STORMWATER MANAGEMENT PLAN

JOSHUA COURT SUBDIVISON

WEST LINCOLN

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March 2024

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REFERENCES

1. Stormwater Management Planning and Design Manual
Ontario Ministry of Environment (March 2003)

STORMWATER MANAGEMENT PLAN

JOSHUA COURT SUBDIVISION

TOWN OF WEST LINCOLN

1.0 INTRODUCTION

1.1 Study Area

The proposed subdivision is located in the Township of West Lincoln as part of the hamlet settlement area of Allen Corners. The subject property is situated south of Young Street, north of Regional Road 20 and east of Grimsby Road (Regional Road 12). This Stormwater Management Plan has been prepared as part of the Draft Plan of Subdivision Process.

The area of the development is approximately 4.27 ha with 3.17 ha within the hamlet and is bound by agricultural lands to the east and existing single residential properties along the north and south boundaries. The drainage areas contributing to this stormwater management plan consist primarily of the subject lands and external northerly land. The receiving body of water for the proposed stormwater flows will be a Tributary of Twenty Mile Creek.

1.2 Objectives

The objectives of this study are as follows:

1. Establish specific criteria for the management of stormwater from this site.

2. Determine the impact of development on the stormwater peak flow & volume from this site.

3. Establish property requirements for the Stormwater Management Facility for the Draft Plan of Subdivision

1.3 Existing & Proposed Conditions

a) Existing Conditions

The subject land use is agricultural. The lands generally convey stormwater flows to either the Grimsby Road (Regional Road 12) roadside ditch or to a tributary of Twenty Mile Creek located at the southeast limits of the site. All flows are part of Twenty Mile Creek located south of the site.

b) Proposed Conditions

As part of the development, 6 residential lots will be created for rural single residential uses. A 0.13 hectare block (Block 7) is provided for Stormwater Management practices. As no sanitary sewer or watermain exists in proximity to the site, each dwelling will be constructed with an associated individual private septic system and water system. Roadside ditches will provide drainage for the roadway conveying flows easterly to Block 7.

2.0 STORMWATER MANAGEMENT CRITERIA

New developments are required to provide stormwater management in accordance with provincial and municipal policies including:

- Stormwater Quality Guidelines for New Development (MECP/MNRF, May 1991)
- Stormwater Management Planning and Design Manual (MECP, March 2003)

Based on the above policies and site specific considerations, the following stormwater management criteria have been established for this site.

- The drainage areas of the development direct stormwater to a tributary of Twenty Mile Creek with an MNR Type 2 habitat watercourse. Therefore, Stormwater **quality** controls require MECP Normal Protection to the stormwater before discharging to the Twenty Mile Creek Tributary.
- Stormwater **quantity** controls are to be provided for the outlet to limit the proposed development peak flows from the 5 and 100 year storm events to existing peak flow levels

3.0 STORMWATER ANALYSIS

A stormwater analysis of the Joshua Court Subdivision development has been prepared using the MIDUSS computer modelling program. A stormwater analysis was conducted to represent the existing and proposed conditions to the various site stormwater outlets.

This program was selected because it is applicable to an urban drainage area like the study area, it is relatively easy to use and modify for the proposed drainage conditions and control facilities, and it readily allows for the use of design storm hydrographs for the various return periods being investigated. Copies of the current model output files are enclosed in Appendix B.

3.1 Design Storms

Design storm hydrographs were developed using a Chicago distribution based on the Intensity-Duration-Frequency curves for the development area in West Lincoln. Hydrographs for the 25mm, 5, and 100 year events were developed using a 4 hour Chicago distribution. Table 1 summarizes the rainfall data.

Table 1. Rainfall Data

Design Storm (Return Period)	Chicago Distribution Parameters		
	a	b	c
25mm	512.000	6.000	0.800
5 Year	3175.000	20.000	1.000
100 Year	6300.000	15.000	1.000

$$Intensity\ (mm/hr) = \frac{a}{(t_d + b)^c}$$

3.2 Existing Conditions

The existing conditions were modelled to establish the stormwater peak flows and volumes prior to development within this site. The existing drainage areas for the subject lands are shown in Figure 1 outlining the various drainage areas to 4 separate stormwater outlets. These areas were determined from field investigations and a combination of topographic surveys and topographic information from the Regional Niagara DTM.

Outlet A contains the stormwater directed to the Grimsby Road (Regional Road 12) roadside ditch, and is represented by Drainage Area EX2. Outlet B comprises of the stormwater that outlets at the southeast portion of the site through an existing ditch and includes drainage area EX4. Outlet C comprises of the stormwater that outlets at the northeast corner of the site and the tributary of Twenty Mile Creek that crosses through the northeast corner of the site. This outlet includes Drainage Areas EX1 and EX3. Outlet D contains the tributary of Twenty Mile Creek prior to entering the site. Drainage Area EX1 represents the entire drainage area for the tributary for Twenty Mile Creek from the start of the watercourse to Outlet D where it enters the subject lands. Outlet E represents the combination of stormwater from Outlets B and C, that converge southeast of the site.

All stormwater flows from the development site are ultimately conveyed southerly and converge with the tributary of Twenty Mile Creek. Table 3 details the stormwater peak flows generated by the various design storm events.

3.3 Proposed Conditions

The future drainage areas for the proposed development, shown in Figure 2, were modelled to establish the stormwater peak flows once development has been completed at the proposed site. The proposed development will continue to discharge stormwater flows at allowable levels.

Stormwater flows as part of Drainage Area A10 will be directed to the roadside ditch on Grimsby Road (Regional Road 12) outletting at Outlet A. Outlet B will contain Drainage Areas A20, A30, A40 and A70. Drainage areas A30 and A40 will be conveyed through the proposed roadside ditches, Drainage Area A20 will be directed through a series of rear yard swales and Drainage Area A70 will drain directly to Outlet B. Outlet C will contain Drainage Ares A50, A60 and A80. Drainage Areas A50 and A60 will be directed through a series of rear yard swales that will outlet at Outlet C. Drainage Area A80 contains the entire drainage area for the tributary of Twenty Mile Creek before entering the site at Outlet D.

It is proposed to redirect 100m of the tributary of Twenty Mile Creek that crosses the northeast corner of the site between Outlet D to Outlet C. The channel will be redirected to flow easterly directly behind Blocks 5 and 6, and will converge with the proposed-on site ditch in Block 5 at the northeast corner of the site.

Input parameters for the computer model with the proposed development conditions are shown in Table 2. The impervious values for each drainage area have been estimated based on the existing and future land uses with calculations included in Appendix A.

Table 2. Hydrologic Parameters					
Area No.	**Area (ha)**	**Length (m)**	**Slope (%)**	**SCS CN**	**Percent Impervious**
Existing Conditions					
EX1	19.77	363	0.5	74	7.9
EX2	0.42	53	0.5	74	42.6
EX3	2.23	122	0.5	74	5.6
EX4	2.29	123	0.5	74	3.8
	24.71	**Total Area**			
Future Conditions					
A10	0.45	55	0.5	74	40.7
A20	1.59	103	1.0	74	7.5
A30	0.39	51	0.5	74	35.1
A40	0.37	47	0.5	74	39.5
A50	1.39	92	1.0	74	10.6
A60	0.36	49	1.0	74	5.4
A70	0.39	51	0.5	74	6.2
A80	19.77	363	0.5	74	7.9
	24.71	**Total Area**			

The results of the modelling are shown in Table 3, where the peak flows were calculated for the 5 and 100 year design storm events.

Table 3. Peak Flows			
Design Storm	**Peak Flow (m^3/s)**		
	Existing	**Future***	**Change**
Outlet A			
5 Year	0.040	0.041	+2.50%
100 Year	0.109	0.112	+2.75%
Outlet B			
5 Year	0.040	0.098	+145.00%
100 Year	0.245	0.395	+61.22%
Outlet C			
5 Year	0.376	0.385	+2.39%
100 Year	1.449	1.357	-6.35%
Outlet D			
5 Year	0.340	0.340	0%
100 Year	1.270	1.270	0%
Outlet E			
5 Year	0.403	0.481	+19.35%
100 Year	1.649	1.717	+4.12%
Note: * Represents future stormwater conditions without stormwater quantity controls			

For the purpose of Table 3, the total peak stormwater flow values discharging to Outlet E is the confluence of peak flows from Outlet B and C that converge east of the subject lands. The future peak flows from the site have been calculated and outlined in this table to provide conclusions regarding the necessity of quantity controls.

As seen in Table 3, the change in stormwater flows at Outlet A and C are negligible during all modelled storm events. However, peak stormwater flows at Outlet B are greatly increased under proposed conditions and stormwater quantity controls will be required. By controlling stormwater flows at Outlet B, the stormwater flows at Outlet E will be reduced.

It is proposed to construct a Dry Pond Stormwater Management Facility within Block 7 to provide the necessary quantity controls to restrict peak stormwater flows to allowable levels prior to discharge from the site. The quantity controls will ensure that the combined future peak stormwater flows discharging to Outlet B from Drainage Areas A20, A30, A40, and A70 will be reduced to allowable levels outlined by Drainage Area EX4.

LEGEND

A0
0.00
0.00

DRAINAGE AREA NUMBER

DRAINAGE AREA IN HECTARES

IMPERVIOUSNESS

DRAINAGE AREA BOUNDARY

OVERLAND FLOW ROUTE

A — STORMWATER OUTLET

REGIONAL ROAD 20 (HIGHWAY 20)

REGIONAL ROAD 12 (GRIMSBY ROAD)

EXISTING LANDS OF OWNER OUTSIDE SETTLEMENT AREA

EX1
19.77
7.9%

EX2
0.42
42.6%

EX3
2.23
5.6%

EX4
2.29
3.8%

A B C D E

PRELIMINARY

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

JOSHUA COURT SUBDIVISION, WEST LINCOLN
EXISTING EXTERNAL STORM DRAINAGE AREA PLAN

DATE	2024–03–12
SCALE	1:2500 m
REF No.	19126
DWG No.	FIGURE 1

DRAWING FILE: F:\19126\Engineering\19126–SWM BASE.dwg PLOTTED: Mar 13, 2024 – 4:34pm PLOTTED BY: zachb

LEGEND

- **A0** / 0.00 / 0.00 — DRAINAGE AREA NUMBER; DRAINAGE AREA IN HECTARES; IMPERVIOUSNESS
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- A — STORMWATER OUTLET

A10 0.45 / 40.7%

A30 0.39 / 35.1%

A20 1.59 / 7.5%

A50 1.39 / 10.6%

A70 0.39 / 6.2%

A60 0.36 / 5.4%

A40 0.37 / 39.5%

A80 19.77 / 7.9%

REGIONAL ROAD 12 (GRIMSBY ROAD)

REGIONAL ROAD 20 (HIGHWAY 20)

JOSHUA COURT

EXISTING LANDS OF OWNER OUTSIDE SETTLEMENT AREA

PROPOSED CHANNEL

PROPOSED SWM FACILITY

A, B, C, D, E

PRELIMINARY

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

JOSHUA COURT SUBDIVISION, WEST LINCOLN
PROPOSED EXTERNAL STORM DRAINAGE AREA PLAN

DATE	2024–03–07
SCALE	1:2500 m
REF No.	19126
DWG No.	FIGURE 2

DRAWING FILE: F:\19126\Engineering\19126–SWM BASE.dwg PLOTTED: Mar 13, 2024 – 8:33am PLOTTED BY: zachb

4.0 STORMWATER MANAGEMENT PLAN

A MIDUSS model was created to assess existing, future and ultimate development peak flows by the proposed subdivision. The stormwater management facility was sized according to MECP Guidelines (MECP, March 2003) as follows:

4.1 Stormwater Quantity Control

As stated previously through conclusions provided from Table 3, stormwater flows discharging to Outlets A and C have a minimal increase compared to existing conditions and quantity controls will not be required. Drainage Area A70 will provide quantity controls to ensure that the combined future peak stormwater flows discharging to Outlet B from Drainage Areas A20, A30, and A40 will be reduced to allowable levels outlined by Drainage Area EX4. Stormwater flows at Outlet E that contain the flows from Outlet B and C will be analysed to ensure the flows are reduced to allowable levels outlined by Drainage Areas EX1, EX3 and EX4.

A Dry Pond located at the east portion of the site in Block 7 will provide the necessary controls to reduce peak flows to allowable levels.

4.1.1 Stormwater Management Facility Configuration

The layout of the stormwater management facility is providing a single outlet at Outlet B, prior to converging with the tributary of Twenty Mile Creek. A dry pond will be located 80 meters north of the outlet and a 600mm diameter pipe slopped at 0.1% will provide an outlet for the dry pond and convey flows to Outlet B. The swale at the southeast corner of the property will provide additional storage. A retaining wall will be constructed beginning at the south side of Outlet B and follow the property line along the rear yard swale in Lot 4 at an elevation of 194.00m to ensure water does not spill over onto the adjacent properties during stormwater controlled events.

To provide the required quantity controls, it is proposed to construct a two-stage headwall at Outlet B. The headwall will have a 0.050m wide slot weir from the base elevation of 192.52m. At an elevation of 193.25m to an elevation of 194.00m at the top of the headwall, the slot weir will increase to 0.2m wide. This will act as an emergency overflow weir to allow stormwater flow to discharge at greatly increased rates during extreme storm events. Storage will be provided by the proposed dry pond, a 600mm diameter pipe that connects the dry pond to the headwall and the southern area of Block 7 swale in Drainage Area A20. See Appendix A for the storage calculations provided by the dry pond and rear yard swale in Drainage Area A20.

Table 4 below outlines the stormwater characteristics experienced by the Stormwater Management Dry Pond Facility during the modelled storm events. Based on the configuration of the facility, a storage volume of approximately 1043.08m^3 will be provided for stormwater management. See Appendix A for the Stage Storage Discharge Calculations.

Table 4. Stormwater Management Facility Characteristics				
Design Storm	**Peak Flows (L/s)**		**Maximum Elevation (m)**	**Maximum Volume (m^3)**
	Inflow	**Outflow**		
5 Year	95	39	193.07	215
100 Year	391	211	193.66	654

Therefore, stormwater within the facility will reach a maximum elevation of 193.66m during the 100-year design storm event. Stormwater levels during all modelled storm events will remain below the overflow weir elevation of 194.00m. A freeboard of 0.34m will be experienced by the dry pond during the 100 year event.

4.1.2 (Outlet B and E) Flow Comparison

The combined peak stormwater flows discharging to Outlet B from Drainage Areas A20, A30, A40 and A70 are outlined in Table 5 below.

Table 5. Outlet B - Peak Stormwater Flows			
Design Storm	**Existing Peak Flows (L/s)**	***Future Peak Flows (L/s)**	**Percent Change**
5 Year	40	39	-2.50%
100 Year	245	211	-13.88%
Note: * Represents future stormwater conditions with stormwater quantity controls			

Therefore, peak stormwater flows at Outlet B will be reduced to less than existing levels under the proposed Stormwater Management Plan.

The combined peak stormwater flows discharging to Outlet E contains the flows from Outlets B and C (Drainage Areas A20, A30, A40, A50, A60, A70 and A80), is outlined in Table 6 below.

Table 6. Outlet E - Peak Stormwater Flows			
Design Storm	**Existing Peak Flows (L/s)**	***Future Peak Flows (L/s)**	**Percent Change**
5 Year	403	400	-0.74%
100 Year	1649	1569	-4.85%
Note: * Represents future stormwater conditions with stormwater quantity controls			

Therefore, peak stormwater flows at Outlet E will be reduced to less than existing levels under the proposed Stormwater Management Plan.

4.2 Stormwater Quality Control

The Township of West Lincoln as well as the Regional Niagara require the development to provide stormwater quality enhancements to Normal Protection levels prior to discharge from the site. The majority of the development site, particularly all of Drainage Areas A10, A20, A50, A60, and A70 will consist of rear yards and roof top areas that is considered clean stormwater. The driveways and main roadway area within the site will be the sole significant source of contaminates with the development. It is proposed to utilize the roadside ditches to provide the necessary quality controls for the proposed subdivision.

All stormwater from the roadway and driveways within Drainage Area A30 and A40 will be directed to the proposed roadside ditches. The ditches will ultimately convey stormwater flows to the Dry Pond facility prior to discharge from the site. Drainage Area A30 outlines the drainage area for the south roadside ditch and Drainage Area A40 relates to the north roadside ditch.

The ditches will be designed in accordance with the MECP SWM Planning and Design Manual (2003) to provide the necessary water quality enhancements. Grassed swales designed for water quality treatment should be designed to convey peak stormwater flows during a 4 hour 25mm storm at a velocity of less than 0.5 m/s.

An analysis of the 25mm storm has been completed to model the expected stormwater characteristics in the roadside ditches.

Table 7 below outlines the stormwater characteristics of the roadside ditches utilized within the MIDUSS modelling as well as conclusions observed.

Table 7. Roadside Ditch Stormwater Characteristics

Drainage Areas		Roadside Ditch			
No.	**Area (ha)**	**Slope (%)**	**Depth of Flow (m)**	**Flow Rate (m^3/s)**	**Velocity (m/s)**
A30	0.39	0.5	0.1	0.012	0.27
A40	0.37	0.5	0.1	0.013	0.27

As shown in Table 7, the stormwater peak flows and velocities within the proposed roadside ditches will be less than 0.5m/s. Therefore, the internal roadside ditches (Enhanced Swales) will provide sufficient quality enhancements for stormwater discharging from the site.

4.3 Northerly Swale Relocation

As stated previously, it is proposed to redirect 100m of the tributary of Twenty Mile Creek that crosses the northeast corner of the site between Outlet D to Outlet C. The channel will be redirected to flow easterly directly behind Blocks 5 and 6, and will converge with the proposed-on site ditch in Block 5 at the northeast corner of the site. The redirected portion of the channel has been designed to accommodate the 5 year design storm event in Drainage Area A80. The redirected channel will be 0.5 meters deep, 1.2 meters wide at the bottom, and have 3:1 side slopes.

5.0 STORMWATER MANAGEMENT FACILITY MAINTENANCE

5.1 Dry Pond Facility

The dry detention stormwater management facility for this development may be subject to frequent wetting and deposition of sediments as a result of frequent low intensity storm events. The purpose of the dry detention area is to detain peak flows to existing levels. For the initial operation period of the stormwater management facility, the required frequency of maintenance is not definitively known and many of the maintenance tasks will be performed on an 'as required' basis. For example, during the construction phase of the development, there will be a greater potential for increased maintenance frequency, which depends on the maintenance of the upstream oil/grit separator and the effectiveness of the sediment and erosion control techniques employed.

Inspections of the dry detention areas will indicate whether or not maintenance is required. Inspections should be made after every significant storm during the first two years of operation or until all development is completed to ensure the dry detention area is functioning properly. This may translate into an average of six inspections per year. Once all building activity is finalized, inspections shall be performed annually.

The following points should be addressed during inspections of the facility.

Standing water above at the headwall outlet above the base a day or more after a storm may indicate a blockage in the control structure. The blockage may be caused by trash or sediment and a visual inspection would be required to determine the cause.

The dry detention area has been created by excavating a detention area and the integrity of the embankment should be periodically checked to ensure that the side slopes have not sloughed.

Trash removal is an integral part of maintenance and annual clean up, usually in the spring, is a minimum requirement. After this, trash removal is performed on an as required basis on observation of trash build-up during inspections.

Grass cutting is a maintenance activity that is done solely for aesthetic purposes. It is recommended that grass cutting by limited to the upper embankment areas. It should be noted that municipal by-laws may require regular grass maintenance for weed control.

5.2 Internal Roadside Ditches (Enhanced Swales)

For the proposed internal roadside ditches, very minor maintenance will be required. In order to provide optimal enhancement measures, it is suggested that the swales maintain moderately overgrown conditions. Per the MECP Guidelines, grass should be allowed to grow higher than 75mm to enhance the filtration of suspended solids. Regular trimming (i.e. mowing) of the conveyance swales could potentially conclude in adverse effects and will prevent the swales from operating as intended. Frequent inspections should be conducted during the first year of operation and annually during spring to ensure a build-up of sediment does not occur.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Therefore, based on the above comments and design calculations provided for this site, the following summarizes the stormwater management plan for this site.

1. Stormwater quality improvements will be provided to Normal Protection by the proposed roadside ditches along Joshua Court, which function as grassed swales in accordance with MECP guidelines.

2. Quantity controls will be provided by the proposed two stage headwall and storage will be provided by the dry pond, a 600mm diameter pipe conveying flows from the dry pond to the headwall and the rear yard swale located in the southeast corner of the site to control the 5 and 100 year storm events to existing conditions.

3. The tributary of Twenty Mile Creek that crosses the northeast corner of the site will be redirected to flow easterly directly behind Blocks 5 and 6, and will converge with the proposed-on site ditch in Block 5 at the northeast corner of the site.

We trust the above comments and enclosed calculations are satisfactory for approval. If you have any questions or require additional information, please do not hesitate to contact our office.

Prepared By:

Zach Barber, E.I.T.

Reviewed By:

Jason Schooley, P.Eng.
Revised March 13, 2024

APPENDICES

APPENDIX A

Weighted Impervious Calculation Sheet
Dry Pond Stage-Storage-Discharge Calculations
Dry-Pond Volume Calculations
A20 Rear Yard Swale Volume Calculations

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	Joshua Court Subdivision
Project Number:	19126
Date:	February 23, 2024
Person:	Zach Barber

EX - EXISTING CONDITIONS

EX1	*Footprint*	*% Impervious*	*Effective Impervious Area*
Existing Buildings, Asphalt Road and Driveways	15364.5 m^2	100.0% ea	15364.5 m^2
Landscape/Greenspace	182319.6 m^2	0.1% ea	182.3 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			15,547 m^2
TOTAL CATCHMENT AREA			197,684 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**7.9 %**
	RUNOFF COEFFICIENT		**0.26**

EX - EXISTING CONDITIONS

EX 2	*Footprint*	*% Impervious*	*Effective Impervious Area*
Existing Buildings, Asphalt Road and Driveways	1787.995 m^2	100.0% ea	1788.0 m^2
Landscape/Greenspace	2411.8 m^2	0.1% ea	2.4 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,790 m^2
TOTAL CATCHMENT AREA			4,200 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**42.6 %**
	RUNOFF COEFFICIENT		**0.50**

EX - EXISTING CONDITIONS

EX3	*Footprint*	*% Impervious*	*Effective Impervious Area*
Existing Buildings, Asphalt Road/Parking Areas & Concrete Apron.	1237.239 m^2	100.0% ea	1237.2 m^2
Landscape/Greenspace	21049.6 m^2	0.1% ea	21.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,258 m^2
TOTAL CATCHMENT AREA			22,287 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**5.6 %**
	RUNOFF COEFFICIENT		**0.24**

EX - EXISTING CONDITIONS

EX4	*Footprint*	*% Impervious*	*Effective Impervious Area*
Existing Buildings, Asphalt Road/Parking Areas & Concrete Apron.	857.3 m^2	100.0% ea	857.3 m^2
Landscape/Greenspace	22023.6 m^2	0.1% ea	22.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			879 m^2
TOTAL CATCHMENT AREA			22,881 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**3.8 %**
	RUNOFF COEFFICIENT		**0.23**

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	Joshua Court Subdivision
Project Number:	19126
Date:	February 23, 2024
Person:	Zach Barber

PROP - PROPOSED CONDITIONS

A10	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	40.6 m^2	100.0% ea	40.6 m^2
Existing Buildings, Asphalt Road and Driveways	1788.0 m^2	100.0% ea	1788.0 m^2
Landscape/Greenspace	2669.2 m^2	0.1% ea	2.7 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,831 m^2
TOTAL CATCHMENT AREA			4,498 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**40.7 %**
	RUNOFF COEFFICIENT		**0.49**

PROP - PROPOSED CONDITIONS

A20	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	312.7 m^2	100.0% ea	312.7 m^2
Existing Buildings, Asphalt Road and Driveways	857.3 m^2	100.0% ea	857.3 m^2
Landscape/Greenspace	14696.2 m^2	0.1% ea	14.7 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,185 m^2
TOTAL CATCHMENT AREA			15,866 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**7.5 %**
	RUNOFF COEFFICIENT		**0.25**

PROP - PROPOSED CONDITIONS

A30	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	1353.0 m^2	100.0% ea	1353.0 m^2
Existing Buildings, Asphalt Road and Driveways	0.0 m^2	100.0% ea	0.0 m^2
Landscape/Greenspace	2513.7 m^2	0.1% ea	2.5 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,356 m^2
TOTAL CATCHMENT AREA			3,867 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**35.1 %**
	RUNOFF COEFFICIENT		**0.45**

PROP - PROPOSED CONDITIONS

A40	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	1472.7 m^2	100.0% ea	1472.7 m^2
Existing Buildings, Asphalt Road and Driveways	0.0 m^2	100.0% ea	0.0 m^2
Landscape/Greenspace	2258.4 m^2	0.1% ea	2.3 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,475 m^2
TOTAL CATCHMENT AREA			3,731 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**39.5 %**
	RUNOFF COEFFICIENT		**0.48**

PROP - PROPOSED CONDITIONS

A50	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	233.1 m^2	100.0% ea	233.1 m^2
Existing Buildings, Asphalt Road and Driveways	1237.2 m^2	100.0% ea	1237.2 m^2
Landscape/Greenspace	12475.4 m^2	0.1% ea	12.5 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,483 m^2
TOTAL CATCHMENT AREA			13,946 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**10.6 %**
	RUNOFF COEFFICIENT		**0.27**

PROP - PROPOSED CONDITIONS			
A60	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	185.8 m^2	100.0% ea	185.8 m^2
Existing Buildings, Asphalt Road and Driveways	0.0 m^2	100.0% ea	0.0 m^2
Landscape/Greenspace	3340.5 m^2	0.1% ea	3.3 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			189 m^2
TOTAL CATCHMENT AREA			3,526 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**5.4 %**
	RUNOFF COEFFICIENT		**0.24**

PROP - PROPOSED CONDITIONS			
A70	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	236.7 m^2	100.0% ea	236.7 m^2
Existing Buildings, Asphalt Road and Driveways	0.0 m^2	100.0% ea	0.0 m^2
Landscape/Greenspace	3615.2 m^2	0.1% ea	3.6 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			240 m^2
TOTAL CATCHMENT AREA			3,852 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**6.2 %**
	RUNOFF COEFFICIENT		**0.24**

PROP - PROPOSED CONDITIONS			
A80	*Footprint*	*% Impervious*	*Effective Impervious Area*
Prop Buildings, Asphalt Road and Driveways	0.0 m^2	100.0% ea	0.0 m^2
Existing Buildings, Asphalt Road and Driveways	15364.5 m^2	100.0% ea	15364.5 m^2
Landscape/Greenspace	182319.6 m^2	0.1% ea	182.3 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			15,547 m^2
TOTAL CATCHMENT AREA			197,684 m^2
	EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**7.9 %**
	RUNOFF COEFFICIENT		**0.26**

Stage Storage Discharge Calculations

DRY POND FACILITY

Project Name: JOSHUA COURT SUBDIVISON
Project No.: 19126
Date: March 2024

		Pipe				Slot Weir	Slot Weir	Total Outflow
Controlling Rim Elev:								
Invert:		192.53	**DITCH VOLUME**	**DRY POND VOLUME**	**TOTAL VOLUME**	Width (m) = 0.050	Width (m) = 0.200	
Pipe Diameter:		0.610				Invert (m) = 192.52	Invert (m) = 193.25	
Structure/Pipe Length:		80.00						
								DISCHARGE
Elevation (m)		(m^3)	(m^3)	(m^3)	(m^3)	Slot Weir (m^3/s)	Slot Weir (m^3/s)	(m3/s)
194	1.48	23.38	324.87	694.83	1043.08	0.166	0.239	0.405
193.9	1.38	23.38	263.45	629.99	916.82	0.149	0.193	0.342
193.8	1.28	23.38	210.3	562.24	795.92	0.133	0.150	0.283
193.7	**1.18**	**23.38**	**164.84**	**500.51**	**688.73**	**0.118**	**0.111**	**0.229**
193.6	1.08	23.38	126.46	441.72	591.56	0.103	0.076	0.179
193.5	0.98	23.38	94.56	385.81	503.75	0.089	0.046	0.135
193.4	**0.88**	**23.38**	**68.54**	**332.69**	**424.61**	**0.076**	**0.021**	**0.097**
193.3	0.78	23.38	47.79	282.31	353.48	0.063	0.004	0.067
193.2	0.68	23.38	31.73	234.58	289.69	0.052	-	0.052
193.1	0.58	22.73	19.75	189.44	231.92	0.041	-	0.041
193.06	**0.54**	**21.57**	**15.98**	**172.1**	**209.65**	**0.037**	-	**0.037**
193	0.48	19.33	11.28	146.82	177.43	0.031	-	0.031
192.9	0.38	14.84	5.66	106.63	127.13	0.022	-	0.022
192.8	**0.28**	**9.99**	**2.32**	**68.81**	**81.12**	**0.014**	-	**0.014**
192.7	0.18	5.32	0.66	33.29	39.27	0.007	-	0.007
192.6	0.08	1.49	0.08	0	1.57	0.002	-	0.002
192.52	**0.00**	**0.00**	**0**	**0**	**0.00**	**0.000**	-	**0.000**

Upper Canada Consultants
261 Martindale Road, Unit 1
St. Catharines, Ontario L2W 1A1

MUNICIPALITY: **TOWN OF WEST LINCOLN**
PROJECT NAME: **JOSHUA COURT SUBDIVISION**
PROJECT NO.: **19126**

STORAGE AND OUTFLOW

DRY POND

Elevation (m)	Increment Depth (m)	Active Depth (m)	Surface Area (m^2)	Average Surface Area (m^2)	Increment Volume (m^3)	Total Volume (m^3)
192.60		0.00	322.00			0.0
	0.10			332.95	33.29	
192.70		0.10	343.89			33.29
	0.10			355.20	35.52	
192.80		0.20	366.51			68.81
	0.10			378.17	37.82	
192.90		0.30	389.84			106.63
	0.10			401.87	40.19	
193.00		0.40	413.89			146.82
	0.06			421.28	25.28	
193.06		0.46	428.67			172.10
	0.04			433.67	17.35	
193.10		0.50	438.67			189.44
	0.10			451.41	45.14	
193.20		0.60	464.16			234.58
	0.10			477.27	47.73	
193.30		0.70	490.37			282.31
	0.10			503.84	50.38	
193.4		0.80	517.31			332.69
	0.10			531.13	53.11	
193.5		0.90	544.96			385.81
	0.10			559.15	55.91	
193.6		1.00	573.33			441.72
	0.10			587.88	58.79	
193.7		1.10	602.43			500.51
	0.10			617.33	61.73	
193.8		1.20	632.24			562.24
	0.10			647.51	64.75	
193.9		1.30	662.77			626.99
	0.10			678.40	67.84	
194		1.40	694.03			694.83

Upper Canada Consultants
261 Martindale Road, Unit 1
St. Catharines, Ontario L2W 1A1

MUNICIPALITY: TOWNSHIP OF WEST LINCOLN
PROJECT NAME: JOSHUA COURT SUBDIVISION
PROJECT NO.: 19126

STORAGE AND OUTFLOW

A20 1% Ditch Storage: Calculation is per ditch

Elevation (m)	Increment Depth (m)	Active Depth (m)	Cross-Section Area (m^2)	Average Cross-Section Area (m^2)	Increment Volume (m^3)	Total Volume (m^3)
192.52		0.00	0.00			0.0
	0.08			0.010	0.08	
192.60		0.08	0.02			0.08
	0.10			0.058	0.58	
192.70		0.18	0.10			0.66
	0.10			0.166	1.66	
192.80		0.28	0.24			2.32
	0.10			0.334	3.34	
192.90		0.38	0.43			5.66
	0.10			0.562	5.62	
193.00		0.48	0.69			11.28
	0.06			0.783	4.70	
193.06		0.54	0.87			15.98
	0.04			0.942	3.77	
193.10		0.58	1.01			19.75
	0.10			1.198	11.98	
193.20		0.68	1.39			31.73
	0.10			1.606	16.06	
193.30		0.78	1.83			47.79
	0.10			2.074	20.74	
193.40		0.88	2.32			68.54
	0.10			2.602	26.02	
193.50		0.98	2.88			94.56
	0.10			3.190	31.90	
193.60		1.08	3.50			126.46
	0.10			3.838	38.38	
193.70		1.18	4.18			164.84
	0.10			4.546	45.46	
193.80		1.28	4.92			210.30
	0.10			5.314	53.14	
193.90		1.38	5.71			263.45
	0.10			6.142	61.42	
194.00		1.48	6.57			324.87

APPENDIX B

MIDUSS Output Files – Overall Stormwater Management Plan Calculations

Existing Conditions

```
       Output File (4.7) EX.OUT      opened 2024-03-06  16:16
       Units used are defined by G =    9.810
           24   144    10.000       are MAXDT MAXHYD & DTMIN values
       Licensee: UPPER CANADA CONSULTANTS
 35     COMMENT
       3    line(s) of comment
        ALAN CORNERS SUBDIVISION, WEST LINCOLN
        STORMWATER MANAGEMENT PLAN
        EXISTING CONDITIONS
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        ******************
        5 YEAR DESIGN STORM EVENT
        ******************
  2     STORM
           1    1=Chicago;2=Huff;3=User;4=Cdnlhr;5=Historic
     3175.000    Coefficient  a
       20.000    Constant  b    (min)
        1.000    Exponent  c
         .450    Fraction to peak  r
      240.000    Duration ó  240 min
              48.843 mm    Total depth
  3     IMPERVIOUS
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015    Manning "n"
        98.000    SCS Curve No or C
         .100    Ia/S Coefficient
         .518    Initial Abstraction
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET A
        *
  4     CATCHMENT
        2.000    ID No.ó 99999
         .420    Area in hectares
       52.915    Length (PERV) metres
         .500    Gradient (%)
       42.600    Per cent Impervious
       52.915    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .040      .000      .000      .000 c.m/s
              .252      .877      .518    C perv/imperv/total
 15     ADD RUNOFF
              .040      .040      .000      .000 c.m/s
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET B
        *
  4     CATCHMENT
        4.000    ID No.ó 99999
        2.290    Area in hectares
      123.558    Length (PERV) metres
         .500    Gradient (%)
        3.800    Per cent Impervious
      123.558    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .040      .000      .000      .000 c.m/s
              .253      .876      .276    C perv/imperv/total
 15     ADD RUNOFF
              .040      .040      .000      .000 c.m/s
  9     ROUTE
         .000    Conduit Length
         .000    No Conduit defined
         .000    Zero lag
         .000    Beta weighting factor
         .000    Routing timestep
           0    No. of sub-reaches
              .040      .040      .040      .000 c.m/s
 17     COMBINE
       1    Junction Node No.
              .040      .040      .040      .040 c.m/s
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET D
        *
  4     CATCHMENT
        1.000    ID No.ó 99999
       19.770    Area in hectares
      363.043    Length (PERV) metres
         .500    Gradient (%)
        7.900    Per cent Impervious
      363.043    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .340      .000      .040      .040 c.m/s
              .253      .889      .303    C perv/imperv/total
 15     ADD RUNOFF
              .340      .340      .040      .040 c.m/s
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET C
        *
  4     CATCHMENT
        3.000    ID No.ó 99999
        2.230    Area in hectares
      121.929    Length (PERV) metres
         .500    Gradient (%)
        5.600    Per cent Impervious
      121.929    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .040      .340      .040      .040 c.m/s
              .253      .876      .287    C perv/imperv/total
 15     ADD RUNOFF
              .040      .375      .040      .040 c.m/s
  9     ROUTE
         .000    Conduit Length
         .000    No Conduit defined
         .000    Zero lag
         .000    Beta weighting factor
         .000    Routing timestep
           0    No. of sub-reaches
              .040      .375      .375      .040 c.m/s
 17     COMBINE
       1    Junction Node No.
              .040      .375      .375      .402 c.m/s
 18     CONFLUENCE
       1    Junction Node No.
              .040      .402      .375      .000 c.m/s
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        ********************
        100 YEAR DESIGN STORM EVENT
        ********************
  2     STORM
           1    1=Chicago;2=Huff;3=User;4=Cdnlhr;5=Historic
     6300.000    Coefficient  a
       15.000    Constant  b    (min)
        1.000    Exponent  c
         .450    Fraction to peak  r
      240.000    Duration ó  240 min
              98.819 mm    Total depth
  3     IMPERVIOUS
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015    Manning "n"
        98.000    SCS Curve No or C
         .100    Ia/S Coefficient
         .518    Initial Abstraction
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET A
        *
  4     CATCHMENT
        2.000    ID No.ó 99999
         .420    Area in hectares
       52.915    Length (PERV) metres
         .500    Gradient (%)
       42.600    Per cent Impervious
       52.915    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .109      .000      .375      .000 c.m/s
              .456      .933      .659    C perv/imperv/total
 15     ADD RUNOFF
              .109      .109      .375      .000 c.m/s
 14     START
       1    1=Zero; 2=Define
 35     COMMENT
       3    line(s) of comment
        *
        OUTLET B
        *
  4     CATCHMENT
        4.000    ID No.ó 99999
        2.290    Area in hectares
      123.558    Length (PERV) metres
         .500    Gradient (%)
        3.800    Per cent Impervious
      123.558    Length (IMPERV)
         .000    %Imp. with Zero Dpth
           1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250    Manning "n"
       74.000    SCS Curve No or C
         .100    Ia/S Coefficient
        8.924    Initial Abstraction
           1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .245      .000      .375      .000 c.m/s
              .455      .931      .473    C perv/imperv/total
 15     ADD RUNOFF
              .245      .245      .375      .000 c.m/s
  9     ROUTE
         .000    Conduit Length
         .000    No Conduit defined
         .000    Zero lag
         .000    Beta weighting factor
         .000    Routing timestep
           0    No. of sub-reaches
              .245      .245      .245      .000 c.m/s
 17     COMBINE
       1    Junction Node No.
              .245      .245      .245      .245 c.m/s
 14     START
```

```
      1    1=Zero; 2=Define
35    COMMENT
      3    line(s) of comment
       *
       OUTLET D
       *
 4    CATCHMENT
       1.000     ID No.ó 99999
      19.770     Area in hectares
     363.043     Length (PERV) metres
        .500     Gradient (%)
       7.900     Per cent Impervious
     363.043     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
      74.000     SCS Curve No or C
       .100     Ia/S Coefficient
      8.924     Initial Abstraction
          1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
       1.270      .000      .245      .245 c.m/s
        .456      .944      .495    C perv/imperv/total
15    ADD RUNOFF
       1.270     1.270      .245      .245 c.m/s
35    COMMENT
      3    line(s) of comment
       *
       OUTLET C
       *
 4    CATCHMENT
       3.000     ID No.ó 99999
       2.230     Area in hectares
     121.929     Length (PERV) metres
        .500     Gradient (%)
       5.600     Per cent Impervious
     121.929     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
      74.000     SCS Curve No or C
       .100     Ia/S Coefficient
      8.924     Initial Abstraction
          1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
       .239     1.270      .245      .245 c.m/s
       .455      .931      .482    C perv/imperv/total
15    ADD RUNOFF
       .239     1.450      .245      .245 c.m/s
 9    ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
          0    No. of sub-reaches
       .239     1.450     1.450      .245 c.m/s
17    COMBINE
      1    Junction Node No.
       .239     1.450     1.450     1.649 c.m/s
18    CONFLUENCE
      1    Junction Node No.
       .239     1.649     1.450      .000 c.m/s
20    MANUAL
```

Developed Conditions – NO SWM

```
        Output File (4.7) PROP.OUT     opened 2024-03-08  13:05
        Units used are defined by G =    9.810
            24   144    10.000        are MAXDT MAXHYD & DTMIN values
        Licensee: UPPER CANADA CONSULTANTS
 35     COMMENT
       3     line(s) of comment
        ALAN CORNERS SUBDIVISION, WEST LINCOLN
        STORMWATER MANAGEMENT PLAN
        EXISTING CONDITIONS
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        ******************
        5 YEAR DESIGN STORM EVENT
        ******************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdnlhr;5=Historic
     3175.000     Coefficient  a
       20.000     Constant  b    (min)
        1.000     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
                 48.843 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 35     COMMENT
       3     line(s) of comment
        *
        OUTLET A
        *
  4     CATCHMENT
       10.000     ID No.ó 99999
         .450     Area in hectares
       54.772     Length (PERV) metres
         .500     Gradient (%)
       40.700     Per cent Impervious
       54.772     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .041       .000       .000       .000 c.m/s
               .252       .876       .506     C perv/imperv/total
 15     ADD RUNOFF
               .041       .041       .000       .000 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        *
        OUTLET B
        *
  4     CATCHMENT
       20.000     ID No.ó 99999
        1.590     Area in hectares
      102.956     Length (PERV) metres
        1.000     Gradient (%)
        7.500     Per cent Impervious
      102.956     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .036       .000       .000       .000 c.m/s
               .252       .877       .299     C perv/imperv/total
 15     ADD RUNOFF
               .036       .036       .000       .000 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .036       .036       .036       .000 c.m/s
 17     COMBINE
       1     Junction Node No.
               .036       .036       .036       .036 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       30.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
       35.100     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .031       .000       .036       .036 c.m/s
               .252       .878       .472     C perv/imperv/total
 15     ADD RUNOFF
               .031       .031       .036       .036 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .031       .031       .031       .036 c.m/s
 17     COMBINE
       1     Junction Node No.
               .031       .031       .031       .060 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       40.000     ID No.ó 99999
         .370     Area in hectares
       49.665     Length (PERV) metres
         .500     Gradient (%)
       39.500     Per cent Impervious
       49.665     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .033       .000       .031       .060 c.m/s
               .252       .879       .500     C perv/imperv/total
 15     ADD RUNOFF
               .033       .033       .031       .060 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .033       .033       .033       .060 c.m/s
 17     COMBINE
       1     Junction Node No.
               .033       .033       .033       .092 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       70.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
        6.200     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .010       .000       .033       .092 c.m/s
               .252       .878       .291     C perv/imperv/total
 15     ADD RUNOFF
               .010       .010       .033       .092 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .010       .010       .010       .092 c.m/s
 17     COMBINE
       1     Junction Node No.
               .010       .010       .010       .098 c.m/s
 14     START
       1     1=Zero; 2=Define
 18     CONFLUENCE
       1     Junction Node No.
               .010       .098       .010       .000 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .010       .098       .098       .000 c.m/s
 17     COMBINE
       3     Junction Node No.
               .010       .098       .098       .098 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        *
        OUTLET C
        *
  4     CATCHMENT
       80.000     ID No.ó 99999
       19.770     Area in hectares
      363.043     Length (PERV) metres
         .500     Gradient (%)
        7.900     Per cent Impervious
      363.043     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .340       .000       .098       .098 c.m/s
               .253       .889       .303     C perv/imperv/total
 15     ADD RUNOFF
               .340       .340       .098       .098 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .340       .340       .340       .098 c.m/s
```

```
17     COMBINE
       2     Junction Node No.
             .340       .340       .340       .340 c.m/s
14     START
       1     1=Zero; 2=Define
 4     CATCHMENT
       50.000     ID No.ó 99999
        1.390     Area in hectares
       92.263     Length (PERV) metres
        1.000     Gradient (%)
       10.600     Per cent Impervious
       92.263     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .037       .000       .340       .340 c.m/s
               .252       .876       .318     C perv/imperv/total
15     ADD RUNOFF
             .037       .037       .340       .340 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .037       .037       .037       .340 c.m/s
17     COMBINE
       2     Junction Node No.
             .037       .037       .037       .377 c.m/s
14     START
       1     1=Zero; 2=Define
 4     CATCHMENT
       60.000     ID No.ó 99999
         .360     Area in hectares
       48.990     Length (PERV) metres
        1.000     Gradient (%)
        5.400     Per cent Impervious
       46.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .011       .000       .037       .377 c.m/s
               .252       .883       .286     C perv/imperv/total
15     ADD RUNOFF
             .011       .011       .037       .377 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .011       .011       .011       .377 c.m/s
17     COMBINE
       2     Junction Node No.
             .011       .011       .011       .385 c.m/s
14     START
       1     1=Zero; 2=Define
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .011       .000       .000       .385 c.m/s
18     CONFLUENCE
       2     Junction Node No.
             .011       .385       .000       .000 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .011       .385       .385       .000 c.m/s
17     COMBINE
       3     Junction Node No.
             .011       .385       .385       .481 c.m/s
14     START
       1     1=Zero; 2=Define
35     COMMENT
       3     line(s) of comment
        *
        OUTLET E
        *
18     CONFLUENCE
       3     Junction Node No.
             .011       .481       .385       .000 c.m/s
14     START
       1     1=Zero; 2=Define
35     COMMENT
       3     line(s) of comment
        ********************
        100 YEAR DESIGN STORM EVENT
        ********************
 2     STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    6300.000     Coefficient  a
      15.000     Constant  b    (min)
       1.000     Exponent  c
        .450     Fraction to peak  r
     240.000     Duration ó  240 min
               98.819 mm     Total depth
 3     IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
35     COMMENT
       3     line(s) of comment
        *
        OUTLET A
        *
 4     CATCHMENT
       10.000     ID No.ó 99999
         .450     Area in hectares
       54.772     Length (PERV) metres
         .500     Gradient (%)
       40.700     Per cent Impervious
       54.772     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .112       .000       .385       .000 c.m/s
               .455       .933       .649     C perv/imperv/total
15     ADD RUNOFF
             .112       .112       .385       .000 c.m/s
14     START
       1     1=Zero; 2=Define
35     COMMENT
       3     line(s) of comment
        *
        OUTLET B
        *
 4     CATCHMENT
       20.000     ID No.ó 99999
        1.590     Area in hectares
      102.956     Length (PERV) metres
        1.000     Gradient (%)
        7.500     Per cent Impervious
      102.307     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .221       .000       .385       .000 c.m/s
               .456       .934       .492     C perv/imperv/total
15     ADD RUNOFF
             .221       .221       .385       .000 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .221       .221       .221       .000 c.m/s
17     COMBINE
       1     Junction Node No.
             .221       .221       .221       .221 c.m/s
14     START
       1     1=Zero; 2=Define
 4     CATCHMENT
       30.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
       35.100     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .086       .000       .221       .221 c.m/s
               .456       .933       .623     C perv/imperv/total
15     ADD RUNOFF
             .086       .086       .221       .221 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
           0     No. of sub-reaches
             .086       .086       .086       .221 c.m/s
17     COMBINE
       1     Junction Node No.
             .086       .086       .086       .280 c.m/s
14     START
       1     1=Zero; 2=Define
 4     CATCHMENT
       40.000     ID No.ó 99999
         .370     Area in hectares
       49.665     Length (PERV) metres
         .500     Gradient (%)
       39.500     Per cent Impervious
       49.665     Length (IMPERV)
         .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .091       .000       .086       .280 c.m/s
               .456       .932       .644     C perv/imperv/total
15     ADD RUNOFF
             .091       .091       .086       .280 c.m/s
 9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
```

```
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .091       .091       .091       .280 c.m/s
 17    COMBINE
       1     Junction Node No.
              .091       .091       .091       .339 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       70.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
        6.200     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .059       .000       .091       .339 c.m/s
              .456       .933       .486     C perv/imperv/total
 15    ADD RUNOFF
              .059       .059       .091       .339 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .059       .059       .059       .339 c.m/s
 17    COMBINE
       1     Junction Node No.
              .059       .059       .059       .395 c.m/s
 14    START
       1     1=Zero; 2=Define
 18    CONFLUENCE
       1     Junction Node No.
              .059       .395       .059       .000 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .059       .395       .395       .000 c.m/s
 17    COMBINE
       3     Junction Node No.
              .059       .395       .395       .395 c.m/s
 14    START
       1     1=Zero; 2=Define
 35    COMMENT
       3     line(s) of comment
        *
        OUTLET C
        *
  4    CATCHMENT
       80.000     ID No.ó 99999
       19.770     Area in hectares
      363.043     Length (PERV) metres
         .500     Gradient (%)
        7.900     Per cent Impervious
      363.043     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             1.270       .000       .395       .395 c.m/s
              .456       .944       .495     C perv/imperv/total
 15    ADD RUNOFF
             1.270      1.270       .395       .395 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
             1.270      1.270      1.270       .395 c.m/s
 17    COMBINE
       2     Junction Node No.
             1.270      1.270      1.270      1.270 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       50.000     ID No.ó 99999
        1.390     Area in hectares
       92.263     Length (PERV) metres
        1.000     Gradient (%)
       10.600     Per cent Impervious
       92.263     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .200       .000      1.270      1.270 c.m/s
              .454       .935       .505     C perv/imperv/total
 15    ADD RUNOFF
              .200       .200      1.270      1.270 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .200       .200       .200      1.270 c.m/s
 17    COMBINE
       2     Junction Node No.
              .200       .200       .200      1.342 c.m/s
 14    START
       1     1=Zero; 2=Define
  4    CATCHMENT
       60.000     ID No.ó 99999
         .360     Area in hectares
       48.990     Length (PERV) metres
        1.000     Gradient (%)
        5.400     Per cent Impervious
       46.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .062       .000       .200      1.342 c.m/s
              .455       .923       .480     C perv/imperv/total
 15    ADD RUNOFF
              .062       .062       .200      1.342 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .062       .062       .062      1.342 c.m/s
 17    COMBINE
       2     Junction Node No.
              .062       .062       .062      1.357 c.m/s
 14    START
       1     1=Zero; 2=Define
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .062       .000       .000      1.357 c.m/s
 18    CONFLUENCE
       2     Junction Node No.
              .062      1.357       .000       .000 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
              .062      1.357      1.357       .000 c.m/s
 17    COMBINE
       3     Junction Node No.
              .062      1.357      1.357      1.717 c.m/s
 14    START
       1     1=Zero; 2=Define
 35    COMMENT
       3     line(s) of comment
        *
        OUTLET E
        *
 18    CONFLUENCE
       3     Junction Node No.
              .062      1.717      1.357       .000 c.m/s
 20    MANUAL
```

Developed Conditions – FULL SWM

```
        Output File (4.7) SWM.OUT      opened 2024-03-12  16:40
        Units used are defined by G =    9.810
            24   144    10.000        are MAXDT MAXHYD & DTMIN values
        Licensee: UPPER CANADA CONSULTANTS
 35     COMMENT
       3     line(s) of comment
        ALAN CORNERS SUBDIVISION, WEST LINCOLN
        STORMWATER MANAGEMENT PLAN
        EXISTING CONDITIONS
 35     COMMENT
       3     line(s) of comment
        **************
        25mm MOEE DESIGN STORM
        **************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      512.000     Coefficient  a
        6.000     Constant  b    (min)
         .800     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
                 25.035 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       30.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
       35.100     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .012       .000       .000       .000 c.m/s
               .098       .796       .343     C perv/imperv/total
 15     ADD RUNOFF
               .012       .012       .000       .000 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .500     O/a Depth in metres
         .500     Select Grade in %
        Depth          =      .108 metres
        Velocity       =      .266 m/sec
        Flow Capacity  =      .554 c.m/s
        Critical depth =      .066 metres
  9     ROUTE
      110.000     Conduit Length
         .458     Supply X-factor <.5
      309.776     Supply K-lag (sec)
         .500     Beta weighting factor
      300.000     Routing timestep
            1     No. of sub-reaches
               .012       .012       .012       .000 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       40.000     ID No.ó 99999
         .370     Area in hectares
       49.665     Length (PERV) metres
         .500     Gradient (%)
       39.500     Per cent Impervious
       49.665     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .013       .000       .012       .000 c.m/s
               .098       .797       .374     C perv/imperv/total
 15     ADD RUNOFF
               .013       .013       .012       .000 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .600     O/a Depth in metres
         .500     Select Grade in %
        Depth          =      .111 metres
        Velocity       =      .271 m/sec
        Flow Capacity  =      .888 c.m/s
        Critical depth =      .068 metres
  9     ROUTE
       76.000     Conduit Length
         .438     Supply X-factor <.5
      210.169     Supply K-lag (sec)
         .500     Beta weighting factor
      200.000     Routing timestep
            1     No. of sub-reaches
               .013       .013       .013       .000 c.m/s
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        *****************
        5 YEAR DESIGN STORM EVENT
        *****************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     3175.000     Coefficient  a
       20.000     Constant  b    (min)
        1.000     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
                 48.843 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 35     COMMENT
       3     line(s) of comment
        *
        OUTLET B
        *
  4     CATCHMENT
       30.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
       35.100     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .031       .000       .013       .000 c.m/s
               .252       .878       .472     C perv/imperv/total
 15     ADD RUNOFF
               .031       .031       .013       .000 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .500     O/a Depth in metres
         .500     Select Grade in %
        Depth          =      .159 metres
        Velocity       =      .336 m/sec
        Flow Capacity  =      .554 c.m/s
        Critical depth =      .101 metres
  9     ROUTE
      110.000     Conduit Length
         .441     Supply X-factor <.5
      245.520     Supply K-lag (sec)
         .500     Beta weighting factor
      200.000     Routing timestep
            1     No. of sub-reaches
               .031       .031       .028       .000 c.m/s
 17     COMBINE
       1     Junction Node No.
               .031       .031       .028       .028 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       40.000     ID No.ó 99999
         .370     Area in hectares
       49.665     Length (PERV) metres
         .500     Gradient (%)
       39.500     Per cent Impervious
       49.665     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .033       .000       .028       .028 c.m/s
               .252       .879       .500     C perv/imperv/total
 15     ADD RUNOFF
               .033       .033       .028       .028 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .600     O/a Depth in metres
         .500     Select Grade in %
        Depth          =      .163 metres
        Velocity       =      .342 m/sec
        Flow Capacity  =      .888 c.m/s
        Critical depth =      .104 metres
  9     ROUTE
       76.000     Conduit Length
         .412     Supply X-factor <.5
      166.890     Supply K-lag (sec)
         .500     Beta weighting factor
      150.000     Routing timestep
            1     No. of sub-reaches
               .033       .033       .029       .028 c.m/s
 17     COMBINE
       1     Junction Node No.
               .033       .033       .029       .057 c.m/s
 14     START
       1     1=Zero; 2=Define
  4     CATCHMENT
       20.000     ID No.ó 99999
        1.590     Area in hectares
      102.956     Length (PERV) metres
        1.000     Gradient (%)
        7.500     Per cent Impervious
      102.307     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .036       .000       .029       .057 c.m/s
```

```
            .252       .877       .299     C perv/imperv/total
 15     ADD RUNOFF
            .036       .036       .029       .057 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .750     O/a Depth in metres
        1.000     Select Grade in %
        Depth          =      .147 metres
        Velocity       =      .454 m/sec
        Flow Capacity  =     2.246 c.m/s
        Critical depth =      .109 metres
  9     ROUTE
      211.000     Conduit Length
         .486     Supply X-factor <.5
      348.695     Supply K-lag (sec)
         .500     Beta weighting factor
      300.000     Routing timestep
            1     No. of sub-reaches
            .036       .036       .036       .057 c.m/s
 17     COMBINE
        1     Junction Node No.
            .036       .036       .036       .087 c.m/s
 18     CONFLUENCE
        1     Junction Node No.
            .036       .087       .036       .000 c.m/s
  4     CATCHMENT
       70.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
        6.200     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .010       .087       .036       .000 c.m/s
            .252       .878       .291     C perv/imperv/total
 15     ADD RUNOFF
            .010       .095       .036       .000 c.m/s
 10     POND
       5 Depth - Discharge - Volume sets
        192.520        .000          .0
        192.800       .0140        82.1
        193.060       .0370       209.6
        193.400       .0970       424.6
        193.700        .229       688.7
        Peak Outflow    =      .039 c.m/s
        Maximum Depth   =   193.069 metres
        Maximum Storage =      215. c.m
            .010       .095       .039       .000 c.m/s
 17     COMBINE
        2     Junction Node No.
            .010       .095       .039       .039 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        3     line(s) of comment
         *
         OUTLET D
         *
  4     CATCHMENT
       80.000     ID No.ó 99999
       19.770     Area in hectares
      363.043     Length (PERV) metres
         .500     Gradient (%)
        7.900     Per cent Impervious
      363.043     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .340       .000       .039       .039 c.m/s
            .253       .889       .303     C perv/imperv/total
 15     ADD RUNOFF
            .340       .340       .039       .039 c.m/s
 11     CHANNEL
        1.200     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .025     Manning's "n"
         .500     O/a Depth in metres
         .300     Select Grade in %
        Depth          =      .252 metres
        Velocity       =      .689 m/sec
        Flow Capacity  =     1.353 c.m/s
        Critical depth =      .173 metres
  9     ROUTE
       77.000     Conduit Length
         .217     Supply X-factor <.5
       83.774     Supply K-lag (sec)
         .500     Beta weighting factor
      120.000     Routing timestep
            1     No. of sub-reaches
            .340       .340       .312       .039 c.m/s
 35     COMMENT
        3     line(s) of comment
         *
         OUTLET C
         *
  4     CATCHMENT
       50.000     ID No.ó 99999
        1.390     Area in hectares
       92.263     Length (PERV) metres
        1.000     Gradient (%)
       10.600     Per cent Impervious
       92.263     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .037       .340       .312       .039 c.m/s
            .252       .876       .318     C perv/imperv/total
 15     ADD RUNOFF
            .037       .377       .312       .039 c.m/s
  4     CATCHMENT
       60.000     ID No.ó 99999
         .360     Area in hectares
       48.990     Length (PERV) metres
        1.000     Gradient (%)
        5.400     Per cent Impervious
       46.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .011       .377       .312       .039 c.m/s
            .252       .883       .286     C perv/imperv/total
 15     ADD RUNOFF
            .011       .386       .312       .039 c.m/s
  9     ROUTE
         .000     Conduit Length
         .500     Supply X-factor <.5
         .000     Supply K-lag (sec)
         .500     Beta weighting factor
      600.000     Routing timestep
            1     No. of sub-reaches
            .011       .386       .386       .039 c.m/s
 17     COMBINE
        2     Junction Node No.
            .011       .386       .386       .400 c.m/s
 35     COMMENT
        3     line(s) of comment
         *
         OUTLET E
         *
 18     CONFLUENCE
        2     Junction Node No.
            .011       .400       .386       .000 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        3     line(s) of comment
         ********************
         100 YEAR DESIGN STORM EVENT
         ********************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     6300.000     Coefficient  a
       15.000     Constant  b    (min)
        1.000     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
                 98.819 mm     Total depth
  3     IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 35     COMMENT
        3     line(s) of comment
         *
         OUTLET B
         *
  4     CATCHMENT
       30.000     ID No.ó 99999
         .390     Area in hectares
       50.990     Length (PERV) metres
         .500     Gradient (%)
       35.100     Per cent Impervious
       50.990     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       74.000     SCS Curve No or C
         .100     Ia/S Coefficient
        8.924     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .086       .000       .386       .000 c.m/s
            .456       .933       .623     C perv/imperv/total
 15     ADD RUNOFF
            .086       .086       .386       .000 c.m/s
 11     CHANNEL
         .100     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .040     Manning's "n"
         .500     O/a Depth in metres
         .500     Select Grade in %
        Depth          =      .241 metres
        Velocity       =      .435 m/sec
        Flow Capacity  =      .554 c.m/s
        Critical depth =      .160 metres
  9     ROUTE
      110.000     Conduit Length
         .412     Supply X-factor <.5
      189.501     Supply K-lag (sec)
         .500     Beta weighting factor
      200.000     Routing timestep
            1     No. of sub-reaches
            .086       .086       .083       .000 c.m/s
 17     COMBINE
        1     Junction Node No.
            .086       .086       .083       .083 c.m/s
 14     START
        1     1=Zero; 2=Define
  4     CATCHMENT
       40.000     ID No.ó 99999
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        .370     Area in hectares
       49.665    Length (PERV) metres
        .500     Gradient (%)
       39.500    Per cent Impervious
       49.665    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .091       .000       .083       .083 c.m/s
              .456       .932       .644     C perv/imperv/total
15     ADD RUNOFF
              .091       .091       .083       .083 c.m/s
11     CHANNEL
        .100     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .040     Manning's "n"
        .600     O/a Depth in metres
        .500     Select Grade in %
       Depth          =      .246 metres
       Velocity       =      .441 m/sec
       Flow Capacity  =      .888 c.m/s
       Critical depth =      .164 metres
 9     ROUTE
       76.000    Conduit Length
        .371     Supply X-factor <.5
      129.326    Supply K-lag (sec)
        .500     Beta weighting factor
      150.000    Routing timestep
           1     No. of sub-reaches
              .091       .091       .083       .083 c.m/s
17     COMBINE
       1     Junction Node No.
              .091       .091       .083       .166 c.m/s
14     START
       1     1=Zero; 2=Define
 4     CATCHMENT
       20.000    ID No.ó 99999
        1.590    Area in hectares
      102.956    Length (PERV) metres
        1.000    Gradient (%)
        7.500    Per cent Impervious
      102.307    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .221       .000       .083       .166 c.m/s
              .456       .934       .492     C perv/imperv/total
15     ADD RUNOFF
              .221       .221       .083       .166 c.m/s
11     CHANNEL
        .100     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .040     Manning's "n"
        .750     O/a Depth in metres
       1.000     Select Grade in %
       Depth          =      .305 metres
       Velocity       =      .714 m/sec
       Flow Capacity  =     2.246 c.m/s
       Critical depth =      .240 metres
 9     ROUTE
      211.000    Conduit Length
        .471     Supply X-factor <.5
      221.722    Supply K-lag (sec)
        .500     Beta weighting factor
      200.000    Routing timestep
           1     No. of sub-reaches
              .221       .221       .205       .166 c.m/s
17     COMBINE
       1     Junction Node No.
              .221       .221       .205       .332 c.m/s
18     CONFLUENCE
       1     Junction Node No.
              .221       .332       .205       .000 c.m/s
 4     CATCHMENT
       70.000    ID No.ó 99999
        .390     Area in hectares
       50.990    Length (PERV) metres
        .500     Gradient (%)
        6.200    Per cent Impervious
       50.990    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .059       .332       .205       .000 c.m/s
              .456       .933       .486     C perv/imperv/total
15     ADD RUNOFF
              .059       .391       .205       .000 c.m/s
10     POND
       5 Depth - Discharge - Volume sets
       192.520        .000          .0
       192.800       .0140        82.1
       193.060       .0370       209.6
       193.400       .0970       424.6
       193.700        .229       688.7
       Peak Outflow    =      .211 c.m/s
       Maximum Depth   =   193.660 metres
       Maximum Storage =      654. c.m
              .059       .391       .211       .000 c.m/s
17     COMBINE
       2     Junction Node No.
              .059       .391       .211       .211 c.m/s
14     START
       1     1=Zero; 2=Define
35     COMMENT
       3     line(s) of comment
        *
       OUTLET D
        *
 4     CATCHMENT
       80.000    ID No.ó 99999
       19.770    Area in hectares
      363.043    Length (PERV) metres
        .500     Gradient (%)
        7.900    Per cent Impervious
      363.043    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          1.270       .000       .211       .211 c.m/s
           .456       .944       .495     C perv/imperv/total
15     ADD RUNOFF
          1.270      1.270       .211       .211 c.m/s
11     CHANNEL
       1.200     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .025     Manning's "n"
        .515     O/a Depth in metres
        .300     Select Grade in %
       Depth          =      .485 metres
       Velocity       =      .986 m/sec
       Flow Capacity  =     1.440 c.m/s
       Critical depth =      .360 metres
 9     ROUTE
       77.000    Conduit Length
        .000     Supply X-factor <.5
       58.581    Supply K-lag (sec)
        .500     Beta weighting factor
      100.000    Routing timestep
           1     No. of sub-reaches
          1.270      1.270      1.263       .211 c.m/s
35     COMMENT
       3     line(s) of comment
        *
       OUTLET C
        *
 4     CATCHMENT
       50.000    ID No.ó 99999
        1.390    Area in hectares
       92.263    Length (PERV) metres
        1.000    Gradient (%)
       10.600    Per cent Impervious
       92.263    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .200      1.270      1.263       .211 c.m/s
           .454       .935       .505     C perv/imperv/total
15     ADD RUNOFF
           .200      1.342      1.263       .211 c.m/s
 4     CATCHMENT
       60.000    ID No.ó 99999
        .360     Area in hectares
       48.990    Length (PERV) metres
        1.000    Gradient (%)
        5.400    Per cent Impervious
       46.990    Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
       74.000    SCS Curve No or C
        .100     Ia/S Coefficient
        8.924    Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .062      1.342      1.263       .211 c.m/s
           .455       .923       .480     C perv/imperv/total
15     ADD RUNOFF
           .062      1.358      1.263       .211 c.m/s
 9     ROUTE
        .000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
      600.000    Routing timestep
           1     No. of sub-reaches
           .062      1.358      1.358       .211 c.m/s
17     COMBINE
       2     Junction Node No.
           .062      1.358      1.358      1.569 c.m/s
35     COMMENT
       3     line(s) of comment
        *
       OUTLET E
        *
18     CONFLUENCE
       2     Junction Node No.
           .062      1.569      1.358       .000 c.m/s
20     MANUAL
```