

D. G. Biddle & Associates Limited

consulting engineers and planners

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January 25, 2018

Revised: January 16, 2019

Cavan Hills Veterinary Hospital
303 Highway 7A
Cavan Ont.
L0A 1C0

Attention: Mr. Richard Maser

**Re: Stormwater Management Report
Proposed Veterinary Clinic
303 Highway 7A
Cavan, Ontario
Our File: 116536**

Dear Sir:

In support of the Site Plan Application for the above referenced property at 303 Highway 7A, we herewith submit the following Stormwater Management Report. This report primarily addresses the Town of Cavan Monaghan water, sanitary, and stormwater management concerns and includes Servicing, Grading, Drainage and Erosion and Sediment Control Plans for the proposed development. This report identifies what is required to provide adequate servicing for the proposed development.

Please contact our office at your convenience, should you have any questions or require additional information on the enclosed report.

Yours truly,

D.G. BIDDLE & ASSOCIATES LIMITED

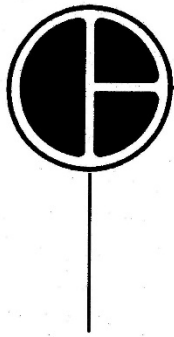
K.G. Keuning, P.Eng.

KGK/kgk

Encl.

\\FSHR\Staff\Job Files\116000\116536 Cavan Hills Vet Hospital\116536 Reports\116536 SWM Report.docx





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STORMWATER MANAGEMENT REPORT

FOR

PROPOSED VETERINARY CLINIC

303 HIGHWAY 7A

TOWNSHIP OF CAVAN MONAGHAN

TABLE OF CONTENTS

1.0	INTRODUCTION
2.0	SITE SERVICING
2.1	Water Services
2.2	Sanitary Services
2.3	Storm Services
3.0	STORMWATER MANAGEMENT
3.1	Stormwater Quantity
3.2	Stormwater Quality
4.0	TEMPORARY SEDIMENT AND EROSION CONTROLS
5.0	CONCLUSIONS

LIST OF FIGURES & SHEETS

FIGURE 1 - Site Location Plan

LIST OF DRAWINGS

116536-SG-1 - Site Grading & Servicing Plan
116536-SD-1 - Pre-Development Drainage Scheme
116536-SD-2 - Storm Drainage Plan
116536-ES-1 - Erosion and Sediment Control Plan

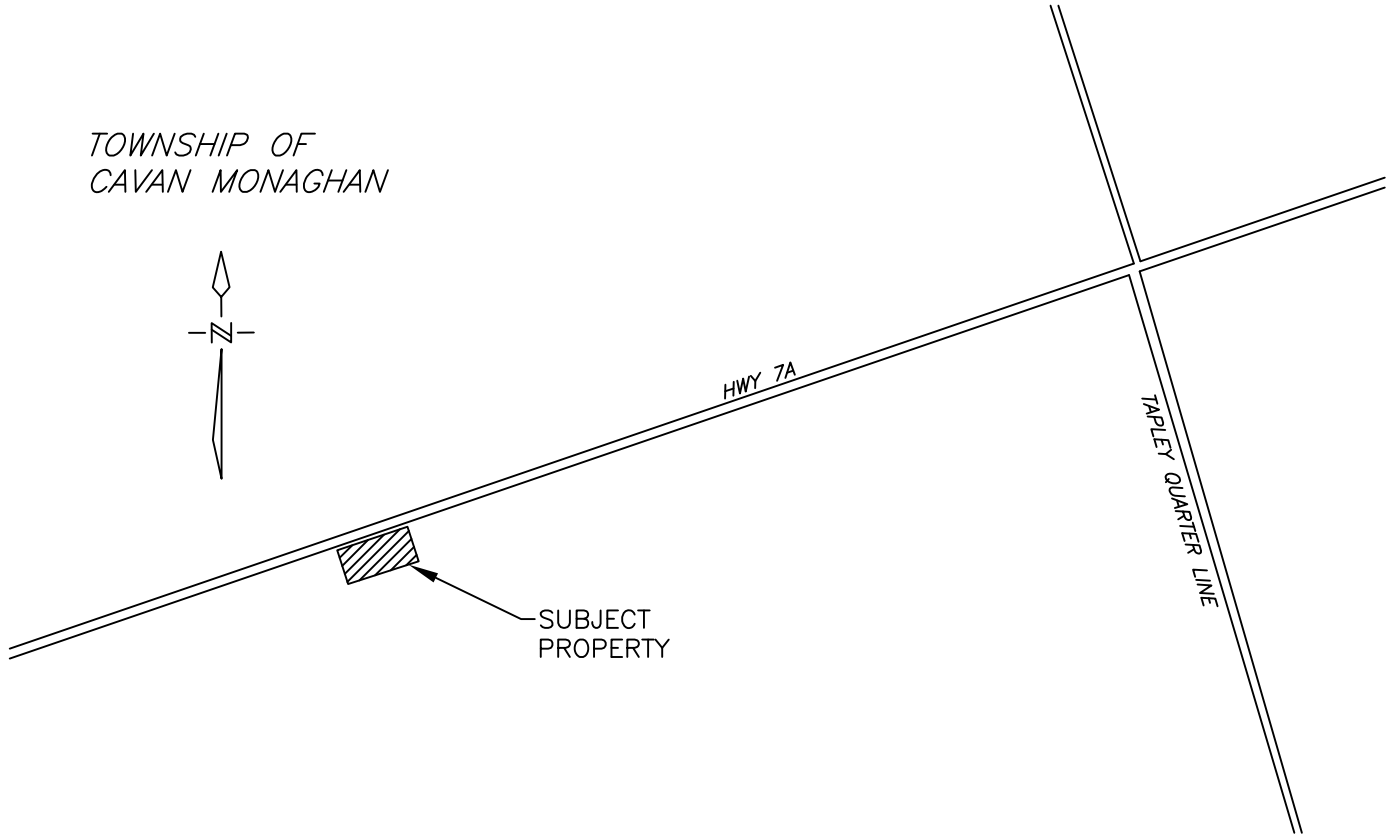
1.0 INTRODUCTION

The subject property is located on 303 Highway 7A in Cavan, Ontario which is located in Peterborough County. The property is 4.46ha in size. The property currently consists of an existing veterinary clinic building with an associated gravel parking lot. The remaining majority of the property remains undeveloped and consists of native vegetation. The site is bounded on the north by Highway 7A, on the east and west by rural residential properties and on the south by agricultural lands. A site location plan is attached as Figure 1.

The development proposes a new veterinary building and expanded parking lot serving both the existing and proposed building.

This report was prepared to address stormwater drainage, sanitary drainage and domestic water servicing opportunities for the proposed development. Servicing and storm water management are to be in accordance with the requirements of the Township of Cavan Monaghan and the Ministry of Transportation.

TOWNSHIP OF
CAVAN MONAGHAN



CAVAN HILLS VETERINARY – 303 HWY 7, CAVAN ON

SITE LOCATION PLAN



D.G. Biddle & Associates Limited
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SCALE N.T.S.
DRAWN K.G.K.
DESIGN
CHECKED
DATE JAN 2018

PROJECT
116536

DWG
FIG 1

2.0 SITE SERVICING

The Site Grading and Servicing is illustrated on drawing 116536 SG-1, appended to this report.

2.1 Water Services

Currently the site is serviced by an existing well. The proposed building is to be serviced by the existing well. The well connection and associated distribution pipes are to be designed by a qualified professional.

2.2 Sanitary Services

The site is currently serviced by an existing onsite septic system. During construction, the existing septic system is to be removed and replaced in order to accommodate the site's development. The septic system proposed is to be in accordance with Part 8 of the 2012 Ontario Building Code and is to be designed by a qualified septic designer.

2.3 Storm Services

Currently the site drains to the southeast where runoff sheet flows across a vegetated field without onsite quantity control. The development stormwater proposal is to capture runoff from the majority of impervious surfaces in a dry pond. The rooftop is to be drained to the proposed dry pond by means of a 200mm PVC storm sewer. Low Impact Development practices are to be implemented within the developed area to mitigate the increase in runoff and to promote groundwater infiltration.

Foundation drainage is to be discharged to grade, discharging from the south side of the building, as shown on drawing 116536 SG-1. The foundation drainage will flow to the existing field, where it will disperse and sheet flow to the southeast, ultimately following the existing drainage pattern.

3.0 STORMWATER MANAGEMENT

As noted above, there will be an increase in runoff generated through the proposed development. Therefore, a stormwater dry pond has been sized to capture and release runoff at a controlled rate to control post-development runoff to pre-development rates. Low Impact Development techniques are proposed to assist in runoff mitigation and infiltration.

3.1 Stormwater Quantity

The introduction of impervious surfaces, namely the proposed veterinary clinic and associated asphalt parking lot will result in an increase in the rate of storm water runoff. Therefore, a dry pond for quantity controls is proposed for this site. The asphalt area east of the building and the rooftop drainage will be directed to the stormwater management pond through a minor storm sewer system. The pond has a capacity to store a volume of approximately 264m³. The pond has been designed to discharge to the existing southeast watercourse. Post development peak flows will be attenuated to pre-development levels through the use of a 70mm plate orifice control device.

Additionally, to help mitigate stormwater runoff from pre to post development conditions, an infiltration gallery and a bioretention cell have been proposed to capture 25mm of runoff from the impervious areas tributary to them. A low impact development sizing spreadsheet has been appended to this report. Details have been included on the Site Grading Plan, drawing 116536 SG-1.

The pre-development site consists of three areas, 0.02 ha of an existing building, 0.12 ha of gravel parking and 4.32 ha of undeveloped lands. The existing building percent imperviousness has been modelled at 90%, with the gravel parking lot modelled at 80% impervious. The NASHYD was selected for undeveloped land, as it is 100% pervious. The CN value for all areas was selected as 74 after reviewing bore-hole samples and soils mapping from the property utilizing the MTO design charts for CN valued.

The post-development site consists of five areas, 0.02 ha of an existing building, 0.06 ha for the proposed building, 0.32 ha for asphalt parking, 0.12 ha for the MTO setback and 3.88 ha of undeveloped lands. The existing building, asphalt parking, and proposed building have been modelled with 90% imperviousness. The MTO setback lands were modelled as NASHYD as they are undeveloped green space. The NASHYD was selected for undeveloped land, as it is 100% pervious. The time of concentration and percent imperviousness for each area have been tabulated and is included appended to this report.

The pre and post development peak flows from the property were simulated from the property using the computer program Visual HYMO V3.0. The runoff from the developed portion of the site was simulated using the STANDHYD sub-routine. The runoff from the undeveloped green space was simulated using the NASHYD sub-routine. The dry pond and associated orifice control were simulated using the ROUTE RESERVOIR sub-routine. The dry pond stage-storage-discharge spreadsheet has been appended this report.

Pre and post development peak flow rates can be found summarized in Table 1. Detailed HYMO output is appended to this report.

TABLE 1: PRE & POST DEVELOPMENT PEAK FLOWS

RETURN FREQUENCY (YEARS)	PRE DEVELOPMENT FLOWS (L/s)	POST DEVELOPMENT FLOWS (L/s)	STORMWATER STORAGE REQUIRED (m³)
2	60	63	49
5	111	110	75
10	158	152	100
25	208	198	124
50	263	247	151
100	304	284	170

As reported above, post-development peak flows are generally less than or equal to the pre-development levels; therefore, no adverse impacts on the downstream watercourse are anticipated.

3.2 Stormwater Quality

With the relatively small increase in flows from the subject property, it is not expected to increase sediment loading from the subject property. The infiltration gallery and bioretention cell will serve to reduce flows from exiting the subject property overland, which will in turn reduce sediment transport.

4.0 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
2. Perimeter Silt Fence
3. Coir Logs protection L.I.D. features
4. Good Housekeeping Practices

The above techniques are illustrated on the Erosion and Sediment Control Plan, drawing 116536 ES-1.

5.0 CONCLUSIONS

The preceding report identifies and justified the methods in which the proposed development can be serviced in accordance with the Town of Cavan Monaghan and Ministry of Transportation requirements. The investigations into these requirements have resulted in the following conclusions for the Site Plan Application:

- The existing on-site well is to be utilized to service both the existing and proposed building.
- The existing septic system used to service the existing building is to be abandoned. A new septic system is to be installed that will have capacity for both the existing and proposed building.
- Stormwater quantity control is proposed in the form of a stormwater dry-pond. Low Impact Development techniques are proposed in the form of an infiltration gallery in the bottom of the dry pond and a bio-retention cell west of the septic area.
- There is no anticipated decrease in stormwater quality from the subject property. Low Impact Development techniques will assist in reducing runoff and in turn reduce sediment transport.
- Temporary sediment controls during construction can be managed by the use of perimeter enviro fence, construction vehicle access route and good housekeeping practices.

SCHEDULE 1

116536

Cavan Veterinary

Bioretention Cell A Sizing

i 15 mm/hr
Area 800 m²
Capture 25 mm
WQV 20 m³
vr 0.4
ts 48 hours

dc max $i*ts/vr$ max depth of rain garden
1800 mm

Therefore Use dc = 1400 mm

Mulch	vr	0.7	Bioreactive Soil	vr	0.3
	depth	0.075		depth	0.6
	Storage	0.0525 /m ²		Storage	0.18 /m ²
Pea Gravel	vr	0.4	Storage Reservoir	vr	0.4
	depth	0.1		depth	1.4
	Storage	0.04 /m ²		Storage	0.56 /m ²
	Total Storage	0.8325 /m ²			

Af $WQV/total\ storage$
24.0 m²

Proposed Dimensions

AREA 24.0 m² (2mx12m)
DEPTH 1.4 m

Infiltration Gallery B Sizing

i 15 mm/hr
Area 3000 m²
Capture 25 mm
WQV 75 m³
vr 0.4
ts 48 hours

dc max $i*ts/vr$ max depth of gallery
1800 mm

Therefore Use dc = 1500 mm

Af $WQV/(dc*vr)$ footprint area required
125.0 m²

Proposed Dimensions

AREA 129.0 m² Refer to SG-1 (Pond Bottom)
DEPTH 1.5 m

CAVAN HILLS VETERINARY - 303 HWY 7, CAVAN ON

116536

	ELEV m	AREA m ²	AVERAGE AREA m ²	DEPTH m	VOLUME m ³	TOTAL VOLUME m ³	ORIFICE 1	
							HEAD m	FLOW cms
Fluctuating	256.00	3.31				0.00	0.00	0
Pool			30.41	0.50	15.20			
	256.50	57.50				15.20	0.60	0.008055
			113.88	0.50	56.94			
	257.00	170.25				72.14	1.10	0.010906
			266.50	0.72	191.88			
	257.72	362.75				264.02	1.82	0.014028

Quality Orifice 1

$$Q=CA(2gh)^{0.5}$$

Diameter= 0.07 m

Area= 0.0038 m²

C= 0.61 (PLATE)

C/L Elev= 255.9 m

Name	Hydrograph Number	Hydrograph Type	CN Value*	Area	Length	Slope (%)	% Impervious	tc**	tp***
Pre-Dev Building	101	STANDHYD	74	0.02	N/A	N/A	N/A	N/A	N/A
Pre-Dev Pervious	102	NASHYD	74	4.32	325	3.70	N/A	0.57	0.38
Pre-Dev Gravel Driveway	103	STANDHYD	74	0.12	N/A	N/A	N/A	N/A	N/A
Post-Dev Pervious to Pond	201	NASHYD	74	0.18	103	5.00	N/A	0.29	0.19
Post Dev Building & Driveway to Pond	202	STANDHYD	74	0.3	N/A	N/A	90%	N/A	N/A
Post Dev Ex Building and Driveway Uncontrolled	205	STANDHYD	74	0.1	N/A	N/A	90%	N/A	N/A
Post Dev Pervious Uncontrolled	207	NASHYD	74	3.88	325	3.70	N/A	0.57	0.38

* CN based off MTO Design Chart 1.09

**tc calculated with the airport method

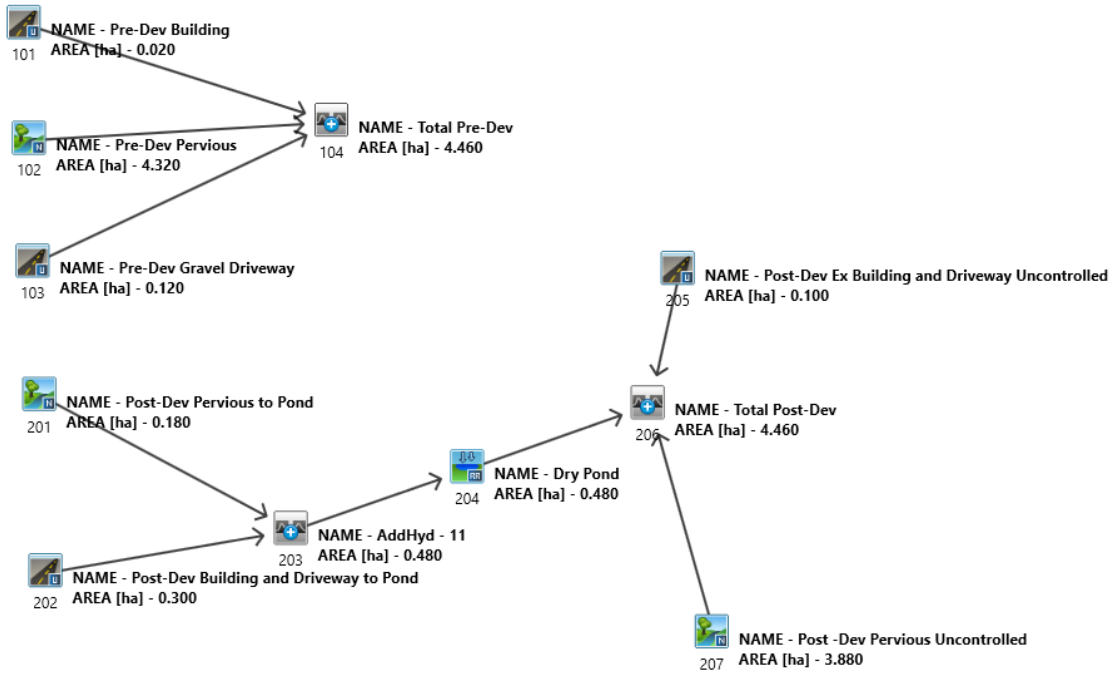
***tp = $2/3tc$

Design Chart 1.09: Soil Conservation Service Curve Numbers (Continued)

Land Use or Surface	Hydrologic Soil Group						
	A	AB	B	BC	C	CD	D
Fallow (special cases only)	77	82	86	89	91	93	94
Crop and other improved land	66** (62)	70** (68)	74	78	82	84	86 AMC I
Pasture & other unimproved land	58* (38)	62* (51)	65	71	76	79	81
Woodlots and forest	50* (30)	54* (44)	58	65	71	74	77
Impervious areas (paved)							98
Bare bedrock draining directly to stream by surface flow							98
Bare bedrock draining indirectly to stream as groundwater (usual case)							70
Lakes and wetlands							50

Notes

- (i) All values are based on AMC II except those marked by * (AMC III) or ** (mean of AMC II and AMC III).
- (ii) Values in brackets are AMC II and are to be used only for special cases.
- (iii) Table is not applicable to frozen soils or to periods in which snowmelt contributes to runoff.



```

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

000   TTTTT TTTTT 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)\VH Suite 3.0\VO2\voim.dat
 Output filename: C:\Users\kurtis.keuning\AppData\Local\Temp\ae0d7cf7-ada5-4831-89a8-1c75a857c144\Scenario.o
 Summary filename: C:\Users\kurtis.keuning\AppData\Local\Temp\ae0d7cf7-ada5-4831-89a8-1c75a857c144\Scenario.s

DATE: 01-16-2019 TIME: 07:36:10

USER:

COMMENTS: _____

 ** SIMULATION NUMBER: 1 **

 | CHICAGO STORM |
Ptotal= 34.03 mm

IDF curve parameters: A= 662.000
 B= 7.500
 C= 0.790
 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

2 YEAR

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.29	1.17	18.79	2.17	5.56	3.17	2.73
0.33	2.63	1.33	69.00	2.33	4.70	3.33	2.53
0.50	3.11	1.50	24.52	2.50	4.09	3.50	2.36
0.67	3.85	1.67	13.09	2.67	3.62	3.67	2.21
0.83	5.12	1.83	8.95	2.83	3.26	3.83	2.09
1.00	7.88	2.00	6.84	3.00	2.97	4.00	1.97

 | CALIB |
 | NASHYD (0102) |
ID= 1 DT= 5.0 min

Area (ha)= 4.32 Curve Number (CN)= 74.0
 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.38

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

----- TRANSFORMED HYETOGRAPH -----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.29	1.083	18.79	2.083	5.56	3.08	2.73
0.167	2.29	1.167	18.79	2.167	5.56	3.17	2.73
0.250	2.63	1.250	69.00	2.250	4.70	3.25	2.53
0.333	2.63	1.333	69.00	2.333	4.70	3.33	2.53
0.417	3.11	1.417	24.52	2.417	4.09	3.42	2.36
0.500	3.11	1.500	24.52	2.500	4.09	3.50	2.36
0.583	3.85	1.583	13.09	2.583	3.62	3.58	2.21
0.667	3.85	1.667	13.09	2.667	3.62	3.67	2.21
0.750	5.12	1.750	8.95	2.750	3.26	3.75	2.09
0.833	5.12	1.833	8.95	2.833	3.26	3.83	2.09
0.917	7.88	1.917	6.84	2.917	2.97	3.92	1.97
1.000	7.88	2.000	6.84	3.000	2.97	4.00	1.97

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.057 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 7.123
TOTAL RAINFALL (mm)= 34.028
RUNOFF COEFFICIENT = 0.209

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

```

-----
| CALIB |
| STANDHYD (0103) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 0.12
Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.10 0.02
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 1.00 2.00
Length (m)= 28.28 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 69.00 NaN
over (min) 5.00 10.00
Storage Coeff. (min)= 1.39 (ii) 6.09 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.33 0.15

PEAK FLOW (cms)= 0.02 0.00 *TOTALS*
TIME TO PEAK (hrs)= 1.33 1.42 0.019 (iii)
RUNOFF VOLUME (mm)= 33.03 8.69 1.33
TOTAL RAINFALL (mm)= 34.03 34.03 28.14
RUNOFF COEFFICIENT = 0.97 0.26 34.03
0.83

```

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0101) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 0.02
Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.02 0.00
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 1.00 2.00
Length (m)= 11.55 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 69.00 14.71
over (min) 5.00 5.00
Storage Coeff. (min)= 0.81 (ii) 4.21 (ii)
Unit Hyd. Tpeak (min)= 5.00 5.00
Unit Hyd. peak (cms)= 0.34 0.24

PEAK FLOW (cms)= 0.00 0.00 *TOTALS*
TIME TO PEAK (hrs)= 1.33 1.33 0.004 (iii)
RUNOFF VOLUME (mm)= 33.03 8.69 1.33
TOTAL RAINFALL (mm)= 34.03 34.03 30.59
RUNOFF COEFFICIENT = 0.97 0.26 34.03
0.90

```

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0104) |
| 1 + 2 = 3 |
-----
ID1= 1(0101): AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
0.02 0.004 1.33 30.59

```

+ ID2= 2 (0102):	4.32	0.057	1.83	7.12
ID = 3 (0104):	4.34	0.057	1.83	7.23

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0104)	AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0104):	4.34	0.057	1.83	7.23
+ ID2= 2 (0103):	0.12	0.019	1.33	28.14
ID = 1 (0104):	4.46	0.060	1.83	7.79

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	Area (ha)=	3.88	Curve Number (CN)=	74.0
NASHYD (0207)	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
ID= 1 DT= 5.0 min	U.H. Tp(hrs)=	0.38		

Unit Hyd Qpeak (cms)= 0.390

PEAK FLOW (cms)= 0.051 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 7.123
 TOTAL RAINFALL (mm)= 34.028
 RUNOFF COEFFICIENT = 0.209

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

CALIB	Area (ha)=	0.18	Curve Number (CN)=	74.0
NASHYD (0201)	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
ID= 1 DT= 5.0 min	U.H. Tp(hrs)=	0.19		

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.003 (i)
 TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 7.105
 TOTAL RAINFALL (mm)= 34.028
 RUNOFF COEFFICIENT = 0.209

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

CALIB	Area (ha)=	0.30	Dir. Conn.(%)=	90.00
STANDHYD (0202)	Total Imp(%)=	90.00		
ID= 1 DT= 5.0 min				

Surface Area (ha)=	IMPERVIOUS	PERVIOUS (i)
Dep. Storage (mm)=	0.27	0.03
Average Slope (%)=	1.00	1.50
Length (m)=	44.72	2.00
Mannings n =	0.013	40.00
		0.250

Max.Eff.Inten.(mm/hr)=	69.00	14.71
over (min)	5.00	10.00
Storage Coeff. (min)=	1.83 (ii)	5.23 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.32	0.16

TOTALS
 PEAK FLOW (cms)= 0.05 0.00 0.052 (iii)
 TIME TO PEAK (hrs)= 1.33 1.42 1.33
 RUNOFF VOLUME (mm)= 33.03 8.69 30.59
 TOTAL RAINFALL (mm)= 34.03 34.03 34.03
 RUNOFF COEFFICIENT = 0.97 0.26 0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 74.0 Ia = Dep. Storage (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.

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

ADD HYD (0203)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0201):	0.18	0.003	1.50	7.10
+ ID2= 2 (0202):	0.30	0.052	1.33	30.59
=====				
ID = 3 (0203):	0.48	0.054	1.33	21.78

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0204)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2---> OUT= 1				
DT= 5.0 min				
	0.0000	0.0000	0.0109	0.0072
	0.0081	0.0015	0.0132	0.0190
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0203)	0.480	0.054	1.33	21.78
OUTFLOW: ID= 1 (0204)	0.480	0.010	1.75	21.70
PEAK FLOW REDUCTION [Qout/Qin](%)=	17.90			
TIME SHIFT OF PEAK FLOW (min)=	25.00			
MAXIMUM STORAGE USED (ha.m.)=	0.0049			

CALIB STANDHYD (0205)	Area (ha)	IMP (ha)	PERVIOUS (i)	Dir. Conn.(%)
ID= 1 DT= 5.0 min	0.10	90.00		90.00
Surface Area (ha)=	0.09		0.01	
Dep. Storage (mm)=	1.00		1.50	
Average Slope (%)=	1.00		2.00	
Length (m)=	25.82		40.00	
Mannings n =	0.013		0.250	
Max.Eff.Inten.(mm/hr)=	69.00		14.71	
over (min)	5.00		5.00	
Storage Coeff. (min)=	1.32 (ii)		4.71 (ii)	
Unit Hyd. Tpeak (min)=	5.00		5.00	
Unit Hyd. peak (cms)=	0.33		0.22	
				TOTALS
PEAK FLOW (cms)=	0.02		0.00	0.018 (iii)
TIME TO PEAK (hrs)=	1.33		1.33	1.33
RUNOFF VOLUME (mm)=	33.03		8.69	30.59
TOTAL RAINFALL (mm)=	34.03		34.03	34.03
RUNOFF COEFFICIENT =	0.97		0.26	0.90

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0206)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0204):	0.48	0.010	1.75	21.70
+ ID2= 2 (0205):	0.10	0.018	1.33	30.59
=====				
ID = 3 (0206):	0.58	0.026	1.33	23.23

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0206)	AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1				

	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0206):	0.58	0.026	1.33	23.23
+ ID2= 2 (0207):	3.88	0.051	1.83	7.12
=====				
ID = 1 (0206):	4.46	0.063	1.83	9.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ** SIMULATION NUMBER: 2 **

5 YEAR

CHICAGO STORM
 Ptotal= 44.88 mm

IDF curve parameters: A=1098.000
 B= 10.100
 C= 0.830
 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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	2.66	1.17	26.50	2.17	7.15	3.17	3.24
0.33	3.11	1.33	90.98	2.33	5.94	3.33	2.98
0.50	3.75	1.50	34.82	2.50	5.08	3.50	2.76
0.67	4.75	1.67	18.23	2.67	4.44	3.67	2.57
0.83	6.53	1.83	12.10	2.83	3.95	3.83	2.41
1.00	10.53	2.00	9.00	3.00	3.56	4.00	2.26

CALIB
 NASHYD (0102)
 ID= 1 DT= 5.0 min

Area (ha)= 4.32 Curve Number (CN)= 74.0
 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.38

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.66	1.083	26.50	2.083	7.15	3.08	3.24
0.167	2.66	1.167	26.50	2.167	7.15	3.17	3.24
0.250	3.11	1.250	90.98	2.250	5.94	3.25	2.98
0.333	3.11	1.333	90.98	2.333	5.94	3.33	2.98
0.417	3.75	1.417	34.82	2.417	5.08	3.42	2.76
0.500	3.75	1.500	34.82	2.500	5.08	3.50	2.76
0.583	4.75	1.583	18.23	2.583	4.44	3.58	2.57
0.667	4.75	1.667	18.23	2.667	4.44	3.67	2.57
0.750	6.53	1.750	12.10	2.750	3.95	3.75	2.41
0.833	6.53	1.833	12.10	2.833	3.95	3.83	2.41
0.917	10.53	1.917	9.00	2.917	3.56	3.92	2.26
1.000	10.53	2.000	9.00	3.000	3.56	4.00	2.26

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.106 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 12.316
 TOTAL RAINFALL (mm)= 44.883
 RUNOFF COEFFICIENT = 0.274

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

CALIB
 STANDHYD (0103)
 ID= 1 DT= 5.0 min

Area (ha)= 0.12
 Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.10	0.02
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	28.28	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	90.98	24.87
over (min)	5.00	10.00

Storage Coeff. (min)=	1.24 (ii)	5.45 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.33	0.16	
			TOTALS
PEAK FLOW (cms)=	0.02	0.00	0.025 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	43.88	14.19	37.92
TOTAL RAINFALL (mm)=	44.88	44.88	44.88
RUNOFF COEFFICIENT =	0.98	0.32	0.84

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB          |
| STANDHYD (0101) |
| ID= 1 DT= 5.0 min |
|-----|
Area (ha)= 0.02
Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.02		0.00	
Dep. Storage (mm)=	1.00		1.50	
Average Slope (%)=	1.00		2.00	
Length (m)=	11.55		40.00	
Mannings n =	0.013		0.250	
Max.Eff.Inten.(mm/hr)=	90.98		24.87	
over (min)	5.00		5.00	
Storage Coeff. (min)=	0.73 (ii)		3.77 (ii)	
Unit Hyd. Tpeak (min)=	5.00		5.00	
Unit Hyd. peak (cms)=	0.34		0.25	
				TOTALS
PEAK FLOW (cms)=	0.00	0.00		0.005 (iii)
TIME TO PEAK (hrs)=	1.33	1.33		1.33
RUNOFF VOLUME (mm)=	43.88	14.19		40.91
TOTAL RAINFALL (mm)=	44.88	44.88		44.88
RUNOFF COEFFICIENT =	0.98	0.32		0.91

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0104) |
| 1 + 2 = 3 |
|-----|
AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 1 (0101): 0.02 0.005 1.33 40.91
+ ID2= 2 (0102): 4.32 0.106 1.83 12.32
=====
ID = 3 (0104): 4.34 0.107 1.83 12.45

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0104) |
| 3 + 2 = 1 |
|-----|
AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 3 (0104): 4.34 0.107 1.83 12.45
+ ID2= 2 (0103): 0.12 0.025 1.33 37.92
=====
ID = 1 (0104): 4.46 0.111 1.83 13.13

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| CALIB          |
| NASHYD (0207) |
| ID= 1 DT= 5.0 min |
|-----|
Area (ha)= 3.88 Curve Number (CN)= 74.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.38

```

Unit Hyd Qpeak (cms)= 0.390

PEAK FLOW (cms)= 0.095 (i)

TIME TO PEAK (hrs)= 1.833

RUNOFF VOLUME (mm)= 12.316

TOTAL RAINFALL (mm)= 44.883

RUNOFF COEFFICIENT = 0.274

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

```

-----
| CALIB |
| NASHYD (0201) | Area (ha)= 0.18 Curve Number (CN)= 74.0
| ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.19

```

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.006 (i)

TIME TO PEAK (hrs)= 1.500

RUNOFF VOLUME (mm)= 12.288

TOTAL RAINFALL (mm)= 44.883

RUNOFF COEFFICIENT = 0.274

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

```

-----
| CALIB |
| STANDHYD (0202) | Area (ha)= 0.30
| ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
|-----|

```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.27	0.03
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	44.72	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.(mm/hr)=	90.98	24.87
over (min)	5.00	5.00
Storage Coeff. (min)=	1.64 (ii)	4.68 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.32	0.22

TOTALS		
PEAK FLOW (cms)=	0.07	0.00
TIME TO PEAK (hrs)=	1.33	1.33
RUNOFF VOLUME (mm)=	43.88	14.19
TOTAL RAINFALL (mm)=	44.88	44.88
RUNOFF COEFFICIENT =	0.98	0.32
		0.91

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0203) |
| 1 + 2 = 3 |
|-----|
| ID1= 1 (0201): | AREA QPEAK TPEAK R.V.
|                   | (ha) (cms) (hrs) (mm)
| + ID2= 2 (0202): | 0.18 0.006 1.50 12.29
|                   | 0.30 0.070 1.33 40.91
|=====|
| ID = 3 (0203): | 0.48 0.074 1.33 30.18

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0204) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
|-----|
| OUTFLOW STORAGE | OUTFLOW STORAGE
| (cms) (ha.m.) | (cms) (ha.m.)
| 0.0000 0.0000 | 0.0109 0.0072
| 0.0081 0.0015 | 0.0132 0.0190
|-----|
| AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)

```


INFLOW : ID= 2 (0203) 0.480 0.074 1.33 30.18
 OUTFLOW: ID= 1 (0204) 0.480 0.011 1.92 30.09

PEAK FLOW REDUCTION [Qout/Qin](%)= 14.83
 TIME SHIFT OF PEAK FLOW (min)= 35.00
 MAXIMUM STORAGE USED (ha.m.)= 0.0075

 CALIB
 STANDHYD (0205)
 ID= 1 DT= 5.0 min

Area (ha)=	0.10		
Total Imp(%)=	90.00	Dir. Conn.(%)=	90.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.09	0.01	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	25.82	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	90.98	24.87	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.18 (ii)	4.22 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.33	0.24	
PEAK FLOW (cms)=	0.02	0.00	*TOTALS*
TIME TO PEAK (hrs)=	1.33	1.33	0.023 (iii)
RUNOFF VOLUME (mm)=	43.88	14.19	1.33
TOTAL RAINFALL (mm)=	44.88	44.88	40.91
RUNOFF COEFFICIENT =	0.98	0.32	44.88
			0.91

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ADD HYD (0206)
 1 + 2 = 3

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0204):	0.48	0.011	1.92	30.09
+ ID2= 2 (0205):	0.10	0.023	1.33	40.91
=====				
ID = 3 (0206):	0.58	0.033	1.33	31.96

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ADD HYD (0206)
 3 + 2 = 1

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0206):	0.58	0.033	1.33	31.96
+ ID2= 2 (0207):	3.88	0.095	1.83	12.32
=====				
ID = 1 (0206):	4.46	0.110	1.83	14.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ** SIMULATION NUMBER: 3 **

10 YEAR

 CHICAGO STORM
 Ptotal= 53.50 mm

IDF curve parameters: A=1560.000
 B= 13.000
 C= 0.860

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.17	2.91	1.17	33.34	2.17	8.57	3.17	3.62

0.33	3.45	1.33	105.21	2.33	7.00	3.33	3.30
0.50	4.24	1.50	43.73	2.50	5.91	3.50	3.03
0.67	5.50	1.67	22.99	2.67	5.10	3.67	2.80
0.83	7.78	1.83	15.02	2.83	4.49	3.83	2.61
1.00	12.98	2.00	10.97	3.00	4.01	4.00	2.44

CALIB
 NASHYD (0102) | Area (ha)= 4.32 | Curve Number (CN)= 74.0
 ID= 1 DT= 5.0 min | Ia (mm)= 5.00 | # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.38

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.91	1.083	33.34	2.083	8.57	3.08	3.62
0.167	2.91	1.167	33.34	2.167	8.57	3.17	3.62
0.250	3.45	1.250	105.21	2.250	7.00	3.25	3.30
0.333	3.45	1.333	105.21	2.333	7.00	3.33	3.30
0.417	4.24	1.417	43.73	2.417	5.91	3.42	3.03
0.500	4.24	1.500	43.73	2.500	5.91	3.50	3.03
0.583	5.50	1.583	22.99	2.583	5.10	3.58	2.80
0.667	5.50	1.667	22.99	2.667	5.10	3.67	2.80
0.750	7.78	1.750	15.02	2.750	4.49	3.75	2.61
0.833	7.78	1.833	15.02	2.833	4.49	3.83	2.61
0.917	12.98	1.917	10.97	2.917	4.01	3.92	2.44
1.000	12.98	2.000	10.97	3.000	4.01	4.00	2.44

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.152 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 17.074
 TOTAL RAINFALL (mm)= 53.500
 RUNOFF COEFFICIENT = 0.319

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

CALIB
 STANDHYD (0103) | Area (ha)= 0.12 | Dir. Conn.(%)= 80.00
 ID= 1 DT= 5.0 min | Total Imp(%)= 80.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.10	0.02	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	28.28	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	105.21	33.18	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.17 (ii)	5.15 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.34	0.16	
			TOTALS
PEAK FLOW (cms)=	0.03	0.00	0.030 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	52.50	19.14	45.80
TOTAL RAINFALL (mm)=	53.50	53.50	53.50
RUNOFF COEFFICIENT =	0.98	0.36	0.86

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
 STANDHYD (0101) | Area (ha)= 0.02 | Dir. Conn.(%)= 90.00
 ID= 1 DT= 5.0 min | Total Imp(%)= 90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.02	0.00

Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	11.55	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		105.21	33.18	
over (min)		5.00	5.00	
Storage Coeff. (min)=		0.69 (ii)	3.56 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.34	0.26	
				TOTALS
PEAK FLOW (cms)=		0.01	0.00	0.005 (iii)
TIME TO PEAK (hrs)=		1.33	1.33	1.33
RUNOFF VOLUME (mm)=		52.50	19.14	49.16
TOTAL RAINFALL (mm)=		53.50	53.50	53.50
RUNOFF COEFFICIENT =		0.98	0.36	0.92

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0104)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0101):	0.02	0.005	1.33	49.16
+ ID2= 2 (0102):	4.32	0.152	1.83	17.07
=====				
ID = 3 (0104):	4.34	0.153	1.83	17.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0104)				
3 + 2 = 1				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0104):	4.34	0.153	1.83	17.22
+ ID2= 2 (0103):	0.12	0.030	1.33	45.80
=====				
ID = 1 (0104):	4.46	0.158	1.83	17.99

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD (0207)				
ID= 1 DT= 5.0 min				
	Area	(ha)=	3.88	Curve Number (CN)= 74.0
	Ia	(mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp	(hrs)=	0.38	

Unit Hyd Qpeak (cms)= 0.390

PEAK FLOW (cms)= 0.137 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 17.074
 TOTAL RAINFALL (mm)= 53.500
 RUNOFF COEFFICIENT = 0.319

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

CALIB				
NASHYD (0201)				
ID= 1 DT= 5.0 min				
	Area	(ha)=	0.18	Curve Number (CN)= 74.0
	Ia	(mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp	(hrs)=	0.19	

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.009 (i)
 TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 17.035
 TOTAL RAINFALL (mm)= 53.500
 RUNOFF COEFFICIENT = 0.318

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

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-----
CALIB
STANDHYD (0202) | Area (ha)= 0.30
ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
-----

```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.27	0.03	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	44.72	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		105.21	33.18	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.54 (ii)	4.42 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.33	0.23	
				TOTALS
PEAK FLOW (cms)=		0.08	0.00	0.082 (iii)
TIME TO PEAK (hrs)=		1.33	1.33	1.33
RUNOFF VOLUME (mm)=		52.50	19.14	49.16
TOTAL RAINFALL (mm)=		53.50	53.50	53.50
RUNOFF COEFFICIENT =		0.98	0.36	0.92

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
ADD HYD (0203) |
1 + 2 = 3 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0201):	0.18	0.009	1.50	17.03
+ ID2= 2 (0202):	0.30	0.082	1.33	49.16
=====				
ID = 3 (0203):	0.48	0.087	1.33	37.11

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
RESERVOIR (0204) |
IN= 2----> OUT= 1 |
DT= 5.0 min |
-----

```

	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0109	0.0072
	0.0081	0.0015	0.0132	0.0190
		AREA (ha)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0203)		0.480	1.33	37.11
OUTFLOW: ID= 1 (0204)		0.480	2.08	37.03

PEAK FLOW REDUCTION [Qout/Qin](%)= 13.12
TIME SHIFT OF PEAK FLOW (min)= 45.00
MAXIMUM STORAGE USED (ha.m.)= 0.0100

```

-----
CALIB
STANDHYD (0205) | Area (ha)= 0.10
ID= 1 DT= 5.0 min | Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00
-----

```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.09	0.01	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	25.82	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		105.21	33.18	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.11 (ii)	3.98 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.34	0.24	
				TOTALS

```

PEAK FLOW      (cms)=      0.03      0.00      0.027 (iii)
TIME TO PEAK   (hrs)=      1.33      1.33      1.33
RUNOFF VOLUME  (mm)=      52.50     19.14     49.16
TOTAL RAINFALL (mm)=      53.50     53.50     53.50
RUNOFF COEFFICIENT =      0.98      0.36      0.92

```

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0206) |
| 1 + 2 = 3 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0204):  0.48  0.011  2.08  37.03
+ ID2= 2 (0205):  0.10  0.027  1.33  49.16
=====
ID = 3 (0206):  0.58  0.037  1.33  39.12

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0206) |
| 3 + 2 = 1 |
-----
          AREA      QPEAK      TPEAK      R.V.
          (ha)      (cms)      (hrs)      (mm)
ID1= 3 (0206):  0.58  0.037  1.33  39.12
+ ID2= 2 (0207):  3.88  0.137  1.83  17.07
=====
ID = 1 (0206):  4.46  0.152  1.83  19.94

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

** SIMULATION NUMBER: 4 **

25 YEAR

```

-----
| CHICAGO STORM |
| Ptotal= 61.50 mm |
-----
IDF curve parameters: A=2010.000
                      B= 14.000
                      C= 0.880
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

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	3.09	1.17	39.20	2.17	9.66	3.17	3.89
0.33	3.70	1.33	122.63	2.33	7.82	3.33	3.53
0.50	4.60	1.50	51.58	2.50	6.53	3.50	3.22
0.67	6.06	1.67	26.88	2.67	5.60	3.67	2.97
0.83	8.73	1.83	17.34	2.83	4.89	3.83	2.75
1.00	14.90	2.00	12.51	3.00	4.33	4.00	2.56

```

-----
| CALIB |
| NASHYD (0102) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 4.32 Curve Number (CN)= 74.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.38

```

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.09	1.083	39.20	2.083	9.66	3.08	3.89
0.167	3.09	1.167	39.20	2.167	9.66	3.17	3.89
0.250	3.70	1.250	122.63	2.250	7.82	3.25	3.53
0.333	3.70	1.333	122.63	2.333	7.82	3.33	3.53
0.417	4.60	1.417	51.58	2.417	6.53	3.42	3.22
0.500	4.60	1.500	51.58	2.500	6.53	3.50	3.22

0.583	6.06	1.583	26.88	2.583	5.60	3.58	2.97
0.667	6.06	1.667	26.88	2.667	5.60	3.67	2.97
0.750	8.73	1.750	17.34	2.750	4.89	3.75	2.75
0.833	8.73	1.833	17.34	2.833	4.89	3.83	2.75
0.917	14.90	1.917	12.51	2.917	4.33	3.92	2.56
1.000	14.90	2.000	12.51	3.000	4.33	4.00	2.56

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.202 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 21.898
 TOTAL RAINFALL (mm)= 61.498
 RUNOFF COEFFICIENT = 0.356

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

CALIB STANDHYD (0103) ID= 1 DT= 5.0 min	Area (ha)= 0.12 Total Imp(%)= 80.00	Dir. Conn.(%)= 80.00
---	--	----------------------

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.10	0.02	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	28.28	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	122.63	43.18	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.10 (ii)	4.84 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.22	
			TOTALS
PEAK FLOW (cms)=	0.03	0.00	0.035 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	60.50	24.12	53.21
TOTAL RAINFALL (mm)=	61.50	61.50	61.50
RUNOFF COEFFICIENT =	0.98	0.39	0.87

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0101) ID= 1 DT= 5.0 min	Area (ha)= 0.02 Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00
---	--	----------------------

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.02	0.00	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	11.55	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	122.63	43.18	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.64 (ii)	3.35 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.26	
			TOTALS
PEAK FLOW (cms)=	0.01	0.00	0.006 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	60.50	24.12	56.86
TOTAL RAINFALL (mm)=	61.50	61.50	61.50
RUNOFF COEFFICIENT =	0.98	0.39	0.92

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0104)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0101):	0.02	0.006	1.33	56.86
+ ID2= 2 (0102):	4.32	0.202	1.75	21.90
=====				
ID = 3 (0104):	4.34	0.203	1.75	22.06

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0104)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0104):	4.34	0.203	1.75	22.06
+ ID2= 2 (0103):	0.12	0.035	1.33	53.21
=====				
ID = 1 (0104):	4.46	0.208	1.75	22.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (0207)	Area (ha)	Ia (mm)	U.H. Tp(hrs)	Curve Number (CN)	# of Linear Res.(N)
ID= 1 DT= 5.0 min	3.88	5.00	0.38	74.0	3.00

Unit Hyd Qpeak (cms)= 0.390

PEAK FLOW (cms)= 0.181 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 21.898
 TOTAL RAINFALL (mm)= 61.498
 RUNOFF COEFFICIENT = 0.356

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

CALIB NASHYD (0201)	Area (ha)	Ia (mm)	U.H. Tp(hrs)	Curve Number (CN)	# of Linear Res.(N)
ID= 1 DT= 5.0 min	0.18	5.00	0.19	74.0	3.00

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.012 (i)
 TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 21.848
 TOTAL RAINFALL (mm)= 61.498
 RUNOFF COEFFICIENT = 0.355

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

CALIB STANDHYD (0202)	Area (ha)	Total Imp(%)	Dir. Conn.(%)
ID= 1 DT= 5.0 min	0.30	90.00	90.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.27	0.03
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	44.72	40.00
Mannings n =	0.013	0.250

Max. Eff. Inten. (mm/hr)=	122.63	43.18
over (min)	5.00	5.00
Storage Coeff. (min)=	1.45 (ii)	4.15 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.33	0.24

TOTALS
 PEAK FLOW (cms)= 0.096 (iii)
 TIME TO PEAK (hrs)= 1.33
 RUNOFF VOLUME (mm)= 56.86
 TOTAL RAINFALL (mm)= 61.50
 RUNOFF COEFFICIENT = 0.92

PEAK FLOW (cms)=	0.09	0.00	0.096 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	60.50	24.12	56.86
TOTAL RAINFALL (mm)=	61.50	61.50	61.50
RUNOFF COEFFICIENT =	0.98	0.39	0.92

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0203)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0201):	0.18	0.012	1.50	21.85
+ ID2= 2 (0202):	0.30	0.096	1.33	56.86
ID = 3 (0203):	0.48	0.103	1.33	43.73

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0204)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2---> OUT= 1	0.0000	0.0000	0.0109	0.0072
DT= 5.0 min	0.0081	0.0015	0.0132	0.0190

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0203)	0.480	0.103	1.33	43.73
OUTFLOW: ID= 1 (0204)	0.480	0.012	2.17	43.64

PEAK FLOW REDUCTION [Qout/Qin](%)= 11.55
 TIME SHIFT OF PEAK FLOW (min)= 50.00
 MAXIMUM STORAGE USED (ha.m.)= 0.0124

CALIB STANDHYD (0205)	Area (ha)	IMP (ha)	PERVIOUS (i)	Dir. Conn.(%)
ID= 1 DT= 5.0 min	0.10	90.00		90.00

	IMP (ha)	PERVIOUS (i)	
Surface Area (ha)=	0.09	0.01	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	25.82	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	122.63	43.18	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.04 (ii)	3.75 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.25	
PEAK FLOW (cms)=	0.03	0.00	*TOTALS* 0.032 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	60.50	24.12	56.85
TOTAL RAINFALL (mm)=	61.50	61.50	61.50
RUNOFF COEFFICIENT =	0.98	0.39	0.92

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0206)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0204):	0.48	0.012	2.17	43.64
+ ID2= 2 (0205):	0.10	0.032	1.33	56.85
ID = 3 (0206):	0.58	0.042	1.33	45.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.


```

-----
| ADD HYD (0206) |
| 3 + 2 = 1 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 3 (0206):  0.58    0.042    1.33    45.92
+ ID2= 2 (0207):  3.88    0.181    1.75    21.90
=====
ID = 1 (0206):  4.46    0.198    1.75    25.02

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

50 YEAR

```

-----
| CHICAGO STORM |
| Ptotal= 71.00 mm |
-----
IDF curve parameters: A=2200.000
                      B= 14.600
                      C= 0.870
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

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	3.80	1.17	45.14	2.17	11.57	3.17	4.75
0.33	4.53	1.33	135.62	2.33	9.41	3.33	4.32
0.50	5.61	1.50	58.97	2.50	7.90	3.50	3.96
0.67	7.33	1.67	31.37	2.67	6.79	3.67	3.65
0.83	10.47	1.83	20.48	2.83	5.95	3.83	3.39
1.00	17.66	2.00	14.89	3.00	5.28	4.00	3.16

```

-----
| CALIB NASHYD (0102) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 4.32 Curve Number (CN)= 74.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.38

```

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

```

-----
      ----- TRANSFORMED HYETOGRAPH -----
      TIME RAIN TIME RAIN TIME RAIN TIME RAIN
      hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr
0.083 3.80 1.083 45.14 2.083 11.57 3.08 4.75
0.167 3.80 1.167 45.14 2.167 11.57 3.17 4.75
0.250 4.53 1.250 135.62 2.250 9.41 3.25 4.32
0.333 4.53 1.333 135.62 2.333 9.41 3.33 4.32
0.417 5.61 1.417 58.97 2.417 7.90 3.42 3.96
0.500 5.61 1.500 58.97 2.500 7.90 3.50 3.96
0.583 7.33 1.583 31.37 2.583 6.79 3.58 3.65
0.667 7.33 1.667 31.37 2.667 6.79 3.67 3.65
0.750 10.47 1.750 20.48 2.750 5.95 3.75 3.39
0.833 10.47 1.833 20.48 2.833 5.95 3.83 3.39
0.917 17.66 1.917 14.89 2.917 5.28 3.92 3.16
1.000 17.66 2.000 14.89 3.000 5.28 4.00 3.16

```

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.255 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 28.052
 TOTAL RAINFALL (mm)= 70.997
 RUNOFF COEFFICIENT = 0.395

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

```

-----
| CALIB STANDHYD (0103) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 0.12
Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

```

Surface Area (ha)= IMPERVIOUS 0.10 PERVIOUS (i) 0.02
 Dep. Storage (mm)= 1.00 1.50

Average Slope	(%)=	1.00	2.00	
Length	(m)=	28.28	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		135.62	52.86	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.06 (ii)	4.65 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.34	0.22	
				TOTALS
PEAK FLOW (cms)=		0.04	0.00	0.040 (iii)
TIME TO PEAK (hrs)=		1.33	1.33	1.33
RUNOFF VOLUME (mm)=		70.00	30.43	62.06
TOTAL RAINFALL (mm)=		71.00	71.00	71.00
RUNOFF COEFFICIENT =		0.99	0.43	0.87

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| CALIB |
| STANDHYD (0101) |
| ID= 1 DT= 5.0 min |
-----
Area (ha)= 0.02
Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.02	0.00	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	11.55	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		135.62	52.86	
over (min)		5.00	5.00	
Storage Coeff. (min)=		0.62 (ii)	3.21 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.34	0.27	
				TOTALS
PEAK FLOW (cms)=		0.01	0.00	0.007 (iii)
TIME TO PEAK (hrs)=		1.33	1.33	1.33
RUNOFF VOLUME (mm)=		70.00	30.43	66.03
TOTAL RAINFALL (mm)=		71.00	71.00	71.00
RUNOFF COEFFICIENT =		0.99	0.43	0.93

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0104) |
| 1 + 2 = 3 |
-----
AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 1 (0101): 0.02 0.007 1.33 66.03
+ ID2= 2 (0102): 4.32 0.255 1.75 28.05
=====
ID = 3 (0104): 4.34 0.256 1.75 28.23

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0104) |
| 3 + 2 = 1 |
-----
AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 3 (0104): 4.34 0.256 1.75 28.23
+ ID2= 2 (0103): 0.12 0.040 1.33 62.06
=====
ID = 1 (0104): 4.46 0.263 1.75 29.14

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| CALIB                               |
| NASHYD (0207)                       | Area (ha)= 3.88   Curve Number (CN)= 74.0
| ID= 1 DT= 5.0 min                   | Ia (mm)= 5.00   # of Linear Res.(N)= 3.00
|                                     | U.H. Tp(hrs)= 0.38
-----

```

Unit Hyd Qpeak (cms)= 0.390

PEAK FLOW (cms)= 0.229 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 28.052
 TOTAL RAINFALL (mm)= 70.997
 RUNOFF COEFFICIENT = 0.395

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

```

-----
| CALIB                               |
| NASHYD (0201)                       | Area (ha)= 0.18   Curve Number (CN)= 74.0
| ID= 1 DT= 5.0 min                   | Ia (mm)= 5.00   # of Linear Res.(N)= 3.00
|                                     | U.H. Tp(hrs)= 0.19
-----

```

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.015 (i)
 TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 27.990
 TOTAL RAINFALL (mm)= 70.997
 RUNOFF COEFFICIENT = 0.394

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

```

-----
| CALIB                               |
| STANDHYD (0202)                     | Area (ha)= 0.30   Dir. Conn.(%)= 90.00
| ID= 1 DT= 5.0 min                   | Total Imp(%)= 90.00
-----

```

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.27	0.03
Dep. Storage (mm)=	1.00	1.50
Average Slope (%)=	1.00	2.00
Length (m)=	44.72	40.00
Mannings n =	0.013	0.250

Max.Eff.Inten.(mm/hr)=	135.62	52.86
over (min)	5.00	5.00
Storage Coeff. (min)=	1.40 (ii)	3.99 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.33	0.24

TOTALS
 PEAK FLOW (cms)= 0.10 0.00 0.106 (iii)
 TIME TO PEAK (hrs)= 1.33 1.33 1.33
 RUNOFF VOLUME (mm)= 70.00 30.43 66.04
 TOTAL RAINFALL (mm)= 71.00 71.00 71.00
 RUNOFF COEFFICIENT = 0.99 0.43 0.93

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0203)                       |
| 1 + 2 = 3                             |
|                                     | AREA QPEAK TPEAK R.V.
|                                     | (ha) (cms) (hrs) (mm)
| ID1= 1 (0201):                       | 0.18 0.015 1.50 27.99
| + ID2= 2 (0202):                     | 0.30 0.106 1.33 66.04
|=====
| ID = 3 (0203):                       | 0.48 0.116 1.33 51.77
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR (0204)                     |
| IN= 2---> OUT= 1                     |
| DT= 5.0 min                           |
|                                     | OUTFLOW STORAGE | OUTFLOW STORAGE
-----

```

```

-----
                (cms)      (ha.m.) | (cms)      (ha.m.)
                0.0000    0.0000 | 0.0109    0.0072
                0.0081    0.0015 | 0.0132    0.0190

```

```

                AREA      QPEAK      TPEAK      R.V.
                (ha)      (cms)      (hrs)      (mm)
INFLOW : ID= 2 (0203)  0.480    0.116    1.33    51.77
OUTFLOW: ID= 1 (0204)  0.480    0.012    2.25    51.68

```

```

PEAK FLOW REDUCTION [Qout/Qin](%)= 10.71
TIME SHIFT OF PEAK FLOW (min)= 55.00
MAXIMUM STORAGE USED (ha.m.)= 0.0151

```

```

-----
| CALIB          |
| STANDHYD (0205) |
| ID= 1 DT= 5.0 min |
|-----|
Area (ha)= 0.10
Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

```

```

                IMPERVIOUS      PERVIOUS (i)
Surface Area (ha)= 0.09      0.01
Dep. Storage (mm)= 1.00      1.50
Average Slope (%)= 1.00      2.00
Length (m)= 25.82      40.00
Mannings n = 0.013      0.250

Max.Eff.Inten.(mm/hr)= 135.62      52.86
over (min)= 5.00      5.00
Storage Coeff. (min)= 1.00 (ii)      3.60 (ii)
Unit Hyd. Tpeak (min)= 5.00      5.00
Unit Hyd. peak (cms)= 0.34      0.26

PEAK FLOW (cms)= 0.03      0.00      *TOTALS*
TIME TO PEAK (hrs)= 1.33      1.33      0.035 (iii)
RUNOFF VOLUME (mm)= 70.00      30.43      1.33
TOTAL RAINFALL (mm)= 71.00      71.00      66.03
RUNOFF COEFFICIENT = 0.99      0.43      71.00
                0.93

```

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0206) |
| 1 + 2 = 3 |
|-----|
                AREA      QPEAK      TPEAK      R.V.
                (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0204):  0.48    0.012    2.25    51.68
+ ID2= 2 (0205):  0.10    0.035    1.33    66.03
=====
ID = 3 (0206):  0.58    0.046    1.33    54.16

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0206) |
| 3 + 2 = 1 |
|-----|
                AREA      QPEAK      TPEAK      R.V.
                (ha)      (cms)      (hrs)      (mm)
ID1= 3 (0206):  0.58    0.046    1.33    54.16
+ ID2= 2 (0207):  3.88    0.229    1.75    28.05
=====
ID = 1 (0206):  4.46    0.247    1.75    31.45

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

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

```

100 YEAR

```

-----
| CHICAGO STORM |
| Ptotal= 76.49 mm |
|-----|
IDF curve parameters: A=2507.000
                    B= 14.800
                    C= 0.880
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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	3.91	1.17	49.06	2.17	12.26	3.17	4.92
0.33	4.69	1.33	148.61	2.33	9.92	3.33	4.46
0.50	5.83	1.50	64.28	2.50	8.29	3.50	4.08
0.67	7.68	1.67	33.91	2.67	7.10	3.67	3.75
0.83	11.07	1.83	21.97	2.83	6.19	3.83	3.48
1.00	18.89	2.00	15.87	3.00	5.49	4.00	3.24

CALIB
 NASHYD (0102) | Area (ha)= 4.32 | Curve Number (CN)= 74.0
 ID= 1 DT= 5.0 min | Ia (mm)= 5.00 | # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.38

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.91	1.083	49.06	2.083	12.26	3.08	4.92
0.167	3.91	1.167	49.06	2.167	12.26	3.17	4.92
0.250	4.69	1.250	148.61	2.250	9.92	3.25	4.46
0.333	4.69	1.333	148.61	2.333	9.92	3.33	4.46
0.417	5.83	1.417	64.28	2.417	8.29	3.42	4.08
0.500	5.83	1.500	64.28	2.500	8.29	3.50	4.08
0.583	7.68	1.583	33.91	2.583	7.10	3.58	3.75
0.667	7.68	1.667	33.91	2.667	7.10	3.67	3.75
0.750	11.07	1.750	21.97	2.750	6.19	3.75	3.48
0.833	11.07	1.833	21.97	2.833	6.19	3.83	3.48
0.917	18.89	1.917	15.87	2.917	5.49	3.92	3.24
1.000	18.89	2.000	15.87	3.000	5.49	4.00	3.24

Unit Hyd Qpeak (cms)= 0.434

PEAK FLOW (cms)= 0.296 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 31.793
 TOTAL RAINFALL (mm)= 76.492
 RUNOFF COEFFICIENT = 0.416

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

CALIB
 STANDHYD (0103) | Area (ha)= 0.12 | Dir. Conn.(%)= 80.00
 ID= 1 DT= 5.0 min | Total Imp(%)= 80.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.10	0.02	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	28.28	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	148.61	61.14	
over (min)	5.00	5.00	
Storage Coeff. (min)=	1.02 (ii)	4.48 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.23	
			TOTALS
PEAK FLOW (cms)=	0.04	0.00	0.044 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	75.49	34.24	67.22
TOTAL RAINFALL (mm)=	76.49	76.49	76.49
RUNOFF COEFFICIENT =	0.99	0.45	0.88

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0101) ID= 1 DT= 5.0 min	Area (ha)= 0.02 Total Imp(%)= 90.00	Dir. Conn.(%)= 90.00
---	--	----------------------

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.02	0.00	
Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	11.55	40.00	
Mannings n =	0.013	0.250	
Max.Eff.Inten.(mm/hr)=	148.61	61.14	
over (min)=	5.00	5.00	
Storage Coeff. (min)=	0.60 (ii)	3.10 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.27	
			TOTALS
PEAK FLOW (cms)=	0.01	0.00	0.008 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	75.49	34.24	71.36
TOTAL RAINFALL (mm)=	76.49	76.49	76.49
RUNOFF COEFFICIENT =	0.99	0.45	0.93

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0104)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0101):	0.02	0.008	1.33	71.36
+ ID2= 2 (0102):	4.32	0.296	1.75	31.79
=====				
ID = 3 (0104):	4.34	0.297	1.75	31.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0104)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0104):	4.34	0.297	1.75	31.98
+ ID2= 2 (0103):	0.12	0.044	1.33	67.22
=====				
ID = 1 (0104):	4.46	0.304	1.75	32.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (0207) ID= 1 DT= 5.0 min	Area (ha)= 3.88 Ia (mm)= 5.00 U.H. Tp(hrs)= 0.38	Curve Number (CN)= 74.0 # of Linear Res.(N)= 3.00
---	--	--

Unit Hyd Qpeak (cms)=	0.390
PEAK FLOW (cms)=	0.266 (i)
TIME TO PEAK (hrs)=	1.750
RUNOFF VOLUME (mm)=	31.793
TOTAL RAINFALL (mm)=	76.492
RUNOFF COEFFICIENT =	0.416

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

CALIB NASHYD (0201) ID= 1 DT= 5.0 min	Area (ha)= 0.18 Ia (mm)= 5.00 U.H. Tp(hrs)= 0.19	Curve Number (CN)= 74.0 # of Linear Res.(N)= 3.00
---	--	--

Unit Hyd Qpeak (cms)=	0.036
PEAK FLOW (cms)=	0.018 (i)

TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 31.722
 TOTAL RAINFALL (mm)= 76.492
 RUNOFF COEFFICIENT = 0.415

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

CALIB				
STANDHYD (0202)				
ID= 1 DT= 5.0 min				

Area (ha)=	0.30			
Total Imp(%)=	90.00	Dir. Conn.(%)=	90.00	
		IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.27		0.03	
Dep. Storage (mm)=	1.00		1.50	
Average Slope (%)=	1.00		2.00	
Length (m)=	44.72		40.00	
Mannings n =	0.013		0.250	
Max.Eff.Inten.(mm/hr)=	148.61		61.14	
over (min)	5.00		5.00	
Storage Coeff. (min)=	1.35 (ii)		3.85 (ii)	
Unit Hyd. Tpeak (min)=	5.00		5.00	
Unit Hyd. peak (cms)=	0.33		0.25	
				TOTALS
PEAK FLOW (cms)=	0.11		0.01	0.117 (iii)
TIME TO PEAK (hrs)=	1.33		1.33	1.33
RUNOFF VOLUME (mm)=	75.49		34.24	71.36
TOTAL RAINFALL (mm)=	76.49		76.49	76.49
RUNOFF COEFFICIENT =	0.99		0.45	0.93

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0203)				
1 + 2 = 3				

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0201):	0.18	0.018	1.50	31.72
+ ID2= 2 (0202):	0.30	0.117	1.33	71.36
=====				
ID = 3 (0203):	0.48	0.128	1.33	56.50

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0204)				
IN= 2---> OUT= 1				
DT= 5.0 min				

	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0109	0.0072
	0.0081	0.0015	0.0132	0.0190
		AREA	QPEAK	TPEAK
		(ha)	(cms)	(hrs)
INFLOW : ID= 2 (0203)	0.480	0.128	1.33	56.50
OUTFLOW: ID= 1 (0204)	0.480	0.013	2.25	56.41
		PEAK FLOW REDUCTION [Qout/Qin](%)=	9.97	
		TIME SHIFT OF PEAK FLOW (min)=	55.00	
		MAXIMUM STORAGE USED (ha.m.)=	0.0170	

CALIB				
STANDHYD (0205)				
ID= 1 DT= 5.0 min				

Area (ha)=	0.10			
Total Imp(%)=	90.00	Dir. Conn.(%)=	90.00	
		IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.09		0.01	
Dep. Storage (mm)=	1.00		1.50	
Average Slope (%)=	1.00		2.00	
Length (m)=	25.82		40.00	
Mannings n =	0.013		0.250	

Max.Eff.Inten.(mm/hr)=	148.61	61.14	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.97 (ii)	3.47 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.26	
			TOTALS
PEAK FLOW (cms)=	0.04	0.00	0.039 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	75.49	34.24	71.36
TOTAL RAINFALL (mm)=	76.49	76.49	76.49
RUNOFF COEFFICIENT =	0.99	0.45	0.93

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----
| ADD HYD (0206) |
| 1 + 2 = 3 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 1 (0204):  0.48  0.013  2.25  56.41
+ ID2= 2 (0205):  0.10  0.039  1.33  71.36
=====
ID = 3 (0206):  0.58  0.050  1.33  58.98

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD (0206) |
| 3 + 2 = 1 |
-----
      AREA      QPEAK      TPEAK      R.V.
      (ha)      (cms)      (hrs)      (mm)
ID1= 3 (0206):  0.58  0.050  1.33  58.98
+ ID2= 2 (0207):  3.88  0.266  1.75  31.79
=====
ID = 1 (0206):  4.46  0.284  1.75  35.33

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH