Industrial Building Development
James Snow Parkway North
Milton, Ontario

FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

Prepared for:

Emery Investments

Prepared by:

MGM Consulting Inc.
555 Industrial Drive
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Milton, Ontario
L9T 5E1

File No. 2022-024
Site Plan No.: TBD

Date: November 25, 2022

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Figures

Appendices

1. INTRODUCTION

MGM Consulting Inc. has been retained to prepare a Functional Servicing and Stormwater Report to address the site-specific infrastructure required to support a proposed Rezoning Application for the redevelopment of a property located at 7260 No. 5 Sideroad in the Town of Milton.

The legal description of the subject lands is Part 16 of Lot 5, Concession 2, Registered Plan No 20R-20039, Town of Milton, Regional Municipality of Halton.

2. EXISTING CONDITIONS AND DEVELOPMENT LIMITS

The subject site has an area in the order of 1.382 ha, proposed for redevelopment. The site is within the Escarpment Business Community West, Phase 1 Lands located immediately east of the roundabout where it intersects No 5 Side Road and James Snow Parkway North in the Town of Milton. The site abuts No 5 Side Road to the north, James Snow Parkway to the south, and new industrial development to the west. The site is currently covered with vegetation and a low channel running east-west to convey drainage from the subject site toward the north roadside ditch of James Snow Parkway.

Storm runoff from the subject site was included in the design of SWM pond S34 which provides stormwater quality, quantity and erosion controls, consistent with the requirements of the governing sub-watershed study. The SWM pond facility designed by Valdor Engineering Ltd. was approved by the Town of Milton, Conservation of Halton and the Ministry of Transportation. The facility was constructed in 2011 and is currently functioning consistent with the approved design.

The existing site location and drainage areas are indicated in Figures No. 1

The subdivision storm drainage plan is included in Appendix E

The subdivision Functional Servicing Report is included in Appendix G

3. PROPOSED DEVELOPMENT SCENARIO

The proposed development includes the construction of two one-storey industrial buildings and surface parking areas surrounded by landscaped areas and two vehicular accesses off of No 5 Side Road and one vehicular access off of James Snow Parkway North. The proposed site development and drainage areas are indicated in Figure No. 2.

4. PROPOSED GRADING AND DRAINAGE

The proposed site grading will take into account the existing topography and perimeter elevations, as required to accommodate the proposed building finish floor elevation, provide safe vehicular and pedestrian access, and provide minimum cover on storm servicing as required for frost protection. Slopes within the paved areas of the site will typically be set between 1% and 5%. Grading will also be completed such that the majority of the storm drainage from the development area will be contained with storm runoff being conveyed to proposed on-site catchbasins, swales, and an internal storm system outletting to the existing storm sewer within the James Snow Parkway right of way.

As indicated on the appended Site Servicing Plan – CV3, drainage from the building roof is proposed to be directed to infiltration pits as required to achieve water balance objectives. Redirection of clean roof water will promote groundwater recharge. Any overflow from the pits at MH15 is to be conveyed to the proposed internal storm system.

Proposed site grading is indicated on the Site Grading Plan, Drawing No. CV-2.

Emergency overland during severe storm events, or when an outlet is blocked, will be to the James Snow Parkway North right of way at an elevation of 220.80 m through the southeast corner of the site.

5. PROPOSED STORMWATER MANAGEMENT

Proposed stormwater management controls for the site have been completed based on the proposed redevelopment area of 1.382ha. and a runoff coefficient of 0.75 as allowed for in the design for the James Snow Parkway storm system, and SWM Pond S34. The following summarizes the proposed minor and major storm drainage systems, and the stormwater management features proposed for the subject site. Detailed calculations supporting the selection of proposed storm servicing and stormwater management are included in **Appendix A**.

Water Quantity Storage Requirements

The stormwater management design has been based on reducing flows from the site to below the peak flows during the 2 to 100-year storm event based on a runoff coefficient of 0.75 as per subdivision drainage area to SWM pond S34. Site drainage is conveyed to SWM pond S34 via regional storm sewer on James Snow Parkway which has been designed to convey a 10-year storm event. Based on the storm drainage areas, the storm sewer system was designed to accept storm drainage from the subject site having an area of 1.51ha and a runoff coefficient of 0.75. Subdivision drainage areas and storm sewer drainage areas have been included in **Appendix E.**

Pre and post-development storm drainage areas for the site are included in **Figures 2 and 3**.

Water Quality Requirement

Stormwater quality controls are proposed as required to remove an estimated 80% of the total suspended solids, on an annual loading basis.

5.1 Proposed Minor Storm System

The proposed minor system has been designed to convey the 5-year flow, without surcharging, which is consistent with current Town of Milton standards. The internal storm systems will consist of a series of underground storm sewers, manholes and catchbasins as indicated on the attached Site Servicing Plan-CV2

A storm design sheet for the components of the proposed internal storm system is included in Appendix A

5.2 Proposed Major Storm System

Major storm flows from the site are to be conveyed to James Snow Parkway right of way through the south-east corner of the site at an elevation of 220.80m. This elevation is 900 mm below the lowest proposed building finish floor elevation. Perimeter elevations surrounding attenuated areas of the site have been set at a minimum elevation of 221.00 m to ensure conveyance of overland flow to the municipal right of way and contain major site flow without impacting adjacent properties.

5.3 Proposed Stormwater Rate Controls and Site Storage

The stormwater rate controls objective is to control post-development flows from the site to the peak flow during 2 to 100-year storm events based on a runoff coefficient of 0.75. Based on a site area of 1.382 ha, the weight average site runoff coefficient is calculated as follows:

Site Feature	"c"	Area (ha)
Conv. roof	0.95	0.314
Landscaped	0.25	0.567
Paved Areas	0.90	0.501
Total	**0.64**	**1.382**

Based on the above, the post-development average runoff coefficient is below the design coefficient used in the subdivision design, and as such peak rate storm controls are not being proposed. The internal storm servicing is proposed to connect to the existing storm sewer system on James Snow Parkway North at an existing manhole with an available invert elevation of 218.10.

Detailed Stormwater Management Calculations are included in **Appendix A**.

5.4 Proposed Storm Water Quality Controls

The current stormwater quality control objective is to provide an “enhanced” level of treatment which is equivalent to removing 80% of the total suspended solids from the site runoff on an annual loading basic. Quality controls for developments within the Escarpment Business Community West are provided within the downstream stormwater management pond which has been designed to provide quality treatment for all site developments within the subdivision. Additional stormwater quality controls for drainage from the parking area and driveway of the site are to be provided with the installation of a package treatment unit, installed at the downstream end of the proposed internal storm system before outletting to the municipal storm system.

A Stormceptor Model EF4 is proposed to assist in achieving additional sediment filtering. Based on the manufacturer’s modelling software, the selected unit has been designed to provide the removal of an estimated 94% of the Total Suspended Solids.

In the effort of integrating LID measures under the post-development condition, infiltration pits are proposed to promote groundwater infiltration. The location of infiltration pit is located east of the proposed building.

Output from the manufacturer’s modelling software used to select the proposed package treatment unit is included in **Appendix C**.

6. SEDIMENT AND EROSION CONTROLS DURING CONSTRUCTION

In 2019, Toronto and Region Conservation Authority (TRCA) under the Sustainable Technology Program (STEP) prepared a guideline entitled "Toronto and Region Conservation Authority (TRCA). 2019. Erosion & Sediment Control Guideline for Urban Construction. Toronto and Region Conservation Authority, Vaughan, Ontario". Based on the guideline, all projects involving the removal of topsoil or site alteration require an Erosion and Sediment Control (ESC) Plan in place prior to commencing construction. Failure to adhere to the plan could lead to the potential for prosecution under various environmental legislations.

The following principles assist in creating an effective ESC Plan.

(Ref. Erosion and Sediment Control Guidelines for Urban Construction, 2019)

- Adopt a multi-barrier approach to provide erosion and sediment control through erosion controls first.
- Retain existing ground cover and stabilize exposed soils with vegetation where possible.
- Stabilize bare soil areas that are inactive for 30 days or longer.
- Reducing flow velocities and flow runoff using flow interrupters (e.g check dams) & erosion controls (e.g vegetation).

- Limit the duration of soil exposure and phase construction where possible.
- Limit the size of disturbed areas by minimizing nonessential clearing and grading.
- Minimize slope length (>30m) and gradient (>10%) of disturbed areas.
- Maintain overland sheet flow and avoid concentrated flows.
- Store/stockpile soil away (e.g. greater than 15 meters) from watercourses, drainage features and top of steep slopes.
- Ensure contractors and all involved in the ESC practices are trained in ESC Plan, implementation, inspections, maintenance, and repairs.
- Adjust ESC Plan at the construction site to adapt to site features.
- Assess all ESC practices before and after all rainfall and significant snowmelt events.

7. PROPOSED SANITARY SERVICING

Sanitary servicing is proposed with a 200mm connection to the existing 300mm sanitary sewer located within James Snow Parkway right of way. Based on the available invert elevation of 216.00m a gravity sewer connection can be provided to both buildings. Gravity sanitary servicing is proposed beyond the building envelopes as indicated on the Site Servicing Plan, Drawing No. CV-3.

The proposed sanitary flow calculation has been attached in **Appendix D**.

8. PROPOSED WATER SERVICING

A preliminary calculation for the required water demand for fire protection and domestic supply is included in **Appendix B**. The proposed water supply requirements are calculated in accordance with the Fire Underwriter Survey.

As indicated, the estimated domestic water consumption of 1.24 L/s is required to service the proposed development. The maximum daily demand plus fire flow is calculated as 67.90 L/sec which is the flow that is required to be available at a local hydrant at a minimum pressure of 140 KPa. Fire protection for the proposed buildings will be provided by existing fire hydrants located along of north side of James Snow Parkway and the new hydrant proposed onsite. The final location of the domestic water service connections will be confirmed during the detailed design phase.

Due to the service watermain fronting the site on James Snow Parkway is not yet in commission, a pressure test has been completed on the nearest hydrants on the service watermain at James Snow Parkway and Mount Pleasant Way intersection. The result of theoretical flow at 20 psi (140kPa) indicates an available flow of 9200 usgpm (34800 L/min) at the existing hydrant which satisfies the minimum required flow for the development.

The fire hydrant test result is included in **Appendix F**.

A new 150mm fire line & 100mm domestic are proposed to adequately provide fire protection and domestic water supply to the site via a 200mm connection to the existing 300mm watermain on James Snow Parkway right of way. The construction of 300mm watermain on James Snow Parkway right of way has been completed but are not commissioned.

9. SUMMARY

The following summarizes the proposed site works as required to accommodate the proposed site redevelopment:

- Site grading can be completed taking into account perimeter elevations, and as required to accommodate the proposed building finish floor elevation, provide safe vehicular and pedestrian access and provide minimum cover on storm servicing as required for frost protection, convey storm flows to proposed drainage features and to safely convey major storm flows to the adjacent municipal right of way,
- Storm drainage is provided to contain site drainage, convey minor storm flows to the existing municipal storm system, and as required to convey the 5-year storm flows without surcharging,
- Stormwater management peak flow objectives can be achieved with the current proposed runoff coefficient below the subdivision designed runoff coefficient of 0.75 for the 2-100 year flow.
- Stormwater quality controls are proposed to be achieved using a package treatment unit, and additional treatment at the downstream SWM pond,
- Sanitary service for the development is proposed with a 250mm connection to the existing 300mm sanitary sewer on James Snow Parkway Right of way.
- Water service for the development is proposed with 100mm domestic line and 150mm fire line from 200mm connection to existing 300mm watermain on James Snow Parkway right of way.
- Sediment and erosion controls as indicated in the Removals/Sediment and Erosion Control Plan are to be implemented prior to construction and maintained until the site is stabilized.

Prepared by:

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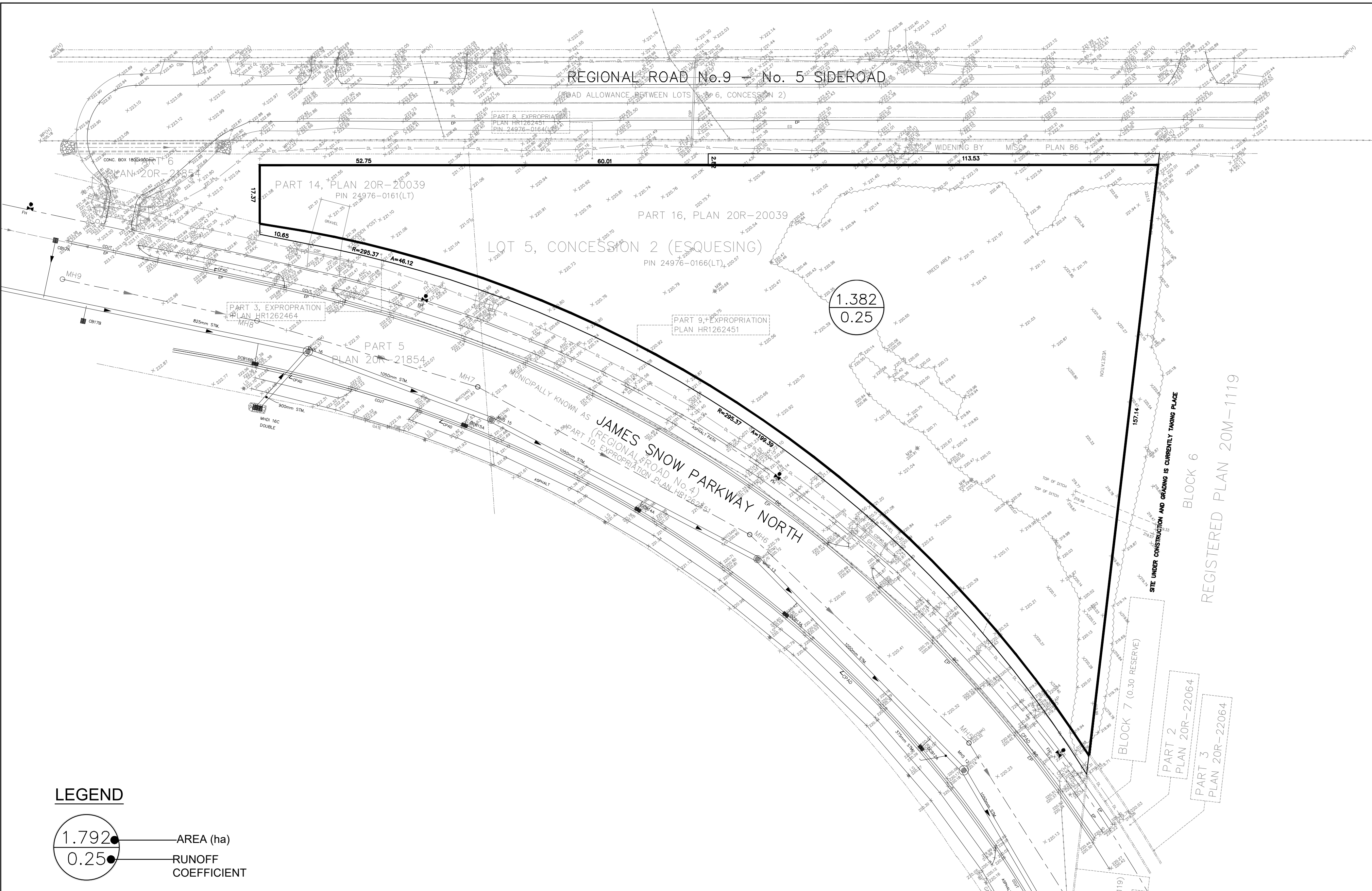
Calvin Dang, B.Eng

M.L. Stairs, P.Eng.



JAMES SNOW PARKWAY NORTH DEVELOPMENT

MILTON, ON

PRE-DEVELOPMENT DRAINAGE AREAS

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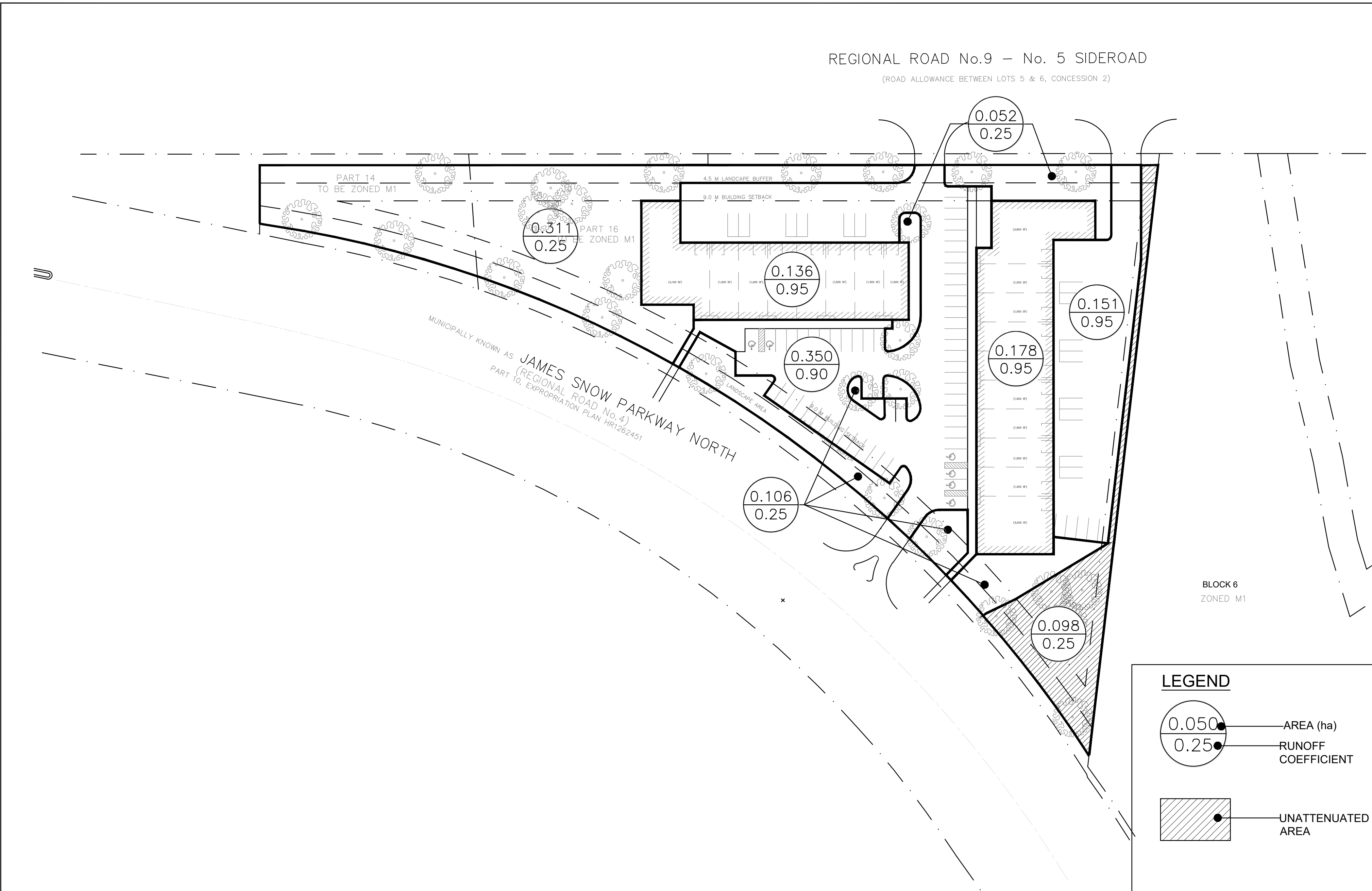
FIGURE 1

DATE: NOV-2022
SCALE: 1:1000
DWG # 2022-024-C2



JAMES SNOW PARKWAY NORTH DEVELOPMENT

MILTON, ON

POST-DEVELOPMENT DRAINAGE AREAS

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FIGURE 2

DATE: SEPT 2020

SCALE: 1:1000

DWG # 2019-070-C4

APPENDIX A

STORMWATER MANAGEMENT CALCULATIONS

INDUSTRIAL DEVELOPMENT
JAMES SNOW PARKWAY NORTH, MILTON, ON
STORMWATER MANAGEMENT CALCULATIONS

1.0 Drainage Area Characteristics

1.1 Existing Drainage Areas (see Figure No. 1):

	"c"	Area (ha)
Attenuated Areas:		
Landscaped Area	0.25	1.382
Sub Total	**0.25**	**1.382**
Total Area		**1.382**
Runoff Coefficient (Entire Site)		**0.25**

1.2 Proposed Drainage Areas (see Figure No. 2):

	"c"	Area (ha)
Attenuated Areas:		
Building	0.95	0.314
Paved Area	0.90	0.501
Landscaped Area	0.25	0.469
Sub Total	**0.67**	**1.284**
Unattenuated Areas:		
Landscaped Area	0.25	0.098
Sub Total	**0.25**	**0.098**
Total Area		**1.382**
Runoff Coefficient (Entire Site)		**0.64**

2.0 Allowable Post Development Flows

Subject site is part of the inductrial lot within the Escarpment Business Community West Subdivision (EBC West) in Milton, Ontario. A storm water management pond S34 has been designed for the above subdivision which provided stormwater quality, quantitty and erosion controls. consistent with the requirements of the governing watershed study. The subdivition storm sewer design and the design of the dowwnstream SWM facility were completed based on site being developed with an overall imperviousness of 0.75.
The post development runoff coefficient as shown in Section 1.2 is below the design runoff coefficient. Therefore, rate control is not proposed to the site.

3.0 Rooftop Controlled Flow Calculations

There is no roof control proposed to the development

4.0 Water Balance Calculations

Water balance objectives are proposed to be achieved in soft landscaped areas, and through infiltration via proposed infiltration pit, is as follows:

7.1 Water balance calculations:

Proposed infiltration feature dimension = 9x15x0.7(m)=	94.5	cu.m.
Volume of storage base inside infiltration pit =	37.8	cu.m.
Equivalent depth of water over site area =	2.7	mm.

Estimated water balance achieved in soft landscaped areas and areas of permeable pavement are as follows:

Surface Construction	Area (ha)	Initial Abstraction (mm)	Prorated Depth over Site Area
Pavement	0.815	0.5	0.3
Soft Landscaping	0.567	5	2.1

Based on the above, the total water balance provided by the proposed features is approxim **5.1 mm.**

The estimated time to infiltrate water contained within the infiltration trench is as follows:

Depth of trench =	500	mm		
Average "T" time =	57.00	min/cm. (to be confirmed by the Geotechnical Engineer)		
Time to infiltrate =	2850	min =	**47.5**	hours

MGM CONSULTING INC.
STORM SEWER DESIGN SHEET

Project No.:	2022-024		
Subdivision:			
Date:	22-Nov-22	Revised:	
Des. By:	CD	Chk. By:	

Location				Areas		A * C			Rainfall			Sewer Design						Surcharge
Manhole from	Invert m.	Manhole to	Invert m.	Area ha	Cumulative Area ha	Coefficent C	Incremental A * C	Cumulative A * C	Time min	Intensity 5-year mm/hr.	Q Total cms	Equiv. Circ. Pipe Diameter mm.	Slope %	Max. Flow Q cap cms	Max Velocity V max m./sec.	Length m.	Time in Section min.	Actual Flow to Max. Allowable Flow Ratio %
CBMH11		MH10		0.086	0.086	0.90	0.077	0.077	10.0	105.3	0.023	250	0.50	0.042	0.86	51.8	1.01	54%
AD1-AD2		MH10		0.035	0.035	0.31	0.011	0.011	10.0	105.3	0.003	150	1.00	0.015	0.86	29.3	0.57	21%
MH10		CBMH9			0.121			0.088	11.0	100.1	0.025	250	1.00	0.060	1.21	18.6	0.26	41%
CBMH9		CBMH8		0.059	0.180	0.79	0.047	0.135	11.3	98.9	0.037	250	1.00	0.060	1.21	21.0	0.29	62%
Building 2		CBMH8		0.178	0.178	0.95	0.169	0.169	10.0	105.3	0.049	300	1.00	0.097	1.37	8.9	0.11	51%
CBMH8		MH2		0.066	0.424	0.79	0.052	0.356	11.5	97.6	0.097	375	0.90	0.167	1.51	26.9	0.30	58%
CB7		CBMH6		0.080	0.080	0.90	0.072	0.072	10.0	105.3	0.021	250	0.50	0.042	0.86	29.4	0.57	50%
CBMH6		CBMH5		0.051	0.131	0.90	0.046	0.118	10.6	102.3	0.034	300	0.50	0.068	0.97	28.5	0.49	49%
CBMH5		CBMH4		0.021	0.152	0.90	0.019	0.137	11.1	99.9	0.038	300	0.50	0.068	0.97	31.9	0.55	55%
CBMH4		CBMH3		0.052	0.204	0.25	0.013	0.150	11.6	97.3	0.041	300	0.50	0.068	0.97	39.9	0.69	59%
CBMH3		MH2		0.079	0.283	0.78	0.062	0.212	12.3	94.3	0.056	300	0.50	0.068	0.97	15.4	0.26	81%
CB12		CBMH13		0.280	0.280	0.25	0.070	0.070	10.0	105.3	0.020	250	0.50	0.042	0.86	29.5	0.57	49%
CBMH13		CBMH14		0.020	0.300	0.48	0.010	0.080	10.6	102.3	0.023	250	1.00	0.060	1.21	26.8	0.37	38%
Building 1		CBMH14		0.136	0.136	0.95	0.129	0.129	10.0	105.3	0.038	250	1.00	0.060	1.21	29.5	0.41	63%
CBMH14		MH2		0.099	0.535	0.74	0.073	0.282	10.9	100.4	0.079	375	0.50	0.124	1.12	13.7	0.20	63%
MH2		OGS			1.242			0.849	12.6	93.2	0.220	450	2.00	0.404	2.54	2.8	0.02	55%
OGS		MH1			1.242			0.849	12.6	93.2	0.220	450	2.00	0.404	2.54	2.8	0.02	54%
MH1		EX. STM-MH			1.242			0.849	12.6	93.1	0.220	450	1.00	0.286	1.80	30.0	0.28	77%

n = 0.013

5 Year Rainfall Coefficient

A = 959

B = 5.7

C = 0.8024

APPENDIX B

WATER DEMAND & FIRE CALCULATIONS

Fire Flow Calculation

The FUS requires that a minimum water supply source 'F' be provided at 140 kPa
The min flow 'F' can be calculated as such:

$F=220C\sqrt{A}$
where:
F- Required fire flow in L/min
C- Coefficient related to construction
A- Total area in sq.m

C = 0.8 (Non-Combusitble construction)

For non-combustible construction, the area shall be a total of all floors (excluding basements at least 50 percent below grade) in the building being considered.

A = 1756 sq.m (largest building onsite)

Therefore,

F= 7375.2 L/min
= 7000 L/min (rounded to nearest 1000)

Reduction Factors:

F'=F*f1*f2

where:
f1- Occupancy factor
Low hazard occupancy, f1 = 25%

Therefore, the reduction due to low hazard occupancy = 1750 l/min.
and F = **5250** l/min

f2- Sprinkler protection factor

Based on automated sprinkler system & standard water supply, maximum reduction = 40%

Reduction = **2100** L/min

Exposure Factors:
F" = F'*f3
where:
f3- Exposure factor not to exceed 75%

Separation between subject building and other structures, and associated charges are as follows:

	Distance (m)	Charge
North Side	Road, >30	0%
South Side	Road, >30	0%
East Side	>30	0%
West Side	17	15%

Total	**15%**

The total increase for exposures is 15%
and the increase due to exposures = 787.5

The resulting required minimum flow, F = **3937.5** l/min

Therefore a minimum flow of approximately **4000** L/min must be available
at the nearest hydrant with a minimum pressure of 140 kPa.

Note: This fireflow calculation has been prepared as a guide only. Confirmation should be obtained from a Fire Protection professional for confirmation

Appendix B
Industrial Building
Town Of Milton
Regional of Halton

Site Redevelopment
Water Demand Calculations

Date: November 10, 2022

According to the Region of Halton Design Guildlines for Drinking Water System

Connection Point – Main Street					
		Industrial			
Total equivalent population to be serviced		173	persons		
Industrial Per Capital Demand (L/ha/Day)		34.375	m3/ha/day		
Total Lands to be Serviced		1.382	ha		
Hydrant Flow Test Location					
	Hydrant Flow Test Location				
				Pressure (kPa)	Time
Minimum water pressure				N/A	
Maximum water pressure				N/A	

No.	Water Demands			
	Demand type	Demand (units)		
		Use 1	Use 2	Total
1	Average day flow (l/s)	0.550	0	0.550
2	Maximum day flow (l/s)	1.24	0	1.24
3	Peak hour flow (l/s)	1.24	0	1.24
4	Fire Flow (l/s)	66.67	0	66.67
Analysis				
5	Maximum day plus fire flow (l/s)			67.90
6	Peak hour flow (l/s)			1.24
7	Maximum demand flow (l/s)			67.90

Note: Fire flow calculated based on the largest proposed building on the site.

APPENDIX C

TREATMENT UNIT SIZING REPORT

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/10/2022

Province:	Ontario
City:	Milton
Nearest Rainfall Station:	TORONTO CITY
Climate Station Id:	6158355
Years of Rainfall Data:	20
Site Name:	
Drainage Area (ha):	0.50
% Imperviousness:	90.00
Runoff Coefficient 'c':	0.84
Particle Size Distribution:	OK-110
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	13.57
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Industrial Building
Project Number:	2022-024
Designer Name:	Calvin Dang
Designer Company:	MGM Consulting
Designer Email:	cdang@mgm.on.ca
Designer Phone:	416-985-1214
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	94
EF6	98
EF8	99
EF10	100
EF12	100

Recommended Stormceptor EF Model:	**EF4**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**94**
Water Quality Runoff Volume Capture (%):	**> 90**

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)

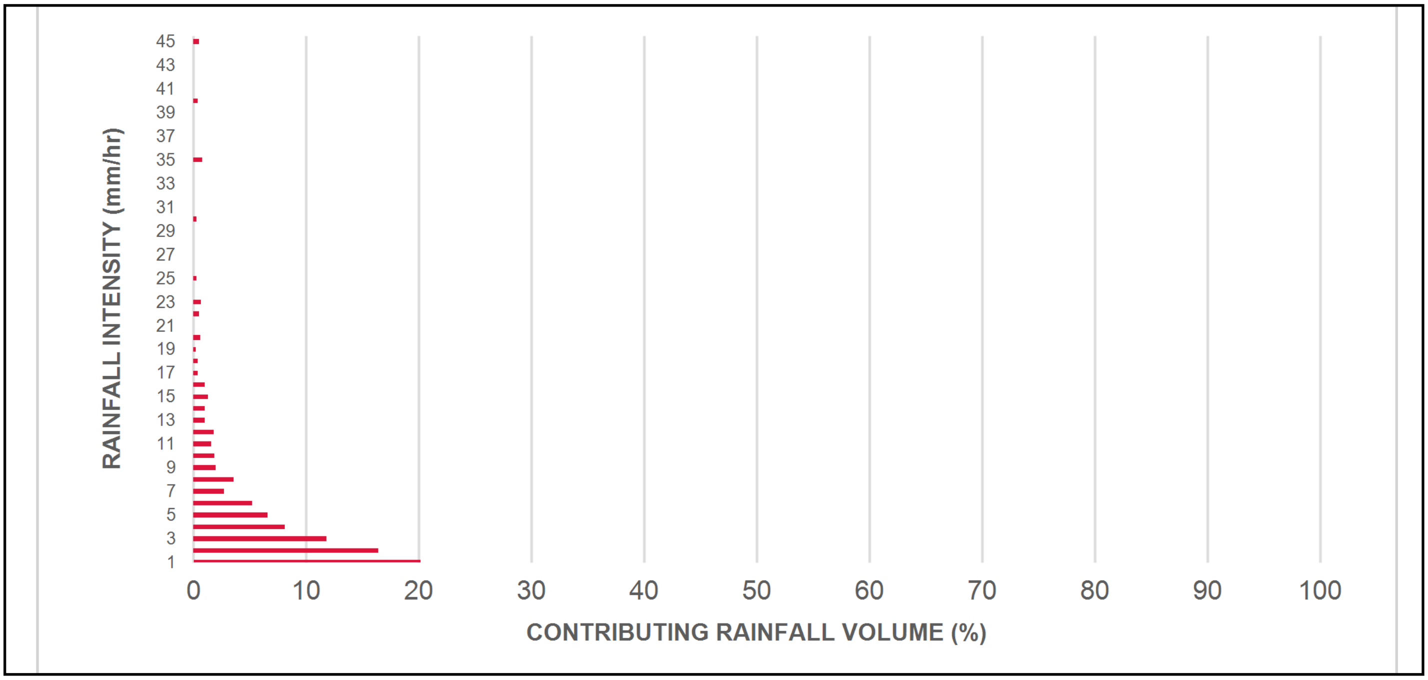
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

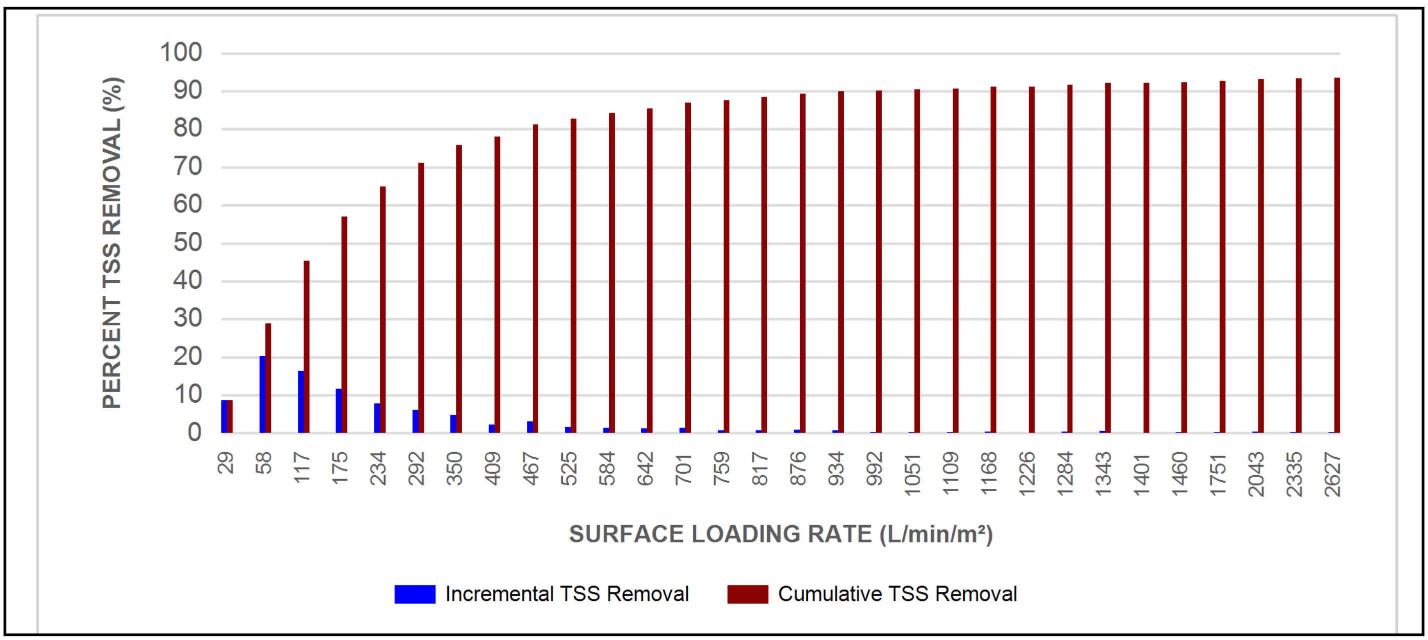
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.7	8.7	0.58	35.0	29.0	100	8.7	8.7
1	20.2	28.9	1.17	70.0	58.0	100	20.2	28.9
2	16.4	45.3	2.34	140.0	117.0	100	16.4	45.3
3	11.8	57.1	3.50	210.0	175.0	99	11.7	57.0
4	8.1	65.2	4.67	280.0	234.0	97	7.9	64.9
5	6.6	71.9	5.84	350.0	292.0	94	6.2	71.1
6	5.2	77.1	7.01	420.0	350.0	90	4.7	75.8
7	2.7	79.8	8.17	490.0	409.0	87	2.3	78.1
8	3.6	83.4	9.34	560.0	467.0	84	3.1	81.2
9	2.0	85.4	10.51	631.0	525.0	82	1.6	82.8
10	1.9	87.3	11.68	701.0	584.0	79	1.5	84.3
11	1.6	88.9	12.84	771.0	642.0	77	1.2	85.5
12	1.8	90.7	14.01	841.0	701.0	76	1.4	86.9
13	1.0	91.6	15.18	911.0	759.0	75	0.7	87.6
14	1.0	92.7	16.35	981.0	817.0	73	0.8	88.4
15	1.3	93.9	17.51	1051.0	876.0	72	0.9	89.3
16	1.0	95.0	18.68	1121.0	934.0	71	0.7	90.0
17	0.4	95.3	19.85	1191.0	992.0	69	0.2	90.2
18	0.4	95.7	21.02	1261.0	1051.0	72	0.3	90.5
19	0.2	95.9	22.18	1331.0	1109.0	75	0.2	90.7
20	0.6	96.5	23.35	1401.0	1168.0	78	0.5	91.2
21	0.0	96.5	24.52	1471.0	1226.0	82	0.0	91.2
22	0.5	97.0	25.69	1541.0	1284.0	85	0.4	91.6
23	0.7	97.7	26.85	1611.0	1343.0	89	0.6	92.2
24	0.0	97.7	28.02	1681.0	1401.0	92	0.0	92.2
25	0.3	98.0	29.19	1751.0	1460.0	88	0.2	92.4
30	0.3	98.3	35.03	2102.0	1751.0	74	0.2	92.7
35	0.8	99.1	40.87	2452.0	2043.0	63	0.5	93.2
40	0.4	99.5	46.70	2802.0	2335.0	55	0.2	93.4
45	0.5	100.0	52.54	3153.0	2627.0	50	0.3	93.6
Estimated Net Annual Sediment (TSS) Load Reduction =								**94 %**

Climate Station ID: 6158355 *Years of Rainfall Data*: 20

RAINFALL DATA FROM TORONTO CITY 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

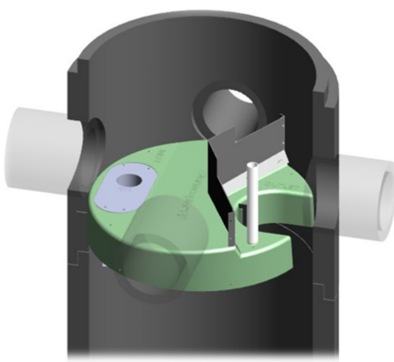
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

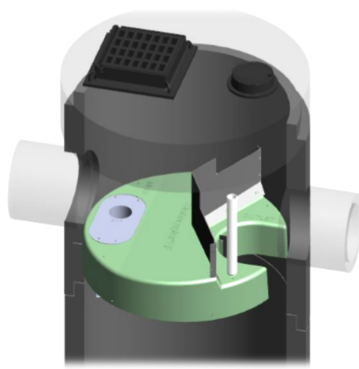
DESIGN FLEXIBILITY

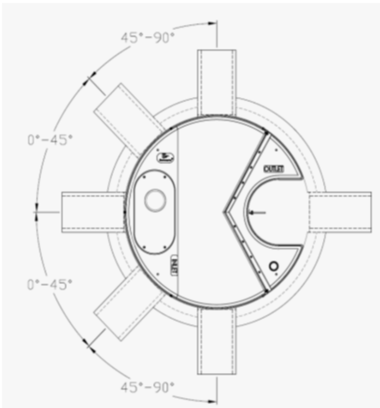
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	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/ft³)

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

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

APPENDIX D

SANITARY DESIGN CALCULATIONS

MGM CONSULTING INC.

TOWN OF MILTON

SANITARY SEWER DESIGN SHEET

Project No. 2022-024
Subdivision Industrial Building Development
Date: 10-Nov-22
Des. By: CD Chk. By:

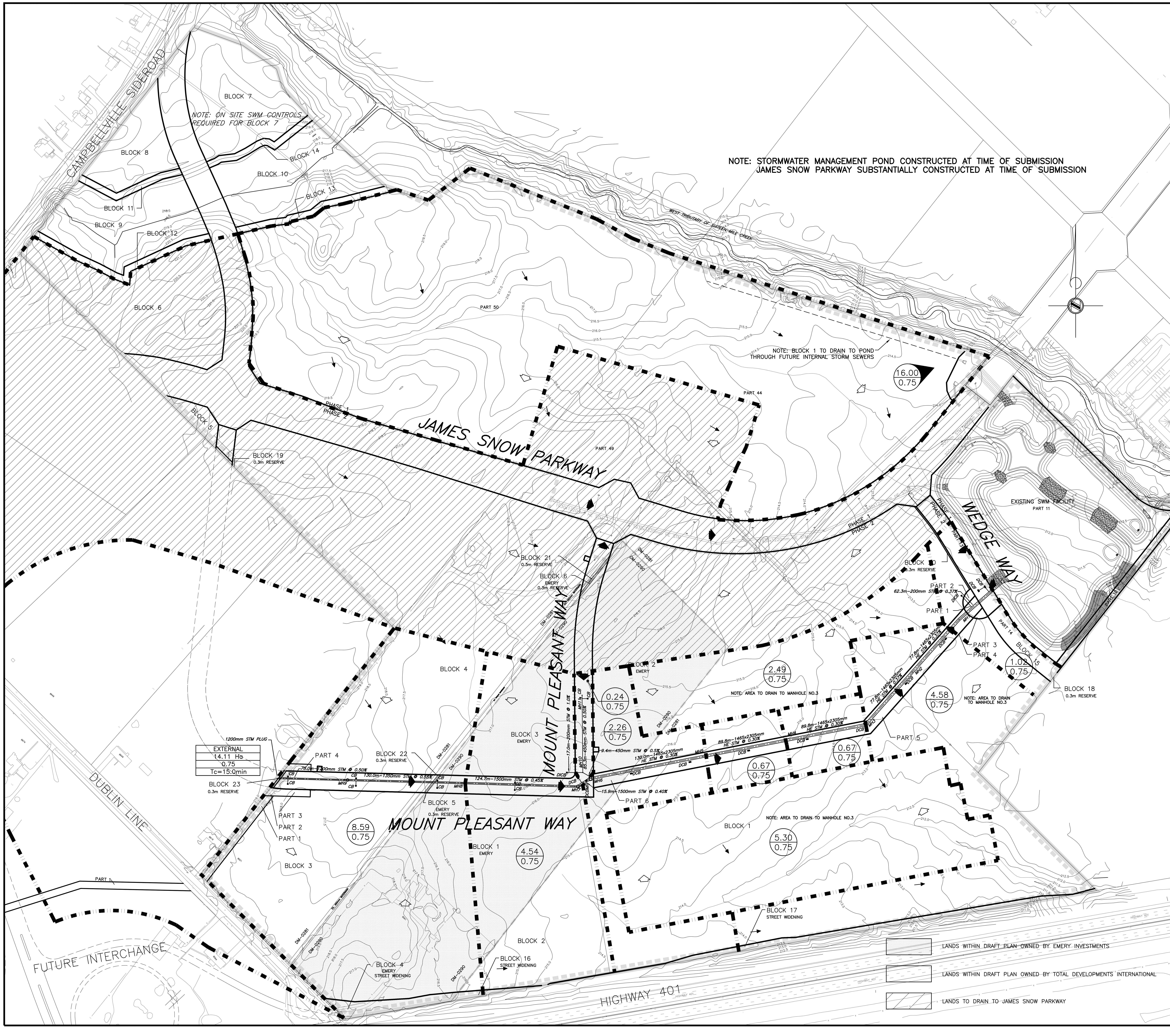
1. Sanitary Design Flow for Proposed Development

	Tributary Area Hectare				Population Tributary				Average	Average					SEWER					PIPE			
	Increment			Total	Increment			Total	Increment	Total	Peaking	Max.	Infiltration	Max. Flow			Q	V m/S					
Street	Res. ha	Comm. ha	Ind. ha	ha	Res.	Comm.	Ind.		L/s	L/s	Factor	m^3/s	L/s	L/s	mm.	%	L/s	Full Flow	Act. Flow	Type	n	Class	**REMARKS**
MHA1 to James Snow Pr			1.38	1.38			173	173	0.5507	0.5507	3.336	1.837	0.395	2.232	200	2.00	46.40	1.48	0.2	PVC	0.013	SDR35	

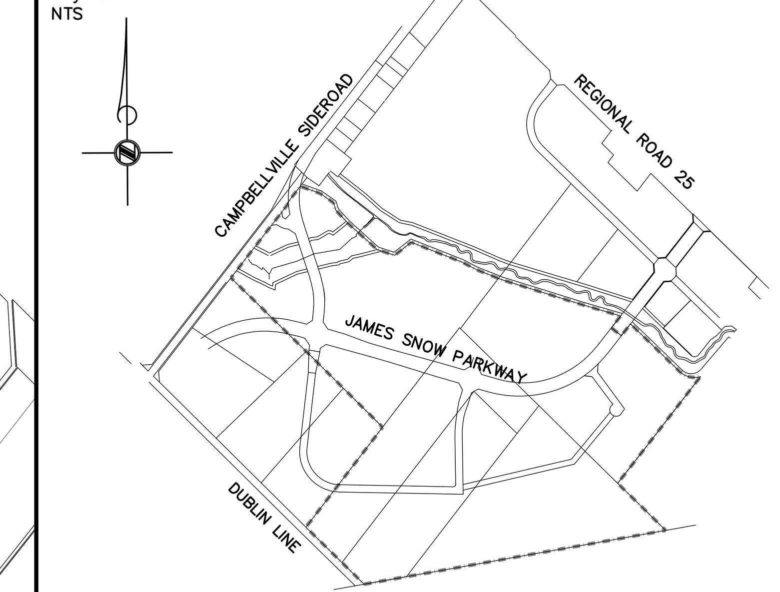
* Min peaking factor based on Region of Halton Design Guidelines = 2.0
* Population density for light industrial = 125 person/hectare
* Unit Sewage Flow = 0.003183*10^-3 m3/ha/s
* Infiltration = 0.286 L/s

APPENDIX E

SUBDIVISION STORM DRAINAGE PLANS



Key Plan:
NTS



Legend:

	STORM SEWER
	CATCHBASIN
4.83	DRAINAGE AREA
0.75	COEFFICIENT
EXTERNAL 14.11 Ha	EXTERNAL DRAINAGE AREA
0.75	COEFFICIENT
Tc=15.0min	TIME OF CONCENTRATION
	STORM DRAINAGE AREA BOUNDARY
	FUTURE OVERLAND FLOW WITHIN FUTURE LOTS
	PROPOSED OVERLAND FLOW ALONG ROADWAY
	EXISTING DRAINAGE PATTERN
	DRAFT PLAN BOUNDARY
	PHASING LINE
	OWNERSHIP BOUNDARY
	EXISTING CONTOUR

Benchmark Info

CONC. BRIDGE CARRYING REG. RD. 22 OVER HWY 401. TABLET IS SET HORIZ. IN THE SOUTH FACE OF NORTH ABUTMENT, 40 CM EAST OF THE S.W. CORNER AND 91CM ABOVE GROUND.
ELEVATION: 222.844, EASTING: 586084.000, NORTHING: 4819304.000

No.	By	Date	Description	Approval
6				
5	JB	13 JUNE 12	FIFTH SUBMISSION	MS
4	JB	4 JAN 12	FOURTH SUBMISSION	MS
3	JB	24 OCT 11	THIRD SUBMISSION	MS
2	JB	11 FEB 11	SECOND SUBMISSION	MS
1	JB	4 AUG 10	FIRST SUBMISSION	MS

TOWN OF MILTON
ENGINEERING SERVICES DEPARTMENT

DIRECTOR OF ENGINEERING SERVICES

Professional Stamp:

REGIONAL:
DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

LEGISLATIVE AND PLANNING SERVICES

DATE

Halton

Consultant Firm:

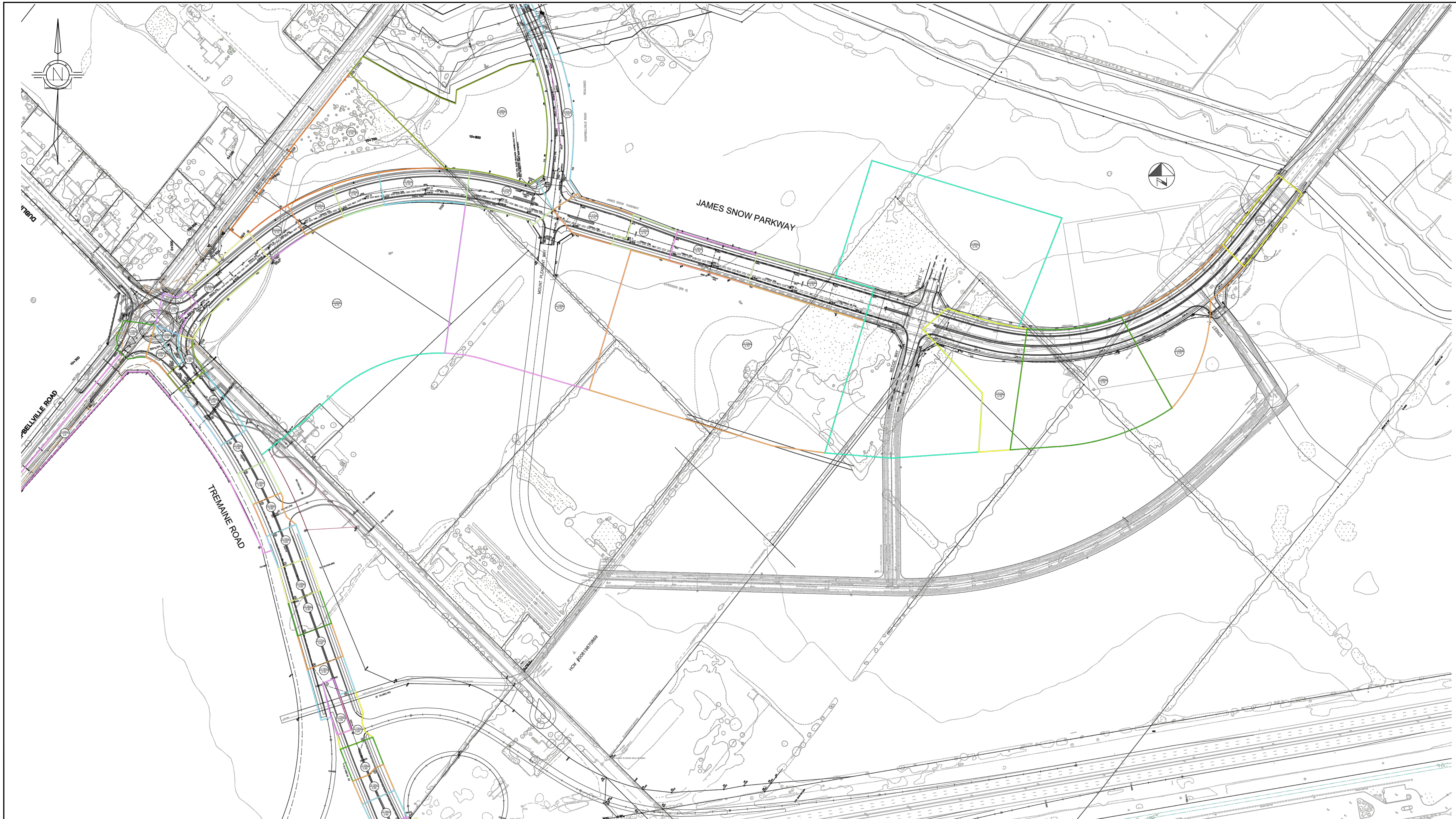
MGM CONSULTING INC.
Planning, Consulting Engineering & Project Management
400 Bronte Street South, Suite 219, Milton, Ontario L9T 0H7
Tel: (905) 567-8678
Fax: (905) 875-1339
Email: mgm@mgm.on.ca

Consultant File No.
2004-002

ESCARPMENT BUSINESS COMMUNITY WEST
MILTON, ONTARIO

STORM DRAINAGE PLAN

Date:	30 JUNE 2010	Drawing No.
Scale:	1:2000	201
Drawn/Designed By:	JB	
Checked By:	MLS	
Regional File No.	24T-88027/M DM-0132	DWG. 8 OF 36



EBC WEST PHASE III SUBDIVISION

JAMES SNOW PARKWAY STORM DRAINAGE AREAS

MGM
CONSULTING INC
Consulting Engineering & Project Management
555 Industrial Drive
Suite 201
Milton, Ontario
L9T 5E1
Tel: (905)567-8678
Fax: (905)875-1339
Email: mgm@mgm.on.ca
www.mgm.on.ca

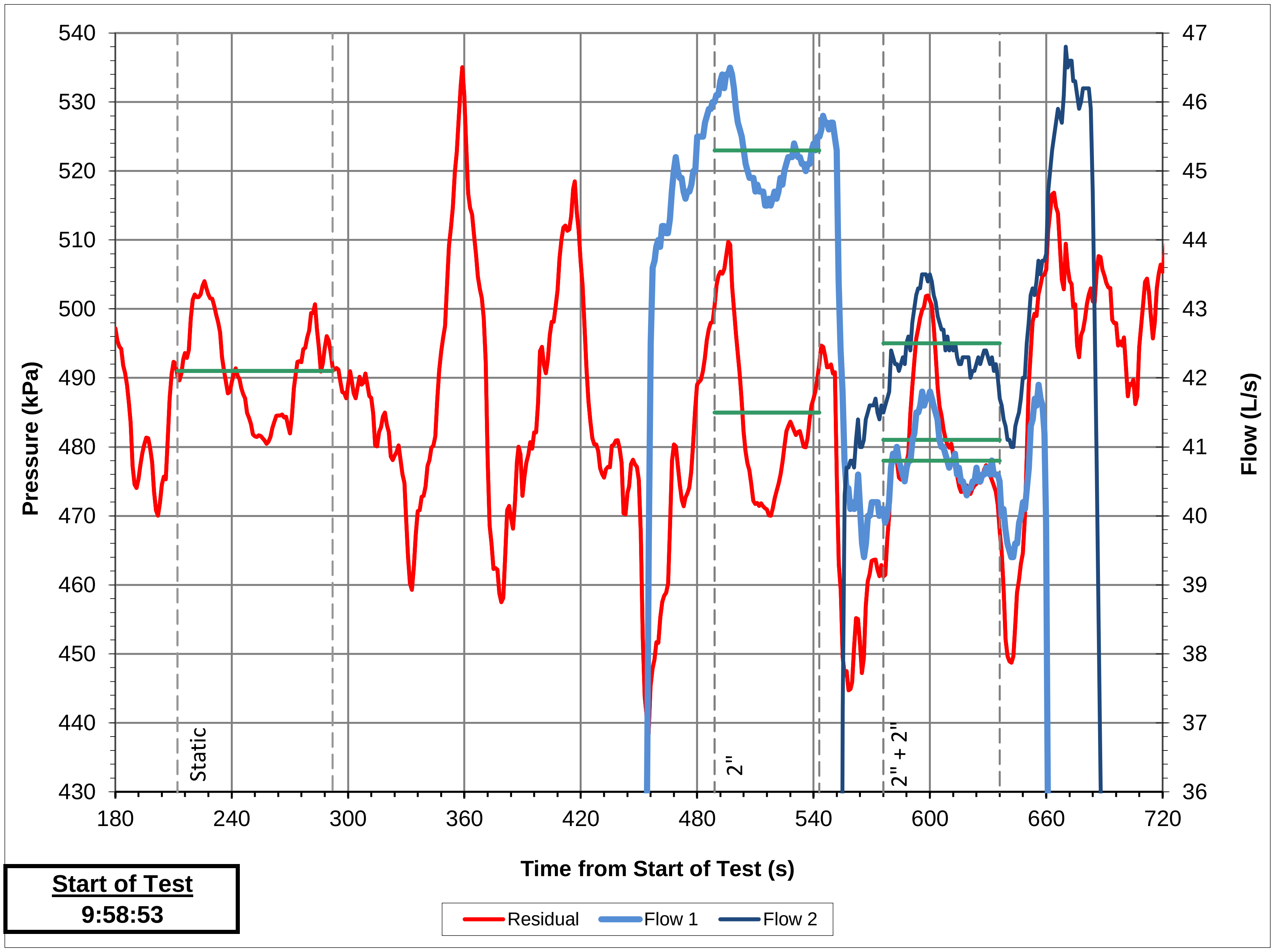
FIGURE #3

DATE: APRIL 2021
SCALE: 1:4000
DWG#: 2021-004 C2

APPENDIX F

HYDRANT TESTING RESULTS

Test 1 - 3333 James Snow Pkwy N



Subject Watermain Details			
Diameter:	450 mm	**Material:**	PVC
Area:	0.159 m2		

Subject Hydrant & Valve Details	
Residual Hydrant:	
Flow Hydrant:	

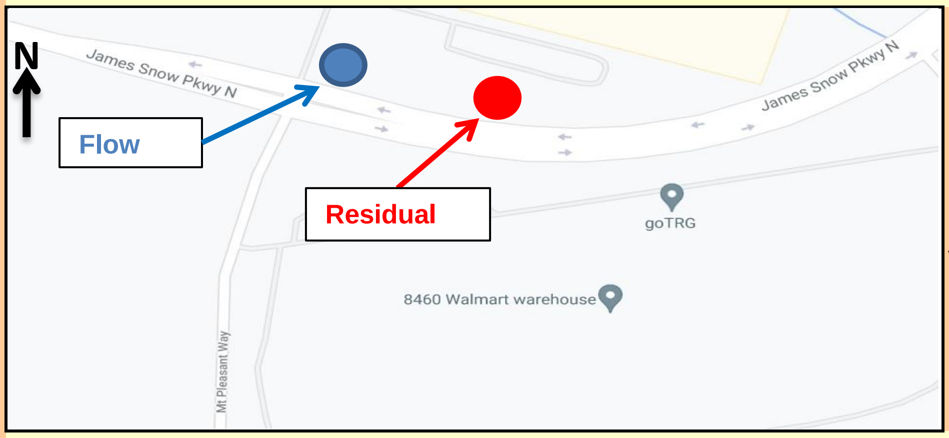
TABLE A: TESTED PRESSURES AND FLOWS

Point	Time		Residual on Residual Hydra		Flow Hydrant ()				Total Flow		Velocity
					Port 1 (S1)		Port 2 (S2)				
	Start	Finish	(kPa)	(psi)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(m/s)
Static	212	292	491	71.2	0.0	0	0.0	0	0.0	0	0.0
2"	489	543	485	70.3	45.3	718	0.0	0	45.3	718	0.3
2"			0	0.0	0.0	0	0.0	0	0.0	0	0.0
1" + 2"			0	0.0	0.0	0	0.0	0	0.0	0	0.0
2" + 2"	576	636	481	69.8	40.8	647	42.5	674	83.3	1320	0.5

3333 James Snow Pkwy N

HYDRANT FLOW TEST RESULTS

Date:	12-Jul-21	Time:	9:58 (hh/mm)	Municipality	City of Milton
Tested By:	Sen			Operator:	Justin
				Test No:	**1**



Conditions before Test (STATIC)

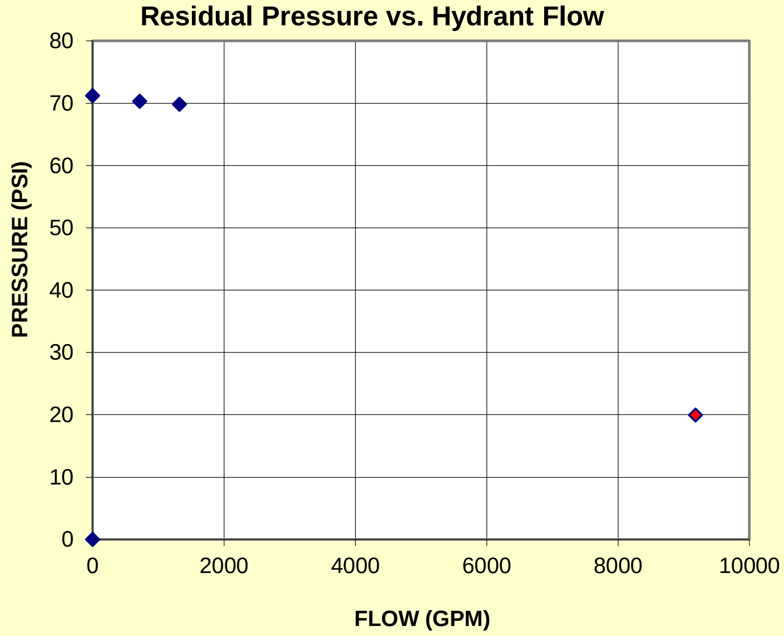
Residual Hydrant:	71.2 psi	491 kPa
Hydrant that will Flow:	71.2 psi	491 kPa
∆ pressure:	0.0 psi	0 kPa
Elevation Difference: (Flow El. - Residual El.)	0.0 ft	0.0 m

Test Notes:

TEST		TEST FLOW		RESIDUAL PRESSURE (psi)		Minimum Residual P_r (psi)	Fire Flow at Minimum Residual, Q_r (USGPM)	Fire Flow at Minimum Residual, Q_r (L/s)	1.9% Pressure Drop Achieved?
Port Size (in)	Nozzle Pressure (psi)	(USGPM)	(L/s)	Monitoring Hydrant	Flow Hydrant (Corrected) *				
STATIC	n/a	0	0	71.2	71.2				
Single Port Tests									
2	21.2	718.0	45.3	70.3	70.3	20	6315	398	NO
2						20			
Two Port Test									
1						20			
2									
Two Port Test									
2	17.2	647.0	40.8	69.8	69.8	20	9179	579	YES
2	18.7	674.0	42.5						

* Pressure correction is equal to the elevation difference. Column 2 (and Table A) show the nozzle pressure while flowing.

Residual Pressure vs. Hydrant Flow



Results			
Static Pressure		Flow at 20 psi (140kPa)*	
(psi)	(kPa)	(gpm)	(L/s)
71.2	491	9200	580

* Results carried to nearest 50 gpm or 100 gpm if over 1000 gpm

Hydrant Classification as per NFPA 291			
Class	AA	Color	BLUE

Water Discharged During Test:	15200 L

Rounded up to closest 100L

DISCLAIMER FOR FIRE FLOW TESTS

While WSP makes every effort to ensure that the information contained herein is accurate and up to date, WSP is not responsible for unintended or incorrect use of the data and information described and/or contained herein. The user must make his/her own determination as to its accuracy and suitability. The information is representative for a dynamic water system that may change over time.

APPENDIX G

SUBDIVISION FUNCTIONAL SERVICING REPORT

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers

661 Chrislea Road, Suite 11
Woodbridge, Ontario L4L 8A3
TEL (905) 264-0054
FAX (905) 264-0069
info@valdor-engineering.com
www.valdor-engineering.com

Functional Stormwater Management Report

Escarpment Business Community West

Part of Lots 3, 4 and 5, Concession 2
Town of Milton (24T-88027/M)
Regional Municipality of Halton

March 2004
January 2007 (Revised)
April 2007 (Revised)

Prepared For:

Total Developments International Ltd.
&
Emery Investments Limited

File: **03156**

s:\projects\2003\03156\reports\functional swm\18 april 2007\03156-fswmr apr 2007.doc

CONTENTS

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICIES

LIST OF DRAWINGS

1.0 INTRODUCTION

1.1 Appointment

Valdor Engineering Inc. has been retained by Total Developments International Ltd. (TDI) and Emery Investments Limited (EIL) to prepare a Functional Stormwater Management Report for development of the Escarpment Business Community (EBC) West located in the Highway 401 Industrial/Business Park Secondary Plan Area within the Town of Milton, Regional Municipality of Halton.

1.2 Study Area

The EBC West Study Area, as indicated in **Figure 1** is bounded to the north by Campbellville Sideroad, to the west by Dublin Line and to the south by Highway 401 and to the southeast by lands owned by McKinlay Transport Ltd. (McKinlay). The study area is bound to the east by a tributary of Sixteen Mile Creek (N2-B) which was re-aligned in conjunction with an existing industrial subdivision beyond. The legal description of the Study Area is: Part of Lots 3, 4 and 5, Concession 2 in the Town of Milton. In addition to the TDI and EIL lands, the EBC West community encompasses non-participating lands owned by Pettiuello and Zulian as indicated In **Figure 1**.

1.3 Proposed Land Use

The proposed land use of the subject site is anticipated to comprise of commercial and industrial development, and a stormwater management facility. The development concept for the Study Area is illustrated in **Figure 4** and includes the extension of James Snow Parkway and the re-alignment of Dublin Line to accommodate the proposed Tremaine Road / Highway 401 interchange. The McKinlay lands have development potential beyond the current transport truck yard, however, the owner has not participated in development planning activities over the past 25 years and is not expected to participate in the current process.

1.4 Purpose of Report

This report has been prepared in support of the application for Draft Plan approval for TDI's property west of the Sixteen Mile Creek tributary. The primary intent of the report is to establish storm drainage scheme for the lands, including conceptual design information for the proposed stormwater management (SWM) facility. In addition, this report considers the future development of the McKinlay lands and the Region's Class EA for the Tremaine Road / Highway 401 interchange and the James Snow Parkway extension.

1.5 Approving Authorities

This report will be circulated for review, comment and approval to:

1. The Town of Milton, Development Engineering Services Department
2. Conservation Halton (CH)

3. Regional Municipality of Halton

1.6 Background

The design of the storm drainage servicing for the subject lands is based on the Functional Servicing and Environmental Management Strategy, Highway 401 Industrial/Business Park Secondary Plan Area (FSEMS) prepared by Philips Engineering for the Town of Milton. Stormwater management criteria cited in the FSEMS are derived from the Subwatershed Planning Study, Sixteen Mile Creek Watershed, Areas 2 & 7 (SPS) prepared by Philips Engineering. The preliminary stormwater management facility design has considered the Town of Milton Engineering and Parks Development Standards and the MOE Stormwater Management Planning and Design (SWMP) Manual. Additional studies used in the preparation of this report are listed in the References & Bibliography section.

The SPS has indicated a SWM facility (Pond S34) located at the south limit of the neighbouring McKinlay lands, as shown in **Figure 2**. Pond S34 is intended to provide water quality, extended detention and flood controls for runoff from Catchment 2024, which includes the majority of the Study Area, as shown in **Figure 3**. A portion of the Study Area is located within Catchment 2040.

To date, McKinlay has been a non-participant in the development approval process for the Study Area and has not filed any development applications, provided any development concept plans or advised of a development schedule. This report therefore explores the opportunity to construct a permanent SWM facility (Pond S34) on the TDI lands, while identifying stormwater management options that provide both economical solutions and flexibility for the ultimate development of McKinlay lands.

The draft plan, storm drainage areas, preliminary grading and storm sewer alignment have been provided by MGM Consulting Inc. (MGM), in conjunction with their preparation of a Subwatershed Impact Study (SIS) for the area.

2.0 POLICIES AND CRITERIA

The SPS adopted a unitary rate approach to specifying design criteria for stormwater management facilities within the 401 Industrial/Business Park. These criteria address water quality, extended detention and flood control of surface runoff from the Milton North planning area, and are summarized in **Tables 1** through **Table 3**.

Table 1: Water Quality Storage Requirements

Protection Level	SMWP Type	Storage Volume (m^3/ha for 80 % Impervious Level)
Enhanced (Level 1) 80% long-term S.S. removal	Wet Pond	240

Note: Storage volumes include 40 m^3/ha for extended detention storage

Table 2: Extended Detention Storage / Discharge Requirements

Planning Area	Erosion Control Storage (Extended Detention) (m^3/imp ha)	Extended Detention Flow Rate (m^3/s development ha)
Milton North	229	.0012

Table 3: Flood Control Storage / Discharge Requirements

Design Storm Event	Storage Volume Rate (m^3/imp ha)	Release Rate (m^3/s Development ha)
25 year	229+277=506	0.0124
100 year	229+366=595	0.0177

3.0 STORM DRAINAGE SYSTEM DESIGN

3.1 Storm Drainage Areas

The SPS suggested that Pond S34 to accept drainage from approximately 98.6 hectares (including the McKinlay lands) in Catchment 2024, as shown in **Figure 3**. This drainage boundary has been refined based on MGM's functional servicing and grading design for the EBC West lands as well the Region of Halton's requirements for the alignment of their Tremaine Road / Hwy 401 interchange and James Snow Parkway extension. The following is a summary of the drainage areas as delineated in **Figure 4**:

Area "A"

Area "A" represents the lands within Catchment 2024 and the EIL Lands and the majority of the TDI lands. This area is to drain to the subject SWM facility for quality, extended detention and flood control.

Area "B"

Area "B" includes a portion of the EIL Lands and TDI lands and will be directed to the subject SWM facility. Given that Area "B" is within Catchment 2040, it will be treated for quality and extended detention, however, flood control will be provided in the existing SWM facility (Pond S36) located at the northeast corner of Regional Road 25 and Highway 401.

Area "C"

Area "C" represents a small parcel within the TDI lands located north of tributary N2-B and within Catchment 2040. Its location north of this tributary physically isolates the parcel from the SWM facility catchment area and therefore private on-site stormwater management controls are to be provided. These controls could be a combination of facilities such as sub-surface detention, parking lot detention, roof top detention and oil /grit separator. Flood control will be provided in the existing SWM facility (Pond S36) located at the northeast corner of Regional Road 25 and Highway 401. Should it be determined at the site plan stage that on-site controls for water quality and erosion are not viable, the Town of Milton has indicated that consideration could be given for "treatment-in-lieu" options elsewhere that could also satisfy the criteria regarding water quality and erosion control for these lands.

Area "D"

Area "D" represents the lands associated with the Region of Halton's proposed Tremaine Road / Highway 401 interchange. At the request of the Region, and in order to eliminate their proposed SWM facility in the vicinity of the interchange, this area will drain to the subject SWM facility for quality, extended detention and flood control.

Area "E"

Area "E" represents the portion of the McKinlay lands within Catchment 2024. This area will not drain to the subject SWM facility, however, alternatives have been identified and outlined in Section 4.2 of this report.

External Catchment 2021

The lands north of Campbellville Sideroad (No. 5 Sideroad), delineated as Catchment 2021 on **Figure 3,** currently drain to Tributary N2-B. These lands are beyond the limits of the subject Secondary Plan Area and there are currently no development plans. Upon development of the EBC West lands, this external drainage will continue to be directed to the subject tributary. When these lands proceed to development they will require a stormwater management facility to provide quality, extended detention and flood control treatment which will discharge to the subject tributary.

3.2 Storm Drainage System

The minor storm drainage system will be sized to capture the runoff from the 5 year return period event. Based on the preliminary design prepared by MGM, the minor system will discharge via three inlets into the proposed SWM facility. The schematic storm sewer design is illustrated on **Drawing FSP-1.**

Based on the preliminary grading design prepared by MGM, major flows from the site will be routed to the SWM facility via the roadway system. The major system flows will generally travel south and east, collecting at a low point on each of the two streets adjacent to the facility. Modelling of the major systems will be conducted at the detailed design stage to ensure that the overland flow depths are contained within the public rights-of-way. The overland flow route is delineated on **Drawing FSP-1**.

As requested by the Region of Halton, both the minor system and major system are to be designed to convey flows from the 2.3 Ha area (Area "D") associated with their proposed Tremaine Road / Hwy 400 interchange.

3.3 Preliminary Site Grading

A preliminary grading exercise has been completed by MGM to estimate the roadway elevations relative to the existing ground and the proposed SWM facility, and these details have been presented on **Drawing FSP-1**. In general, the roadways can be graded close to existing ground. Some cut areas will be generated in the vicinity of the SWM facility to assist with filling low areas associated with the existing minor drainage course (Tributary N1-A) that flows through the Study Area. Roadway slopes in the vicinity of 0.50% will likely be required throughout the EBC West lands to minimize earthworks requirements.

3.4 SWM Facility Outlet Location

Given that the Study Area is comprised of lands within both Catchment 2024 and Catchment 2040, discharge from the SWM facility will direct flows to both Tributary N1-A and Tributary N2-B. With regards to the distribution of flows, based on comments received from the Conservation Authority, it has been determined that flow is to be directed to the Tributary N1-A under all rainfall events to support downstream fish habitat.

4.0 STORMWATER MANAGEMENT POND DESIGN

4.1 Pond S34 on TDI Lands

The study area is comprised of lands within both Catchment 2024 (87.9 ha) and Catchment 2040 (10.1 Ha). Given that their respective Tributaries N1-A and Tributary N2-B in the vicinity of the SWM facility are at different elevations, and due to limitations with available vertical grade in the study area, the SWM facility has been designed with two separate cells. The conceptual design of the facility which is included in **Figure 5,** indicates that the west cell has been designed with a normal water level (NWL) of 210.40m and the east cell has been designed with a NWL of 211.40m. Each cell operates independently for the quality control and extended detention functions for their respective contributing areas identified as areas "East" and "West" in **Drawing FSP-1**. Under flood control conditions, the SWM facility operates as a single cell to a 100 year high water level (HWL) of 212.30m. The stage / storage /discharge characteristics of the facility are included in **Appendix "A"**. The following is a summary of the facility sizing, operation and design features:

4.1.1 Quality Control

Various source control, conveyance and end-of-pipe SWMPs have been considered as options for providing the appropriate level of stormwater quality control. Consideration must be given to the size of the site and proposed industrial/commercial land use.

- *Reduced Lot Grading (Lot Level)*: The average grade across the site is 0.5% to 1.0%; therefore, successful implementation of reduced lot grading is possible. In general, grades of 2.0% will likely be used on the industrial lots.
- *Roof Leader to Ponding Areas or Soakaway Pits (Lot Level)*: The Town of Milton design criteria do not address the use of ponding areas or soakaway pits. Roof leaders, where possible, should discharge directly to pervious surfaces to encourage infiltration and filtration on the lots. Soakaway pits can be an effective means of improving infiltration of stormwater, but are not recommended for this site due to the land use and the presence of stiff to hard clayey silt till soils.
- *Grassed Swales (Conveyance)*: A majority of the business park will comprise parking and rooftop area; therefore, the opportunity to direct runoff to swales is limited.
- *Stormwater Management Facilities (End-of-Pipe)*: The FSEMS identified the need for stormwater management to provide water quality, extended detention and flood control of stormwater runoff. A stormwater management facility will be built within the Study Area.
- *Oil/Grit Separation Technologies (End-of-Pipe)*: These SWMPs can be effective for smaller, high impervious sites where spill protection is desired and when area for a stormwater pond is unavailable. The construction of a main stormwater pond normally eliminates the need for any oil/grit separation units, however, in accordance with Town requirements these units are to be installed on sites with hazardous uses including vehicle maintenance or high truck traffic. Based on the foregoing, each industrial lot will require an oil/grit separator.
- *Infiltration Trenches/Basins (End-of-Pipe)*: These SWMPs are only effective in areas with highly pervious soils and large areas. The soils on the site are not conducive to infiltration.

In accordance with the SPS, an Enhanced Level (Level 1) water quality control is to be provided by the proposed SWM facility. For a wetpond with an extended detention active storage zone servicing an area with 80% imperviousness, the SWMP Manual calculates the permanent pool volume as follows:

Volume required:	240 m^3/ha
Less 40 m^3/ha of extended detention storage zone:	- 40 m^3/ha
Permanent Pool Volume Required:	200 m^3/ha

The required quality control volumes (permanent pools) and the NWL elevations for the east and west cell of the SWM facility are indicated in **Table 4**.

4.1.2 Extended Detention Control

In accordance with the SPS, extended detention control is to be provided using an active storage zone sized to capture the runoff resulting from a 25 mm rainfall event and release the runoff over a minimum duration of 48 hours. Under extended detention discharge, the west cell will outlet easterly to the lower Tributary N2-B and the east cell will outlet southerly to the higher Tributary N1-A as indicated in **Figure 5**.

The extended detention release for each cell will be controlled with a separate orifice plate located in the control structure to provide the required drawdown time. The orifice diameter is to be verified at the detailed design stage in accordance with the drawdown time calculation method specified in the SWMP Manual.

The required extended detention volumes, discharge rates and operating range for the east and west cells of the SWM facility are indicated in **Table 4.** The actual discharge to the east outlet is based on the desire to limit detention time to a maximum of 168 hours. The actual discharge to the south is based on achieving the minimum detention time of 48 hours.

4.1.3 Flood Control

Flood control of stormwater runoff from the Study Area is provided by the proposed SWM facility, up to the 100 year level. Under this flood control condition, the facility operates as a single cell to a 100 year HWL of 212.30m. As indicated in **Figure 5**, discharge under flood control conditions will be directed to each of the two watercourses. The 25 year and 100 year storage volumes, discharge rates and operating range for the SWM facility are indicated in **Table 4**.

Discharge southerly to Tributary N1-A will be controlled to the required unit rate based on the area in Catchment 2024 (Area "A"+ "D"= 87.9 Ha).

Discharge easterly to Tributary N2-B will be released at post-development rates based on the area in Catchment 2040 (Area "B"=10.1 Ha) given that quantity control for this catchment is provided in the existing downstream SWM facility (Pond S36) located at the northeast corner of Regional Road 25 and Highway 401. The calculation of the post-development rates for the lands within Area "B" is included in **Appendix "B"**.

Table 4: Storage / Discharge Requirements for Pond S34 on TDI Lands

Quality Control

West Cell West Area = 82.0 Ha, Imp = 80%			East Cell East Area = 16.0 Ha, Imp = 80%		
Stage (m)	Storage (m^3)		Stage (m)	Storage (m^3)	
	Required	Provided		Required	Provided
208.90 to 210.40	16,400	26,113	209.90 to 211.40	3,200	7,603

Extended Detention

West Cell West Area = 82.0 Ha, Imp = 80%					East Cell East Area = 16.0 Ha, Imp = 80%				
Stage (m)	Storage (m^3)		Discharge (m^3/s) East Outlet		Stage (m)	Storage (m^3)		Discharge (m^3/s) South Outlet	
	Required	Provided	Allowable	Actual		Required	Provided	Allowable	Actual
210.40 to 211.30	15,022	19,135	0.012 10.1 Ha at Unit Rate	0.045 168 hr. release	211.40 to 211.90	2,931	3,863	0.105 87.9 Ha at Unit Rate	0.018 48 hr. release

Flood Control

Combined Cells Area =98.0-10.1(Catchment 2040)=87.9 Ha, Imp = 80%							
Design Storm	Stage (m)	Cumulative Storage (m^3) (Including Extended Detention Component)		Discharge (m^3/s)			
				East Outlet		South Outlet	
		Required 87.9 Ha at Unit Rate	Provided	Allowable 10.1 Ha at Post-Dev	Actual	Allowable 87.9 Ha at Unit Rate	Actual
25 Year	212.10	37,432	48,403	2.9	1.57	1.1	1.02
100 Year	212.30	43,690	55,624	3.8	3.78	1.6	1.57

4.1.4 Preliminary SWM Facility Design

A preliminary design for the SWM facility has been prepared and illustrated in **Figure 5**. The key design features are as follows:

a) Facility Grading

The design includes 5H:1V side slopes above and near the permanent pool and 3H:1V side slopes from 0.60 m below the permanent pool level to the bottom. A 4.0 m wide access road has been provided to the control structures and to the bottom of the main pool.

b) Forebay Design

A sediment forebay is to be provided at each inlet location to facilitate maintenance and improve pollutant removal. The forebay configuration is to reflect the length-to-width ratio, particulate settling calculation, flow dispersion calculation and minimum bottom width calculations in accordance with the SWMP Manual. This sizing is to be provided at the detailed engineering design stage.

c) Outlet Configuration

The pond outlet headwall is to be located in an embankment to minimize its visibility and improve aesthetics. The headwall is to be aligned to discharge in the direction of flow in the receiving watercourse. A plunge pool is to be located downstream of the headwall to reduce runoff velocities, followed by a level spreader for flow dispersion. The facility is to be designed with an emergency spillway to allow safe passage of the Regional Storm peak flow which is to be discharged southerly. As a result of site servicing constraints due to the flat topography (i.e. to accommodate the storm sewer inverts) associated with the proposed development, the proposed SWM pond will have two cells and dual outlet structures. This will enable the conveyance of extended detention flow from the east catchment (16.0 ha) to Tributary N1-A and from the west catchment (82.0 ha) to Tributary N2-B where the invert of the proposed outfall will better accommodate the storm sewer constraints. With regards to flood control, the pond operates as a single cell and the two control structures discharge flows to Tributary N2-B and Tributary N1-A.

d) Thermal Mitigation Measures

Mitigation measures will be incorporated into the SWM pond design to minimize impact on the two receiving watercourses. These measures include the following:

i) Bottom Draw Pipe

Instead of the common perforated riser configuration, a bottom draw pipe will be implemented for the extended detention component to discharge water from the deepest section of the pond where the water temperature is lowest. This outlet consists of a submerged intake headwall and a bottom draw pipe which discharges via an orifice plate in a control structure. Given that this pipe is sized for frequent rainfall events (25mm storm), it will provide the greatest benefit to the thermal regime of the receiving watercourse.

ii) Cooling Trench

To further enhance the discharge of the frequent rainfall events, flow from the bottom draw pipe will be conveyed via a perforated pipe to the outfall headwall. This perforated pipe will be installed in a cooling trench filled with 25mm clear stone and wrapped in filter fabric. A detail of the trench is provided in **Appendix "D"**.

By routing flow through this trench, heat is transferred to the stone thereby reducing the water temperature. The relatively small stone size will provide a high surface area for heat transfer. The trench is to be free draining to ensure that water is not retained for an extended period. As indicated in **Figure 5**, the location of the bottom draw pipe and the outlet headwall have been situated to maximize the length of the cooling trench in order to increase the opportunity for heat transfer.

Maintenance of the cooling trench is important to its long term performance. Manholes will be installed at the upstream and downstream end of the trench to facilitate access for visual and video inspection as well as flushing. The upstream manhole will be constructed with a sump to capture sediment. If perforations become clogged they can be opened using radial washing in which the downstream end is capped and a water hose is inserted, essentially pressurizing the pipe and forcing water out the perforations.

iii) Planting Strategy

In accordance with the Town and Conservation Halton requirements the SWM Facility will be planted to provide a natural appearance and provide environmental benefits. The landscape plan, which will be prepared in conjunction with the detailed engineering design, will specify shade producing species to minimize solar heating of the permanent pool during summer months. The SWM concept indicates a long and narrow facility which maximizes the potential for shading.

e) Operation & Maintenance Manual

In addition to proper design and construction of SWM facilities, operation and maintenance is important to ensure that the facility performs to the design criteria. In this regard an operation and maintenance manual is to be prepared at the detailed engineering design stage addressing the following:

i) Facility Operation

The operation and maintenance manual is to include the following operational information:

- A description and plan of the contributing drainage area for the facility.
- A description of the quality control, extended detention control and flood control provisions of the facility.
- A description of the various components and their purpose such as the sediment forebay, permanent pool, inlet headwalls, outlet headwalls, control structure, bottom draw pipes, cooling trenches and emergency spillway.
- The operational theory related to the control structure and its components including the high water levels for the various storm events and the related discharge through the various orifice plates and weirs to the two receiving watercourses.
- A copy of the approved SWM facility plans for reference.

ii) Facility Maintenance & Inspections

The operation and maintenance manual is to include the following maintenance and inspection information:

- The purpose and frequency of inspections.
- A copy of an inspection form for the facility highlighting regular points of inspection.
- Information with respect to the required documentation of maintenance activities (ie. Class EA process, reporting protocols, etc)
- Trouble shooting information highlighting the possible causes of common operating problems and recommended remedial actions.
- Regular maintenance information including the removal of trash and debris from the facility grounds and in particular accumulations around structures, weirs and grates

as well as "spring and fall cleanup" activities. Inspection and maintenance information must be included for the cooling trenches. In this regard visual inspections must be completed periodically at the upstream and downstream manholes associated with each trench including the sump and perforated pipe. Removal and flushing of sediment will be completed as required to ensure the continued proper operation and performance.

- Information regarding grass cutting policies and, in particular, the desire to not cut grass in the facility block.
- Information regarding weed control and, in particular, that the use of herbicides and insecticides is prohibited as they create water quality problems.
- Information regarding the use of fertilizer and, in particular, that it should be limited to minimize the nutrient loadings to the downstream receiving waters.
- Information regarding the landscaping in the facility including the upland, shoreline fringe and aquatic plantings and their requirements for maintenance, re-planting and harvesting.

iii) Monitoring and Sediment Removal

In accordance with the SWMP Manual, it is recommended that accumulated sediment be monitored and removed from the facility in order to maintain its removal efficiency. The frequency of removal is typically every 10 years. The operation and maintenance manual is to include the following sediment removal information:

- Frequency and method of sediment depth monitoring to determine the rate of accumulation and distribution within the facility for the purpose of establishing clean-out schedules.
- Information with respect to the method of removal. In this case, given that the permanent pool is relatively shallow (1.5 m in the forebays and main cells of the pond), it is recommended that a dry excavation procedure be followed. This procedure involves drawing down the permanent pool and removal of the sediment using conventional excavating and earth moving equipment (e.g., bobcat, backhoe, etc.) and disposal off-site. Given that the facility is divided into two cells, each having a forebay, the operation can be staged and completed during the summer months under dry conditions to facilitate dry sediment removal. In addition, due to the configuration of the pond, the permanent pool volume is significantly larger than required which will decrease the frequency of cleanout. Based on the above, a sediment drying area is therefore not required.
- Information regarding the required testing of the sediment in accordance with MOE guidelines prior to disposal off-site. The results of the testing will determine whether it can be used as clean fill, dumped at a licensed land fill facility or whether it is to be disposed of at a special facility licensed to accept contaminated material.
- Information with respect to re-instatement of vegetation disturbed during the sediment removal activity.

4.1.5 Impact on Receiving Watercourses

The Town and Conservation Halton have expressed their desire to maintain healthy streams in terms of both peak flows and runoff volumes to each watercourse under the full range of storm events.

The SWM facility was sized on the basis of the unit storage volumes and unit release rates which were limited to only the 25mm, 25 year and 100 year storm events as provided in the FSEMS. In order to address the concern a comparison of the pre and the post-development discharge to each watercourse was undertaken for the 25mm and 2 year through 100 year storm events.

The pre-development drainage area to each watercourse was delineated and a pre-development Visual OTTHYMO model was created to compute the pre-development peak flows and runoff volumes. The Visual OTTHYMO program was also used to simulate the actual performance of the SWM facility based on the stage / storage / discharge characteristics contained in **Appendix "A"** which were established to satisfy the unit rate criteria. The DIVERT HYD command in VO2 was utilized to best reflect the nested pond design and dual outlet structures associated with the proposed SWMP. The rating curves for the east and west cells and the combined pond are included in **Appendix "A"**.

The pre-development drainage area plan (**Figure 6**), Visual OTTHYMO output and the peak flow and runoff volume summary (**Table 6**) are contained in **Appendix "C"**. A review of **Table 6** confirms that the SWM facility has been designed with sufficient storage volume and that the post-development peak flow rates discharged southerly to Tributary N1-A are less than pre-development rates and the specified unit rates. As expected, post-development discharge easterly to Tributary N2-B exceeds pre-development peak flow rates given that flood control will be provided by the downstream SWM Facility S36. Also, as expected by the increase in imperviousness, post-development runoff volumes exceed pre-development runoff volumes.

Hydrograph plots are provided in **Appendix "C"** which provide a comparison between the proposed flow from Pond S34 to Tributaries N1-A and N2-B and the pre-development and/or "allowed" flow for the 2-yr and the 100-yr return period events. In addition, at the request of Conservation Halton, the 25 mm, 5-yr and 10-yr events are included for Tributary N1-A. Based on the hydrograph output, it is evident that additional flow volume will be provided to Tributary N1-A without exceeding the peak flow constraints. It is anticipated that this will be beneficial to local fisheries within this headwater tributary.

At the request of Conservation Halton, a continuous erosion analysis using QUALHYMO was completed for the reach along Tributary N2-B between the proposed outlet of Pond S34 and Hwy. 25. The erosion model was run for 6 years using critical flow thresholds provided by Parish Geomorphic based on field investigations. Results of the erosion analysis are provided in **Appendix "E"**. Parish Geomorphic has reviewed the analysis and has determined that no significant impact regarding erosion in Tributaries N1-A and N2-B is anticipated as a result of the proposed SWMP discharge. A copy of the geomorphology report is included in **Appendix "E"**.

4.2 SWM Alternatives for McKinlay Lands

Catchment 2024 includes 17.8 Ha of the 24.0 Ha McKinlay parcel located south of the subject lands. The remaining portion of the McKinlay parcel is within Catchment 2040 and is therefore to drain eastward to Tributary N-2B. Given that McKinlay is a non-participating landowner, there are no concept plans available for the lands. Regardless of the form of development, however, the following storage and discharge rates are to be provided for the portion of McKinlay lands within Catchment 2024 based on the criteria in the SPS:

Table 5: SWM Storage / Discharge Requirements for McKinlay Lands

Criteria (17.8 Ha in Catchment 2024)	Required Storage Volume (m^3)	Discharge Rate (m^3/s)
Quality Control (Permanent Pool)	3,560	N/A
Extended Detention Control	3,261	0.019
25 Year Quantity Control	7,205	0.198
100 year Quantity Control	8,473	0.283

Without the benefit of a concept plan for the McKinlay lands, the following stormwater management alternatives have been identified to provide economical solutions and flexibility for their ultimate development:

4.2.1 Alternative A: Expansion of Pond S34

Alternative A represents the construction of a separate cell on the McKinlay lands immediately adjacent to the subject SWM facility. The construction of a separate cell would avoid any retrofit costs while remaining a single facility. The cost of this expansion would be borne by McKinlay as the sole benefiting party. A preliminary grading / servicing / earthworks analysis undertaken by MGM in their SIS has confirmed that this alternative is feasible on the following basis:

- An adequate storm sewer system can convey flows within the McKinlay lands to the separate cell.
- An overland flow route can be maintained from Pond S34 to the south limit of the McKinlay lands
- A balance in the earthworks (cut / fill) within the McKinlay lands can be achieved.

4.2.2 Alternative B: Re-Location of Pond S34

Alternative B represents the re-location of the subject SWM facility on the TDI lands to the south limit or other suitable location on McKinlay lands. The cost of this re-location would be borne by McKinlay, however, the over-sizing costs would be offset by an appropriate land exchange with the Town related to the subject pond block on the TDI lands. A preliminary cost analysis prepared by MGM is included in their SIS. With regards to stormwater storage and discharge, the relocated Pond S34 would have to be expanded to provide the additional storage to accommodate the McKinlay lands as listed **Table 5**.

4.2.3 Alternative C: Private On-Site SWM Controls

Alternative C represents the implementation of private on-site stormwater management controls in the event that the McKinlay lands are developed as a single private parcel through the site plan process. These controls could be a combination of facilities such as a pond, sub-surface detention, parking lot detention, roof top detention and oil /grit separators. The cost of such on-site controls would be borne by McKinlay as the sole benefiting party. With regards to stormwater storage and discharge, the combination of facilities would have to achieve the equivalent of the criteria established in **Table 5**.

5.0 CONCLUSIONS

This report has provided an analysis with respect to stormwater management for the lands within the study area. Based on the analysis, the following storm drainage concept has been established:

1. A SWM facility (Pond S34) is to be constructed on the TDI lands to serve a drainage area (Areas "A", "B" & "D") which includes the EIL Lands and the majority of the TDI lands. A small parcel (Area "C") located within the north limit of the TDI lands, will be served by on-site stormwater management controls or subject to "treatment-in-lieu" given its physical isolation from the remainder of the site due to the location of the watercourse.

2. The subject SWM facility has been over-sized to accommodate lands beyond those owned by EIL and TDI. These include the non-participating lands owned by Pettiuello and Zulian. In addition, and at the request of the Region of Halton, the SWM facility has also been over-sized to accommodate a 2.3 Ha area (Area "D") associated with their proposed Tremaine Road / Highway 401 interchange in accordance with the Region's Class EA.

3. The balance of Catchment 2024 includes 17.8 Ha (Area "E") of the 24.0 Ha McKinlay parcel located south of the subject lands. This non-participating landowner has not filed any planning approval applications and, to date, has not provided any concept plans or advised of a development schedule. The following stormwater management alternatives have been identified for the McKinlay lands which provide both economical solutions and flexibility for their ultimate development:

    a) The construction of a separate cell on the McKinlay lands immediately adjacent to the subject SWM facility. The construction of a separate cell would avoid any retrofit costs while remaining a single facility. The cost of this expansion would be borne by McKinlay as the sole benefiting party.

    b) The re-location of the subject SWM facility to the south limit or other suitable location on McKinlay lands. The cost of this re-location would be borne by McKinlay, however, the over-sizing costs would be offset by an appropriate land exchange with the Town related to the subject pond block on the TDI lands.

    c) The implementation of private on-site stormwater management controls in the event that the McKinlay lands are developed as a single private parcel through the site plan process. These controls could be a combination of facilities such as a pond, sub-surface detention, parking lot detention, roof top detention and oil /grit separators. The cost of such on-site controls would be borne by McKinlay as the sole benefiting party.

4. The subject SWM facility has been designed to direct flows southerly to Tributary N1-A and easterly to Tributary N2-B under all rainfall events to maintain healthy streams and downstream fish habitat as required by the Town of Milton and Halton Conservation.

5. An operation and maintenance manual is to be prepared for the subject SWM facility at the detailed engineering design stage in accordance with the requirements of the Town of Milton.

6. In accordance with development industry standards, the cost of the subject SWM facility is to be shared by the owners of all of the benefiting lands on a proportionate contributing area basis.

In conclusion, the preliminary storm drainage concept for the Study Area is consistent with the intent of the Sixteen Mile Creek Subwatershed Planning Study that guides development within the Milton North Planning Area, as well as conforming to the Town of Milton's Engineering and Parks Development Standards and the requirements of Conservation Halton.

It has been demonstrated that it is feasible to construct Pond S34 as a permanent facility on the TDI lands. It is recommended that the approval of the subject subdivision application reflect a stormwater management block size and configuration as identified on **Drawing FSP-1**. It is noted that the conceptual design and associated analysis presented herein is of a preliminary nature and subject to final design at the detailed subdivision engineering stage.

6.0 REFERENCES & BIBLIOGRAPHY

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Respectfully Submitted,

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Consulting Engineer

LICENSED PROFESSIONAL ENGINEER D. A. GIUGOVAZ PROVINCE OF ONTARIO

VALDOR ENGINEERING INC.

Bill Coffey, M.Sc., P.Eng.
Head of Water Resources
Water Resources / Environmental Engineer

LICENSED PROFESSIONAL ENGINEER W. L. P. COFFEY PROVINCE OF ONTARIO

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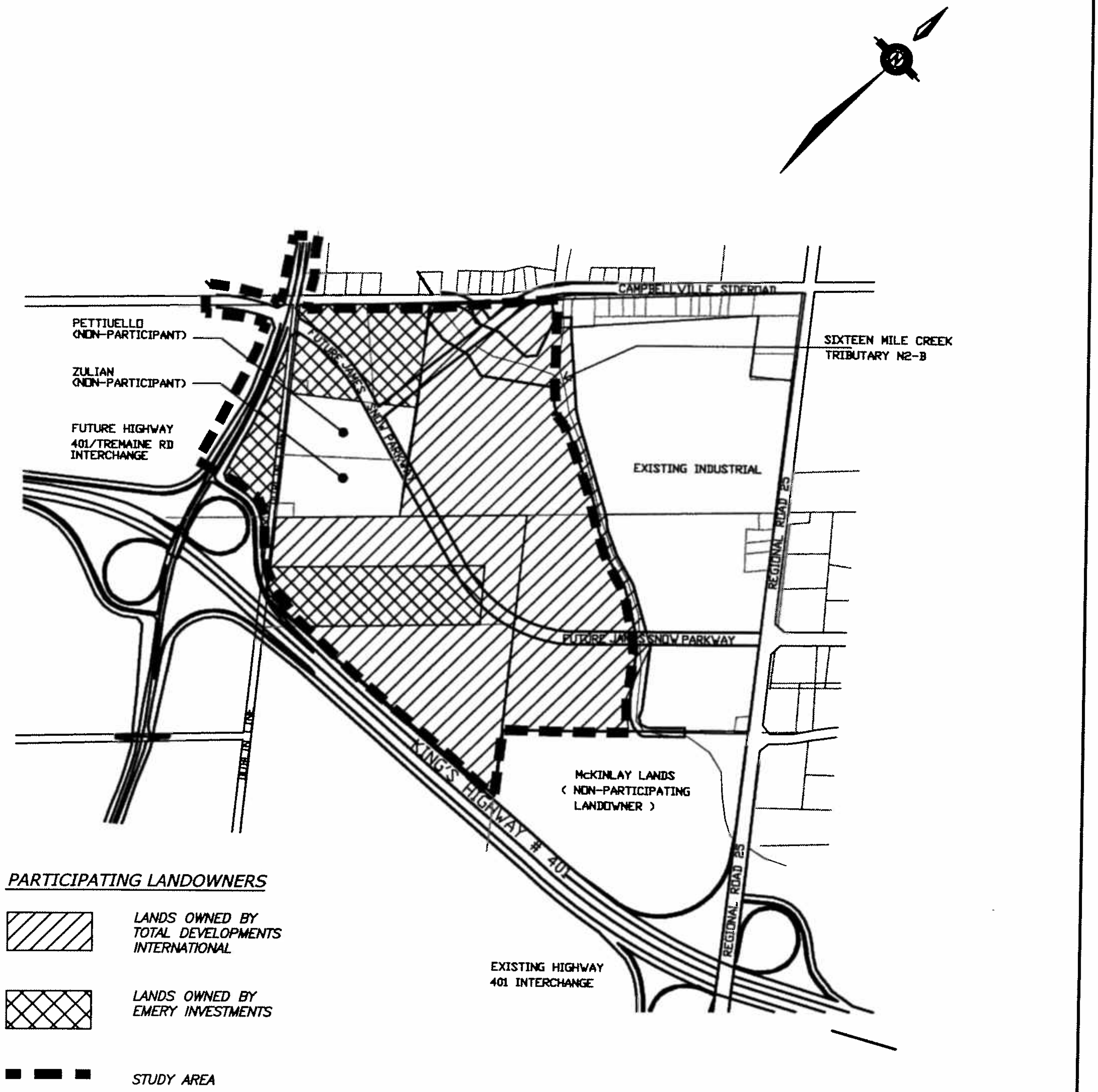
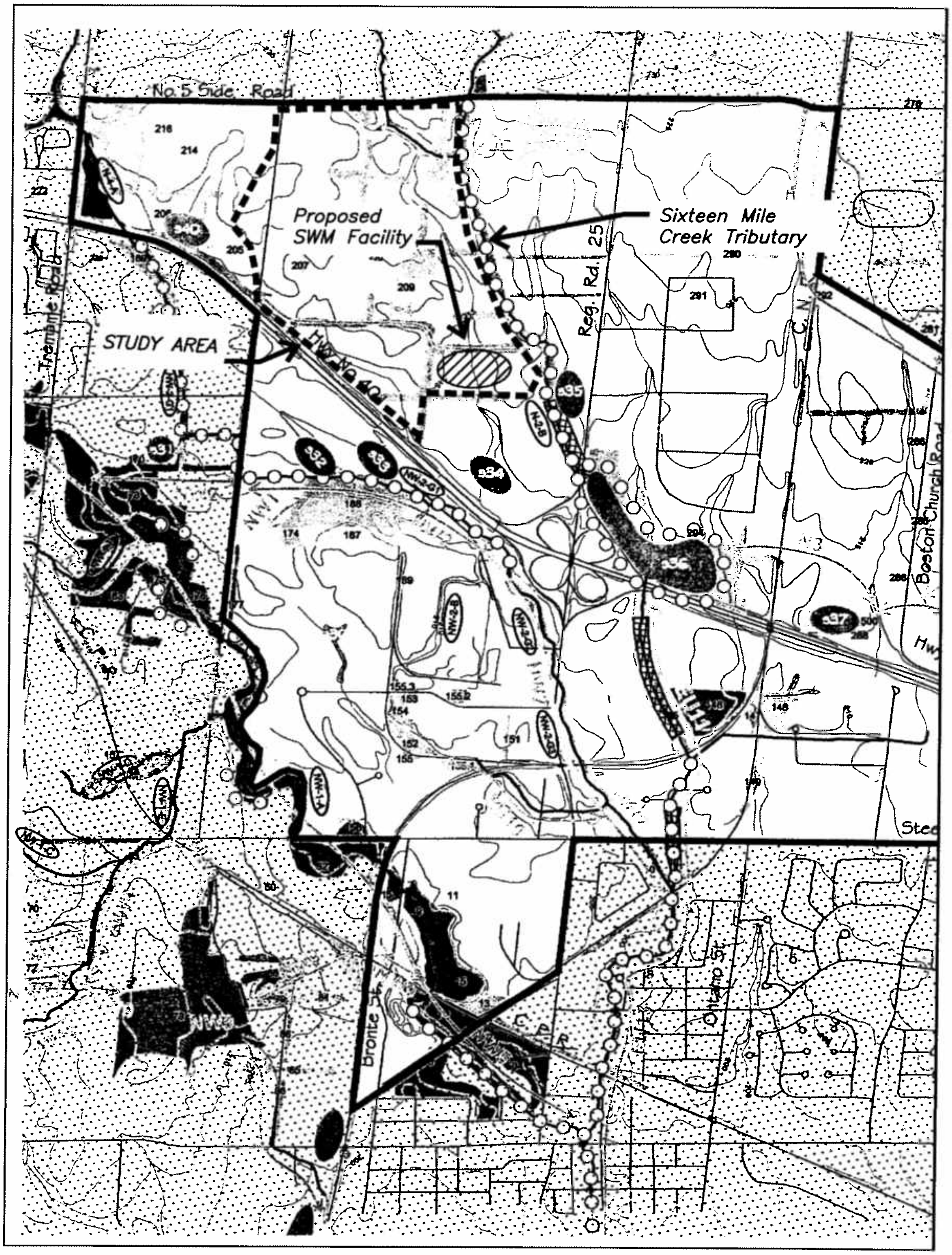
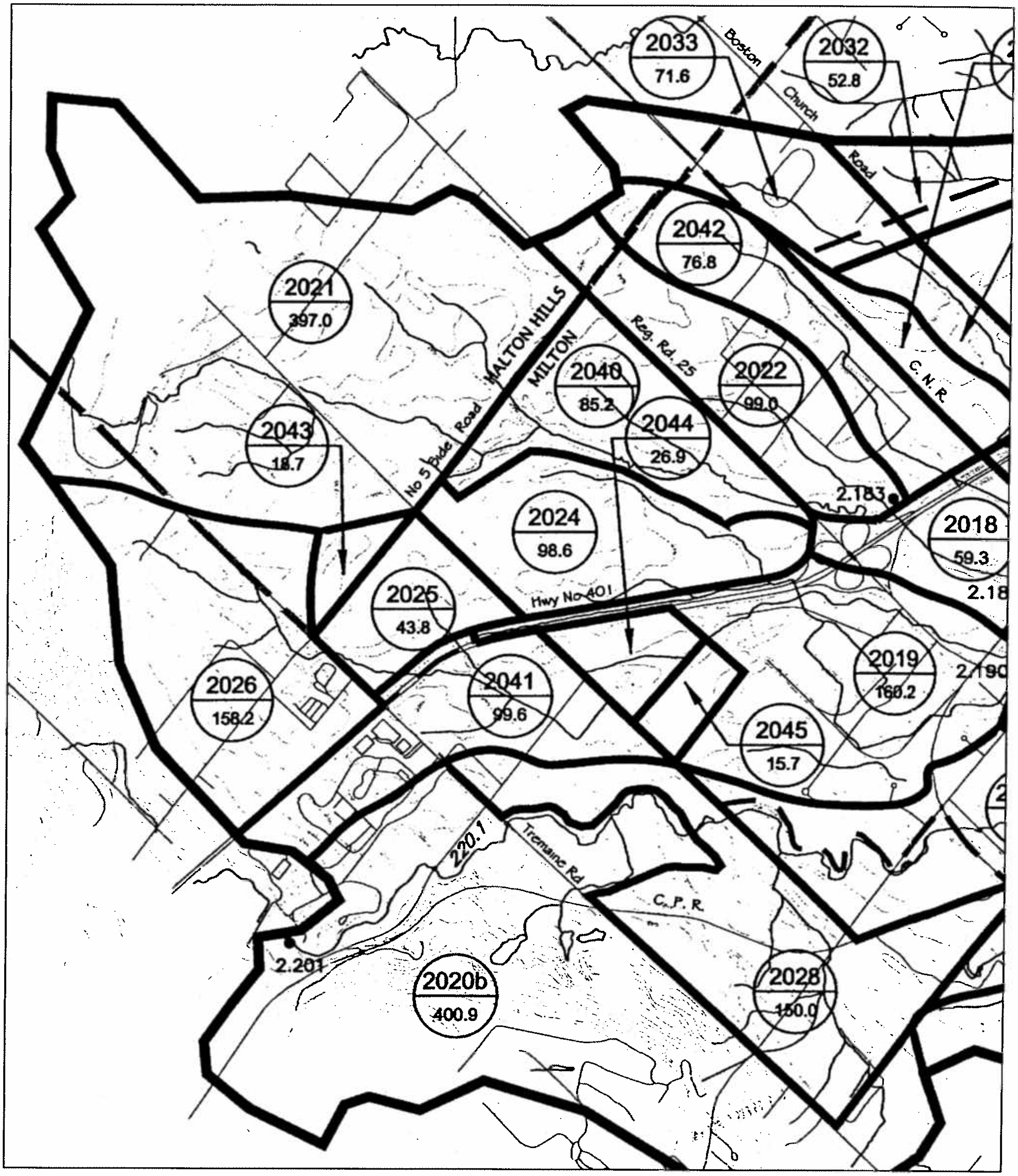


ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com		
	CHECKED. BY D.G.			
KEY PLAN	DATE JAN, 2007	SCALE N.T.S.	PROJECT 03156	DWG. FIGURE 1



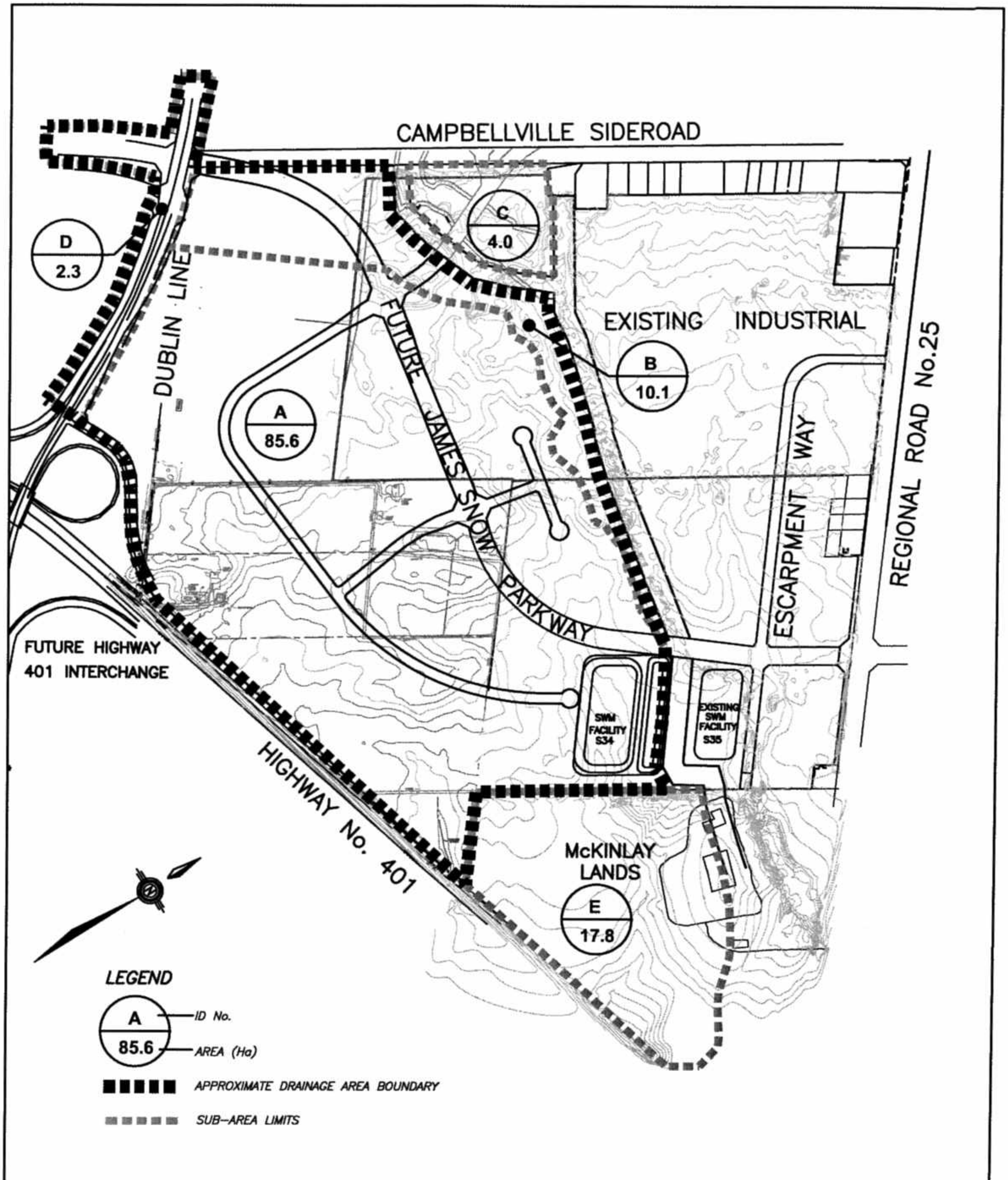
Source: FSEMS, Philips Engineering, 2000 (Figure 8)

ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com			
	CHECKED. BY D.G.				
OPPORTUNITIES PLAN	DATE JAN, 2007	SCALE N.T.S.	PROJECT 03156	DWG. FIGURE 2	

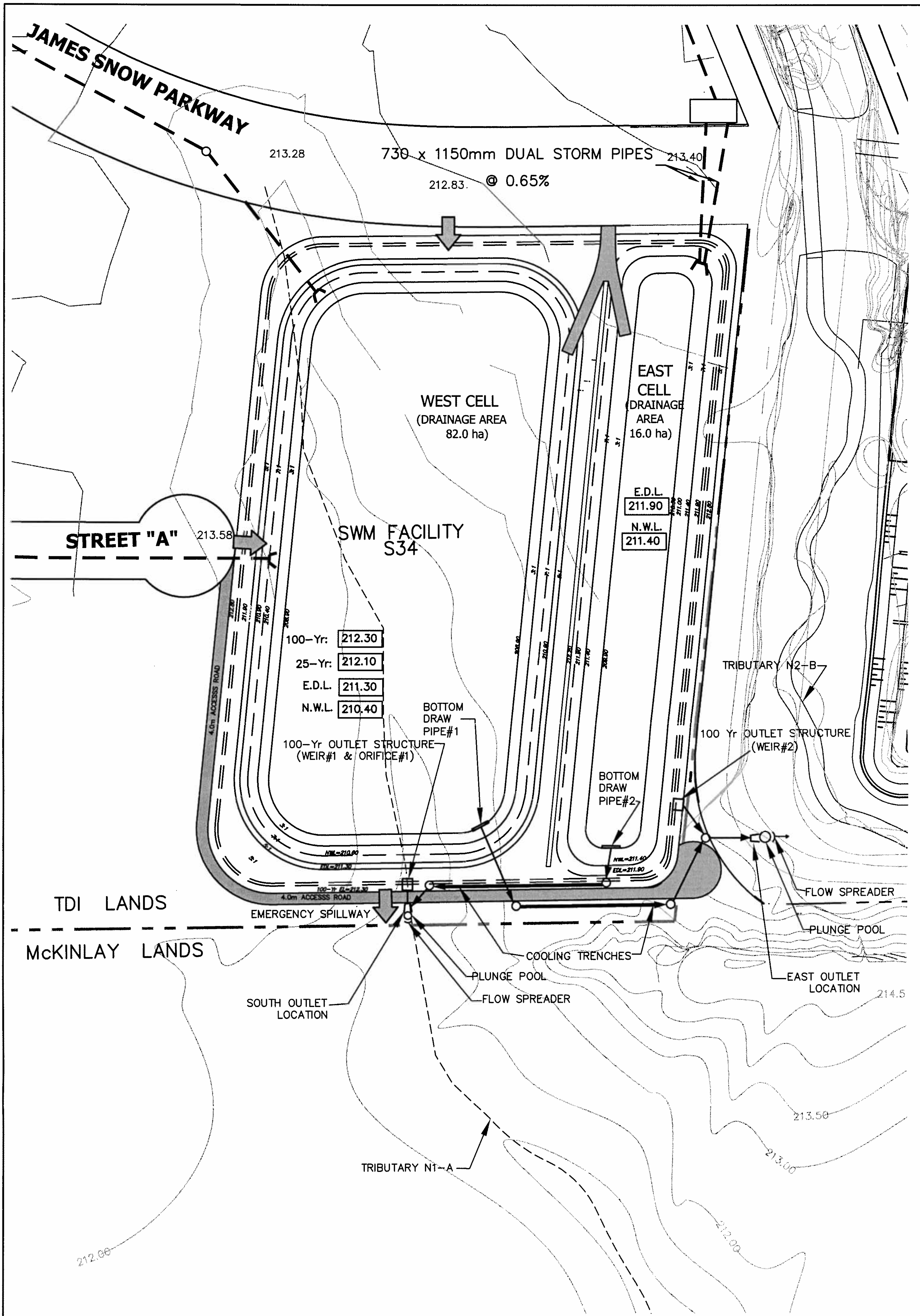


Source: FSEMS, Philips Engineering, 2000 (Figure B-2)

ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com		
	CHECKED. BY D.G.			
FUTURE WATERSHED BOUNDARY PLAN	DATE JAN, 2007	SCALE N.T.S.	PROJECT 03156	DWG. FIGURE 3



ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 861 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com		
	CHECKED. BY D.G.			
FUTURE STORM DRAINAGE PLAN	DATE JAN, 2007	SCALE N.T.S.	PROJECT 03156	DWG. FIGURE 4



ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON SWM FACILITY S34 CONCEPT PLAN	DRAWN BY J.J.M CHECKED. BY D.G.	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com	
	DATE JAN, 2007	SCALE 1:1250	PROJECT 03156
			DWG. FIGURE 5

APPENDIX "A"

SWM FACILITY S34 OPERATION

STAGE / STORAGE / DISCHARGE CHARACTERISTICS

VALDOR ENGINEERING INC.
661 Chrislea Road, Suite 11
Woodbridge, Ontario
L4L 8A3

Project Name: Escarpment Business Community West
Municipality: Town of Milton
Project No.: 3156
Designed by: JJM
Date: January 4, 2007

STORAGE							STAGE		DISCHARGE (m^3/s)									Obs:
Elevation (m)	Section Area (sq.m.)	Avg Area (sq.m)	Section Volume (m^3)	Cumulative Volume (m^3)	Volume Above NWL (m^3)	Total Active Storage (ha.m)	Active (m) West Cell	Active (m) East Cell	Structure:	Bottom Draw #1	Quantity Orifice#1	Quantity Weir #1	Bottom Draw #2	Quantity Weir #2	Total Outflow to South	Total Outflow to East	Total Outflow	Weir Eq'n: $Q = 1.67xLxH^{3/2}$
									Type:	Orifice	Orifice	1 Weir @	Orifice	4 Weirs @				Orifice Eq'n: $Q = 0.6CxAx(2gH)^{1/2}$
									Size (m):	**0.155**	**0.860**	**2.100**	**0.115**	**1.820**				
									Inv. (m):	210.40	211.30	212.15	211.40	211.90				
									Outlet:	East	South	South	South	East				
West Cell																		
208.90	15,850																	
210.00	17,900	16,875	18,562	18,562														
210.40	19,850	18,875	7,550	26,113	**NWL**	0.000	0.00			0.000								
210.90	21,450	20,650	10,325	36,438	10,325	1.033	0.50			0.033						0.033		
211.30	22,600	22,025	8,810	45,248	**19,135**	1.914	0.90			0.045						**0.045**		**Extended Detention**
211.40					**21,918**	2.192	1.00			0.048						**0.048**		**(released over 7 days)**
East Cell																		
209.90	3,900																	
211.00	5,450	4,675	5,142	5,142														
211.40	6,850	6,150	2,460	7,603	**NWL**	0.000		0.00					0.000					
211.90	8,600	7,725	3,863	11,465	**3,863**	0.386		0.50					0.018		**0.018**			**Extended Detention**
																		(released over 48 hours)
Combined Cells																		
211.30	22,600						0.90			0.045	0.000							
211.90	33,050	27,825	16,695	16,695	39,693	3.969	1.50	0.50		0.060	0.637		0.018	0.000	0.65	0.060	0.71	
211.95	34,261	33,656	1,683	18,378	41,375	4.138	1.55	0.55		0.061	0.724		0.019	0.136	0.74	0.197	0.94	
211.96	34,316	34,289	343	18,721	41,718	4.172	1.56	0.56		0.061	0.740		0.020	0.179	0.76	0.240	1.00	
211.97	34,372	34,344	343	19,064	42,062	4.206	1.57	0.57		0.061	0.756		0.020	0.225	0.78	0.286	1.06	
212.00	34,540	34,456	1,034	20,098	43,095	4.310	1.60	0.60		0.062	0.802		0.020	0.384	0.82	0.446	1.27	
212.10	35,950	35,245	3,524	23,622	46,620	4.662	1.70	0.70		0.064	0.939		0.022	1.087	0.96	1.151	2.11	
212.15	35,377	35,664	1,783	25,405	48,403	4.840	1.75	0.75		0.065	1.000	0.000	0.023	1.520	1.02	1.585	2.61	
212.20	35,656	35,517	1,776	27,181	50,179	5.018	1.80	0.80		0.066	1.058	0.039	0.024	1.998	1.12	2.064	3.18	
212.22	35,767	35,712	714	27,896	50,893	5.089	1.82	0.82		0.066	1.081	0.065	0.024	2.201	1.17	2.267	3.44	
212.25	35,935	35,851	1,076	28,971	51,969	5.197	1.85	0.85		0.067	1.113	0.111	0.025	2.517	1.25	2.584	3.83	
212.30	36,700	36,318	1,816	30,787	53,784	5.378	1.90	0.90		0.068	1.166	0.204	0.025	3.076	1.39	3.143	4.54	
212.35	36,900	36,800	1,840	32,627	55,624	5.562	1.95	0.95		0.069	1.216	0.314	0.026	3.670	1.56	3.739	5.3	
212.40					57,551	5.755	2.00	1.00		0.070	1.264	0.438	0.027	4.298	1.73	4.368	6.1	

Figure 8
Escarpment Business Community West SWM Pond - West Cell Extended Detention
Stage-Storage-Discharge CURVE

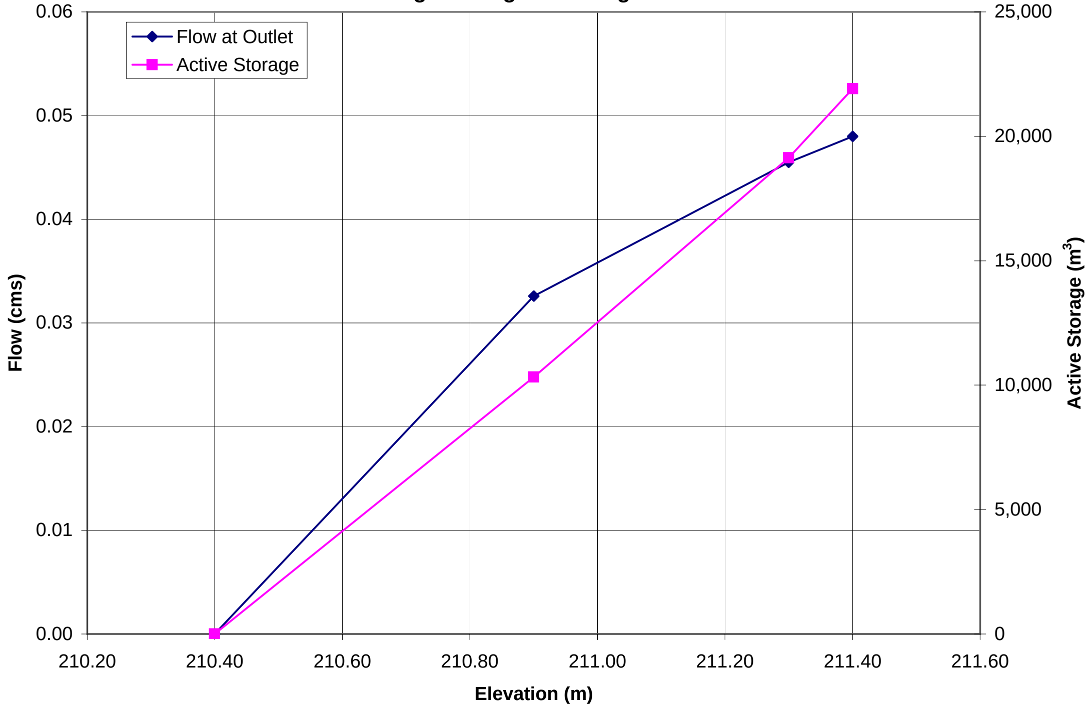


Figure 9
Escarpment Business Community West SWM Pond - East Cell Extended Detention
Stage-Storage-Discharge CURVE

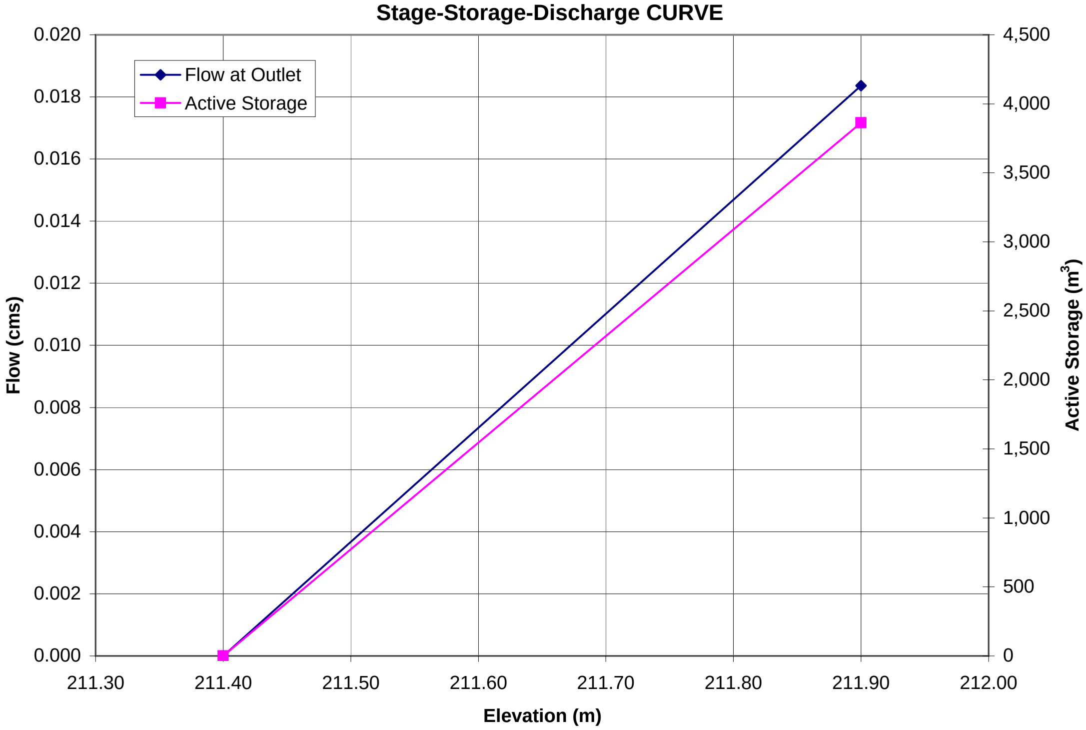


Figure 10
Escarpment Business Community West SWM Pond - East and West Cells Combined
Stage-Storage-Discharge CURVE

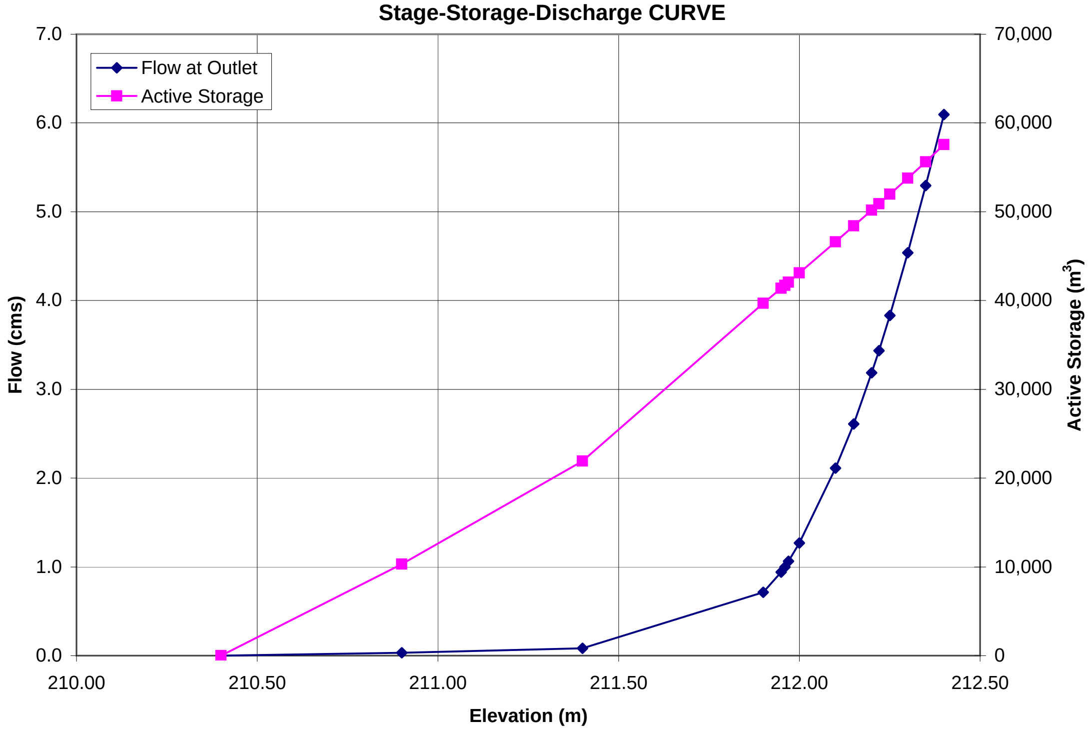
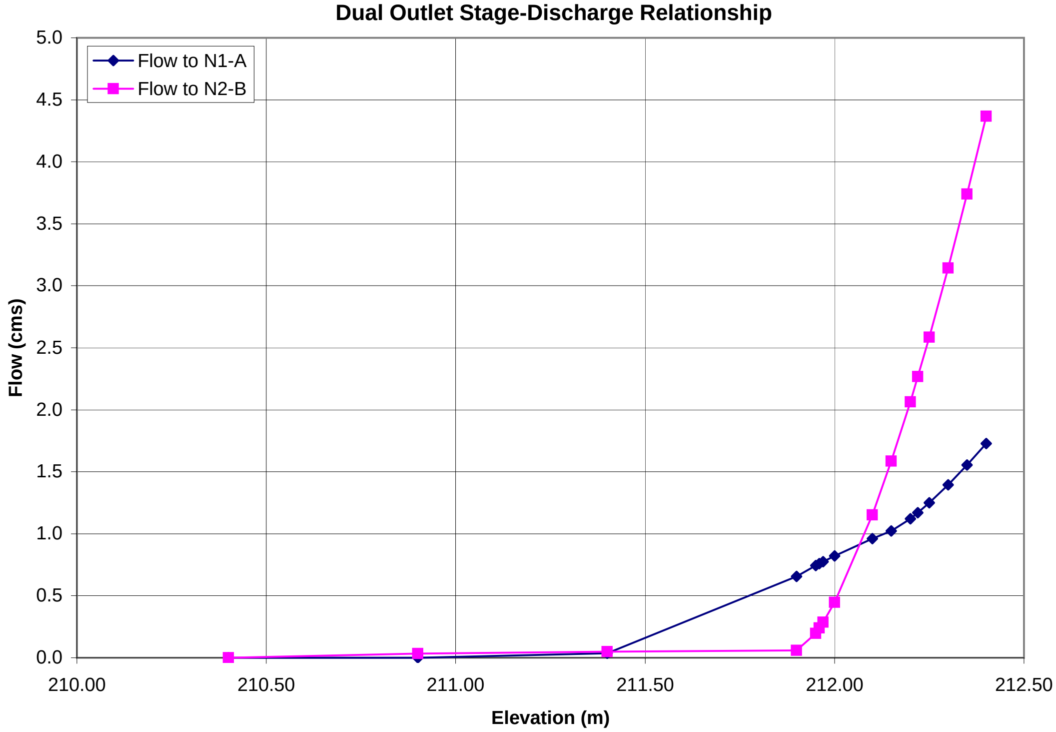


Figure 11
Escarpment Business Community West SWM Pond - East and West Cells Combined
Dual Outlet Stage-Discharge Relationship



APPENDIX "B"

Allowable Post-Development Flows - Area "B"

Project Name: Ecarpment Business Community
Municipality: Town of Milton
Project No.: 03156
Date: January 4, 2007

OTTHYMO Model Results

25-Year Storm=	**2.93**	m^3/s
100-Year Storm=	**3.75**	m^3/s

```
======================================================================================================

      V    V   I    SSSSS  U    U     A     L
      V    V   I    SS     U    U    A A    L
       V  V    I     SS    U    U   AAAAA   L
       V  V    I      SS   U    U   A    A  L
        VV     I    SSSSS  UUUUU   A    A  LLLLL

       OOO    TTTTT   TTTTT   H    H  Y    Y  M    M   OOO     TM, Version 2.0
      O   O     T       T     H    H   Y Y    MM MM  O    O
      O   O     T       T     H    H    Y     M    M  O    O   Licensed To: Valdor Engineering
       OOO      T       T     H    H    Y     M    M   OOO                  VO2-0102
```

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***** D E T A I L E D   O U T P U T *****

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Summary filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\10.14ha. Post-dev\December 2006\Post Chicago 24 Hour.sum

DATE: 12/12/2006   TIME: 3:02:28 PM

USER:

COMMENTS: 25-YEAR STORM

AREA "B" POST-DEVELOPMENT

****
** SIMULATION NUMBER: 4 **
****

| CHICAGO STORM |
| Ptotal= 97.22 mm |

IDF curve parameters: A=1234.000
B= 5.500
C= .786
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = .33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.89	6.08	2.81	12.08	2.64	18.08	1.27
.17	.89	6.17	2.91	12.17	2.60	18.17	1.26
.25	.90	6.25	3.03	12.25	2.56	18.25	1.25
.33	.91	6.33	3.16	12.33	2.52	18.33	1.25
.42	.92	6.42	3.29	12.42	2.48	18.42	1.24
.50	.93	6.50	3.45	12.50	2.44	18.50	1.23
.58	.93	6.58	3.62	12.58	2.40	18.58	1.22
.67	.94	6.67	3.81	12.67	2.37	18.67	1.21
.75	.95	6.75	4.03	12.75	2.34	18.75	1.21
.83	.96	6.83	4.27	12.83	2.30	18.83	1.20
.92	.97	6.92	4.56	12.92	2.27	18.92	1.19
1.00	.98	7.00	4.88	13.00	2.24	19.00	1.19
1.08	.99	7.08	5.27	13.08	2.21	19.08	1.18
1.17	1.00	7.17	5.73	13.17	2.18	19.17	1.17
1.25	1.01	7.25	6.30	13.25	2.15	19.25	1.16
1.33	1.02	7.33	7.00	13.33	2.12	19.33	1.16
1.42	1.03	7.42	7.91	13.42	2.10	19.42	1.15
1.50	1.04	7.50	9.13	13.50	2.07	19.50	1.14
1.58	1.05	7.58	10.85	13.58	2.05	19.58	1.14
1.67	1.06	7.67	13.50	13.67	2.02	19.67	1.13
1.75	1.07	7.75	18.07	13.75	2.00	19.75	1.12
1.83	1.08	7.83	27.92	13.83	1.98	19.83	1.12
1.92	1.09	7.92	64.21	13.92	1.95	19.92	1.11
2.00	1.11	8.00	194.38	14.00	1.93	20.00	1.11
2.08	1.12	8.08	82.51	14.08	1.91	20.08	1.10
2.17	1.13	8.17	46.00	14.17	1.89	20.17	1.09
2.25	1.15	8.25	31.70	14.25	1.87	20.25	1.09
2.33	1.16	8.33	24.20	14.33	1.85	20.33	1.08
2.42	1.17	8.42	19.63	14.42	1.83	20.42	1.08
2.50	1.19	8.50	16.55	14.50	1.81	20.50	1.07
2.58	1.20	8.58	14.34	14.58	1.79	20.58	1.06

2.67	1.22	8.67	12.68	14.67	1.77	20.67	1.06
2.75	1.23	8.75	11.39	14.75	1.76	20.75	1.05
2.83	1.25	8.83	10.35	14.83	1.74	20.83	1.05
2.92	1.26	8.92	9.50	14.92	1.72	20.92	1.04
3.00	1.28	9.00	8.79	15.00	1.70	21.00	1.04
3.08	1.30	9.08	8.18	15.08	1.69	21.08	1.03
3.17	1.32	9.17	7.66	15.17	1.67	21.17	1.03
3.25	1.34	9.25	7.21	15.25	1.66	21.25	1.02
3.33	1.36	9.33	6.81	15.33	1.64	21.33	1.02
3.42	1.37	9.42	6.46	15.42	1.63	21.42	1.01
3.50	1.40	9.50	6.15	15.50	1.61	21.50	1.01
3.58	1.42	9.58	5.87	15.58	1.60	21.58	1.00
3.67	1.44	9.67	5.61	15.67	1.58	21.67	1.00
3.75	1.46	9.75	5.38	15.75	1.57	21.75	.99
3.83	1.48	9.83	5.17	15.83	1.56	21.83	.99
3.92	1.51	9.92	4.98	15.92	1.54	21.92	.98
4.00	1.53	10.00	4.80	16.00	1.53	22.00	.98
4.08	1.56	10.08	4.64	16.08	1.52	22.08	.97
4.17	1.59	10.17	4.49	16.17	1.51	22.17	.97
4.25	1.62	10.25	4.34	16.25	1.49	22.25	.96
4.33	1.65	10.33	4.21	16.33	1.48	22.33	.96
4.42	1.68	10.42	4.09	16.42	1.47	22.42	.95
4.50	1.71	10.50	3.97	16.50	1.46	22.50	.95
4.58	1.74	10.58	3.87	16.58	1.45	22.58	.95
4.67	1.78	10.67	3.77	16.67	1.43	22.67	.94
4.75	1.82	10.75	3.67	16.75	1.42	22.75	.94
4.83	1.86	10.83	3.58	16.83	1.41	22.83	.93
4.92	1.90	10.92	3.49	16.92	1.40	22.92	.93
5.00	1.94	11.00	3.41	17.00	1.39	23.00	.93
5.08	1.98	11.08	3.34	17.08	1.38	23.08	.92
5.17	2.03	11.17	3.26	17.17	1.37	23.17	.92
5.25	2.08	11.25	3.19	17.25	1.36	23.25	.91
5.33	2.14	11.33	3.13	17.33	1.35	23.33	.91
5.42	2.19	11.42	3.06	17.42	1.34	23.42	.91
5.50	2.25	11.50	3.00	17.50	1.33	23.50	.90
5.58	2.32	11.58	2.94	17.58	1.32	23.58	.90
5.67	2.38	11.67	2.89	17.67	1.31	23.67	.89
5.75	2.46	11.75	2.84	17.75	1.31	23.75	.89
5.83	2.54	11.83	2.79	17.83	1.30	23.83	.89
5.92	2.62	11.92	2.74	17.92	1.29	23.92	.88
6.00	2.71	12.00	2.69	18.00	1.28	24.00	.88

```
------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (0002)   |   Area     (ha)=  10.14
|ID= 1 DT= 5.0 min   |   Total Imp(%)=  75.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      7.61          2.54
     Dep. Storage      (mm)=      1.00          1.50
     Average Slope      (%)=      1.00          2.00
     Length             (m)=    260.00         40.00
     Mannings n           =       .013          .250

     Max.Eff.Inten.(mm/hr)=     194.38        201.72
                over (min)        5.00         10.00
     Storage Coeff.   (min)=      3.47 (ii)     7.57 (ii)
     Unit Hyd. Tpeak  (min)=      5.00         10.00
     Unit Hyd. peak   (cms)=       .26           .13
                                                          *TOTALS*
     PEAK FLOW        (cms)=      2.27          1.07         2.926 (iii)
     TIME TO PEAK     (hrs)=      8.00          8.08          8.00
     RUNOFF VOLUME     (mm)=     96.22         68.14         82.18
     TOTAL RAINFALL    (mm)=     97.22         97.22         97.22
     RUNOFF COEFFICIENT   =        .99           .70           .85

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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.

------------------------------------------------------------------------------

 FINISH
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     V     V   I    SSSSS  U    U     A     L
     V     V   I    SS     U    U    A A    L
      V   V    I     SS    U    U   AAAAA   L
      V   V    I      SS   U    U   A    A  L
       VV      I    SSSSS  UUUUU   A     A  LLLLL

      OOO    TTTTT  TTTTT  H    H  Y    Y   M    M    OOO       TM, Version 2.0
     O   O     T      T    H    H   Y Y     MM MM    O    O
     O   O     T      T    H    H    Y      M    M   O    O     Licensed To: Valdor Engineering
      OOO      T      T    H    H    Y      M    M    OOO                    VO2-0102
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***** D E T A I L E D   O U T P U T *****

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DATE: 12/12/2006   TIME: 3:03:03 PM

USER:

COMMENTS: 100-Year Storm

AREA "B" POST DEVELOPMENT

```
****************************
** SIMULATION NUMBER:   6 **
****************************
```

CHICAGO STORM
Ptotal=122.49 mm

IDF curve parameters: A=1435.000
B= 5.200
C= .775
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = .33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.17	6.08	3.64	12.08	3.43	18.08	1.67
.17	1.18	6.17	3.78	12.17	3.38	18.17	1.66
.25	1.19	6.25	3.92	12.25	3.32	18.25	1.65
.33	1.20	6.33	4.08	12.33	3.27	18.33	1.64
.42	1.21	6.42	4.26	12.42	3.22	18.42	1.63
.50	1.22	6.50	4.45	12.50	3.17	18.50	1.62
.58	1.23	6.58	4.67	12.58	3.13	18.58	1.61
.67	1.25	6.67	4.91	12.67	3.08	18.67	1.60
.75	1.26	6.75	5.18	12.75	3.04	18.75	1.59
.83	1.27	6.83	5.49	12.83	3.00	18.83	1.58
.92	1.28	6.92	5.85	12.92	2.96	18.92	1.57
1.00	1.29	7.00	6.26	13.00	2.92	19.00	1.56
1.08	1.30	7.08	6.75	13.08	2.88	19.08	1.55
1.17	1.32	7.17	7.32	13.17	2.84	19.17	1.54
1.25	1.33	7.25	8.03	13.25	2.80	19.25	1.53
1.33	1.34	7.33	8.90	13.33	2.77	19.33	1.52
1.42	1.36	7.42	10.03	13.42	2.74	19.42	1.52
1.50	1.37	7.50	11.53	13.50	2.70	19.50	1.51
1.58	1.38	7.58	13.65	13.58	2.67	19.58	1.50
1.67	1.40	7.67	16.87	13.67	2.64	19.67	1.49
1.75	1.41	7.75	22.41	13.75	2.61	19.75	1.48
1.83	1.43	7.83	34.27	13.83	2.58	19.83	1.47
1.92	1.44	7.92	77.82	13.92	2.55	19.92	1.46
2.00	1.46	8.00	237.24	14.00	2.52	20.00	1.46
2.08	1.48	8.08	99.80	14.08	2.49	20.08	1.45
2.17	1.49	8.17	55.94	14.17	2.47	20.17	1.44
2.25	1.51	8.25	38.81	14.25	2.44	20.25	1.43
2.33	1.53	8.33	29.82	14.33	2.41	20.33	1.43
2.42	1.54	8.42	24.30	14.42	2.39	20.42	1.42
2.50	1.56	8.50	20.58	14.50	2.37	20.50	1.41
2.58	1.58	8.58	17.90	14.58	2.34	20.58	1.40

2.67	1.60	8.67	15.88	14.67	2.32	20.67	1.40
2.75	1.62	8.75	14.30	14.75	2.30	20.75	1.39
2.83	1.64	8.83	13.03	14.83	2.27	20.83	1.38
2.92	1.66	8.92	11.98	14.92	2.25	20.92	1.37
3.00	1.69	9.00	11.11	15.00	2.23	21.00	1.37
3.08	1.71	9.08	10.36	15.08	2.21	21.08	1.36
3.17	1.73	9.17	9.72	15.17	2.19	21.17	1.35
3.25	1.76	9.25	9.16	15.25	2.17	21.25	1.35
3.33	1.78	9.33	8.67	15.33	2.15	21.33	1.34
3.42	1.81	9.42	8.23	15.42	2.13	21.42	1.33
3.50	1.83	9.50	7.84	15.50	2.11	21.50	1.33
3.58	1.86	9.58	7.49	15.58	2.09	21.58	1.32
3.67	1.89	9.67	7.17	15.67	2.07	21.67	1.32
3.75	1.92	9.75	6.89	15.75	2.06	21.75	1.31
3.83	1.95	9.83	6.62	15.83	2.04	21.83	1.30
3.92	1.98	9.92	6.38	15.92	2.02	21.92	1.30
4.00	2.01	10.00	6.16	16.00	2.01	22.00	1.29
4.08	2.05	10.08	5.95	16.08	1.99	22.08	1.28
4.17	2.08	10.17	5.76	16.17	1.97	22.17	1.28
4.25	2.12	10.25	5.58	16.25	1.96	22.25	1.27
4.33	2.16	10.33	5.42	16.33	1.94	22.33	1.27
4.42	2.20	10.42	5.26	16.42	1.93	22.42	1.26
4.50	2.24	10.50	5.12	16.50	1.91	22.50	1.26
4.58	2.28	10.58	4.98	16.58	1.90	22.58	1.25
4.67	2.33	10.67	4.85	16.67	1.88	22.67	1.24
4.75	2.37	10.75	4.73	16.75	1.87	22.75	1.24
4.83	2.42	10.83	4.62	16.83	1.85	22.83	1.23
4.92	2.48	10.92	4.51	16.92	1.84	22.92	1.23
5.00	2.53	11.00	4.41	17.00	1.83	23.00	1.22
5.08	2.59	11.08	4.31	17.08	1.81	23.08	1.22
5.17	2.65	11.17	4.22	17.17	1.80	23.17	1.21
5.25	2.72	11.25	4.13	17.25	1.79	23.25	1.21
5.33	2.78	11.33	4.05	17.33	1.78	23.33	1.20
5.42	2.86	11.42	3.97	17.42	1.76	23.42	1.20
5.50	2.93	11.50	3.89	17.50	1.75	23.50	1.19
5.58	3.01	11.58	3.81	17.58	1.74	23.58	1.19
5.67	3.10	11.67	3.74	17.67	1.73	23.67	1.18
5.75	3.19	11.75	3.68	17.75	1.72	23.75	1.18
5.83	3.29	11.83	3.61	17.83	1.70	23.83	1.17
5.92	3.40	11.92	3.55	17.92	1.69	23.92	1.17
6.00	3.52	12.00	3.49	18.00	1.68	24.00	1.16

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-----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (0002)   |   Area     (ha)=  10.14
|ID= 1 DT= 5.0 min   |   Total Imp(%)=  75.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=      7.61          2.54
     Dep. Storage      (mm)=      1.00          1.50
     Average Slope      (%)=      1.00          2.00
     Length             (m)=    260.00         40.00
     Mannings n            =      .013          .250

     Max.Eff.Inten.(mm/hr)=     237.24        264.45
                over (min)        5.00         10.00
     Storage Coeff.   (min)=      3.21 (ii)     6.99 (ii)
     Unit Hyd. Tpeak  (min)=      5.00         10.00
     Unit Hyd. peak   (cms)=       .27           .14
                                                          *TOTALS*
     PEAK FLOW        (cms)=      2.84          1.47        3.750 (iii)
     TIME TO PEAK     (hrs)=      8.00          8.08        8.00
     RUNOFF VOLUME     (mm)=    121.49         91.58      106.54
     TOTAL RAINFALL    (mm)=    122.49        122.49      122.49
     RUNOFF COEFFICIENT   =       .99           .75         .87

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  76.0    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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 FINISH
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APPENDIX "C"

Project Name: Escarpment Business Community West
Municipality: Town of Milton
Project No.: 03516
Date: 28-Mar-2007

TABLE 6: SUMMARY OF PRE & POST DEVELOPMENT DISCHARGE

EXTENDED DETENTION

Design Storm	DRAINING SOUTH TO TRIBUTARY N1-A					DRAINING EAST TO TRIBUTARY N2-B							SWM Pond HWL Elevation (m)		Total					
	Pre-development (Area = 53.6 ha)		Post-development (East Cell)			Pre-development (Area = 10.1 ha)		Post-development (Area = 10.1 ha)		Post-development (West Cell)					Runoff Volume		Discharge			Storage
	Q_{peak} (m^3/s)	Runoff Volume (m^3)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Runoff Volume (m^3)	Q_{peak} (m^3/s)	Runoff Volume (m^3)	Qpeak (m^3/s)	Runoff Volume (m^3)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Runoff Volume (m^3)	West Cell	East Cell	Pre-Dev (m^3)	Post-Dev (m^3)	Pre-Dev Q_{peak} (m^3/s)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Used (m^3)
25mm	0.20	2,240	0.11	0.01	2,901	0.05	424	0.53	1,682	0.012	0.040	13,350	211.05	211.75	2,664	16,251	0.25	0.12	0.05	18,330

FLOOD CONTROL

Design Storm	DRAINING SOUTH TO TRIBUTARY N1-A					DRAINING EAST TO TRIBUTARY N2-B							SWM Pond HWL Elevation (m)		Total					
	Pre-development (Area = 53.6 ha)		Post-development			Pre-development (Area = 10.1 ha)		Post-development (Area = 10.1 ha)		Post-development					Runoff Volume		Discharge			Storage
	Q_{peak} (m^3/s)	Runoff Volume (m^3)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Runoff Volume (m^3)	Q_{peak} (m^3/s)	Runoff Volume (m^3)	Qpeak (m^3/s)	Runoff Volume (m^3)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Runoff Volume (m^3)	West Cell	East Cell	Pre-Dev (m^3)	Post-Dev (m^3)	Pre-Dev Q_{peak} (m^3/s)	Allowable Q_{peak} (m^3/s)	Actual Q_{peak} (m^3/s)	Used (m^3)
2-year	0.56	8,061		0.26	17,163	0.17	1,525	1.3	3,639		0.05	16,157	211.60	211.90	9,586	33,320	0.730		0.31	28,276
5-year	1.02	14,761		0.59	33,561	0.31	2,792	2.0	5,461		0.06	17,124	211.85	211.90	17,553	50,685	1.3		0.65	37,910
10-year	1.35	19,526		0.82	41,588	0.41	3,695	2.4	6,651		0.42	20,436	212.00		23,221	62,024	1.8		1.24	42,957
25-year	1.83	26,645	1.1	1.02	47,947	0.56	5,041	2.9	8,333	2.9	1.57	30,119	212.15		31,686	78,066	2.4	4.0	2.59	48,357
50-year	2.19	31,988		1.25	52,003	0.67	6,051	3.3	9,548		2.59	37,657	212.25		38,039	89,660	2.9		3.84	52,005
100-year	2.58	37,649	1.6	1.57	56,019	0.79	7,123	3.8	10,803	3.8	3.78	45,626	212.35		44,772	101,645	3.4	5.4	5.35	55,805

VALDOR ENGINEERING
661 Chrislea Road, Suite 11
Woodbridge - Ontario L4L 8A3
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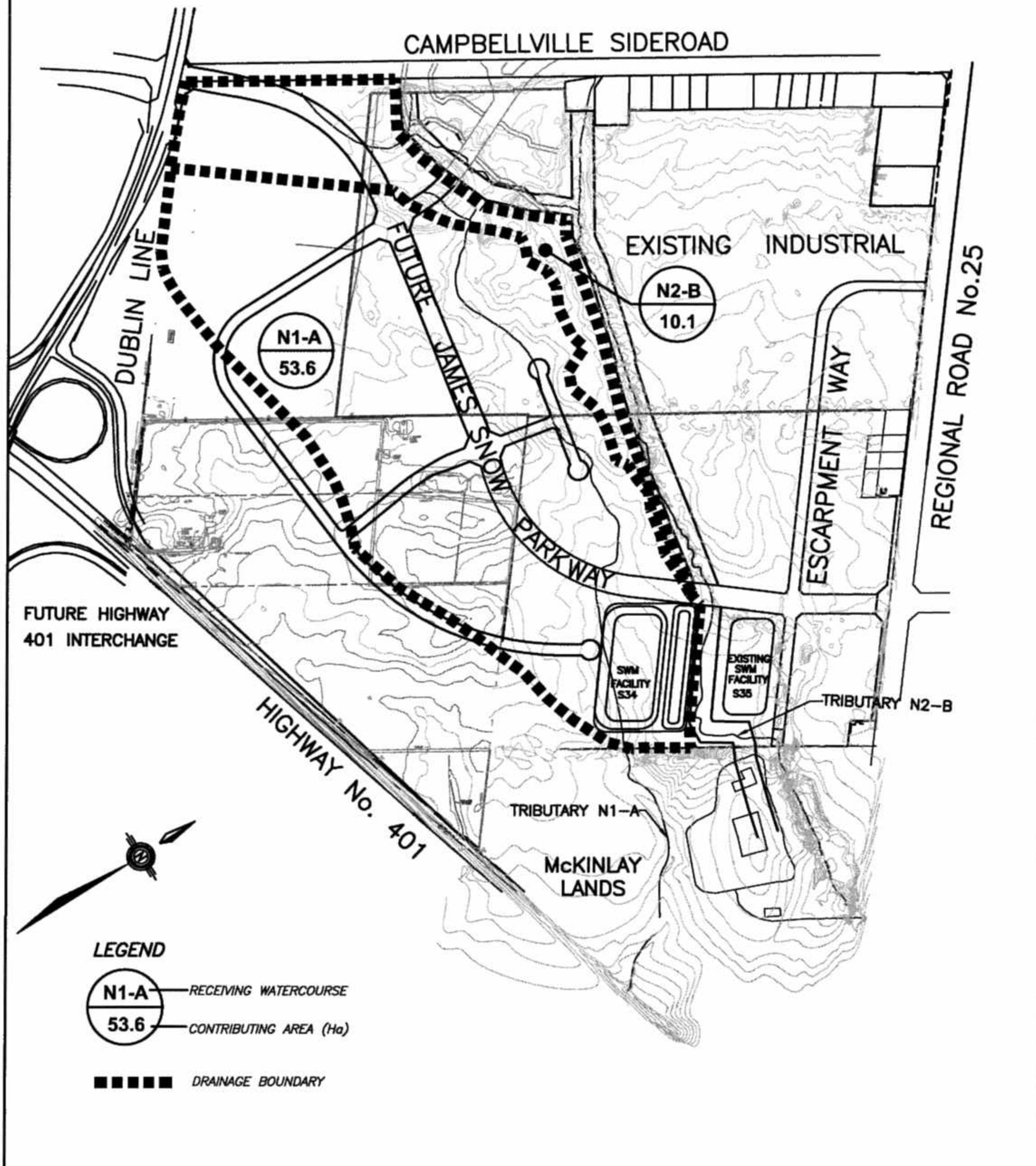
S:\Projects\2003\03156\Hydrotechnical\28 March 2007\03156 Pond-(Plus 2.3ha)-Final-v7.xls



ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M	VALDOR ENGINEERING INC. Consulting Engineers – Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL. (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com	
	CHECKED. BY D.G.		
PRE-DEVELOPMENT DRAINAGE PLAN	DATE JAN, 2007	SCALE N.T.S.	PROJECT 03156
			DWG. FIGURE 6

Pre-development Peak Flow to Tributary N2-B

Project Name: Escarpment Bussines Community West
Municipality: Town of Milton
Project No.: 03516
Designed by: JJM
Date: December 4, 2006

Drainage Area = **10.14** ha.

Airport Method

$$t_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{\ 0.33}}$$

Tc= 50.22

Time to Peak

$$tp = 0.67tc$$

Tp= 0.56

Tc:	50.22	Time of Concentration (min)	
Tp:	0.56	Time to Peak (hrs)	
L=	1255	Catchment Length	(m)
Ah=	6.50		
Sw=	0.52	Catchment Slope	(%)
C=	0.75	Runoff Coefficient	

OTTHYMO Model Parameters

CN= 76
IA= 4.5mm.
Tp= 0.56hrs

OTTHYMO Model Results (Chicago 24-hour Storm)

25mm Storm =	**0.05**	m^3/s
2-Year Storm=	0.17	m^3/s
5-Year Storm=	0.31	m^3/s
10-Year Storm=	0.41	m^3/s
25-Year Storm=	**0.56**	**m^3/s**
50-Year Storm=	0.67	m^3/s
100-Year Storm=	**0.79**	**m^3/s**

```
==========================================================================================
=====

      V     V   I    SSSSS  U   U    A    L
      V     V   I    SS     U   U   A A   L
       V   V    I     SS    U   U  AAAAA  L
        V V     I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM, Version 2.0
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O   Licensed To: Valdor Engineering
       OOO     T      T    H   H    Y    M   M   OOO                 V02-0102
```

Developed and Distributed by Greenland International Consulting Inc.

***** D E T A I L E D   O U T P U T *****

```
  Input   filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
  Output  filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\10.14ha. Post-dev
\December 2006\Pre-Chicago 24 Hour.out
  Summary filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\10.14ha. Post-dev
\December 2006\Pre-Chicago 24 Hour.sum

DATE: 1/8/2007                          TIME: 9:15:17 AM

USER:

COMMENTS: PRE-DEVELOPMENT
10.1 Ha TRIBUTARY TO N2-B
-----
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

 --------------------
 |   READ STORM      |    Filename: S:\SWM Library\Storms\25mmchi.stm
 | Ptotal= 25.02 mm  |    Comments: 25mm CHICAGO Storm
 --------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	2.17	1.17	6.20	2.17	5.62	3.17	2.95
.33	2.38	1.33	12.18	2.33	4.80	3.33	2.76
.50	2.66	1.50	41.67	2.50	4.21	3.50	2.62
.67	3.03	1.67	15.28	2.67	3.78	3.67	2.47
.83	3.58	1.83	9.22	2.83	3.45	3.83	2.35
1.00	4.47	2.00	6.88	3.00	3.18	4.00	2.23

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

 --------------------
 | CALIB             |
 | NASHYD    (0001)  |   Area     (ha)=  10.14   Curve Number    (CN)= 76.0
 |ID= 1 DT= 5.0 min  |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=     .56

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Unit Hyd Qpeak (cms)=   .692

```
PEAK FLOW          (cms)=     .053 (i)
TIME TO PEAK       (hrs)=    2.333
RUNOFF VOLUME       (mm)=    4.181
TOTAL RAINFALL      (mm)=   25.023
RUNOFF COEFFICIENT    =       .167

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

```
****************************
** SIMULATION NUMBER:   2 **
****************************
```

```
--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 779.000
| Ptotal= 47.56 mm |                           B=    6.000
--------------------                           C=     .821
                         used in:    INTENSITY =  A / (t + B)^C

                         Duration of storm   = 24.00 hrs
                         Storm time step     =  5.00 min
                         Time to peak ratio  =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.36	6.08	1.23	12.08	1.15	18.08	.53
.17	.37	6.17	1.28	12.17	1.13	18.17	.53
.25	.37	6.25	1.33	12.25	1.11	18.25	.53
.33	.37	6.33	1.39	12.33	1.10	18.33	.52
.42	.38	6.42	1.46	12.42	1.08	18.42	.52
.50	.38	6.50	1.53	12.50	1.06	18.50	.51
.58	.39	6.58	1.61	12.58	1.04	18.58	.51
.67	.39	6.67	1.70	12.67	1.03	18.67	.51
.75	.39	6.75	1.81	12.75	1.01	18.75	.50
.83	.40	6.83	1.92	12.83	1.00	18.83	.50
.92	.40	6.92	2.06	12.92	.98	18.92	.50
1.00	.40	7.00	2.22	13.00	.97	19.00	.49
1.08	.41	7.08	2.41	13.08	.95	19.08	.49
1.17	.41	7.17	2.64	13.17	.94	19.17	.49
1.25	.42	7.25	2.92	13.25	.93	19.25	.49
1.33	.42	7.33	3.27	13.33	.92	19.33	.48
1.42	.43	7.42	3.73	13.42	.90	19.42	.48
1.50	.43	7.50	4.36	13.50	.89	19.50	.48
1.58	.44	7.58	5.25	13.58	.88	19.58	.47
1.67	.44	7.67	6.65	13.67	.87	19.67	.47
1.75	.45	7.75	9.12	13.75	.86	19.75	.47
1.83	.45	7.83	14.59	13.83	.85	19.83	.47
1.92	.46	7.92	35.30	13.92	.84	19.92	.46
2.00	.46	8.00	108.78	14.00	.83	20.00	.46
2.08	.47	8.08	45.80	14.08	.82	20.08	.46
2.17	.47	8.17	24.85	14.17	.81	20.17	.45
2.25	.48	8.25	16.71	14.25	.80	20.25	.45
2.33	.48	8.33	12.51	14.33	.79	20.33	.45
2.42	.49	8.42	9.98	14.42	.78	20.42	.45
2.50	.50	8.50	8.30	14.50	.77	20.50	.44
2.58	.50	8.58	7.10	14.58	.76	20.58	.44
2.67	.51	8.67	6.22	14.67	.76	20.67	.44
2.75	.52	8.75	5.53	14.75	.75	20.75	.44
2.83	.52	8.83	4.99	14.83	.74	20.83	.43
2.92	.53	8.92	4.55	14.92	.73	20.92	.43
3.00	.54	9.00	4.18	15.00	.73	21.00	.43
3.08	.55	9.08	3.87	15.08	.72	21.08	.43
3.17	.55	9.17	3.60	15.17	.71	21.17	.43
3.25	.56	9.25	3.38	15.25	.70	21.25	.42
3.33	.57	9.33	3.18	15.33	.70	21.33	.42
3.42	.58	9.42	3.00	15.42	.69	21.42	.42
3.50	.59	9.50	2.84	15.50	.68	21.50	.42
3.58	.60	9.58	2.70	15.58	.68	21.58	.41
3.67	.61	9.67	2.58	15.67	.67	21.67	.41
3.75	.62	9.75	2.46	15.75	.67	21.75	.41
3.83	.63	9.83	2.36	15.83	.66	21.83	.41
3.92	.64	9.92	2.27	15.92	.65	21.92	.41
4.00	.65	10.00	2.18	16.00	.65	22.00	.40
4.08	.66	10.08	2.10	16.08	.64	22.08	.40
4.17	.67	10.17	2.03	16.17	.64	22.17	.40
4.25	.69	10.25	1.96	16.25	.63	22.25	.40
4.33	.70	10.33	1.90	16.33	.63	22.33	.40
4.42	.71	10.42	1.84	16.42	.62	22.42	.39
4.50	.73	10.50	1.78	16.50	.62	22.50	.39
4.58	.74	10.58	1.73	16.58	.61	22.58	.39
4.67	.76	10.67	1.68	16.67	.61	22.67	.39
4.75	.78	10.75	1.64	16.75	.60	22.75	.39
4.83	.79	10.83	1.59	16.83	.60	22.83	.38
4.92	.81	10.92	1.55	16.92	.59	22.92	.38
5.00	.83	11.00	1.51	17.00	.59	23.00	.38
5.08	.85	11.08	1.48	17.08	.58	23.08	.38
5.17	.87	11.17	1.44	17.17	.58	23.17	.38

5.25	.90	11.25	1.41	17.25	.57	23.25	.38
5.33	.92	11.33	1.38	17.33	.57	23.33	.37
5.42	.95	11.42	1.35	17.42	.56	23.42	.37
5.50	.97	11.50	1.32	17.50	.56	23.50	.37
5.58	1.00	11.58	1.29	17.58	.56	23.58	.37
5.67	1.03	11.67	1.27	17.67	.55	23.67	.37
5.75	1.07	11.75	1.24	17.75	.55	23.75	.37
5.83	1.10	11.83	1.22	17.83	.54	23.83	.36
5.92	1.14	11.92	1.20	17.92	.54	23.92	.36
6.00	1.18	12.00	1.18	18.00	.54	24.00	.36

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----------------------------------------------------------------------------
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| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  10.14   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=     .56

    Unit Hyd Qpeak  (cms)=     .692

    PEAK FLOW       (cms)=     .172 (i) <--
    TIME TO PEAK    (hrs)=    8.667
    RUNOFF VOLUME    (mm)=   15.041
    TOTAL RAINFALL   (mm)=   47.561
    RUNOFF COEFFICIENT   =     .316

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

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  ** SIMULATION NUMBER:   3 **
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| CHICAGO STORM      |    IDF curve parameters: A= 959.000
| Ptotal= 67.24 mm   |                          B=    5.700
--------------------                            C=     .802
                          used in:    INTENSITY =  A / (t + B)^C

                          Duration of storm   = 24.00 hrs
                          Storm time step     =  5.00 min
                          Time to peak ratio  =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.57	6.08	1.85	12.08	1.74	18.08	.82
.17	.57	6.17	1.92	12.17	1.71	18.17	.82
.25	.58	6.25	2.00	12.25	1.68	18.25	.81
.33	.58	6.33	2.09	12.33	1.66	18.33	.81
.42	.59	6.42	2.18	12.42	1.63	18.42	.80
.50	.59	6.50	2.29	12.50	1.60	18.50	.79
.58	.60	6.58	2.40	12.58	1.58	18.58	.79
.67	.61	6.67	2.54	12.67	1.56	18.67	.78
.75	.61	6.75	2.68	12.75	1.53	18.75	.78
.83	.62	6.83	2.85	12.83	1.51	18.83	.77
.92	.62	6.92	3.05	12.92	1.49	18.92	.77
1.00	.63	7.00	3.27	13.00	1.47	19.00	.77
1.08	.64	7.08	3.54	13.08	1.45	19.08	.76
1.17	.64	7.17	3.86	13.17	1.43	19.17	.76
1.25	.65	7.25	4.26	13.25	1.41	19.25	.75
1.33	.65	7.33	4.75	13.33	1.39	19.33	.75
1.42	.66	7.42	5.39	13.42	1.37	19.42	.74
1.50	.67	7.50	6.25	13.50	1.36	19.50	.74
1.58	.68	7.58	7.48	13.58	1.34	19.58	.73
1.67	.68	7.67	9.37	13.67	1.32	19.67	.73
1.75	.69	7.75	12.67	13.75	1.31	19.75	.72
1.83	.70	7.83	19.89	13.83	1.29	19.83	.72
1.92	.71	7.92	46.83	13.92	1.28	19.92	.72
2.00	.71	8.00	143.30	14.00	1.26	20.00	.71
2.08	.72	8.08	60.46	14.08	1.25	20.08	.71
2.17	.73	8.17	33.27	14.17	1.23	20.17	.70
2.25	.74	8.25	22.67	14.25	1.22	20.25	.70
2.33	.75	8.33	17.15	14.33	1.21	20.33	.70
2.42	.76	8.42	13.81	14.42	1.19	20.42	.69
2.50	.77	8.50	11.57	14.50	1.18	20.50	.69
2.58	.78	8.58	9.98	14.58	1.17	20.58	.69
2.67	.79	8.67	8.78	14.67	1.16	20.67	.68
2.75	.80	8.75	7.86	14.75	1.14	20.75	.68
2.83	.81	8.83	7.11	14.83	1.13	20.83	.67
2.92	.82	8.92	6.51	14.92	1.12	20.92	.67
3.00	.83	9.00	6.00	15.00	1.11	21.00	.67
3.08	.84	9.08	5.58	15.08	1.10	21.08	.66
3.17	.85	9.17	5.21	15.17	1.09	21.17	.66
3.25	.86	9.25	4.89	15.25	1.08	21.25	.66
3.33	.88	9.33	4.62	15.33	1.07	21.33	.65
3.42	.89	9.42	4.37	15.42	1.06	21.42	.65

3.50	.90	9.50	4.15	15.50	1.05	21.50	.65
3.58	.92	9.58	3.96	15.58	1.04	21.58	.64
3.67	.93	9.67	3.78	15.67	1.03	21.67	.64
3.75	.95	9.75	3.62	15.75	1.02	21.75	.64
3.83	.96	9.83	3.47	15.83	1.01	21.83	.63
3.92	.98	9.92	3.34	15.92	1.00	21.92	.63
4.00	1.00	10.00	3.22	16.00	.99	22.00	.63
4.08	1.01	10.08	3.10	16.08	.99	22.08	.63
4.17	1.03	10.17	3.00	16.17	.98	22.17	.62
4.25	1.05	10.25	2.90	16.25	.97	22.25	.62
4.33	1.07	10.33	2.81	16.33	.96	22.33	.62
4.42	1.09	10.42	2.73	16.42	.95	22.42	.61
4.50	1.11	10.50	2.65	16.50	.95	22.50	.61
4.58	1.14	10.58	2.57	16.58	.94	22.58	.61
4.67	1.16	10.67	2.50	16.67	.93	22.67	.60
4.75	1.18	10.75	2.44	16.75	.92	22.75	.60
4.83	1.21	10.83	2.38	16.83	.92	22.83	.60
4.92	1.24	10.92	2.32	16.92	.91	22.92	.60
5.00	1.27	11.00	2.26	17.00	.90	23.00	.59
5.08	1.30	11.08	2.21	17.08	.90	23.08	.59
5.17	1.33	11.17	2.16	17.17	.89	23.17	.59
5.25	1.36	11.25	2.11	17.25	.88	23.25	.59
5.33	1.40	11.33	2.07	17.33	.88	23.33	.58
5.42	1.44	11.42	2.02	17.42	.87	23.42	.58
5.50	1.48	11.50	1.98	17.50	.86	23.50	.58
5.58	1.52	11.58	1.94	17.58	.86	23.58	.58
5.67	1.57	11.67	1.91	17.67	.85	23.67	.57
5.75	1.61	11.75	1.87	17.75	.84	23.75	.57
5.83	1.67	11.83	1.84	17.83	.84	23.83	.57
5.92	1.72	11.92	1.80	17.92	.83	23.92	.57
6.00	1.79	12.00	1.77	18.00	.83	24.00	.56

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| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  10.14   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=     .56

    Unit Hyd Qpeak  (cms)=     .692

    PEAK FLOW       (cms)=     .312  (i) <----
    TIME TO PEAK    (hrs)=    8.667
    RUNOFF VOLUME    (mm)=   27.537
    TOTAL RAINFALL   (mm)=   67.243
    RUNOFF COEFFICIENT   =     .410

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

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  ** SIMULATION NUMBER:   4 **
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| CHICAGO STORM      |    IDF curve parameters: A=1089.000
| Ptotal= 79.77 mm   |                          B=    5.700
--------------------                            C=     .796
                          used in:    INTENSITY =  A / (t + B)^C

                          Duration of storm  = 24.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =    .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.69	6.08	2.24	12.08	2.11	18.08	1.00
.17	.70	6.17	2.32	12.17	2.07	18.17	.99
.25	.71	6.25	2.42	12.25	2.04	18.25	.99
.33	.71	6.33	2.52	12.33	2.00	18.33	.98
.42	.72	6.42	2.63	12.42	1.97	18.42	.97
.50	.73	6.50	2.76	12.50	1.94	18.50	.97
.58	.73	6.58	2.90	12.58	1.91	18.58	.96
.67	.74	6.67	3.06	12.67	1.88	18.67	.96
.75	.75	6.75	3.23	12.75	1.86	18.75	.95
.83	.75	6.83	3.43	12.83	1.83	18.83	.94
.92	.76	6.92	3.67	12.92	1.80	18.92	.94
1.00	.77	7.00	3.94	13.00	1.78	19.00	.93
1.08	.78	7.08	4.25	13.08	1.75	19.08	.93
1.17	.78	7.17	4.63	13.17	1.73	19.17	.92
1.25	.79	7.25	5.10	13.25	1.71	19.25	.92
1.33	.80	7.33	5.69	13.33	1.69	19.33	.91
1.42	.81	7.42	6.44	13.42	1.67	19.42	.90
1.50	.82	7.50	7.46	13.50	1.64	19.50	.90
1.58	.82	7.58	8.90	13.58	1.62	19.58	.89
1.67	.83	7.67	11.12	13.67	1.60	19.67	.89

1.75	.84	7.75	14.99	13.75	1.58	19.75	.88
1.83	.85	7.83	23.39	13.83	1.57	19.83	.88
1.92	.86	7.92	54.52	13.92	1.55	19.92	.87
2.00	.87	8.00	165.06	14.00	1.53	20.00	.87
2.08	.88	8.08	70.22	14.08	1.51	20.08	.86
2.17	.89	8.17	38.89	14.17	1.50	20.17	.86
2.25	.90	8.25	26.62	14.25	1.48	20.25	.85
2.33	.91	8.33	20.22	14.33	1.46	20.33	.85
2.42	.92	8.42	16.32	14.42	1.45	20.42	.84
2.50	.93	8.50	13.71	14.50	1.43	20.50	.84
2.58	.95	8.58	11.84	14.58	1.42	20.58	.84
2.67	.96	8.67	10.44	14.67	1.40	20.67	.83
2.75	.97	8.75	9.35	14.75	1.39	20.75	.83
2.83	.98	8.83	8.48	14.83	1.37	20.83	.82
2.92	1.00	8.92	7.76	14.92	1.36	20.92	.82
3.00	1.01	9.00	7.17	15.00	1.35	21.00	.81
3.08	1.02	9.08	6.67	15.08	1.33	21.08	.81
3.17	1.04	9.17	6.23	15.17	1.32	21.17	.81
3.25	1.05	9.25	5.86	15.25	1.31	21.25	.80
3.33	1.07	9.33	5.53	15.33	1.30	21.33	.80
3.42	1.08	9.42	5.24	15.42	1.29	21.42	.79
3.50	1.10	9.50	4.98	15.50	1.27	21.50	.79
3.58	1.12	9.58	4.75	15.58	1.26	21.58	.79
3.67	1.13	9.67	4.54	15.67	1.25	21.67	.78
3.75	1.15	9.75	4.35	15.75	1.24	21.75	.78
3.83	1.17	9.83	4.17	15.83	1.23	21.83	.77
3.92	1.19	9.92	4.01	15.92	1.22	21.92	.77
4.00	1.21	10.00	3.87	16.00	1.21	22.00	.77
4.08	1.23	10.08	3.73	16.08	1.20	22.08	.76
4.17	1.26	10.17	3.61	16.17	1.19	22.17	.76
4.25	1.28	10.25	3.49	16.25	1.18	22.25	.76
4.33	1.30	10.33	3.38	16.33	1.17	22.33	.75
4.42	1.33	10.42	3.28	16.42	1.16	22.42	.75
4.50	1.35	10.50	3.19	16.50	1.15	22.50	.75
4.58	1.38	10.58	3.10	16.58	1.14	22.58	.74
4.67	1.41	10.67	3.02	16.67	1.13	22.67	.74
4.75	1.44	10.75	2.94	16.75	1.12	22.75	.73
4.83	1.47	10.83	2.87	16.83	1.11	22.83	.73
4.92	1.50	10.92	2.80	16.92	1.11	22.92	.73
5.00	1.54	11.00	2.73	17.00	1.10	23.00	.73
5.08	1.57	11.08	2.67	17.08	1.09	23.08	.72
5.17	1.61	11.17	2.61	17.17	1.08	23.17	.72
5.25	1.65	11.25	2.55	17.25	1.07	23.25	.72
5.33	1.70	11.33	2.50	17.33	1.07	23.33	.71
5.42	1.74	11.42	2.45	17.42	1.06	23.42	.71
5.50	1.79	11.50	2.40	17.50	1.05	23.50	.71
5.58	1.84	11.58	2.35	17.58	1.04	23.58	.70
5.67	1.90	11.67	2.30	17.67	1.04	23.67	.70
5.75	1.95	11.75	2.26	17.75	1.03	23.75	.70
5.83	2.02	11.83	2.22	17.83	1.02	23.83	.69
5.92	2.09	11.92	2.18	17.92	1.01	23.92	.69
6.00	2.16	12.00	2.14	18.00	1.01	24.00	.69

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| CALIB              |
| NASHYD     (0001)  |   Area      (ha)=   10.14   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia        (mm)=    4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=     .56

    Unit Hyd Qpeak   (cms)=     .692

    PEAK FLOW        (cms)=     .413 (i)
    TIME TO PEAK     (hrs)=    8.667
    RUNOFF VOLUME     (mm)=   36.435
    TOTAL RAINFALL    (mm)=   79.766
    RUNOFF COEFFICIENT   =      .457

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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  ** SIMULATION NUMBER:   5 **
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| CHICAGO STORM      |     IDF curve parameters: A=1234.000
| Ptotal= 97.22 mm   |                           B=    5.500
--------------------                             C=     .786
                           used in:   INTENSITY =  A / (t + B)^C

                           Duration of storm   = 24.00 hrs
                           Storm time step     =  5.00 min
                           Time to peak ratio  =   .33
```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	.89	6.08	2.81	12.08	2.64	18.08	1.27
.17	.89	6.17	2.91	12.17	2.60	18.17	1.26
.25	.90	6.25	3.03	12.25	2.56	18.25	1.25
.33	.91	6.33	3.16	12.33	2.52	18.33	1.25
.42	.92	6.42	3.29	12.42	2.48	18.42	1.24
.50	.93	6.50	3.45	12.50	2.44	18.50	1.23
.58	.93	6.58	3.62	12.58	2.40	18.58	1.22
.67	.94	6.67	3.81	12.67	2.37	18.67	1.21
.75	.95	6.75	4.03	12.75	2.34	18.75	1.21
.83	.96	6.83	4.27	12.83	2.30	18.83	1.20
.92	.97	6.92	4.56	12.92	2.27	18.92	1.19
1.00	.98	7.00	4.88	13.00	2.24	19.00	1.19
1.08	.99	7.08	5.27	13.08	2.21	19.08	1.18
1.17	1.00	7.17	5.73	13.17	2.18	19.17	1.17
1.25	1.01	7.25	6.30	13.25	2.15	19.25	1.16
1.33	1.02	7.33	7.00	13.33	2.12	19.33	1.16
1.42	1.03	7.42	7.91	13.42	2.10	19.42	1.15
1.50	1.04	7.50	9.13	13.50	2.07	19.50	1.14
1.58	1.05	7.58	10.85	13.58	2.05	19.58	1.14
1.67	1.06	7.67	13.50	13.67	2.02	19.67	1.13
1.75	1.07	7.75	18.07	13.75	2.00	19.75	1.12
1.83	1.08	7.83	27.92	13.83	1.98	19.83	1.12
1.92	1.09	7.92	64.21	13.92	1.95	19.92	1.11
2.00	1.11	8.00	194.38	14.00	1.93	20.00	1.11
2.08	1.12	8.08	82.51	14.08	1.91	20.08	1.10
2.17	1.13	8.17	46.00	14.17	1.89	20.17	1.09
2.25	1.15	8.25	31.70	14.25	1.87	20.25	1.09
2.33	1.16	8.33	24.20	14.33	1.85	20.33	1.08
2.42	1.17	8.42	19.63	14.42	1.83	20.42	1.08
2.50	1.19	8.50	16.55	14.50	1.81	20.50	1.07
2.58	1.20	8.58	14.34	14.58	1.79	20.58	1.06
2.67	1.22	8.67	12.68	14.67	1.77	20.67	1.06
2.75	1.23	8.75	11.39	14.75	1.76	20.75	1.05
2.83	1.25	8.83	10.35	14.83	1.74	20.83	1.05
2.92	1.26	8.92	9.50	14.92	1.72	20.92	1.04
3.00	1.28	9.00	8.79	15.00	1.70	21.00	1.04
3.08	1.30	9.08	8.18	15.08	1.69	21.08	1.03
3.17	1.32	9.17	7.66	15.17	1.67	21.17	1.03
3.25	1.34	9.25	7.21	15.25	1.66	21.25	1.02
3.33	1.36	9.33	6.81	15.33	1.64	21.33	1.02
3.42	1.37	9.42	6.46	15.42	1.63	21.42	1.01
3.50	1.40	9.50	6.15	15.50	1.61	21.50	1.01
3.58	1.42	9.58	5.87	15.58	1.60	21.58	1.00
3.67	1.44	9.67	5.61	15.67	1.58	21.67	1.00
3.75	1.46	9.75	5.38	15.75	1.57	21.75	.99
3.83	1.48	9.83	5.17	15.83	1.56	21.83	.99
3.92	1.51	9.92	4.98	15.92	1.54	21.92	.98
4.00	1.53	10.00	4.80	16.00	1.53	22.00	.98
4.08	1.56	10.08	4.64	16.08	1.52	22.08	.97
4.17	1.59	10.17	4.49	16.17	1.51	22.17	.97
4.25	1.62	10.25	4.34	16.25	1.49	22.25	.96
4.33	1.65	10.33	4.21	16.33	1.48	22.33	.96
4.42	1.68	10.42	4.09	16.42	1.47	22.42	.95
4.50	1.71	10.50	3.97	16.50	1.46	22.50	.95
4.58	1.74	10.58	3.87	16.58	1.45	22.58	.95
4.67	1.78	10.67	3.77	16.67	1.43	22.67	.94
4.75	1.82	10.75	3.67	16.75	1.42	22.75	.94
4.83	1.86	10.83	3.58	16.83	1.41	22.83	.93
4.92	1.90	10.92	3.49	16.92	1.40	22.92	.93
5.00	1.94	11.00	3.41	17.00	1.39	23.00	.93
5.08	1.98	11.08	3.34	17.08	1.38	23.08	.92
5.17	2.03	11.17	3.26	17.17	1.37	23.17	.92
5.25	2.08	11.25	3.19	17.25	1.36	23.25	.91
5.33	2.14	11.33	3.13	17.33	1.35	23.33	.91
5.42	2.19	11.42	3.06	17.42	1.34	23.42	.91
5.50	2.25	11.50	3.00	17.50	1.33	23.50	.90
5.58	2.32	11.58	2.94	17.58	1.32	23.58	.90
5.67	2.38	11.67	2.89	17.67	1.31	23.67	.89
5.75	2.46	11.75	2.84	17.75	1.31	23.75	.89
5.83	2.54	11.83	2.79	17.83	1.30	23.83	.89
5.92	2.62	11.92	2.74	17.92	1.29	23.92	.88
6.00	2.71	12.00	2.69	18.00	1.28	24.00	.88

```
--------------------
| CALIB              |
| NASHYD    (0001)   |   Area      (ha)=  10.14   Curve Number     (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia        (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=      .56

    Unit Hyd Qpeak   (cms)=      .692

    PEAK FLOW        (cms)=      .560  (i)
    TIME TO PEAK     (hrs)=     8.667
    RUNOFF VOLUME     (mm)=    49.711
```

```
TOTAL RAINFALL    (mm)=  97.219
RUNOFF COEFFICIENT   =     .511

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

```
****************************
** SIMULATION NUMBER:   6 **
****************************

--------------------
| CHICAGO STORM     |      IDF curve parameters: A=1323.000
| Ptotal=109.69 mm  |                            B=    5.300
--------------------                           C=     .779
                           used in:   INTENSITY =  A / (t + B)^C

                           Duration of storm  = 24.00 hrs
                           Storm time step    =  5.00 min
                           Time to peak ratio =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.03	6.08	3.23	12.08	3.04	18.08	1.47
.17	1.04	6.17	3.35	12.17	2.99	18.17	1.46
.25	1.05	6.25	3.48	12.25	2.94	18.25	1.45
.33	1.06	6.33	3.62	12.33	2.90	18.33	1.45
.42	1.07	6.42	3.78	12.42	2.85	18.42	1.44
.50	1.08	6.50	3.95	12.50	2.81	18.50	1.43
.58	1.09	6.58	4.15	12.58	2.77	18.58	1.42
.67	1.10	6.67	4.36	12.67	2.73	18.67	1.41
.75	1.11	6.75	4.61	12.75	2.69	18.75	1.40
.83	1.12	6.83	4.88	12.83	2.65	18.83	1.39
.92	1.13	6.92	5.20	12.92	2.62	18.92	1.38
1.00	1.14	7.00	5.57	13.00	2.58	19.00	1.38
1.08	1.15	7.08	6.01	13.08	2.55	19.08	1.37
1.17	1.16	7.17	6.52	13.17	2.51	19.17	1.36
1.25	1.17	7.25	7.16	13.25	2.48	19.25	1.35
1.33	1.18	7.33	7.95	13.33	2.45	19.33	1.34
1.42	1.19	7.42	8.96	13.42	2.42	19.42	1.34
1.50	1.21	7.50	10.31	13.50	2.39	19.50	1.33
1.58	1.22	7.58	12.23	13.58	2.36	19.58	1.32
1.67	1.23	7.67	15.15	13.67	2.33	19.67	1.31
1.75	1.24	7.75	20.18	13.75	2.31	19.75	1.31
1.83	1.26	7.83	30.97	13.83	2.28	19.83	1.30
1.92	1.27	7.92	70.67	13.92	2.25	19.92	1.29
2.00	1.29	8.00	215.06	14.00	2.23	20.00	1.28
2.08	1.30	8.08	90.70	14.08	2.20	20.08	1.28
2.17	1.31	8.17	50.73	14.17	2.18	20.17	1.27
2.25	1.33	8.25	35.11	14.25	2.16	20.25	1.26
2.33	1.35	8.33	26.91	14.33	2.13	20.33	1.26
2.42	1.36	8.42	21.89	14.42	2.11	20.42	1.25
2.50	1.38	8.50	18.51	14.50	2.09	20.50	1.24
2.58	1.39	8.58	16.08	14.58	2.07	20.58	1.24
2.67	1.41	8.67	14.25	14.67	2.05	20.67	1.23
2.75	1.43	8.75	12.82	14.75	2.03	20.75	1.22
2.83	1.45	8.83	11.67	14.83	2.01	20.83	1.22
2.92	1.47	8.92	10.72	14.92	1.99	20.92	1.21
3.00	1.49	9.00	9.93	15.00	1.97	21.00	1.20
3.08	1.51	9.08	9.26	15.08	1.95	21.08	1.20
3.17	1.53	9.17	8.68	15.17	1.93	21.17	1.19
3.25	1.55	9.25	8.18	15.25	1.92	21.25	1.19
3.33	1.57	9.33	7.73	15.33	1.90	21.33	1.18
3.42	1.59	9.42	7.34	15.42	1.88	21.42	1.18
3.50	1.62	9.50	6.99	15.50	1.86	21.50	1.17
3.58	1.64	9.58	6.68	15.58	1.85	21.58	1.16
3.67	1.67	9.67	6.39	15.67	1.83	21.67	1.16
3.75	1.69	9.75	6.13	15.75	1.82	21.75	1.15
3.83	1.72	9.83	5.90	15.83	1.80	21.83	1.15
3.92	1.75	9.92	5.68	15.92	1.79	21.92	1.14
4.00	1.78	10.00	5.48	16.00	1.77	22.00	1.14
4.08	1.81	10.08	5.29	16.08	1.76	22.08	1.13
4.17	1.84	10.17	5.12	16.17	1.74	22.17	1.13
4.25	1.87	10.25	4.96	16.25	1.73	22.25	1.12
4.33	1.90	10.33	4.82	16.33	1.71	22.33	1.12
4.42	1.94	10.42	4.68	16.42	1.70	22.42	1.11
4.50	1.98	10.50	4.55	16.50	1.69	22.50	1.11
4.58	2.02	10.58	4.43	16.58	1.67	22.58	1.10
4.67	2.06	10.67	4.31	16.67	1.66	22.67	1.10
4.75	2.10	10.75	4.20	16.75	1.65	22.75	1.09
4.83	2.14	10.83	4.10	16.83	1.64	22.83	1.09
4.92	2.19	10.92	4.00	16.92	1.62	22.92	1.08
5.00	2.24	11.00	3.91	17.00	1.61	23.00	1.08
5.08	2.29	11.08	3.82	17.08	1.60	23.08	1.07
5.17	2.34	11.17	3.74	17.17	1.59	23.17	1.07
5.25	2.40	11.25	3.66	17.25	1.58	23.25	1.06
5.33	2.46	11.33	3.59	17.33	1.57	23.33	1.06
5.42	2.53	11.42	3.52	17.42	1.56	23.42	1.05

5.50	2.60	11.50	3.45	17.50	1.54	23.50	1.05
5.58	2.67	11.58	3.38	17.58	1.53	23.58	1.04
5.67	2.75	11.67	3.32	17.67	1.52	23.67	1.04
5.75	2.83	11.75	3.26	17.75	1.51	23.75	1.04
5.83	2.92	11.83	3.20	17.83	1.50	23.83	1.03
5.92	3.01	11.92	3.15	17.92	1.49	23.92	1.03
6.00	3.12	12.00	3.09	18.00	1.48	24.00	1.02

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--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD     (0001)  |    Area      (ha)=  10.14    Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min  |    Ia        (mm)=   4.50    # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=     .56

     Unit Hyd Qpeak  (cms)=     .692

     PEAK FLOW       (cms)=     .667 (i)
     TIME TO PEAK    (hrs)=    8.667
     RUNOFF VOLUME    (mm)=   59.678
     TOTAL RAINFALL   (mm)=  109.689
     RUNOFF COEFFICIENT   =     .544

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

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| CHICAGO STORM      |     IDF curve parameters: A=1435.000
| Ptotal=122.49 mm   |                           B=    5.200
--------------------                             C=     .775
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm   = 24.00 hrs
                          Storm time step     =  5.00 min
                          Time to peak ratio =    .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.17	6.08	3.64	12.08	3.43	18.08	1.67
.17	1.18	6.17	3.78	12.17	3.38	18.17	1.66
.25	1.19	6.25	3.92	12.25	3.32	18.25	1.65
.33	1.20	6.33	4.08	12.33	3.27	18.33	1.64
.42	1.21	6.42	4.26	12.42	3.22	18.42	1.63
.50	1.22	6.50	4.45	12.50	3.17	18.50	1.62
.58	1.23	6.58	4.67	12.58	3.13	18.58	1.61
.67	1.25	6.67	4.91	12.67	3.08	18.67	1.60
.75	1.26	6.75	5.18	12.75	3.04	18.75	1.59
.83	1.27	6.83	5.49	12.83	3.00	18.83	1.58
.92	1.28	6.92	5.85	12.92	2.96	18.92	1.57
1.00	1.29	7.00	6.26	13.00	2.92	19.00	1.56
1.08	1.30	7.08	6.75	13.08	2.88	19.08	1.55
1.17	1.32	7.17	7.32	13.17	2.84	19.17	1.54
1.25	1.33	7.25	8.03	13.25	2.80	19.25	1.53
1.33	1.34	7.33	8.90	13.33	2.77	19.33	1.52
1.42	1.36	7.42	10.03	13.42	2.74	19.42	1.52
1.50	1.37	7.50	11.53	13.50	2.70	19.50	1.51
1.58	1.38	7.58	13.65	13.58	2.67	19.58	1.50
1.67	1.40	7.67	16.87	13.67	2.64	19.67	1.49
1.75	1.41	7.75	22.41	13.75	2.61	19.75	1.48
1.83	1.43	7.83	34.27	13.83	2.58	19.83	1.47
1.92	1.44	7.92	77.82	13.92	2.55	19.92	1.46
2.00	1.46	8.00	237.24	14.00	2.52	20.00	1.46
2.08	1.48	8.08	99.80	14.08	2.49	20.08	1.45
2.17	1.49	8.17	55.94	14.17	2.47	20.17	1.44
2.25	1.51	8.25	38.81	14.25	2.44	20.25	1.43
2.33	1.53	8.33	29.82	14.33	2.41	20.33	1.43
2.42	1.54	8.42	24.30	14.42	2.39	20.42	1.42
2.50	1.56	8.50	20.58	14.50	2.37	20.50	1.41
2.58	1.58	8.58	17.90	14.58	2.34	20.58	1.40
2.67	1.60	8.67	15.88	14.67	2.32	20.67	1.40
2.75	1.62	8.75	14.30	14.75	2.30	20.75	1.39
2.83	1.64	8.83	13.03	14.83	2.27	20.83	1.38
2.92	1.66	8.92	11.98	14.92	2.25	20.92	1.37
3.00	1.69	9.00	11.11	15.00	2.23	21.00	1.37
3.08	1.71	9.08	10.36	15.08	2.21	21.08	1.36
3.17	1.73	9.17	9.72	15.17	2.19	21.17	1.35
3.25	1.76	9.25	9.16	15.25	2.17	21.25	1.35
3.33	1.78	9.33	8.67	15.33	2.15	21.33	1.34
3.42	1.81	9.42	8.23	15.42	2.13	21.42	1.33
3.50	1.83	9.50	7.84	15.50	2.11	21.50	1.33
3.58	1.86	9.58	7.49	15.58	2.09	21.58	1.32
3.67	1.89	9.67	7.17	15.67	2.07	21.67	1.32

3.75	1.92	9.75	6.89	15.75	2.06	21.75	1.31
3.83	1.95	9.83	6.62	15.83	2.04	21.83	1.30
3.92	1.98	9.92	6.38	15.92	2.02	21.92	1.30
4.00	2.01	10.00	6.16	16.00	2.01	22.00	1.29
4.08	2.05	10.08	5.95	16.08	1.99	22.08	1.28
4.17	2.08	10.17	5.76	16.17	1.97	22.17	1.28
4.25	2.12	10.25	5.58	16.25	1.96	22.25	1.27
4.33	2.16	10.33	5.42	16.33	1.94	22.33	1.27
4.42	2.20	10.42	5.26	16.42	1.93	22.42	1.26
4.50	2.24	10.50	5.12	16.50	1.91	22.50	1.26
4.58	2.28	10.58	4.98	16.58	1.90	22.58	1.25
4.67	2.33	10.67	4.85	16.67	1.88	22.67	1.24
4.75	2.37	10.75	4.73	16.75	1.87	22.75	1.24
4.83	2.42	10.83	4.62	16.83	1.85	22.83	1.23
4.92	2.48	10.92	4.51	16.92	1.84	22.92	1.23
5.00	2.53	11.00	4.41	17.00	1.83	23.00	1.22
5.08	2.59	11.08	4.31	17.08	1.81	23.08	1.22
5.17	2.65	11.17	4.22	17.17	1.80	23.17	1.21
5.25	2.72	11.25	4.13	17.25	1.79	23.25	1.21
5.33	2.78	11.33	4.05	17.33	1.78	23.33	1.20
5.42	2.86	11.42	3.97	17.42	1.76	23.42	1.20
5.50	2.93	11.50	3.89	17.50	1.75	23.50	1.19
5.58	3.01	11.58	3.81	17.58	1.74	23.58	1.19
5.67	3.10	11.67	3.74	17.67	1.73	23.67	1.18
5.75	3.19	11.75	3.68	17.75	1.72	23.75	1.18
5.83	3.29	11.83	3.61	17.83	1.70	23.83	1.17
5.92	3.40	11.92	3.55	17.92	1.69	23.92	1.17
6.00	3.52	12.00	3.49	18.00	1.68	24.00	1.16

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------------------------------------------------------------------------------

--------------------
| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  10.14   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=     .692

     PEAK FLOW       (cms)=     .785 (i) <-
     TIME TO PEAK    (hrs)=    8.667
     RUNOFF VOLUME    (mm)=   70.242
     TOTAL RAINFALL   (mm)=  122.495
     RUNOFF COEFFICIENT  =      .573

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

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 FINISH
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```

Pre-development Flows to Tributary N1-A

Project Name: Ecarpment Business Community
Municipality: Town of Milton
Project No.: 03156
Date: 22-Nov-06

Drainage Area = **53.6** ha.

Airport Method

$$t_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{\ 0.33}}$$

Tc= 97.35

Time to Peak

$$tp = 0.67tc$$

Tp= 1.09

Tc:	97.35	Time of Concentration (min)	
Tp:	1.09	Time to Peak (hrs)	
L=	1200	Catchment Length	(m)
Ah=	11.50	Delta Heigth (m)	
Sw=	1.0	Catchment Slope	(%)
C=	0.25	Runoff Coefficient	

OTTHYMO Model Parameters

CN= 76
IA= 4.5mm.
Tp= 1.09hrs

OTTHYMO Model Results (Chicago 24 hour Storm)

25mm Storm =	**0.20**	m^3/s
2-Year Storm=	0.56	m^3/s
5-Year Storm=	1.02	m^3/s
10-Year Storm=	1.35	m^3/s
25-Year Storm=	**1.83**	m^3/s
50-Year Storm=	2.19	m^3/s
100-Year Storm=	**2.58**	m^3/s

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

      V     V   I    SSSSS  U   U    A     L
      V     V   I    SS     U   U   A A    L
       V   V    I     SS    U   U  AAAAA   L
        V V     I      SS   U   U  A   A   L
         VV     I    SSSSS  UUUUU  A   A   LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM, Version 2.0
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O    Licensed To: Valdor Engineering
       OOO     T      T    H   H    Y    M   M   OOO                  V02-0102
```

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***** D E T A I L E D   O U T P U T *****

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\53.6ha. Pre-dev\03156 - Nov. 2006\Pre Chicago 24 Hour.out
Summary filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\53.6ha. Pre-dev\03156 - Nov. 2006\Pre Chicago 24 Hour.sum

DATE: 1/8/2007 TIME: 9:04:45 AM

USER:

COMMENTS: PRE-DEVELOPMENT
53.6 Ha TO TRIBUTARY N1-A

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 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************
```

READ STORM	Filename: S:\SWM Library\Storms\25mmchi.stm
Ptotal= 25.02 mm	Comments: 25mm CHICAGO Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	2.17	1.17	6.20	2.17	5.62	3.17	2.95
.33	2.38	1.33	12.18	2.33	4.80	3.33	2.76
.50	2.66	1.50	41.67	2.50	4.21	3.50	2.62
.67	3.03	1.67	15.28	2.67	3.78	3.67	2.47
.83	3.58	1.83	9.22	2.83	3.45	3.83	2.35
1.00	4.47	2.00	6.88	3.00	3.18	4.00	2.23

CALIB NASHYD (0001) ID= 1 DT= 5.0 min		
Area (ha)= 53.60	Curve Number (CN)= 76.0	
Ia (mm)= 4.50	# of Linear Res.(N)= 3.00	
U.H. Tp(hrs)= 1.09		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Unit Hyd Qpeak (cms)= 1.878

```
PEAK FLOW          (cms)=     .200 (i)
TIME TO PEAK       (hrs)=    3.250
RUNOFF VOLUME       (mm)=    4.181
TOTAL RAINFALL      (mm)=   25.023
RUNOFF COEFFICIENT    =      .167

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

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****************************
** SIMULATION NUMBER:   2 **
****************************

--------------------
| CHICAGO STORM     |     IDF curve parameters: A= 779.000
| Ptotal= 47.56 mm  |                           B=   6.000
--------------------                            C=    .821
                          used in:   INTENSITY = A / (t + B)^C

                          Duration of storm  = 24.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.36	6.08	1.23	12.08	1.15	18.08	.53
.17	.37	6.17	1.28	12.17	1.13	18.17	.53
.25	.37	6.25	1.33	12.25	1.11	18.25	.53
.33	.37	6.33	1.39	12.33	1.10	18.33	.52
.42	.38	6.42	1.46	12.42	1.08	18.42	.52
.50	.38	6.50	1.53	12.50	1.06	18.50	.51
.58	.39	6.58	1.61	12.58	1.04	18.58	.51
.67	.39	6.67	1.70	12.67	1.03	18.67	.51
.75	.39	6.75	1.81	12.75	1.01	18.75	.50
.83	.40	6.83	1.92	12.83	1.00	18.83	.50
.92	.40	6.92	2.06	12.92	.98	18.92	.50
1.00	.40	7.00	2.22	13.00	.97	19.00	.49
1.08	.41	7.08	2.41	13.08	.95	19.08	.49
1.17	.41	7.17	2.64	13.17	.94	19.17	.49
1.25	.42	7.25	2.92	13.25	.93	19.25	.49
1.33	.42	7.33	3.27	13.33	.92	19.33	.48
1.42	.43	7.42	3.73	13.42	.90	19.42	.48
1.50	.43	7.50	4.36	13.50	.89	19.50	.48
1.58	.44	7.58	5.25	13.58	.88	19.58	.47
1.67	.44	7.67	6.65	13.67	.87	19.67	.47
1.75	.45	7.75	9.12	13.75	.86	19.75	.47
1.83	.45	7.83	14.59	13.83	.85	19.83	.47
1.92	.46	7.92	35.30	13.92	.84	19.92	.46
2.00	.46	8.00	108.78	14.00	.83	20.00	.46
2.08	.47	8.08	45.80	14.08	.82	20.08	.46
2.17	.47	8.17	24.85	14.17	.81	20.17	.45
2.25	.48	8.25	16.71	14.25	.80	20.25	.45
2.33	.48	8.33	12.51	14.33	.79	20.33	.45
2.42	.49	8.42	9.98	14.42	.78	20.42	.45
2.50	.50	8.50	8.30	14.50	.77	20.50	.44
2.58	.50	8.58	7.10	14.58	.76	20.58	.44
2.67	.51	8.67	6.22	14.67	.76	20.67	.44
2.75	.52	8.75	5.53	14.75	.75	20.75	.44
2.83	.52	8.83	4.99	14.83	.74	20.83	.43
2.92	.53	8.92	4.55	14.92	.73	20.92	.43
3.00	.54	9.00	4.18	15.00	.73	21.00	.43
3.08	.55	9.08	3.87	15.08	.72	21.08	.43
3.17	.55	9.17	3.60	15.17	.71	21.17	.43
3.25	.56	9.25	3.38	15.25	.70	21.25	.42
3.33	.57	9.33	3.18	15.33	.70	21.33	.42
3.42	.58	9.42	3.00	15.42	.69	21.42	.42
3.50	.59	9.50	2.84	15.50	.68	21.50	.42
3.58	.60	9.58	2.70	15.58	.68	21.58	.41
3.67	.61	9.67	2.58	15.67	.67	21.67	.41
3.75	.62	9.75	2.46	15.75	.67	21.75	.41
3.83	.63	9.83	2.36	15.83	.66	21.83	.41
3.92	.64	9.92	2.27	15.92	.65	21.92	.41
4.00	.65	10.00	2.18	16.00	.65	22.00	.40
4.08	.66	10.08	2.10	16.08	.64	22.08	.40
4.17	.67	10.17	2.03	16.17	.64	22.17	.40
4.25	.69	10.25	1.96	16.25	.63	22.25	.40
4.33	.70	10.33	1.90	16.33	.63	22.33	.40
4.42	.71	10.42	1.84	16.42	.62	22.42	.39
4.50	.73	10.50	1.78	16.50	.62	22.50	.39
4.58	.74	10.58	1.73	16.58	.61	22.58	.39
4.67	.76	10.67	1.68	16.67	.61	22.67	.39
4.75	.78	10.75	1.64	16.75	.60	22.75	.39
4.83	.79	10.83	1.59	16.83	.60	22.83	.38
4.92	.81	10.92	1.55	16.92	.59	22.92	.38
5.00	.83	11.00	1.51	17.00	.59	23.00	.38
5.08	.85	11.08	1.48	17.08	.58	23.08	.38
5.17	.87	11.17	1.44	17.17	.58	23.17	.38

5.25	.90	11.25	1.41	17.25	.57	23.25	.38
5.33	.92	11.33	1.38	17.33	.57	23.33	.37
5.42	.95	11.42	1.35	17.42	.56	23.42	.37
5.50	.97	11.50	1.32	17.50	.56	23.50	.37
5.58	1.00	11.58	1.29	17.58	.56	23.58	.37
5.67	1.03	11.67	1.27	17.67	.55	23.67	.37
5.75	1.07	11.75	1.24	17.75	.55	23.75	.37
5.83	1.10	11.83	1.22	17.83	.54	23.83	.36
5.92	1.14	11.92	1.20	17.92	.54	23.92	.36
6.00	1.18	12.00	1.18	18.00	.54	24.00	.36

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----------------------------------------------------------------------------
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| CALIB              |
| NASHYD     (0001)  |   Area     (ha)=  53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=    1.09

    Unit Hyd Qpeak   (cms)=    1.878

    PEAK FLOW        (cms)=     .561 (i)
    TIME TO PEAK     (hrs)=    9.333
    RUNOFF VOLUME     (mm)=   15.042
    TOTAL RAINFALL    (mm)=   47.561
    RUNOFF COEFFICIENT    =     .316

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

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  ** SIMULATION NUMBER:   3 **
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| CHICAGO STORM      |     IDF curve parameters: A= 959.000
| Ptotal= 67.24 mm   |                           B=   5.700
--------------------                             C=    .802
                           used in:    INTENSITY =  A / (t + B)^C

                           Duration of storm   = 24.00 hrs
                           Storm time step     =  5.00 min
                           Time to peak ratio  =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.57	6.08	1.85	12.08	1.74	18.08	.82
.17	.57	6.17	1.92	12.17	1.71	18.17	.82
.25	.58	6.25	2.00	12.25	1.68	18.25	.81
.33	.58	6.33	2.09	12.33	1.66	18.33	.81
.42	.59	6.42	2.18	12.42	1.63	18.42	.80
.50	.59	6.50	2.29	12.50	1.60	18.50	.79
.58	.60	6.58	2.40	12.58	1.58	18.58	.79
.67	.61	6.67	2.54	12.67	1.56	18.67	.78
.75	.61	6.75	2.68	12.75	1.53	18.75	.78
.83	.62	6.83	2.85	12.83	1.51	18.83	.77
.92	.62	6.92	3.05	12.92	1.49	18.92	.77
1.00	.63	7.00	3.27	13.00	1.47	19.00	.77
1.08	.64	7.08	3.54	13.08	1.45	19.08	.76
1.17	.64	7.17	3.86	13.17	1.43	19.17	.76
1.25	.65	7.25	4.26	13.25	1.41	19.25	.75
1.33	.65	7.33	4.75	13.33	1.39	19.33	.75
1.42	.66	7.42	5.39	13.42	1.37	19.42	.74
1.50	.67	7.50	6.25	13.50	1.36	19.50	.74
1.58	.68	7.58	7.48	13.58	1.34	19.58	.73
1.67	.68	7.67	9.37	13.67	1.32	19.67	.73
1.75	.69	7.75	12.67	13.75	1.31	19.75	.72
1.83	.70	7.83	19.89	13.83	1.29	19.83	.72
1.92	.71	7.92	46.83	13.92	1.28	19.92	.72
2.00	.71	8.00	143.30	14.00	1.26	20.00	.71
2.08	.72	8.08	60.46	14.08	1.25	20.08	.71
2.17	.73	8.17	33.27	14.17	1.23	20.17	.70
2.25	.74	8.25	22.67	14.25	1.22	20.25	.70
2.33	.75	8.33	17.15	14.33	1.21	20.33	.70
2.42	.76	8.42	13.81	14.42	1.19	20.42	.69
2.50	.77	8.50	11.57	14.50	1.18	20.50	.69
2.58	.78	8.58	9.98	14.58	1.17	20.58	.69
2.67	.79	8.67	8.78	14.67	1.16	20.67	.68
2.75	.80	8.75	7.86	14.75	1.14	20.75	.68
2.83	.81	8.83	7.11	14.83	1.13	20.83	.67
2.92	.82	8.92	6.51	14.92	1.12	20.92	.67
3.00	.83	9.00	6.00	15.00	1.11	21.00	.67
3.08	.84	9.08	5.58	15.08	1.10	21.08	.66
3.17	.85	9.17	5.21	15.17	1.09	21.17	.66
3.25	.86	9.25	4.89	15.25	1.08	21.25	.66
3.33	.88	9.33	4.62	15.33	1.07	21.33	.65
3.42	.89	9.42	4.37	15.42	1.06	21.42	.65

3.50	.90	9.50	4.15	15.50	1.05	21.50	.65
3.58	.92	9.58	3.96	15.58	1.04	21.58	.64
3.67	.93	9.67	3.78	15.67	1.03	21.67	.64
3.75	.95	9.75	3.62	15.75	1.02	21.75	.64
3.83	.96	9.83	3.47	15.83	1.01	21.83	.63
3.92	.98	9.92	3.34	15.92	1.00	21.92	.63
4.00	1.00	10.00	3.22	16.00	.99	22.00	.63
4.08	1.01	10.08	3.10	16.08	.99	22.08	.63
4.17	1.03	10.17	3.00	16.17	.98	22.17	.62
4.25	1.05	10.25	2.90	16.25	.97	22.25	.62
4.33	1.07	10.33	2.81	16.33	.96	22.33	.62
4.42	1.09	10.42	2.73	16.42	.95	22.42	.61
4.50	1.11	10.50	2.65	16.50	.95	22.50	.61
4.58	1.14	10.58	2.57	16.58	.94	22.58	.61
4.67	1.16	10.67	2.50	16.67	.93	22.67	.60
4.75	1.18	10.75	2.44	16.75	.92	22.75	.60
4.83	1.21	10.83	2.38	16.83	.92	22.83	.60
4.92	1.24	10.92	2.32	16.92	.91	22.92	.60
5.00	1.27	11.00	2.26	17.00	.90	23.00	.59
5.08	1.30	11.08	2.21	17.08	.90	23.08	.59
5.17	1.33	11.17	2.16	17.17	.89	23.17	.59
5.25	1.36	11.25	2.11	17.25	.88	23.25	.59
5.33	1.40	11.33	2.07	17.33	.88	23.33	.58
5.42	1.44	11.42	2.02	17.42	.87	23.42	.58
5.50	1.48	11.50	1.98	17.50	.86	23.50	.58
5.58	1.52	11.58	1.94	17.58	.86	23.58	.58
5.67	1.57	11.67	1.91	17.67	.85	23.67	.57
5.75	1.61	11.75	1.87	17.75	.84	23.75	.57
5.83	1.67	11.83	1.84	17.83	.84	23.83	.57
5.92	1.72	11.92	1.80	17.92	.83	23.92	.57
6.00	1.79	12.00	1.77	18.00	.83	24.00	.56

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| CALIB              |
| NASHYD     (0001) |   Area     (ha)=  53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min  |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   1.09

     Unit Hyd Qpeak  (cms)=   1.878

     PEAK FLOW       (cms)=   1.019 (i) <-
     TIME TO PEAK    (hrs)=   9.333
     RUNOFF VOLUME    (mm)=  27.538
     TOTAL RAINFALL   (mm)=  67.243
     RUNOFF COEFFICIENT   =    .410

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

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  ** SIMULATION NUMBER:   4 **
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| CHICAGO STORM      |    IDF curve parameters: A=1089.000
| Ptotal= 79.77 mm  |                            B=    5.700
--------------------                               C=     .796
                          used in:    INTENSITY =  A / (t + B)^C

                          Duration of storm  = 24.00 hrs
                          Storm time step    =  5.00 min
                          Time to peak ratio =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.69	6.08	2.24	12.08	2.11	18.08	1.00
.17	.70	6.17	2.32	12.17	2.07	18.17	.99
.25	.71	6.25	2.42	12.25	2.04	18.25	.99
.33	.71	6.33	2.52	12.33	2.00	18.33	.98
.42	.72	6.42	2.63	12.42	1.97	18.42	.97
.50	.73	6.50	2.76	12.50	1.94	18.50	.97
.58	.73	6.58	2.90	12.58	1.91	18.58	.96
.67	.74	6.67	3.06	12.67	1.88	18.67	.96
.75	.75	6.75	3.23	12.75	1.86	18.75	.95
.83	.75	6.83	3.43	12.83	1.83	18.83	.94
.92	.76	6.92	3.67	12.92	1.80	18.92	.94
1.00	.77	7.00	3.94	13.00	1.78	19.00	.93
1.08	.78	7.08	4.25	13.08	1.75	19.08	.93
1.17	.78	7.17	4.63	13.17	1.73	19.17	.92
1.25	.79	7.25	5.10	13.25	1.71	19.25	.92
1.33	.80	7.33	5.69	13.33	1.69	19.33	.91
1.42	.81	7.42	6.44	13.42	1.67	19.42	.90
1.50	.82	7.50	7.46	13.50	1.64	19.50	.90
1.58	.82	7.58	8.90	13.58	1.62	19.58	.89
1.67	.83	7.67	11.12	13.67	1.60	19.67	.89

1.75	.84	7.75	14.99	13.75	1.58	19.75	.88
1.83	.85	7.83	23.39	13.83	1.57	19.83	.88
1.92	.86	7.92	54.52	13.92	1.55	19.92	.87
2.00	.87	8.00	165.06	14.00	1.53	20.00	.87
2.08	.88	8.08	70.22	14.08	1.51	20.08	.86
2.17	.89	8.17	38.89	14.17	1.50	20.17	.86
2.25	.90	8.25	26.62	14.25	1.48	20.25	.85
2.33	.91	8.33	20.22	14.33	1.46	20.33	.85
2.42	.92	8.42	16.32	14.42	1.45	20.42	.84
2.50	.93	8.50	13.71	14.50	1.43	20.50	.84
2.58	.95	8.58	11.84	14.58	1.42	20.58	.84
2.67	.96	8.67	10.44	14.67	1.40	20.67	.83
2.75	.97	8.75	9.35	14.75	1.39	20.75	.83
2.83	.98	8.83	8.48	14.83	1.37	20.83	.82
2.92	1.00	8.92	7.76	14.92	1.36	20.92	.82
3.00	1.01	9.00	7.17	15.00	1.35	21.00	.81
3.08	1.02	9.08	6.67	15.08	1.33	21.08	.81
3.17	1.04	9.17	6.23	15.17	1.32	21.17	.81
3.25	1.05	9.25	5.86	15.25	1.31	21.25	.80
3.33	1.07	9.33	5.53	15.33	1.30	21.33	.80
3.42	1.08	9.42	5.24	15.42	1.29	21.42	.79
3.50	1.10	9.50	4.98	15.50	1.27	21.50	.79
3.58	1.12	9.58	4.75	15.58	1.26	21.58	.79
3.67	1.13	9.67	4.54	15.67	1.25	21.67	.78
3.75	1.15	9.75	4.35	15.75	1.24	21.75	.78
3.83	1.17	9.83	4.17	15.83	1.23	21.83	.77
3.92	1.19	9.92	4.01	15.92	1.22	21.92	.77
4.00	1.21	10.00	3.87	16.00	1.21	22.00	.77
4.08	1.23	10.08	3.73	16.08	1.20	22.08	.76
4.17	1.26	10.17	3.61	16.17	1.19	22.17	.76
4.25	1.28	10.25	3.49	16.25	1.18	22.25	.76
4.33	1.30	10.33	3.38	16.33	1.17	22.33	.75
4.42	1.33	10.42	3.28	16.42	1.16	22.42	.75
4.50	1.35	10.50	3.19	16.50	1.15	22.50	.75
4.58	1.38	10.58	3.10	16.58	1.14	22.58	.74
4.67	1.41	10.67	3.02	16.67	1.13	22.67	.74
4.75	1.44	10.75	2.94	16.75	1.12	22.75	.73
4.83	1.47	10.83	2.87	16.83	1.11	22.83	.73
4.92	1.50	10.92	2.80	16.92	1.11	22.92	.73
5.00	1.54	11.00	2.73	17.00	1.10	23.00	.73
5.08	1.57	11.08	2.67	17.08	1.09	23.08	.72
5.17	1.61	11.17	2.61	17.17	1.08	23.17	.72
5.25	1.65	11.25	2.55	17.25	1.07	23.25	.72
5.33	1.70	11.33	2.50	17.33	1.07	23.33	.71
5.42	1.74	11.42	2.45	17.42	1.06	23.42	.71
5.50	1.79	11.50	2.40	17.50	1.05	23.50	.71
5.58	1.84	11.58	2.35	17.58	1.04	23.58	.70
5.67	1.90	11.67	2.30	17.67	1.04	23.67	.70
5.75	1.95	11.75	2.26	17.75	1.03	23.75	.70
5.83	2.02	11.83	2.22	17.83	1.02	23.83	.69
5.92	2.09	11.92	2.18	17.92	1.01	23.92	.69
6.00	2.16	12.00	2.14	18.00	1.01	24.00	.69

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| CALIB              |
| NASHYD      (0001) |   Area      (ha)=  53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia        (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=   1.09

    Unit Hyd Qpeak   (cms)=    1.878

    PEAK FLOW        (cms)=    1.351 (i)
    TIME TO PEAK     (hrs)=    9.333
    RUNOFF VOLUME     (mm)=   36.436
    TOTAL RAINFALL    (mm)=   79.766
    RUNOFF COEFFICIENT    =     .457

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

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 ** SIMULATION NUMBER:   5 **
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| CHICAGO STORM      |     IDF curve parameters: A=1234.000
| Ptotal= 97.22 mm   |                           B=   5.500
--------------------                             C=    .786
                           used in:   INTENSITY =  A / (t + B)^C

                           Duration of storm  = 24.00 hrs
                           Storm time step    =  5.00 min
                           Time to peak ratio =   .33
```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	.89	6.08	2.81	12.08	2.64	18.08	1.27
.17	.89	6.17	2.91	12.17	2.60	18.17	1.26
.25	.90	6.25	3.03	12.25	2.56	18.25	1.25
.33	.91	6.33	3.16	12.33	2.52	18.33	1.25
.42	.92	6.42	3.29	12.42	2.48	18.42	1.24
.50	.93	6.50	3.45	12.50	2.44	18.50	1.23
.58	.93	6.58	3.62	12.58	2.40	18.58	1.22
.67	.94	6.67	3.81	12.67	2.37	18.67	1.21
.75	.95	6.75	4.03	12.75	2.34	18.75	1.21
.83	.96	6.83	4.27	12.83	2.30	18.83	1.20
.92	.97	6.92	4.56	12.92	2.27	18.92	1.19
1.00	.98	7.00	4.88	13.00	2.24	19.00	1.19
1.08	.99	7.08	5.27	13.08	2.21	19.08	1.18
1.17	1.00	7.17	5.73	13.17	2.18	19.17	1.17
1.25	1.01	7.25	6.30	13.25	2.15	19.25	1.16
1.33	1.02	7.33	7.00	13.33	2.12	19.33	1.16
1.42	1.03	7.42	7.91	13.42	2.10	19.42	1.15
1.50	1.04	7.50	9.13	13.50	2.07	19.50	1.14
1.58	1.05	7.58	10.85	13.58	2.05	19.58	1.14
1.67	1.06	7.67	13.50	13.67	2.02	19.67	1.13
1.75	1.07	7.75	18.07	13.75	2.00	19.75	1.12
1.83	1.08	7.83	27.92	13.83	1.98	19.83	1.12
1.92	1.09	7.92	64.21	13.92	1.95	19.92	1.11
2.00	1.11	8.00	194.38	14.00	1.93	20.00	1.11
2.08	1.12	8.08	82.51	14.08	1.91	20.08	1.10
2.17	1.13	8.17	46.00	14.17	1.89	20.17	1.09
2.25	1.15	8.25	31.70	14.25	1.87	20.25	1.09
2.33	1.16	8.33	24.20	14.33	1.85	20.33	1.08
2.42	1.17	8.42	19.63	14.42	1.83	20.42	1.08
2.50	1.19	8.50	16.55	14.50	1.81	20.50	1.07
2.58	1.20	8.58	14.34	14.58	1.79	20.58	1.06
2.67	1.22	8.67	12.68	14.67	1.77	20.67	1.06
2.75	1.23	8.75	11.39	14.75	1.76	20.75	1.05
2.83	1.25	8.83	10.35	14.83	1.74	20.83	1.05
2.92	1.26	8.92	9.50	14.92	1.72	20.92	1.04
3.00	1.28	9.00	8.79	15.00	1.70	21.00	1.04
3.08	1.30	9.08	8.18	15.08	1.69	21.08	1.03
3.17	1.32	9.17	7.66	15.17	1.67	21.17	1.03
3.25	1.34	9.25	7.21	15.25	1.66	21.25	1.02
3.33	1.36	9.33	6.81	15.33	1.64	21.33	1.02
3.42	1.37	9.42	6.46	15.42	1.63	21.42	1.01
3.50	1.40	9.50	6.15	15.50	1.61	21.50	1.01
3.58	1.42	9.58	5.87	15.58	1.60	21.58	1.00
3.67	1.44	9.67	5.61	15.67	1.58	21.67	1.00
3.75	1.46	9.75	5.38	15.75	1.57	21.75	.99
3.83	1.48	9.83	5.17	15.83	1.56	21.83	.99
3.92	1.51	9.92	4.98	15.92	1.54	21.92	.98
4.00	1.53	10.00	4.80	16.00	1.53	22.00	.98
4.08	1.56	10.08	4.64	16.08	1.52	22.08	.97
4.17	1.59	10.17	4.49	16.17	1.51	22.17	.97
4.25	1.62	10.25	4.34	16.25	1.49	22.25	.96
4.33	1.65	10.33	4.21	16.33	1.48	22.33	.96
4.42	1.68	10.42	4.09	16.42	1.47	22.42	.95
4.50	1.71	10.50	3.97	16.50	1.46	22.50	.95
4.58	1.74	10.58	3.87	16.58	1.45	22.58	.95
4.67	1.78	10.67	3.77	16.67	1.43	22.67	.94
4.75	1.82	10.75	3.67	16.75	1.42	22.75	.94
4.83	1.86	10.83	3.58	16.83	1.41	22.83	.93
4.92	1.90	10.92	3.49	16.92	1.40	22.92	.93
5.00	1.94	11.00	3.41	17.00	1.39	23.00	.93
5.08	1.98	11.08	3.34	17.08	1.38	23.08	.92
5.17	2.03	11.17	3.26	17.17	1.37	23.17	.92
5.25	2.08	11.25	3.19	17.25	1.36	23.25	.91
5.33	2.14	11.33	3.13	17.33	1.35	23.33	.91
5.42	2.19	11.42	3.06	17.42	1.34	23.42	.91
5.50	2.25	11.50	3.00	17.50	1.33	23.50	.90
5.58	2.32	11.58	2.94	17.58	1.32	23.58	.90
5.67	2.38	11.67	2.89	17.67	1.31	23.67	.89
5.75	2.46	11.75	2.84	17.75	1.31	23.75	.89
5.83	2.54	11.83	2.79	17.83	1.30	23.83	.89
5.92	2.62	11.92	2.74	17.92	1.29	23.92	.88
6.00	2.71	12.00	2.69	18.00	1.28	24.00	.88

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| CALIB              |
| NASHYD     (0001)  |   Area      (ha)=   53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia        (mm)=    4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=    1.09

    Unit Hyd Qpeak  (cms)=    1.878

    PEAK FLOW       (cms)=    1.834 (i) <--
    TIME TO PEAK    (hrs)=    9.333
    RUNOFF VOLUME    (mm)=   49.713
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TOTAL RAINFALL (mm) = 97.219
RUNOFF COEFFICIENT = .511

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

****
** SIMULATION NUMBER: 6 **
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| CHICAGO STORM |
| Ptotal=109.69 mm |

IDF curve parameters: A=1323.000
B= 5.300
C= .779
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = .33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.03	6.08	3.23	12.08	3.04	18.08	1.47
.17	1.04	6.17	3.35	12.17	2.99	18.17	1.46
.25	1.05	6.25	3.48	12.25	2.94	18.25	1.45
.33	1.06	6.33	3.62	12.33	2.90	18.33	1.45
.42	1.07	6.42	3.78	12.42	2.85	18.42	1.44
.50	1.08	6.50	3.95	12.50	2.81	18.50	1.43
.58	1.09	6.58	4.15	12.58	2.77	18.58	1.42
.67	1.10	6.67	4.36	12.67	2.73	18.67	1.41
.75	1.11	6.75	4.61	12.75	2.69	18.75	1.40
.83	1.12	6.83	4.88	12.83	2.65	18.83	1.39
.92	1.13	6.92	5.20	12.92	2.62	18.92	1.38
1.00	1.14	7.00	5.57	13.00	2.58	19.00	1.38
1.08	1.15	7.08	6.01	13.08	2.55	19.08	1.37
1.17	1.16	7.17	6.52	13.17	2.51	19.17	1.36
1.25	1.17	7.25	7.16	13.25	2.48	19.25	1.35
1.33	1.18	7.33	7.95	13.33	2.45	19.33	1.34
1.42	1.19	7.42	8.96	13.42	2.42	19.42	1.34
1.50	1.21	7.50	10.31	13.50	2.39	19.50	1.33
1.58	1.22	7.58	12.23	13.58	2.36	19.58	1.32
1.67	1.23	7.67	15.15	13.67	2.33	19.67	1.31
1.75	1.24	7.75	20.18	13.75	2.31	19.75	1.31
1.83	1.26	7.83	30.97	13.83	2.28	19.83	1.30
1.92	1.27	7.92	70.67	13.92	2.25	19.92	1.29
2.00	1.29	8.00	215.06	14.00	2.23	20.00	1.28
2.08	1.30	8.08	90.70	14.08	2.20	20.08	1.28
2.17	1.31	8.17	50.73	14.17	2.18	20.17	1.27
2.25	1.33	8.25	35.11	14.25	2.16	20.25	1.26
2.33	1.35	8.33	26.91	14.33	2.13	20.33	1.26
2.42	1.36	8.42	21.89	14.42	2.11	20.42	1.25
2.50	1.38	8.50	18.51	14.50	2.09	20.50	1.24
2.58	1.39	8.58	16.08	14.58	2.07	20.58	1.24
2.67	1.41	8.67	14.25	14.67	2.05	20.67	1.23
2.75	1.43	8.75	12.82	14.75	2.03	20.75	1.22
2.83	1.45	8.83	11.67	14.83	2.01	20.83	1.22
2.92	1.47	8.92	10.72	14.92	1.99	20.92	1.21
3.00	1.49	9.00	9.93	15.00	1.97	21.00	1.20
3.08	1.51	9.08	9.26	15.08	1.95	21.08	1.20
3.17	1.53	9.17	8.68	15.17	1.93	21.17	1.19
3.25	1.55	9.25	8.18	15.25	1.92	21.25	1.19
3.33	1.57	9.33	7.73	15.33	1.90	21.33	1.18
3.42	1.59	9.42	7.34	15.42	1.88	21.42	1.18
3.50	1.62	9.50	6.99	15.50	1.86	21.50	1.17
3.58	1.64	9.58	6.68	15.58	1.85	21.58	1.16
3.67	1.67	9.67	6.39	15.67	1.83	21.67	1.16
3.75	1.69	9.75	6.13	15.75	1.82	21.75	1.15
3.83	1.72	9.83	5.90	15.83	1.80	21.83	1.15
3.92	1.75	9.92	5.68	15.92	1.79	21.92	1.14
4.00	1.78	10.00	5.48	16.00	1.77	22.00	1.14
4.08	1.81	10.08	5.29	16.08	1.76	22.08	1.13
4.17	1.84	10.17	5.12	16.17	1.74	22.17	1.13
4.25	1.87	10.25	4.96	16.25	1.73	22.25	1.12
4.33	1.90	10.33	4.82	16.33	1.71	22.33	1.12
4.42	1.94	10.42	4.68	16.42	1.70	22.42	1.11
4.50	1.98	10.50	4.55	16.50	1.69	22.50	1.11
4.58	2.02	10.58	4.43	16.58	1.67	22.58	1.10
4.67	2.06	10.67	4.31	16.67	1.66	22.67	1.10
4.75	2.10	10.75	4.20	16.75	1.65	22.75	1.09
4.83	2.14	10.83	4.10	16.83	1.64	22.83	1.09
4.92	2.19	10.92	4.00	16.92	1.62	22.92	1.08
5.00	2.24	11.00	3.91	17.00	1.61	23.00	1.08
5.08	2.29	11.08	3.82	17.08	1.60	23.08	1.07
5.17	2.34	11.17	3.74	17.17	1.59	23.17	1.07
5.25	2.40	11.25	3.66	17.25	1.58	23.25	1.06
5.33	2.46	11.33	3.59	17.33	1.57	23.33	1.06
5.42	2.53	11.42	3.52	17.42	1.56	23.42	1.05

5.50	2.60	11.50	3.45	17.50	1.54	23.50	1.05
5.58	2.67	11.58	3.38	17.58	1.53	23.58	1.04
5.67	2.75	11.67	3.32	17.67	1.52	23.67	1.04
5.75	2.83	11.75	3.26	17.75	1.51	23.75	1.04
5.83	2.92	11.83	3.20	17.83	1.50	23.83	1.03
5.92	3.01	11.92	3.15	17.92	1.49	23.92	1.03
6.00	3.12	12.00	3.09	18.00	1.48	24.00	1.02

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| CALIB              |
| NASHYD    (0001)   |   Area    (ha)=  53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia      (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------     U.H. Tp(hrs)=   1.09

    Unit Hyd Qpeak  (cms)=   1.878

    PEAK FLOW       (cms)=   2.190 (i) <-
    TIME TO PEAK    (hrs)=   9.333
    RUNOFF VOLUME    (mm)=  59.680
    TOTAL RAINFALL   (mm)= 109.689
    RUNOFF COEFFICIENT  =     .544

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

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  ** SIMULATION NUMBER:   7 **
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| CHICAGO STORM      |    IDF curve parameters: A=1435.000
| Ptotal=122.49 mm   |                          B=    5.200
--------------------                            C=     .775
                          used in:   INTENSITY =  A / (t + B)^C

                          Duration of storm   = 24.00 hrs
                          Storm time step     =  5.00 min
                          Time to peak ratio =    .33
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TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.17	6.08	3.64	12.08	3.43	18.08	1.67
.17	1.18	6.17	3.78	12.17	3.38	18.17	1.66
.25	1.19	6.25	3.92	12.25	3.32	18.25	1.65
.33	1.20	6.33	4.08	12.33	3.27	18.33	1.64
.42	1.21	6.42	4.26	12.42	3.22	18.42	1.63
.50	1.22	6.50	4.45	12.50	3.17	18.50	1.62
.58	1.23	6.58	4.67	12.58	3.13	18.58	1.61
.67	1.25	6.67	4.91	12.67	3.08	18.67	1.60
.75	1.26	6.75	5.18	12.75	3.04	18.75	1.59
.83	1.27	6.83	5.49	12.83	3.00	18.83	1.58
.92	1.28	6.92	5.85	12.92	2.96	18.92	1.57
1.00	1.29	7.00	6.26	13.00	2.92	19.00	1.56
1.08	1.30	7.08	6.75	13.08	2.88	19.08	1.55
1.17	1.32	7.17	7.32	13.17	2.84	19.17	1.54
1.25	1.33	7.25	8.03	13.25	2.80	19.25	1.53
1.33	1.34	7.33	8.90	13.33	2.77	19.33	1.52
1.42	1.36	7.42	10.03	13.42	2.74	19.42	1.52
1.50	1.37	7.50	11.53	13.50	2.70	19.50	1.51
1.58	1.38	7.58	13.65	13.58	2.67	19.58	1.50
1.67	1.40	7.67	16.87	13.67	2.64	19.67	1.49
1.75	1.41	7.75	22.41	13.75	2.61	19.75	1.48
1.83	1.43	7.83	34.27	13.83	2.58	19.83	1.47
1.92	1.44	7.92	77.82	13.92	2.55	19.92	1.46
2.00	1.46	8.00	237.24	14.00	2.52	20.00	1.46
2.08	1.48	8.08	99.80	14.08	2.49	20.08	1.45
2.17	1.49	8.17	55.94	14.17	2.47	20.17	1.44
2.25	1.51	8.25	38.81	14.25	2.44	20.25	1.43
2.33	1.53	8.33	29.82	14.33	2.41	20.33	1.43
2.42	1.54	8.42	24.30	14.42	2.39	20.42	1.42
2.50	1.56	8.50	20.58	14.50	2.37	20.50	1.41
2.58	1.58	8.58	17.90	14.58	2.34	20.58	1.40
2.67	1.60	8.67	15.88	14.67	2.32	20.67	1.40
2.75	1.62	8.75	14.30	14.75	2.30	20.75	1.39
2.83	1.64	8.83	13.03	14.83	2.27	20.83	1.38
2.92	1.66	8.92	11.98	14.92	2.25	20.92	1.37
3.00	1.69	9.00	11.11	15.00	2.23	21.00	1.37
3.08	1.71	9.08	10.36	15.08	2.21	21.08	1.36
3.17	1.73	9.17	9.72	15.17	2.19	21.17	1.35
3.25	1.76	9.25	9.16	15.25	2.17	21.25	1.35
3.33	1.78	9.33	8.67	15.33	2.15	21.33	1.34
3.42	1.81	9.42	8.23	15.42	2.13	21.42	1.33
3.50	1.83	9.50	7.84	15.50	2.11	21.50	1.33
3.58	1.86	9.58	7.49	15.58	2.09	21.58	1.32
3.67	1.89	9.67	7.17	15.67	2.07	21.67	1.32

3.75	1.92	9.75	6.89	15.75	2.06	21.75	1.31
3.83	1.95	9.83	6.62	15.83	2.04	21.83	1.30
3.92	1.98	9.92	6.38	15.92	2.02	21.92	1.30
4.00	2.01	10.00	6.16	16.00	2.01	22.00	1.29
4.08	2.05	10.08	5.95	16.08	1.99	22.08	1.28
4.17	2.08	10.17	5.76	16.17	1.97	22.17	1.28
4.25	2.12	10.25	5.58	16.25	1.96	22.25	1.27
4.33	2.16	10.33	5.42	16.33	1.94	22.33	1.27
4.42	2.20	10.42	5.26	16.42	1.93	22.42	1.26
4.50	2.24	10.50	5.12	16.50	1.91	22.50	1.26
4.58	2.28	10.58	4.98	16.58	1.90	22.58	1.25
4.67	2.33	10.67	4.85	16.67	1.88	22.67	1.24
4.75	2.37	10.75	4.73	16.75	1.87	22.75	1.24
4.83	2.42	10.83	4.62	16.83	1.85	22.83	1.23
4.92	2.48	10.92	4.51	16.92	1.84	22.92	1.23
5.00	2.53	11.00	4.41	17.00	1.83	23.00	1.22
5.08	2.59	11.08	4.31	17.08	1.81	23.08	1.22
5.17	2.65	11.17	4.22	17.17	1.80	23.17	1.21
5.25	2.72	11.25	4.13	17.25	1.79	23.25	1.21
5.33	2.78	11.33	4.05	17.33	1.78	23.33	1.20
5.42	2.86	11.42	3.97	17.42	1.76	23.42	1.20
5.50	2.93	11.50	3.89	17.50	1.75	23.50	1.19
5.58	3.01	11.58	3.81	17.58	1.74	23.58	1.19
5.67	3.10	11.67	3.74	17.67	1.73	23.67	1.18
5.75	3.19	11.75	3.68	17.75	1.72	23.75	1.18
5.83	3.29	11.83	3.61	17.83	1.70	23.83	1.17
5.92	3.40	11.92	3.55	17.92	1.69	23.92	1.17
6.00	3.52	12.00	3.49	18.00	1.68	24.00	1.16

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| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  53.60   Curve Number    (CN)= 76.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   4.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    1.09

     Unit Hyd Qpeak  (cms)=    1.878

     PEAK FLOW       (cms)=    2.579 (i)
     TIME TO PEAK    (hrs)=    9.250
     RUNOFF VOLUME    (mm)=   70.244
     TOTAL RAINFALL   (mm)=  122.495
     RUNOFF COEFFICIENT   =     .573

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

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 FINISH
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Post-Development Flows

Project Name: Ecarpment Business Community
Municipality: Town of Milton
Project No.: 03156
Date: January 4, 2007

OTTHYMO Model Results

25mm Storm =	**0.040**	m^3/s	West Cell
25mm Storm =	**0.010**	m^3/s	East Cell
2-Year Storm=	0.460	m^3/s	
5-Year Storm=	0.650	m^3/s	
10-Year Storm=	1.110	m^3/s	
25-Year Storm=	**2.380**	m^3/s	
50-Year Storm=	3.540	m^3/s	
100-Year Storm=	**4.970**	m^3/s	

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       V    V   I    SSSSS  U    U    A     L
       V    V   I    SS     U    U   A A    L
        V  V    I     SS    U    U  AAAAA   L
        V  V    I      SS   U    U  A    A  L
         VV     I    SSSSS  UUUUU  A    A   LLLLL

        OOO   TTTTT  TTTTT  H    H  Y    Y  M    M    OOO    TM, Version 2.0
       O   O    T      T    H    H   Y Y    MM MM   O   O
       O   O    T      T    H    H    Y     M    M  O   O   Licensed To: Valdor Engineering
        OOO     T      T    H    H    Y     M    M    OOO                 VO2-0102
```



```
                 ***** D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
  Output  filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\Post-Development\Post Chicago 24 Hour
-82ha.out
  Summary filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\Post-Development\Post Chicago 24 Hour
-82ha.sum


DATE: 1/8/2007                         TIME: 8:39:08 AM

USER:


COMMENTS: POST DEVELOPMENT
          25mm STORM -WEST CELL
-------------------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************


 -------------------
 |   READ STORM    |     Filename: S:\SWM Library\Storms\25mmchi.stm
 | Ptotal= 25.02 mm |    Comments: 25mm CHICAGO Storm
 -------------------
                TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |  hrs   mm/hr |  hrs   mm/hr
                 .17    2.17 | 1.17    6.20 | 2.17    5.62 | 3.17    2.95
                 .33    2.38 | 1.33   12.18 | 2.33    4.80 | 3.33    2.76
                 .50    2.66 | 1.50   41.67 | 2.50    4.21 | 3.50    2.62
                 .67    3.03 | 1.67   15.28 | 2.67    3.78 | 3.67    2.47
                 .83    3.58 | 1.83    9.22 | 2.83    3.45 | 3.83    2.35
                1.00    4.47 | 2.00    6.88 | 3.00    3.18 | 4.00    2.23

 ----------------------------------------------------------------------------


 -------------------
 | CALIB            |
 | STANDHYD  (0009) |    Area     (ha)=  82.00
 |ID= 1 DT= 5.0 min |    Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=     61.50        20.50
     Dep. Storage      (mm)=      1.00         1.50
     Average Slope      (%)=      1.00         2.00
     Length             (m)=    739.40        40.00
     Mannings n            =      .013         .250

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


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
               .083    2.17 | 1.083    6.20 | 2.083    5.62 |  3.08    2.95
               .167    2.17 | 1.167    6.20 | 2.167    5.62 |  3.17    2.95
               .250    2.38 | 1.250   12.18 | 2.250    4.80 |  3.25    2.76
               .333    2.38 | 1.333   12.18 | 2.333    4.80 |  3.33    2.76
               .417    2.66 | 1.417   41.67 | 2.417    4.21 |  3.42    2.62
               .500    2.66 | 1.500   41.67 | 2.500    4.21 |  3.50    2.62
               .583    3.03 | 1.583   15.28 | 2.583    3.78 |  3.58    2.47
               .667    3.03 | 1.667   15.28 | 2.667    3.78 |  3.67    2.47
               .750    3.58 | 1.750    9.22 | 2.750    3.45 |  3.75    2.35
```

```
            .833     3.58 | 1.833    9.22 | 2.833    3.45 |  3.83    2.35
            .917     4.47 | 1.917    6.88 | 2.917    3.18 |  3.92    2.23
           1.000     4.47 | 2.000    6.88 | 3.000    3.18 |  4.00    2.23

     Max.Eff.Inten.(mm/hr)=      32.87         4.98
                over (min)       15.00        40.00
     Storage Coeff.  (min)=      13.24 (ii)   36.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        40.00
     Unit Hyd. peak  (cms)=        .08          .03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.03          .14         4.083 (iii)
     TIME TO PEAK    (hrs)=       1.67         2.25          1.67
     RUNOFF VOLUME    (mm)=      24.02         5.33         19.35
     TOTAL RAINFALL   (mm)=      25.02        25.02         25.02
     RUNOFF COEFFICIENT   =        .96          .21           .77


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0     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.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (0012) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0450     1.9135
                           .0330     1.0325   |    .0000      .0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0009)     82.00      4.08      1.67      19.35
     OUTFLOW: ID= 1 (0012)     82.00       .04      4.83      16.28

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .98
                   TIME SHIFT OF PEAK FLOW        (min)=190.00
                   MAXIMUM  STORAGE   USED       (ha.m.)= 1.5375

-------------------------------------------------------------------------------

 FINISH
===========================================================================================================
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===========================================================================================

      V     V    I    SSSSS  U    U     A     L
      V     V    I    SS     U    U    A A    L
       V   V     I     SS    U    U   AAAAA   L
       V   V     I      SS   U    U   A   A   L
        VV       I    SSSSS  UUUUU   A   A   LLLLL

       OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO    TM, Version 2.0
      O   O     T      T    H    H   Y Y    MM MM   O   O
      O   O     T      T    H    H    Y     M    M  O   O   Licensed To: Valdor Engineering
       OOO      T      T    H    H    Y     M    M   OOO                 VO2-0102
```

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***** D E T A I L E D   O U T P U T *****

Input filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
Output filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\Post-Development\Post Chicago 24 Hour -16ha.out
Summary filename: S:\Projects\2003\03156\Hydrotechnical\Stormwater Management\Post-Development\Post Chicago 24 Hour -16ha.sum

DATE: 1/8/2007   TIME: 8:38:31 AM

USER:

COMMENTS: POST - DEVELOPMENT
25mm STORM - EAST CELL

****
** SIMULATION NUMBER: 1 **
****

READ STORM	Filename: S:\SWM Library\Storms\25mmchi.stm
Ptotal= 25.02 mm	Comments: 25mm CHICAGO Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	2.17	1.17	6.20	2.17	5.62	3.17	2.95
.33	2.38	1.33	12.18	2.33	4.80	3.33	2.76
.50	2.66	1.50	41.67	2.50	4.21	3.50	2.62
.67	3.03	1.67	15.28	2.67	3.78	3.67	2.47
.83	3.58	1.83	9.22	2.83	3.45	3.83	2.35
1.00	4.47	2.00	6.88	3.00	3.18	4.00	2.23

CALIB STANDHYD (0009) ID= 1 DT= 5.0 min	Area (ha)= 16.00 Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	12.00	4.00
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	326.60	40.00
Mannings n	=	.013	.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35

```
              .833    3.58 | 1.833    9.22 | 2.833    3.45 |  3.83    2.35
              .917    4.47 | 1.917    6.88 | 2.917    3.18 |  3.92    2.23
             1.000    4.47 | 2.000    6.88 | 3.000    3.18 |  4.00    2.23

    Max.Eff.Inten.(mm/hr)=       41.67          4.98
             over (min)           5.00         35.00
    Storage Coeff.  (min)=        7.38 (ii)    30.80 (ii)
    Unit Hyd. Tpeak (min)=        5.00         35.00
    Unit Hyd. peak  (cms)=         .17           .04
                                                          *TOTALS*
    PEAK FLOW       (cms)=        1.12           .03        1.127 (iii)
    TIME TO PEAK    (hrs)=        1.50          2.08         1.50
    RUNOFF VOLUME    (mm)=       24.02          5.33        19.35
    TOTAL RAINFALL   (mm)=       25.02         25.02        25.02
    RUNOFF COEFFICIENT   =         .96           .21          .77


      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  76.0    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.

-----------------------------------------------------------------------------
--------------------
| RESERVOIR (0012) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000       .0000   |   .0180      .3863

                                  AREA     QPEAK     TPEAK        R.V.
                                  (ha)     (cms)     (hrs)        (mm)
    INFLOW : ID= 2 (0009)        16.00      1.13      1.50       19.35
    OUTFLOW: ID= 1 (0012)        16.00       .01      4.33       18.13

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.22
                  TIME SHIFT OF PEAK FLOW         (min)=170.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  .2955

-----------------------------------------------------------------------------

 FINISH
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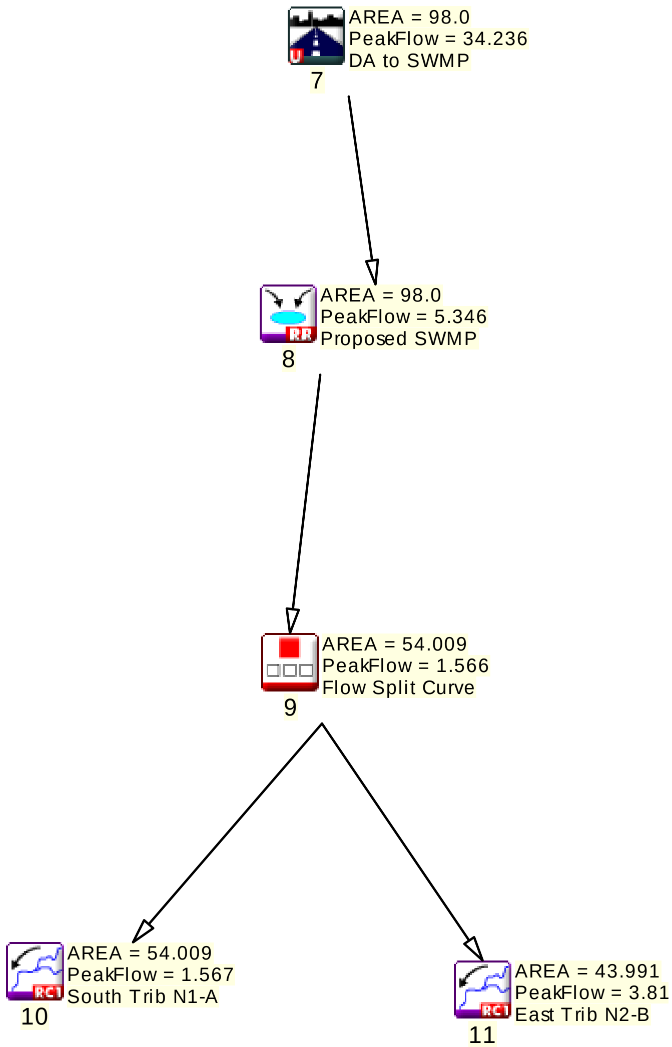
Hydrologic Model (VO2) Schematic
Post-development Conditions – Combined SWMP



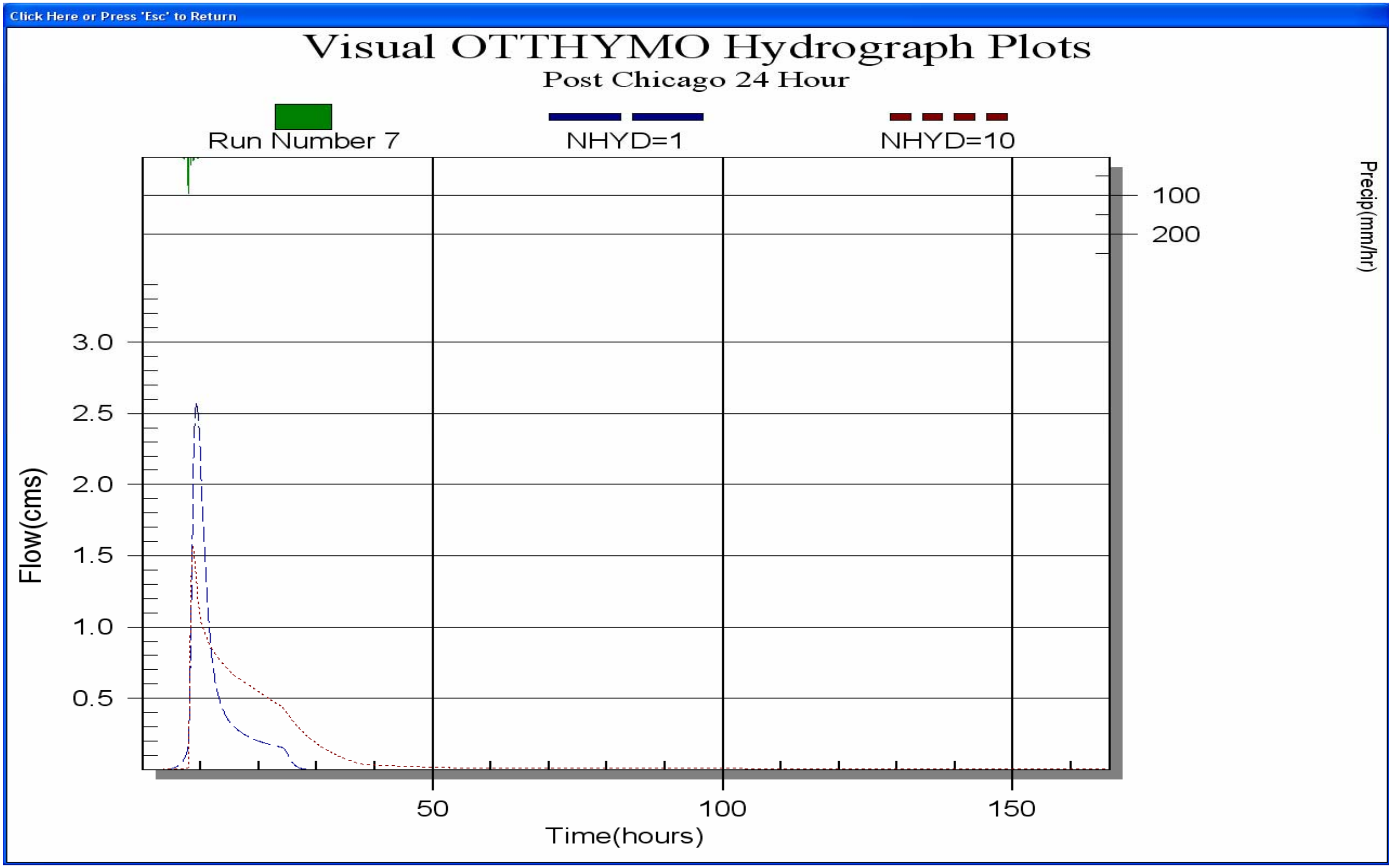


Figure 1: 100-yr Existing (NHYD=1) and Post-development (NHYD=10) hydrographs from SWMP to Trib N1-A.

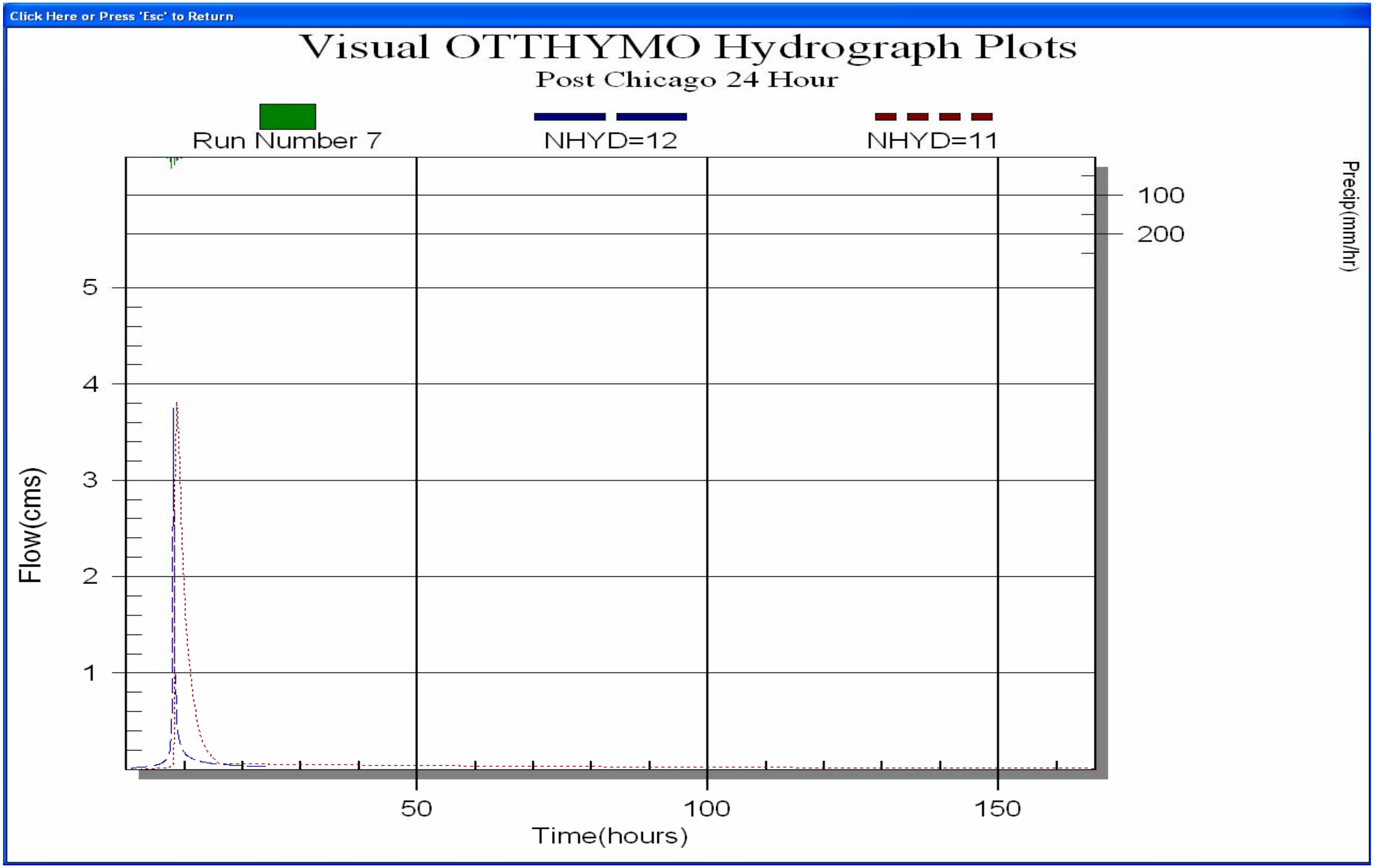


Figure 2: 100-yr Allowable (NHYD=12) and Post-development (NHYD=11) hydrographs from SWMP to Trib N2-B.

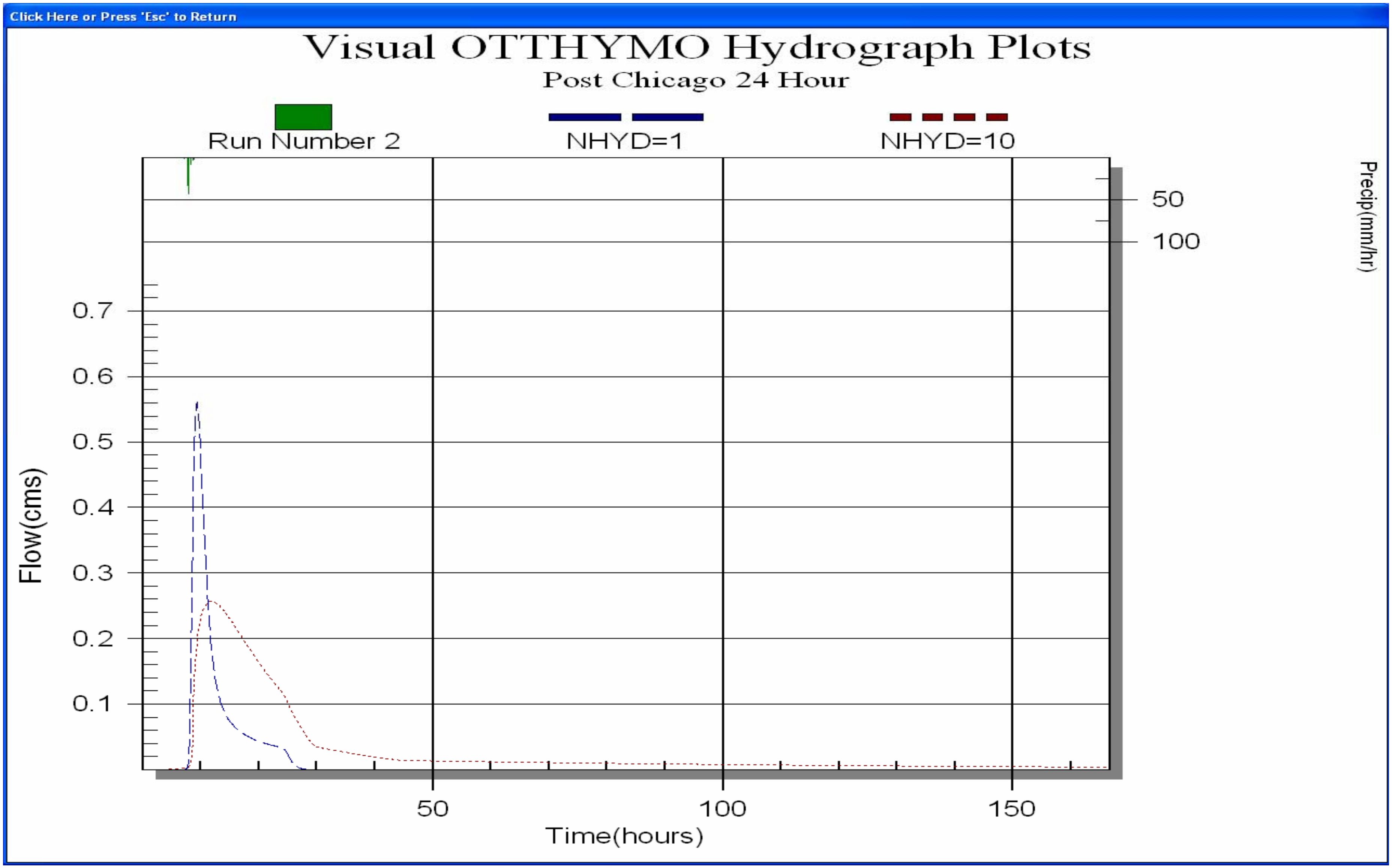


Figure 3: 2-yr Existing (NHYD=1) and Post-development (NHYD=10) hydrographs from SWMP to Trib N1-A.

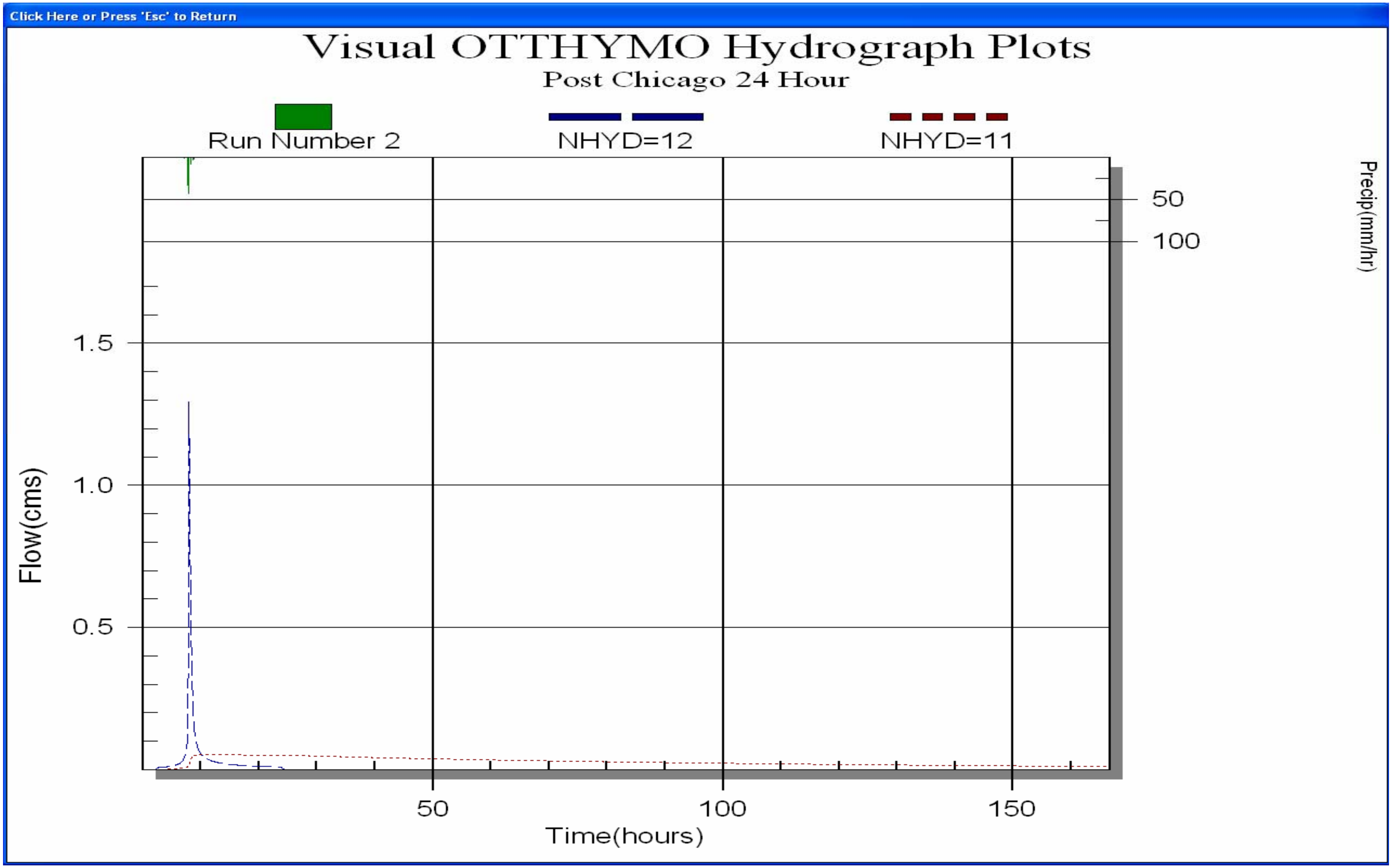


Figure 4: 2-yr Allowable (NHYD=12) and Post-development (NHYD=11) hydrographs from SWMP to Trib N2-B.

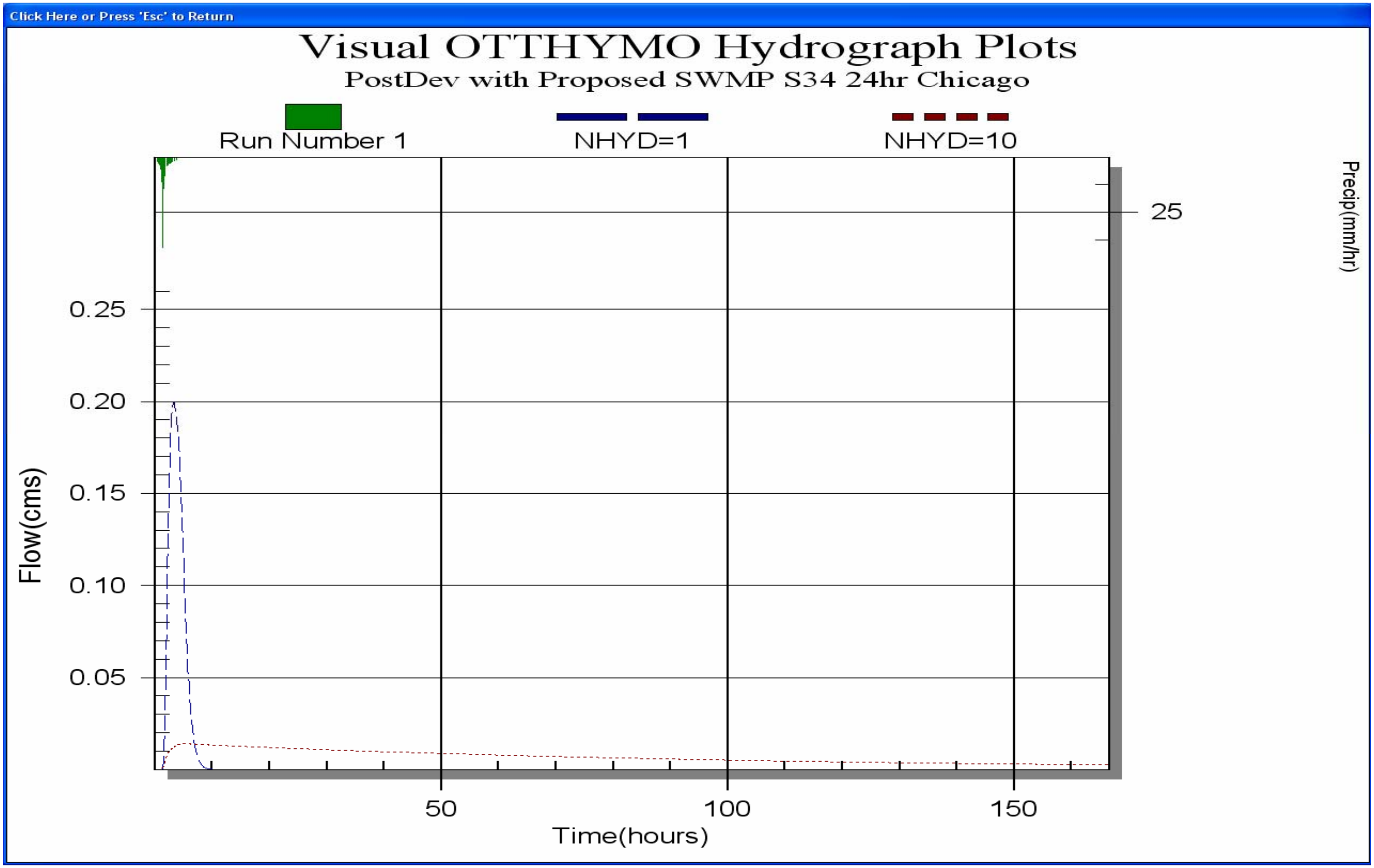


Figure 5: 25 mm Existing (NHYD=1) and Post-development (NHYD=10) hydrographs from SWMP to Trib N1-A.

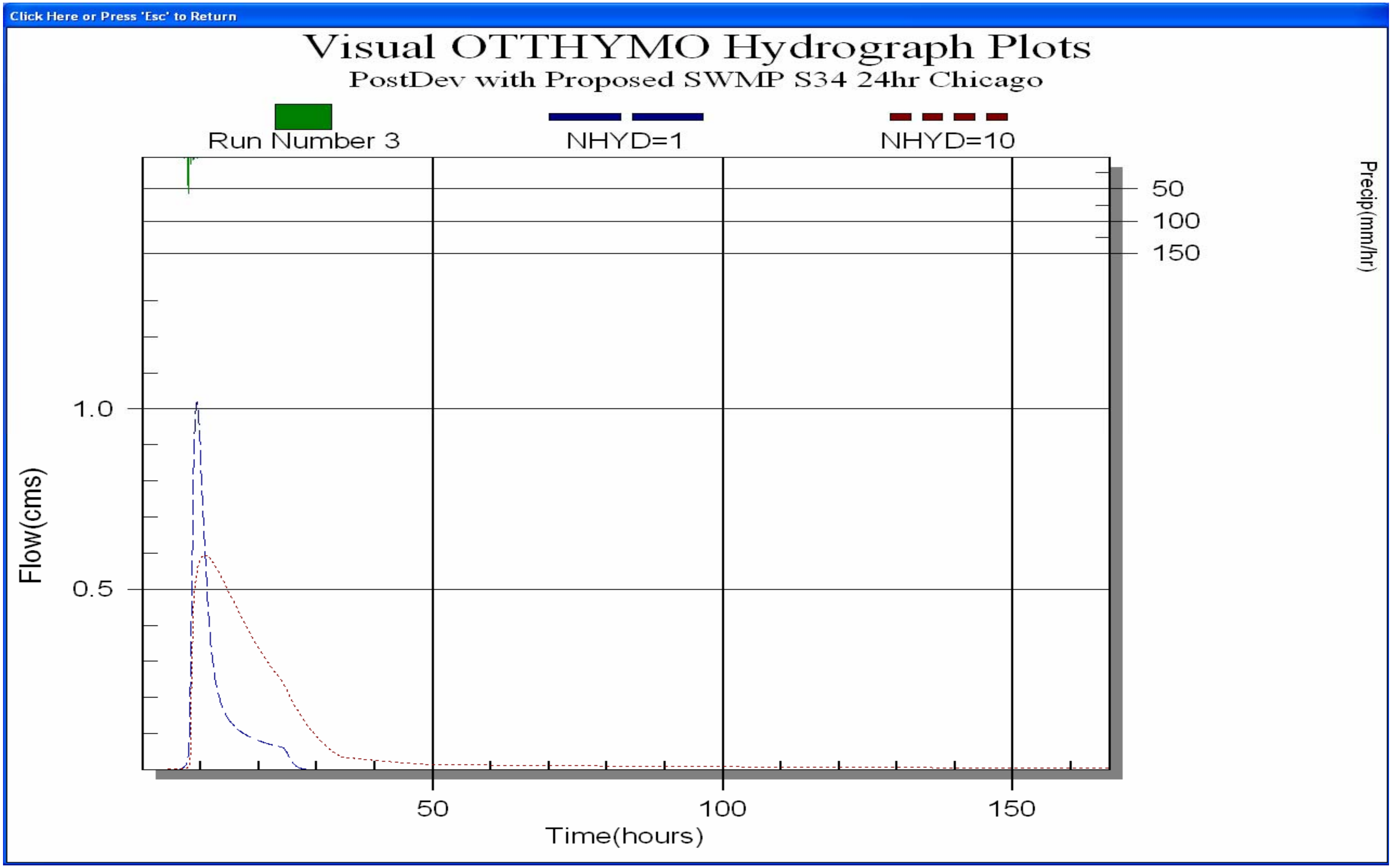


Figure 6: 5-yr Existing (NHYD=1) and Post-development (NHYD=10) hydrographs from SWMP to Trib N1-A.

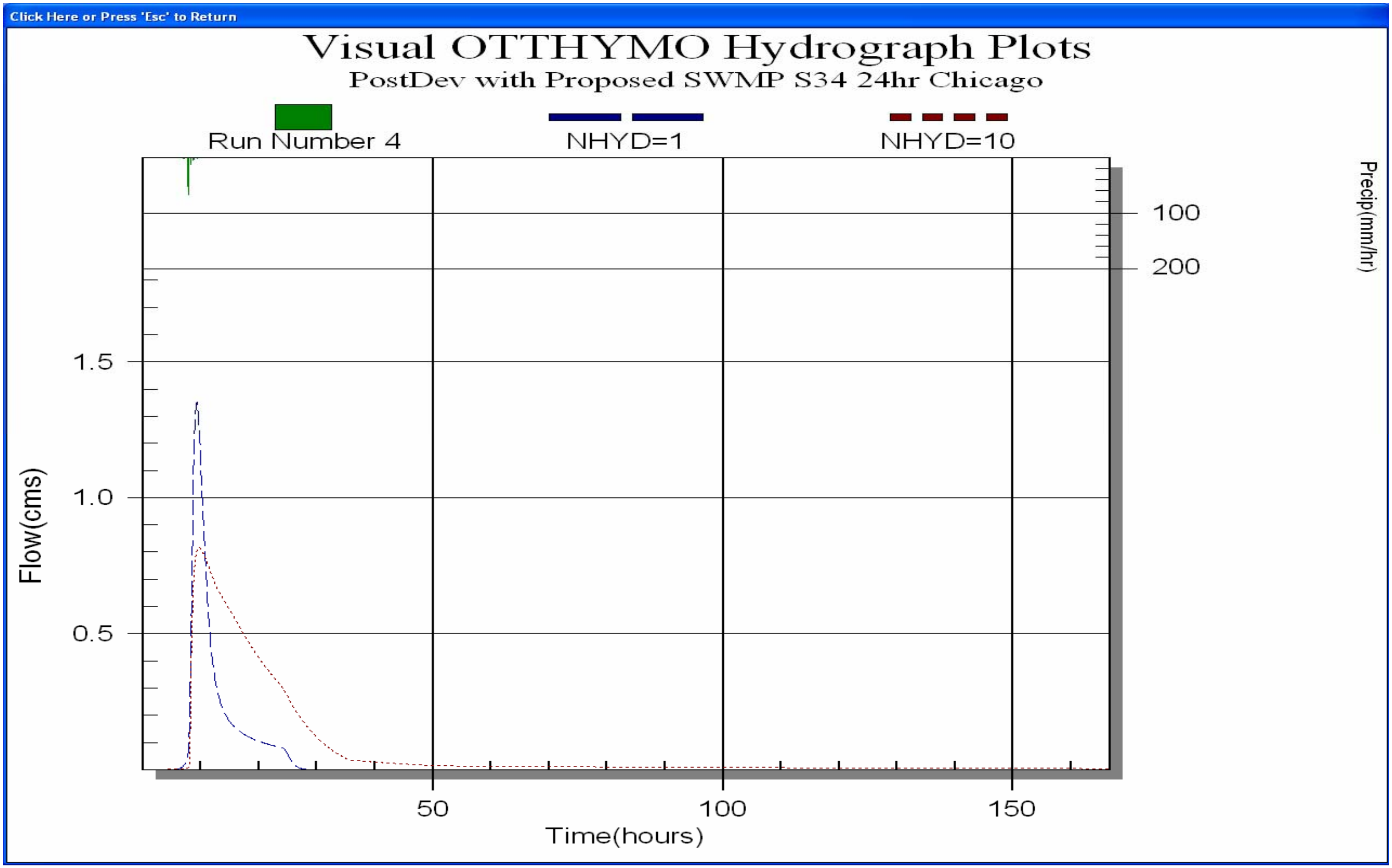


Figure 7: 10-yr Existing (NHYD=1) and Post-development (NHYD=10) hydrographs from SWMP to Trib N1-A.

Post-development VO2 Output
Combined SWMP (2-yr to 100-yr)

```
=====================================================================================
=================

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM, Version 2.0
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O   Licensed To: Valdor Engineering
Inc.
       OOO     T      T    H   H    Y    M   M   OOO                VO2-0102
```

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***** D E T A I L E D   O U T P U T *****

```
  Input   filename: C:\Program Files\Visual OTTHYMO v2.0\voin.dat
  Output  filename: C:\DOCUME~1\bcoffey\Desktop\POST-D~1\Post Chicago 24 Hour.out
  Summary filename: C:\DOCUME~1\bcoffey\Desktop\POST-D~1\Post Chicago 24 Hour.sum
```

DATE: 3/30/2007   TIME: 5:28:34 PM

USER:

COMMENTS: ____

```
-------------------------------------------------------------------------------------
-----------------
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 779.000
| Ptotal= 47.56 mm |                          B=   6.000
--------------------                          C=    .821
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.36	6.08	1.23	12.08	1.15	18.08	.53
.17	.37	6.17	1.28	12.17	1.13	18.17	.53
.25	.37	6.25	1.33	12.25	1.11	18.25	.53
.33	.37	6.33	1.39	12.33	1.10	18.33	.52
.42	.38	6.42	1.46	12.42	1.08	18.42	.52
.50	.38	6.50	1.53	12.50	1.06	18.50	.51
.58	.39	6.58	1.61	12.58	1.04	18.58	.51
.67	.39	6.67	1.70	12.67	1.03	18.67	.51
.75	.39	6.75	1.81	12.75	1.01	18.75	.50
.83	.40	6.83	1.92	12.83	1.00	18.83	.50
.92	.40	6.92	2.06	12.92	.98	18.92	.50
1.00	.40	7.00	2.22	13.00	.97	19.00	.49
1.08	.41	7.08	2.41	13.08	.95	19.08	.49
1.17	.41	7.17	2.64	13.17	.94	19.17	.49
1.25	.42	7.25	2.92	13.25	.93	19.25	.49
1.33	.42	7.33	3.27	13.33	.92	19.33	.48
1.42	.43	7.42	3.73	13.42	.90	19.42	.48
1.50	.43	7.50	4.36	13.50	.89	19.50	.48
1.58	.44	7.58	5.25	13.58	.88	19.58	.47
1.67	.44	7.67	6.65	13.67	.87	19.67	.47
1.75	.45	7.75	9.12	13.75	.86	19.75	.47
1.83	.45	7.83	14.59	13.83	.85	19.83	.47
1.92	.46	7.92	35.30	13.92	.84	19.92	.46
2.00	.46	8.00	108.78	14.00	.83	20.00	.46
2.08	.47	8.08	45.80	14.08	.82	20.08	.46
2.17	.47	8.17	24.85	14.17	.81	20.17	.45
2.25	.48	8.25	16.71	14.25	.80	20.25	.45
2.33	.48	8.33	12.51	14.33	.79	20.33	.45
2.42	.49	8.42	9.98	14.42	.78	20.42	.45
2.50	.50	8.50	8.30	14.50	.77	20.50	.44
2.58	.50	8.58	7.10	14.58	.76	20.58	.44
2.67	.51	8.67	6.22	14.67	.76	20.67	.44
2.75	.52	8.75	5.53	14.75	.75	20.75	.44
2.83	.52	8.83	4.99	14.83	.74	20.83	.43
2.92	.53	8.92	4.55	14.92	.73	20.92	.43
3.00	.54	9.00	4.18	15.00	.73	21.00	.43
3.08	.55	9.08	3.87	15.08	.72	21.08	.43
3.17	.55	9.17	3.60	15.17	.71	21.17	.43
3.25	.56	9.25	3.38	15.25	.70	21.25	.42
3.33	.57	9.33	3.18	15.33	.70	21.33	.42
3.42	.58	9.42	3.00	15.42	.69	21.42	.42
3.50	.59	9.50	2.84	15.50	.68	21.50	.42
3.58	.60	9.58	2.70	15.58	.68	21.58	.41
3.67	.61	9.67	2.58	15.67	.67	21.67	.41
3.75	.62	9.75	2.46	15.75	.67	21.75	.41
3.83	.63	9.83	2.36	15.83	.66	21.83	.41
3.92	.64	9.92	2.27	15.92	.65	21.92	.41
4.00	.65	10.00	2.18	16.00	.65	22.00	.40
4.08	.66	10.08	2.10	16.08	.64	22.08	.40
4.17	.67	10.17	2.03	16.17	.64	22.17	.40
4.25	.69	10.25	1.96	16.25	.63	22.25	.40
4.33	.70	10.33	1.90	16.33	.63	22.33	.40
4.42	.71	10.42	1.84	16.42	.62	22.42	.39
4.50	.73	10.50	1.78	16.50	.62	22.50	.39
4.58	.74	10.58	1.73	16.58	.61	22.58	.39
4.67	.76	10.67	1.68	16.67	.61	22.67	.39
4.75	.78	10.75	1.64	16.75	.60	22.75	.39
4.83	.79	10.83	1.59	16.83	.60	22.83	.38
4.92	.81	10.92	1.55	16.92	.59	22.92	.38
5.00	.83	11.00	1.51	17.00	.59	23.00	.38
5.08	.85	11.08	1.48	17.08	.58	23.08	.38
5.17	.87	11.17	1.44	17.17	.58	23.17	.38
5.25	.90	11.25	1.41	17.25	.57	23.25	.38
5.33	.92	11.33	1.38	17.33	.57	23.33	.37
5.42	.95	11.42	1.35	17.42	.56	23.42	.37
5.50	.97	11.50	1.32	17.50	.56	23.50	.37
5.58	1.00	11.58	1.29	17.58	.56	23.58	.37
5.67	1.03	11.67	1.27	17.67	.55	23.67	.37
5.75	1.07	11.75	1.24	17.75	.55	23.75	.37
5.83	1.10	11.83	1.22	17.83	.54	23.83	.36
5.92	1.14	11.92	1.20	17.92	.54	23.92	.36
6.00	1.18	12.00	1.18	18.00	.54	24.00	.36

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      73.50        24.50
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     808.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      77.29        50.18
```

```
              over (min)       10.00        15.00
     Storage Coeff.  (min)=       9.92 (ii)   14.32 (ii)
     Unit Hyd. Tpeak (min)=      10.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                           *TOTALS*
     PEAK FLOW      (cms)=      10.94          .86         11.527 (iii)
     TIME TO PEAK    (hrs)=       8.08         8.25           8.08
     RUNOFF VOLUME    (mm)=      46.56        16.80          39.12
     TOTAL RAINFALL   (mm)=      47.56        47.56          47.56
     RUNOFF COEFFICIENT   =        .98          .35            .82


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |  2.1120     4.6620
                          .0540     1.8330    |  2.6080     4.8403
                          .0830     2.1918    |  3.1850     5.0179
                          .7150     3.9693    |  3.4370     5.0893
                          .9400     4.1375    |  3.8330     5.1969
                         1.0000     4.1718    |  4.5380     5.3784
                         1.0620     4.2062    |  5.2940     5.5624
                         1.2690     4.3095    |  6.0970     5.7551

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     11.53      8.08      39.12
     OUTFLOW: ID= 1 (0008)     98.00       .31     11.83      34.00

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)=  2.68
                   TIME SHIFT OF PEAK FLOW         (min)=225.00
                   MAXIMUM  STORAGE   USED       (ha.m.)= 2.8276

--------------------------------------------------------------------------------
--------------------
| DIVERT HYD (0009)|
| IN= 1   # OUT= 2 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  98.00       .31     11.83   34.00
     ==================================================
     ID= 2  (   9)    :  50.48       .26     11.83   34.00
     ID= 3  (   9)    :  47.52       .05     11.83   34.00
--------------------------------------------------------------------------------
```

```
--------------------
| ROUTE CHN (0010) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.50         .0500
                   1.00        100.70         .0500
                   1.50        100.55     .0500 / .0300  Main Channel
                   2.00         99.50         .0300      Main Channel
                   3.50         99.60         .0300      Main Channel
                   4.50        100.65     .0300 / .0500  Main Channel
                   6.00        101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .10    99.60    .353E+01        .0          .19       4.37
        .19    99.69    .112E+02        .1          .37       2.28
        .29    99.79    .195E+02        .2          .49       1.70
        .38    99.88    .285E+02        .3          .59       1.42
        .48    99.98    .381E+02        .5          .67       1.25
        .57   100.07    .484E+02        .7          .74       1.13
        .67   100.17    .594E+02        .9          .80       1.04
        .76   100.26    .710E+02       1.2          .86        .97
        .86   100.36    .832E+02       1.5          .91        .92
        .95   100.45    .961E+02       1.8          .96        .87
       1.05   100.55    .110E+03       2.2         1.00        .83
       1.16   100.66    .127E+03       2.7         1.07        .78
       1.28   100.78    .148E+03       3.4         1.14        .73
       1.39   100.89    .170E+03       4.1         1.20        .69
       1.50   101.00    .195E+03       4.9         1.25        .67
       1.61   101.11    .221E+03       5.8         1.30        .64
       1.72   101.22    .250E+03       6.7         1.34        .62
       1.84   101.34    .280E+03       7.7         1.38        .60
       1.95   101.45    .313E+03       8.8         1.41        .59

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)  50.48     .26   11.83  34.00      .33       .53
     OUTFLOW: ID= 1 (0010)  50.48     .26   11.83  34.00      .33       .53


--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0011) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.50         .0500
                   1.00        100.70         .0500
                   1.50        100.55     .0500 / .0300  Main Channel
                   2.00         99.50         .0300      Main Channel
                   3.50         99.60         .0300      Main Channel
                   4.50        100.65     .0300 / .0500  Main Channel
                   6.00        101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .10    99.60    .353E+01        .0          .19       4.37
        .19    99.69    .112E+02        .1          .37       2.28
        .29    99.79    .195E+02        .2          .49       1.70
        .38    99.88    .285E+02        .3          .59       1.42
        .48    99.98    .381E+02        .5          .67       1.25
        .57   100.07    .484E+02        .7          .74       1.13
        .67   100.17    .594E+02        .9          .80       1.04
        .76   100.26    .710E+02       1.2          .86        .97
        .86   100.36    .832E+02       1.5          .91        .92
        .95   100.45    .961E+02       1.8          .96        .87
       1.05   100.55    .110E+03       2.2         1.00        .83
       1.16   100.66    .127E+03       2.7         1.07        .78
       1.28   100.78    .148E+03       3.4         1.14        .73
```

1.39	100.89	.170E+03	4.1	1.20	.69
1.50	101.00	.195E+03	4.9	1.25	.67
1.61	101.11	.221E+03	5.8	1.30	.64
1.72	101.22	.250E+03	6.7	1.34	.62
1.84	101.34	.280E+03	7.7	1.38	.60
1.95	101.45	.313E+03	8.8	1.41	.59

	<---- hydrograph ---->				<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0009)	47.52	.05	11.83	34.00	.15	.26
OUTFLOW: ID= 1 (0011)	47.52	.05	11.83	34.00	.15	.26

```
-----------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 959.000
| Ptotal= 67.24 mm |                          B=   5.700
--------------------                          C=    .802
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.57	6.08	1.85	12.08	1.74	18.08	.82
.17	.57	6.17	1.92	12.17	1.71	18.17	.82
.25	.58	6.25	2.00	12.25	1.68	18.25	.81
.33	.58	6.33	2.09	12.33	1.66	18.33	.81
.42	.59	6.42	2.18	12.42	1.63	18.42	.80
.50	.59	6.50	2.29	12.50	1.60	18.50	.79
.58	.60	6.58	2.40	12.58	1.58	18.58	.79
.67	.61	6.67	2.54	12.67	1.56	18.67	.78
.75	.61	6.75	2.68	12.75	1.53	18.75	.78
.83	.62	6.83	2.85	12.83	1.51	18.83	.77
.92	.62	6.92	3.05	12.92	1.49	18.92	.77
1.00	.63	7.00	3.27	13.00	1.47	19.00	.77
1.08	.64	7.08	3.54	13.08	1.45	19.08	.76
1.17	.64	7.17	3.86	13.17	1.43	19.17	.76
1.25	.65	7.25	4.26	13.25	1.41	19.25	.75
1.33	.65	7.33	4.75	13.33	1.39	19.33	.75
1.42	.66	7.42	5.39	13.42	1.37	19.42	.74
1.50	.67	7.50	6.25	13.50	1.36	19.50	.74
1.58	.68	7.58	7.48	13.58	1.34	19.58	.73
1.67	.68	7.67	9.37	13.67	1.32	19.67	.73
1.75	.69	7.75	12.67	13.75	1.31	19.75	.72
1.83	.70	7.83	19.89	13.83	1.29	19.83	.72
1.92	.71	7.92	46.83	13.92	1.28	19.92	.72
2.00	.71	8.00	143.30	14.00	1.26	20.00	.71
2.08	.72	8.08	60.46	14.08	1.25	20.08	.71
2.17	.73	8.17	33.27	14.17	1.23	20.17	.70
2.25	.74	8.25	22.67	14.25	1.22	20.25	.70
2.33	.75	8.33	17.15	14.33	1.21	20.33	.70
2.42	.76	8.42	13.81	14.42	1.19	20.42	.69
2.50	.77	8.50	11.57	14.50	1.18	20.50	.69
2.58	.78	8.58	9.98	14.58	1.17	20.58	.69
2.67	.79	8.67	8.78	14.67	1.16	20.67	.68
2.75	.80	8.75	7.86	14.75	1.14	20.75	.68
2.83	.81	8.83	7.11	14.83	1.13	20.83	.67
2.92	.82	8.92	6.51	14.92	1.12	20.92	.67
3.00	.83	9.00	6.00	15.00	1.11	21.00	.67
3.08	.84	9.08	5.58	15.08	1.10	21.08	.66
3.17	.85	9.17	5.21	15.17	1.09	21.17	.66
3.25	.86	9.25	4.89	15.25	1.08	21.25	.66
3.33	.88	9.33	4.62	15.33	1.07	21.33	.65
3.42	.89	9.42	4.37	15.42	1.06	21.42	.65
3.50	.90	9.50	4.15	15.50	1.05	21.50	.65
3.58	.92	9.58	3.96	15.58	1.04	21.58	.64
3.67	.93	9.67	3.78	15.67	1.03	21.67	.64
3.75	.95	9.75	3.62	15.75	1.02	21.75	.64
3.83	.96	9.83	3.47	15.83	1.01	21.83	.63
3.92	.98	9.92	3.34	15.92	1.00	21.92	.63
4.00	1.00	10.00	3.22	16.00	.99	22.00	.63
4.08	1.01	10.08	3.10	16.08	.99	22.08	.63
4.17	1.03	10.17	3.00	16.17	.98	22.17	.62
4.25	1.05	10.25	2.90	16.25	.97	22.25	.62
4.33	1.07	10.33	2.81	16.33	.96	22.33	.62
4.42	1.09	10.42	2.73	16.42	.95	22.42	.61
4.50	1.11	10.50	2.65	16.50	.95	22.50	.61
4.58	1.14	10.58	2.57	16.58	.94	22.58	.61
4.67	1.16	10.67	2.50	16.67	.93	22.67	.60
4.75	1.18	10.75	2.44	16.75	.92	22.75	.60
4.83	1.21	10.83	2.38	16.83	.92	22.83	.60
4.92	1.24	10.92	2.32	16.92	.91	22.92	.60
5.00	1.27	11.00	2.26	17.00	.90	23.00	.59
5.08	1.30	11.08	2.21	17.08	.90	23.08	.59
5.17	1.33	11.17	2.16	17.17	.89	23.17	.59
5.25	1.36	11.25	2.11	17.25	.88	23.25	.59
5.33	1.40	11.33	2.07	17.33	.88	23.33	.58
5.42	1.44	11.42	2.02	17.42	.87	23.42	.58
5.50	1.48	11.50	1.98	17.50	.86	23.50	.58
5.58	1.52	11.58	1.94	17.58	.86	23.58	.58
5.67	1.57	11.67	1.91	17.67	.85	23.67	.57
5.75	1.61	11.75	1.87	17.75	.84	23.75	.57
5.83	1.67	11.83	1.84	17.83	.84	23.83	.57
5.92	1.72	11.92	1.80	17.92	.83	23.92	.57
6.00	1.79	12.00	1.77	18.00	.83	24.00	.56

```
-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      73.50        24.50
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     808.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     101.88        42.71
                over (min)      10.00        15.00
     Storage Coeff.  (min)=       8.88 (ii)   12.82 (ii)
     Unit Hyd. Tpeak (min)=      10.00        15.00
     Unit Hyd. peak  (cms)=        .12          .08
                                                         *TOTALS*
     PEAK FLOW      (cms)=      15.25         1.57        16.355 (iii)
     TIME TO PEAK    (hrs)=       8.08         8.17          8.08
     RUNOFF VOLUME    (mm)=      66.24        29.61         57.09
     TOTAL RAINFALL   (mm)=      67.24        67.24         67.24
     RUNOFF COEFFICIENT   =        .99          .44           .85


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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.

-----------------------------------------------------------------------------
--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |
--------------------
```

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.0000	.0000	2.1120	4.6620
.0540	1.8330	2.6080	4.8403
.0830	2.1918	3.1850	5.0179
.7150	3.9693	3.4370	5.0893
.9400	4.1375	3.8330	5.1969
1.0000	4.1718	4.5380	5.3784
1.0620	4.2062	5.2940	5.5624

```
                       1.2690     4.3095   |   6.0970     5.7551

                               AREA      QPEAK      TPEAK       R.V.
                               (ha)      (cms)      (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     16.35       8.08      57.09
     OUTFLOW: ID= 1 (0008)     98.00       .65      10.67      51.72

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)=  3.98
                   TIME SHIFT OF PEAK FLOW         (min)=155.00
                   MAXIMUM  STORAGE   USED       (ha.m.)= 3.7910

 -------------------------------------------------------------------------------
 --------------------
 | DIVERT HYD (0009)|
 | IN= 1   # OUT= 2 |
 --------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  98.00       .65     10.67   51.72
     =====================================================
     ID= 2  (   9)    :  64.89       .59     10.67   51.72
     ID= 3  (   9)    :  33.11       .06     10.67   51.72
 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (0010) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
 --------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00       101.50        .0500
                   1.00       100.70        .0500
                   1.50       100.55     .0500 / .0300  Main Channel
                   2.00        99.50          .0300      Main Channel
                   3.50        99.60          .0300      Main Channel
                   4.50       100.65     .0300 / .0500  Main Channel
                   6.00       101.45        .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .10     99.60    .353E+01       .0          .19        4.37
        .19     99.69    .112E+02       .1          .37        2.28
        .29     99.79    .195E+02       .2          .49        1.70
        .38     99.88    .285E+02       .3          .59        1.42
        .48     99.98    .381E+02       .5          .67        1.25
        .57    100.07    .484E+02       .7          .74        1.13
        .67    100.17    .594E+02       .9          .80        1.04
        .76    100.26    .710E+02      1.2          .86         .97
        .86    100.36    .832E+02      1.5          .91         .92
        .95    100.45    .961E+02      1.8          .96         .87
       1.05    100.55    .110E+03      2.2         1.00         .83
       1.16    100.66    .127E+03      2.7         1.07         .78
       1.28    100.78    .148E+03      3.4         1.14         .73
       1.39    100.89    .170E+03      4.1         1.20         .69
       1.50    101.00    .195E+03      4.9         1.25         .67
       1.61    101.11    .221E+03      5.8         1.30         .64
       1.72    101.22    .250E+03      6.7         1.34         .62
       1.84    101.34    .280E+03      7.7         1.38         .60
       1.95    101.45    .313E+03      8.8         1.41         .59

                                   <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   64.89      .59   10.67  51.72       .52       .69
     OUTFLOW: ID= 1 (0010)   64.89      .59   10.67  51.72       .52       .69

 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (0011) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
 --------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00       101.50        .0500
                   1.00       100.70        .0500
                   1.50       100.55     .0500 / .0300  Main Channel
                   2.00        99.50          .0300      Main Channel
                   3.50        99.60          .0300      Main Channel
                   4.50       100.65     .0300 / .0500  Main Channel
                   6.00       101.45        .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .10     99.60    .353E+01       .0          .19        4.37
        .19     99.69    .112E+02       .1          .37        2.28
        .29     99.79    .195E+02       .2          .49        1.70
        .38     99.88    .285E+02       .3          .59        1.42
        .48     99.98    .381E+02       .5          .67        1.25
        .57    100.07    .484E+02       .7          .74        1.13
        .67    100.17    .594E+02       .9          .80        1.04
        .76    100.26    .710E+02      1.2          .86         .97
        .86    100.36    .832E+02      1.5          .91         .92
        .95    100.45    .961E+02      1.8          .96         .87
       1.05    100.55    .110E+03      2.2         1.00         .83
       1.16    100.66    .127E+03      2.7         1.07         .78
       1.28    100.78    .148E+03      3.4         1.14         .73
       1.39    100.89    .170E+03      4.1         1.20         .69
       1.50    101.00    .195E+03      4.9         1.25         .67
       1.61    101.11    .221E+03      5.8         1.30         .64
       1.72    101.22    .250E+03      6.7         1.34         .62
       1.84    101.34    .280E+03      7.7         1.38         .60
       1.95    101.45    .313E+03      8.8         1.41         .59

                                   <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   33.11      .06   10.67  51.72       .16       .28
     OUTFLOW: ID= 1 (0011)   33.11      .06   10.75  51.71       .16       .28

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   ****************************
   ** SIMULATION NUMBER:   4 **
   ****************************

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 | CHICAGO STORM    |    IDF curve parameters: A=1089.000
 | Ptotal= 79.77 mm |                          B=   5.700
 --------------------                          C=    .796
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .33

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

.08	.69	6.08	2.24	12.08	2.11	18.08	1.00
.17	.70	6.17	2.32	12.17	2.07	18.17	.99
.25	.71	6.25	2.42	12.25	2.04	18.25	.99
.33	.71	6.33	2.52	12.33	2.00	18.33	.98
.42	.72	6.42	2.63	12.42	1.97	18.42	.97
.50	.73	6.50	2.76	12.50	1.94	18.50	.97
.58	.73	6.58	2.90	12.58	1.91	18.58	.96
.67	.74	6.67	3.06	12.67	1.88	18.67	.96
.75	.75	6.75	3.23	12.75	1.86	18.75	.95
.83	.75	6.83	3.43	12.83	1.83	18.83	.94
.92	.76	6.92	3.67	12.92	1.80	18.92	.94
1.00	.77	7.00	3.94	13.00	1.78	19.00	.93
1.08	.78	7.08	4.25	13.08	1.75	19.08	.93
1.17	.78	7.17	4.63	13.17	1.73	19.17	.92
1.25	.79	7.25	5.10	13.25	1.71	19.25	.92
1.33	.80	7.33	5.69	13.33	1.69	19.33	.91
1.42	.81	7.42	6.44	13.42	1.67	19.42	.90
1.50	.82	7.50	7.46	13.50	1.64	19.50	.90
1.58	.82	7.58	8.90	13.58	1.62	19.58	.89
1.67	.83	7.67	11.12	13.67	1.60	19.67	.89
1.75	.84	7.75	14.99	13.75	1.58	19.75	.88
1.83	.85	7.83	23.39	13.83	1.57	19.83	.88
1.92	.86	7.92	54.52	13.92	1.55	19.92	.87
2.00	.87	8.00	165.06	14.00	1.53	20.00	.87
2.08	.88	8.08	70.22	14.08	1.51	20.08	.86
2.17	.89	8.17	38.89	14.17	1.50	20.17	.86
2.25	.90	8.25	26.62	14.25	1.48	20.25	.85
2.33	.91	8.33	20.22	14.33	1.46	20.33	.85
2.42	.92	8.42	16.32	14.42	1.45	20.42	.84
2.50	.93	8.50	13.71	14.50	1.43	20.50	.84
2.58	.95	8.58	11.84	14.58	1.42	20.58	.84
2.67	.96	8.67	10.44	14.67	1.40	20.67	.83
2.75	.97	8.75	9.35	14.75	1.39	20.75	.83
2.83	.98	8.83	8.48	14.83	1.37	20.83	.82
2.92	1.00	8.92	7.76	14.92	1.36	20.92	.82
3.00	1.01	9.00	7.17	15.00	1.35	21.00	.81
3.08	1.02	9.08	6.67	15.08	1.33	21.08	.81
3.17	1.04	9.17	6.23	15.17	1.32	21.17	.81
3.25	1.05	9.25	5.86	15.25	1.31	21.25	.80
3.33	1.07	9.33	5.53	15.33	1.30	21.33	.80
3.42	1.08	9.42	5.24	15.42	1.29	21.42	.79
3.50	1.10	9.50	4.98	15.50	1.27	21.50	.79
3.58	1.12	9.58	4.75	15.58	1.26	21.58	.79
3.67	1.13	9.67	4.54	15.67	1.25	21.67	.78
3.75	1.15	9.75	4.35	15.75	1.24	21.75	.78
3.83	1.17	9.83	4.17	15.83	1.23	21.83	.77
3.92	1.19	9.92	4.01	15.92	1.22	21.92	.77
4.00	1.21	10.00	3.87	16.00	1.21	22.00	.77
4.08	1.23	10.08	3.73	16.08	1.20	22.08	.76
4.17	1.26	10.17	3.61	16.17	1.19	22.17	.76
4.25	1.28	10.25	3.49	16.25	1.18	22.25	.76
4.33	1.30	10.33	3.38	16.33	1.17	22.33	.75
4.42	1.33	10.42	3.28	16.42	1.16	22.42	.75
4.50	1.35	10.50	3.19	16.50	1.15	22.50	.75
4.58	1.38	10.58	3.10	16.58	1.14	22.58	.74
4.67	1.41	10.67	3.02	16.67	1.13	22.67	.74
4.75	1.44	10.75	2.94	16.75	1.12	22.75	.73
4.83	1.47	10.83	2.87	16.83	1.11	22.83	.73
4.92	1.50	10.92	2.80	16.92	1.11	22.92	.73
5.00	1.54	11.00	2.73	17.00	1.10	23.00	.73
5.08	1.57	11.08	2.67	17.08	1.09	23.08	.72
5.17	1.61	11.17	2.61	17.17	1.08	23.17	.72
5.25	1.65	11.25	2.55	17.25	1.07	23.25	.72
5.33	1.70	11.33	2.50	17.33	1.07	23.33	.71
5.42	1.74	11.42	2.45	17.42	1.06	23.42	.71
5.50	1.79	11.50	2.40	17.50	1.05	23.50	.71
5.58	1.84	11.58	2.35	17.58	1.04	23.58	.70
5.67	1.90	11.67	2.30	17.67	1.04	23.67	.70
5.75	1.95	11.75	2.26	17.75	1.03	23.75	.70
5.83	2.02	11.83	2.22	17.83	1.02	23.83	.69
5.92	2.09	11.92	2.18	17.92	1.01	23.92	.69
6.00	2.16	12.00	2.14	18.00	1.01	24.00	.69

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

--------------------
| CALIB            |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      73.50         24.50
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     808.30         40.00
     Mannings n           =       .013          .250

     Max.Eff.Inten.(mm/hr)=     117.64         55.12
                over (min)      10.00         15.00
     Storage Coeff.  (min)=       8.39 (ii)   12.11 (ii)
     Unit Hyd. Tpeak (min)=      10.00         15.00
     Unit Hyd. peak  (cms)=        .12           .09
                                                        *TOTALS*
     PEAK FLOW       (cms)=      18.10          2.11        19.595 (iii)
     TIME TO PEAK    (hrs)=       8.08          8.17          8.08
     RUNOFF VOLUME    (mm)=      78.77         38.65         68.74
     TOTAL RAINFALL   (mm)=      79.77         79.77         79.77
     RUNOFF COEFFICIENT   =        .99           .48           .86


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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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--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.1120     4.6620
                           .0540     1.8330   |   2.6080     4.8403
                           .0830     2.1918   |   3.1850     5.0179
                           .7150     3.9693   |   3.4370     5.0893
                           .9400     4.1375   |   3.8330     5.1969
                          1.0000     4.1718   |   4.5380     5.3784
                          1.0620     4.2062   |   5.2940     5.5624
                          1.2690     4.3095   |   6.0970     5.7551

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     19.60      8.08      68.74
     OUTFLOW: ID= 1 (0008)     98.00      1.24      9.67      63.29

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.33
                   TIME SHIFT OF PEAK FLOW        (min)= 95.00
                   MAXIMUM  STORAGE   USED      (ha.m.)= 4.2957

--------------------------------------------------------------------------------
--------------------
| DIVERT HYD (0009)|
| IN= 1   # OUT= 2 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
```

```
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                           AREA     QPEAK     TPEAK    R.V.
                           (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  98.00      1.24      9.67   63.29
     ====================================================
     ID= 2  (   9)    :  65.71       .82      9.67   63.29
     ID= 3  (   9)    :  32.29       .42      9.67   63.29
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0010) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.50         .0500
                   1.00        100.70         .0500
                   1.50        100.55     .0500 / .0300  Main Channel
                   2.00         99.50         .0300      Main Channel
                   3.50         99.60         .0300      Main Channel
                   4.50        100.65     .0300 / .0500  Main Channel
                   6.00        101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE     VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .10    99.60    .353E+01       .0           .19       4.37
        .19    99.69    .112E+02       .1           .37       2.28
        .29    99.79    .195E+02       .2           .49       1.70
        .38    99.88    .285E+02       .3           .59       1.42
        .48    99.98    .381E+02       .5           .67       1.25
        .57   100.07    .484E+02       .7           .74       1.13
        .67   100.17    .594E+02       .9           .80       1.04
        .76   100.26    .710E+02      1.2           .86        .97
        .86   100.36    .832E+02      1.5           .91        .92
        .95   100.45    .961E+02      1.8           .96        .87
       1.05   100.55    .110E+03      2.2          1.00        .83
       1.16   100.66    .127E+03      2.7          1.07        .78
       1.28   100.78    .148E+03      3.4          1.14        .73
       1.39   100.89    .170E+03      4.1          1.20        .69
       1.50   101.00    .195E+03      4.9          1.25        .67
       1.61   101.11    .221E+03      5.8          1.30        .64
       1.72   101.22    .250E+03      6.7          1.34        .62
       1.84   101.34    .280E+03      7.7          1.38        .60
       1.95   101.45    .313E+03      8.8          1.41        .59

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   65.71      .82    9.67  63.29       .61       .76
     OUTFLOW: ID= 1 (0010)   65.71      .82    9.58  63.29       .61       .76

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--------------------
| ROUTE CHN (0011) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.50         .0500
                   1.00        100.70         .0500
                   1.50        100.55     .0500 / .0300  Main Channel
                   2.00         99.50         .0300      Main Channel
                   3.50         99.60         .0300      Main Channel
                   4.50        100.65     .0300 / .0500  Main Channel
                   6.00        101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE     VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
```

```
        .10    99.60    .353E+01       .0           .19       4.37
        .19    99.69    .112E+02       .1           .37       2.28
        .29    99.79    .195E+02       .2           .49       1.70
        .38    99.88    .285E+02       .3           .59       1.42
        .48    99.98    .381E+02       .5           .67       1.25
        .57   100.07    .484E+02       .7           .74       1.13
        .67   100.17    .594E+02       .9           .80       1.04
        .76   100.26    .710E+02      1.2           .86        .97
        .86   100.36    .832E+02      1.5           .91        .92
        .95   100.45    .961E+02      1.8           .96        .87
       1.05   100.55    .110E+03      2.2          1.00        .83
       1.16   100.66    .127E+03      2.7          1.07        .78
       1.28   100.78    .148E+03      3.4          1.14        .73
       1.39   100.89    .170E+03      4.1          1.20        .69
       1.50   101.00    .195E+03      4.9          1.25        .67
       1.61   101.11    .221E+03      5.8          1.30        .64
       1.72   101.22    .250E+03      6.7          1.34        .62
       1.84   101.34    .280E+03      7.7          1.38        .60
       1.95   101.45    .313E+03      8.8          1.41        .59

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   32.29      .42    9.67  63.29       .43       .62
     OUTFLOW: ID= 1 (0011)   32.29      .42    9.75  63.28       .43       .62

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  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1234.000
| Ptotal= 97.22 mm |                          B=   5.500
--------------------                          C=    .786
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  = 24.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .08     .89 |  6.08    2.81 | 12.08    2.64 | 18.08    1.27
                  .17     .89 |  6.17    2.91 | 12.17    2.60 | 18.17    1.26
                  .25     .90 |  6.25    3.03 | 12.25    2.56 | 18.25    1.25
                  .33     .91 |  6.33    3.16 | 12.33    2.52 | 18.33    1.25
                  .42     .92 |  6.42    3.29 | 12.42    2.48 | 18.42    1.24
                  .50     .93 |  6.50    3.45 | 12.50    2.44 | 18.50    1.23
                  .58     .93 |  6.58    3.62 | 12.58    2.40 | 18.58    1.22
                  .67     .94 |  6.67    3.81 | 12.67    2.37 | 18.67    1.21
                  .75     .95 |  6.75    4.03 | 12.75    2.34 | 18.75    1.21
                  .83     .96 |  6.83    4.27 | 12.83    2.30 | 18.83    1.20
                  .92     .97 |  6.92    4.56 | 12.92    2.27 | 18.92    1.19
                 1.00     .98 |  7.00    4.88 | 13.00    2.24 | 19.00    1.19
                 1.08     .99 |  7.08    5.27 | 13.08    2.21 | 19.08    1.18
                 1.17    1.00 |  7.17    5.73 | 13.17    2.18 | 19.17    1.17
                 1.25    1.01 |  7.25    6.30 | 13.25    2.15 | 19.25    1.16
                 1.33    1.02 |  7.33    7.00 | 13.33    2.12 | 19.33    1.16
                 1.42    1.03 |  7.42    7.91 | 13.42    2.10 | 19.42    1.15
                 1.50    1.04 |  7.50    9.13 | 13.50    2.07 | 19.50    1.14
                 1.58    1.05 |  7.58   10.85 | 13.58    2.05 | 19.58    1.14
                 1.67    1.06 |  7.67   13.50 | 13.67    2.02 | 19.67    1.13
                 1.75    1.07 |  7.75   18.07 | 13.75    2.00 | 19.75    1.12
                 1.83    1.08 |  7.83   27.92 | 13.83    1.98 | 19.83    1.12
                 1.92    1.09 |  7.92   64.21 | 13.92    1.95 | 19.92    1.11
                 2.00    1.11 |  8.00  194.38 | 14.00    1.93 | 20.00    1.11
                 2.08    1.12 |  8.08   82.51 | 14.08    1.91 | 20.08    1.10
                 2.17    1.13 |  8.17   46.00 | 14.17    1.89 | 20.17    1.09
                 2.25    1.15 |  8.25   31.70 | 14.25    1.87 | 20.25    1.09
                 2.33    1.16 |  8.33   24.20 | 14.33    1.85 | 20.33    1.08
                 2.42    1.17 |  8.42   19.63 | 14.42    1.83 | 20.42    1.08
                 2.50    1.19 |  8.50   16.55 | 14.50    1.81 | 20.50    1.07
                 2.58    1.20 |  8.58   14.34 | 14.58    1.79 | 20.58    1.06
```

2.67	1.22	8.67	12.68	14.67	1.77	20.67	1.06
2.75	1.23	8.75	11.39	14.75	1.76	20.75	1.05
2.83	1.25	8.83	10.35	14.83	1.74	20.83	1.05
2.92	1.26	8.92	9.50	14.92	1.72	20.92	1.04
3.00	1.28	9.00	8.79	15.00	1.70	21.00	1.04
3.08	1.30	9.08	8.18	15.08	1.69	21.08	1.03
3.17	1.32	9.17	7.66	15.17	1.67	21.17	1.03
3.25	1.34	9.25	7.21	15.25	1.66	21.25	1.02
3.33	1.36	9.33	6.81	15.33	1.64	21.33	1.02
3.42	1.37	9.42	6.46	15.42	1.63	21.42	1.01
3.50	1.40	9.50	6.15	15.50	1.61	21.50	1.01
3.58	1.42	9.58	5.87	15.58	1.60	21.58	1.00
3.67	1.44	9.67	5.61	15.67	1.58	21.67	1.00
3.75	1.46	9.75	5.38	15.75	1.57	21.75	.99
3.83	1.48	9.83	5.17	15.83	1.56	21.83	.99
3.92	1.51	9.92	4.98	15.92	1.54	21.92	.98
4.00	1.53	10.00	4.80	16.00	1.53	22.00	.98
4.08	1.56	10.08	4.64	16.08	1.52	22.08	.97
4.17	1.59	10.17	4.49	16.17	1.51	22.17	.97
4.25	1.62	10.25	4.34	16.25	1.49	22.25	.96
4.33	1.65	10.33	4.21	16.33	1.48	22.33	.96
4.42	1.68	10.42	4.09	16.42	1.47	22.42	.95
4.50	1.71	10.50	3.97	16.50	1.46	22.50	.95
4.58	1.74	10.58	3.87	16.58	1.45	22.58	.95
4.67	1.78	10.67	3.77	16.67	1.43	22.67	.94
4.75	1.82	10.75	3.67	16.75	1.42	22.75	.94
4.83	1.86	10.83	3.58	16.83	1.41	22.83	.93
4.92	1.90	10.92	3.49	16.92	1.40	22.92	.93
5.00	1.94	11.00	3.41	17.00	1.39	23.00	.93
5.08	1.98	11.08	3.34	17.08	1.38	23.08	.92
5.17	2.03	11.17	3.26	17.17	1.37	23.17	.92
5.25	2.08	11.25	3.19	17.25	1.36	23.25	.91
5.33	2.14	11.33	3.13	17.33	1.35	23.33	.91
5.42	2.19	11.42	3.06	17.42	1.34	23.42	.91
5.50	2.25	11.50	3.00	17.50	1.33	23.50	.90
5.58	2.32	11.58	2.94	17.58	1.32	23.58	.90
5.67	2.38	11.67	2.89	17.67	1.31	23.67	.89
5.75	2.46	11.75	2.84	17.75	1.31	23.75	.89
5.83	2.54	11.83	2.79	17.83	1.30	23.83	.89
5.92	2.62	11.92	2.74	17.92	1.29	23.92	.88
6.00	2.71	12.00	2.69	18.00	1.28	24.00	.88

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      73.50        24.50
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     808.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     138.45        72.95
                over (min)      10.00        15.00
     Storage Coeff.  (min)=       7.86 (ii)   11.35 (ii)
     Unit Hyd. Tpeak (min)=      10.00        15.00
     Unit Hyd. peak  (cms)=        .13          .09
                                                          *TOTALS*
     PEAK FLOW      (cms)=      21.94         2.90         24.033 (iii)
     TIME TO PEAK    (hrs)=       8.08         8.17           8.08
     RUNOFF VOLUME    (mm)=      96.22        52.08          85.18
     TOTAL RAINFALL   (mm)=      97.22        97.22          97.22
     RUNOFF COEFFICIENT   =        .99          .54            .88


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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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--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.1120     4.6620
                           .0540     1.8330   |   2.6080     4.8403
                           .0830     2.1918   |   3.1850     5.0179
                           .7150     3.9693   |   3.4370     5.0893
                           .9400     4.1375   |   3.8330     5.1969
                          1.0000     4.1718   |   4.5380     5.3784
                          1.0620     4.2062   |   5.2940     5.5624
                          1.2690     4.3095   |   6.0970     5.7551

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     24.03      8.08      85.18
     OUTFLOW: ID= 1 (0008)     98.00      2.59      9.08      79.66

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.78
                   TIME SHIFT OF PEAK FLOW        (min)= 60.00
                   MAXIMUM  STORAGE   USED      (ha.m.)= 4.8357

--------------------------------------------------------------------------------
--------------------
| DIVERT HYD (0009)|
| IN= 1   # OUT= 2 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  98.00      2.59      9.08   79.66
     ==================================================
     ID= 2  (   9)    :  60.19      1.02      9.08   79.66
     ID= 3  (   9)    :  37.81      1.57      9.08   79.66
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0010) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   .00        101.50         .0500
                  1.00        100.70         .0500
                  1.50        100.55     .0500 / .0300  Main Channel
                  2.00         99.50         .0300      Main Channel
                  3.50         99.60         .0300      Main Channel
                  4.50        100.65     .0300 / .0500  Main Channel
                  6.00        101.45         .0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .10    99.60    .353E+01        .0           .19       4.37
```

.19	99.69	.112E+02	.1	.37	2.28
.29	99.79	.195E+02	.2	.49	1.70
.38	99.88	.285E+02	.3	.59	1.42
.48	99.98	.381E+02	.5	.67	1.25
.57	100.07	.484E+02	.7	.74	1.13
.67	100.17	.594E+02	.9	.80	1.04
.76	100.26	.710E+02	1.2	.86	.97
.86	100.36	.832E+02	1.5	.91	.92
.95	100.45	.961E+02	1.8	.96	.87
1.05	100.55	.110E+03	2.2	1.00	.83
1.16	100.66	.127E+03	2.7	1.07	.78
1.28	100.78	.148E+03	3.4	1.14	.73
1.39	100.89	.170E+03	4.1	1.20	.69
1.50	101.00	.195E+03	4.9	1.25	.67
1.61	101.11	.221E+03	5.8	1.30	.64
1.72	101.22	.250E+03	6.7	1.34	.62
1.84	101.34	.280E+03	7.7	1.38	.60
1.95	101.45	.313E+03	8.8	1.41	.59

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
		<---- hydrograph	---->		<-pipe /	channel->
INFLOW : ID= 2 (0009)	60.19	1.02	9.08	79.66	.69	.81
OUTFLOW: ID= 1 (0010)	60.19	1.02	9.08	79.66	.69	.81

| ROUTE CHN (0011) |
| IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
.00	101.50	.0500	
1.00	100.70	.0500	
1.50	100.55	.0500 / .0300	Main Channel
2.00	99.50	.0300	Main Channel
3.50	99.60	.0300	Main Channel
4.50	100.65	.0300 / .0500	Main Channel
6.00	101.45	.0500	

<-------------------- TRAVEL TIME TABLE --------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
.10	99.60	.353E+01	.0	.19	4.37
.19	99.69	.112E+02	.1	.37	2.28
.29	99.79	.195E+02	.2	.49	1.70
.38	99.88	.285E+02	.3	.59	1.42
.48	99.98	.381E+02	.5	.67	1.25
.57	100.07	.484E+02	.7	.74	1.13
.67	100.17	.594E+02	.9	.80	1.04
.76	100.26	.710E+02	1.2	.86	.97
.86	100.36	.832E+02	1.5	.91	.92
.95	100.45	.961E+02	1.8	.96	.87
1.05	100.55	.110E+03	2.2	1.00	.83
1.16	100.66	.127E+03	2.7	1.07	.78
1.28	100.78	.148E+03	3.4	1.14	.73
1.39	100.89	.170E+03	4.1	1.20	.69
1.50	101.00	.195E+03	4.9	1.25	.67
1.61	101.11	.221E+03	5.8	1.30	.64
1.72	101.22	.250E+03	6.7	1.34	.62
1.84	101.34	.280E+03	7.7	1.38	.60
1.95	101.45	.313E+03	8.8	1.41	.59

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
		<---- hydrograph	---->		<-pipe /	channel->
INFLOW : ID= 2 (0009)	37.81	1.57	9.08	79.66	.88	.92
OUTFLOW: ID= 1 (0011)	37.81	1.56	9.08	79.66	.88	.92

****
** SIMULATION NUMBER: 6 **
****

| CHICAGO STORM |
| Ptotal=109.69 mm |

IDF curve parameters: A=1323.000
B=   5.300
C=   .779
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step   = 5.00 min
Time to peak ratio =   .33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.03	6.08	3.23	12.08	3.04	18.08	1.47
.17	1.04	6.17	3.35	12.17	2.99	18.17	1.46
.25	1.05	6.25	3.48	12.25	2.94	18.25	1.45
.33	1.06	6.33	3.62	12.33	2.90	18.33	1.45
.42	1.07	6.42	3.78	12.42	2.85	18.42	1.44
.50	1.08	6.50	3.95	12.50	2.81	18.50	1.43
.58	1.09	6.58	4.15	12.58	2.77	18.58	1.42
.67	1.10	6.67	4.36	12.67	2.73	18.67	1.41
.75	1.11	6.75	4.61	12.75	2.69	18.75	1.40
.83	1.12	6.83	4.88	12.83	2.65	18.83	1.39
.92	1.13	6.92	5.20	12.92	2.62	18.92	1.38
1.00	1.14	7.00	5.57	13.00	2.58	19.00	1.38
1.08	1.15	7.08	6.01	13.08	2.55	19.08	1.37
1.17	1.16	7.17	6.52	13.17	2.51	19.17	1.36
1.25	1.17	7.25	7.16	13.25	2.48	19.25	1.35
1.33	1.18	7.33	7.95	13.33	2.45	19.33	1.34
1.42	1.19	7.42	8.96	13.42	2.42	19.42	1.34
1.50	1.21	7.50	10.31	13.50	2.39	19.50	1.33
1.58	1.22	7.58	12.23	13.58	2.36	19.58	1.32
1.67	1.23	7.67	15.15	13.67	2.33	19.67	1.31
1.75	1.24	7.75	20.18	13.75	2.31	19.75	1.31
1.83	1.26	7.83	30.97	13.83	2.28	19.83	1.30
1.92	1.27	7.92	70.67	13.92	2.25	19.92	1.29
2.00	1.29	8.00	215.06	14.00	2.23	20.00	1.28
2.08	1.30	8.08	90.70	14.08	2.20	20.08	1.28
2.17	1.31	8.17	50.73	14.17	2.18	20.17	1.27
2.25	1.33	8.25	35.11	14.25	2.16	20.25	1.26
2.33	1.35	8.33	26.91	14.33	2.13	20.33	1.26
2.42	1.36	8.42	21.89	14.42	2.11	20.42	1.25
2.50	1.38	8.50	18.51	14.50	2.09	20.50	1.24
2.58	1.39	8.58	16.08	14.58	2.07	20.58	1.24
2.67	1.41	8.67	14.25	14.67	2.05	20.67	1.23
2.75	1.43	8.75	12.82	14.75	2.03	20.75	1.22
2.83	1.45	8.83	11.67	14.83	2.01	20.83	1.22
2.92	1.47	8.92	10.72	14.92	1.99	20.92	1.21
3.00	1.49	9.00	9.93	15.00	1.97	21.00	1.20
3.08	1.51	9.08	9.26	15.08	1.95	21.08	1.20
3.17	1.53	9.17	8.68	15.17	1.93	21.17	1.19
3.25	1.55	9.25	8.18	15.25	1.92	21.25	1.19
3.33	1.57	9.33	7.73	15.33	1.90	21.33	1.18
3.42	1.59	9.42	7.34	15.42	1.88	21.42	1.18
3.50	1.62	9.50	6.99	15.50	1.86	21.50	1.17
3.58	1.64	9.58	6.68	15.58	1.85	21.58	1.16
3.67	1.67	9.67	6.39	15.67	1.83	21.67	1.16
3.75	1.69	9.75	6.13	15.75	1.82	21.75	1.15
3.83	1.72	9.83	5.90	15.83	1.80	21.83	1.15
3.92	1.75	9.92	5.68	15.92	1.79	21.92	1.14
4.00	1.78	10.00	5.48	16.00	1.77	22.00	1.14
4.08	1.81	10.08	5.29	16.08	1.76	22.08	1.13
4.17	1.84	10.17	5.12	16.17	1.74	22.17	1.13
4.25	1.87	10.25	4.96	16.25	1.73	22.25	1.12
4.33	1.90	10.33	4.82	16.33	1.71	22.33	1.12
4.42	1.94	10.42	4.68	16.42	1.70	22.42	1.11
4.50	1.98	10.50	4.55	16.50	1.69	22.50	1.11
4.58	2.02	10.58	4.43	16.58	1.67	22.58	1.10
4.67	2.06	10.67	4.31	16.67	1.66	22.67	1.10
4.75	2.10	10.75	4.20	16.75	1.65	22.75	1.09
4.83	2.14	10.83	4.10	16.83	1.64	22.83	1.09
4.92	2.19	10.92	4.00	16.92	1.62	22.92	1.08
5.00	2.24	11.00	3.91	17.00	1.61	23.00	1.08
5.08	2.29	11.08	3.82	17.08	1.60	23.08	1.07
5.17	2.34	11.17	3.74	17.17	1.59	23.17	1.07

```
                 5.25    2.40 | 11.25    3.66 | 17.25    1.58 | 23.25    1.06
                 5.33    2.46 | 11.33    3.59 | 17.33    1.57 | 23.33    1.06
                 5.42    2.53 | 11.42    3.52 | 17.42    1.56 | 23.42    1.05
                 5.50    2.60 | 11.50    3.45 | 17.50    1.54 | 23.50    1.05
                 5.58    2.67 | 11.58    3.38 | 17.58    1.53 | 23.58    1.04
                 5.67    2.75 | 11.67    3.32 | 17.67    1.52 | 23.67    1.04
                 5.75    2.83 | 11.75    3.26 | 17.75    1.51 | 23.75    1.04
                 5.83    2.92 | 11.83    3.20 | 17.83    1.50 | 23.83    1.03
                 5.92    3.01 | 11.92    3.15 | 17.92    1.49 | 23.92    1.03
                 6.00    3.12 | 12.00    3.09 | 18.00    1.48 | 24.00    1.02

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       73.50       24.50
     Dep. Storage     (mm)=        1.00        1.50
     Average Slope     (%)=        1.00        2.00
     Length            (m)=      808.30       40.00
     Mannings n           =        .013        .250

     Max.Eff.Inten.(mm/hr)=      152.88       86.02
                over (min)        10.00       15.00
     Storage Coeff.  (min)=        7.55 (ii)   10.90 (ii)
     Unit Hyd. Tpeak (min)=       10.00       15.00
     Unit Hyd. peak  (cms)=         .13         .09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       24.65        3.51        27.198 (iii)
     TIME TO PEAK    (hrs)=        8.08        8.17          8.08
     RUNOFF VOLUME    (mm)=      108.69       62.13         97.05
     TOTAL RAINFALL   (mm)=      109.69      109.69        109.69
     RUNOFF COEFFICIENT   =         .99         .57           .88

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   2.1120     4.6620
                            .0540     1.8330   |   2.6080     4.8403
                            .0830     2.1918   |   3.1850     5.0179
                            .7150     3.9693   |   3.4370     5.0893
                            .9400     4.1375   |   3.8330     5.1969
                           1.0000     4.1718   |   4.5380     5.3784
                           1.0620     4.2062   |   5.2940     5.5624
                           1.2690     4.3095   |   6.0970     5.7551

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     27.20      8.08      97.05
     OUTFLOW: ID= 1 (0008)     98.00      3.84      8.83      91.49

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)= 14.13
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED      (ha.m.)= 5.2005

-------------------------------------------------------------------------------
--------------------
| DIVERT HYD (0009)|
| IN= 1   # OUT= 2 |
--------------------
     Outflow / Inflow  Relationships
```

```
      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                          AREA     QPEAK     TPEAK     R.V.
                          (ha)     (cms)     (hrs)     (mm)
     TOTAL HYD.(ID= 1):  98.00      3.84      8.83    91.49
     =================================================
     ID= 2  (    9)    :  56.84      1.25      8.83    91.49
     ID= 3  (    9)    :  41.16      2.59      8.83    91.49
-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0010) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                    .00        101.50         .0500
                   1.00        100.70         .0500
                   1.50        100.55     .0500 / .0300  Main Channel
                   2.00         99.50         .0300      Main Channel
                   3.50         99.60         .0300      Main Channel
                   4.50        100.65     .0300 / .0500  Main Channel
                   6.00        101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .10    99.60    .353E+01       .0           .19        4.37
        .19    99.69    .112E+02       .1           .37        2.28
        .29    99.79    .195E+02       .2           .49        1.70
        .38    99.88    .285E+02       .3           .59        1.42
        .48    99.98    .381E+02       .5           .67        1.25
        .57   100.07    .484E+02       .7           .74        1.13
        .67   100.17    .594E+02       .9           .80        1.04
        .76   100.26    .710E+02      1.2           .86         .97
        .86   100.36    .832E+02      1.5           .91         .92
        .95   100.45    .961E+02      1.8           .96         .87
       1.05   100.55    .110E+03      2.2          1.00         .83
       1.16   100.66    .127E+03      2.7          1.07         .78
       1.28   100.78    .148E+03      3.4          1.14         .73
       1.39   100.89    .170E+03      4.1          1.20         .69
       1.50   101.00    .195E+03      4.9          1.25         .67
       1.61   101.11    .221E+03      5.8          1.30         .64
       1.72   101.22    .250E+03      6.7          1.34         .62
       1.84   101.34    .280E+03      7.7          1.38         .60
       1.95   101.45    .313E+03      8.8          1.41         .59

                              <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   56.84    1.25    8.83  91.49       .78       .86
     OUTFLOW: ID= 1 (0010)   56.84    1.25    8.83  91.48       .77       .86


-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0011) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
```

```
<------ DATA FOR SECTION (   1.1) ------>
Distance      Elevation       Manning
    .00        101.50          .0500
   1.00        100.70          .0500
   1.50        100.55     .0500 / .0300  Main Channel
   2.00         99.50          .0300     Main Channel
   3.50         99.60          .0300     Main Channel
   4.50        100.65     .0300 / .0500  Main Channel
   6.00        101.45          .0500

<-------------------- TRAVEL TIME TABLE --------------------->
 DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
  (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
  .10    99.60    .353E+01        .0          .19       4.37
  .19    99.69    .112E+02        .1          .37       2.28
  .29    99.79    .195E+02        .2          .49       1.70
  .38    99.88    .285E+02        .3          .59       1.42
  .48    99.98    .381E+02        .5          .67       1.25
  .57   100.07    .484E+02        .7          .74       1.13
  .67   100.17    .594E+02        .9          .80       1.04
  .76   100.26    .710E+02       1.2          .86        .97
  .86   100.36    .832E+02       1.5          .91        .92
  .95   100.45    .961E+02       1.8          .96        .87
 1.05   100.55    .110E+03       2.2         1.00        .83
 1.16   100.66    .127E+03       2.7         1.07        .78
 1.28   100.78    .148E+03       3.4         1.14        .73
 1.39   100.89    .170E+03       4.1         1.20        .69
 1.50   101.00    .195E+03       4.9         1.25        .67
 1.61   101.11    .221E+03       5.8         1.30        .64
 1.72   101.22    .250E+03       6.7         1.34        .62
 1.84   101.34    .280E+03       7.7         1.38        .60
 1.95   101.45    .313E+03       8.8         1.41        .59

                             <---- hydrograph ---->  <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                        (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
INFLOW : ID= 2 (0009)   41.16     2.59    8.83  91.49      1.14      1.05
OUTFLOW: ID= 1 (0011)   41.16     2.59    8.92  91.48      1.14      1.05

-------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=1435.000
| Ptotal=122.49 mm |                           B=   5.200
--------------------                           C=    .775
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .33

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .08    1.17 |  6.08    3.64 | 12.08    3.43 | 18.08    1.67
                   .17    1.18 |  6.17    3.78 | 12.17    3.38 | 18.17    1.66
                   .25    1.19 |  6.25    3.92 | 12.25    3.32 | 18.25    1.65
                   .33    1.20 |  6.33    4.08 | 12.33    3.27 | 18.33    1.64
                   .42    1.21 |  6.42    4.26 | 12.42    3.22 | 18.42    1.63
                   .50    1.22 |  6.50    4.45 | 12.50    3.17 | 18.50    1.62
                   .58    1.23 |  6.58    4.67 | 12.58    3.13 | 18.58    1.61
                   .67    1.25 |  6.67    4.91 | 12.67    3.08 | 18.67    1.60
                   .75    1.26 |  6.75    5.18 | 12.75    3.04 | 18.75    1.59
                   .83    1.27 |  6.83    5.49 | 12.83    3.00 | 18.83    1.58
                   .92    1.28 |  6.92    5.85 | 12.92    2.96 | 18.92    1.57
                  1.00    1.29 |  7.00    6.26 | 13.00    2.92 | 19.00    1.56
                  1.08    1.30 |  7.08    6.75 | 13.08    2.88 | 19.08    1.55
                  1.17    1.32 |  7.17    7.32 | 13.17    2.84 | 19.17    1.54
                  1.25    1.33 |  7.25    8.03 | 13.25    2.80 | 19.25    1.53
                  1.33    1.34 |  7.33    8.90 | 13.33    2.77 | 19.33    1.52
                  1.42    1.36 |  7.42   10.03 | 13.42    2.74 | 19.42    1.52
                  1.50    1.37 |  7.50   11.53 | 13.50    2.70 | 19.50    1.51
                  1.58    1.38 |  7.58   13.65 | 13.58    2.67 | 19.58    1.50
                  1.67    1.40 |  7.67   16.87 | 13.67    2.64 | 19.67    1.49
                  1.75    1.41 |  7.75   22.41 | 13.75    2.61 | 19.75    1.48
                  1.83    1.43 |  7.83   34.27 | 13.83    2.58 | 19.83    1.47
                  1.92    1.44 |  7.92   77.82 | 13.92    2.55 | 19.92    1.46
                  2.00    1.46 |  8.00  237.24 | 14.00    2.52 | 20.00    1.46
                  2.08    1.48 |  8.08   99.80 | 14.08    2.49 | 20.08    1.45
                  2.17    1.49 |  8.17   55.94 | 14.17    2.47 | 20.17    1.44
                  2.25    1.51 |  8.25   38.81 | 14.25    2.44 | 20.25    1.43
                  2.33    1.53 |  8.33   29.82 | 14.33    2.41 | 20.33    1.43
                  2.42    1.54 |  8.42   24.30 | 14.42    2.39 | 20.42    1.42
                  2.50    1.56 |  8.50   20.58 | 14.50    2.37 | 20.50    1.41
                  2.58    1.58 |  8.58   17.90 | 14.58    2.34 | 20.58    1.40
                  2.67    1.60 |  8.67   15.88 | 14.67    2.32 | 20.67    1.40
                  2.75    1.62 |  8.75   14.30 | 14.75    2.30 | 20.75    1.39
                  2.83    1.64 |  8.83   13.03 | 14.83    2.27 | 20.83    1.38
                  2.92    1.66 |  8.92   11.98 | 14.92    2.25 | 20.92    1.37
                  3.00    1.69 |  9.00   11.11 | 15.00    2.23 | 21.00    1.37
                  3.08    1.71 |  9.08   10.36 | 15.08    2.21 | 21.08    1.36
                  3.17    1.73 |  9.17    9.72 | 15.17    2.19 | 21.17    1.35
                  3.25    1.76 |  9.25    9.16 | 15.25    2.17 | 21.25    1.35
                  3.33    1.78 |  9.33    8.67 | 15.33    2.15 | 21.33    1.34
                  3.42    1.81 |  9.42    8.23 | 15.42    2.13 | 21.42    1.33
                  3.50    1.83 |  9.50    7.84 | 15.50    2.11 | 21.50    1.33
                  3.58    1.86 |  9.58    7.49 | 15.58    2.09 | 21.58    1.32
                  3.67    1.89 |  9.67    7.17 | 15.67    2.07 | 21.67    1.32
                  3.75    1.92 |  9.75    6.89 | 15.75    2.06 | 21.75    1.31
                  3.83    1.95 |  9.83    6.62 | 15.83    2.04 | 21.83    1.30
                  3.92    1.98 |  9.92    6.38 | 15.92    2.02 | 21.92    1.30
                  4.00    2.01 | 10.00    6.16 | 16.00    2.01 | 22.00    1.29
                  4.08    2.05 | 10.08    5.95 | 16.08    1.99 | 22.08    1.28
                  4.17    2.08 | 10.17    5.76 | 16.17    1.97 | 22.17    1.28
                  4.25    2.12 | 10.25    5.58 | 16.25    1.96 | 22.25    1.27
                  4.33    2.16 | 10.33    5.42 | 16.33    1.94 | 22.33    1.27
                  4.42    2.20 | 10.42    5.26 | 16.42    1.93 | 22.42    1.26
                  4.50    2.24 | 10.50    5.12 | 16.50    1.91 | 22.50    1.26
                  4.58    2.28 | 10.58    4.98 | 16.58    1.90 | 22.58    1.25
                  4.67    2.33 | 10.67    4.85 | 16.67    1.88 | 22.67    1.24
                  4.75    2.37 | 10.75    4.73 | 16.75    1.87 | 22.75    1.24
                  4.83    2.42 | 10.83    4.62 | 16.83    1.85 | 22.83    1.23
                  4.92    2.48 | 10.92    4.51 | 16.92    1.84 | 22.92    1.23
                  5.00    2.53 | 11.00    4.41 | 17.00    1.83 | 23.00    1.22
                  5.08    2.59 | 11.08    4.31 | 17.08    1.81 | 23.08    1.22
                  5.17    2.65 | 11.17    4.22 | 17.17    1.80 | 23.17    1.21
                  5.25    2.72 | 11.25    4.13 | 17.25    1.79 | 23.25    1.21
                  5.33    2.78 | 11.33    4.05 | 17.33    1.78 | 23.33    1.20
                  5.42    2.86 | 11.42    3.97 | 17.42    1.76 | 23.42    1.20
                  5.50    2.93 | 11.50    3.89 | 17.50    1.75 | 23.50    1.19
                  5.58    3.01 | 11.58    3.81 | 17.58    1.74 | 23.58    1.19
                  5.67    3.10 | 11.67    3.74 | 17.67    1.73 | 23.67    1.18
                  5.75    3.19 | 11.75    3.68 | 17.75    1.72 | 23.75    1.18
                  5.83    3.29 | 11.83    3.61 | 17.83    1.70 | 23.83    1.17
                  5.92    3.40 | 11.92    3.55 | 17.92    1.69 | 23.92    1.17
                  6.00    3.52 | 12.00    3.49 | 18.00    1.68 | 24.00    1.16

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0007) |   Area    (ha)=  98.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      73.50        24.50
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     808.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     237.24       100.36
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       6.34 (ii)    9.56 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .19          .12
                                                             *TOTALS*
```

```
     PEAK FLOW       (cms)=      31.52         4.55         34.236 (iii)
     TIME TO PEAK    (hrs)=       8.00         8.08          8.00
     RUNOFF VOLUME    (mm)=     121.49        72.76        109.31
     TOTAL RAINFALL   (mm)=     122.49       122.49        122.49
     RUNOFF COEFFICIENT   =        .99          .59           .89


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  76.0    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.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (0008) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.1120     4.6620
                           .0540     1.8330   |   2.6080     4.8403
                           .0830     2.1918   |   3.1850     5.0179
                           .7150     3.9693   |   3.4370     5.0893
                           .9400     4.1375   |   3.8330     5.1969
                          1.0000     4.1718   |   4.5380     5.3784
                          1.0620     4.2062   |   5.2940     5.5624
                          1.2690     4.3095   |   6.0970     5.7551

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0007)     98.00     34.24      8.00     109.31
     OUTFLOW: ID= 1 (0008)     98.00      5.35      8.67     103.72

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.62
                   TIME SHIFT OF PEAK FLOW        (min)= 40.00
                   MAXIMUM  STORAGE   USED      (ha.m.)= 5.5805

-------------------------------------------------------------------------------
--------------------
| DIVERT HYD (0009)|
| IN= 1   # OUT= 2 |
--------------------
     Outflow / Inflow  Relationships

      Flow 1 + Flow 2 = Total
      (cms)    (cms)    (cms)
        .00      .00      .00
        .01      .04      .05
        .04      .05      .08
        .65      .06      .71
        .74      .20      .94
        .76      .24     1.00
        .78      .29     1.06
        .82      .45     1.27
        .96     1.15     2.11
       1.02     1.59     2.61
       1.12     2.06     3.18
       1.17     2.27     3.44
       1.25     2.58     3.83
       1.39     3.14     4.54
       1.55     3.74     5.29
       1.73     4.37     6.10

                          AREA     QPEAK     TPEAK    R.V.
                          (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  98.00      5.35      8.67  103.72
     ==================================================
     ID= 2  (   9)   :  54.01      1.57      8.67  103.72
     ID= 3  (   9)   :  43.99      3.78      8.67  103.72
-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0010) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
```

```
                    Distance      Elevation       Manning
                        .00         101.50         .0500
                       1.00         100.70         .0500
                       1.50         100.55     .0500 / .0300  Main Channel
                       2.00          99.50          .0300     Main Channel
                       3.50          99.60          .0300     Main Channel
                       4.50         100.65     .0300 / .0500  Main Channel
                       6.00         101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
        .10    99.60    .353E+01       .0           .19       4.37
        .19    99.69    .112E+02       .1           .37       2.28
        .29    99.79    .195E+02       .2           .49       1.70
        .38    99.88    .285E+02       .3           .59       1.42
        .48    99.98    .381E+02       .5           .67       1.25
        .57   100.07    .484E+02       .7           .74       1.13
        .67   100.17    .594E+02       .9           .80       1.04
        .76   100.26    .710E+02      1.2           .86        .97
        .86   100.36    .832E+02      1.5           .91        .92
        .95   100.45    .961E+02      1.8           .96        .87
       1.05   100.55    .110E+03      2.2          1.00        .83
       1.16   100.66    .127E+03      2.7          1.07        .78
       1.28   100.78    .148E+03      3.4          1.14        .73
       1.39   100.89    .170E+03      4.1          1.20        .69
       1.50   101.00    .195E+03      4.9          1.25        .67
       1.61   101.11    .221E+03      5.8          1.30        .64
       1.72   101.22    .250E+03      6.7          1.34        .62
       1.84   101.34    .280E+03      7.7          1.38        .60
       1.95   101.45    .313E+03      8.8          1.41        .59

                                  <---- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                           (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   54.01     1.57    8.67 103.72       .88       .92
     OUTFLOW: ID= 1 (0010)   54.01     1.57    8.58 103.71       .87       .91

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (0011) |
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
                    Distance      Elevation       Manning
                        .00         101.50         .0500
                       1.00         100.70         .0500
                       1.50         100.55     .0500 / .0300  Main Channel
                       2.00          99.50          .0300     Main Channel
                       3.50          99.60          .0300     Main Channel
                       4.50         100.65     .0300 / .0500  Main Channel
                       6.00         101.45         .0500

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
        .10    99.60    .353E+01       .0           .19       4.37
        .19    99.69    .112E+02       .1           .37       2.28
        .29    99.79    .195E+02       .2           .49       1.70
        .38    99.88    .285E+02       .3           .59       1.42
        .48    99.98    .381E+02       .5           .67       1.25
        .57   100.07    .484E+02       .7           .74       1.13
        .67   100.17    .594E+02       .9           .80       1.04
        .76   100.26    .710E+02      1.2           .86        .97
        .86   100.36    .832E+02      1.5           .91        .92
        .95   100.45    .961E+02      1.8           .96        .87
       1.05   100.55    .110E+03      2.2          1.00        .83
       1.16   100.66    .127E+03      2.7          1.07        .78
       1.28   100.78    .148E+03      3.4          1.14        .73
       1.39   100.89    .170E+03      4.1          1.20        .69
       1.50   101.00    .195E+03      4.9          1.25        .67
       1.61   101.11    .221E+03      5.8          1.30        .64
       1.72   101.22    .250E+03      6.7          1.34        .62
       1.84   101.34    .280E+03      7.7          1.38        .60
```

```
       1.95   101.45    .313E+03       8.8          1.41        .59

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (0009)   43.99     3.78    8.67 103.72      1.34      1.17
     OUTFLOW: ID= 1 (0011)   43.99     3.82    8.58 103.71      1.34      1.17


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 FINISH
===========================================================================================
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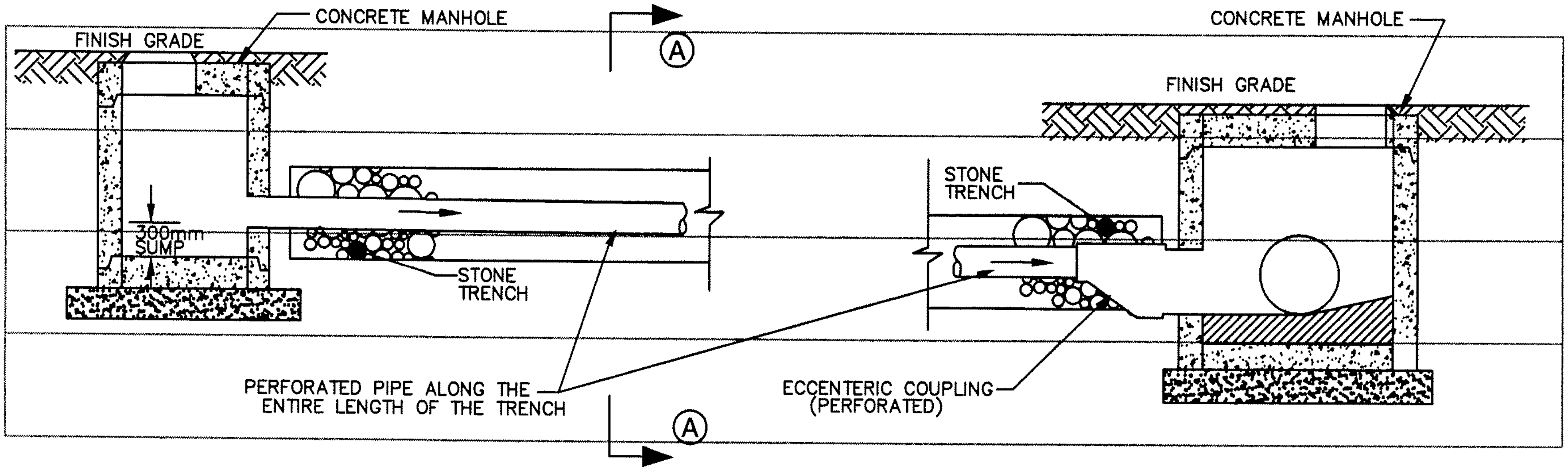
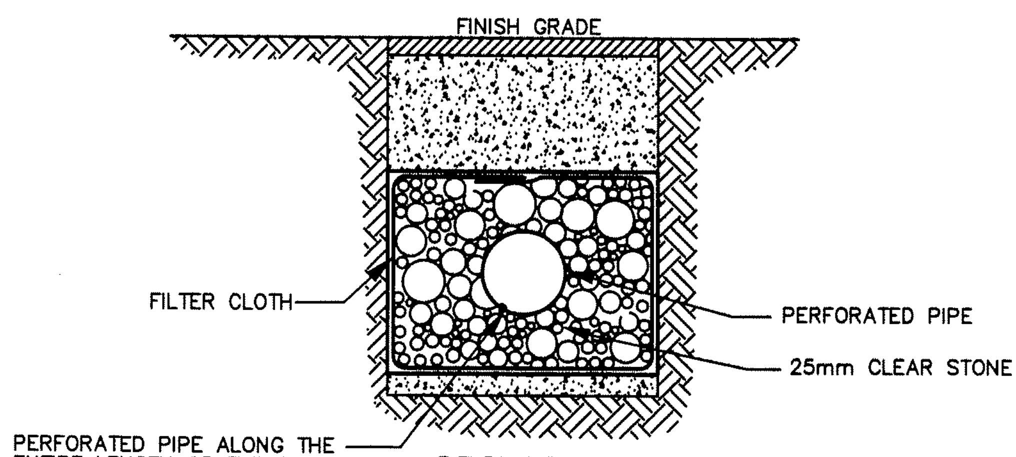
APPENDIX "D"

COOLING TRENCH PROFILE





SECTION A-A

ESCARPMENT BUSINESS COMMUNITY WEST TOWN OF MILTON	DRAWN BY J.J.M			VALDOR ENGINEERING INC. Consulting Engineers — Project Managers 661 CHRISLEA ROAD, SUITE 11, WOODBRIDGE, ONTARIO, L4L 8A3 TEL (905)264-0054, FAX (905)264-0069 E-MAIL: info@valdor-engineering.com www.valdor-engineering.com
	CHECKED. BY D.G.			
COOLING TRENCH DETAILS	DATE JAN, 2007	SCALE NTS	PROJECT 03156	FIGURE 7

APPENDIX “E”

TO: Matt Stairs, P.Eng.,
MGM Consulting Inc.

DATE: May 1, 2007

FROM: Chris Cummings, Shelley Gorenc, M.Sc., G.I.T., and John Parish, P.Geo.

SUBJECT: High Point West – Tributaries N1-A and N2-B Channel Stability Analysis and Culvert Removal Recommendations (Revised)

Memorandum

During the December 13th SIS meeting regarding the EBC West development in Milton, Conservation Halton raised questions regarding the potential impacts of stormwater discharge into Tributary N1-A, also referred to as the McKinley Tributary and Tributary N2-B. Questions were also raised regarding the future removal of a farm lane culvert on the East-West Tributary at the north end of the site. Subsequent to these issues, a series of comments were provided by Conservation Halton in a letter to the Town of Milton dated April 10, 2007. In the following comment extracted from the letter, Conservation Halton requested that PARISH Geomorphic Ltd. Provide additional comments regarding geomorphic impacts of the proposed Valdor Engineering diversions:

> ***Engineering – Comment 8***
>
> *Staff have reviewed the Functional Stormwater Management Report completed by Valdor Engineering Inc. (included in Appendix A of the SIS). Regarding Section 4.1.5 'Impact on Receiving Watercourses', please provide pre and post development hydrographs for each catchment and design storm from the Visual OTTHYMO output and a digital copy of the model. Geomorphic impacts of the receiving watercourses, relating to the proposed diversions, should be evaluated with respect to proposed changes in hydrograph shape, peak flows and flow durations for the full range of design storms. Staff request that Parish Geomorphic provide additional comments in this regard. Additionally, the potential impacts to the operation of SWM facility S36 should also be evaluated with respect to the proposed diversions.*

The following memorandum provides additional insight regarding the suitability of pre and post development flow conditions as identified by Valdor Engineering (see **Table 1**). It is hoped that this text will address all issues and comments raised by Conservation Halton.

Tributary N1-A

As a result of not having direct access to the tributary in question we were forced to utilize surrogate information to develop our opinions. On November 14th of 2006, a field investigation was carried out on the N1-A tributary adjacent to Highway 401, south of the McKinley Lands. During this investigation, observations pertaining to channel condition and sensitivity were made. Due to restricted access, observations within the McKinley lands were limited to the area visible from the 401 corridor. The channel conditions along the 401 are quite stable in nature. The channel has been 'ditched' and vegetated to act as drainage for areas along the highway (**Photo 1.**). At the time of this inspection, the channel exhibited no signs of instability such as active migration or excessive deposition. Immediately upstream of the property line the channel has a more natural form with some sinuosity and sorted substrate materials. The channel in this area flows between two active agricultural fields and appears to have been recently modified as a result of farm equipment being driven over the channel (**Photo 2.**).

Table 1 - Erosion Index Values for Baseline and Proposed Scenarios (1986 -- 1991)
Tributary N2-B Reach Between Pond S34 Outfall and Hwy 25
Escarpment Business Community West

Critical Flow = 0.17 m^3/s

Scenario	Erosion Index	% Difference	Duration of Exceedence (hours)	% Difference
Baseline	665,586	0.0	759	100.0
Proposed	761,958	14.5	1016	33.9

Critical Flow = 1.26 m^3/s

Scenario	Erosion Index	% Difference	Duration of Exceedence (hours)	% Difference
Baseline	103,410	0.0	50.3	0.0
Proposed	103,086	-0.3	49.8	-1.0

VALDOR ENGINEERING INC.
661 Chrislea Road, Suite 11
Woodbridge, Ontario
L4L 8A3

On April 23, 2007 supplementary fieldwork was conducted on Tributary N1-A in order to confirm existing conditions and develop a local energy gradient. This information was then utilized to derive a critical discharge (erosion threshold) for the system. The erosion threshold was based on the discharge required to initiate entrainment (i.e. mobilization) of the D_{50} median grain size, which is the common practice. Analysis of the field data resulted in a critical discharge of 0.13 m^3/s being established for Tributary N1-A. Upon reviewing the Summary of Pre and Post Development Discharges (Table 6, dated April 10, 2007) provided by Valdor Engineering, the allowable Q_{peak} during a 25mm event is 0.11m^3/s while the actual Q_{peak} during the same event is 0.01 m^3/s. The critical discharge calculated for Tributary N1-A approximates the allowable 25mm Q_{peak} and sits well above the actual Q_{peak} for this event.

Air photo analysis of this same section revealed that, approximately 300 m downstream of the proposed discharge point, exists a small on-line pond. As a result, the pond acts to provide additional flow attenuation, essentially negating the impacts of the stormwater discharge to areas downstream of the pond. For areas upstream of the pond, the anticipated impacts are also expected to be minimal. Based on the air photo analysis of land use and vegetative conditions, complimented by observations of the tributary made downstream of the site, the channel has a high degree of vegetative control consisting mainly of grasses and herbaceous vegetation. This vegetation acts to stabilize and maintain the channel form during all stages of flow. Consequently, based upon this analysis, along with the critical discharge evaluation relating to post-development flow conditions, it is our opinion that, the impacts of the stormwater discharge to the McKinley Tributary would be minimal or negligible.

Tributary N2-B

On April 23, 2007 a field investigation was also completed on Tributary N2-B in order to quantify channel dimensions and the local energy gradient in support of an erosion assessment. This erosion assessment also involved a sensitivity analysis to determine the most appropriate threshold for the site, given the variable nature of existing channel conditions (i.e., the combination of an armored trapezoidal constructed trench – **Photos 4 & 5** with a more natural vegetated channel – **Photo 6**). As such, D_{50} critical flows were calculated based on both the existing vegetated conditions and the armored substrate. In order to provide a more direct comparison with the armored section, D_{65} and D_{84} thresholds for the more natural section were also calculated. **Table 2** presents the results of this assessment. The disparity in critical flows between the D50 and D65 thresholds for the 'natural' vegetated channel are reflective of a bi-modal substrate distribution. While this type of distribution is typical of riffle-pool morphology, field data was collected solely from riffle transects, indicating the deposition of fine materials (i.e. aggradation) over a coarser native substrate. Based on this information, it is likely that the D_{50} threshold provided for the vegetated natural cross-section likely underestimates the flows required to mobilize the channel bed.

Table 2. Erosion assessment and sensitivity analysis for Tributary N2-B.

'Natural' Vegetated Section	
D_{50} Threshold	0.17 cms
D_{65} Threshold	1.33 cms
D_{84} Threshold	2.54 cms
Armored Section	
D_{50} Threshold	1.26 cms

As illustrated by **Table 1**, pre and post development exceedence analysis was conducted for both D_{50} thresholds. While it was identified that the recommended critical discharge of 0.17 m^3/s (the threshold identified for the more sensitive section of channel) was to be exceeded based on post-development conditions, this exceedence mimics natural processes which act to maintain sediment transport and flush fine materials from the system. A comparison was made, however, between the D_{50}, D_{65} and D_{84} thresholds to ensure that a larger flow event would not mobilize the entire bed of the channel. Results of this analysis revealed that the D_{65} threshold for the more natural section (1.33 cms) provided a more robust threshold than that calculated for the armored channel (1.26 cms). Since **Table 1** illustrates that the proposed post-development conditions not only match but reduce the percent exceedence of the D_{50} threshold for the constructed channel, and field observations of existing conditions indicate this section of the Tributary is not exhibiting evidence of active erosion, but is in fact prone to aggradation, the proposed flows should pose no significant concern with respect to channel erosion and we are able to support the proposed development scenario for Tributary N2-B.

East-West Tributary Culvert Removal

During the SIS meeting Conservation Halton requested input relating to channel stabilization during the removal of the existing farm lane culvert on the East-West Tributary. It was also noted in the meeting that a significant amount of urban waste has been dumped in and near the channel at this location. It is our recommendation that the garbage within the channel be removed. This should be done in such a fashion as to limit disturbance to the creek. The garbage should also be properly disposed of off-site. In reference to the culvert removal, we recommend that upon its removal, the channel through this section be improved by re-constructing the stream banks to locally-appropriate conditions. This would include matching the local floodplain elevations and ensuring the banks are constructed in such a way as to provide a channel width which replicates conditions upstream and downstream. As the details of the work will need to be determined on-site at the time of construction and the final channel configuration will be a 'field fit', it is recommended that the works be supervised by a qualified geomorphologist.

It is also recommended that, if at all feasible, these works not be carried out until the proposed realignment of Campbellville Sideroad is initiated. Since proposed Campbellville Sideroad crossing of the East-West Tributary is located in the vicinity of the existing farm lane, removal of the culvert in conjunction with this construction would limit the level of disturbance to the site.

Although we have not reviewed pre and post design hydrographs, we are confident, based on the pre and post development discharge data that the proposed changes are fairly subdued. The post-development flow regime would have the greatest effect during the minor, more frequent events. During these conditions, the changes are minor, and given existing channel conditions, we do not anticipate any effect on channel function. Post-development flow regime above the 2-year event would have even less implications on channel function. As a result we do not feel that these proposed flows will have any significant impacts on the geomorphic function of the receiving watercourses.

Summary and Conclusions

The purpose of this memorandum was to provide additional insight regarding the suitability of pre and post development flow conditions for Tributaries N1-A and N2-B in the EBC West development, Milton. Erosion thresholds were provided in the form of critical flows for both tributaries. Based on the exceedence analysis provided by Valdor Engineering (see **Table 1**), we feel that we can support the proposed development scenario conditions. We trust that this memorandum addresses the concerns raised during the December 13th SIS meeting. If further elaboration on either of these matters is required please do not hesitate to contact us at your earliest convenience.

Photo 1. *Nov 14, 2006* - View of channel conditions of Tributary N1-A adjacent to Highway 401. Note the dense vegetation and trapezoidal shape of the channel

Photo 2. *Nov 14, 2006* - View looking upstream at channel conditions immediately upstream of the 401 at the southern limits of the McKinley lands. Note the tractor crossing in the upper portion of the photo.

Photo 3. *Apr 23, 2007* - View looking upstream from north of the McKinlay property line on Trib N1-A. Note the well vegetated nature of the channel which is situated between agricultural fields.

Photo 4. *Apr 28, 2006* - View looking downstream from McKinley driveway at trapezoidal channel. Note the wide nature of the channel and the early growth of bank vegetation which includes shrub plantings.

Photo 5. *Apr 23, 2007* - View looking upstream immediately downstream of property line. Note the wide, trapezoidal shape of the channel. Also note the extensive vegetative growth on the slopes and channel bed.

Photo 6. *Dec 7, 2006* - View looking downstream near proposed discharge point on Tributary N2-B. Note that this channel is a constructed natural channel design with dense bank and floodplain vegetation.

Table 1 - Erosion Index Values for Baseline and Proposed Scenarios (1986 -- 1991)
Tributary N2-B Reach Between Pond S34 Outfall and Hwy 25
Escarpment Business Community West

Critical Flow = 0.17 m^3/s

Scenario	Erosion Index	% Difference	Duration of Exceedence (hours)	% Difference
Baseline	665,586	0.0	759	100.0
Proposed	761,958	14.5	1016	33.9

Critical Flow = 1.26 m^3/s

Scenario	Erosion Index	% Difference	Duration of Exceedence (hours)	% Difference
Baseline	103,410	0.0	50.3	0.0
Proposed	103,086	-0.3	49.8	-1.0

VALDOR ENGINEERING INC.
661 Chrislea Road, Suite 11
Woodbridge, Ontario
L4L 8A3

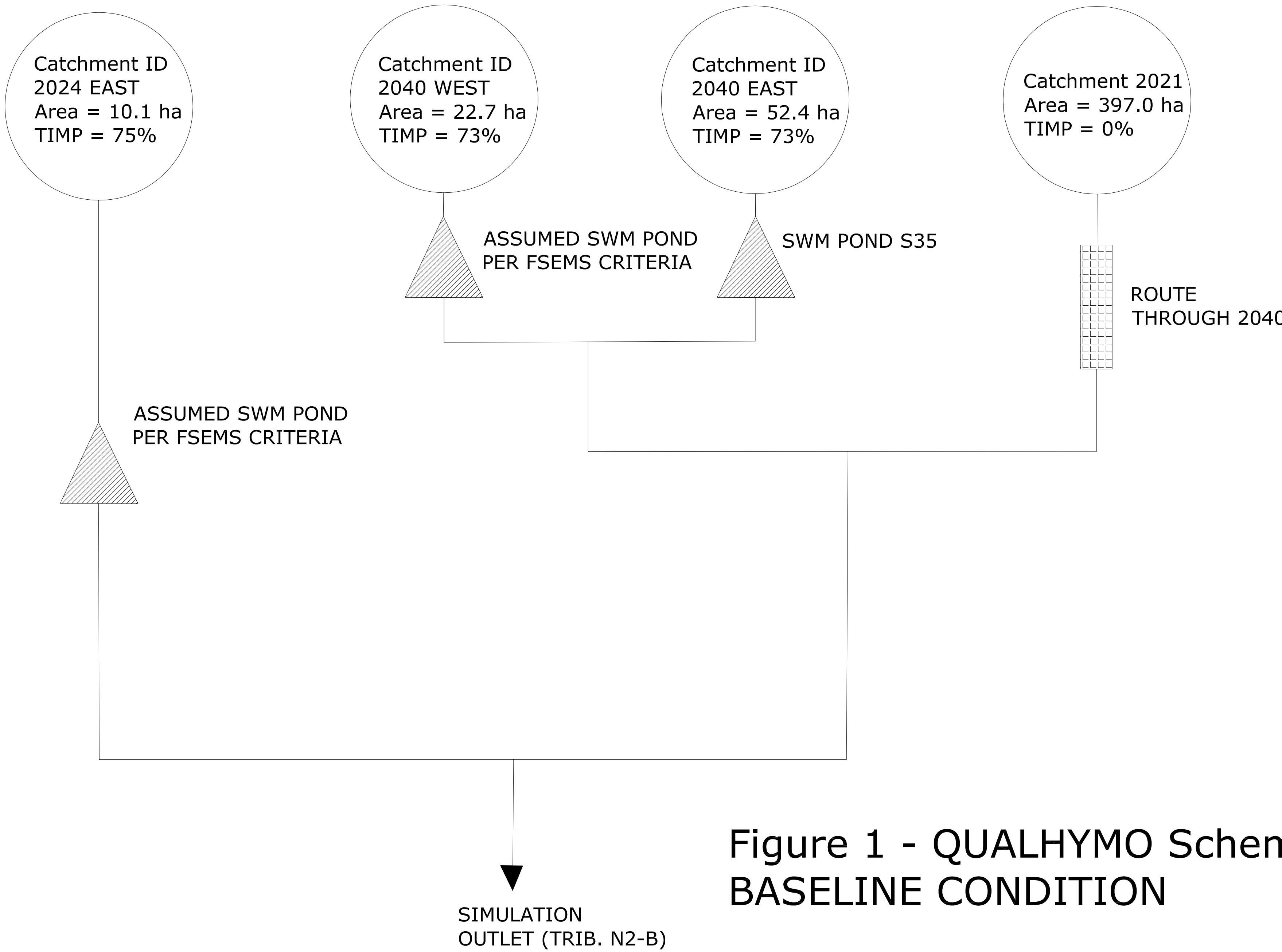


Figure 1 - QUALHYMO Schematic
BASELINE CONDITION

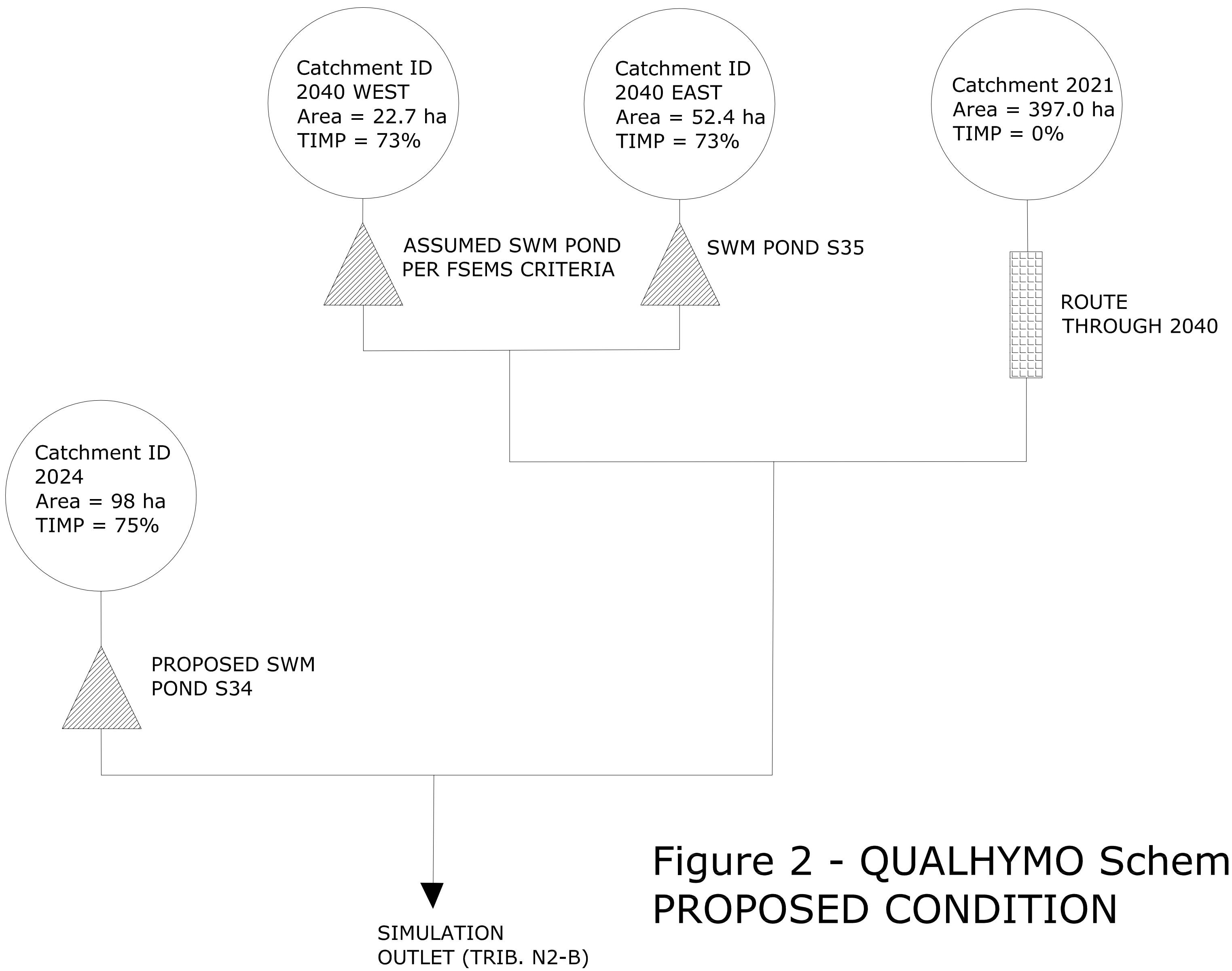


Figure 2 - QUALHYMO Schematic
PROPOSED CONDITION

```
1234567890 *./-
21
START                1 27
STORE                2  4
GENERATE             3 53
PRINT SPAN           4 10
PLOT SPAN            5 10
ADD SERIES           6  4
POND                 7310
REACH                8310
CALIBRATE            9310
POLLUTANT SERIES    10  9
SPLIT SERIES        11310
DUMP PRINT          12  1
EXCEEDANCE CURVES   13310
DUMP PLOT           14  9
SHEAR1              15310
MAXFLW              16  8
SERIES STATS        17  7
PRINT FLOWS         18  8
ROUTE RESERVOIR     19 64
SCAN SERIES         20 16
FINISH              21  0
*
*  *****************    Q  U  A  L  H  Y  M  O    ********************
*                            VERSION 2.22
*
*  TOWN OF MILTON
*  QUALHYMO EROSION ANALYSIS
*  VALDOR ENGINEERING INC.
*  PROJECT:  03156
*  FILENAME: MILTON.FUT
*  TIME: APRIL 2007
*  MODELLER: CHAODONG SHENG
*
***********************************************************************
*
*
*                ****************************************************
*                ***                 BASELINE SCENARIO             ***
*                ****************************************************
*
*
*  NOTES: 1) Program Version: QUALHYMO v 2.22
*         2) Catchment 2021 and Catchment 2040
*
*######################################################################
START               START DATE OF SIMULATION             86 01 01
                    END DATE OF SIMULATION               91 12 31
                    RAINFALL WILL BE READ ON DEVICE            21
                    PRECIP IS IN AES HOURLY FORMAT     IPFORM   1
                    FLOW FILE WILL BE READ ON DEVICE           99
                    READ TEMP IN AES FORMAT            ITFORM   1
                    SET EVAPORATION FLAG TO READ VALUES ICASE   1
                    EVAPORATION PAN CORRECTION COEF     CPAN  1.0
                           EVAPORATION IN MM PER MO
                             FROM THE BARRIE WPCC
                        JAN   0.0  FEB   1.1  MAR   2.5
                        APR  19.1  MAY  66.2  JUN 106.9
                        JUL 150.0  AUG  99.6  SEP  77.2
                        OCT  55.4  NOV  22.7  DEC   4.3
                    SET POLLUTANT FLAG OFF                IFDECA=0
                    SET SEDIMENTATION FLAG OFF            IFSEDT=0
*#######################################################################
***
****************** CATCHMENT 2021
***
GENERATE            IDOUT=1 ISER=20211 DT=0.25 HR
                    DA=397.0 HA AB=0 FRIMP=0.0
                    ***PERVIOUS DATA***
                       WILLIAMS UH AA=2
                       K=3 TP=2.7 HR
                       SMIN=36.7 MM  SMAX=244.5 MM SK=0.05
                       APIK=0.9 APII=12.0 MM ABSER=4.5 MM
                       CETPER=1.0
                    NSVOL=0 BASMIN=0.0 CMS BFACR=1.00
                    SVOL=0.0 MM SWILT=0.01 SFIELD=10.0
                    SLOSKA=0.0000007 SLOSKB=0.15
                    EVAPOTRANSPIRATION COEF  CET=0.005
                    ***** COEFFICIENT SNOWMELT ANALYSIS *****
                      WITH NO SNOW REMOVAL FROM THE BASINS
                    ISNOW=1      BASET=1.0   SNOFAC=1.00  PACDEP=0.0
                    ALPHAA=2.5   XKL=15      BCOEF=1.1    XNCOEF=150
                    KFLAG=0
***
REACH               IDOUT=2   ISER=1000   NIDH=1   IDH(ONE)=1  NIDL=0
                    IFAORM=1 (ACTUAL CHANNEL SECTION FROM ORIGINAL MODEL)
                    NELS=1     SMAX=3.05 M  XLEN=2000.0 M  RTINC=0.25 HRS
                    COEF=1.35 EXPON=1.97
                    REACH VOLUME DATA =================================
                     NUMBER OF PTS ON DEPTH VOLUME CURVE       NPTSV=6
                     DEPTH     VOLUME
                      (m)     (cu m )
                      0.00       0.00
                      0.25    1125.00
                      0.50    3500.00
                      1.50   10125.00
                      2.50  100000.00
                      3.50  200000.00
                    REACH HORIZONTAL AREA DATA =========================
                    NUMBER OF PTS ON STAGE AREA CURVE       NPTSV=0
*
****************** CATCHMENT 2040 WEST
***
GENERATE            IDOUT=1 ISER=20401 DT=0.25 HR
                    DA=22.7 HA AB=0 FRIMP=0.73
                    ***IMPERVIOUS DATA***
                            WILLIAMS UH AA=2
                            K=0.34 hrs TP=0.25 hrs
                            ABSIMP=0.5 mm
                            VOL RUNOFF COEFF RIMP=1.0
                            CETIMP=1.0
                    ***PERVIOUS DATA***
                       WILLIAMS UH AA=2
                       K=3 TP=0.9 HR
                       SMIN=36.7 MM  SMAX=244.5 MM SK=0.05
                       APIK=0.9 APII=12.0 MM ABSER=1.5 MM
                       CETPER=1.0
                    NSVOL=0 BASMIN=0.0 CMS BFACR=1.00
                    SVOL=0.0 MM SWILT=0.01 SFIELD=10.0
                    SLOSKA=0.00000065 SLOSKB=0.15
                    EVAPOTRANSPIRATION COEF  CET=0.005
                    ***** COEFFICIENT SNOWMELT ANALYSIS *****
                      WITH NO SNOW REMOVAL FROM THE BASINS
                    ISNOW=1      BASET=1.0   SNOFAC=1.00  PACDEP=0.0
                    ALPHAA=2.5   XKL=15      BCOEF=1.1    XNCOEF=150
                    KFLAG=0
*
*
*
********************************************************************
***                    DUMMY POND FOR S35 WEST                   ***
********************************************************************
POND                IDOUT=3     ISER=2000     IDH=1
                    BATCH DETENTION TIME                 TDET=0 HRS
                    NUMBER OF CSTRS IS                   NELS=1
                    FLOW ROUTING TIME STEP IS            RTINC=0.25 HRS
                    BASEFLOW                             QBAS=0.0 CMS
                    EVAPORATION CORRECTION COEFFICIENT   CPAN=1.0
                    DRY WEATHER FLAG                     IFQBY=0
                    APPROACH FLOW CURVE ***************************
                     NPTQQ = 0
                    CONTINUOUS FLOW CURVE *************************
                     NPTSQ(ONE) = 0
                    OPERATED OUTFLOW CURVE ************************
                     ISIG=1 NPTSQ(TWO)=3
                     STAGE(m) OUTFLOW(cms)
                       209.50    0.0
                       210.00    0.027
                       210.50   10.0
```

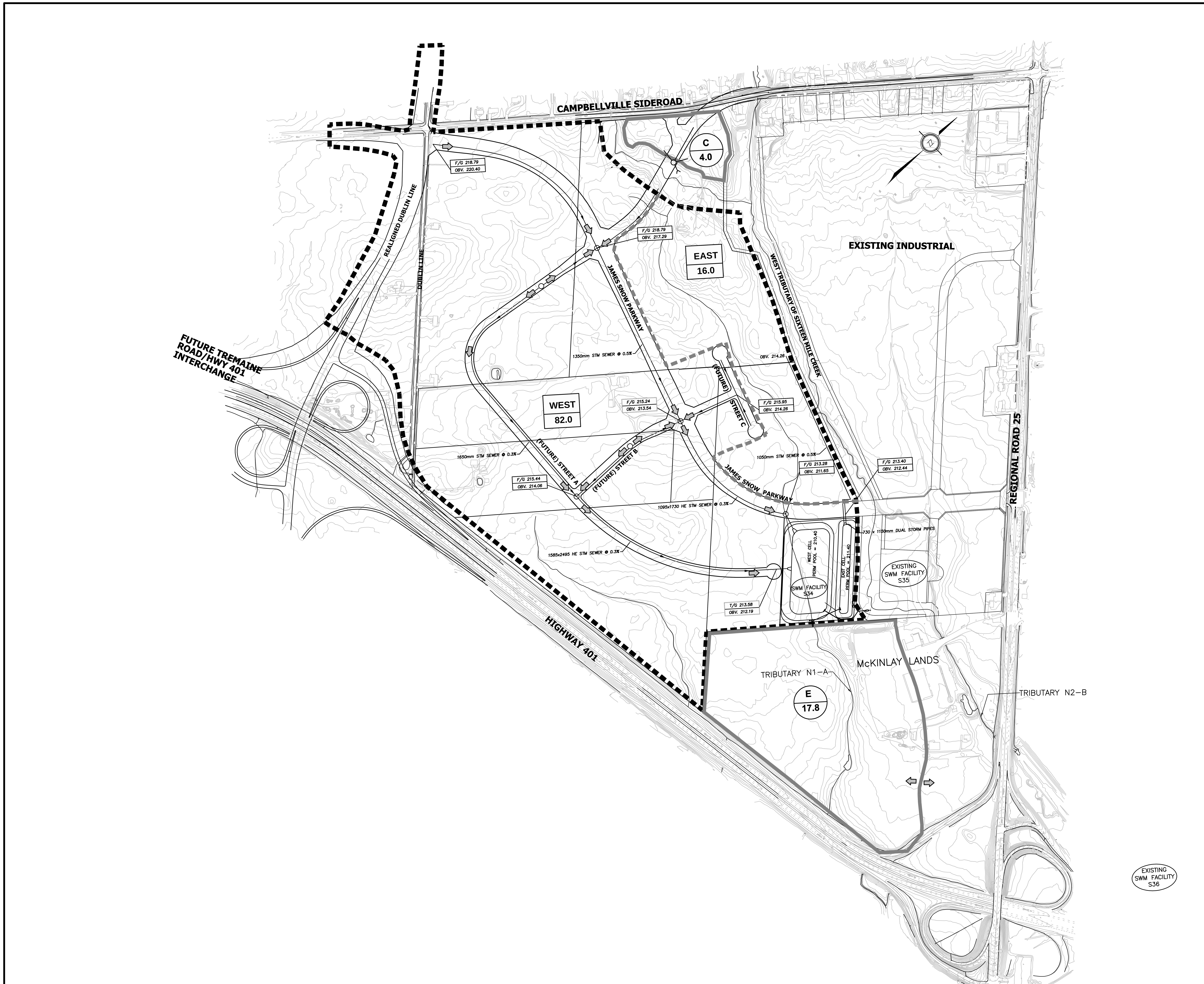
```
                   OVERFLOW CURVE ************************************
                    ISIG=1 NPTSQV=0
                   RATING CURVE DATA *********************************
                    STAGE VOLUME CURVE *******************************
                     ISIG=1 NPTSV=3
                      STAGE(m) VOLUME(cubic m)
                      209.50       0.0
                      210.00     3794.0
                      210.50     3800.0
                   POND AREA CURVE ***********************************
                   NPTSA=0
                   OTHER REQUIRED VARIABLES
                   STARTING STAGE                          SBEGIN=209.5 M
                   MULTIPLICATION FACTOR FOR POLLUTANTS     FEMULT=1
                   MULTIPLICATION FACTOR FOR SEDIMENT       SEMULT=1
                   STAGE FOR INITIATION OF OVERFLOW         SPILL=210.5 M
*
*
****************** CATCHMENT 2040 EAST
***
GENERATE           IDOUT=1 ISER=20402 DT=0.25 HR
                   DA=52.4 HA AB=0 FRIMP=0.73
                   ***IMPERVIOUS DATA***
                          WILLIAMS UH AA=2
                          K=0.34 hrs TP=0.25 hrs
                          ABSIMP=0.5 mm
                          VOL RUNOFF COEFF RIMP=1.0
                          CETIMP=1.0
                   ***PERVIOUS DATA***
                      WILLIAMS UH AA=2
                      K=3 TP=1.2 HR
                      SMIN=36.7 MM  SMAX=244.5 MM SK=0.05
                      APIK=0.9 APII=12.0 MM ABSER=1.5 MM
                      CETPER=1.0
                   NSVOL=0 BASMIN=0.0 CMS BFACR=1.00
                   SVOL=0.0 MM SWILT=0.01 SFIELD=10.0
                   SLOSKA=0.00000065 SLOSKB=0.15
                   EVAPOTRANSPIRATION COEF  CET=0.005
                   ***** COEFFICIENT SNOWMELT ANALYSIS *****
                     WITH NO SNOW REMOVAL FROM THE BASINS
                   ISNOW=1      BASET=1.0   SNOFAC=1.00  PACDEP=0.0
                   ALPHAA=2.5   XKL=15      BCOEF=1.1    XNCOEF=150
                   KFLAG=0
*
*
*
*******************************************************************
***                         POND S35                            ***
*******************************************************************
POND               IDOUT=4     ISER=4000     IDH=1
                   BATCH DETENTION TIME                 TDET=0 HRS
                   NUMBER OF CSTRS IS                   NELS=1
                   FLOW ROUTING TIME STEP IS            RTINC=0.25 HRS
                   BASEFLOW                             QBAS=0.0 CMS
                   EVAPORATION CORRECTION COEFFICIENT   CPAN=1.0
                   DRY WEATHER FLAG                     IFQBY=0
                   APPROACH FLOW CURVE ***************************
                    NPTQQ = 0
                   CONTINUOUS FLOW CURVE *************************
                    NPTSQ(ONE) = 0
                   OPERATED OUTFLOW CURVE ************************
                    ISIG=1 NPTSQ(TWO)=9
                    STAGE(m) OUTFLOW(cms)
                      209.50   0.0
                      210.13   0.065
                      210.26   0.073
                      210.34   0.078
                      210.39   0.081
                      210.43   0.084
                      210.46   0.085
                      210.50   1.515
                      211.50  50.00
                   OVERFLOW CURVE ************************************
                    ISIG=1 NPTSQV=0
                   RATING CURVE DATA *********************************
```

```
                    STAGE VOLUME CURVE ********************************
                     ISIG=1 NPTSV=9
                      STAGE(m) VOLUME(cubic m)
                      209.50       0.0
                      210.13    5670.0
                      210.26    6921.0
                      210.34    7682.0
                      210.39    8225.0
                      210.43    8643.0
                      210.46    8980.0
                      210.50    9255.0
                      211.50   15036.0
                   POND AREA CURVE ***********************************
                   NPTSA=0
                   OTHER REQUIRED VARIABLES
                   STARTING STAGE                          SBEGIN=209.5 M
                   MULTIPLICATION FACTOR FOR POLLUTANTS     FEMULT=1
                   MULTIPLICATION FACTOR FOR SEDIMENT       SEMULT=1
                   STAGE FOR INITIATION OF OVERFLOW         SPILL=211.5 M
*
ADD SERIES         IDOUT=1 HYDNO=5000 IDI=3 IDII=4
*
ADD SERIES         IDOUT=5 HYDNO=3000 IDI=1 IDII=2
*
*
****************** CATCHMENT 2024 EAST
***
GENERATE           IDOUT=1 ISER=20241 DT=0.25 HR
                   DA=10.1 HA AB=0 FRIMP=0.75
                   ***IMPERVIOUS DATA***
                          WILLIAMS UH AA=2
                          K=0.34 hrs TP=0.25 hrs
                          ABSIMP=0.5 mm
                          VOL RUNOFF COEFF RIMP=1.0
                          CETIMP=1.0
                   ***PERVIOUS DATA***
                      WILLIAMS UH AA=2
                      K=3 TP=0.5 HR
                      SMIN=32.5 MM  SMAX=216.4 MM SK=0.05
                      APIK=0.9 APII=12.0 MM ABSER=1.5 MM
                      CETPER=1.0
                   NSVOL=0 BASMIN=0.0 CMS BFACR=1.00
                   SVOL=0.0 MM SWILT=0.01 SFIELD=10.0
                   SLOSKA=0.00000065 SLOSKB=0.15
                   EVAPOTRANSPIRATION COEF  CET=0.005
                   ***** COEFFICIENT SNOWMELT ANALYSIS *****
                     WITH NO SNOW REMOVAL FROM THE BASINS
                   ISNOW=1      BASET=1.0   SNOFAC=1.00  PACDEP=0.0
                   ALPHAA=2.5   XKL=15      BCOEF=1.1    XNCOEF=150
                   KFLAG=0
*
*
*
*******************************************************************
***                   DUMMY POND FOR 2024 EAT                   ***
*******************************************************************
POND               IDOUT=2     ISER=2000     IDH=1
                   BATCH DETENTION TIME                 TDET=0 HRS
                   NUMBER OF CSTRS IS                   NELS=1
                   FLOW ROUTING TIME STEP IS            RTINC=0.25 HRS
                   BASEFLOW                             QBAS=0.0 CMS
                   EVAPORATION CORRECTION COEFFICIENT   CPAN=1.0
                   DRY WEATHER FLAG                     IFQBY=0
                   APPROACH FLOW CURVE ***************************
                    NPTQQ = 0
                   CONTINUOUS FLOW CURVE *************************
                    NPTSQ(ONE) = 0
                   OPERATED OUTFLOW CURVE ************************
                    ISIG=1 NPTSQ(TWO)=3
                    STAGE(m) OUTFLOW(cms)
                      209.50    0.0
                      210.00    0.012
                      210.50   10.0
                   OVERFLOW CURVE ************************************
                    ISIG=1 NPTSQV=0
```

```
                    RATING CURVE DATA **********************************
                     STAGE VOLUME CURVE ********************************
                      ISIG=1 NPTSV=3
                       STAGE(m) VOLUME(cubic m)
                       209.50       0.0
                       210.00     1735.0
                       210.50     1750.0
                    POND AREA CURVE ***********************************
                    NPTSA=0
                    OTHER REQUIRED VARIABLES
                    STARTING STAGE                          SBEGIN=209.5 M
                    MULTIPLICATION FACTOR FOR POLLUTANTS    FEMULT=1
                    MULTIPLICATION FACTOR FOR SEDIMENT      SEMULT=1
                    STAGE FOR INITIATION OF OVERFLOW        SPILL=210.5 M
*
ADD SERIES          IDOUT=6 HYDNO=10000 IDI=5 IDII=2
*
SERIES STATS        IDIN=6
                    SYR=86 SMO=01 SDY=01
                    EYR=91 EMO=12 EDY=31
*
*
PRINT FLOWS         NSERIES=1
                    ID(ONE)=6
                    NFLOWFILE=1
*
*######################################################################
***
*BASELINE SCENARIO FINISHED
***
*######################################################################
*
*
*            ****************************************************
*            *** ESCARPMENT BUSINESS COMMUNITY WEST DIVERSION ***
*            ****************************************************
*
*
*######################################################################
***
****************** CATCHMENT 2024 EAST
***
GENERATE            IDOUT=1 ISER=2024 DT=0.25 HR
                    DA=98 HA AB=0 FRIMP=0.75
                    ***IMPERVIOUS DATA***
                            WILLIAMS UH AA=2
                            K=0.34 hrs TP=0.25 hrs
                            ABSIMP=0.5 mm
                            VOL RUNOFF COEFF RIMP=1.0
                            CETIMP=1.0
                    ***PERVIOUS DATA***
                       WILLIAMS UH AA=2
                       K=3 TP=1.1 HR
                       SMIN=32.5 MM  SMAX=216.4 MM SK=0.05
                       APIK=0.9 APII=12.0 MM ABSER=1.5 MM
                       CETPER=1.0
                    NSVOL=0 BASMIN=0.0 CMS BFACR=1.00
                    SVOL=0.0 MM SWILT=0.01 SFIELD=10.0
                    SLOSKA=0.00000065 SLOSKB=0.15
                    EVAPOTRANSPIRATION COEF  CET=0.005
                    ***** COEFFICIENT SNOWMELT ANALYSIS *****
                      WITH NO SNOW REMOVAL FROM THE BASINS
                    ISNOW=1      BASET=1.0   SNOFAC=1.00  PACDEP=0.0
                    ALPHAA=2.5   XKL=15      BCOEF=1.1    XNCOEF=150
                    KFLAG=0
*
*
*
******************************************************************
***                          POND S34                          ***
******************************************************************
POND                IDOUT=2     ISER=6000     IDH=1
                    BATCH DETENTION TIME                TDET=0 HRS
                    NUMBER OF CSTRS IS                  NELS=1
                    FLOW ROUTING TIME STEP IS           RTINC=0.25 HRS
```

```
                    BASEFLOW                             QBAS=0.0 CMS
                    EVAPORATION CORRECTION COEFFICIENT   CPAN=1.0
                    DRY WEATHER FLAG                     IFQBY=0
                    APPROACH FLOW CURVE ****************************
                     NPTQQ = 0
                    CONTINUOUS FLOW CURVE **************************
                     NPTSQ(ONE) = 0
                    OPERATED OUTFLOW CURVE *************************
                     ISIG=1 NPTSQ(TWO)=16
                     STAGE(m) OUTFLOW(cms)
                       210.40   0.0
                       210.90   0.033
                       211.40   0.083
                       211.90   0.715
                       211.95   0.940
                       211.96   1.000
                       211.97   1.062
                       212.00   1.269
                       212.10   2.112
                       212.15   2.608
                       212.20   3.185
                       212.22   3.437
                       212.25   3.833
                       212.30   4.538
                       212.35   5.294
                       212.40   6.097
                    OVERFLOW CURVE *************************************
                     ISIG=1 NPTSQV=0
                    RATING CURVE DATA **********************************
                     STAGE VOLUME CURVE ********************************
                      ISIG=1 NPTSV=16
                       STAGE(m) VOLUME(cubic m)
                       210.40       0.0
                       210.90   10325.0
                       211.40   21918.0
                       211.90   39693.0
                       211.95   41375.0
                       211.96   41718.0
                       211.97   42062.0
                       212.00   43095.0
                       212.10   46620.0
                       212.15   48403.0
                       212.20   50197.0
                       212.22   50893.0
                       212.25   51969.0
                       212.30   53787.0
                       212.35   55624.0
                       212.40   57551.0
                    POND AREA CURVE ***********************************
                    NPTSA=0
                    OTHER REQUIRED VARIABLES
                    STARTING STAGE                          SBEGIN=210.4 M
                    MULTIPLICATION FACTOR FOR POLLUTANTS    FEMULT=1
                    MULTIPLICATION FACTOR FOR SEDIMENT      SEMULT=1
                    STAGE FOR INITIATION OF OVERFLOW        SPILL=212.4 M
*
*************************************************************************
***                     SPLIT FLOW SIMULATION                         ***
*************************************************************************
*
*          SPLIT INTO N2-B
*
SPLIT SERIES        INPUT ID=2
                    IDOUT A=3   ISER=7000
                    IDOUT B=4   ISER=8000
                    16 POINTS ON FLOW SPLIT CURVE
                    APPROCH FLOW      FLOW TO SERIES A
                    CU M PER SEC      CU M PER SEC
                       0.0            0.0
                       0.033          0.033
                       0.083          0.048
                       0.715          0.060
                       0.940          0.197
                       1.000          0.240
                       1.062          0.286
```

```
                       1.269          0.446
                       2.112          1.151
                       2.608          1.585
                       3.185          2.064
                       3.437          2.267
                       3.833          2.584
                       4.538          3.143
                       5.294          3.739
                       6.097          4.368
*
ADD SERIES          IDOUT=6 HYDNO=7000 IDI=5 IDII=3
*
SERIES STATS        IDIN=6
                    SYR=86 SMO=01 SDY=01
                    EYR=91 EMO=12 EDY=31
*
*
PRINT FLOWS         NSERIES=1
                    ID(ONE)=6
                    NFLOWFILE=2
*
*
*
*
FINISH
```



METRIC
ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE SHOWN

KEY PLAN

LEGEND

- MAJOR SYSTEM FLOW DIRECTION
- MINOR SYSTEM
- OBV. 215.95 — STORM SEWER OBVERT ELEVATION
- F/G. 211.65 — FINISHED GRADE
- SWM POND S34 CATCHMENT
- POND S34 CELL CATCHMENTS
- NON-CONTRIBUTING AREA BOUNDARY
- C / 4.0 — NON-CONTRIBUTING AREA ID / AREA (Ha)
- EAST / 16.0 — RECEIVING SWM POND CELL / CONTRIBUTING AREA (Ha)

No.	Revision	Date	By	Appr'd
1	TOWN,REGION & CA COMMENTS	DEC 4/06	D.G	

Benchmarks

No.	Elevation	Description

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Client :

TOTAL DEVELOPMENTS INTERNATIONAL

TOWN OF MILTON
ENGINEERING AND PARKS DEPARTMENT

ESCARPMENT BUSINESS COMMUNITY WEST

FUNCTIONAL STORM DRAINAGE PLAN

Surveyed by:	Checked by: D.G.	Project 03156
Drawn by: J.J.M.	Approved by: D.G.	
Designed by:	Date: MAR 22,2004	Drawing No. FSP-1
Scale 1 : 4000		Sheet No. 1 OF 1