

**FUNCTIONAL SERVICING AND
STORMWATER MANAGEMENT REPORT**

**FOR
TRADEMARK HOMES**

1310 KING STREET

**TOWNSHIP OF SCUGOG
REGIONAL MUNICIPALITY OF DURHAM**

PROJECT NO. 125055

DATE: August 2026

CIVIL

STRUCTURAL

MECHANICAL

ELECTRICAL

PLANNING

August 8, 2026

Trademark Homes
1000 Simcoe Street North
Oshawa, ON. L1G 8E6
admin@trademarkbuilt.com

Attention: Anna Camposeo

**Re: Functional Servicing and Stormwater Management Report
1310 King Street
Township of Scugog
Our File: 125055**

Dear Anna Camposeo:

In support of the Zoning By-Law Amendment and Lot Creation applications for the above-referenced proposal, we herewith submit the following Functional Servicing and Stormwater Management Report. This report has been prepared to identify the method in which the proposed development will meet the stormwater management requirements for the Township of Scugog and Kawartha Conservation Authority and identify the infrastructure required to service the proposed development.

If you should require anything further, please contact our office at your convenience.

Yours Truly,

D.G. Biddle & Associates Limited



David McNaull, P. Eng.
Senior Project Engineer, Associate
Civil Group
DDM
Encl.



X:\Staff\Job Files\125000\125055 1310 King Street, Manchester\125055 Reports\125055 20260808 Functional Servicing and SWM Report.doc

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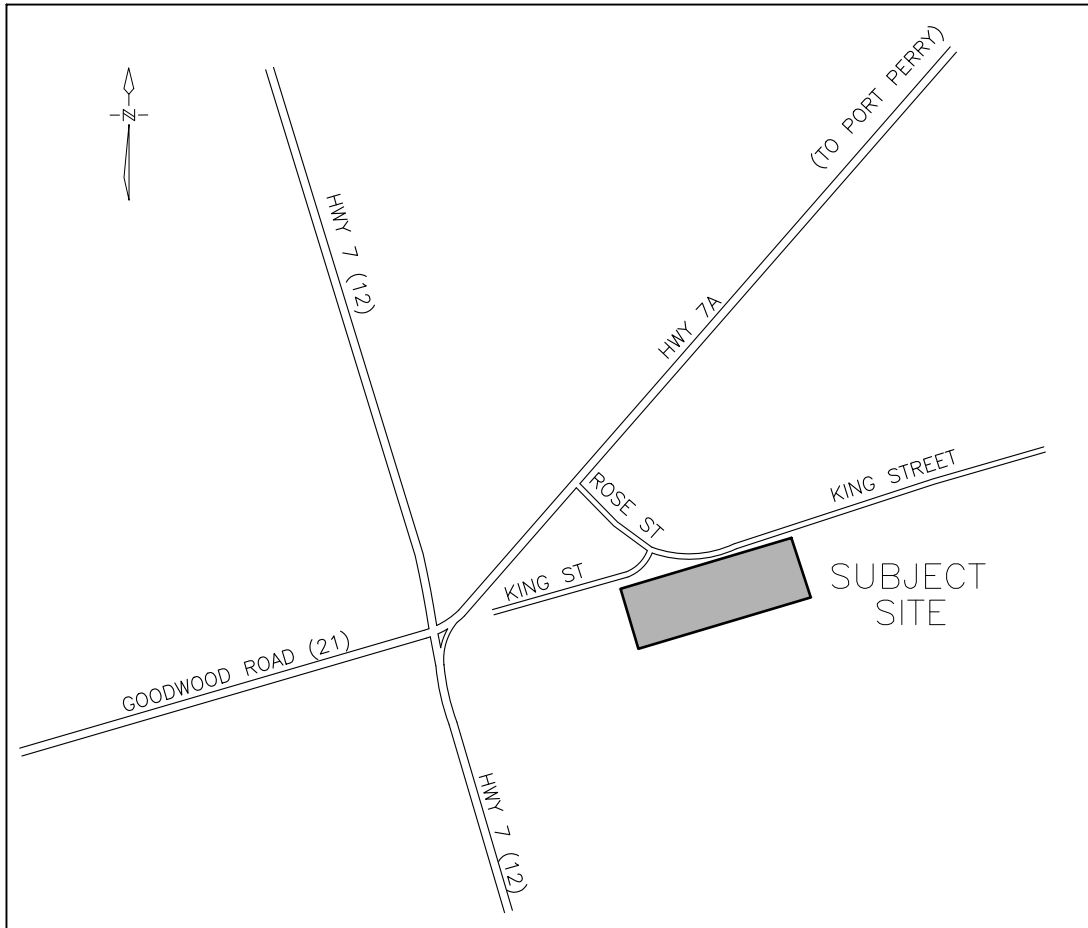


1.0 INTRODUCTION

- 1.1 Purpose:** This Functional Servicing and Stormwater Management Report has been prepared to recommend and illustrate the infrastructure required to provide municipal services for the proposed Draft Plan of Subdivision. It will address sanitary services, watermain services, stormwater drainage works, and site grading required to proceed with the development. This report will also discuss the stormwater quality and quantity control objectives for the site in accordance with the requirements of the Township of Scugog and the Kawartha Conservation Authority (KCA).
- 1.2 Site Location and Description:** The subject property is located on the south side of King Street, Part of Lot 13, Concession 4, in the Geographic Township of Reach, now in the Township of Scugog, Regional Municipality of Durham, locally known as 1310 King Street. The site is bounded on the north by King Street and on the south, east and west by existing residential properties and agricultural lands. The site encompasses an area of approximately 2.97ha. A Site Location Plan is attached as Figure 1.
- 1.3 Land Use and Planning Context:** The site is currently vacant and consists of steep rolling topography sloping north-west towards the existing ditch on King Street. It is proposed to rezone the subject property to create 6 residential lots. King Street is fully constructed as a rural road. A copy of the Draft Plan is attached as drawing 125055 DP-1.

2.0 WATER SUPPLY AND DISTRIBUTION

- 2.1 Existing System:** Currently, the site is not serviced with a connection to a municipal water system. There is no municipal water infrastructure present on King Street. There are three (3) existing drilled test wells located on the subject property adjacent to the southern property line.
- 2.2 Proposed System:** The domestic water supply will be provided privately on-site. Domestic water for each dwelling will be supplied by individual water wells located on



1310 KING STREET, TOWNSHIP OF SCUGOG

SITE LOCATION PLAN



**D.G. BIDDLE
& ASSOCIATES**
CONSULTING ENGINEERS & PLANNERS

481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON

Phone: 905-576-8500

info@dgbiddle.com
dgbiddle.com

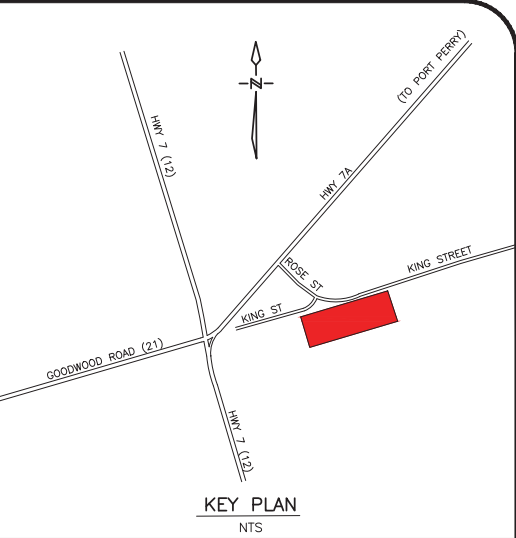
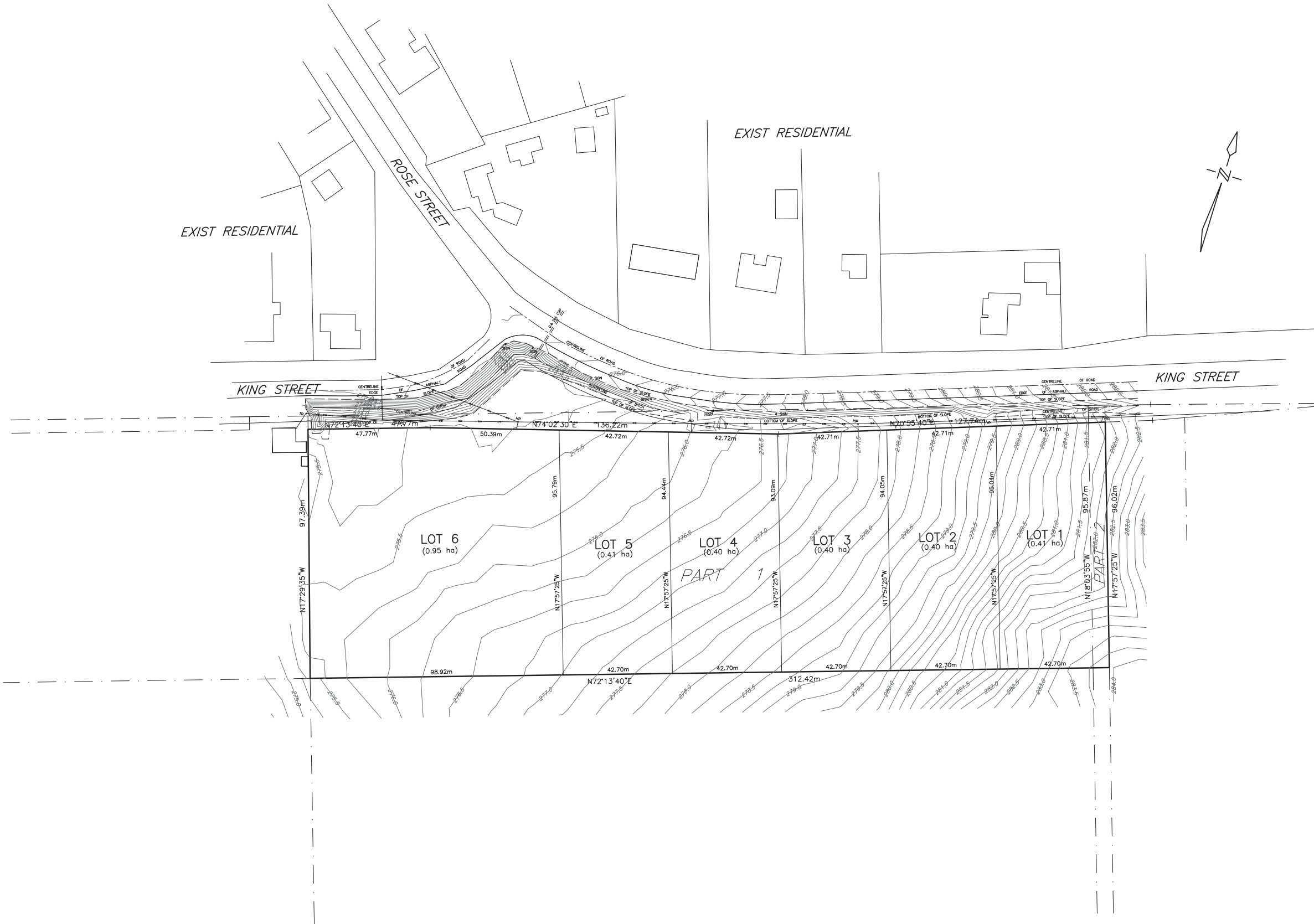
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M.R.W.
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D.D.M.
SEPT 2025

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FIG 1



LAND USE SCHEDULE				
PROPOSED USE	LOT/BLK #	# OF LOTS/BLKS	# OF UNITS	AREA (ha)
LOW DENSITY RESIDENTIAL DETACHED (42.70m) DETACHED	LOTS 1-5	5	5	2.02
	LOT 6	1	1	0.95
NON RESIDENTIAL				
TOTALS		6	6	2.97

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

E NORTH - RESIDENTIAL
SOUTH - ESTATE RESIDENTIAL/VALLEY LAND
EAST - ESTATE RESIDENTIAL
WEST - RESIDENTIAL
H - PIPED MUNICIPAL WATER
I - TILL
K - ALL MUNICIPAL SERVICES AVAILABLE

OWNER'S AUTHORIZATION	SURVEYOR'S CERTIFICATE
I/WE LAND OWNER BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE D.G.BIDDLE AND ASSOC. LTD. TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL SIGNED _____ TITLE _____ DATE _____	I HEREBY CERTIFY THAT THE BOUNDARY OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN ONTARIO LAND SURVEYOR ONTARIO LAND SURVEYORS SIGNED _____ O.L.S. _____ DATE _____

No.	REVISION	DATE	BY	APPROVED

PROPOSED
DRAFT PLAN
PART OF LOT 13, CONC 4,
FORMERLY IN THE TOWNSHIP OF REACH
NOW IN THE
TOWNSHIP OF SCUGOG
REGIONAL MUNICIPALITY OF DURHAM



D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS

481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

SCALE: 1:750	125055
DRAWN BY: B.B.	DP-1
DESIGN BY: M.J.F.	
CHECKED BY: M.J.F.	
PLOT DATE: 15/07/2025	

each lot installed by a well driller who has been licensed by the Ministry of Environment and Climate Change. Approximate locations of the proposed water wells are illustrated on the Preliminary Grading and Servicing Plan, drawing 125055 GS-1. The existing test wells on the property are to be decommissioned.

The firefighting water supply will be provided remotely. The subject site is within the 8km radius of the Fire Station 61 located at 30 Crandell Street, Port Perry which has received Tanker Shuttle Accreditation. The fire station has capabilities of delivering a continuous 200 gallons per minute of water for a period of 120 minutes for all residential developments within 8km.

3.0 SANITARY SERVICING

3.1 Existing System: Currently, the site is not serviced with a connection to a municipal sanitary system. There is no municipal sanitary infrastructure present on King Street.

3.2 Proposed System: Individual on-site septic systems will provide treatment of the sanitary sewage from the proposed dwellings. Detailed sizing of the individual septic systems will occur at building permit submission. The approximate layout of the proposed individual septic systems is illustrated on the Preliminary Grading and Servicing Plan, drawing 125055 GS-1, attached at the end of this report.

4.0 STORM SERVICING

4.1 Existing System: Currently, the site is not serviced with a connection to a municipal storm system. There is no municipal storm infrastructure present on King Street.

The subject property drains via overland sheet flow to the north-west towards an open ditch drainage conveyance system on King Street. The ditch conveys flows to an existing culvert draining north under King Street.

4.2 Proposed System: Stormwater runoff will continue draining to the existing ditch on King Street as per pre-development conditions. The existing open ditch drainage

system on King Street will include the use of culverts to maintain positive drainage towards its outlet. The external upstream drainage area will flow through the proposed subdivision via swales and ditches to maintain existing pre-development patterns

The proposed direction of stormwater drainage is illustrated on the attached Preliminary Grading and Servicing Plan, drawing 125055 GS-1.

5.0 STORMWATER QUANTITY CONTROL

Post-development flows from the site are proposed to discharge into the existing ditch on King Street as per the existing drainage pattern. Pre-development and post-development flows were calculated for the drainage area flowing to the ditch using the VISUAL OTTHYMO 6.0 program.

5.1 Pre-Development Conditions: As illustrated on Figure 2, the pre-development drainage area, tributary to King Street ditch fronting the subject site, is 2.93ha. The remaining 0.04ha lands in the southwest corner within the subject site drains westerly. The site is mainly a grassed area and therefore a CN value of 71 was used to simulate pre-development conditions. The NASHHYD sub-routine in the computer modelling software Visual Otthymo 6.0 was used to simulate the impervious surfaces of the site and calculate the pre-development peak flows for the drainage area. Peak flows were computed using a 4-hour Chicago distribution rainfall for the 2 year to 100 year return frequency events. Tabulated below, in Table 1, are the anticipated pre-development peak flows draining offsite to King Street.

TABLE 1 – PRE-DEVELOPMENT PEAK FLOWS TO KING STREET CULVERT

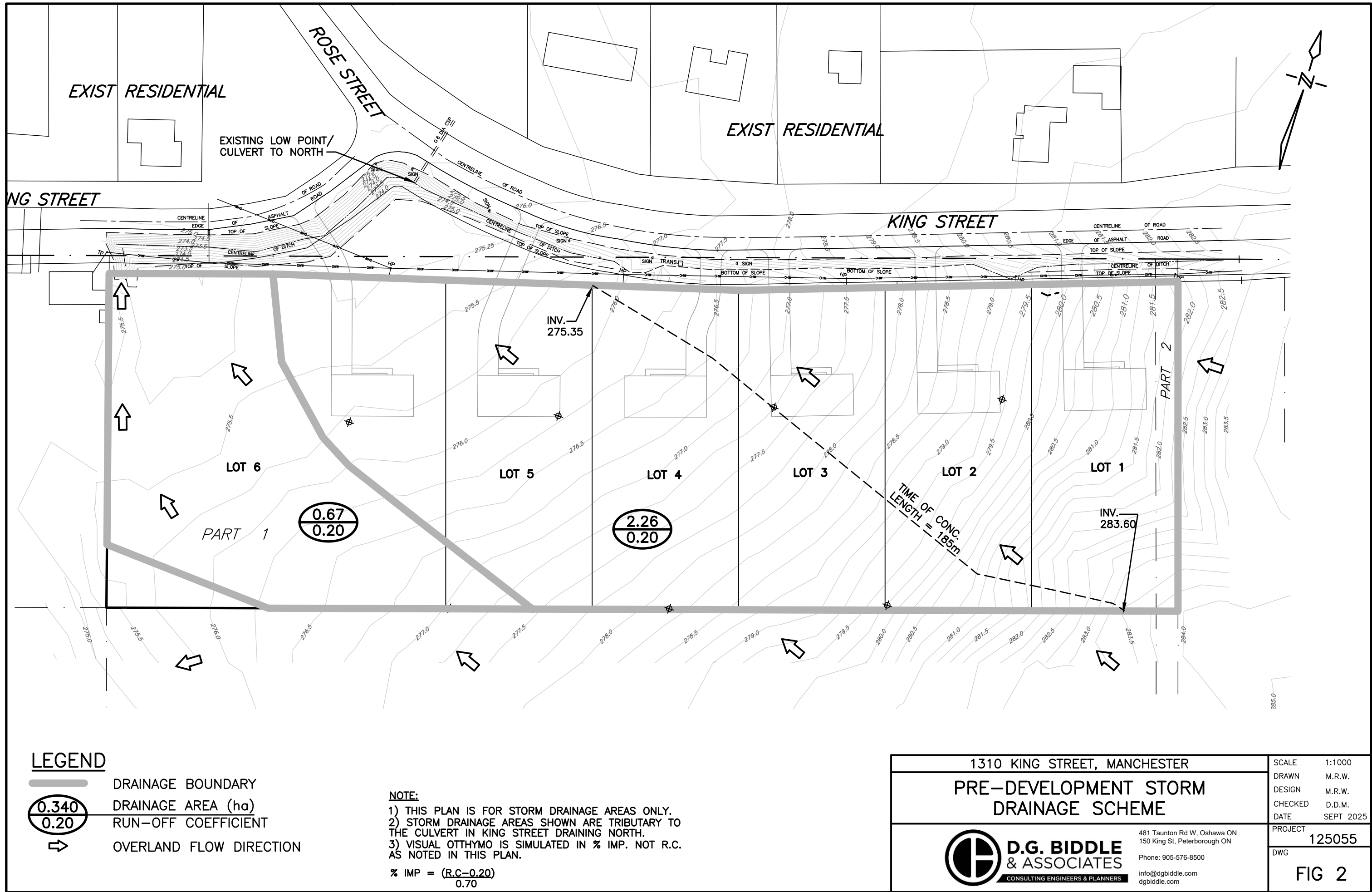
RETURN PERIOD (Years)	4hr CHICAGO PRE-DEVELOPMENT PEAK FLOW (L/s)
2	65
5	123
10	168
25	232
50	283
100	338

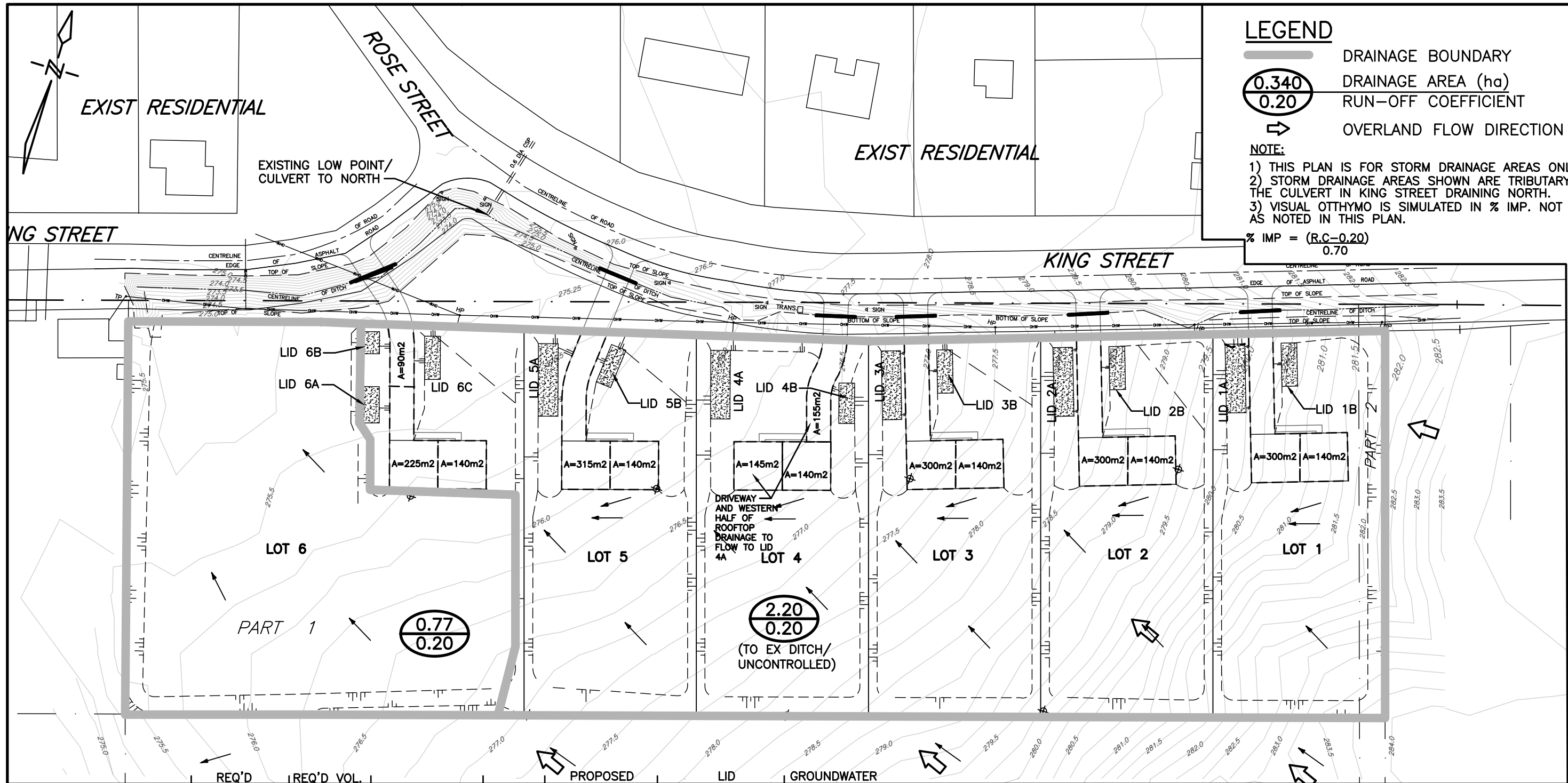
The time of concentration for the pre-development flows has been determined based on cumulative travel time through the watershed. One hydraulic point of analysis has been chosen to compare pre-development and post-development flows. The time of concentration calculations associated with the pre-development flows are provided in Appendix 1 and the time of concentration path is shown in Figure 2.

5.2 Post-Development Conditions: The post development flows will continue to drain offsite to the low point on King Street with a slight overall increase in imperviousness, refer to Figure 3, Post Development Storm Drainage Scheme. The 2.70ha of the subject site will remain as a softscape surface in post-development conditions and the remaining area of 0.27ha will result in an increase in imperviousness due to the proposed driveways and dwelling units. Two (2) sand bars on each lot, three (3) for Lot 6, for a total of 13 sand bars are proposed to capture the 25-year flow rate from the hardscape surfaces which is equivalent to a ~59mm runoff depth. Capturing the 59mm runoff depth from the hardscape surfaces via the sand bars effectively reduces post development flows to pre-development levels.

The external drainage areas upstream of the subject site, as shown in Figure 4, will drain through the subject site via the rear and side yards at the property lines. Refer to the Preliminary Grading and Servicing Plan for details of the swales and Appendix 1 for swale capacity calculations.

The post-development watershed has been reviewed using the STANDHYD sub-routines of the computer modelling software Visual Otthymo 3.0. For a direct comparison with pre-development, the post-development watershed for the subject property has been modelled using a 4-hour Chicago distribution rainfall event for the 2, 5, 10, 25, 50 and 100 year events. A comparison of the pre- and post-development peak flows is tabulated below in Table 2 for the 4-hour Chicago design storm. The detailed Visual Otthymo output files are included in Appendix 2.





LID ID#	TRIB. AREA (m2)	REQ'D		REQ'D VOL. WITH STONE (m)	LENGTH (m)	WIDTH (m)	DEPTH (m3)	PROPOSED		LID	GROUNDWATER
		45mm VOL. (m3)						VOL. PROVIDED (m)			
LID 1A	300	13.5		40.5	17	4.0	0.60	41.0		280.05	279.20
LID 1B	140	6.3		18.0	10	3.0	0.60	18.0		280.75	279.75
LID 2A	300	13.5		40.5	17	4.0	0.60	41.0		278.35	277.35
LID 2B	140	6.3		18.0	10	3.0	0.60	18.0		278.80	277.75
LID 3A	300	13.5		40.5	17	4.0	0.60	41.0		277.35	276.32
LID 3B	140	6.3		18.0	10	3.0	0.60	18.0		277.60	276.60
LID 4A	300	13.5		40.5	17	4.0	0.60	41.0		276.45	275.45
LID 4B	140	6.3		18.0	10	3.0	0.60	18.0		276.90	275.95
LID 5A	315	14.2		40.5	17	4.0	0.60	41.0		275.85	274.85
LID 5B	140	6.3		18.0	10	3.0	0.60	18.0		276.10	275.00
LID 6A	225	10.1		28.9	10	4.0	0.60	24.0		275.50	274.68
LID 6B	90	4.1		11.7	10	3.0	0.30	9.0		275.20	274.67
LID 6C	140	6.3		18.0	10	3.0	0.60	18.0		275.50	274.50
TOTAL AREA OF IMP.		2,670									

1310 KING STREET, MANCHESTER

POST-DEVELOPMENT STORM DRAINAGE SCHEME

 **D.G. BIDDLE & ASSOCIATES**
CONSULTING ENGINEERS & PLANNERS

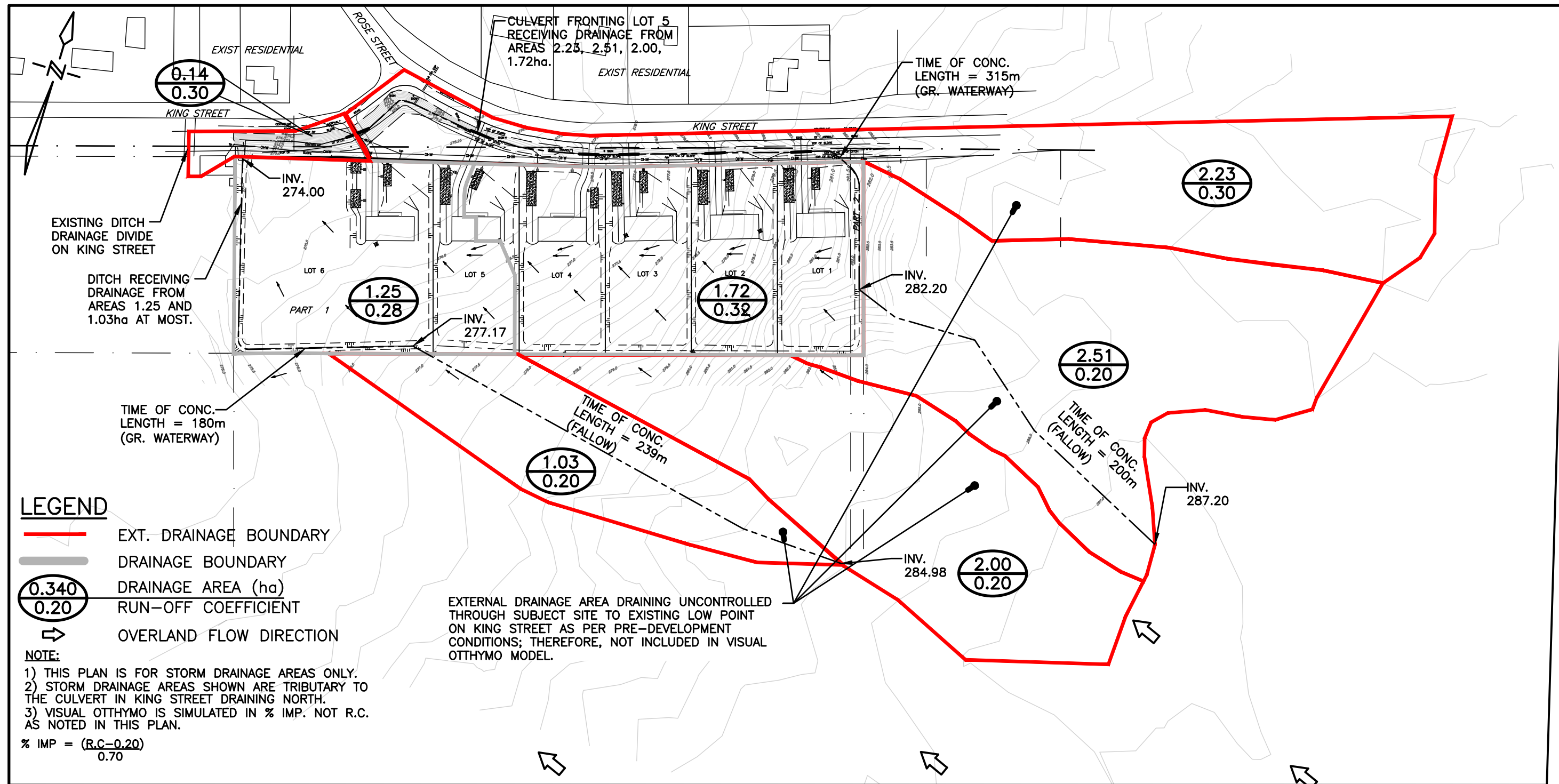
481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON
Phone: 905-576-8500
info@dgbididdle.com
dgbididdle.com

SCALE 1:1000
DRAWN M.R.W.
DESIGN M.R.W.
CHECKED D.D.M.
DATE SEPT 2025

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FIG 3

X:\STAFF\JOB FILES\125055 DRAWINGS\125055 DRAWINGS CIVIL\125055 CONCEPTUAL DEVELOPMENT AND PRELIMINARY ENGINEERING\125055 FIGURE 2 AND FIGURE 3 - PRE AND POST DRAINAGE.DWG



DRAINAGE AREA 1.72ha

PROPOSED USE	RUN-OFF COEFF.	AREA (ha)
ASPHALT DRIVEWAY	0.95	0.065
HOUSES	0.95	0.130
LANDSCAPE	0.20	1.449
FEATURE LANDSCAPE	0.95	0.076
		1.720

$$0.065 \times 0.95 = 0.062$$

$$0.130 \times 0.95 = 0.124$$

$$1.449 \times 0.20 = 0.290$$

$$0.076 \times 0.95 = 0.072$$

$$0.548$$

$$R.C. = 0.548 / 1.720$$

$$R.C. = 0.32$$

$$\%IMP = 17\%$$

DRAINAGE AREA 1.25ha

PROPOSED USE	RUN-OFF COEFF.	AREA (ha)
ASPHALT DRIVEWAY	0.95	0.019
HOUSES	0.95	0.058
LANDSCAPE	0.20	1.117
FEATURE LANDSCAPE	0.95	0.056
		1.250

$$0.019 \times 0.95 = 0.018$$

$$0.058 \times 0.95 = 0.055$$

$$1.117 \times 0.20 = 0.223$$

$$0.056 \times 0.95 = 0.053$$

$$0.349$$

$$R.C. = 0.349 / 1.250$$

$$R.C. = 0.28$$

$$\%IMP = 11\%$$

DRAINAGE AREA 2.23ha

PROPOSED USE	RUN-OFF COEFF.	AREA (ha)
ASPHALT DRIVEWAY	0.95	0.044
ASPHALT (KING)	0.95	0.232
LANDSCAPE	0.20	1.954
		2.230

$$0.044 \times 0.95 = 0.042$$

$$0.232 \times 0.95 = 0.220$$

$$1.954 \times 0.20 = 0.391$$

$$0.653$$

$$R.C. = 0.653 / 2.230$$

$$R.C. = 0.30$$

$$\%IMP = 15\%$$

OVERALL DRAINAGE AREA

$$1.720 \times 0.32 = 0.550$$

$$1.250 \times 0.28 = 0.350$$

$$2.230 \times 0.30 = 0.669$$

$$2.510 \times 0.20 = 0.502$$

$$2.000 \times 0.20 = 0.400$$

$$1.030 \times 0.20 = 0.206$$

$$10.74 \quad 2.680$$

$$R.C. = 2.680 / 10.74$$

$$R.C. = 0.25$$

$$\%IMP = 7\%$$

THEREFORE, SINCE THE %IMP. IS LESS THAN 20%, THE NASHYD WILL BE USED TO SIMULATE THE PEAK FLOWS DRAINING TO THE CULVERT

1310 KING STREET, MANCHESTER

EXTERNAL AREA DRAINAGE SCHEME



481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON
Phone: 905-576-8500
info@dgiddle.com
dgiddle.com

SCALE 1:2000
DRAWN D.D.M.
DESIGN D.D.M.
CHECKED D.D.M.
DATE NOV 2025

PROJECT 125055

DWG
FIG 4

TABLE 2 – PRE- vs POST-DEVELOPMENT PEAK FLOWS

RETURN PERIOD years	PRE-DEVELOPMENT PEAK FLOWS (L/s)	ROUTED POST-DEVELOPMENT PEAK FLOWS (L/s)	DIFFERENCE (%)
2	65	63	-3%
5	123	118	-4%
10	168	161	-4%
25	232	222	-4%
50	283	271	-4%
100	338	322	-5%

As reported above, all post-development flows up to and including the 100-year return frequency will be effectively attenuated to their respective pre-development levels for the culvert draining north in King Street. Therefore, no adverse impact to the downstream drainage system is anticipated.

There are 6 entrance culverts connecting to King Street to convey flows within the existing rural side ditch. Flows volumes conveyed through the entrance culverts converge at the low point located on the south side of King Street via the 600mm diameter cross culvert. Due to the unknown external drainage area south and west of Lot 1, the entrance culvert has been sized to a 600mm diameter which is equivalent to the cross-culvert under King Street. The remainder of the entrance culverts for Lots 2-6, only Lot 2 was assessed, since flow volumes will be highest at the most downstream entrance culvert. Figure 4 shows the tributary area draining to this entrance culvert, from the subject site and the external drainage area. The 100-year storm event has been modelled using the NASHYD sub-routine of the computer modelling software Visual Otthymo 3.0. The culvert design sheet, in Appendix 1, shows that a minimum 525mm culvert at a 1.4% slope is sufficient to convey the 100-year flows.

6.0 STORMWATER QUALITY CONTROL

Stormwater runoff from the site is conveyed to the King Street culvert through landscaped areas and grassed roadside ditches, allowing for extended contact of clean stormwater runoff and the promotion of stormwater infiltration. Quality control measures have been proposed for the development to address the slight increase in imperviousness and further enhance the quality of the stormwater. Roof downspouts from all dwelling units will discharge directly onto splash pads at grade level. The downspouts will drain to side and rear yard swales which are conducive to the settling of sediment. A Low Impact Development practice in the form of sand bars will be implemented near the rear yard swale locations to promote further groundwater recharge and mitigate nitrate/phosphorous runoff. The sand bars have been sized to capture a 59mm rainfall event from the individual building rooftops and driveways which would then percolate into the native soils. Excess rainfall would drain via overland sheet flow into the existing ditch on King Street. The total volume of storage for water to be infiltrated from sand bars is 160m^3 , refer to Appendix 1 for supporting sizing calculations. The locations and details of the sand bars are shown on the Preliminary Grading and Servicing Plan, drawing 125055 GS-1.

Phosphorus loading is also taken into consideration due to the proximity to Lake Scugog. As such, total annual phosphorus loads have been calculated for both pre and post development conditions, refer to Appendix 1 for calculations. A spreadsheet based on documentation provided by The Nottawasaga Valley Conservation Authority (NVCA) has been prepared to quantify phosphorus loading.

The predevelopment scenario represents the 2.93ha site as effectively “Hay/Pasture.” Model parameters were obtained from the Hutchinson documentation, including phosphorus export coefficients and LID removal efficiencies. The calculated predevelopment annual phosphorus export is 0.234kg. See the Phosphorus Loading Calculations attached at the end of this report.

The post development site has been modelled with a variety of sub catchments with various land uses. The majority of the site will remain undeveloped, but the inclusion of impervious surfaces leads to higher phosphorus export values. Without including mitigating factors in the model the annual phosphorus export is 1.306kg. Thus, the phosphorus export must be decreased by approximately 1.071kg per year to match predevelopment export levels. LID features and best management practices are required to offset the increase in phosphorus export.

A sand filter which is effectively modelled as an enhanced swale due to its elongated footprint, comprised of a 0.6m deep sand area, has been designed to provide phosphorus removal. Storm runoff, up to a 59mm event, will traverse towards the swale area and slowly percolate through the sand filter and into the groundwater regime. Storm events beyond this should not facilitate significant phosphorus loadings from the catchment areas and will discharge overland offsite.

TABLE 3: PHOSPHORUS EXPORT

	PRE-DEVELOPMENT	POST-DEVELOPMENT (NO MITIGATION)	POST-DEVELOPMENT (C/W MITIGATION)
PHOSPHORUS EXPORT (kg/yr)	0.234	1.306	0.243

As illustrated in Table 3, phosphorus exports have been reduced and is effectively equivalent to pre-development conditions.



7.0 SITE GRADING

In general, the site will be graded in a manner which will achieve the Township of Scugog lot grading criteria, which includes the following:

- Minimum Landscape Area Grade: 2.0%
- Maximum Landscape Area Grade: 5.0%

The lot grades have been conceptually designed to provide continuous grades for overland flow conveyance while minimizing the cut/fill differential. Details of the site grading design are illustrated on the Preliminary Grading and Servicing Plan, drawing 125055 GS-1, attached at the end of this report.

8.0 TEMPORARY SEDIMENT AND EROSION CONTROLS

During the construction period, the removal of natural vegetation causes the transport of large amounts of sediment during rainfall events. To minimize the sediment laden storm water leaving the site during construction, it is recommended the following sediment control techniques be implemented.

1. Construction Vehicle Access Route (Mud Mat)
2. Perimeter Enviro Fence
3. Rock Check Dams
4. Good Housekeeping Practices

The above techniques are illustrated on the attached Preliminary Erosion Control Plan, drawing 125055 ES-1.

9.0 CONCLUSIONS

The preceding report identifies the functional servicing and stormwater management requirements for the development proposal. The investigations into these requirements have resulted in the following conclusions for the development proposal:

- Domestic water supply for each dwelling will be supplied by individual water wells located on each lot installed by a well driller who has been licensed by the Ministry of Environment and Climate Change.
- Sanitary servicing for each dwelling will be provided through individual septic systems on each lot. Detailed sizing of the individual septic systems will occur during the building permit process.
- Stormwater runoff will drain directly into the existing roadside ditch on King Street. Stormwater quantity controls are provided through the use of sand bars which captures the first 59mm of runoff from the hardscape surfaces. The sand bars also provide Stormwater quality controls.
- Temporary sediment controls during construction can be managed by the use of perimeter enviro fence, construction vehicle access route, rip rap check dams and good engineering practices.

APPENDIX 1

- SAND BAR SIZING CALCULATIONS**
- TIME OF CONCENTRATION CALCULATIONS**
- SWALE CAPACITY CALCULATIONS**
 - CULVERT DESIGN SHEET**
 - CN WEIGHTED CALCULATIONS**
 - IDF CURVE LOOKUP MTO**
- PHOSPHOROUS LOADING CALCULATIONS**



PROJECT 1310 King Street, Township of Scugog
PROJECT # 125055

Sand Bar Sizing

	<u>Half of Rooftop & Driveway</u>	<u>Remaining Half of Rooftop</u>	
Drainage Area	315	140	m2 (Typ. Roof Area)
Storm event	58.65	58.65	mm
Porosity	0.35	0.35	

Volume of Water	18.5	8.2	m3
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Vol. of Water & Sand Needed	52.8	23.5	m3
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Max Ponding	5	5	mm
*Infiltration Rate	8	8	mm/hr
Drainage Time	48	48	hr

Max LID Depth	$\frac{(infiltration\ rate) \times (drainage\ time - \frac{ponding}{infiltration\ rate})}{porosity}$		
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Max LID Depth	1.1	1.1	m
---------------	-----	-----	---

Dimensions

Depth	0.60	0.60	m
Length	18.0	10.0	m
Width	4.9	3.9	m
Vol. Provided / Lot	52.9	23.4	m3
Vol. Provided for 6 Lots	317.5	140.4	m3

* Conservative assumption of 8mm/hr was used. Infiltration tests to confirm if rate is sufficient.

Total volume of storm drainage to be infiltrated up to a 59mm stm event	111.1	49.1	m3	(0.35 porosity)
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Time of Concentration Calculations

Pre-development Drainage Area - Refer to Figure 2 (hyd 5 in Visual Otthymo Output)

$$L = 185 \text{ m}$$

$$S = \frac{283.9 - 276.12}{185} = 4.21\%$$

$$V = 0.33 \text{ m/sec} \quad (\text{See attached Figure 15-2. Existing land use is primarily agricultural, as '...Fallow, Contour or Strip Crop'})$$

$$V = 1.08 \text{ ft/sec}$$

$$V = \frac{L}{tc}$$

$$tc = \frac{185 \text{ m}}{0.330 \text{ m/sec}}$$

$$tc = \frac{561 \text{ sec}}{9.3 \text{ min}}$$

Use minimum 10 min Tc.

$$10.0 \text{ min}$$

$$0.17 \text{ hr}$$

$$tc = 0.17 \text{ hr}$$

$$tp = 0.67 * tc \text{ Time to Peak}$$

$$tp = 0.11 \text{ hr}$$

Therefore, use Time to Peak of 0.11 hours in the Visual Otthymo Model (node 5).

Driveway Culvert Sizing - Refer to Figure 4

$$L = 200 \text{ m}$$

$$S = \frac{287.2 - 282.20}{200} = 2.50\%$$

$$L = 315 \text{ m}$$

$$S = \frac{282.20 - 273.57}{315} = 2.74\%$$

$$V = 0.22 \text{ m/sec} \quad \dots \text{Fallow, Contour or Strip Crop}$$

$$V = 0.72 \text{ ft/sec}$$

$$V = 0.75 \text{ m/sec} \quad \text{Grassed Waterway}$$

$$V = 2.46 \text{ ft/sec}$$

$$V = \frac{L}{tc}$$

$$tc = \frac{200 \text{ m}}{0.220 \text{ m/sec}}$$

$$tc = \frac{909 \text{ sec}}{15.2 \text{ min}}$$

$$22.2 \text{ min}$$

$$0.37 \text{ hr}$$

$$tc = 0.37 \text{ hr}$$

$$tp = 0.67 * tc \text{ Time to Peak}$$

$$tp = 0.25 \text{ hr}$$

Therefore, use Time to Peak of 0.25 hours in the Visual Otthymo Model (node 10).

Ditch Sizing West Side of Lot 6- Refer to Figure 4

L= 239 m		L= 180 m	
S= $\frac{284.98 - 277.17}{239}$	= 3.27%	S= $\frac{277.17 - 274.00}{180}$	= 1.76%
V= 0.28 m/sec	...Fallow, Contour or	V= 0.60 m/sec	Grassed Waterway
V= 0.92 ft/sec	Strip Crop	V= 1.97 ft/sec	
$V = \frac{L}{tc}$		$V = \frac{L}{tc}$	
tc= $\frac{239}{0.280}$ m		tc= $\frac{180}{0.600}$ m	
tc= 854 sec	/	tc= 300 sec	/
14.2 min		5.0 min	
19.2 min			
0.32 hr			
tc= 0.32 hr			
tp= 0.67*tc	Time to Peak		
tp= 0.21 hr			

Therefore, use Time to Peak of 0.21 hours in the Visual Otthymo Model (node 12).

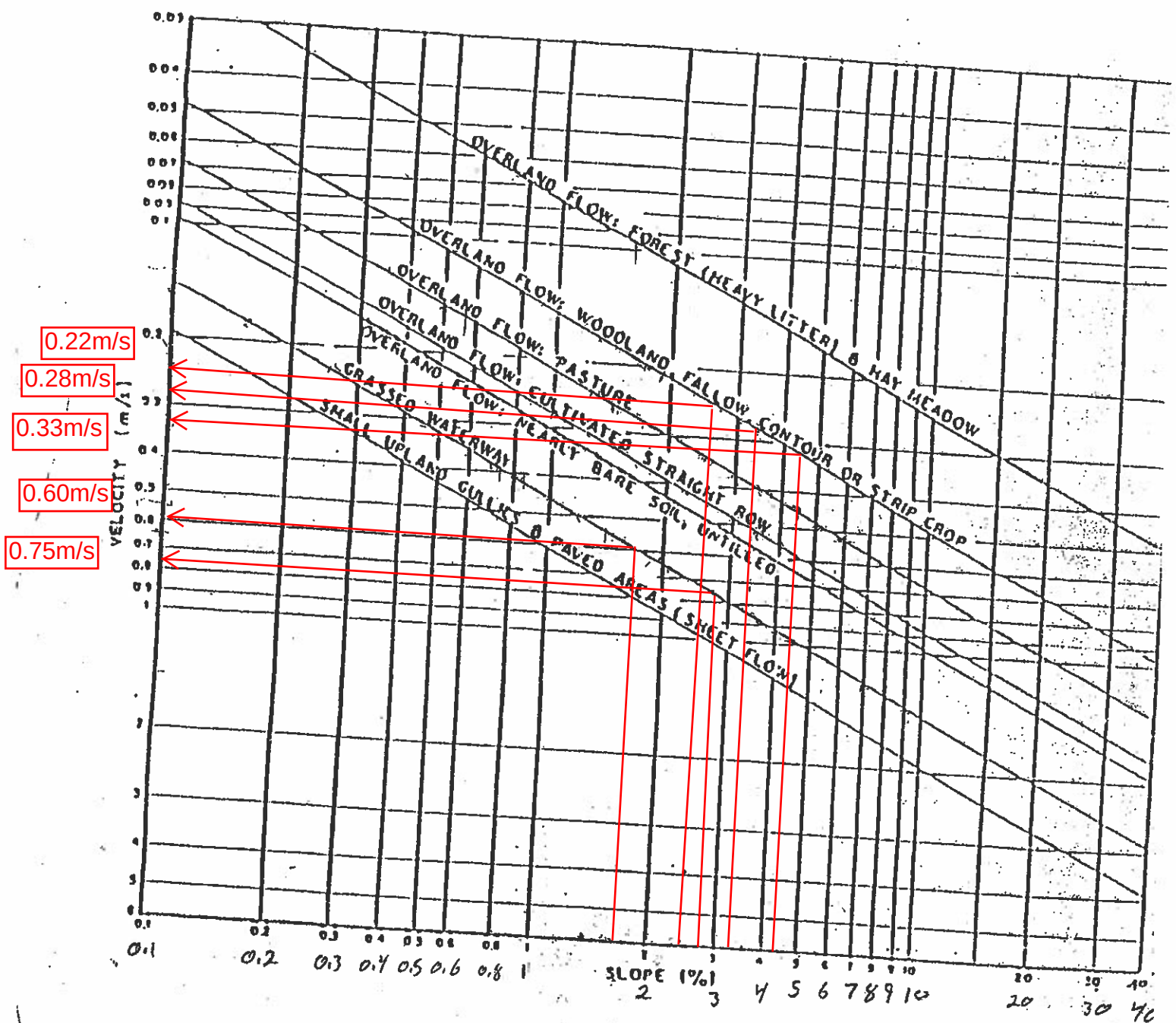


Figure A.5.2: Upland Method for Estimating Time of Concentration
(SCS National Engineering Handbook, 1971)

Refer to Time of Conc. Calc. Sheet

PROJECT 1310 King Street, Manchester
PROJECT # 125055

Swale Capacity Calculations

East Ditch of Lot 1

$$Q = \frac{1}{n} A x R^{2/3} S^{1/2}$$

$$Q = \frac{1}{0.035} 0.310 0.152^{2/3} 0.020^{1/2}$$

$$Q_{CAP} = 0.357 \text{ m}^3/\text{s}$$

$$V = \frac{Q}{A}$$

$$V = 1.151 \text{ m/s}$$

Bottom Channel Base Width=	0 m
Top Channel Width=	1.94 m
Depth=	0.32 m
Manning's Coefficient	0.035
Channel Slope (min)	0.02 m/m
A=Area	0.310 m ²
P=Wetted Perimeter	2.040 m
R=Hydraulic Radius=A/P	0.152 m

Drainage ditch within subject property to receive the largest flow volumes is the side yard (east side) of Lot 1 with a tributary area of 2.51ha. The pre development area of the subject site was modelled with a larger drainage area (2.93ha) and minimum time to peak of 0.11hours. Flows from the above mentioned 2.51ha drainage area should not exceed flows from the subject site. Therefore, the 100year flows from the subject site is assumed to be the maximum flow volume draining to the Lot 1 drainage ditch.

$$Q_{100\text{yr}} = 0.338 \text{ m}^3/\text{s}$$

$$Q_{CAP} > Q_{100\text{yr}}$$

Therefore, the channel has sufficient capacity to convey the 100 year flows.

PROJECT 1310 King Street, Manchester
PROJECT # 125055

Swale Capacity Calculations

West Ditch of Lot 6

$$Q = \frac{1}{n} A x R^{2/3} S^{1/2}$$

$$Q = \frac{1}{0.035} 0.270 0.142^{2/3} 0.015^{1/2}$$

$$Q_{CAP} = 0.257 \text{ m}^3/\text{s}$$

$$V = \frac{Q}{A}$$

$$V = 0.953 \text{ m/s}$$

Bottom Channel Base Width=	0 m
Top Channel Width=	1.8 m
Depth=	0.30 m
Manning's Coefficient	0.035
Channel Slope (min)	0.015 m/m
A=Area	0.270 m ²
P=Wetted Perimeter	1.900 m
R=Hydraulic Radius=A/P	0.142 m

Refer to Visual Otthymo Node 12 for actual flows to Ditch on west side of Lot 6.

$$Q_{100\text{yr}} = 0.180 \text{ m}^3/\text{s}$$

$$Q_{CAP} > Q_{100\text{yr}}$$

Therefore, the channel has sufficient capacity to convey the 100 year flows.

South Ditch of Lot 6

$$Q = \frac{1}{n} A x R^{2/3} S^{1/2}$$

$$Q = \frac{1}{0.035} 0.120 0.095^{2/3} 0.015^{1/2}$$

$$Q_{CAP} = 0.09 \text{ m}^3/\text{s}$$

$$V = \frac{Q}{A}$$

$$V = 0.727 \text{ m/s}$$

Bottom Channel Base Width=	0
Top Channel Width=	1.2
Depth=	0.20
Manning's Coefficient	0.035
Channel Slope (min)	0.015
A=Area	0.120
P=Wetted Perimeter	1.268
R=Hydraulic Radius=A/P	0.095

Refer to Visual Otthymo Node 14 for actual flows to Ditch on west side of Lot 6.

$$Q_{100\text{yr}} = 0.095 \text{ m}^3/\text{s}$$

$$Q_{CAP} > Q_{100\text{yr}}$$

Therefore, the channel has sufficient capacity to convey the 100 year flows.

PAGE 1 OF 1

consulting engineers

CRITERIA

n

0.013

STORM 100 YEAR

RUN OFF CO-EFFICIENTS

PARK

SINGLE FAMILY RES.

TOWNHOUSES

SCHOOLS

COMMERCIAL

$I=0.20$

$I=0.50$

 $I=0.65$

$I=0.70$

$I=0.90$

MUNICIPALITY	Township of Scugog
PROJECT	1310 King Street
PROJECT #	125055

DESIGN BY	D.D.M.
CHK'D BY	D.D.M.
DATE	Nov 13/25
REV	Aug 3/26

[illegible]

Project: Manchester Lots
Job Number: 125055

Weighted Curve Number Calculations

Remaining landscaped area (VH Node 2), not including driveways and building footprint is assumed to have ~5% of additional landscape features - decks, walkway, pavers.

Typical lot is ~4,000m², assume 5% of land area consists of impervious features.

Featured landscape area = 200m² x 6 lots = 1,200m² (0.12ha)

The below calculation takes into account the increased CN value from the featured landscape area.

<u>Node/Surface</u>	<u>Area</u>	<u>CN</u>	
Landscape	2.583	71	183
Sheds/Pavers/ Walkways	0.12	100	12
	2.703		195

Weighted CN 72

Therefore, increase CN value to 72 for Node 2

Active coordinate

44° 4' 45" N, 78° 58' 45" W (44.079167,-78.979167)

Retrieved: Wed, 05 Nov 2025 17:11:23 GMT



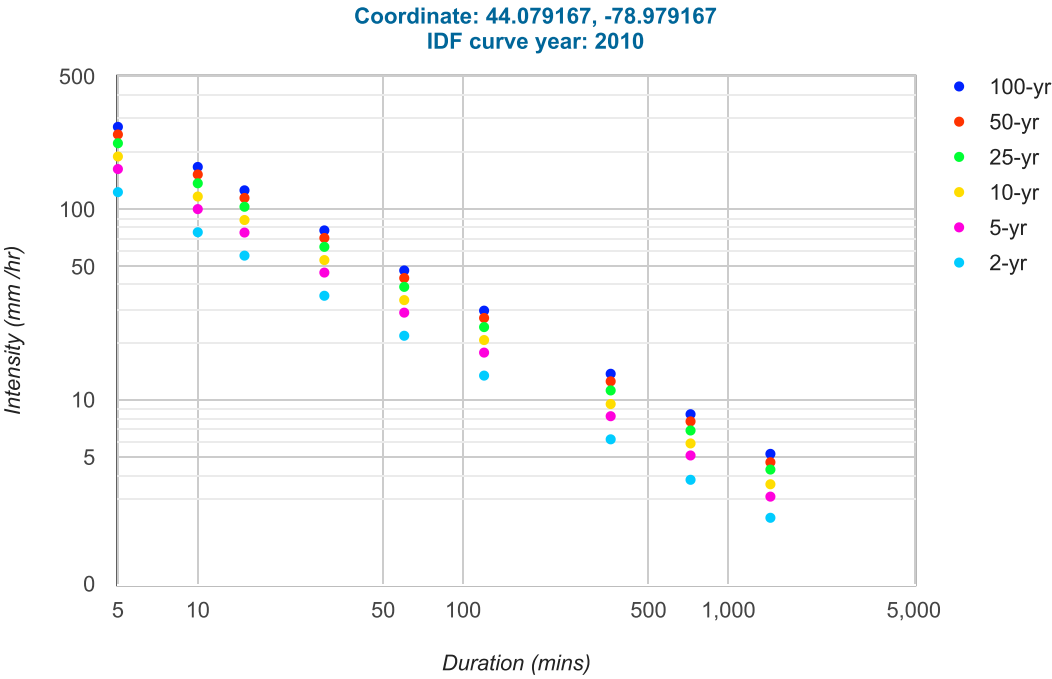
Location summary

These are the locations in the selection.

IDF Curve: 44° 4' 45" N, 78° 58' 45" W (44.079167,-78.979167)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 44° 4' 45" N, 78° 58' 45" W (44.079167,-78.979167)

Retrieved: Wed, 05 Nov 2025 17:11:23 GMT

Data year: 2010

IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.7	28.7	33.4	39.2	43.6	47.8
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr⁻¹)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	123.3	75.9	57.2	35.2	21.7	13.4	6.2	3.8	2.4
5-yr	163.0	100.4	75.6	46.6	28.7	17.7	8.2	5.1	3.1
10-yr	189.7	116.9	88.0	54.2	33.4	20.6	9.5	5.9	3.6
25-yr	222.7	137.2	103.3	63.6	39.2	24.1	11.2	6.9	4.3
50-yr	247.6	152.6	114.9	70.8	43.6	26.9	12.5	7.7	4.7
100-yr	271.5	167.2	126.0	77.6	47.8	29.4	13.7	8.4	5.2

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.3	12.7	14.3	17.6	21.7	26.7	37.2	45.8	56.5
5-yr	13.6	16.7	18.9	23.3	28.7	35.4	49.2	60.6	74.7
10-yr	15.8	19.5	22.0	27.1	33.4	41.1	57.3	70.6	86.9
25-yr	18.6	22.9	25.8	31.8	39.2	48.3	67.2	82.8	102.0
50-yr	20.6	25.4	28.7	35.4	43.6	53.7	74.8	92.1	113.5
100-yr	22.6	27.9	31.5	38.8	47.8	58.9	82.0	101.0	124.4

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Last Modified: September 2016

PHOSPHORUS LOADING

Pre-dev	Area (ha)	Imp. (ha)	P coef	P load (kg/yr)
Hay/Pasture	2.93	0.00	0.08	0.234

Total	2.93			0.234
--------------	-------------	--	--	--------------

Post-dev	Area (ha)	Imp. (ha)	P coef	P load (kg/yr)
*Front/Side/Backyard (Turf/Sod)	0.90	0.00	0.11	0.099
Hay/Pasture	1.80	0.00	0.08	0.144
Rooftop	0.174	0.174	0.50	0.692
Asphalt drive entrance	0.093	0.093	0.50	0.370

Total	2.97			1.306
--------------	-------------	--	--	--------------

* It is assumed the front and sideyards and ~5m of backyard will be regraded with sod

Natural Heritage land uses:

Phosphorus Export (kg/ha/yr) = $f2 \cdot f4$

$f2$ = Area (ha)

$f4$ = P coeff (kg/ha/yr)

Urban land uses:

Phosphorus Export (kg/ha/yr) = $f2 \cdot (e0 \cdot f4 \cdot e1 \cdot (0.05 + 0.91 \cdot (f3/f2))) / 100$

$f2$ = Area (ha)

$f3$ = Imp Area (ha)

$f4$ = P coeff (kg/ha/yr)

$e0$ = Precip (mm/yr)

921 mm

$e1$ = Frac Precip

0.9

Target	P load (kg/yr)
Total Pre-dev	0.234

Target Reduction	1.071
------------------	-------

BMPs + LIDs	Removal %
Enhanced Grass Swale / Sand Bar	100.0

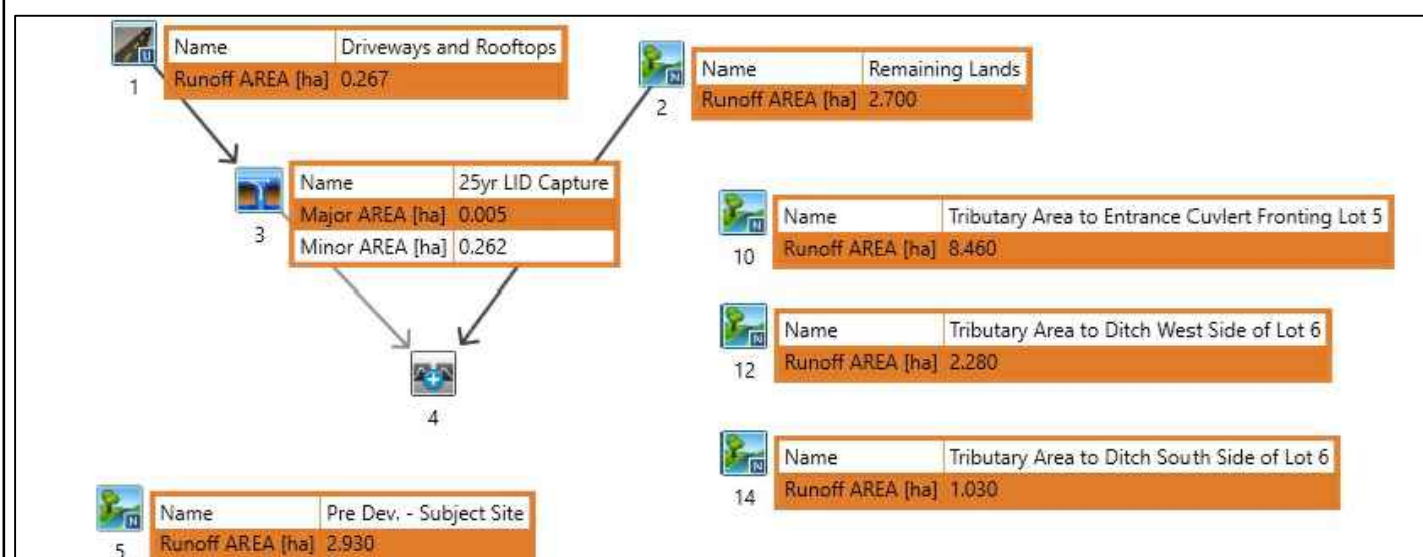
Land cover	Area (ha) treated per BMPs/LIDs		
	No Treatment	Enhanced Swale / Sand Bar	Total Removal (kg/yr)
*Front/Side/Backyard (Turf/Sod)	0.90		-
Hay/Pasture	1.80		
Rooftop		0.174	0.692
Asphalt drive entrance		0.093	0.370
TOTAL			1.062

Phosphorus Load Calculations	Area (ha)	P load (kg)
Pre-dev	2.93	0.234
Post-dev w/ no Mitigation	2.97	1.3056
Target for net-zero		1.071
BMPs/LIDs		1.0623
Post Dev c/w Mitigation		0.243

APPENDIX 2

-VISUAL OTTHYMO OUTPUT





1310 KING STREET, TOWNSHIP OF SCUGOG

VISUAL OTTHYMO SCHEMATIC



481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON

Phone: 905-576-8500

info@dgbiddle.com
dgbiddle.com

SCALE N.T.S.
DRAWN D.D.M.
DESIGN D.D.M.
CHECKED D.D.M.
DATE SEPT 2025

PROJECT
125055

DWG

FIG 5

=====

V V I SSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
WV I SSSS UUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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

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Summary filename: C:\Users\david.mcnaull\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\16e7e

DATE: 08-03-2026 TIME: 07:03:06

USER:

COMMENTS: Pre-Development Flows 2-yr to 100-yr

** SIMULATION : 1 - 2-year **

CHICAGO STORM | IDf curve parameters: A= 443.644
Ptotal= 33.40 mm | B= 1.500
C= 0.724
used in: INTENSITY = A / (t + B)^C
Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9996

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	123.30	114.42
10.	75.90	75.70
15.	57.20	58.29
30.	35.20	36.50
60.	21.70	22.48
120.	13.40	13.73
360.	6.20	6.24
720.	3.80	3.78
1440.	2.40	2.29

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.63	1.00	14.62	2.00	5.45	3.00	3.06
0.17	2.96	1.17	75.70	2.17	4.76	3.17	2.87
0.33	3.40	1.33	18.47	2.33	4.25	3.33	2.71
0.50	4.05	1.50	10.78	2.50	3.86	3.50	2.56
0.67	5.10	1.67	7.95	2.67	3.54	3.67	2.44
0.83	7.18	1.83	6.42	2.83	3.28	3.83	2.33

CALIB NASHYD (0005) | Area (ha)= 2.93 Curve Number (CN)= 71.0
ID= 1 DT= 2.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----							
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	2.63	1.033	14.62	2.033	5.45	3.03	3.06
0.067	2.63	1.067	14.62	2.067	5.45	3.07	3.06
0.100	2.63	1.100	14.62	2.100	5.45	3.10	3.06
0.133	2.63	1.133	14.62	2.133	5.45	3.13	3.06
0.167	2.63	1.167	14.62	2.167	5.45	3.17	3.06
0.200	2.96	1.200	75.70	2.200	4.76	3.20	2.87
0.233	2.96	1.233	75.70	2.233	4.76	3.23	2.87
0.267	2.96	1.267	75.70	2.267	4.76	3.27	2.87
0.300	2.96	1.300	75.70	2.300	4.76	3.30	2.87
0.333	2.96	1.333	75.70	2.333	4.76	3.33	2.87
0.367	3.40	1.367	18.47	2.367	4.25	3.37	2.71
0.400	3.40	1.400	18.47	2.400	4.25	3.40	2.71
0.433	3.40	1.433	18.47	2.433	4.25	3.43	2.71
0.467	3.40	1.467	18.47	2.467	4.25	3.47	2.71
0.500	3.40	1.500	18.47	2.500	4.25	3.50	2.71
0.533	4.05	1.533	10.78	2.533	3.86	3.53	2.56
0.567	4.05	1.567	10.78	2.567	3.86	3.57	2.56
0.600	4.05	1.600	10.78	2.600	3.86	3.60	2.56
0.633	4.05	1.633	10.78	2.633	3.86	3.63	2.56
0.667	4.05	1.667	10.78	2.667	3.86	3.67	2.56
0.700	5.10	1.700	7.95	2.700	3.54	3.70	2.44
0.733	5.10	1.733	7.95	2.733	3.54	3.73	2.44
0.767	5.10	1.767	7.95	2.767	3.54	3.77	2.44
0.800	5.10	1.800	7.95	2.800	3.54	3.80	2.44
0.833	5.10	1.833	7.95	2.833	3.54	3.83	2.44
0.867	7.18	1.867	6.42	2.867	3.28	3.87	2.33
0.900	7.18	1.900	6.42	2.900	3.28	3.90	2.33
0.933	7.18	1.933	6.42	2.933	3.28	3.93	2.33
0.967	7.18	1.967	6.42	2.967	3.28	3.97	2.33
1.000	7.18	2.000	6.42	3.000	3.28	4.00	2.33

Unit Hyd Qpeak (cms)= 1.017

PEAK FLOW (cms)= 0.065 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 6.099
TOTAL RAINFALL (mm)= 33.397
RUNOFF COEFFICIENT = 0.183

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

=====

V V I SSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
WV I SSSS UUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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

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Output filename: C:\Users\david.mcnaull\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\876a1
Summary filename: C:\Users\david.mcnaull\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\876a1

DATE: 08-03-2026 TIME: 07:03:06

USER:

COMMENTS: _____

** SIMULATION : 2 - 5-year **

CHICAGO STORM
Ptotal= 44.14 mm

IDF curve parameters: A= 589.626
B= 1.507
C= 0.725
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	163.00	151.66
10.	100.40	100.32
15.	75.60	77.23
30.	46.60	48.33
60.	28.70	29.76
120.	17.70	18.17
360.	8.20	8.24
720.	5.10	4.99
1440.	3.10	3.02

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.47	1.00	19.32	2.00	7.19	3.00	4.03
0.17	3.90	1.17	100.32	2.17	6.28	3.17	3.78
0.33	4.49	1.33	24.43	2.33	5.61	3.33	3.57
0.50	5.34	1.50	14.24	2.50	5.09	3.50	3.38
0.67	6.73	1.67	10.50	2.67	4.67	3.67	3.21
0.83	9.48	1.83	8.47	2.83	4.32	3.83	3.06

CALIB
NASHYD (0005)
ID= 1 DT= 2.0 min

Area (ha)= 2.93 Curve Number (CN)= 71.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.47	1.033	19.32	2.033	7.19	3.03	4.03
0.067	3.47	1.067	19.32	2.067	7.19	3.07	4.03
0.100	3.47	1.100	19.32	2.100	7.19	3.10	4.03
0.133	3.47	1.133	19.32	2.133	7.19	3.13	4.03
0.167	3.47	1.167	19.32	2.167	7.19	3.17	4.03
0.200	3.90	1.200	100.32	2.200	6.28	3.20	3.78
0.233	3.90	1.233	100.32	2.233	6.28	3.23	3.78
0.267	3.90	1.267	100.32	2.267	6.28	3.27	3.78
0.300	3.90	1.300	100.32	2.300	6.28	3.30	3.78
0.333	3.90	1.333	100.32	2.333	6.28	3.33	3.78
0.367	4.49	1.367	24.43	2.367	5.61	3.37	3.57
0.400	4.49	1.400	24.43	2.400	5.61	3.40	3.57
0.433	4.49	1.433	24.43	2.433	5.61	3.43	3.57
0.467	4.49	1.467	24.43	2.467	5.61	3.47	3.57
0.500	4.49	1.500	24.43	2.500	5.61	3.50	3.57
0.533	5.34	1.533	14.24	2.533	5.09	3.53	3.38
0.567	5.34	1.567	14.24	2.567	5.09	3.57	3.38
0.600	5.34	1.600	14.24	2.600	5.09	3.60	3.38
0.633	5.34	1.633	14.24	2.633	5.09	3.63	3.38
0.667	5.34	1.667	14.24	2.667	5.09	3.67	3.38
0.700	6.73	1.700	10.50	2.700	4.67	3.70	3.21
0.733	6.73	1.733	10.50	2.733	4.67	3.73	3.21
0.767	6.73	1.767	10.50	2.767	4.67	3.77	3.21
0.800	6.73	1.800	10.50	2.800	4.67	3.80	3.21
0.833	6.73	1.833	10.50	2.833	4.67	3.83	3.21
0.867	9.48	1.867	8.48	2.867	4.32	3.87	3.06
0.900	9.48	1.900	8.47	2.900	4.32	3.90	3.06
0.933	9.48	1.933	8.47	2.933	4.32	3.93	3.06
0.967	9.48	1.967	8.47	2.967	4.32	3.97	3.06
1.000	9.48	2.000	8.47	3.000	4.32	4.00	3.06

Unit Hyd Peak (cms)= 1.017

PEAK FLOW (cms)= 0.123 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 10.717

TOTAL RAINFALL (mm)= 44.143
RUNOFF COEFFICIENT = 0.243

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

V V I SSSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\dauid.mcnaul\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1cc65.
Summary filename: C:\Users\dauid.mcnaul\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1cc65.

DATE: 08-03-2026

TIME: 07:03:06

USER:

COMMENTS:

** SIMULATION : 3 10-year **

CHICAGO STORM
Ptotal= 51.20 mm

IDF curve parameters: A= 687.677
B= 1.501
C= 0.726
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	189.70	176.67
10.	116.90	116.76
15.	88.00	89.84
30.	54.20	56.18
60.	33.40	34.57
120.	20.60	21.09
360.	9.50	9.55
720.	5.90	5.79
1440.	3.60	3.50

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.01	1.00	22.39	2.00	8.31	3.00	4.66
0.17	4.51	1.17	116.76	2.17	7.27	3.17	4.37
0.33	5.19	1.33	28.32	2.33	6.49	3.33	4.12
0.50	6.18	1.50	16.49	2.50	5.88	3.50	3.90
0.67	7.78	1.67	12.15	2.67	5.39	3.67	3.71
0.83	10.97	1.83	9.81	2.83	4.99	3.83	3.54

CALIB
NASHYD (0005)

Area (ha)= 2.93 Curve Number (CN)= 71.0

|ID= 1 DT= 2.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

--- TRANSFORMED HYETOGRAPH ---									
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.033	4.01	1.033	22.39	2.033	8.31	3.03	4.66		
0.067	4.01	1.067	22.39	2.067	8.31	3.07	4.66		
0.100	4.01	1.100	22.39	2.100	8.31	3.10	4.66		
0.133	4.01	1.133	22.39	2.133	8.31	3.13	4.66		
0.167	4.01	1.167	22.39	2.167	8.31	3.17	4.66		
0.200	4.51	1.200	116.76	2.200	7.27	3.20	4.37		
0.233	4.51	1.233	116.76	2.233	7.27	3.23	4.37		
0.267	4.51	1.267	116.76	2.267	7.27	3.27	4.37		
0.300	4.51	1.300	116.76	2.300	7.27	3.30	4.37		
0.333	4.51	1.333	116.76	2.333	7.27	3.33	4.37		
0.367	5.19	1.367	28.32	2.367	6.49	3.37	4.12		
0.400	5.19	1.400	28.32	2.400	6.49	3.40	4.12		
0.433	5.19	1.433	28.32	2.433	6.49	3.43	4.12		
0.467	5.19	1.467	28.32	2.467	6.49	3.47	4.12		
0.500	5.19	1.500	28.32	2.500	6.49	3.50	4.12		
0.533	6.18	1.533	16.49	2.533	5.88	3.53	3.90		
0.567	6.18	1.567	16.49	2.567	5.88	3.57	3.90		
0.600	6.18	1.600	16.49	2.600	5.88	3.60	3.90		
0.633	6.18	1.633	16.49	2.633	5.88	3.63	3.90		
0.667	6.18	1.667	16.49	2.667	5.88	3.67	3.90		
0.700	7.78	1.700	12.15	2.700	5.40	3.70	3.71		
0.733	7.78	1.733	12.15	2.733	5.39	3.73	3.71		
0.767	7.78	1.767	12.15	2.767	5.39	3.77	3.71		
0.800	7.78	1.800	12.15	2.800	5.39	3.80	3.71		
0.833	7.78	1.833	12.15	2.833	5.39	3.83	3.71		
0.867	10.97	1.867	9.81	2.867	4.99	3.87	3.54		
0.900	10.97	1.900	9.81	2.900	4.99	3.90	3.54		
0.933	10.97	1.933	9.81	2.933	4.99	3.93	3.54		
0.967	10.97	1.967	9.81	2.967	4.99	3.97	3.54		
1.000	10.97	2.000	9.81	3.000	4.99	4.00	3.54		

Unit Hyd Qpeak (cms)= 1.017

PEAK FLOW (cms)= 0.168 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 14.228
TOTAL RAINFALL (mm)= 51.202
RUNOFF COEFFICIENT = 0.278

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

=====

V V I SSSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\david.mcnau1\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\6ab2f
Summary filename: C:\Users\david.mcnau1\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\6ab2f

DATE: 08-03-2026 TIME: 07:03:06

USER:

COMMENTS: _____

** SIMULATION : 4 - 25-year **

CHICAGO STORM IDF curve parameters: A= 802.590
Ptotal= 60.42 mm B= 1.500
C= 0.724
used in: INTENSITY = A / (t + B)^{AC}
Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9996

TIME	INPUT INT.	TAB. INT.
(min)	(mm/hr)	(mm/hr)
5.	222.70	206.99
10.	137.20	136.95
15.	103.30	105.45
30.	63.60	66.03
60.	39.20	40.68
120.	24.10	24.85
360.	11.20	11.28
720.	6.90	6.84
1440.	4.30	4.14

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	4.76	1.00	26.45	2.00	9.86	3.00	5.53
0.17	5.35	1.17	136.95	2.17	8.62	3.17	5.19
0.33	6.16	1.33	33.42	2.33	7.70	3.33	4.90
0.50	7.33	1.50	19.50	2.50	6.98	3.50	4.64
0.67	9.23	1.67	14.39	2.67	6.40	3.67	4.41
0.83	12.99	1.83	11.62	2.83	5.93	3.83	4.21

CALIB NASHYD (0005) Area (ha)= 2.93 Curve Number (CN)= 71.0
ID= 1 DT= 2.0 min Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

--- TRANSFORMED HYETOGRAPH ---									
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.033	4.76	1.033	26.45	2.033	9.86	3.03	5.53		
0.067	4.76	1.067	26.45	2.067	9.86	3.07	5.53		
0.100	4.76	1.100	26.45	2.100	9.86	3.10	5.53		
0.133	4.76	1.133	26.45	2.133	9.86	3.13	5.53		
0.167	4.76	1.167	26.45	2.167	9.86	3.17	5.53		
0.200	5.35	1.200	136.95	2.200	8.62	3.20	5.19		
0.233	5.35	1.233	136.95	2.233	8.62	3.23	5.19		
0.267	5.35	1.267	136.95	2.267	8.62	3.27	5.19		
0.300	5.35	1.300	136.95	2.300	8.62	3.30	5.19		
0.333	5.35	1.333	136.95	2.333	8.62	3.33	5.19		
0.367	6.16	1.367	33.42	2.367	7.70	3.37	4.90		
0.400	6.16	1.400	33.42	2.400	7.70	3.40	4.90		
0.433	6.16	1.433	33.42	2.433	7.70	3.43	4.90		
0.467	6.16	1.467	33.42	2.467	7.70	3.47	4.90		
0.500	6.16	1.500	33.42	2.500	7.70	3.50	4.90		
0.533	7.33	1.533	19.50	2.533	6.98	3.53	4.64		
0.567	7.33	1.567	19.50	2.567	6.98	3.57	4.64		
0.600	7.33	1.600	19.50	2.600	6.98	3.60	4.64		
0.633	7.33	1.633	19.50	2.633	6.98	3.63	4.64		
0.667	7.33	1.667	19.50	2.667	6.98	3.67	4.64		
0.700	9.23	1.700	14.39	2.700	6.40	3.70	4.41		
0.733	9.23	1.733	14.39	2.733	6.40	3.73	4.41		
0.767	9.23	1.767	14.39	2.767	6.40	3.77	4.41		
0.800	9.23	1.800	14.39	2.800	6.40	3.80	4.41		
0.833	9.23	1.833	14.39	2.833	6.40	3.83	4.41		
0.867	12.99	1.867	11.62	2.867	5.93	3.87	4.21		
0.900	12.99	1.900	11.62	2.900	5.93	3.90	4.21		
0.933	12.99	1.933	11.62	2.933	5.93	3.93	4.21		
0.967	12.99	1.967	11.62	2.967	5.93	3.97	4.21		
1.000	12.99	2.000	11.62	3.000	5.93	4.00	4.21		

Unit Hyd Qpeak (cms)= 1.017

PEAK FLOW (cms)= 0.232 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 19.285
TOTAL RAINFALL (mm)= 60.418
RUNOFF COEFFICIENT = 0.319

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

V V I SSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\dauid.mcnau1\AppData\Local\Civica\5H5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\c9386
Summary filename: C:\Users\dauid.mcnau1\AppData\Local\Civica\5H5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\c9386

DATE: 08-03-2026 TIME: 07:03:06

USER:

COMMENTS: _____

** SIMULATION : 5 - 50-year **

CHICAGO STORM | IDF curve parameters: A= 896.910
Ptotal= 66.78 mm | B= 1.500
C= 0.726
used in: INTENSITY = A / (t + B)^C
Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	247.60	230.45
10.	152.60	152.29
15.	114.90	117.18
30.	70.80	73.28
60.	43.60	45.08
120.	26.90	27.50
360.	12.50	12.46
720.	7.70	7.55
1440.	4.70	4.57

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.23	1.00	29.20	2.00	10.84	3.00	6.07
0.17	5.88	1.17	152.29	2.17	9.48	3.17	5.70
0.33	6.77	1.33	36.94	2.33	8.46	3.33	5.38
0.50	8.06	1.50	21.51	2.50	7.67	3.50	5.09
0.67	10.15	1.67	15.85	2.67	7.04	3.67	4.84
0.83	14.31	1.83	12.79	2.83	6.51	3.83	4.62

CALIB
NASHYD (0005) | Area (ha)= 2.93 Curve Number (CN)= 71.0
ID= 1 DT= 2.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.23	1.033	29.20	2.033	10.84	3.03	6.07
0.067	5.23	1.067	29.20	2.067	10.84	3.07	6.07
0.100	5.23	1.100	29.20	2.100	10.84	3.10	6.07
0.133	5.23	1.133	29.20	2.133	10.84	3.13	6.07
0.167	5.23	1.167	29.21	2.167	10.84	3.17	6.07
0.200	5.88	1.200	152.29	2.200	9.48	3.20	5.70
0.233	5.88	1.233	152.29	2.233	9.48	3.23	5.70
0.267	5.88	1.267	152.29	2.267	9.48	3.27	5.70
0.300	5.88	1.300	152.29	2.300	9.48	3.30	5.70
0.333	5.88	1.333	152.29	2.333	9.48	3.33	5.70
0.367	6.77	1.367	36.94	2.367	8.46	3.37	5.38
0.400	6.77	1.400	36.94	2.400	8.46	3.40	5.38
0.433	6.77	1.433	36.94	2.433	8.46	3.43	5.38
0.467	6.77	1.467	36.94	2.467	8.46	3.47	5.38
0.500	6.77	1.500	36.94	2.500	8.46	3.50	5.38
0.533	8.06	1.533	21.51	2.533	7.67	3.53	5.09
0.567	8.06	1.567	21.51	2.567	7.67	3.57	5.09
0.600	8.06	1.600	21.51	2.600	7.67	3.60	5.09
0.633	8.06	1.633	21.51	2.633	7.67	3.63	5.09
0.667	8.06	1.667	21.51	2.667	7.67	3.67	5.09
0.700	10.15	1.700	15.85	2.700	7.04	3.70	4.84
0.733	10.15	1.733	15.85	2.733	7.04	3.73	4.84
0.767	10.15	1.767	15.85	2.767	7.04	3.77	4.84
0.800	10.15	1.800	15.85	2.800	7.04	3.80	4.84
0.833	10.15	1.833	15.85	2.833	7.04	3.83	4.84
0.867	14.31	1.867	12.79	2.867	6.51	3.87	4.62
0.900	14.31	1.900	12.79	2.900	6.51	3.90	4.62
0.933	14.31	1.933	12.79	2.933	6.51	3.93	4.62
0.967	14.31	1.967	12.79	2.967	6.51	3.97	4.62
1.000	14.31	2.000	12.79	3.000	6.51	4.00	4.62

Unit Hyd Qpeak (cms)= 1.017

PEAK FLOW (cms)= 0.283 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 23.047
TOTAL RAINFALL (mm)= 66.781
RUNOFF COEFFICIENT = 0.345

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

FINISH

V V I SSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLL

OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\dauid.mcnau1\AppData\Local\Civica\5H5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e
Summary filename: C:\Users\dauid.mcnau1\AppData\Local\Civica\5H5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e

TIME: 07:03:06

USER:

COMMENTS: _____

```
*****
** SIMULATION : 6 - 100-year                               **
*****
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```
CHICAGO STORM      IDF curve parameters: A= 981.377
Ptotal= 73.47 mm  B= 1.501
                   C= 0.725
used in:  INTENSITY = A / (t + B)^C
Duration of storm = 4.00 hrs
Storm time step   = 10.00 min
Time to peak ratio = 0.33
```

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	271.50	252.60
10.	167.20	167.03
15.	126.00	128.57
30.	77.60	80.45
60.	47.80	49.53
120.	29.40	30.24
360.	13.70	13.72
720.	8.40	8.31
1440.	5.20	5.03

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	5.77	1.00	32.15	2.00	11.96	3.00	6.70
0.17	6.49	1.17	167.03	2.17	10.46	3.17	6.29
0.33	7.47	1.33	40.64	2.33	9.34	3.33	5.93
0.50	8.89	1.50	23.69	2.50	8.46	3.50	5.62
0.67	11.20	1.67	17.47	2.67	7.76	3.67	5.35
0.83	15.77	1.83	14.10	2.83	7.19	3.83	5.10

CALIB	Area (ha)=	2.93	Curve Number (CN)=	71.0
NASHYD (0005)	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
ID= 1 DT= 2.0 min	U.H. Tp(hrs)=	0.11		

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

----- TRANSFORMED HETEROGRAPH -----							
TIME	RAIN	---	RAIN	---	TIME	RAIN	---
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	7.47	1.333	40.64	2.333	16.93	3.33	5.93
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62

0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10
0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Unit Hyd Qpeak (cms)= 1.017

PEAK FLOW	(cms)=	0.338	(i)
TIME TO PEAK	(hrs)=	1.400	
RUNOFF VOLUME	(mm)=	27.209	
TOTAL RAINFALL	(mm)=	73.472	
RUNOFF COEFFICIENT	=	0.370	

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

=====

V V I SSSS U U A L (v 6.2.2021)

V V I SS U U A A L

V V I SS U U A A A A L

V V I SS U U A A L

WV I SSSS UUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM

O O T T H H Y Y MM MM O O

O O T T H H Y M M O O

000 T T H H Y M M 000

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename: C:\Users\ david.mcnau11\AppData\Local\Civica\ \VH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\16e7e

Summary filename: C:\Users\ david.mcnau11\AppData\Local\Civica\ \VH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\16e7e

DATE: 08-03-2026 TIME: 07:04:53

USER:

COMMENTS: Post Development 2-yr to 100-yr

** SIMULATION : 1 - 2-year **

CHICAGO STORM IDf curve parameters: A= 443.644

Ptotal= 33.40 mm B= 1.500

C= 0.724

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs

Storm time step = 10.00 min

Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9996

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	123.30	114.42
10.	75.90	75.70
15.	57.20	58.29
30.	35.20	36.50
60.	21.70	22.48
120.	13.40	13.73
360.	6.20	6.24
720.	3.80	3.78
1440.	2.40	2.29

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.63	1.00	14.62	2.00	5.45	3.00	3.06
0.17	2.96	1.17	75.70	2.17	4.76	3.17	2.87
0.33	3.40	1.33	18.47	2.33	4.25	3.33	2.71
0.50	4.05	1.50	10.78	2.50	3.86	3.50	2.56
0.67	5.10	1.67	7.95	2.67	3.54	3.67	2.44
0.83	7.18	1.83	6.42	2.83	3.28	3.83	2.33

CALIB NASHYD (0002) Area (ha)= 2.70 Curve Number (CN)= 72.0

ID= 1 DT= 2.0 min Ia (mm)= 5.00 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	2.63	1.033	14.62	2.033	5.45	3.03	3.06
0.067	2.63	1.067	14.62	2.067	5.45	3.07	3.06
0.100	2.63	1.100	14.62	2.100	5.45	3.10	3.06
0.133	2.63	1.133	14.62	2.133	5.45	3.13	3.06
0.167	2.63	1.167	14.62	2.167	5.45	3.17	3.06
0.200	2.96	1.200	75.70	2.200	4.76	3.20	2.87
0.233	2.96	1.233	75.70	2.233	4.76	3.23	2.87
0.267	2.96	1.267	75.70	2.267	4.76	3.27	2.87
0.300	2.96	1.300	75.70	2.300	4.76	3.30	2.87
0.333	2.96	1.333	75.70	2.333	4.76	3.33	2.87
0.367	3.40	1.367	18.47	2.367	4.25	3.37	2.71
0.400	3.40	1.400	18.47	2.400	4.25	3.40	2.71
0.433	3.40	1.433	18.47	2.433	4.25	3.43	2.71
0.467	3.40	1.467	18.47	2.467	4.25	3.47	2.71
0.500	3.40	1.500	18.47	2.500	4.25	3.50	2.71
0.533	4.05	1.533	10.78	2.533	3.86	3.53	2.56
0.567	4.05	1.567	10.78	2.567	3.86	3.57	2.56
0.600	4.05	1.600	10.78	2.600	3.86	3.60	2.56
0.633	4.05	1.633	10.78	2.633	3.86	3.63	2.56
0.667	4.05	1.667	10.78	2.667	3.86	3.67	2.56
0.700	5.10	1.700	7.95	2.700	3.54	3.70	2.44
0.733	5.10	1.733	7.95	2.733	3.54	3.73	2.44
0.767	5.10	1.767	7.95	2.767	3.54	3.77	2.44
0.800	5.10	1.800	7.95	2.800	3.54	3.80	2.44
0.833	5.10	1.833	7.95	2.833	3.54	3.83	2.44
0.867	7.18	1.867	6.42	2.867	3.28	3.87	2.33
0.900	7.18	1.900	6.42	2.900	3.28	3.90	2.33
0.933	7.18	1.933	6.42	2.933	3.28	3.93	2.33
0.967	7.18	1.967	6.42	2.967	3.28	3.97	2.33
1.000	7.18	2.000	6.42	3.000	3.28	4.00	2.33

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.063 (i)

TIME TO PEAK (hrs)= 1.400

RUNOFF VOLUME (mm)= 6.337

TOTAL RAINFALL (mm)= 33.397

RUNOFF COEFFICIENT = 0.190

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

CALIB STANDHYD (0001) Area (ha)= 0.27

ID= 1 DT= 2.0 min Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

IMPERVIOUS 0.26

PERVIOUS (i) 0.01

Surface Area (ha)= 0.26

Dep. Storage (mm)= 1.00

Average Slope (%)= 1.00

Length (m)= 42.19

Mannings n = 0.013

0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	2.63	1.033	14.62	2.033	5.45	3.03	3.06
0.067	2.63	1.067	14.62	2.067	5.45	3.07	3.06
0.100	2.63	1.100	14.62	2.100	5.45	3.10	3.06
0.133	2.63	1.133	14.62	2.133	5.45	3.13	3.06
0.167	2.63	1.167	14.62	2.167	5.45	3.17	3.06
0.200	2.96	1.200	75.70	2.200	4.76	3.20	2.87
0.233	2.96	1.233	75.70	2.233	4.76	3.23	2.87
0.267	2.96	1.267	75.70	2.267	4.76	3.27	2.87
0.300	2.96	1.300	75.70	2.300	4.76	3.30	2.87
0.333	2.96	1.333	75.70	2.333	4.76	3.33	2.87
0.367	3.40	1.367	18.47	2.367	4.25	3.37	2.71
0.400	3.40	1.400	18.47	2.400	4.25	3.40	2.71
0.433	3.40	1.433	18.47	2.433	4.25	3.43	2.71
0.467	3.40	1.467	18.47	2.467	4.25	3.47	2.71
0.500	3.40	1.500	18.47	2.500	4.25	3.50	2.71
0.533	4.05	1.533	10.78	2.533	3.86	3.53	2.56
0.567	4.05	1.567	10.78	2.567	3.86	3.57	2.56
0.600	4.05	1.600	10.78	2.600	3.86	3.60	2.56
0.633	4.05	1.633	10.78	2.633	3.86	3.63	2.56
0.667	4.05	1.667	10.78	2.667	3.86	3.67	2.56
0.700	5.10	1.700	7.95	2.700	3.54	3.70	2.44

0.733	5.10	1.733	7.95	2.733	3.54	3.73	2.44
0.767	5.10	1.767	7.95	2.767	3.54	3.77	2.44
0.800	5.10	1.800	7.95	2.800	3.54	3.80	2.44
0.833	5.10	1.833	7.95	2.833	3.54	3.83	2.44
0.867	7.18	1.867	6.42	2.867	3.28	3.87	2.33
0.900	7.18	1.900	6.42	2.900	3.28	3.90	2.33
0.933	7.18	1.933	6.42	2.933	3.28	3.93	2.33
0.967	7.18	1.967	6.42	2.967	3.28	3.97	2.33
1.000	7.18	2.000	6.42	3.000	3.28	4.00	2.33

Max.Eff.Inten.(mm/hr)= 75.70 14.13
over (min) 5.00 4.00
Storage Coeff. (min)= 1.70 (ii) 3.36 (ii)
Unit Hyd. Tpeak (min)= 4.00 4.00
Unit Hyd. peak (cms)= 0.44 0.31

PEAK FLOW (cms)= 0.05 0.00 0.055 (iii)
TIME TO PEAK (hrs)= 1.33 1.33 1.33
RUNOFF VOLUME (mm)= 32.40 7.50 31.90
TOTAL RAINFALL (mm)= 33.40 33.40 33.40
RUNOFF COEFFICIENT = 0.97 0.22 0.96

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 71.0 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.

DUHYD (0003)				
Inlet Cap.= 0.111				
#of Inlets= 1				
Total(cms)= 0.1				
TOTAL HYD. (ID= 1):	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	0.27	0.05	1.33	31.90
MAJOR SYS. (ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS. (ID= 3):	0.27	0.05	1.33	31.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)				
1 + 2 = 3				
*** W A R N I N G :	HYDROGRAPH	0003 <ID= 2> IS DRY.		
*** W A R N I N G :	HYDROGRAPH	0003 = HYDROGRAPH 0001		
ID1= 1 (0002):	2.70	0.063	1.40	6.34
+ ID2= 2 (0003):	0.00	0.000	0.00	0.00
ID = 3 (0004):	2.70	0.063	1.40	6.34

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

V V I SSSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

OOO TTTTT TTTTT H H Y Y M M OOO TM
O O T T H H Y Y M M O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\david.mcnaul\AppData\Local\Civica\XH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\876a1
Summary filename: C:\Users\david.mcnaul\AppData\Local\Civica\XH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\876a1

DATE: 08-03-2026

TIME: 07:04:53

USER:

COMMENTS: _____

** SIMULATION : 2 - 5-year

CHICAGO STORM	IDF curve parameters: A= 589.626
Ptotal= 44.14 mm	B= 1.507
	C= 0.725
	used in: INTENSITY = A / (t + B)^C
	Duration of storm = 4.00 hrs
	Storm time step = 10.00 min
	Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	163.00	151.66
10.	100.40	100.32
15.	75.60	77.23
30.	46.60	48.33
60.	28.70	29.76
120.	17.70	18.17
360.	8.20	8.24
720.	5.10	4.99
1440.	3.10	3.02

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.47	1.00	19.32	2.00	7.19	3.00	4.03
0.17	3.90	1.17	100.32	2.17	6.28	3.17	3.78
0.33	4.49	1.33	24.43	2.33	5.61	3.33	3.57
0.50	5.34	1.50	14.24	2.50	5.09	3.50	3.38
0.67	6.73	1.67	10.50	2.67	4.67	3.67	3.21
0.83	9.48	1.83	8.47	2.83	4.32	3.83	3.06

CALIB			
NASHYD (0002)	Area (ha)= 2.70	Curve Number (CN)= 72.0	
ID= 1 DT= 2.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.11		

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.47	1.033	19.32	2.033	7.19	3.03	4.03
0.067	3.47	1.067	19.32	2.067	7.19	3.07	4.03
0.100	3.47	1.100	19.32	2.100	7.19	3.10	4.03
0.133	3.47	1.133	19.32	2.133	7.19	3.13	4.03
0.167	3.47	1.167	19.32	2.167	7.19	3.17	4.03
0.200	3.90	1.200	100.32	2.200	6.28	3.20	3.78
0.233	3.90	1.233	100.32	2.233	6.28	3.23	3.78
0.267	3.90	1.267	100.32	2.267	6.28	3.27	3.78
0.300	3.90	1.300	100.32	2.300	6.28	3.30	3.78
0.333	3.90	1.333	100.32	2.333	6.28	3.33	3.78
0.367	4.49	1.367	24.43	2.367	5.61	3.37	3.57
0.400	4.49	1.400	24.43	2.400	5.61	3.40	3.57
0.433	4.49	1.433	24.43	2.433	5.61	3.43	3.57
0.467	4.49	1.467	24.43	2.467	5.61	3.47	3.57
0.500	4.49	1.500	24.43	2.500	5.61	3.50	3.57
0.533	5.34	1.533	14.24	2.533	5.09	3.53	3.38
0.567	5.34	1.567	14.24	2.567	5.09	3.57	3.38
0.600	5.34	1.600	14.24	2.600	5.09	3.60	3.38
0.633	5.34	1.633	14.24	2.633	5.09	3.63	3.38
0.667	5.34	1.667	14.24	2.667	5.09	3.67	3.38
0.700	6.73	1.700	10.50	2.700	4.67	3.70	3.21
0.733	6.73	1.733	10.50	2.733	4.67	3.73	3.21

0.767	6.73	1.767	10.50	2.767	4.67	3.77	3.21
0.800	6.73	1.800	10.50	2.800	4.67	3.80	3.21
0.833	6.73	1.833	10.50	2.833	4.67	3.83	3.21
0.867	9.48	1.867	8.48	2.867	4.32	3.87	3.06
0.900	9.48	1.900	8.47	2.900	4.32	3.90	3.06
0.933	9.48	1.933	8.47	2.933	4.32	3.93	3.06
0.967	9.48	1.967	8.47	2.967	4.32	3.97	3.06
1.000	9.48	2.000	8.47	3.000	4.32	4.00	3.06

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.118 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 11.103
TOTAL RAINFALL (mm)= 44.143
RUNOFF COEFFICIENT = 0.252

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

CALIB STANDHYD (0001) ID= 1 DT= 2.0 min	Area (ha)= 0.27 Total Imp(%)= 98.00	Dir. Conn.(%)= 98.00
--	--	----------------------

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.26	0.01
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	42.19	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----							
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	3.47	1.033	19.32	2.033	7.19	3.03	4.03
0.067	3.47	1.067	19.32	2.067	7.19	3.07	4.03
0.100	3.47	1.100	19.32	2.100	7.19	3.10	4.03
0.133	3.47	1.133	19.32	2.133	7.19	3.13	4.03
0.167	3.47	1.167	19.32	2.167	7.19	3.17	4.03
0.200	3.90	1.200	100.32	2.200	6.28	3.20	3.78
0.233	3.90	1.233	100.32	2.233	6.28	3.23	3.78
0.267	3.90	1.267	100.32	2.267	6.28	3.27	3.78
0.300	3.90	1.300	100.32	2.300	6.28	3.30	3.78
0.333	3.90	1.333	100.32	2.333	6.28	3.33	3.78
0.367	4.49	1.367	24.43	2.367	5.61	3.37	3.57
0.400	4.49	1.400	24.43	2.400	5.61	3.40	3.57
0.433	4.49	1.433	24.43	2.433	5.61	3.43	3.57
0.467	4.49	1.467	24.43	2.467	5.61	3.47	3.57
0.500	4.49	1.500	24.43	2.500	5.61	3.50	3.57
0.533	5.34	1.533	14.24	2.533	5.09	3.53	3.38
0.567	5.34	1.567	14.24	2.567	5.09	3.57	3.38
0.600	5.34	1.600	14.24	2.600	5.09	3.60	3.38
0.633	5.34	1.633	14.24	2.633	5.09	3.63	3.38
0.667	5.34	1.667	14.24	2.667	5.09	3.67	3.38
0.700	6.73	1.700	10.50	2.700	4.67	3.70	3.21
0.733	6.73	1.733	10.50	2.733	4.67	3.73	3.21
0.767	6.73	1.767	10.50	2.767	4.67	3.77	3.21
0.800	6.73	1.800	10.50	2.800	4.67	3.80	3.21
0.833	6.73	1.833	10.50	2.833	4.67	3.83	3.21
0.867	9.48	1.867	8.48	2.867	4.32	3.87	3.06
0.900	9.48	1.900	8.47	2.900	4.32	3.90	3.06
0.933	9.48	1.933	8.47	2.933	4.32	3.93	3.06
0.967	9.48	1.967	8.47	2.967	4.32	3.97	3.06
1.000	9.48	2.000	8.47	3.000	4.32	4.00	3.06

Max.Eff.Inten.(mm/hr)= 100.32 24.20
over (min) 5.00 4.00
Storage Coeff. (min)= 1.52 (ii) 3.01 (ii)
Unit Hyd. Tpeak (min)= 4.00 4.00
Unit Hyd. peak (cms)= 0.46 0.33

PEAK FLOW (cms)= 0.07 0.00 0.073 (iii)
TIME TO PEAK (hrs)= 1.33 1.33 1.33
RUNOFF VOLUME (mm)= 43.14 12.42 42.53
TOTAL RAINFALL (mm)= 44.14 44.14 44.14
RUNOFF COEFFICIENT = 0.98 0.28 0.96

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 71.0 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.

DUHYD (0003) Inlet Cap.= 0.111 #of Inlets= 1 Total(cms)= 0.1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.27	0.07	1.33	42.53
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	0.27	0.07	1.33	42.53

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
*** W A R N I N G : HYDROGRAPH 0003 <ID= 2> IS DRY.				
*** W A R N I N G : HYDROGRAPH 0003 = HYDROGRAPH 0001				
ID1= 1 (0002):	2.70	0.118	1.40	11.10
+ ID2= 2 (0003):	0.00	0.000	0.00	0.00
ID = 3 (0004):	2.70	0.118	1.40	11.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

V V I SSSSS U U A L (v 6.2.2021)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL
OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y Y M M O O
OOO T T H H Y Y M M OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\david.mcnault\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1cc65-
Summary filename: C:\Users\david.mcnault\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1cc65-

DATE: 08-03-2026

TIME: 07:04:53

USER:

COMMENTS: _____

** SIMULATION : 3 - 10-year **

CHICAGO STORM Ptotal= 51.20 mm	IDF curve parameters: A= 687.677 B= 1.501 C= 0.726 used in: INTENSITY = A / (t + B)^C Duration of storm = 4.00 hrs Storm time step = 10.00 min Time to peak ratio = 0.33
-----------------------------------	--

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	189.70	176.67
10.	116.90	116.76
15.	88.00	89.84
30.	54.20	56.18
60.	33.40	34.57
120.	20.60	21.09
360.	9.50	9.55
720.	5.90	5.79
1440.	3.60	3.50

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.01	1.00	22.39	2.00	8.31	3.00	4.66
0.17	4.51	1.17	116.76	2.17	7.27	3.17	4.37
0.33	5.19	1.33	28.32	2.33	6.49	3.33	4.12
0.50	6.18	1.50	16.49	2.50	5.88	3.50	3.90
0.67	7.78	1.67	12.15	2.67	5.39	3.67	3.71
0.83	10.97	1.83	9.81	2.83	4.99	3.83	3.54

CALIB NASHYD (0002) ID= 1 DT= 2.0 min	Area (ha)= 2.70 Ia (mm)= 5.00 U.H. Tp(hrs)= 0.11	Curve Number (CN)= 72.0 # of Linear Res.(N)= 3.00
--	--	--

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.01	1.033	22.39	2.033	8.31	3.03	4.66
0.067	4.01	1.067	22.39	2.067	8.31	3.07	4.66
0.100	4.01	1.100	22.39	2.100	8.31	3.10	4.66
0.133	4.01	1.133	22.39	2.133	8.31	3.13	4.66
0.167	4.01	1.167	22.39	2.167	8.31	3.17	4.66
0.200	4.51	1.200	116.76	2.200	7.27	3.20	4.37
0.233	4.51	1.233	116.76	2.233	7.27	3.23	4.37
0.267	4.51	1.267	116.76	2.267	7.27	3.27	4.37
0.300	4.51	1.300	116.76	2.300	7.27	3.30	4.37
0.333	4.51	1.333	116.76	2.333	7.27	3.33	4.37
0.367	5.19	1.367	28.32	2.367	6.49	3.37	4.12
0.400	5.19	1.400	28.32	2.400	6.49	3.40	4.12
0.433	5.19	1.433	28.32	2.433	6.49	3.43	4.12
0.467	5.19	1.467	28.32	2.467	6.49	3.47	4.12
0.500	5.19	1.500	28.32	2.500	6.49	3.50	4.12
0.533	6.18	1.533	16.49	2.533	5.88	3.53	3.90
0.567	6.18	1.567	16.49	2.567	5.88	3.57	3.90
0.600	6.18	1.600	16.49	2.600	5.88	3.60	3.90
0.633	6.18	1.633	16.49	2.633	5.88	3.63	3.90
0.667	6.18	1.667	16.49	2.667	5.88	3.67	3.90
0.700	7.78	1.700	12.15	2.700	5.40	3.70	3.71
0.733	7.78	1.733	12.15	2.733	5.39	3.73	3.71
0.767	7.78	1.767	12.15	2.767	5.39	3.77	3.71
0.800	7.78	1.800	12.15	2.800	5.39	3.80	3.71
0.833	7.78	1.833	12.15	2.833	5.39	3.83	3.71
0.867	10.97	1.867	9.81	2.867	4.99	3.87	3.54
0.900	10.97	1.900	9.81	2.900	4.99	3.90	3.54
0.933	10.97	1.933	9.81	2.933	4.99	3.93	3.54
0.967	10.97	1.967	9.81	2.967	4.99	3.97	3.54
1.000	10.97	2.000	9.81	3.000	4.99	4.00	3.54

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.161 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 14.716
TOTAL RAINFALL (mm)= 51.202
RUNOFF COEFFICIENT = 0.287

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

CALIB STANDHYD (0001) ID= 1 DT= 2.0 min	Area (ha)= 0.27 Total Imp(%)= 98.00	Dir. Conn.(%)= 98.00
--	--	----------------------

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.26	0.01
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	42.19	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.01	1.033	22.39	2.033	8.31	3.03	4.66
0.067	4.01	1.067	22.39	2.067	8.31	3.07	4.66
0.100	4.01	1.100	22.39	2.100	8.31	3.10	4.66
0.133	4.01	1.133	22.39	2.133	8.31	3.13	4.66
0.167	4.01	1.167	22.39	2.167	8.31	3.17	4.66
0.200	4.51	1.200	116.76	2.200	7.27	3.20	4.37
0.233	4.51	1.233	116.76	2.233	7.27	3.23	4.37
0.267	4.51	1.267	116.76	2.267	7.27	3.27	4.37
0.300	4.51	1.300	116.76	2.300	7.27	3.30	4.37
0.333	4.51	1.333	116.76	2.333	7.27	3.33	4.37
0.367	5.19	1.367	28.32	2.367	6.49	3.37	4.12
0.400	5.19	1.400	28.32	2.400	6.49	3.40	4.12
0.433	5.19	1.433	28.32	2.433	6.49	3.43	4.12
0.467	5.19	1.467	28.32	2.467	6.49	3.47	4.12
0.500	5.19	1.500	28.32	2.500	6.49	3.50	4.12
0.533	6.18	1.533	16.49	2.533	5.88	3.53	3.90
0.567	6.18	1.567	16.49	2.567	5.88	3.57	3.90
0.600	6.18	1.600	16.49	2.600	5.88	3.60	3.90
0.633	6.18	1.633	16.49	2.633	5.88	3.63	3.90
0.667	6.18	1.667	16.49	2.667	5.88	3.67	3.90
0.700	7.78	1.700	12.15	2.700	5.40	3.70	3.71
0.733	7.78	1.733	12.15	2.733	5.39	3.73	3.71
0.767	7.78	1.767	12.15	2.767	5.39	3.77	3.71
0.800	7.78	1.800	12.15	2.800	5.39	3.80	3.71
0.833	7.78	1.833	12.15	2.833	5.39	3.83	3.71
0.867	10.97	1.867	9.81	2.867	4.99	3.87	3.54
0.900	10.97	1.900	9.81	2.900	4.99	3.90	3.54
0.933	10.97	1.933	9.81	2.933	4.99	3.93	3.54
0.967	10.97	1.967	9.81	2.967	4.99	3.97	3.54
1.000	10.97	2.000	9.81	3.000	4.99	4.00	3.54

Max.Eff.Inten.(mm/hr)=	116.76	31.99
over (min)	5.00	4.00
Storage Coeff. (min)=	1.43 (ii)	2.83 (ii)
Unit Hyd. Tpeak (min)=	4.00	4.00
Unit Hyd. peak (cms)=	0.46	0.34

PEAK FLOW (cms)=	0.08	0.00	*TOTALS*
TIME TO PEAK (hrs)=	1.33	1.33	0.085 (iii)
RUNOFF VOLUME (mm)=	50.20	16.10	1.33
TOTAL RAINFALL (mm)=	51.20	51.20	49.52
RUNOFF COEFFICIENT =	0.98	0.31	51.20
			0.97

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 71.0 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.

DUHYD (0003) Inlet Cap.= 0.111 #of Inlets= 1 Total(cms)= 0.1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD. (ID= 1):	0.27	0.09	1.33	49.52
MAJOR SYS. (ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS. (ID= 3):	0.27	0.09	1.33	49.52

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
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*** W A R N I N G : HYDROGRAPH 0003 <ID= 2> IS DRY.
*** W A R N I N G : HYDROGRAPH 0003 = HYDROGRAPH 0001
ID1= 1 (0002): 2.70 0.161 1.40 14.72
+ ID2= 2 (0003): 0.00 0.000 0.00 0.00
=====

ID = 3 (0004): 2.70 0.161 1.40 14.72

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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V V I SSSSS U U A L (v 6.2.2021)

V V I SS U U A A L

V V I SS U U A A A A L

V V I SS U U A A L

VV I SSSSS UUUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM

O O T T H H Y Y MM MM O O

O O T T H H Y Y M M O O

000 T T H H Y Y M M 000

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\david.mcnaull\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\6ab2f
Summary filename: C:\Users\david.mcnaull\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\6ab2f

DATE: 08-03-2026 TIME: 07:04:53

USER:

COMMENTS: _____

** SIMULATION : 4 - 25-year **

CHICAGO STORM Ptotal= 60.42 mm
IDF curve parameters: A= 802.590
B= 1.500
C= 0.724
used in: INTENSITY = A / (t + B)^C
Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9996

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	222.70	206.99
10.	137.20	136.95
15.	103.30	105.45
30.	63.60	66.03
60.	39.20	40.68
120.	24.10	24.85
360.	11.20	11.28
720.	6.90	6.84
1440.	4.30	4.14

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.76	1.00	26.45	2.00	9.86	3.00	5.53
0.17	5.35	1.17	136.95	2.17	8.62	3.17	5.19
0.33	6.16	1.33	33.42	2.33	7.70	3.33	4.90
0.50	7.33	1.50	19.50	2.50	6.98	3.50	4.64
0.67	9.23	1.67	14.39	2.67	6.40	3.67	4.41
0.83	12.99	1.83	11.62	2.83	5.93	3.83	4.21

CALIB NASHYD (0002)
ID= 1 DT= 2.0 min
Area (ha)= 2.70
Ia (mm)= 5.00
U.H. Tp(hrs)= 0.11
Curve Number (CN)= 72.0
of Linear Res.(N)= 3.00

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.76	1.033	26.45	2.033	9.86	3.03	5.53
0.067	4.76	1.067	26.45	2.067	9.86	3.07	5.53
0.100	4.76	1.100	26.45	2.100	9.86	3.10	5.53
0.133	4.76	1.133	26.45	2.133	9.86	3.13	5.53
0.167	4.76	1.167	26.45	2.167	9.86	3.17	5.53
0.200	5.35	1.200	136.95	2.200	8.62	3.20	5.19
0.233	5.35	1.233	136.95	2.233	8.62	3.23	5.19
0.267	5.35	1.267	136.95	2.267	8.62	3.27	5.19
0.300	5.35	1.300	136.95	2.300	8.62	3.30	5.19
0.333	5.35	1.333	136.95	2.333	8.62	3.33	5.19
0.367	6.16	1.367	33.42	2.367	7.70	3.37	4.90
0.400	6.16	1.400	33.42	2.400	7.70	3.40	4.90
0.433	6.16	1.433	33.42	2.433	7.70	3.43	4.90
0.467	6.16	1.467	33.42	2.467	7.70	3.47	4.90
0.500	6.16	1.500	33.42	2.500	7.70	3.50	4.90
0.533	7.33	1.533	19.50	2.533	6.98	3.53	4.64
0.567	7.33	1.567	19.50	2.567	6.98	3.57	4.64
0.600	7.33	1.600	19.50	2.600	6.98	3.60	4.64
0.633	7.33	1.633	19.50	2.633	6.98	3.63	4.64
0.667	7.33	1.667	19.50	2.667	6.98	3.67	4.64
0.700	9.23	1.700	14.39	2.700	6.40	3.70	4.41
0.733	9.23	1.733	14.39	2.733	6.40	3.73	4.41
0.767	9.23	1.767	14.39	2.767	6.40	3.77	4.41
0.800	9.23	1.800	14.39	2.800	6.40	3.80	4.41
0.833	9.23	1.833	14.39	2.833	6.40	3.83	4.41
0.867	12.99	1.867	11.62	2.867	5.93	3.87	4.21
0.900	12.99	1.900	11.62	2.900	5.93	3.90	4.21
0.933	12.99	1.933	11.62	2.933	5.93	3.93	4.21
0.967	12.99	1.967	11.62	2.967	5.93	3.97	4.21
1.000	12.99	2.000	11.62	3.000	5.93	4.00	4.21

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.222 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 19.906
TOTAL RAINFALL (mm)= 60.418
RUNOFF COEFFICIENT = 0.329

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

CALIB STANDHYD (0001)
ID= 1 DT= 2.0 min
Area (ha)= 0.27
Total Imp(%)= 98.00
Dir. Conn.(%)= 98.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.26 0.01
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 1.00 2.00
Length (m)= 42.19 40.00
Mannings n = 0.013 0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	4.76	1.033	26.45	2.033	9.86	3.03	5.53
0.067	4.76	1.067	26.45	2.067	9.86	3.07	5.53
0.100	4.76	1.100	26.45	2.100	9.86	3.10	5.53
0.133	4.76	1.133	26.45	2.133	9.86	3.13	5.53
0.167	4.76	1.167	26.45	2.167	9.86	3.17	5.53
0.200	5.35	1.200	136.95	2.200	8.62	3.20	5.19
0.233	5.35	1.233	136.95	2.233	8.62	3.23	5.19
0.267	5.35	1.267	136.95	2.267	8.62	3.27	5.19
0.300	5.35	1.300	136.95	2.300	8.62	3.30	5.19
0.333	5.35	1.333	136.95	2.333	8.62	3.33	5.19
0.367	6.16	1.367	33.42	2.367	7.70	3.37	4.90
0.400	6.16	1.400	33.42	2.400	7.70	3.40	4.90

0.433	6.16	1.433	33.42	2.433	7.70	3.43	4.90
0.467	6.16	1.467	33.42	2.467	7.70	3.47	4.90
0.500	6.16	1.500	33.42	2.500	7.70	3.50	4.90
0.533	7.33	1.533	19.50	2.533	6.98	3.53	4.64
0.567	7.33	1.567	19.50	2.567	6.98	3.57	4.64
0.600	7.33	1.600	19.50	2.600	6.98	3.60	4.64
0.633	7.33	1.633	19.50	2.633	6.98	3.63	4.64
0.667	7.33	1.667	19.50	2.667	6.98	3.67	4.64
0.700	9.23	1.700	14.39	2.700	6.40	3.70	4.41
0.733	9.23	1.733	14.39	2.733	6.40	3.73	4.41
0.767	9.23	1.767	14.39	2.767	6.40	3.77	4.41
0.800	9.23	1.800	14.39	2.800	6.40	3.80	4.41
0.833	9.23	1.833	14.39	2.833	6.40	3.83	4.41
0.867	12.99	1.867	11.62	2.867	5.93	3.87	4.21
0.900	12.99	1.900	11.62	2.900	5.93	3.90	4.21
0.933	12.99	1.933	11.62	2.933	5.93	3.93	4.21
0.967	12.99	1.967	11.62	2.967	5.93	3.97	4.21
1.000	12.99	2.000	11.62	3.000	5.93	4.00	4.21

Max.Eff.Inten.(mm/hr)= 136.95 42.89
over (min) 5.00 4.00
Storage Coeff. (min)= 1.34 (ii) 2.65 (ii)
Unit Hyd. Tpeak (min)= 4.00 4.00
Unit Hyd. peak (cms)= 0.47 0.36

PEAK FLOW (cms)= 0.10 0.00
TIME TO PEAK (hrs)= 1.33 1.33
RUNOFF VOLUME (mm)= 59.42 21.34
TOTAL RAINFALL (mm)= 60.42 60.42
RUNOFF COEFFICIENT = 0.98 0.35

TOTALS
0.100 (iii)
1.33
58.65
60.42
0.97

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 71.0 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.

DUHYD (0003) Inlet Cap.= 0.111 #of Inlets= 1 Total(cms)= 0.1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.27	0.10	1.33	58.65
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	0.27	0.10	1.33	58.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
*** W A R N I N G : HYDROGRAPH 0003 <ID= 2> IS DRY.				
*** W A R N I N G : HYDROGRAPH 0003 = HYDROGRAPH 0001				
ID1= 1 (0002):	2.70	0.222	1.40	19.91
+ ID2= 2 (0003):	0.00	0.000	0.00	0.00
ID = 3 (0004):	2.70	0.222	1.40	19.91

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

V	V	I	SSSS	U	U	A	L	(v 6.2.2021)
V	V	I	SS	U	U	A	A	L
V	V	I	SS	U	U	AAAA	L	
V	V	I	SS	U	U	A	A	L
VV	I	SSSS	UUUU	A	A	LLLL		

000	TTTT	TTTT	H	H	Y	Y	M	M	000	TM	
O	O	T	T	H	H	Y	Y	MM	MM	O	O
O	O	T	T	H	H	Y	M	M	M	O	O
000	T	T	H	H	Y	M	M	M	M	000	

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\dauid.mcnaull\AppData\Local\Civica\XH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\c9386
Summary filename: C:\Users\dauid.mcnaull\AppData\Local\Civica\XH5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\c9386

DATE: 08-03-2026

TIME: 07:04:54

USER:

COMMENTS: _____

** SIMULATION : 5 - 50-year **

CHICAGO STORM Ptotal= 66.78 mm	IDF curve parameters: A= 896.910 B= 1.500 C= 0.726 used in: INTENSITY = A / (t + B) ^{AC} Duration of storm = 4.00 hrs Storm time step = 10.00 min Time to peak ratio = 0.33
-----------------------------------	--

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	247.60	230.45
10.	152.60	152.29
15.	114.90	117.18
30.	70.80	73.28
60.	43.60	45.08
120.	26.90	27.50
360.	12.50	12.46
720.	7.70	7.55
1440.	4.70	4.57

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.23	1.00	29.20	2.00	10.84	3.00	6.07
0.17	5.88	1.17	152.29	2.17	9.48	3.17	5.70
0.33	6.77	1.33	36.94	2.33	8.46	3.33	5.38
0.50	8.06	1.50	21.51	2.50	7.67	3.50	5.09
0.67	10.15	1.67	15.85	2.67	7.04	3.67	4.84
0.83	14.31	1.83	12.79	2.83	6.51	3.83	4.62

CALIB NASHYD (0002) ID= 1 DT= 2.0 min	Area (ha)= 2.70 Ia (mm)= 5.00 U.H. Tp(hrs)= 0.11	Curve Number (CN)= 72.0 # of Linear Res.(N)= 3.00
--	--	--

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.23	1.033	29.20	2.033	10.84	3.033	6.07
0.067	5.23	1.067	29.20	2.067	10.84	3.067	6.07
0.100	5.23	1.100	29.20	2.100	10.84	3.100	6.07
0.133	5.23	1.133	29.20	2.133	10.84	3.133	6.07
0.167	5.23	1.167	29.21	2.167	10.84	3.167	6.07
0.200	5.88	1.200	152.29	2.200	9.48	3.200	5.70
0.233	5.88	1.233	152.29	2.233	9.48	3.233	5.70
0.267	5.88	1.267	152.29	2.267	9.48	3.267	5.70
0.300	5.88	1.300	152.29	2.300	9.48	3.300	5.70
0.333	5.88	1.333	152.29	2.333	9.48	3.333	5.70
0.367	6.77	1.367	36.94	2.367	8.46	3.367	5.38
0.400	6.77	1.400	36.94	2.400	8.46	3.400	5.38
0.433	6.77	1.433	36.94	2.433	8.46	3.433	5.38

0.467	6.77	1.467	36.94	2.467	8.46	3.47	5.38
0.500	6.77	1.500	36.94	2.500	8.46	3.50	5.38
0.533	8.06	1.533	21.51	2.533	7.67	3.53	5.09
0.567	8.06	1.567	21.51	2.567	7.67	3.57	5.09
0.600	8.06	1.600	21.51	2.600	7.67	3.60	5.09
0.633	8.06	1.633	21.51	2.633	7.67	3.63	5.09
0.667	8.06	1.667	21.51	2.667	7.67	3.67	5.09
0.700	10.15	1.700	15.85	2.700	7.04	3.70	4.84
0.733	10.15	1.733	15.85	2.733	7.04	3.73	4.84
0.767	10.15	1.767	15.85	2.767	7.04	3.77	4.84
0.800	10.15	1.800	15.85	2.800	7.04	3.80	4.84
0.833	10.15	1.833	15.85	2.833	7.04	3.83	4.84
0.867	14.31	1.867	12.79	2.867	6.51	3.87	4.62
0.900	14.31	1.900	12.79	2.900	6.51	3.90	4.62
0.933	14.31	1.933	12.79	2.933	6.51	3.93	4.62
0.967	14.31	1.967	12.79	2.967	6.51	3.97	4.62
1.000	14.31	2.000	12.79	3.000	6.51	4.00	4.62

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.271 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 23.760
TOTAL RAINFALL (mm)= 66.781
RUNOFF COEFFICIENT = 0.356

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

CALIB	Area (ha)= 0.27
STANDHYD (0001)	Total Imp(%)= 98.00
ID= 1 DT= 2.0 min	Dir. Conn.(%)= 98.00

Surface Area	(ha)= 0.26	IMPERVIOUS	PERVIOUS (i)
Dep. Storage	(mm)= 1.00		
Average Slope	(%)= 1.00		
Length	(m)= 42.19		
Mannings n	= 0.013		

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

--- TRANSFORMED HYETOGRAPH ---							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.033	5.23	1.033	29.20	2.033	10.84	3.03	6.07
0.067	5.23	1.067	29.20	2.067	10.84	3.07	6.07
0.100	5.23	1.100	29.20	2.100	10.84	3.10	6.07
0.133	5.23	1.133	29.20	2.133	10.84	3.13	6.07
0.167	5.23	1.167	29.21	2.167	10.84	3.17	6.07
0.200	5.88	1.200	152.29	2.200	9.48	3.20	5.70
0.233	5.88	1.233	152.29	2.233	9.48	3.23	5.70
0.267	5.88	1.267	152.29	2.267	9.48	3.27	5.70
0.300	5.88	1.300	152.29	2.300	9.48	3.30	5.70
0.333	5.88	1.333	152.29	2.333	9.48	3.33	5.70
0.367	6.77	1.367	36.94	2.367	8.46	3.37	5.38
0.400	6.77	1.400	36.94	2.400	8.46	3.40	5.38
0.433	6.77	1.433	36.94	2.433	8.46	3.43	5.38
0.467	6.77	1.467	36.94	2.467	8.46	3.47	5.38
0.500	6.77	1.500	36.94	2.500	8.46	3.50	5.38
0.533	8.06	1.533	21.51	2.533	7.67	3.53	5.09
0.567	8.06	1.567	21.51	2.567	7.67	3.57	5.09
0.600	8.06	1.600	21.51	2.600	7.67	3.60	5.09
0.633	8.06	1.633	21.51	2.633	7.67	3.63	5.09
0.667	8.06	1.667	21.51	2.667	7.67	3.67	5.09
0.700	10.15	1.700	15.85	2.700	7.04	3.70	4.84
0.733	10.15	1.733	15.85	2.733	7.04	3.73	4.84
0.767	10.15	1.767	15.85	2.767	7.04	3.77	4.84
0.800	10.15	1.800	15.85	2.800	7.04	3.80	4.84
0.833	10.15	1.833	15.85	2.833	7.04	3.83	4.84
0.867	14.31	1.867	12.79	2.867	6.51	3.87	4.62
0.900	14.31	1.900	12.79	2.900	6.51	3.90	4.62
0.933	14.31	1.933	12.79	2.933	6.51	3.93	4.62
0.967	14.31	1.967	12.79	2.967	6.51	3.97	4.62
1.000	14.31	2.000	12.79	3.000	6.51	4.00	4.62

Max.Eff.Inten.(mm/hr)= 152.29 51.58
over (min)= 5.00 4.00
Storage Coeff. (min)= 1.29 (ii) 2.54 (ii)
Unit Hyd. Tpeak (min)= 4.00 4.00
Unit Hyd. peak (cms)= 0.48 0.36

TOTALS

PEAK FLOW	(cms)=	0.11	0.00	0.111 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	65.78	25.21	64.97
TOTAL RAINFALL	(mm)=	66.78	66.78	66.78
RUNOFF COEFFICIENT	=	0.99	0.38	0.97

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 71.0 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.

DUHYD (0003)	AREA	QPEAK	TPEAK	R.V.
Inlet Cap.= 0.111	(ha)	(cms)	(hrs)	(mm)
#of Inlets= 1				
Total(cms)= 0.1				
TOTAL HYD.(ID= 1):	0.27	0.11	1.33	64.97
MAJOR SYS.(ID= 2):	0.00	0.00	1.33	64.97
MINOR SYS.(ID= 3):	0.27	0.11	1.33	64.97

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	2.70	0.271	1.40	23.76
+ ID2= 2 (0003):	0.00	0.000	1.33	64.97
ID = 3 (0004):	2.70	0.271	1.40	23.76

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

V V I SSSSS U U A L (v 6.2.2021)
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 UUUU A A LLLLL
OOO TTTT TTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voim.dat
Output filename: C:\Users\david.mcnault\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e
Summary filename: C:\Users\david.mcnault\AppData\Local\Civica\vh5\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e

DATE: 08-03-2026

TIME: 07:04:53

USER:

COMMENTS: _____

** SIMULATION : 6 - 100-year **

CHICAGO STORM
Ptotal= 73.47 mm

IDF curve parameters: A= 981.377
B= 1.501
C= 0.725
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	271.50	252.60
10.	167.20	167.03
15.	126.00	128.57
30.	77.60	80.45
60.	47.80	49.53
120.	29.40	30.24
360.	13.70	13.72
720.	8.40	8.31
1440.	5.20	5.03

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.77	1.00	32.15	2.00	11.96	3.00	6.70
0.17	6.49	1.17	167.03	2.17	10.46	3.17	6.29
0.33	7.47	1.33	40.64	2.33	9.34	3.33	5.93
0.50	8.89	1.50	23.69	2.50	8.46	3.50	5.62
0.67	11.20	1.67	17.47	2.67	7.76	3.67	5.35
0.83	15.77	1.83	14.10	2.83	7.19	3.83	5.10

CALIB
NASHYD (0002)
ID= 1 DT= 2.0 min

Area (ha)= 2.70 Curve Number (CN)= 72.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.11

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	6.49	1.333	167.03	2.333	10.46	3.33	6.29
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62
0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10
0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Unit Hyd Qpeak (cms)= 0.938

PEAK FLOW (cms)= 0.322 (i)
TIME TO PEAK (hrs)= 1.400
RUNOFF VOLUME (mm)= 28.017

TOTAL RAINFALL (mm)= 73.472
RUNOFF COEFFICIENT = 0.381

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

CALIB
STANDHYD (0001)
ID= 1 DT= 2.0 min

Area (ha)= 0.27
Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.26	0.01
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	42.19	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	6.49	1.333	167.03	2.333	10.46	3.33	6.29
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62
0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10
0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Max.Eff.Inten.(mm/hr)= 167.03 over (min)= 5.00
Storage Coeff. (min)= 1.24 (ii) 2.45 (ii)
Unit Hyd. Tpeak (min)= 4.00
Unit Hyd. peak (cms)= 0.49 4.00

PEAK FLOW (cms)= 0.12 0.00
TIME TO PEAK (hrs)= 1.33 1.33
RUNOFF VOLUME (mm)= 72.47 29.48
TOTAL RAINFALL (mm)= 73.47 73.47
RUNOFF COEFFICIENT = 0.99 0.40 0.97

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 71.0 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.

DUHYD (0003)
Inlet Cap.= 0.111
#of Inlets= 1
Total(cms)= 0.1

AREA (ha) OPEAK (cms) TPEAK (hrs) R.V. (mm)
TOTAL HYD.(ID= 1): 0.27 0.12 1.33 71.61

MAJOR SYS.(ID= 2): 0.01 0.01 1.33 71.61
MINOR SYS.(ID= 3): 0.26 0.11 1.27 71.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)				
1 + 2 = 3				

ID1= 1 (0002):		AREA	QPEAK	TPEAK
		(ha)	(cms)	(hrs)
		2.70	0.322	1.40
+ ID2= 2 (0003):		0.01	0.011	1.33
				71.61
=====				
ID = 3 (0004):		2.71	0.322	1.40
				28.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

=====

V V I SSSS U U A L (v 6.2.2021)

V V I SS U U A A L

V V I SS U U A A A A L

V V I SS U U A A L

WV I SSSS UUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM

O O T T H H Y Y MM MM O O

O O T T H H Y M M O O

000 T T H H Y M M 000

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename: C:\Users\david.mcnaull\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e

Summary filename: C:\Users\david.mcnaull\AppData\Local\Civica\7879658b-d8b7-44d5-a265-4de3e90bb9e4\1c33e

DATE: 08-03-2026 TIME: 07:06:49

USER:

COMMENTS: Ditch and Culvert Flows - 100-yr

** SIMULATION : 6 - 100-year **

CHICAGO STORM IDf curve parameters: A= 981.377

Ptotal= 73.47 mm B= 1.501

C= 0.725

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs

Storm time step = 10.00 min

Time to peak ratio = 0.33

The CORRELATION coefficient is = 0.9997

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	271.50	252.60
10.	167.20	167.03
15.	126.00	128.57
30.	77.60	80.45
60.	47.80	49.53
120.	29.40	30.24
360.	13.70	13.72
720.	8.40	8.31
1440.	5.20	5.03

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	5.77	1.00	32.15	2.00	11.96	3.00	6.70
0.17	6.49	1.17	167.03	2.17	10.46	3.17	6.29
0.33	7.47	1.33	40.64	2.33	9.34	3.33	5.93
0.50	8.89	1.50	23.69	2.50	8.46	3.50	5.62
0.67	11.20	1.67	17.47	2.67	7.76	3.67	5.35
0.83	15.77	1.83	14.10	2.83	7.19	3.83	5.10

CALIB NASHYD (0010) Area (ha)= 8.46 Curve Number (CN)= 71.0

ID= 1 DT= 2.0 min Ia (mm)= 5.00 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.25

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	6.49	1.333	167.03	2.333	10.46	3.33	6.29
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62
0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10
0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Unit Hyd Qpeak (cms)= 1.293

PEAK FLOW (cms)= 0.591 (i)

TIME TO PEAK (hrs)= 1.567

RUNOFF VOLUME (mm)= 27.223

TOTAL RAINFALL (mm)= 73.472

RUNOFF COEFFICIENT = 0.371

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

CALIB NASHYD (0012) Area (ha)= 2.28 Curve Number (CN)= 71.0

ID= 1 DT= 2.0 min Ia (mm)= 5.00 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.21

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	6.49	1.333	167.03	2.333	10.46	3.33	6.29
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62
0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10

0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Unit Hyd Qpeak (cms)= 0.415

PEAK FLOW (cms)= 0.178 (i) 
TIME TO PEAK (hrs)= 1.533
RUNOFF VOLUME (mm)= 27.223
TOTAL RAINFALL (mm)= 73.472
RUNOFF COEFFICIENT = 0.371

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

CALIB							
NASHYD	(0014)	Area (ha)=	1.03	Curve Number (CN)=	71.0		
ID= 1 DT= 2.0 min		Ia (mm)=	5.00	# of Linear Res.(N)=	3.00		
		U.H. Tp(hrs)=	0.16				

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.033	5.77	1.033	32.15	2.033	11.96	3.03	6.70
0.067	5.77	1.067	32.15	2.067	11.96	3.07	6.70
0.100	5.77	1.100	32.15	2.100	11.96	3.10	6.70
0.133	5.77	1.133	32.15	2.133	11.96	3.13	6.70
0.167	5.77	1.167	32.15	2.167	11.96	3.17	6.70
0.200	6.49	1.200	167.03	2.200	10.46	3.20	6.29
0.233	6.49	1.233	167.03	2.233	10.46	3.23	6.29
0.267	6.49	1.267	167.03	2.267	10.46	3.27	6.29
0.300	6.49	1.300	167.03	2.300	10.46	3.30	6.29
0.333	6.49	1.333	167.03	2.333	10.46	3.33	6.29
0.367	7.47	1.367	40.64	2.367	9.34	3.37	5.93
0.400	7.47	1.400	40.64	2.400	9.34	3.40	5.93
0.433	7.47	1.433	40.64	2.433	9.34	3.43	5.93
0.467	7.47	1.467	40.64	2.467	9.34	3.47	5.93
0.500	7.47	1.500	40.64	2.500	9.34	3.50	5.93
0.533	8.89	1.533	23.69	2.533	8.46	3.53	5.62
0.567	8.89	1.567	23.69	2.567	8.46	3.57	5.62
0.600	8.89	1.600	23.69	2.600	8.46	3.60	5.62
0.633	8.89	1.633	23.69	2.633	8.46	3.63	5.62
0.667	8.89	1.667	23.69	2.667	8.46	3.67	5.62
0.700	11.20	1.700	17.47	2.700	7.76	3.70	5.35
0.733	11.20	1.733	17.47	2.733	7.76	3.73	5.35
0.767	11.20	1.767	17.47	2.767	7.76	3.77	5.35
0.800	11.20	1.800	17.47	2.800	7.76	3.80	5.35
0.833	11.20	1.833	17.47	2.833	7.76	3.83	5.35
0.867	15.77	1.867	14.10	2.867	7.19	3.87	5.10
0.900	15.77	1.900	14.10	2.900	7.19	3.90	5.10
0.933	15.77	1.933	14.10	2.933	7.19	3.93	5.10
0.967	15.77	1.967	14.10	2.967	7.19	3.97	5.10
1.000	15.77	2.000	14.10	3.000	7.19	4.00	5.10

Unit Hyd Qpeak (cms)= 0.246

PEAK FLOW (cms)= 0.095 (i) 
TIME TO PEAK (hrs)= 1.467
RUNOFF VOLUME (mm)= 27.220
TOTAL RAINFALL (mm)= 73.472
RUNOFF COEFFICIENT = 0.370

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