUS    PERVIOUS (i)
01272>      Surface Area    (ha)=    .05          .17
01273>      Dep. Storage    (mm)=   1.00         5.00
01274>      Average Slope    (%)=   2.00         2.00
01275>      Length           (m)=  100.00       115.00
01276>      Mannings n       =      .013         .250
01277>
01278>      Max.eff.Inten.(mm/hr)=  159.96        95.09
01279>                  over (min)     1.00         4.00
01280>      Storage Coeff.  (min)=    .62 (i)      3.79 (i)
01281>      Unit Hyd. Tpeak (min)=   1.00         4.00
01282>      Unit Hyd. peak  (cms)=   1.33          .29
01283>                                        *TOTALS*
01284>      PEAK FLOW     (cms)=    .02          .01          .033 (i)(i)
01285>      TIME TO PEAK  (hrs)=   7.97         8.01         8.000
01286>      RUNOFF VOLUME  (mm)=  122.70        70.11        81.233
01287>      TOTAL RAINFALL (mm)=  124.71       124.71       124.708
01288>      RUNOFF COEFFICIENT  =    .98          .56          .651
01289>
01290>      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01291>          CN* = 75.0    Ia = Dep. Storage  (Above)
01292>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
01293>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01294>
01295> ------------------------------------------------------------------------------------------------------
01296> R0001:C00201----------|-------------------------------------------------------------|
01297> *&----------------|-------------------------------------------------------------|
01298> *&----------------| <ADJACENT 202_00> (Off-Site Flows to 20% system) ------------|
01299> *&----------------|-------------------------------------------------------------|
01300> ------------------------
01301> | CALIB STANDHYD       |   Area    (ha)=   1.70
01302> | 02:202               |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
01303> ------------------------

                             IMPERVIOUS    PERVIOUS (i)
01304>      Surface Area    (ha)=    .76          .94
01305>      Dep. Storage    (mm)=   1.00         5.00
01306>      Average Slope    (%)=   2.00         2.00
01307>      Length           (m)=  100.00       115.00
01308>      Mannings n       =      .013         .250
01309>
01310>      Max.eff.Inten.(mm/hr)=  159.96        95.09
01311>                  over (min)     1.00         4.00
01312>      Storage Coeff.  (min)=    .62 (i)      3.79 (i)
01313>      Unit Hyd. Tpeak (min)=   1.00         4.00
01314>      Unit Hyd. peak  (cms)=   1.33          .29
01315>                                        *TOTALS*
01316>      PEAK FLOW     (cms)=    .02          .01          .033 (i)(i)
01317>      TIME TO PEAK  (hrs)=   7.97         8.01         8.000
01318>      RUNOFF VOLUME  (mm)=  122.70        70.11        81.233
01319>      TOTAL RAINFALL (mm)=  124.71       124.71       124.708
01320>      RUNOFF COEFFICIENT  =    .98          .56          .651
01321>
01322>      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01323>          CN* = 75.0    Ia = Dep. Storage  (Above)
01324>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
01325>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01326>
01327> ------------------------------------------------------------------------------------------------------
01328> R0001:C00301----------|-------------------------------------------------------------|
01329> *&----------------|-------------------------------------------------------------|
01330> *&----------------| <ATTENUATE 103 (Dry Pond and Veg-Taken Area) ----------------|
01331> *&----------------|-------------------------------------------------------------|
01332>
01333> ------------------------
01334> | CALIB STANDHYD       |   Area    (ha)=   1.10
01335> | 03:103               |   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
01336> ------------------------

                             IMPERVIOUS    PERVIOUS (i)
01337>      Surface Area    (ha)=    .54          .56
01338>      Dep. Storage    (mm)=   1.00         5.00
01339>      Average Slope    (%)=   2.00         2.00
01340>      Length           (m)=  100.00       115.00
01341>      Mannings n       =      .013         .250
01342>
01343>      Max.eff.Inten.(mm/hr)=  159.96        95.09
01344>                  over (min)     1.00        22.00
01345>      Storage Coeff.  (min)=   1.01 (ii)    21.93 (ii)
01346>      Unit Hyd. Tpeak (min)=   1.00        22.00
01347>      Unit Hyd. peak  (cms)=    .61          .05
01348>                                        *TOTALS*
01349>      PEAK FLOW     (cms)=    .11          .02          .127 (ii)
01350>      TIME TO PEAK  (hrs)=   8.00         8.32         8.000
01351>      RUNOFF VOLUME  (mm)=  122.70        70.11        95.793
01352>      TOTAL RAINFALL (mm)=  124.71       124.71       124.708
01353>      RUNOFF COEFFICIENT  =    .98          .56          .769
01354>
01355>      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01356>          CN* = 75.0    Ia = Dep. Storage  (Above)
01357>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
```

```
      (1)(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

*----------*-----------------------------------------------------------------*
*----------| TOTAL FLOWS CONTRIBUTING TO JUNCTION |-----------*
*----------*-----------------------------------------------------------*

| ADD HYD          |
| 04:70_END        |   ID=HYD          AREA    QPEAK    TPEAK     R.V.     TAF
|------------------|                    (ha)    (cms)    (hrs)     (mm)    (mcm)
                     ID 1 01:02          1.700     .416    8.000   109.473    .000
                    +ID 2 04:03          1.120     .120    8.000   101.783    .000
                     ---------------------------------------------------------
                     SUM  04:70_END       2.820     .479    8.000   106.873    .000

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOW IF ANY.

*----------*-----------------------------------------------------------------*
*----------| ROUTE RESERVOIR FOR CONTROL SYSTEM |-----------*
*----------*-----------------------------------------------------------*

| ROUTE RESERVOIR -> |   Requested routing time step =  1.0 min.
| IN=04:70_END       |
| OUT=01:02_C        |  ------------------------ OUTFLOW STORAGE TABLE ------------------------
|--------------------|  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE
                          (cms)    (ha.m.)   (cms)    (ha.m.)   (cms)    (ha.m.)   (cms)    (ha.m.)
                         .000  .0000E+00     .048  .3500E-01     .081  .1910E+00     .775  .2918E+00
                         .004  .1000E-01     .061  .1750E-01     .774  .2180E+00     .800  .3021E+00

     ROUTING RESULTS              AREA     QPEAK     TPEAK      R.V.
     ---------------              (ha)     (cms)     (hrs)      (mm)
     INFLOW : 04:70_END           2.820     .479    8.000   106.873
     OUTFLOW : 01:02_C            2.820     .071    8.267   103.828
     OVERFLOW : 01:ROAD_OV         .000     .000    0.000     .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =       0
                    CUMULATIVE TIME OF OVERFLOWS (hours)=     .00
                    PERCENTAGE OF TIME OVERFLOWING       (%)=     .00

                    PEAK  FLOW  REDUCTION (Qout/Qin)(%)=    8.167
                    TIME SHIFT OF PEAK FLOW       (min)=    36.00
                    MAXIMUM STORAGE  USED       (ha.m.)=.1134E+00

*----------*-----------------------------------------------------------------*
*----------| 100 YEAR EVENT |-----------*
*----------*-----------------------------------------------------------*

| CHICAGO STORM    |   IDF curve parameters: A= 458.940
| Ptotal=137.42 mm |                         B=   .045
                   |                         C=   .839
                    Used for  INTENSITY = A / (t + B)^C

                    Duration of storm   = 24.00 hrs
                    Storm time step     = 10.00 min
                    Time to peak ratio  =   .33

     TIME    RAIN    TIME    RAIN    TIME    RAIN    TIME    RAIN    TIME    RAIN
     hours   mm/hr   hours   mm/hr   hours   mm/hr   hours   mm/hr   hours   mm/hr
     0:10    1.619   4:10    2.970   8:10   46.990   12:10    3.433   16:10    2.148
     0:20    1.737   4:20    3.003   8:20   24.912   12:20    3.304   16:20    2.124
     0:30    1.865   4:30    3.036   8:30   16.837   12:30    3.253   16:30    2.100
     0:40    1.985   4:40    3.071   8:40   12.748   12:40    3.184   16:40    2.080
     0:50    2.045   4:50    3.091   8:50   10.348   12:50    3.049   16:50    2.061
     1:00    2.067   5:00    3.112   9:00   11.490   13:00    2.952   17:00    2.041
     1:10    1.993   5:10    3.005   9:10   10.470   13:10    3.003   17:10    2.026
     1:20    2.014   5:20    3.023   9:20    9.748   13:20    2.965   17:20    2.007
     1:30    2.035   5:30    3.038   9:30    9.222   13:30    2.906   17:30    2.000
     1:40    2.057   5:40    3.060   9:40    8.836   13:40    2.914   17:40    1.983
     1:50    2.136   5:50    3.119   9:50    7.353   13:50    2.859   17:50    1.967
     2:00    2.177   6:00    3.177   10:00   7.101   14:00    2.841   18:00    1.951
     2:10    2.160   6:10    3.247   10:10   7.028   14:10    2.811   18:10    1.935
     2:20    2.258   6:20    3.311   10:20   6.868   14:20    2.804   18:20    1.919
     2:30    2.311   6:30    3.374   10:30   6.739   14:30    2.775   18:30    1.904
     2:40    2.336   6:40    3.434   10:40   6.633   14:40    2.752   18:40    1.888
     2:50    2.385   6:50    3.494   10:50   6.532   14:50    2.737   18:50    1.875
     3:00    2.438   7:00    3.553   11:00   6.418   15:00    2.711   19:00    1.860
     3:10    2.519   7:10    4.041   11:10   6.308   15:10    2.693   19:10    1.846
     3:20    2.591   7:20   10.199   11:20   6.223   15:20    2.681   19:20    1.832
     3:30    2.697   7:30   11.001   11:30   6.051   15:30    2.655   19:30    1.819
     3:40    2.758   7:40   17.375   11:40   5.998   15:40    2.651   19:40    1.805
     3:50    2.838   7:50   11.730   11:50   5.947   15:50    2.629   19:50    1.792
     4:00    2.911   8:00  137.755   12:00   5.810   16:00    2.648   20:00    1.779

*----------*-----------------------------------------------------------------*
*----------| CATCHMENT 101 (Controlled flow to Sheet Ave.) |-----------*
*----------*-----------------------------------------------------------*

| CALIB NASHYD     |   Area    (ha)=    1.20   Curve Number  (CN)= 77.10
| 01:101_C     ID= 1 |  Ia       (mm)=    4.70   # of Linear Res.(N)=  3.00
|------------------|  U.H. Tp(hrs)=     .100

     Unit Hyd Qpeak   (cms)=     .081

     PEAK FLOW        (cms)=     .081 (1)
     TIME TO PEAK     (hrs)=    8.033
     DURATION         (hrs)=   24.333, (4444)(hh:mm)=  1100:11
     AVERAGE FLOW     (cms)=     .001
     RUNOFF VOLUME      (mm)=   85.139
     TOTAL RAINFALL     (mm)=  137.417
     RUNOFF COEFFICIENT   =     .619

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

*----------*-----------------------------------------------------------------*
*----------| CATCHMENT 201_UC2 (uncontrolled flow to Sheet Ave.) |-----------*
*----------*-----------------------------------------------------------*

| CALIB STANDHYD   |   Area    (ha)=    1.70   Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
| 02:201_C     ID= 1 |
|------------------|

                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=          .77           .93
     Dep. Storage     (mm)=         1.00          5.00
     Average Slope    (%)=         1.00          2.00
     Length           (m)=       100.00         50.00
     Mannings n       =            .013          .250

     Max.eff.Inten.(mm/hr)=       99.00         99.00
                    over (min)      5.00          5.00
     Storage Coeff.   (min)=       .00 (ii)      .00 (ii)
     Unit Hyd. Tpeak  (min)=       .00           .00
     Unit Hyd. peak   (cms)=       .00           .00

                                                          *TOTALS*
     PEAK FLOW        (cms)=       .00           .00          .000 (iii)
     TIME TO PEAK     (hrs)=      8.00          8.00         8.000
     RUNOFF VOLUME      (mm)=    99.00         99.00        99.000
     TOTAL RAINFALL     (mm)=   137.42        137.42       137.417
     RUNOFF COEFFICIENT   =       .72           .72          .720

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* = 75.0   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.

*----------*-----------------------------------------------------------------*
*----------| CATCHMENT 202_S (surface) th Interval Courtyard |-----------*
*----------*-----------------------------------------------------------*

| CALIB STANDHYD   |   Area    (ha)=    1.14
| 06:202_S     ID= 1 |  Total Imp(%)=  41.00   Dir. Conn.(%)=  41.00
|------------------|

                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=          .48           .66
     Dep. Storage     (mm)=         1.00          5.00
     Average Slope    (%)=         1.00          2.00
     Length           (m)=       100.00         80.00
     Mannings n       =            .013          .150

     Max.eff.Inten.(mm/hr)=       174.76         91.73
                    over (min)      2.00         15.00
     Storage Coeff.   (min)=      1.58 (ii)     13.20 (ii)
     Unit Hyd. Tpeak  (min)=      2.00          13.00
     Unit Hyd. peak   (cms)=       .93           .09

                                                          *TOTALS*
     PEAK FLOW        (cms)=       .17           .10          .244 (iii)
     TIME TO PEAK     (hrs)=      8.00          8.17         8.000
     RUNOFF VOLUME      (mm)=    139.41         80.77       103.173
     TOTAL RAINFALL     (mm)=    137.42        137.42       137.417
     RUNOFF COEFFICIENT   =       1.00           .59          .751

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* = 75.0   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.

*----------*-----------------------------------------------------------------*
*----------| CATCHMENT 203 (Top area and Vegetated Area) |-----------*
*----------*-----------------------------------------------------------*

| CALIB STANDHYD   |   Area    (ha)=    3.20
| 08:203       ID= 1 |  Total Imp(%)=  45.00   Dir. Conn.(%)=  45.00
|------------------|

                                  IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         1.44           .00
     Dep. Storage     (mm)=         1.00          5.00
     Average Slope    (%)=         1.00          2.00
     Length           (m)=       141.42        141.42
     Mannings n       =            .013          .250

     Max.eff.Inten.(mm/hr)=       174.76         91.73
                    over (min)      2.00         20.00
     Storage Coeff.   (min)=      1.55 (ii)     19.92 (ii)
     Unit Hyd. Tpeak  (min)=      2.00          20.00
     Unit Hyd. peak   (cms)=       .95           .04

                                                          *TOTALS*
     PEAK FLOW        (cms)=       .66           .07          .693 (iii)
     TIME TO PEAK     (hrs)=      8.00          8.28         8.000
     RUNOFF VOLUME      (mm)=    138.41         40.77       105.361
     TOTAL RAINFALL     (mm)=    137.42        137.42       137.417
     RUNOFF COEFFICIENT   =       1.00           .59          .767

     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
         CN* = 75.0   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.

*----------*-----------------------------------------------------------------*
*----------| TOTAL FLOWS CONTRIBUTING TO JUNCTION |-----------*
*----------*-----------------------------------------------------------*

| ADD HYD          |
| 04:ID_END        |   ID=HYD          AREA    QPEAK    TPEAK     R.V.     TAF
|------------------|                    (ha)    (cms)    (hrs)     (mm)    (mcm)
                     ID 1 01:02          1.700     .081    8.033   117.950    .020
                    +ID 2 03:203         1.120     .693    8.000   105.361    .000
                     ---------------------------------------------------------
                     SUM  04:ID_END       2.820     .695    8.000   112.750    .019

   NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

*----------*-----------------------------------------------------------------*
*----------| ROUTE RESERVOIR FOR CONTROL SYSTEM |-----------*
*----------*-----------------------------------------------------------*

| ROUTE RESERVOIR -> |   Requested routing time step =  1.0 min.
| IN=04:ID_END       |
| OUT=01:02_C        |  ------------------------ OUTFLOW STORAGE TABLE ------------------------
|--------------------|  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE  OUTFLOW   STORAGE
                          (cms)    (ha.m.)   (cms)    (ha.m.)   (cms)    (ha.m.)   (cms)    (ha.m.)
                         .000  .0000E+00     .048  .3500E-01     .081  .1910E+00     .775  .2918E+00
                         .004  .1902E-01     .061  .1750E-01     .774  .2180E+00     .800  .3021E+00

     ROUTING RESULTS              AREA     QPEAK     TPEAK      R.V.
     ---------------              (ha)     (cms)     (hrs)      (mm)
     INFLOW : 04:ID_END           2.820     .695    8.000   112.750
     OUTFLOW : 01:02_C            2.820     .081    8.267   109.705
     OVERFLOW : 01:ROAD_OV         .000     .000     .000     .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =       0
                    CUMULATIVE TIME OF OVERFLOWS (hours)=     .00
                    PERCENTAGE OF TIME OVERFLOWING       (%)=     .00

                    PEAK  FLOW  REDUCTION (Qout/Qin)(%)=   11.676
                    TIME SHIFT OF PEAK FLOW       (min)=    32.00
                    MAXIMUM STORAGE  USED       (ha.m.)=.1953E+00

*----------*-----------------------------------------------------------------*
*----------| FINISH |-----------*
*----------*-----------------------------------------------------------*

     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2011-07-12     at 17:06:19*
```

South Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.90000	%
Left Side Slope	33.00	%
Right Side Slope	33.00	%
Bottom Width	0.60	m
Discharge	0.28	m^3/s

Results

Normal Depth	0.22	m
Flow Area	0.27	m^2
Wetted Perimeter	1.98	m
Hydraulic Radius	0.14	m
Top Width	1.91	m
Critical Depth	0.20	m
Critical Slope	0.02455	m/m
Velocity	1.05	m/s
Velocity Head	0.06	m
Specific Energy	0.27	m
Froude Number	0.89	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.22	m
Critical Depth	0.20	m
Channel Slope	1.90000	%

South Swale

GVF Output Data

Critical Slope	0.02455	m/m

South Swale

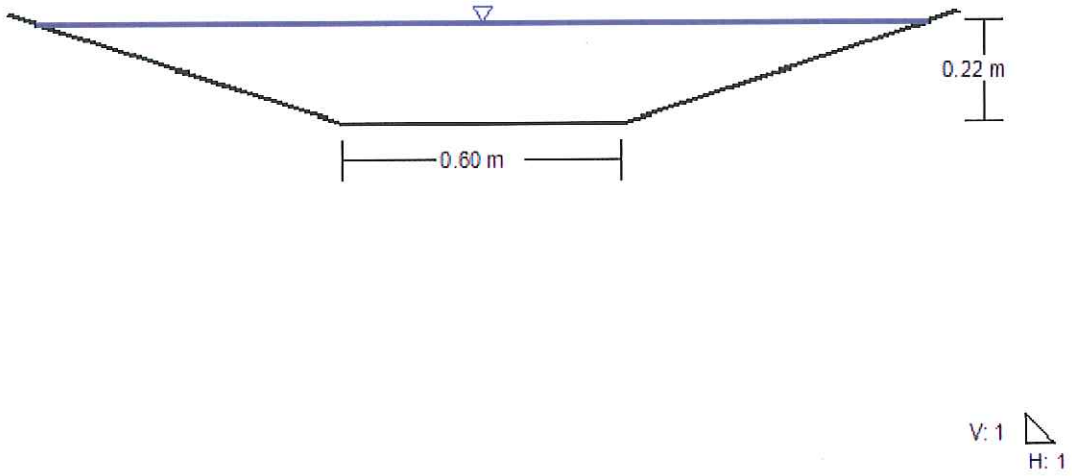
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.90000	%
Normal Depth	0.22	m
Left Side Slope	33.00	%
Right Side Slope	33.00	%
Bottom Width	0.60	m
Discharge	0.28	m³/s

Cross Section Image



West Property Line Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.30000	%
Left Side Slope	33.00	%
Right Side Slope	33.00	%
Bottom Width	0.00	m
Discharge	0.28	m^3/s

Results

Normal Depth	0.32	m
Flow Area	0.31	m^2
Wetted Perimeter	2.03	m
Hydraulic Radius	0.15	m
Top Width	1.93	m
Critical Depth	0.28	m
Critical Slope	0.02472	m/m
Velocity	0.92	m/s
Velocity Head	0.04	m
Specific Energy	0.36	m
Froude Number	0.74	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.32	m
Critical Depth	0.28	m
Channel Slope	1.30000	%

West Property Line Swale

GVF Output Data

Critical Slope	0.02472	m/m

West Property Line Swale

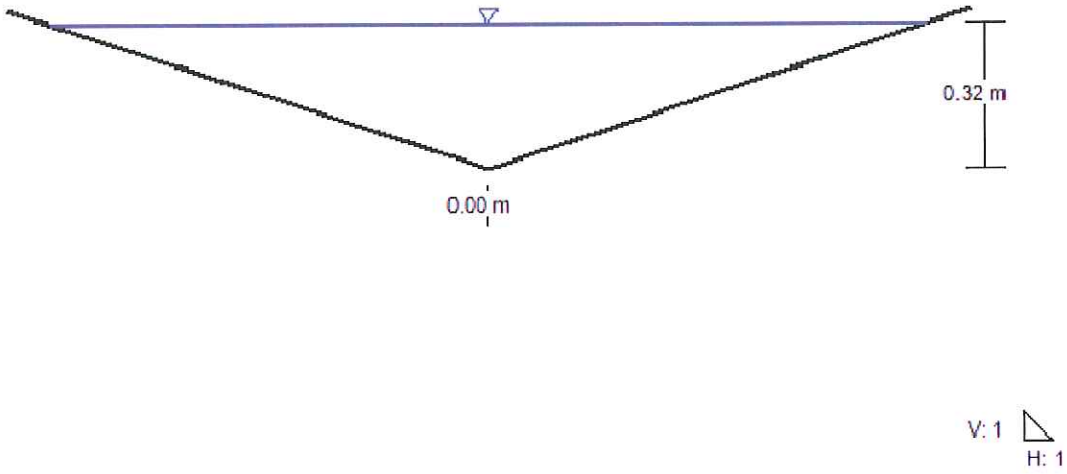
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.30000	%
Normal Depth	0.32	m
Left Side Slope	33.00	%
Right Side Slope	33.00	%
Bottom Width	0.00	m
Discharge	0.28	m³/s

Cross Section Image



Outlet

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.041	
Channel Slope	0.33000	m/m
Left Side Slope	0.33	m/m (H:V)
Right Side Slope	0.33	m/m (H:V)
Bottom Width	84.00	m
Discharge	83.00	L/s

Results

Normal Depth	0.00	m
Flow Area	0.27	m^2
Wetted Perimeter	84.01	m
Hydraulic Radius	0.00	m
Top Width	84.00	m
Critical Depth	0.00	m
Critical Slope	0.09888	m/m
Velocity	0.31	m/s
Velocity Head	0.00	m
Specific Energy	0.01	m
Froude Number	1.76	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

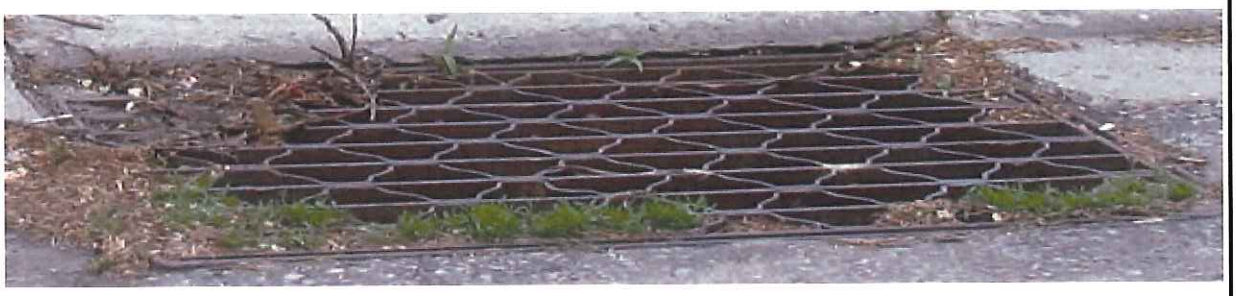
Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.00	m
Critical Depth	0.00	m
Channel Slope	0.33000	m/m

Outlet

GVF Output Data

Critical Slope	0.09888	m/m

Grate Honeycomb Inlet Capacity Evaluation



Size: 0.84m x 0.66m

Inlet Capture Rate (m^3/s) for Grate A Honeycomb inlet (on Sag) and Curb and Gutter Type B

Depth of Ponding (m)	Inlet Capacity (m^3/s)
0	0
0.01	0.0036
0.02	0.0101
0.03	0.0186
0.04	0.0287
0.05	0.0401
0.06	0.0527
0.07	0.0664
0.08	0.0811
0.09	0.0968
0.1	0.1134
0.11	0.1308
0.12	0.1491
0.13	0.1681
0.14	0.1878
0.15	0.2083
0.2	0.3207
0.25	0.4495
0.3	0.4837
0.35	0.5397
0.4	0.5882
0.45	0.6310
0.5	0.6693
0.55	0.7039
0.6	0.7355
0.65	0.7646
0.7	0.7915
0.75	0.8166
0.8	0.8400
0.85	0.8621
0.9	0.8828
0.95	0.9025
1	0.9211

Notes: For flow depth less than 0.3 m, Capture rates derived from formula: $Qi = CPd^{1.5}$; for flow depth equal to or greater than 0.3 m, capture rates extrapolated by using calculation data.

Swale	Catchment	Inlet ID	DICB T/G	Max Ponding Depth (m)	Inlet Capacity	50% Clogged	100YR QP
South	202_S	DICB 9	217.00	0.45	0.6310	0.3155	0.284
West	202_S	CBMH 10	216.80	0.20	0.6414	0.3207	0.284

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CONSULTING ENGINEERS

Date 2021/07/12 Project No: 1259-60716 Prepared By: IC Reviewed By:

Project 12 Henderson Avenue

Subject Rip-Rap Sizing

Pond Inlet

total velocity = 1.75m/s

↳ from storm sewer design sheet

based on 3:1 side slopes of pond and using graph

↳ D_{50} = 78mm

depth = $2 \times D_{50}$ = $2 \times 78mm$ = 156mm

Pond Outlet

total velocity = 0.31 m/s

↳ based on 100-year flow out of the pond (83L/s) and the overland flow spread along the entire length of 84m (determined using FlowMaster)

based on 3:1 side slopes and using graph

↳ D_{50} = 20mm (min.)

depth = $2 \times D_{50}$ = $2 \times 20mm$ = 40mm

** Grid lines are to scale 5mm x 5mm

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CONSULTING ENGINEERS

Date | Project No: | Prepared By: | Reviewed By:

Project

Subject

West Swale

total velocity = 0.92 m/s

↳ FlowMaster results for Swale B

based on 3:1 side slopes and graph:

↳ D_{50} = 20mm

depth = 2 x D_{50} = 2 x 20mm = 40mm

** Grid lines are to scale 5mm x 5mm

GUIDELINES FOR RIP-RAP PROTECTION

In general, vegetative linings can be effective for stream flow velocities less than **1.5 m/s** where the bank is not continuously submerged for more than a few days. Rip-rap lining can be used for stream flow velocities between **1.5 m/s** and **3.5 m/s** or where bank is continuously submerged. Other linings such as armour stone or contrete structures are required for flow velocities exceeding 3.5 m/s.

Special attention should be paid to lining requirements at curves, bridges, culverts and drop structures due to increased local flow velocities.

Stone Size The required median stone diameter for a given velocity may be determined from the attached chart. 50% of the material should be larger than D_{50} and 50% smaller. Oversized riprap should be avoided.

Thickness 2 x D_{50} or 1.0 to 1.5 times the maximum stone diameter, whichever is greater.

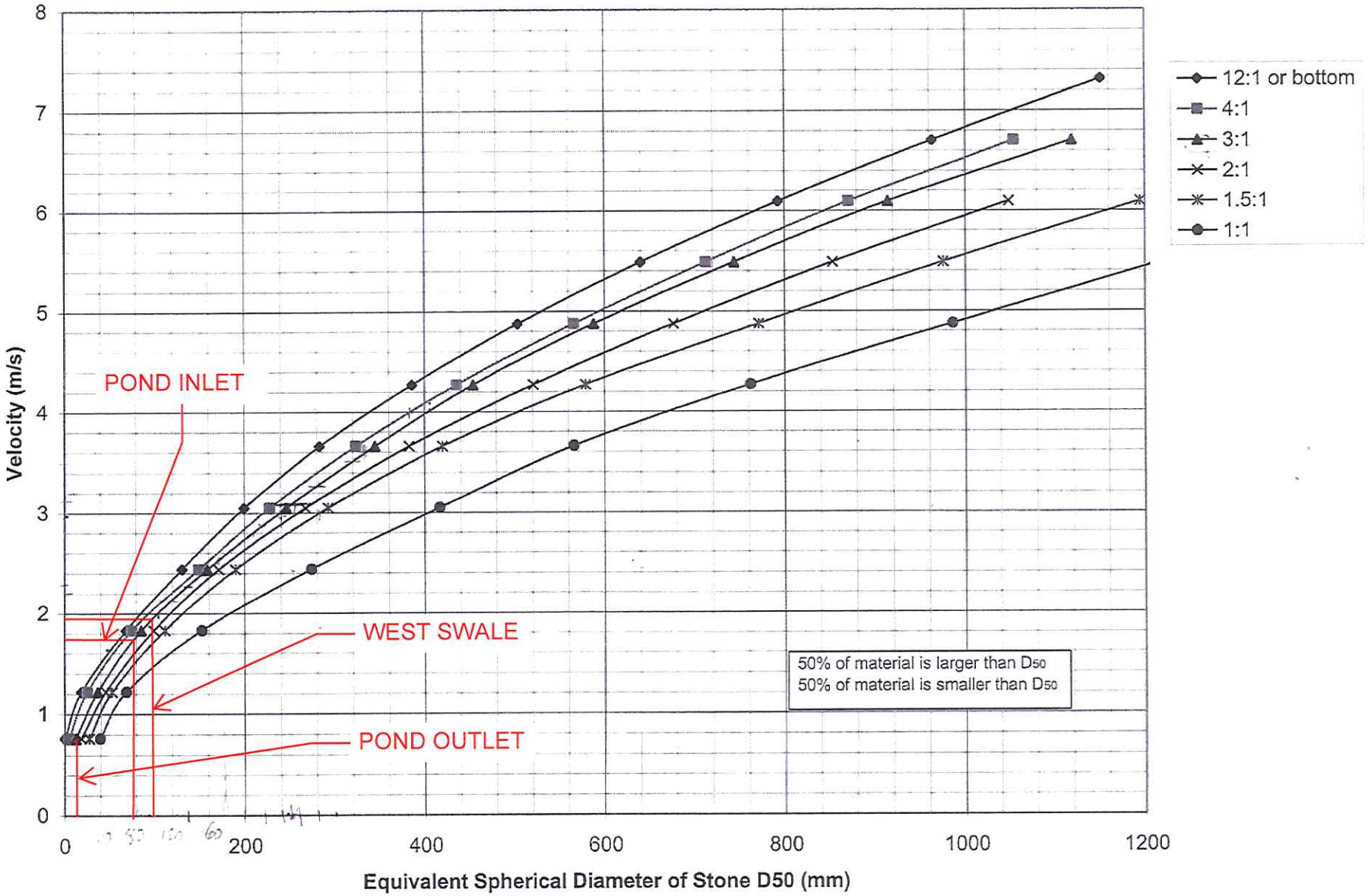
Slope 2:1 preferred, 1.5:1 maximum.

Height Minimum 0.3 m above HWL (High Water Level) profile around fill.

Filter Backing Filters have been found necessary under riprap protection overlying sand and silt bank material subject to significant subsurface outflows. Granular filters are reported to be more effective than geotextile filters for this purpose because downslope migration of the streambank material does not occur.

Source: MTO Drainage Manual (1988) p. I4-22

RIP-RAP SIZING



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CONSULTING ENGINEERS

Project: 12 Henderson Ave.
Project No.: 1241-4515
File: SWM Pond Sizing
Design: IC
Date: 2021.07.12
Check: JS

Dry Pond Stage-Storage-Discharge Calculations

E.D. Orifice Diameter:	0.075 m
E.D. Orifice Invert Elevation:	214.30 m
Extended Detention Elev:	214.45 m
A.S. Orifice Diameter	0.150 m
A.S. Orifice Invert Elevation	214.45 m

Weir Elevation:	214.75 m
Outlet Spill Bot. Width:	1 m
Trap. Side Slopes:	3 :1 H:V

Operating Level	Elev. (m)	Depth Above Pond Bot (m)	Depth Above ED (m)	Area (sqm)	Storage Volume (cu.m)	ED Orifice Discharge (cu.m/s)	AS Orifice Discharge (cu.m/s)	Weir Ave. Width (m)	Weir Discharge (cu.m/s)	Total Discharge (cu.m/s)	Storage (ha-m)
Bottom of Pond	214.30	0.00	0.00	3,158	0	0.000	0.000	0.00	0.000	0.000	0.000
Water Quality Elevation/Second Orifice	214.45	0.15	0.00	3,321	486	0.004	0.000	0.00	0.000	0.004	0.049
	214.60	0.30	0.15	3,408	991	0.006	0.014	0.00	0.000	0.048	0.099
100-Year HWL	214.75	0.45	0.30	3,534	1,522	0.008	0.024	1.01	0.000	0.081	0.152
Top of Berm	214.95	0.65	0.50	3,672	2,231	0.010	0.033	1.60	0.223	0.778	0.223

Notes: 1. E.D. = Extended Detention
2. A.S. = Active Storage

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CONSULTING ENGINEERS

12 Henderson Avenue
STORM SEWER DESIGN SHEET - PHASE 1

PROJECT No.: 1241-4515
DESIGN: MJ/IC
CHECK: AS
UPDATED: 03/03/2021

FREQUENCY - 10 YEAR - CITY OF BRAMPTON RAINFALL INTENTSITIES (DWG. 343)			
Coef. A=	35.1	Coef. B=	-0.695
FREQUENCY - 100 YEAR - CITY OF BRAMPTON RAINFALL INTENTSITIES (DWG. 343)			
Coef. A=	51.3	Coef. B=	-0.686

TIME OF CONCENTRATION 10.00 min MANNINGS "n" 0.013

CATCHMENT AREA I.D.	FR MH NO	TO MH NO	RUN-OFF AREA (A) (Ha)	RUN-OFF COEFF (C_5)	A x C	CUMMULATION A x C	TIME OF CONC. (min.)	I (mm/hr)	Q (RUNOFF) (l/sec)	PIPE SLOPE (%)	PIPE DIA. (mm)	VELOCITY (m/sec)	TIME LENGTH (m)	TIME OF FLOW (min)	CAPACITY (l/sec)	CAPACITY %	PIPE INVERT ELEVATION UPPER END	PIPE INVERT ELEVATION LOWER END	GROUND ELEVATION UPPER END	GROUND ELEVATION LOWER END
301	CB 1	CBMH 2	0.23	0.87	0.20	0.20	10.00	121.93	**68.75**	0.5	375	1.12	80.0	1.19	**123.98**	**0.55**	217.23	216.83	218.50	218.50
302	CBMH 2	MH 3	0.23	0.79	0.18	0.38	11.19	112.78	**119.02**	0.8	375	1.42	35.5	0.42	**156.82**	**0.76**	216.80	216.52	218.50	218.66
303	Internal Courtyard	MH 3	0.54	0.78	0.42	0.42	10.00	175.36	**203.92**	1.0	450	1.79	8.3	0.08	**285.11**	**0.72**	216.10	216.01		
	MH 3	CBMH 6	0.00	0.00	0.00	0.80	11.60	109.95	**319.95**	1.5	525	2.43	42.1	0.29	**526.72**	**0.61**	216.37	215.73	218.66	217.45
304	CB 4	CBMH 5	0.04	0.43	0.02	0.02	10.00	121.93	**6.42**	0.5	250	0.86	21.8	0.42	**42.05**	**0.15**	216.18	216.07	217.70	217.45
305	CBMH 5	CBMH 6	0.04	0.82	0.03	0.05	10.42	118.46	**15.65**	0.5	250	0.86	5.7	0.11	**42.05**	**0.37**	216.04	216.01	217.45	217.45
306	CBMH 6	MH 7	0.02	0.90	0.02	0.86	11.89	108.09	**338.14**	0.7	600	1.82	15.7	0.14	**513.72**	**0.66**	215.66	215.55	217.45	217.43
	MH 7	MH8	0.00	0.00	0.00	0.86	12.04	107.19	**337.02**	0.7	600	1.82	26.8	0.25	**513.72**	**0.66**	215.52	215.33	217.43	217.66
307*	DICB9	MH8	0.60	0.25	0.15	0.15	10.00	175.36	**131.50**	2.0	375	2.25	10.5	0.08	**247.95**	**0.53**	215.77	215.56	217.00	217.66
	MH8	OGS	0.00	0.00	0.00	1.01	12.28	152.29	**429.47**	0.6	675	1.82	5.0	0.05	**651.12**	**0.66**	215.26	215.23	217.66	217.43
	OGS	CBMH10	0.00	0.00	0.00	1.01	12.33	151.90	**428.37**	0.6	675	1.82	5.0	0.05	**651.12**	**0.66**	215.20	215.17	217.43	217.05
	CBMH10	HW	0.00	0.00	0.00	1.01	12.37	151.52	**427.28**	0.6	675	1.75	46.1	0.44	**627.62**	**0.68**	215.11	214.85	217.05	

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CONSULTING ENGINEERS

2021-03-03

12 Henderson Avenue

STORM SEWER DESIGN SHEET - INCLUDING ASSUMED PHASE 2 BUILD OUT

PROJECT No.: 1241-4515
DESIGN: MJ/IC
CHECK: AS
UPDATED: 03/03/2021

FREQUENCY - 10 YEAR - CITY OF BRAMPTON RAINFALL INTENTSITIES (DWG. 343)			
Coef. A=	35.1	Coef. B=	-0.695
FREQUENCY - 100 YEAR - CITY OF BRAMPTON RAINFALL INTENTSITIES (DWG. 343)			
Coef. A=	51.3	Coef. B=	-0.686

TIME OF CONCENTRATION 10.00 min MANNINGS "n" 0.013

CATCHMENT AREA I.D.	FR MH NO	TO MH NO	RUN-OFF AREA (A) (Ha)	RUN-OFF COEFF (C_5)	RUN-OFF A x C	CUMMULATION A x C	TIME OF CONC. (min.)	I (mm/hr)	Q (RUNOFF) (l/sec)	PIPE SLOPE (%)	PIPE DIA. (mm)	VELOCITY (m/sec)	TIME LENGTH (m)	TIME OF FLOW (min)	CAPACITY (l/sec)	CAPACITY %	PIPE INVERT ELEVATION UPPER END	PIPE INVERT ELEVATION LOWER END	GROUND ELEVATION UPPER END	GROUND ELEVATION LOWER END
301	CB 1	CBMH 2	0.23	0.87	0.20	0.20	10.00	121.93	**68.75**	0.5	375	1.12	80.0	1.19	**123.98**	**0.55**	217.23	216.83	218.50	218.50
302	CBMH 2	MH 3	0.23	0.79	0.18	0.38	11.19	112.78	**119.02**	0.8	375	1.42	35.5	0.42	**156.82**	**0.76**	216.80	216.52	218.50	218.66
303	Internal Courtyard	MH 3	0.54	0.78	0.42	0.42	10.00	175.36	**203.92**	1	450	1.79	8.3	0.08	**285.11**	**0.72**	216.10	216.01	0.00	0.00
Future	MH 3	CBMH 6	0.42	0.85	0.36	1.15	11.60	109.95	**428.52**	1.5	525	2.43	42.1	0.29	**526.72**	**0.81**	216.37	215.73	218.66	217.45
304	CB 4	CBMH 5	0.04	0.43	0.02	0.02	10.00	121.93	**6.42**	0.5	250	0.86	21.8	0.42	**42.05**	**0.15**	216.18	216.07	217.70	217.45
305	CBMH 5	CBMH 6	0.04	0.82	0.03	0.05	10.42	118.46	**15.65**	0.5	250	0.86	5.7	0.11	**42.05**	**0.37**	216.04	216.01	217.45	217.45
306	CBMH 6	MH 7	0.02	0.90	0.02	1.22	11.89	108.09	**444.86**	0.7	600	1.82	15.7	0.14	**513.72**	**0.87**	215.66	215.55	217.45	217.43
	MH 7	MH8	0.00	0.00	0.00	1.22	12.04	107.19	**442.86**	0.7	600	1.82	26.8	0.25	**513.72**	**0.86**	215.52	215.33	217.43	217.66
Building	CB9	MH8	0.18	0.90	0.16	0.16	10.00	175.36	**183.32**	2	375	2.25	10.5	0.08	**247.95**	**0.74**	215.77	215.56	217.00	217.66
	MH8	OGS	0.00	0.00	0.00	1.38	12.28	152.29	**584.34**	0.6	675	1.82	5.0	0.05	**651.12**	**0.90**	215.26	215.23	217.66	217.43
	OGS	CBMH9	0.00	0.00	0.00	1.38	12.33	151.90	**582.85**	0.6	675	1.82	5.0	0.05	**651.12**	**0.90**	215.20	215.17	217.43	217.05
	CBMH9	HW	0.00	0.00	0.00	1.38	12.37	151.52	**581.37**	0.6	675	1.75	46.1	0.44	**627.62**	**0.93**	215.11	214.85	217.05	0.00

CROZIER
CONSULTING ENGINEERS

Project: 12 Henderson Ave.
Project No.: 1241-4515
File: SWM Pond Sizing
Design: IC
Date: 2020.01.30
Check: BW

Dry Pond Water Quality Volume Comparison

MOE Stormwater Management Planning and Design Manual, March 2003
Per MOE Table 3.2, Dry Pond To Provide 60% TSS Removal - 48hr Drawdown of ED

Water Quality Volume = 167 m^3/ha * based on 60% Impervious Level (Interpolated)

25 mm/hr Storm - Extended Detention Calculation

Rainfall Depth = 25 mm
Base Runoff = 15.5 mm Runoff volume from 25mm SWMHYMO Model for 2.87 ha upstream drainage area

Total Contributing Area = 2.87 ha
Impervious Level = 60 %

Extended Detention = 167 m^3/ha * 2.87 ha *per MOECC Table 3.2 (Interpolated)
= **479 m^3**

Extended Detention = 15.5 mm * 28,700 m^2 * 0.001 *per 25mm runoff volume from contributing area
= **445 m^3**

CROZIER
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Project: 12 Henderson Ave.
Project No.: 1241-4515
File: Infiltration Trench Sizing
Design: IC
Date: 2020.02.06
Check: BW

Infiltration Trench Water Quality Volume Calculation

MOE Stormwater Management Planning and Design Manual, March 2003
Per MOE Table 3.2, Infiltration Trench To Provide 80% TSS Removal - 48hr Drawdown of ED

Water Quality Volume = 32 m^3/ha * based on 60% Impervious Level (Interpolated)

Total Contributing Area = 2.87 ha
Impervious Level = 60 %

Infiltration Trench Volume = 32 m^3/ha * 2.87 ha *per MOECC Table 3.2 (Interpolated)
= **91 m^3**

CROZIER
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PROJECT: 12 Henderson Ave.
PROJECT No.: 1241-4515
FILE: Infiltration Trench Design
DATE: 2019.05.02
Revised: 2021.07.05
Design: IC
Check: JS

12 HENDERSON AVE. INFILTRATION TRENCH DESIGN SHEET

Impervious Area$_1$ (ha)	1.74
Rainfall Event (mm)	5
Water Balance Volume$_2$ (m^3)	**87**
Water Quality Volume$_3$ (m^3)	**91**

Soil Infiltration rate$_4$ (mm/hr)	15
Safey Factor	2.5
Soil Infiltration Rate As Designed$_5$ (P, mm/hr)	**6**

Maximum Drawdown Time (t_s, hr)	48
Pit Void Ratio (V_r)	0.4

Depth As Designed (m)	0.34
Bottom Area of Trench (A, m^2)	319.20
Width of Pit (m)	3.80
Length of Pit (m)	84.00
Subsurface Volume Provided (m^3)	43.41
Surface Volume Provided (m^3)	47.88
Total Volume Provided (V, m^3)	**91.3**
Time to Drain (hr)	**47.7**

Notes:

1. Imperivous Area equivalent to the total imperivous cover on site.
2. Water Balance Volume is based on retention of the first 5 mm of rainfall over the impervious area on site according to CVC requirements.
3. Water Quality Volume is based on Table 3.2 of the MECP SWM Planning and Design Manual (2003) for 80% TSS removal.
4. Soil Infiltration Rate based on the Geotechnical Investigation and Hydrogeological Study prepared by GeoPro Consulting Limited, dated January 7, 2015.
5. A safety factor of 2.5 was used for the as-designed infiltration rate and as recommended in the Geotechnical Investigation and Hydrogeological Studfy prepared by GeoPro Consulting Limited, dated January 7, 2015.

Equations:

Time to Drain

$$\Delta t = \frac{1000V}{PnA}$$

Stormceptor

Stormceptor EF Sizing Report

ESTIMATED NET ANNNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

Province:	Ontario
City:	Brampton
Nearest Rainfall Station:	TORONTO CENTRAL
NCDC Rainfall Station Id:	0100
Years of Rainfall Data:	18
Site Name:	
Drainage Area (ha):	1.51
% Imperviousness:	78.00
Runoff Coefficient 'c':	0.76
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Require Hydrocarbon Spill Capture?	No
Upstream Flow Control?	No
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	18.22
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	12 Henderson
Project Number:	1241-4515
Designer Name:	Isabelle Cleroux
Designer Company:	C.F. Crozier & Associates
Designer Email/Phone:	icleroux@cfcrozier.ca
EOR Name:	
EOR Company:	
EOR Email/Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	70
EF6	81
EF8	87
EF10	89
EF12	91

Recommended Stormceptor EF Model: EF6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 81

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

▶ **Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

▶ **Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

▶ The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor

Stormceptor EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	53.7	53.7	3.22	193.0	74.0	90	48.3	48.3
2	16.9	70.6	6.45	387.0	147.0	83	13.9	62.3
3	8.6	79.2	9.67	580.0	221.0	74	6.4	68.7
4	6.4	85.6	12.90	774.0	294.0	68	4.3	73.0
5	3.1	88.7	16.12	967.0	368.0	62	1.9	74.9
6	2.0	90.7	19.34	1161.0	441.0	58	1.2	76.1
7	1.5	92.2	22.57	1354.0	515.0	57	0.9	76.9
8	0.7	92.9	25.79	1547.0	588.0	56	0.4	77.3
9	1.8	94.7	29.02	1741.0	662.0	56	1.0	78.3
10	1.3	96.0	32.24	1934.0	735.0	55	0.7	79.0
11	0.9	96.9	35.46	2128.0	809.0	55	0.5	79.5
12	0.4	97.3	38.69	2321.0	883.0	55	0.2	79.7
13	0.4	97.7	41.91	2515.0	956.0	54	0.2	80.0
14	0.4	98.1	45.13	2708.0	1030.0	54	0.2	80.2
15	0.2	98.3	48.36	2902.0	1103.0	55	0.1	80.3
16	0.0	98.3	51.58	3095.0	1177.0	56	0.0	80.3
17	0.0	98.3	54.81	3288.0	1250.0	57	0.0	80.3
18	0.2	98.5	58.03	3482.0	1324.0	58	0.1	80.4
19	0.0	98.5	61.25	3675.0	1397.0	59	0.0	80.4
20	0.0	98.5	64.48	3869.0	1471.0	56	0.0	80.4
21	0.0	98.5	67.70	4062.0	1545.0	54	0.0	80.4
22	0.0	98.5	70.93	4256.0	1618.0	51	0.0	80.4
23	0.0	98.5	74.15	4449.0	1692.0	49	0.0	80.4
24	0.4	98.9	77.37	4642.0	1765.0	47	0.2	80.6
25	0.0	98.9	80.60	4836.0	1839.0	45	0.0	80.6

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Stormceptor

Stormceptor EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.2	99.1	83.82	5029.0	1912.0	43	0.1	80.7
27	0.0	99.1	87.05	5223.0	1986.0	42	0.0	80.7
28	0.0	99.1	90.27	5416.0	2059.0	40	0.0	80.7
29	0.2	99.3	93.49	5610.0	2133.0	39	0.1	80.8
30	0.0	99.3	96.72	5803.0	2206.0	38	0.0	80.8
31	0.0	99.3	99.94	5996.0	2280.0	36	0.0	80.8
32	0.2	99.5	103.17	6190.0	2354.0	35	0.1	80.8
33	0.2	99.7	106.39	6383.0	2427.0	34	0.1	80.9
34	0.0	99.7	109.61	6577.0	2501.0	33	0.0	80.9
35	0.0	99.7	112.84	6770.0	2574.0	32	0.0	80.9
36	0.0	99.7	116.06	6964.0	2648.0	32	0.0	80.9
37	0.0	99.7	119.28	7157.0	2721.0	31	0.0	80.9
38	0.0	99.7	122.51	7351.0	2795.0	31	0.0	80.9
39	0.0	99.7	125.73	7544.0	2868.0	30	0.0	80.9
40	0.0	99.7	128.96	7737.0	2942.0	28	0.0	80.9
41	0.0	99.7	132.18	7931.0	3016.0	28	0.0	80.9
42	0.0	99.7	135.40	8124.0	3089.0	28	0.0	80.9
43	0.0	99.7	138.63	8318.0	3163.0	27	0.0	80.9
44	0.0	99.7	141.85	8511.0	3236.0	26	0.0	80.9
45	0.0	99.7	145.08	8705.0	3310.0	25	0.0	80.9
46	0.0	99.7	148.30	8898.0	3383.0	25	0.0	80.9
47	0.2	99.9	151.52	9091.0	3457.0	24	0.0	80.9
48	0.0	99.9	154.75	9285.0	3530.0	24	0.0	80.9
49	0.0	99.9	157.97	9478.0	3604.0	23	0.0	80.9
50	0.0	99.9	161.20	9672.0	3677.0	23	0.0	80.9
Estimated Net Annual Sediment (TSS) Load Reduction =								81 %

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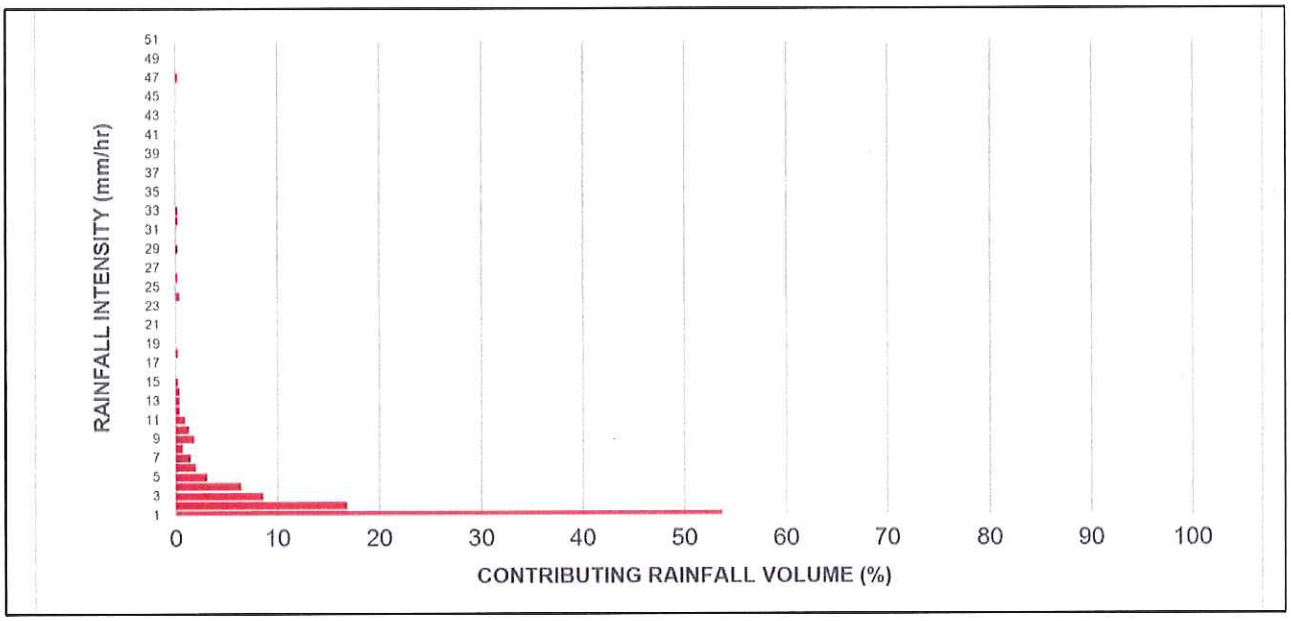
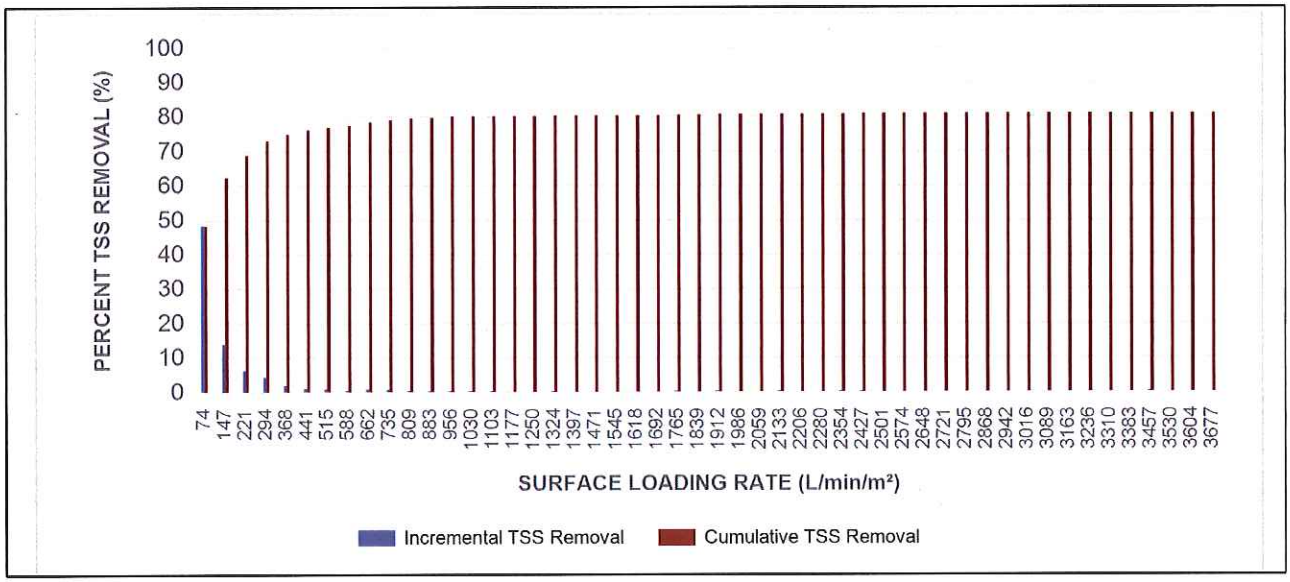
RAINFALL DATA FROM TORONTO CENTRAL RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

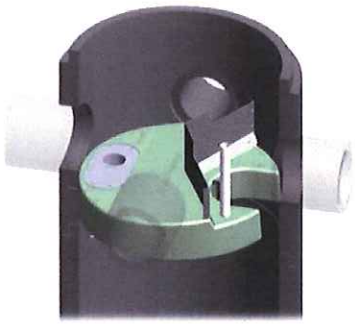
▶ **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

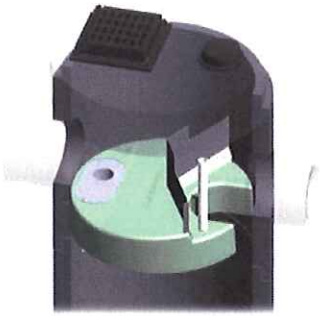
DESIGN FLEXIBILITY

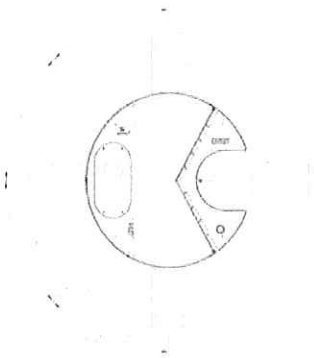
▶ **Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

▶ While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

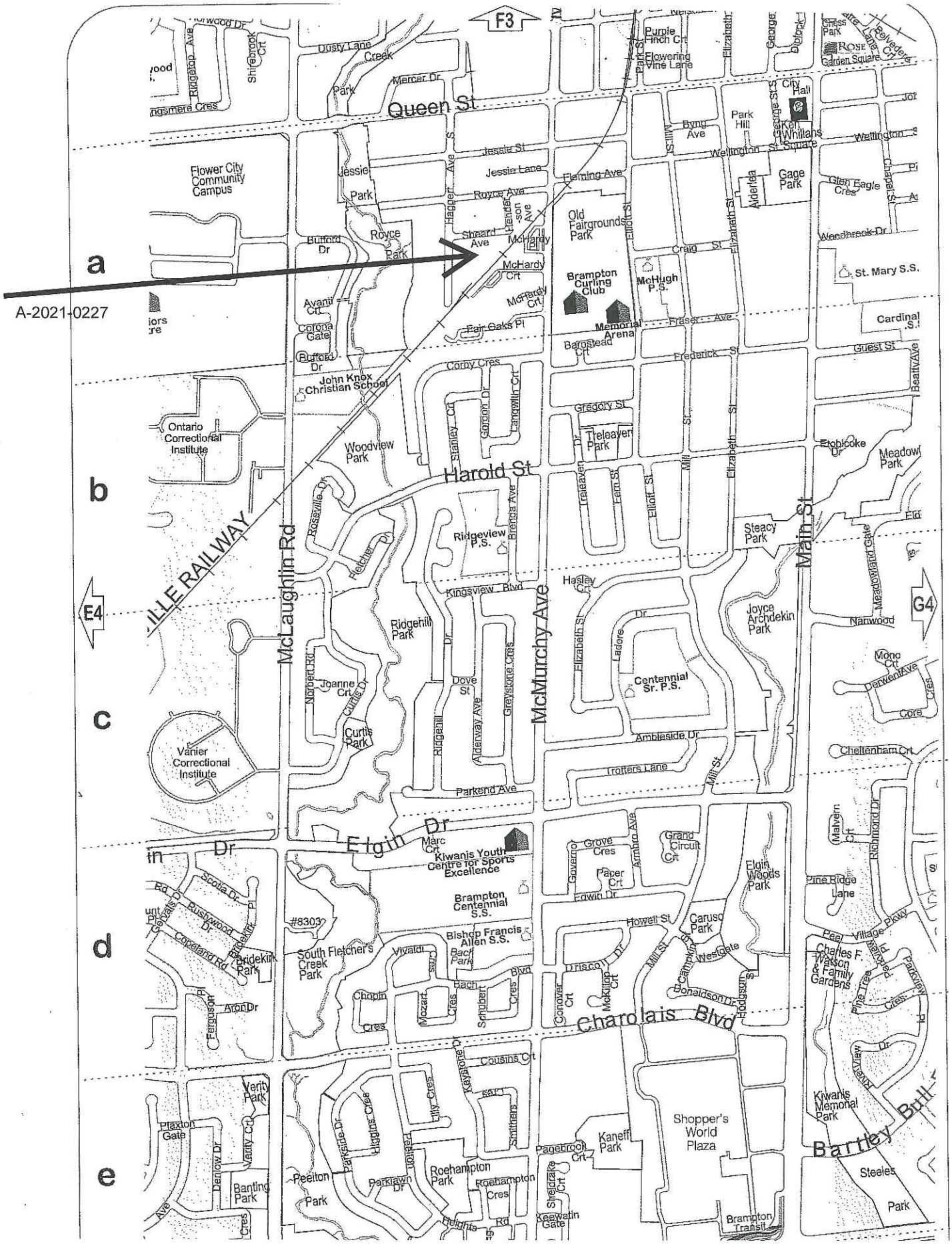
Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef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a
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F3
E4
G4
Queen St
Harold St
Elgin Dr
Charolais Blvd
Bartley Bull
McLaughlin Rd
McMurchy Ave
Main St
Dusty Lane
Creek
Park
Mercer Dr
Flower City Community Campus
Jessie Park
Jessie St
Jessie Lane
Fleming Ave
Royce Park
Royce Ave
Haggert Ave
Chamberlain Ave
Shaard Ave
McHardy Blvd
McHardy Crt
Butford Dr
Avanti Crt
Corona Gate
Fair Oaks Pl
John Knox Christian School
Ontario Correctional Institute
Vanier Correctional Institute
Woodview Park
Corny Cres
Stanley Crt
Gordon Dr
Langwith Crt
Gregory St
Rosedale Dr
Fletcher Dr
Ridgeview P.S.
Brenda Ave
Kingsview Blvd
Ridgehill Park
Norbert Rd
Joanne Crt
Curtis Dr
Curtis Park
Dove St
Greystone Cres
Ridgehill Dr
Aldenway Ave
Parkend Ave
Marc Crt
Kiwanis Youth Centre for Sports Excellence
Brampton Centennial S.S.
#8303
Bishop Francis Allen S.S.
South Fletcher's Creek Park
Vivaldi Cres
Bach Park
Bach Blvd
Chopin Cres
Mozart Cres
Schubert Cres
Cousins Crt
Kaylstone Cres
Lily Cres
Smithers Cres
Higgins Cres
Parkside Dr
Parkdawn Dr
Roehampton Park
Roehampton Cres
Heights Rd
Peelton Park
Verity Park
Verity Crt
Plaxton Gate
Denlow Dr
Banting Park
Scotia Dr
Rushwood Dr
Copeland Rd
Bridekirk Park
Ferguson Pl
Aron Dr
Old Fairgrounds Park
Brampton Curling Club
McHugh P.S.
Memorial Arena
Barnstead Crt
Elliott St
Craig St
Frederick St
Guest St
Beatty Ave
Theleaven Park
Theleaven Dr
Cam St
Mill St
Elizabeth St
Etobicoke Dr
Meadowland Park
Steacy Park
Hasley Crt
Ladore Dr
Elizabeth St
Centennial Sr. P.S.
Joyce Archdekin Park
Nanwood Dr
Mono Crt
Derwent Ave
Core Cres
Ambleside Dr
Trotters Lane
Mill St
Cheltenham Crt
Malvern Crt
Richmond Dr
Pine Ridge Lane
Elgin Woods Park
Grove Cres
Governor Ambro Ave
Grand Circuit Cres
Pacer Crt
Edwin Dr
Howell St
Caruso Park
Driscoll Dr
McKillop Crt
Mill St
Bramkirk Dr
Westgate
Donaldson Dr
Hodgson Pl
Condrac Crt
Charles F. Parkson Family Gardens
Pine Tree Dr
Parkview Cres
Kiwanis Memorial Park
Shopper's World Plaza
Kaneff Park
Pagebrook Crt
Sheldrake Crt
Keewatin Gate
Brampton Transit
Steeles Park
Rose Garden Square
City Hall
Ken Whillans Square
Park Hill
Byng Ave
Wellington St
George St
Gage Park
Alderlea
Glen Eagle Cres
Chapel St
Woodbrook Dr
St. Mary S.S.
Cardinal
Purple Finch Crt
Flowering Vine Lane
Park St
Elizabeth
Diblork
Belvedere Cres
Chess Park
Ridgetop Ave
Shirebrook Crt
Ringsmere Cres