Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923
FAX: (613) 258-0475

HILAN VILLAGE

CONCEPTUAL STORMWATER MANAGEMENT PLAN

PROPOSED RESIDENTIAL SUBDIVISION
38 CARSS STREET, ALMONTE, ONTARIO

Prepared For:
Westview Projects Inc.
18 Louisa Street, Suite 180
Ottawa, Ontario
K1R 6Y6

PROJECT #: 210864

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1 INTRODUCTION

Kollaard Associates was retained by Westview Projects Inc. to complete a conceptual stormwater management design in support of the approval of the proposed draft plan for a residential subdivision development in the community of Almonte, Municipality of Mississippi Mills, Ontario. For the purposes of this report, Carss Street is considered to be oriented along an east west axis. The proposed residential development is located along the north side of Carss Street at the north side of the existing town of Almonte immediately east of the Mississippi River.

The proposed residential development site consists of an about 7.4 hectare parcel of land severed from an about 8.9 hectare parcel of land. The retained about 1.5 hectare parcel contains an existing single family dwelling, is accessed from Carss Street and is outside of the scope of this report. The subject site has a frontage of about 66 metres on Carss Street and extends north from Carss Street along the east side of the retained parcel for a distance of about 103 metres. The subject site extends an additional about 332 metres north from this point and occupies the entire space between the former Canadian Pacific Railway line on the east and the normal water level of the Mississippi River on the west.

Westview Projects Inc is proposing a residential development consisting of a mixture of single family dwellings, semi-detached dwellings and rowhouse development for a total of some 97 lots. The proposed development will be serviced by municipal water and by municipal sanitary and storm sewers. It is understood that a pumping station will be required to facilitate the sanitary sewer.

1.1 Background

The proposed development has a total area of about 7.4 hectares and is presently unoccupied. The site has a total average depth between the former railway line and normal water level in the Mississippi River of about 203 metres. Of this depth an average of about 74 metres is occupied by the valley slope of the Mississippi River. The site has a width along the former railway line of about 435 metres resulting in a table land above the valley slope of about 5.2 hectares.

The table land above the valley slope is covered with a mixture of cultural meadow, thicket and woodland with a small portion used for agricultural purposes. The valley slope to the Mississippi River is densely treed. The Mississippi River adjacent the site has a well defined river channel contained within the river valley.

The Mississippi River is a regulated area under the jurisdiction of the Mississippi Valley Conservation Authority. As such, the first 30 metres for the site area extending east from the water's edge defined by the Ontario Land Surveyor is considered to be within a regulated setback and will be outside of any lot in the proposed development.

A geotechnical assessment was completed by Kollaard Associates Inc to verify the stability of the slope and delineate the limit of hazard lands setback at the site. The limit of hazard lands setback is intended to identify the safe setback distance from a slope for the construction of buildings or infrastructure and has been determined to correspond to 3.3 metres from the top of the slope at the site. As such, no dwellings will be located closer than 3.3 metres from the top of the slope and all development will be limited to the tableland above the slope.

There is some residential development south of Carss Street and east of the former railway. It is understood that there is a current application for a residential subdivision to be located on the remaining undeveloped land between the east side of the subject site and Mitcheson Street.

1.2 Summary

The report shall summarize the stormwater management (SWM) design requirements for the proposed development. The report will summarize the conceptual stormwater management works to be implemented at the site to address the stormwater management requirements in support of the application for draft plan of subdivision approval.

The stormwater management facility for the site will consist of system of swales, catchbasins and storm sewers which capture and convey the runoff, generated on the proposed development area and adjacent offsite areas which contribute runoff to site, to the Mississippi River. The runoff from those areas of the development which are considered sources of pollution will be treated to an enhanced level by means of hydrodynamic separators.

1.3 Supplementary Documents

The following works were also completed in support of the proposed application for draft plan of subdivision approval were referenced during the completion of the stormwater management design:

- Hilan Village Site Plan completed by Hobin Architecture Incorporated.
- Topographich Sketch of 38 Carss Street Almonte, Ontario completed by Annis, O'Sullivan, Vollebekk Ltd.

- Slope Stability Evaluation report completed by Kollaard Associates Ltd.

2 STORMWATER MANAGEMENT DESIGN CRITERIA

2.1 Quantity control criteria consists of the following:

- Due to the proximity of the site to the Mississippi River and the size of the River, there are no restrictions to the post-development runoff rate;
- The storm sewer system is to convey the runoff from a 5 year design storm under gravity flow conditions.
- The HGL during a 100 year storm is to be minimum of 0.3 metres below the underside of footing elevations of the buildings connected to the storm sewer by a storm service.
- Accommodate offsite drainage where encountered;
- Control stormwater flow so as to not affect lands adjacent to the development site;
- Ensure that the storm sewer discharge will have no negative impact to the valley slope.

2.2 Quality control criteria consists of the following:

- An enhanced level of treatment is to be provided for runoff from the site, corresponding to 80% total suspended solids removal.

3 PRE-DEVELOPMENT CONDITIONS

3.1 Offsite Conditions

As previously indicated, the site is located north of Carss Street and is in between the Mississippi River to the west and the Former Canadian Pacific Railway to the east.

The former Canadian Pacific Railway bed is currently being used as a segment of the Ottawa Valley Rail Trail. There is an existing discontinuous ditch along the west side of the former rail bed and a continuous ditch along the east side of the section of the former rail bed adjacent the site. There are three culverts crossing through the form rail bed north of Carss Street conveying runoff from the catchment areas east of the former railway towards the Mississippi River west of the site. The culverts are triangular shaped with a height of 0.53 metres and a bottom width of 0.45 metres. The culverts are oriented with the bottom of the culvert parallel to the ground surface. The first and second culverts are located approximately 10 and 160 metres, respectively, north of the centerline of Carss Street. The third culvert is located more than 250 metres north of the north property line of the site. The runoff from both the first and second culverts is conveyed over the site to a shallow swale which begins at the second culvert and crosses into the retained parcel about 50 metres north of the centerline of Carss Street. This existing swale intersects the ditch along Carss Street about 30 metres west of the site and continues along the side of Carss Street for about 45 metres then angles across the retained parcel at about 40 degrees from the Carss Street alignment to the River.

The first culvert has an invert elevation of about 125.05 m. The second culvert has an invert elevation of about 124.68 m. The catchment area for the first and second culverts was estimated from available topographic information and site visits and extends from Carss Street to the unmaintained Lansdowne Road allowance to the north and from the former Railway to Martin Street on the East. This catchment was estimated to have an area of about 5 hectares. The ground surface elevation of this catchment varies from about 147 metres adjacent Martin Street to about 125 metres along the east side of the railway. Runoff from this catchment accumulates within the ditch along the eastside of the railway and is discharged to the subject site, first though the second culvert and then through both culverts as the ponding depth in the ditch increases.

These two culverts will act as flow restrictions during major storm events limiting the flow rate through the former railway bed to the site. Runoff in excess of the combined culvert capacity is stored in the ditch along the east side of the railway bed. The flow restriction from the culverts results in the stage storage discharge relationship indicated in Table 3-1. It is noted that overflow of the former railway bed would occur at an elevation of about 127.0 metres.

Table 3-1. Former Railway Culverts - Stage, Storage, Discharge Relationship.

Elevation (m)	Depth (m)	Flow Rate (m3/sec)	Storage (ha.m)
125.06	0.38	0.377	0.376
125.00	0.32	0.316	0.364
124.94	0.26	0.260	0.347
124.89	0.21	0.210	0.326
124.85	0.17	0.165	0.301
124.81	0.13	0.126	0.270
124.77	0.09	0.092	0.235
124.74	0.06	0.063	0.196
124.72	0.04	0.039	0.152
124.70	0.02	0.021	0.103
124.69	0.01	0.008	0.050
124.68	0.00	0.000	0.000

The catchment area for the third culvert through the former rail bed extends north from the unmaintained Lansdowne Road Allowance and from the former railway to Martin Street. Runoff from this catchment area accumulates along the east side of the railway in an unevaluated wet area before discharging through the third culvert north of the site. The catchment area for the third culvert does not impact the site or contribute runoff to the site.

There are no culverts crossing through Carss Street in proximity to the site. Runoff from areas south of Carss Street is directed west to the Mississippi River and does not impact the site.

The existing ground surface of the table land north of the subject site and west of the former railway has a general downward slope from east to west towards the Mississippi River. Runoff from the area directly north of the site is directed to the Mississippi River and does not impact the site

3.2 Onsite Conditions

As previously indicated, the site has a table land area above the valley slope of about 5.4 hectares. The table land has an average depth of about 130 metres between the east property line and the top of the valley slope. The main portion of the valley slope has a height ranging from about 24 to 28 metres and an average depth of about 74 metres resulting in an inclined downward toward the Mississippi River at an average angle which varies between 13 and 31 degrees from horizontal. The valley slope is well vegetated with a mixture of mature trees and undergrowth. The vegetation immediately above the normal water level is relatively dense. The table land is vegetated with a mixture of cultural meadow, thicket and woodland with a small portion used for agricultural purposes. There are some mown and maintained walking trails throughout the table land of the site.

Subsurface conditions on the table land vary from south to north and from east to west across the site. The subsurface conditions in the southeast portion of the site consist of silty clay with a thickness of more than 3 metres overlying bedrock. The thickness of the overburden decreases towards the top of slope to the west and towards the north end of the site. The subsurface conditions in the northeast portion of the site consist of fine sand glacial till overlying bedrock at a depth of about 1.1 metres. The subsurface conditions near the top of slope varies from silt clay over glacial till followed by bedrock at 2.1 metres below the ground surface at the south end of the site to a thin layer of glacial till or silty clay over bedrock at a depth of about 0.5 metres below grade at the north end of the site.

The tableland above the valley slope has an overall general slope from the east side of the site to the top of the valley slope. There is a local flow divide which extends diagonally downward from the unmaintained Lansdowne Road allowance towards the top of the slope at the southwest corner of the site. There is a shallow gully which extends into the tableland from the top of slope at about the midpoint of the site. There is a shallow swale which extends down the valley slope from the gully to the Mississippi River. The ground surface of the tableland in the vicinity of the gully gradually slopes upward away from the gully towards the flow divide located south and east of the gully. The ground surface slopes upwards to the north from the top of the gully to about the northern quarter of the site.

3.3 Pre-Development Catchment Areas

The pre-development drainage area considered in the stormwater management model was limited to the onsite areas above the top of slope and the offsite contributing area. The offsite catchment area east of the Ottawa Valley Rail Trail will remain unchanged between the pre- and post- development conditions. This offsite area consists of the large offsite contributing area to the site east of the former railway and south of the Lansdowne Road allowance.

There were two onsite catchment areas considered during pre-development conditions. These catchment areas consisted of CA-B south of the flow divide on the table land discussed above, and CA-A north of the flow divide on the table land. CA-A includes the gully and swale located at about the center of the site which outlets down the slope to the Mississippi River.

3.4 Existing Drainage Patterns

As previously indicated, there is a swale which crosses the southern portion of the site that conveys runoff originating east of the site to the Mississippi River. Runoff generated onsite east of the swale and south of the flow divide is also conveyed by the swale to the Mississippi River.

Other than the existing swale, there is little evidence of concentrated flow on the valley slope south of the flow divide.

Runoff from the table land north of the flow divide is directed by sheet flow west to the top of the valley slope and northwest into the shallow gully at about the midpoint of the site. Runoff from the tableland immediately north of the gully is also directed towards the gully and the top of the valley slope. There is some concentrated flow on the valley slope as a result of the discharge from the gully which is conveyed by means of the shallow swale to the Mississippi River.

The runoff from the tableland at the north end of the site is conveyed by sheet flow to the valley slope of the Mississippi River. There is little evidence of concentrated flow on the valley slope at the north end of the site.

4 POST-DEVELOPMENT CONDITIONS

4.1 Description of Proposed Development

The proposed development will consist of a mixture of single family dwellings, semi-detached dwellings and rowhouse development. An entrance street (Street 1) will extend, parallel to the former railway, from Carss Street to the north end of the site.

A crescent (Street 2) will extend from Street 1 and travel parallel to Street 1 and the valley slope before returning at the north end of the site. The inside of the Street 2 crescent will contain 32 units and a park block (Park Block 67) which is aligned roughly with the gully at the top of the valley slope and the unmaintained Lansdowne Road allowance. The west side of Street 2 will have a total of 22 units, 14 of which will have rear yards adjacent to the valley slope.

The proposed development will contain two additional park blocks. The first park block (Park Block 62) will be located at Carss Street between the east side of Street 1 and the former railway and will extend about 37 meters north from Carss Street. The second park block (Park Block 66) will be located at the southwest corner of the intersection of Street 2 and Street 1. The proposed property line along the south side of this park block will be in line with the north property line of the retained parcel.

4.2 Post-Development Catchment Areas

The post development catchment areas are illustrated on drawing 210864-POST and can be summarized as follows:

Catchment Area CA-1a consists of the large offsite contributing area to the site east east of the former railway and south of the Lansdowne Road allowance. Catchment Area CA-1b consists of the former railway and rear of the lots along Street 1 immediately adjacent to CA-1a. Catchment Area CA-2 consists street 1 and the front of the lots south of the above mentioned flow divide.

Catchment area CA-5, consists of the back half of the proposed units along the east side of Street 1 north of the Lansdowne Road allowance and the offsite area between the proposed development and the Pathway along the former railway north of the Lansdowne Road allowance. Catchment area CA-4 is comprised of the front of the units along the east side of street 1 and the outside of the Street 2 crescent as well as the units within the Street 2 crescent west of CA-5. Catchment area CA-3 consists of the remaining units within the Street 2 crescent as well as the front of the units along the west side of the crescent north of the flow divide and south of Park block 67.

Runoff from Catchment CA-2 is to be collected by storm sewers along Street 1 and direct to a hydrodynamic separator located in Street 1 immediately adjacent to Park Block 66. Discharge from the hydrodynamic flow separator is to be conveyed by a storm sewer which will be extended along the south side of Park Block 66 and along an easement contained within the rear of the units abutting the retained parcel to an outlet swale at the top of the valley slope. Runoff from catchments CA-1a and CA-1b will be collected by means of a storm sewer along the rear of the lots within CA-1b. This sewer will cross street 1 immediately south of the hydrodynamic flow separator providing treatment for the runoff from CA-2 and will be connected to the discharge sewer from the hydrodynamic flow separator.

Runoff from Catchments CA-5 and CA-4 is collected and directed by storm sewers to storm manhole in Street 2 approximately in line with the center of Park block 67. Runoff from Catchment CA-3 is also collected by storm sewers and conveyed to this manhole. Discharge from this manhole is directed through a hydrodynamic flow separator adjacent to Street 2 immediately west of Park Block 67 to the existing channel along the bottom of the gulley at the top of the slope.

The catchment area properties are summarized in Table 4-1.

Table 4-1 – Post-Development Catchment Area Characteristics

Catchment Label	Area	Location	C(1)	CN(2)	Percent Impervious	Time to Peak	Average Catchment Slope
	ha				%	hr	%
CA-1a	4.99	offsite (clean)(3)	0.32	81	11	0.37	10 – 24
Ca-1b	0.72	offsite and onsite (clean)	0.44	85	30	0.17	2 - 6
CA-2	0.74	onsite (streets)	0.62	N/A	58	0.17	2 - 6
CA-3	1.20	onsite (streets)	0.61	N/A	56	0.17	3 - 5
CA-4	1.59	onsite (streets)	0.64	N/A	60	0.17	2 - 4
CA-5	0.63	offsite and onsite (clean)	0.32	81	11	0.17	2 - 7

1) C = Runoff Coefficient used in the Rational Method
2) CN = SCS Modified Curve Number
3) Clean = The catchment areas indicated as "clean" are those that contribute runoff from landscaped areas or impervious areas such as building roofs which are not considered to be significant sources of suspended solids in runoff.

5 STORMWATER DESIGN

5.1 Stormwater Management Model

The hydrologic modeling software, Visual OTTHYMO (V2.6.3) was used to assess the post-development storm water flows at the site.

The post-development conditions for the catchment areas having an impervious ratio of less than 20 percent were also calculated using the NASHHYD watershed command. The post-development conditions for the catchment areas having an impervious ratio of more than 20 percent were calculated using the STANDHYD watershed command.

Rainfall data from Intensity-Duration-Frequency curves obtained from the Ottawa International Airport as provided in the City of Ottawa Sewer Design Guidelines were utilized to model the Chicago storm events at the site.

The IDF formulae utilized are as follows:

100 year Intensity = $1735.688 / (\text{Time in min} + 6.014)^{0.820}$
10 year Intensity = $1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity = $998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 year Intensity = $732.951 / (\text{Time in min} + 6.199)^{0.810}$

The rainfall data used in the SCS Type II storm distribution was obtained from the Ministry of Transportation IDF Curve Lookup Site for Almonte.

The post-development conditions were modeled to determine the flow rates in the storm sewers utilizing Chicago storm distributions of various magnitude. The historical design storms from July 1, 1979 and August 4, 1988 and the MECP Quality Storm (25 mm 4 hour Chicago) were also considered.

The resulting model contain the storm events as follows:

Simulation Number 1 - 25mm 4 hour Chicago
Simulation Number 2 - 6 hour 2 year Chicago
Simulation Number 3 - 6 hour 5 year Chicago
Simulation Number 4 - 6 hour 10 year Chicago
Simulation Number 5 - 6 hour 100 year Chicago
Simulation Number 6 - Historical Aug 4 1988
Simulation Number 7 - Historical July 1 1979

5.2 OTTHYMO Storm Analysis Variables

The NASHYD command uses the following inputs:
DT – Simulation time step increment (min) – must be shorter than TP
Area – Watershed or catchment area (hectares)
DWF – A constant Dry Weather Flow or Baseflow (m3/s) assumed to be 0 (doesn't change from pre to post development)
CN – SCS Modified Curve Number
IA – Initial Abstraction (mm)
N – Number of Linear reservoir used for derivation of the Nash Unit Hydrograph (generally 3)
TP – Unit hydrograph time to peak (hr)

The STANDHYD command uses the following inputs:
DT – Simulation time step increment (min) – must be shorter than TP
Area – Watershed or catchment area (hectares)
DWF – A constant Dry Weather Flow or Baseflow (m3/s) assumed to be 0 (doesn't change from pre to post development)
XIMP – Directly connected imperviousness (ratio of area which is impervious and directly connected to the storm sewer or discharge point
TIMP – Total impervious area (ratio of total impervious area to total catchment area)
LOSS – Loss method (Horton Infiltration Equation)

$f = f_c + (f_0 – f_c)e^{-k(t)}$

f = infiltration rate at time t (mm/hr)

f_c = final infiltration rate = 13.2 mm/hr

f_0 = initital infiltration rate = 76.2 mm/hr

k = decay coefficient (t^{-1}) = 0.00115s^{-1}

SLPP – Pervious area ground slope
LGP – Length of flow over pervious area
MNP – manning's roughness coefficient for sheet flow over pervious area
SCP – Pervious area storage coefficient (set to allow program to calculate)
DPSI – Available impervious area depression storage
SLPI – Impervious area ground slope
LGI – Flow length of impervious area
MNI – Manning's Roughness coefficient for impervious area (channel flow)
SCI – Impervious area storage coefficient (set to allow program to calculate)

5.2.1 Curve Numbers

The NasHyd hydrograph method which uses the SCS loss method for pervious areas. Runoff Curve Numbers (CN) are utilized in the SCS hydrology method. The Curve Number is a function of soil type, ground cover, and antecedent moisture conditions. The soil type was chosen to be

Group C, considering the subsurface conditions encountered at the site. For the purposes of analysis presented in this report, the pervious surfaces were considered to have a runoff coefficient of CN = 79 and Impervious of CN =98. The CN values were taken from the United States Department of Agriculture Urban Hydrology for Small Watersheds Technical Release 55 (USDA TR55).

5.2.2 Initial Abstraction and Potential Storage

The initial abstraction includes all losses before runoff begins, and includes water retained in surface depressions, water taken up by vegetation, evaporation, and infiltration. This value is related to characteristics of the soil and the soil cover. Initial abstraction is a function of the potential storage and considered to be equal to 0.15 S where S is the potential storage.
The potential storage S is related to the runoff coefficient as follows:
S = (25400/CN) - 254

5.2.3 Time of Concentration and Time to Peak

The time to peak is typically considered to be 2/3rds of the time of concentration of a catchment area. The time of concentration of each catchment was determined using the Velocity method. The velocity method assumes that the time of concentration is the sum of travel times for segments along the hydraulically most distant flow path. The segments used in the velocity method may be of three types: sheet flow T_s, shallow concentrated flow T_{sc}, and open channel flow T_c. The open channel flow was modelled using the route Channel Command in OTTHYMO.

Example calculation of time of Concentration for CA-1a:

The Manning's roughness coefficient for sheet flow for the offsite tree covered area was taken as n = 0.42.

$$T_s = \frac{0.091(nl)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

Where T_s = travel time, h
- n = Manning's roughness coefficient sheet flow = 0.42
- l = sheet flow length, 30 m
- P_2 = 2-year 24-hour rainfall, = 49.21 mm
- S = Slope of land surface m/m = 0.02
- T_s = 0.46 hours

Shallow concentrated flow was assumed to occur after a maximum of 30 metres on each catchment.

Travel time for shallow concentrated flow for the offsite Catchment CA-1a was divided into two sections due to the significant change in the overall slope of the land. The first section of the offsite catchment has an average slope of about 10 percent, the second section has an average slope of about 24 percent.

The flow velocity used to calculate the time of travel for shallow concentrated flow was determined using Table 15-3 of Chapter 15 of the USDA handbook. This table can be used to calculate the velocity when the slope and ground cover are known. The ground cover used in reading Table 15-3 for catchment CA-1a was considered to be woodland. From Table 15-3 of the USDA Handbook using a slope of 10%, the flow velocity for the first section was determined to be = 1.5 ft/s or 0.46 m/s. The flow velocity for the second section at 24 percent was determined to be 2.5 ft/s or 0.76 m/s. The distance of shallow concentrated flow was the distance between the point at which sheet flow ended and open channel flow begins or the end of the site. The open channels are considered to be either the road side ditches or the existing water courses.

$$T_{sc} = \frac{l}{3600\,V}$$

Where T_{sc} = travel time, h
l = distance of shallow concentrated flow:
Section 1 = 86 m
Section 2 = 130 m
T_{sc} = 0.05 + 0.05 = 0.10 hrs

The total time of concentration for catchment CA-1a was calculated to be equal to
Tt = 0.46 + 0.10 = 0.56 hrs.
The time to peak for CA-1a is therefore equal to 0.56 x 2/3 = 0.37 hrs = 22 mins.

The time to peak of the remaining catchments was determined to be 10 minutes or 0.17 hrs as this is the minimum time to peak recommended to be used in analysis in order to avoid over estimating the peak flows.

5.2.4 Manning Coefficients

The post-development catchment areas of the proposed development having an impervious ratio above 30 percent were modeled using the StandHyd hydrograph method. The model uses two parallel standard instantaneous unit hydrographs to convolute (or combine by running the two IUH simultaneously) the effective rainfall intensity over the pervious and impervious surfaces. The losses over the impervious surfaces were calculated using the Horton infiltration equation.

The Manning Roughness (n) Coefficients for overland flow selected for impervious site areas was assumed to be 0.013 based on the CofO Guidelines: Appendix 6-C Manning Coefficient values for street and gutter flow assuming weathered asphalt.

The Manning's roughness coefficient for pervious surfaces (MNP) was selected to be 0.30 based on sheet flow through good quality grass in the previous areas.

5.3 Pre-Development Runoff Rates

The pre-development runoff was calculated for each return period to determine the flow rates within the existing swales that are proposed to be used as outlets for the stormwater runoff from the development during post-development conditions. The offsite catchment area CA-1a and the pre-development catchment area CA-B contribute runoff to the existing swale located near the south end of the site. Pre-development catchment CA-A is the only area which contributes significant runoff to the existing swale located at about the center of the site.

The peak flow rates generated at various points in the watershed during pre-development conditions for the 2, 5, 10 and 100 year design storm events are summarized in the following Table 5-1

Table 5-1 Summary of Pre-Development Peak Flow Rates

Catchment	Comment	2 Storm Event Peak Flow	5 Storm Event Peak Flow	10 Storm Event Peak Flow	100 Storm Event Peak Flow
		m^3/sec	m^3/sec	m^3/sec	m^3/sec
CA-1a	Flow upstream of railway culvert	0.057	0.157	0.216	0.435
CA1a	Flow downstream of railway culvert	0.043	0.100	0.126	0.205
CA-B	Peak Flow generated from CA-2	0.022	0.063	0.087	0.175
CA-1a + CA-B	Peak flow along existing south swale from combined site and offsite areas	0.058	0.140	0.183	0.322
CA-A	Peak flow along existing swale at center of site	0.051	0.144	0.199	0.406
Total	Total pre-development runoff	0.107	0.277	0.374	0.726

5.4 Post-Development Quantity Control

5.4.1 Unmitigated Runoff Rates

Table 5-2 summarizes the peak flow rate for each return period assess at various locations adjacent to and within the site. Detailed results of the stormwater model are provided in Appendix A. The flow restriction for the runoff generated on the CA-1a catchment area resulting from the culverts through the former railway was modelled using a reservoir routine with the stage storage relationship shown in Table 3-1.

Table 5-2 Summary of Peak Flows

Catchment	Flow Path	2 Storm Event Peak Flow	5 Storm Event Peak Flow	10 Storm Event Peak Flow	100 Storm Event Peak Flow
		m^3/sec	m^3/sec	m^3/sec	m^3/sec
CA-1a	Railway Culverts	0.040	0.097	0.124	0.203
CA1a & CA1b	Rearyard Sewer	0.046	0.108	0.137	0.223
CA2	Street 1 Sewers (south end)	0.071	0.135	0.169	0.293
CA1a & CA1b & CA2	South Treatment Unit and Outlet	0.086	0.172	0.222	0.407
CA5	Rear yard Sewers and Park block 3 storm sewers	0.011	0.154	0.042	0.086
CA4	Street 2 storm sewers and Park block 3 storm sewers	0.030	0.286	0.372	0.605
CA4 & CA5	North Treatment Unit	0.161	0.306	0.401	0.671
CA3	Street 2 storm sewers and Park block 3 storm sewers	0.106	0.203	0.265	0.450
CA4 & CA5 & CA3	North Treatment Unit	0.270	0.509	0.666	1.121

5.4.2 Low impact Development

The above post-development flow rates provided in Table 5-2 have been obtained from a post-development without the inclusion of any low impact development (LID) techniques. Low impact development techniques are described by the Ministry of Environment Conservation and Parks as stormwater management strategy, system or facility that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to the source as possible.

The proposed development will make use of LID techniques which may include, downspout disconnection, perforated pipe systems, enhanced grass swales, disconnection of impervious areas were possible, and bioretention. These techniques will be modelled and detailed within the detailed stormwater management design submitted in support of subdivision approval.

5.5 Storm Sewer Design

In keeping with the previously provided criteria, the storm sewer will be designed to convey the above design flows during a 100 year storm event with a HGL a minimum of 0.3 m below the underside of footing of the buildings connected to the storm sewer by a storm service. For the purposes of the draft plan design submission, the design flows were calculated for each catchment area to determine a maximum flow within the storm sewers rather than determining the design flow in each specific storm sewer section.

In order to ensure that the 100 year HGL did not exceed the allowable elevations, the size of the storm sewers have been increased to ensure gravity flow during the 100 year event where the sewers will be connected to storm services. As a result, the criteria with respect to maintaining gravity flow in the storm sewers during a 5 year storm event is also met. The preliminary storm sewer design sheet is included in Appendix B.

5.5.1 Accommodate Offsite Drainage

As previously indicated, the anticipated runoff from the offsite catchment area has included in the OTTHYMO stormwater management model. The existing culverts through the former railway bed limit the flow rate during major storm events. The discharge from these culverts will be captured by means of appropriately placed ditch inlet catch basins and will be conveyed through the storm sewer system to the Mississippi River.

5.5.2 Ensure No Negative Impact to Adjacent Lands

The existing drainage pattern is in general from east to west. As such there is no significant contribution of runoff from the site along the north property line of the site to the adjacent land or from the adjacent land to the site. A shallow swale will be located in the rear yards of the dwellings along the north property line of the development. This swale will direct any runoff from the rear yards to the Mississippi River.

The rear yards of the proposed dwellings along the east side of the Retained parcel will result in some runoff being directed west towards the Retained parcel. This runoff will be intersected by a swale adjacent the rear property line. The swale will discharge to the existing swale which currently conveys the runoff from the catchment area east of the former railway. The runoff from the rear yards of the lots in question will be much less than the runoff currently being conveyed. As such, the runoff directed offsite onto the retained parcel following the completion of the development will be much less than current conditions and will have no negative impact to the adjacent lands.

5.5.3 Mitigate Impact of Sewer Discharge to Valley Slope

Discharge from the storm sewers will be directed to the valley slope at two locations. The first location is along the rear of the lots adjacent the retained parcel of land. The second location is within the existing channel at the bottom of the gulley in the valley slope adjacent to Park Block 67. The discharge from the storm sewers will be conveyed to the Mississippi River by means of constructed open channels.

The open channels will be constructed with a bottom width ranging from 0.5 to 1.0 metres and will have side slopes ranging from 3H:1V to 2H:1V. The bottoms of the open channels will consist of bedrock or of a coarse gravel and geotextile liner protected by large size riprap. The side slopes of the open channel will be protected by a geotextile liner and large size riprap. The riprap will be placed to ensure that the individual pieces of riprap are protected from horizontal displacement by interlocking with the adjacent riprap. The channels will be designed to resist erosion resulting from the flows generated during a 100 year storm event.

The first channel will have a total constructed length of about 103 metres and will begin about 20 metres from the top of slope. The existing slope along the channel path ranges from about 3 to 8 percent above the top of slope and from about 10 to 40 percent below the top of slope. The top of slope is about 83 metres from the normal water level. The lower about 55 metres of the slope is inclined at about 12 to 32 percent. The remaining about 28 metres is inclined at about 35 to 40 percent. The first channel is expected to convey the discharge from the combined catchment areas of CA-1a, CA-1b and CA-2. During a 100 year storm event, the peak flow rate will be 0.464 m^3/sec.

A flow rate of 0.464 m^3/sec will result in flow velocity of about 1.8 m/sec (5.9 ft/s) and a flow depth of about 0.26 m in a channel with a bottom width of 0.5 metres, side slopes of 2H:1V and a bottom slope of 40%. A bottom slope of 32 percent will decrease the flow velocity to about 1.6 m/sec and increase the flow depth to about 0.27 m.

The proposed storm sewer will discharge into a constructed channel on the tableland about 35 metres from the top of slope. The constructed channel will outlet into an existing swale located oriented along the bottom of the previously mentioned gully about 18 metres from the top of slope. The constructed channel will have a slope ranging from about 3 to 5 percent. The slope of the existing swale ranges from about 5 to 12 percent before the top of slope. The existing swale has a length of about 67 metres between the top of slope and normal water level and has a slope ranging from about 26 to 47 percent. The lower about 21 metres of the slope is inclined at about 26 to 47 percent. The remaining about 46 metres is inclined at about 35 to 40 percent. The second channel is expected to convey the discharge from the combined catchment areas of CA-3, CA-4 and CA-5. During a 100 year storm event, the peak flow rate will be 1.172 m^3/sec.

A flow rate of 1.172 m^3/sec will result in flow velocity of about 2.4 m/sec (7.9 ft/s) and a flow depth of about 0.38 m in a channel with a bottom width of 0.5 metres, side slopes of 2H:1V and a bottom slope of 47%. A bottom slope of 35 percent will decrease the flow velocity to about 2.2 m/sec and increase the flow depth to about 0.41 m.

The required riprap placement in each channel will be a function of the flow velocity and will be designed to mitigate any potential errosion in the channel along the valley slope. The flow velocity will vary based on the width and steepness of the channels.

The Design relationship between flow velocity and median riprap particle size is presented as follows:

$$D_{50} = 0.005\,94\, V_a^{3} / (d_{avg}^{0.5}\, K_1^{1.5}) \qquad (D_{50} = 0.001\, V_a^{3} / (d_{avg}^{0.5}\, K_1^{1.5})) \qquad (7.36)$$

Where: D_{50} = the median riprap particle size, m (ft)
C = correction factor (described below)
V_a = the average velocity in the main channel, m/s (ft/s)
d_{avg} = the average flow depth in the main flow channel, m (ft)

K_1 is defined as:

$$K_1 = [1-(\sin^2\theta/\sin^2\Phi)]^{0.5} \qquad (7.37)$$

Where: θ = the bank angle with the horizontal
Φ = the riprap material's angle of repose

The average flow depth and velocity used in Equation 7.36 are main channel values. The main channel is defined as the area between the channel banks (see Figure 7-24 below).

Using the above equations, a flow velocity of 1.8 m/sec with a flow depth of 0.26 m results in a median riprap particle size D50 of 275 mm. Expected individual pieces of riprap placed will range in mass from about 15 to 50 kg.

Using the above equations, a flow velocity of 2.4 m/sec with a flow depth of 0.38 m results in a median riprap particle size D50 of 304 mm. Expected individual pieces of riprap placed will range in mass from about 15 to 100 kg.

5.6 Stormwater Management Quality Control

Quality control criteria consists of the following:

- An enhanced level of treatment is to be provided for runoff from the site, corresponding to 80% total suspended solids removal.

As indicated in the Stormwater Management Planning and Design Manual published by the Ontario Ministry of the Environment (The MOE Manual), the recommended strategy for stormwater management is to provide an integrated treatment train approach to water management. In general, best management practices for stormwater management quality control are divided into three categories: source control, conveyance control and end-of-pipe control.

5.6.1 Runoff Pollutant Source

The primary source of total suspended solids and associated runoff pollution under post-development conditions in a residential subdivision is considered to be the areas of a site subject to vehicle traffic. At the proposed development, this consists of the driveways and roadways. In general, vegetated landscaped areas and roof areas are not considered to be a major source of runoff pollution following the completion of the development and establishment of the vegetation in the landscaped areas.

5.6.2 Source Control

The application of de-icing chemicals including salts and sand can be reduced with a best management plan for the application of these products. BMPs with respect to de-icing chemicals include such measures as timing of application, targeted application, and clearing of snow cover before application.

5.6.3 Conveyance Control

The majority of the runoff from the driveways and roadways will be conveyed by the proposed storm sewer system. Coarse grained suspended solids such as coarse sand and fine gravel will settle within the sumps of the catch basins and maintenance holes prior to entering the storm sewers. There is little other significant benefit in terms of quality control within the conveyance system provided by the proposed storm sewers.

5.6.4 End-of-Pipe Control

The stormwater treatment to meet the quality control requirement will be provided by the use of hydrodynamic vortex separators such as the Continuous Deflective System (CDS) by Contech

Engineered Solutions. There will be a total of two of the treatment units provided on the site. The treatment units will be located as shown on Kollaard Associates drawing 210864# SER 1,2. The treatment units will be sized to ensure a minimum of 80 percent total suspended solid removal using a fine particle size distribution. In addition, each treatment unit will be sized to ensure that it has sufficient treatment capacity to treat 100 percent of the water quality control flow from the contributing area without bypass. The water quality flow rate as specified by the MOE Manual is determined by the 25 mm 4 hour Chicago storm event.

The first treatment unit (South) is intended to provide treatment for the catchment area of CA-2. The water quality flow rate for this catchment area is 46 L/sec.

The second treatment unit (North) is intended to provide treatment for the catchment areas CA-3, CA-4, and CA-5. The water quality flow rate for this catchment area is 139 L/sec.

The CDS technology uses a combination of swirl concentration and indirect screening to screen, separate and trap debris, sediment, and hydrocarbons from stormwater runoff.

5.6.5 Quality Control Summary

Based on the above information, quality control to an enhanced level will be achieved as follows:

- Potential pollutants will be reduced at the source by best management practises.
- Coarse Pollutants will be partially removed by sedimentation within the catch basin and maintenance hole sumps.
- Stormwater treatment to 80 percent total suspended solids removal will be provided by Hydrodynamic vortex separators such as the CDS treatment unit designed to treat 100 percent of the flow generated during a quality control storm event.

5.6.6 Best Management Practices

Best Management Practices shall be implemented during and following construction as follows to reduce transport of sediments.

- Construction works are to be timed in order to reduce the length of time between the beginning of construction and the establishment of vegetative cover.
- Keep sediment and erosion control measures in place and maintained during and following construction until vegetation is established.
- Do not disturb vegetated areas outside of the development foot print.
- Use appropriate equipment for the development to reduce the duration of the development.
- Work should be timed to avoid the wet seasons of the year.

- Roof runoff should be discharged onto the ground surface and directed to the grass surfaced swales.
- Winter snow removal, together with salting and sanding should completed in accordance with an established plan and best management practices to reduce the amount of sand and salt required.

5.7 Stormwater System Operation and Maintenance

5.7.1 Catch basin / Catch basin Maintenance hole

The catch basins and maintenance holes should be cleaned with a Hydrovac excavation truck following completion of construction, paving of the asphaltic concrete surface and establishment of adequate grass cover on the landscaped areas.

Following the initial cleaning these structures should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed. Once the sediment accumulation in the catch basin and/or maintenance hole has reached a level equal to 0.2 metres below the outlet invert of the structure, the sediment should be removed by hydro excavation.

5.7.2 CDS Treatment Unit

The CDS hydrodynamic separators should be inspected and cleaned in accordance with the manufacturers recommendations. At minimum:
Inspection:

- The treatment unit should be inspected at regular intervals. At minimum inspections should be performed twice per year.
- Inspections should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen.
- Inspections should also quantify the accumulation of hydrocarbons, trash and sediment in the system.

Maintenance:

- The CDS system should be cleaned when the level of sediment has reached 75% of capacity or when an appreciable level of hydrocarbons and trash have accumulated.

5.7.3 Subdrains / Storm Sewer

Subdrains and storm sewer should be cleaned by flushing in combination with a hydrovac excavation truck following completion of the construction. Following the initial cleaning the storm sewers should be inspected on a semi-annual basis and following major storm events for accumulated sediment until there are sufficient records to develop a maintenance schedule.

Any accumulated sediment, blockages, trash or debris should be removed by means of flushing in combination with hydro excavation at the downstream end.

6 EROSION AND SEDIMENT CONTROL

The developer (and/or contractor) agrees to implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the Township of Mississippi Mills, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current best management practices for erosion and sediment control. It is considered to be the developers and/or contractors responsibility to ensure that the erosion control measures are implemented and maintained.

In order to limit the amount of sediment carried in stormwater runoff from the site during construction, it is recommended to install a silt fence along the west side of the development adjacent the top of slope. The silt fence may be polypropylene, nylon, and polyester or ethylene yarn. If a standard filter fabric is used, it must be backed by a wire fence supported on posts not over 2.0 m apart. Extra strength filter fabric may be used without a wire fence backing if posts are not over 1.0 m apart. Fabric joints should be lapped at least 150 mm (6") and stapled. The bottom edge of the filter fabric should be anchored in a 300 mm (1 ft) deep trench, to prevent flow under the fence. Sections of fence should be cleaned, if blocked with sediment and replaced if torn. The silt fences should only be removed once the site is stabilized and landscaping is completed.

Straw bale flow check dams (OPSD 219.180) should be installed across any natural swale at the top of the slope and across any constructed channel. The straw bale check dam should be maintained until vegetation is well established.

A mud mat or track out plate should be installed at the site construction access point to reduce the transport of sediment from the site to the street. The streets should be kept clean of mud and sediment.

Filter socks should be installed across all catchbasin and storm manhole lids immediately after installation. The filter socks should only be removed once the asphaltic concrete is installed, the landscaping is completed and the site is cleaned. The filter socks should be inspected and cleaned / replaced on a regular basis.

The proposed landscaping works should be completed as soon as possible. The proposed granular and asphaltic concrete surfaced areas should be surfaced as soon as possible.

These measures will reduce the amount of sediment carried from the site during storm events that may occur during construction.

7 CONCLUSIONS

This report addresses stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions for the proposed residential subdivision. Based on the analysis provided in this report, the conclusions are as follows:

- Due to the proximity of the site to the Mississippi River and the size of the River, there are no restrictions to the post-development runoff rate.
- The storm sewer system will convey the runoff from a 5 year design storm under gravity flow conditions and the HGL during a 100 year storm will be minimum of 0.3 metres below the underside of footing elevations of the buildings connected to the storm sewer by a storm service.
- The storm water management facility has been designed to accommodate offsite drainage where encountered and to ensure that stormwater flows will affect lands adjacent to the development site.
- The stormwater channels receiving the discharge from the storm sewers have been designed to ensure that there will be no negative impact to the river valley slope.
- Stormwater treatment will be provided an enhanced level by means of CDS hydrodynamic separator units.
- During all construction activities, erosion and sedimentation shall be controlled.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,
Kollaard Associates, Inc.

LICENSED PROFESSIONAL ENGINEER
13.OCT.2023
S.E. deWit
100079612
PROVINCE OF ONTARIO

Steven deWit, P.Eng.

APPENDICES

Appendix A - Storm Water Management Model

Appendix B - Preliminary Storm Sewer Design Sheet

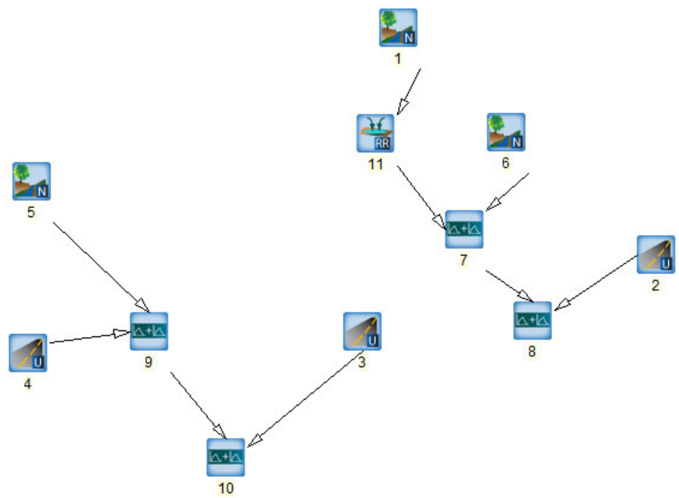
Appendix A – Storm Water Management Model

OTTHYMO Model Schematic

Schematic Summary Table

Detailed Report For Stormwater Management Model

OTTHYMO Model Schematic



Schematic Summary Table

Hydrograph No.	Model Type	Item Represented	Comment
1	NASHYD	Sub-Catchment CA-1a	Catchment representing offsite catchment Area East of CP Rail Trail
6	NASHYD	Sub-Catchment CA-1b	Catchment representing rear yards and offsite catchment area west of Trail for south portion of development
2	STANDHYD	Sub-Catchment CA-2	Catchment representing the south portion of the development discharging through Park Block 2
3	STANDHYD	Sub-Catchment CA-3	Catchment representing the southern portion of the development within the Street 2 Crescent
4	STANDHYD	Sub-Catchment CA-4	Catchment representing the northern portion of the development within the Street 2 Crescent
5	NASHYD	Sub-Catchment CA-5	Catchment representing rear yards and offsite catchment area west of Trail for north portion of development
11	Reservoir	Ponding Upstream of Trail Culvert	Represents the flow restriction for the off- site catchment area east of the Trail and storage resulting from the culvert under the Trial
7,8,9,10	ADD-HYD	Add Hydrograph	Link used to add two hydrographs in the routing

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

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       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
Developed and Distributed by Smart City Water Inc
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                   *****  D E T A I L E D   O U T P U T *****

  ************************************************
  ** SIMULATION : 10 year 6 hr Chicago          **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1174.184
| Ptotal= 57.02 mm |                          B=   6.014
--------------------                          C=   0.816
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  6.00 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
                 0.00    2.05 |  1.50   11.13 |  3.00    5.63 |  4.50    2.66
                 0.17    2.23 |  1.67   28.10 |  3.17    4.97 |  4.67    2.52
                 0.33    2.45 |  1.83  122.14 |  3.33    4.46 |  4.83    2.40
                 0.50    2.73 |  2.00   37.28 |  3.50    4.05 |  5.00    2.29
                 0.67    3.09 |  2.17   18.95 |  3.67    3.71 |  5.17    2.19
                 0.83    3.57 |  2.33   12.70 |  3.83    3.43 |  5.33    2.09
                 1.00    4.25 |  2.50    9.59 |  4.00    3.20 |  5.50    2.01
                 1.17    5.29 |  2.67    7.73 |  4.17    2.99 |  5.67    1.94
                 1.33    7.11 |  2.83    6.50 |  4.33    2.81 |  5.83    1.87


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   4.99  Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90  # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

         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    2.05 | 1.583   11.13 | 3.083    5.63 |  4.58    2.66
```

```
               0.167    2.05 | 1.667   11.13 | 3.167    5.63 |  4.67    2.66
               0.250    2.23 | 1.750   28.10 | 3.250    4.97 |  4.75    2.52
               0.333    2.23 | 1.833   28.10 | 3.333    4.97 |  4.83    2.52
               0.417    2.45 | 1.917  122.14 | 3.417    4.46 |  4.92    2.40
               0.500    2.45 | 2.000  122.14 | 3.500    4.46 |  5.00    2.40
               0.583    2.73 | 2.083   37.28 | 3.583    4.05 |  5.08    2.29
               0.667    2.73 | 2.167   37.28 | 3.667    4.05 |  5.17    2.29
               0.750    3.09 | 2.250   18.95 | 3.750    3.71 |  5.25    2.19
               0.833    3.09 | 2.333   18.95 | 3.833    3.71 |  5.33    2.19
               0.917    3.57 | 2.417   12.70 | 3.917    3.43 |  5.42    2.09
               1.000    3.57 | 2.500   12.70 | 4.000    3.43 |  5.50    2.09
               1.083    4.25 | 2.583    9.59 | 4.083    3.20 |  5.58    2.01
               1.167    4.25 | 2.667    9.59 | 4.167    3.20 |  5.67    2.01
               1.250    5.29 | 2.750    7.73 | 4.250    2.99 |  5.75    1.94
               1.333    5.29 | 2.833    7.73 | 4.333    2.99 |  5.83    1.94
               1.417    7.11 | 2.917    6.50 | 4.417    2.81 |  5.92    1.87
               1.500    7.11 | 3.000    6.50 | 4.500    2.81 |  6.00    1.87

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.210 (i)
     TIME TO PEAK    (hrs)=   2.417
     RUNOFF VOLUME    (mm)=  21.495
     TOTAL RAINFALL   (mm)=  57.019
     RUNOFF COEFFICIENT   =   0.377

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700      0.1260
                          0.0500     0.0080   |   0.3010      0.1650
                          0.1030     0.0210   |   0.3260      0.2100
                          0.1520     0.0390   |   0.3470      0.2600
                          0.1960     0.0630   |   0.3640      0.3160
                          0.2350     0.0920   |   0.3760      0.3770

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990     0.210      2.42      21.50
   OUTFLOW: ID= 1 (  0011)      4.990     0.124      2.92      21.49

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 59.00
                    TIME SHIFT OF PEAK FLOW         (min)= 30.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0288

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0006)|   Area    (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

         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    2.05 | 1.583   11.13 | 3.083    5.63 | 4.58    2.66
     0.167    2.05 | 1.667   11.13 | 3.167    5.63 | 4.67    2.66
     0.250    2.23 | 1.750   28.10 | 3.250    4.97 | 4.75    2.52
     0.333    2.23 | 1.833   28.10 | 3.333    4.97 | 4.83    2.52
     0.417    2.45 | 1.917  122.14 | 3.417    4.46 | 4.92    2.40
     0.500    2.45 | 2.000  122.14 | 3.500    4.46 | 5.00    2.40
     0.583    2.73 | 2.083   37.28 | 3.583    4.05 | 5.08    2.29
     0.667    2.73 | 2.167   37.28 | 3.667    4.05 | 5.17    2.29
     0.750    3.09 | 2.250   18.95 | 3.750    3.71 | 5.25    2.19
     0.833    3.09 | 2.333   18.95 | 3.833    3.71 | 5.33    2.19
     0.917    3.57 | 2.417   12.70 | 3.917    3.43 | 5.42    2.09
     1.000    3.57 | 2.500   12.70 | 4.000    3.43 | 5.50    2.09
     1.083    4.25 | 2.583    9.59 | 4.083    3.20 | 5.58    2.01
     1.167    4.25 | 2.667    9.59 | 4.167    3.20 | 5.67    2.01
     1.250    5.29 | 2.750    7.73 | 4.250    2.99 | 5.75    1.94
     1.333    5.29 | 2.833    7.73 | 4.333    2.99 | 5.83    1.94
     1.417    7.11 | 2.917    6.50 | 4.417    2.81 | 5.92    1.87
     1.500    7.11 | 3.000    6.50 | 4.500    2.81 | 6.00    1.87

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.062 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  26.362
     TOTAL RAINFALL   (mm)=  57.019
     RUNOFF COEFFICIENT   =   0.462

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99    0.124     2.92    21.49
      + ID2= 2 (  0006):     0.72    0.062     2.17    26.36
        ===================================================
        ID = 3 (  0007):     5.71    0.137     2.83    22.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43         0.31
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      70.24        20.00
     Mannings n           =      0.013        0.300

         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    2.05 | 1.583   11.13 | 3.083    5.63 | 4.58    2.66
   0.167    2.05 | 1.667   11.13 | 3.167    5.63 | 4.67    2.66
   0.250    2.23 | 1.750   28.10 | 3.250    4.97 | 4.75    2.52
   0.333    2.23 | 1.833   28.10 | 3.333    4.97 | 4.83    2.52
   0.417    2.45 | 1.917  122.14 | 3.417    4.46 | 4.92    2.40
   0.500    2.45 | 2.000  122.14 | 3.500    4.46 | 5.00    2.40
   0.583    2.73 | 2.083   37.28 | 3.583    4.05 | 5.08    2.29
   0.667    2.73 | 2.167   37.28 | 3.667    4.05 | 5.17    2.29
   0.750    3.09 | 2.250   18.95 | 3.750    3.71 | 5.25    2.19
   0.833    3.09 | 2.333   18.95 | 3.833    3.71 | 5.33    2.19
   0.917    3.57 | 2.417   12.70 | 3.917    3.43 | 5.42    2.09
   1.000    3.57 | 2.500   12.70 | 4.000    3.43 | 5.50    2.09
   1.083    4.25 | 2.583    9.59 | 4.083    3.20 | 5.58    2.01
   1.167    4.25 | 2.667    9.59 | 4.167    3.20 | 5.67    2.01
   1.250    5.29 | 2.750    7.73 | 4.250    2.99 | 5.75    1.94
   1.333    5.29 | 2.833    7.73 | 4.333    2.99 | 5.83    1.94
   1.417    7.11 | 2.917    6.50 | 4.417    2.81 | 5.92    1.87
   1.500    7.11 | 3.000    6.50 | 4.500    2.81 | 6.00    1.87

     Max.Eff.Inten.(mm/hr)=     122.14       108.48
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.37 (ii)    6.04 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.07       0.169 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08        2.00
     RUNOFF VOLUME    (mm)=      55.45        18.90       35.35
     TOTAL RAINFALL   (mm)=      57.02        57.02       57.02
     RUNOFF COEFFICIENT   =       0.97         0.33        0.62

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.74   0.169     2.00    35.35
      + ID2= 2 (  0007):     5.71   0.137     2.83    22.10
        ====================================================
        ID = 3 (  0008):     6.45   0.222     2.00    23.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.17

        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    2.05 | 1.583   11.13 | 3.083    5.63 |  4.58    2.66
                0.167    2.05 | 1.667   11.13 | 3.167    5.63 |  4.67    2.66
                0.250    2.23 | 1.750   28.10 | 3.250    4.97 |  4.75    2.52
                0.333    2.23 | 1.833   28.10 | 3.333    4.97 |  4.83    2.52
                0.417    2.45 | 1.917  122.14 | 3.417    4.46 |  4.92    2.40
                0.500    2.45 | 2.000  122.14 | 3.500    4.46 |  5.00    2.40
                0.583    2.73 | 2.083   37.28 | 3.583    4.05 |  5.08    2.29
                0.667    2.73 | 2.167   37.28 | 3.667    4.05 |  5.17    2.29
                0.750    3.09 | 2.250   18.95 | 3.750    3.71 |  5.25    2.19
                0.833    3.09 | 2.333   18.95 | 3.833    3.71 |  5.33    2.19
                0.917    3.57 | 2.417   12.70 | 3.917    3.43 |  5.42    2.09
                1.000    3.57 | 2.500   12.70 | 4.000    3.43 |  5.50    2.09
                1.083    4.25 | 2.583    9.59 | 4.083    3.20 |  5.58    2.01
                1.167    4.25 | 2.667    9.59 | 4.167    3.20 |  5.67    2.01
                1.250    5.29 | 2.750    7.73 | 4.250    2.99 |  5.75    1.94
                1.333    5.29 | 2.833    7.73 | 4.333    2.99 |  5.83    1.94
                1.417    7.11 | 2.917    6.50 | 4.417    2.81 |  5.92    1.87
                1.500    7.11 | 3.000    6.50 | 4.500    2.81 |  6.00    1.87

     Unit Hyd Qpeak  (cms)=   0.142

     PEAK FLOW       (cms)=   0.042 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  21.422
     TOTAL RAINFALL   (mm)=  57.019
     RUNOFF COEFFICIENT   =   0.376

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

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0004)|   Area    (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.64
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=     102.96        20.00
     Mannings n           =      0.013        0.300

        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    2.05 | 1.583   11.13 | 3.083    5.63 |  4.58    2.66
                0.167    2.05 | 1.667   11.13 | 3.167    5.63 |  4.67    2.66
                0.250    2.23 | 1.750   28.10 | 3.250    4.97 |  4.75    2.52
                0.333    2.23 | 1.833   28.10 | 3.333    4.97 |  4.83    2.52
```

```
                0.417    2.45 | 1.917  122.14 | 3.417    4.46 |  4.92    2.40
                0.500    2.45 | 2.000  122.14 | 3.500    4.46 |  5.00    2.40
                0.583    2.73 | 2.083   37.28 | 3.583    4.05 |  5.08    2.29
                0.667    2.73 | 2.167   37.28 | 3.667    4.05 |  5.17    2.29
                0.750    3.09 | 2.250   18.95 | 3.750    3.71 |  5.25    2.19
                0.833    3.09 | 2.333   18.95 | 3.833    3.71 |  5.33    2.19
                0.917    3.57 | 2.417   12.70 | 3.917    3.43 |  5.42    2.09
                1.000    3.57 | 2.500   12.70 | 4.000    3.43 |  5.50    2.09
                1.083    4.25 | 2.583    9.59 | 4.083    3.20 |  5.58    2.01
                1.167    4.25 | 2.667    9.59 | 4.167    3.20 |  5.67    2.01
                1.250    5.29 | 2.750    7.73 | 4.250    2.99 |  5.75    1.94
                1.333    5.29 | 2.833    7.73 | 4.333    2.99 |  5.83    1.94
                1.417    7.11 | 2.917    6.50 | 4.417    2.81 |  5.92    1.87
                1.500    7.11 | 3.000    6.50 | 4.500    2.81 |  6.00    1.87

     Max.Eff.Inten.(mm/hr)=     122.14       166.21
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.73 (ii)    5.97 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.21           0.372 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08            2.00
     RUNOFF VOLUME    (mm)=      55.45        23.68           34.48
     TOTAL RAINFALL   (mm)=      57.02        57.02           57.02
     RUNOFF COEFFICIENT   =       0.97         0.42            0.60

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):      1.59   0.372     2.00    34.48
      + ID2= 2 (  0005):      0.63   0.042     2.17    21.42
        ===================================================
        ID = 3 (  0009):      2.22   0.401     2.00    30.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.67         0.53
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      89.33        20.00
     Mannings n           =      0.013        0.300
```

```
         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    2.05 | 1.583   11.13 | 3.083    5.63 |  4.58    2.66
                 0.167    2.05 | 1.667   11.13 | 3.167    5.63 |  4.67    2.66
                 0.250    2.23 | 1.750   28.10 | 3.250    4.97 |  4.75    2.52
                 0.333    2.23 | 1.833   28.10 | 3.333    4.97 |  4.83    2.52
                 0.417    2.45 | 1.917  122.14 | 3.417    4.46 |  4.92    2.40
                 0.500    2.45 | 2.000  122.14 | 3.500    4.46 |  5.00    2.40
                 0.583    2.73 | 2.083   37.28 | 3.583    4.05 |  5.08    2.29
                 0.667    2.73 | 2.167   37.28 | 3.667    4.05 |  5.17    2.29
                 0.750    3.09 | 2.250   18.95 | 3.750    3.71 |  5.25    2.19
                 0.833    3.09 | 2.333   18.95 | 3.833    3.71 |  5.33    2.19
                 0.917    3.57 | 2.417   12.70 | 3.917    3.43 |  5.42    2.09
                 1.000    3.57 | 2.500   12.70 | 4.000    3.43 |  5.50    2.09
                 1.083    4.25 | 2.583    9.59 | 4.083    3.20 |  5.58    2.01
                 1.167    4.25 | 2.667    9.59 | 4.167    3.20 |  5.67    2.01
                 1.250    5.29 | 2.750    7.73 | 4.250    2.99 |  5.75    1.94
                 1.333    5.29 | 2.833    7.73 | 4.333    2.99 |  5.83    1.94
                 1.417    7.11 | 2.917    6.50 | 4.417    2.81 |  5.92    1.87
                 1.500    7.11 | 3.000    6.50 | 4.500    2.81 |  6.00    1.87

     Max.Eff.Inten.(mm/hr)=     122.14       136.45
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.59 (ii)    6.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.14           0.265 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08            2.00
     RUNOFF VOLUME    (mm)=      55.45        21.42           33.33
     TOTAL RAINFALL   (mm)=      57.02        57.02           57.02
     RUNOFF COEFFICIENT   =       0.97         0.38            0.58

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
           Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.265     2.00    33.33
      + ID2= 2 (  0009):     2.22   0.401     2.00    30.77
        ====================================================
        ID = 3 (  0010):     3.42   0.666     2.00    31.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
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 FINISH
================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       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\voin.dat
  Output  filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\18b9b949-820e-49a1-a330-75e16a2320b7\scenari
  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\18b9b949-820e-49a1-a330-75e16a2320b7\scenari


DATE: 10-12-2023                           TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________


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  **************************************************
  ** SIMULATION : 100 year 6 hr Chicago          **
  **************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1735.688
| Ptotal= 82.32 mm |                          B=   6.014
--------------------                          C=   0.820
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  6.00 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
```

```
                  0.00    2.90 |  1.50   15.97 |  3.00    8.02 |  4.50    3.77
                  0.17    3.16 |  1.67   40.65 |  3.17    7.08 |  4.67    3.57
                  0.33    3.48 |  1.83  178.56 |  3.33    6.35 |  4.83    3.40
                  0.50    3.88 |  2.00   54.05 |  3.50    5.76 |  5.00    3.24
                  0.67    4.39 |  2.17   27.32 |  3.67    5.28 |  5.17    3.10
                  0.83    5.07 |  2.33   18.24 |  3.83    4.88 |  5.33    2.97
                  1.00    6.05 |  2.50   13.74 |  4.00    4.54 |  5.50    2.85
                  1.17    7.54 |  2.67   11.06 |  4.17    4.25 |  5.67    2.74
                  1.33   10.16 |  2.83    9.29 |  4.33    3.99 |  5.83    2.64


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0001)|   Area     (ha)=   4.99   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
                 0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
                 0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
                 0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
                 0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
                 0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
                 0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
                 0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
                 0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
                 0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
                 0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
                 1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
                 1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
                 1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
                 1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
                 1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
                 1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
                 1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.425 (i)
     TIME TO PEAK    (hrs)=   2.417
     RUNOFF VOLUME    (mm)=  40.522
     TOTAL RAINFALL   (mm)=  82.319
     RUNOFF COEFFICIENT   =   0.492

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700     0.1260
```

```
                          0.0500      0.0080    |   0.3010       0.1650
                          0.1030      0.0210    |   0.3260       0.2100
                          0.1520      0.0390    |   0.3470       0.2600
                          0.1960      0.0630    |   0.3640       0.3160
                          0.2350      0.0920    |   0.3760       0.3770

                                AREA      QPEAK      TPEAK       R.V.
                                (ha)      (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990       0.425      2.42       40.52
   OUTFLOW: ID= 1 (  0011)      4.990       0.203      3.00       40.52

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.78
                   TIME SHIFT OF PEAK FLOW         (min)= 35.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0683

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0006)|   Area    (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
                 0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
                 0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
                 0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
                 0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
                 0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
                 0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
                 0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
                 0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
                 0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
                 0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
                 1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
                 1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
                 1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
                 1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
                 1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
                 1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
                 1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.120 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  47.135
     TOTAL RAINFALL   (mm)=  82.319
     RUNOFF COEFFICIENT   =   0.573

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

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```
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99   0.203     3.00    40.52
      + ID2= 2 (  0006):     0.72   0.120     2.08    47.13
        ===================================================
        ID = 3 (  0007):     5.71   0.223     2.83    41.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43         0.31
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      70.24        20.00
     Mannings n           =      0.013        0.300

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
               0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
               0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
               0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
               0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
               0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
               0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
               0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
               0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
               0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
               0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
               1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
               1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
               1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
               1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
               1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
               1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
               1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Max.Eff.Inten.(mm/hr)=     178.56       209.91
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.18 (ii)    5.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.13          0.293 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08           2.00
     RUNOFF VOLUME    (mm)=      80.75        38.11          57.29
     TOTAL RAINFALL   (mm)=      82.32        82.32          82.32
     RUNOFF COEFFICIENT   =       0.98         0.46           0.70

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

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):      0.74   0.293     2.00    57.29
      + ID2= 2 (  0007):      5.71   0.223     2.83    41.35
        ===================================================
        ID = 3 (  0008):      6.45   0.407     2.00    43.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
               0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
               0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
               0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
               0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
               0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
               0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
               0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
               0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
               0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
               0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
               1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
               1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
               1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
               1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
               1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
               1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
               1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Unit Hyd Qpeak  (cms)=   0.142

     PEAK FLOW       (cms)=   0.086 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  40.384
     TOTAL RAINFALL   (mm)=  82.319
     RUNOFF COEFFICIENT   =   0.491
```

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0004)|   Area     (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.95          0.64
     Dep. Storage     (mm)=        1.57          4.67
     Average Slope     (%)=        3.00          2.00
     Length            (m)=      102.96         20.00
     Mannings n          =       0.013         0.300

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
                0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
                0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
                0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
                0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
                0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
                0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
                0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
                0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
                0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
                0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
                1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
                1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
                1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
                1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
                1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
                1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
                1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Max.Eff.Inten.(mm/hr)=     178.56       276.79
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.48 (ii)    5.88 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.27         0.34          0.605 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08           2.00
     RUNOFF VOLUME    (mm)=      80.75        43.46          56.14
     TOTAL RAINFALL   (mm)=      82.32        82.32          82.32
     RUNOFF COEFFICIENT   =       0.98         0.53           0.68

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.59   0.605     2.00    56.14
      + ID2= 2 (  0005):     0.63   0.086     2.08    40.38
        ================================================
        ID = 3 (  0009):     2.22   0.671     2.00    51.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.67         0.53
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      89.33        20.00
     Mannings n           =      0.013        0.300

         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    2.90 | 1.583   15.97 | 3.083    8.02 |  4.58    3.77
                 0.167    2.90 | 1.667   15.97 | 3.167    8.02 |  4.67    3.77
                 0.250    3.16 | 1.750   40.65 | 3.250    7.08 |  4.75    3.57
                 0.333    3.16 | 1.833   40.66 | 3.333    7.08 |  4.83    3.57
                 0.417    3.48 | 1.917  178.56 | 3.417    6.35 |  4.92    3.40
                 0.500    3.48 | 2.000  178.56 | 3.500    6.35 |  5.00    3.40
                 0.583    3.88 | 2.083   54.05 | 3.583    5.76 |  5.08    3.24
                 0.667    3.88 | 2.167   54.05 | 3.667    5.76 |  5.17    3.24
                 0.750    4.39 | 2.250   27.32 | 3.750    5.28 |  5.25    3.10
                 0.833    4.39 | 2.333   27.32 | 3.833    5.28 |  5.33    3.10
                 0.917    5.07 | 2.417   18.24 | 3.917    4.88 |  5.42    2.97
                 1.000    5.07 | 2.500   18.24 | 4.000    4.88 |  5.50    2.97
                 1.083    6.05 | 2.583   13.74 | 4.083    4.54 |  5.58    2.85
                 1.167    6.05 | 2.667   13.74 | 4.167    4.54 |  5.67    2.85
                 1.250    7.54 | 2.750   11.06 | 4.250    4.25 |  5.75    2.74
                 1.333    7.54 | 2.833   11.06 | 4.333    4.25 |  5.83    2.74
                 1.417   10.16 | 2.917    9.29 | 4.417    3.99 |  5.92    2.64
                 1.500   10.16 | 3.000    9.29 | 4.500    3.99 |  6.00    2.64

     Max.Eff.Inten.(mm/hr)=     178.56       244.53
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.36 (ii)    5.88 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.21         0.25         0.450 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08          2.00
     RUNOFF VOLUME    (mm)=      80.75        41.02         54.92
```

```
     TOTAL RAINFALL    (mm)=       82.32        82.32          82.32
     RUNOFF COEFFICIENT   =         0.98         0.50           0.67

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.450     2.00    54.92
      + ID2= 2 (  0009):     2.22   0.671     2.00    51.67
        ===================================================
        ID = 3 (  0010):     3.42   1.121     2.00    52.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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===============================================================================
============================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       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
Developed and Distributed by Smart City Water Inc
```


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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\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\45087526-a9d6-42b5-ac69-eecc0113da43\scenari
  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\45087526-a9d6-42b5-ac69-eecc0113da43\scenari


DATE: 10-12-2023                           TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________
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  ************************************************
  ** SIMULATION : 2 year 6 hr Chicago           **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 358.659
| Ptotal= 35.15 mm |                          B=   0.000
--------------------                          C=   0.699
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  6.00 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
                 0.00    1.89 |  1.50    6.65 |  3.00    4.11 |  4.50    2.33
                 0.17    2.03 |  1.67   12.38 |  3.17    3.75 |  4.67    2.23
                 0.33    2.18 |  1.83   71.73 |  3.33    3.46 |  4.83    2.14
                 0.50    2.38 |  2.00   15.19 |  3.50    3.22 |  5.00    2.06
                 0.67    2.62 |  2.17    9.58 |  3.67    3.01 |  5.17    1.99
                 0.83    2.92 |  2.33    7.30 |  3.83    2.84 |  5.33    1.93
                 1.00    3.33 |  2.50    6.02 |  4.00    2.68 |  5.50    1.87
                 1.17    3.93 |  2.67    5.17 |  4.17    2.55 |  5.67    1.81
                 1.33    4.86 |  2.83    4.57 |  4.33    2.43 |  5.83    1.76


---------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0001)|   Area    (ha)=   4.99   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

         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    1.89 | 1.583    6.65 | 3.083    4.11 |  4.58    2.33
                0.167    1.89 | 1.667    6.65 | 3.167    4.11 |  4.67    2.33
                0.250    2.03 | 1.750   12.38 | 3.250    3.75 |  4.75    2.23
                0.333    2.03 | 1.833   12.38 | 3.333    3.75 |  4.83    2.23
                0.417    2.18 | 1.917   71.73 | 3.417    3.46 |  4.92    2.14
                0.500    2.18 | 2.000   71.73 | 3.500    3.46 |  5.00    2.14
                0.583    2.38 | 2.083   15.19 | 3.583    3.22 |  5.08    2.06
                0.667    2.38 | 2.167   15.19 | 3.667    3.22 |  5.17    2.06
                0.750    2.62 | 2.250    9.58 | 3.750    3.01 |  5.25    1.99
                0.833    2.62 | 2.333    9.58 | 3.833    3.01 |  5.33    1.99
                0.917    2.92 | 2.417    7.30 | 3.917    2.84 |  5.42    1.93
                1.000    2.92 | 2.500    7.30 | 4.000    2.84 |  5.50    1.93
                1.083    3.33 | 2.583    6.02 | 4.083    2.68 |  5.58    1.87
                1.167    3.33 | 2.667    6.02 | 4.167    2.68 |  5.67    1.87
                1.250    3.93 | 2.750    5.17 | 4.250    2.55 |  5.75    1.81
                1.333    3.93 | 2.833    5.17 | 4.333    2.55 |  5.83    1.81
```

```
               1.417    4.86 | 2.917    4.57 | 4.417    2.43 |  5.92    1.76
               1.500    4.86 | 3.000    4.57 | 4.500    2.43 |  6.00    1.76

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.053 (i)
     TIME TO PEAK    (hrs)=   2.500
     RUNOFF VOLUME    (mm)=   8.026
     TOTAL RAINFALL   (mm)=  35.149
     RUNOFF COEFFICIENT   =   0.228

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700      0.1260
                          0.0500     0.0080   |   0.3010      0.1650
                          0.1030     0.0210   |   0.3260      0.2100
                          0.1520     0.0390   |   0.3470      0.2600
                          0.1960     0.0630   |   0.3640      0.3160
                          0.2350     0.0920   |   0.3760      0.3770

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990      0.053      2.50       8.03
   OUTFLOW: ID= 1 (  0011)      4.990      0.040      2.92       8.02

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 75.54
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0065

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0006)|   Area    (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

         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    1.89 | 1.583    6.65 | 3.083    4.11 |  4.58    2.33
               0.167    1.89 | 1.667    6.65 | 3.167    4.11 |  4.67    2.33
               0.250    2.03 | 1.750   12.38 | 3.250    3.75 |  4.75    2.23
               0.333    2.03 | 1.833   12.38 | 3.333    3.75 |  4.83    2.23
               0.417    2.18 | 1.917   71.73 | 3.417    3.46 |  4.92    2.14
               0.500    2.18 | 2.000   71.73 | 3.500    3.46 |  5.00    2.14
               0.583    2.38 | 2.083   15.19 | 3.583    3.22 |  5.08    2.06
               0.667    2.38 | 2.167   15.19 | 3.667    3.22 |  5.17    2.06
               0.750    2.62 | 2.250    9.58 | 3.750    3.01 |  5.25    1.99
               0.833    2.62 | 2.333    9.58 | 3.833    3.01 |  5.33    1.99
               0.917    2.92 | 2.417    7.30 | 3.917    2.84 |  5.42    1.93
               1.000    2.92 | 2.500    7.30 | 4.000    2.84 |  5.50    1.93
```

```
               1.083    3.33 | 2.583    6.02 | 4.083    2.68 |  5.58    1.87
               1.167    3.33 | 2.667    6.02 | 4.167    2.68 |  5.67    1.87
               1.250    3.93 | 2.750    5.17 | 4.250    2.55 |  5.75    1.81
               1.333    3.93 | 2.833    5.17 | 4.333    2.55 |  5.83    1.81
               1.417    4.86 | 2.917    4.57 | 4.417    2.43 |  5.92    1.76
               1.500    4.86 | 3.000    4.57 | 4.500    2.43 |  6.00    1.76

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.019 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  10.881
     TOTAL RAINFALL   (mm)=  35.149
     RUNOFF COEFFICIENT   =   0.310

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99   0.040     2.92     8.02
      + ID2= 2 (  0006):     0.72   0.019     2.08    10.88
        ===================================================
        ID = 3 (  0007):     5.71   0.046     2.92     8.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.43         0.31
     Dep. Storage     (mm)=        1.57         4.67
     Average Slope     (%)=        3.00         2.00
     Length            (m)=       70.24        20.00
     Mannings n          =       0.013        0.300

         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    1.89 | 1.583    6.65 | 3.083    4.11 |  4.58    2.33
               0.167    1.89 | 1.667    6.65 | 3.167    4.11 |  4.67    2.33
               0.250    2.03 | 1.750   12.38 | 3.250    3.75 |  4.75    2.23
               0.333    2.03 | 1.833   12.38 | 3.333    3.75 |  4.83    2.23
               0.417    2.18 | 1.917   71.73 | 3.417    3.46 |  4.92    2.14
               0.500    2.18 | 2.000   71.73 | 3.500    3.46 |  5.00    2.14
               0.583    2.38 | 2.083   15.19 | 3.583    3.22 |  5.08    2.06
               0.667    2.38 | 2.167   15.19 | 3.667    3.22 |  5.17    2.06
               0.750    2.62 | 2.250    9.58 | 3.750    3.01 |  5.25    1.99
               0.833    2.62 | 2.333    9.58 | 3.833    3.01 |  5.33    1.99
               0.917    2.92 | 2.417    7.30 | 3.917    2.84 |  5.42    1.93
               1.000    2.92 | 2.500    7.30 | 4.000    2.84 |  5.50    1.93
```

```
                1.083    3.33 | 2.583    6.02 | 4.083    2.68 |  5.58    1.87
                1.167    3.33 | 2.667    6.02 | 4.167    2.68 |  5.67    1.87
                1.250    3.93 | 2.750    5.17 | 4.250    2.55 |  5.75    1.81
                1.333    3.93 | 2.833    5.17 | 4.333    2.55 |  5.83    1.81
                1.417    4.86 | 2.917    4.57 | 4.417    2.43 |  5.92    1.76
                1.500    4.86 | 3.000    4.57 | 4.500    2.43 |  6.00    1.76

     Max.Eff.Inten.(mm/hr)=      71.73        30.04
                over (min)         5.00        15.00
     Storage Coeff.  (min)=        1.70 (ii)   10.10 (ii)
     Unit Hyd. Tpeak (min)=        5.00        15.00
     Unit Hyd. peak  (cms)=        0.32         0.10
                                                        *TOTALS*
     PEAK FLOW       (cms)=        0.07         0.01          0.071 (iii)
     TIME TO PEAK    (hrs)=        2.00         2.17           2.00
     RUNOFF VOLUME    (mm)=       33.58         3.82          17.21
     TOTAL RAINFALL   (mm)=       35.15        35.15          35.15
     RUNOFF COEFFICIENT   =        0.96         0.11           0.49

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
           Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.74   0.071     2.00    17.21
      + ID2= 2 (  0007):     5.71   0.046     2.92     8.38
        ====================================================
        ID = 3 (  0008):     6.45   0.086     2.00     9.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

         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    1.89 | 1.583    6.65 | 3.083    4.11 |  4.58    2.33
                0.167    1.89 | 1.667    6.65 | 3.167    4.11 |  4.67    2.33
                0.250    2.03 | 1.750   12.38 | 3.250    3.75 |  4.75    2.23
                0.333    2.03 | 1.833   12.38 | 3.333    3.75 |  4.83    2.23
                0.417    2.18 | 1.917   71.73 | 3.417    3.46 |  4.92    2.14
                0.500    2.18 | 2.000   71.73 | 3.500    3.46 |  5.00    2.14
                0.583    2.38 | 2.083   15.19 | 3.583    3.22 |  5.08    2.06
```

0.667	2.38	2.167	15.19	3.667	3.22	5.17	2.06
0.750	2.62	2.250	9.58	3.750	3.01	5.25	1.99
0.833	2.62	2.333	9.58	3.833	3.01	5.33	1.99
0.917	2.92	2.417	7.30	3.917	2.84	5.42	1.93
1.000	2.92	2.500	7.30	4.000	2.84	5.50	1.93
1.083	3.33	2.583	6.02	4.083	2.68	5.58	1.87
1.167	3.33	2.667	6.02	4.167	2.68	5.67	1.87
1.250	3.93	2.750	5.17	4.250	2.55	5.75	1.81
1.333	3.93	2.833	5.17	4.333	2.55	5.83	1.81
1.417	4.86	2.917	4.57	4.417	2.43	5.92	1.76
1.500	4.86	3.000	4.57	4.500	2.43	6.00	1.76

```
Unit Hyd Qpeak  (cms)=   0.142

PEAK FLOW       (cms)=   0.011 (i)
TIME TO PEAK    (hrs)=   2.167
RUNOFF VOLUME    (mm)=   7.998
TOTAL RAINFALL   (mm)=  35.149
RUNOFF COEFFICIENT   =   0.228

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

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------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0004)|   Area    (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.95         0.64
     Dep. Storage     (mm)=      1.57         4.67
     Average Slope     (%)=      3.00         2.00
     Length            (m)=    102.96        20.00
     Mannings n           =     0.013        0.300

         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	1.89	1.583	6.65	3.083	4.11	4.58	2.33
0.167	1.89	1.667	6.65	3.167	4.11	4.67	2.33
0.250	2.03	1.750	12.38	3.250	3.75	4.75	2.23
0.333	2.03	1.833	12.38	3.333	3.75	4.83	2.23
0.417	2.18	1.917	71.73	3.417	3.46	4.92	2.14
0.500	2.18	2.000	71.73	3.500	3.46	5.00	2.14
0.583	2.38	2.083	15.19	3.583	3.22	5.08	2.06
0.667	2.38	2.167	15.19	3.667	3.22	5.17	2.06
0.750	2.62	2.250	9.58	3.750	3.01	5.25	1.99
0.833	2.62	2.333	9.58	3.833	3.01	5.33	1.99
0.917	2.92	2.417	7.30	3.917	2.84	5.42	1.93
1.000	2.92	2.500	7.30	4.000	2.84	5.50	1.93
1.083	3.33	2.583	6.02	4.083	2.68	5.58	1.87
1.167	3.33	2.667	6.02	4.167	2.68	5.67	1.87
1.250	3.93	2.750	5.17	4.250	2.55	5.75	1.81
1.333	3.93	2.833	5.17	4.333	2.55	5.83	1.81
1.417	4.86	2.917	4.57	4.417	2.43	5.92	1.76
1.500	4.86	3.000	4.57	4.500	2.43	6.00	1.76

```
     Max.Eff.Inten.(mm/hr)=      71.73        59.65
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       2.14 (ii)    8.52 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.07             0.154 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08              2.00
     RUNOFF VOLUME    (mm)=      33.58         6.34             15.60
     TOTAL RAINFALL   (mm)=      35.15        35.15             35.15
     RUNOFF COEFFICIENT   =       0.96         0.18              0.44

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
           Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.59   0.154     2.00    15.60
      + ID2= 2 (  0005):     0.63   0.011     2.17     8.00
        ===================================================
        ID = 3 (  0009):     2.22   0.161     2.00    13.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.67         0.53
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      89.33        20.00
     Mannings n           =      0.013        0.300

         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    1.89 | 1.583    6.65 | 3.083    4.11 |  4.58    2.33
                0.167    1.89 | 1.667    6.65 | 3.167    4.11 |  4.67    2.33
                0.250    2.03 | 1.750   12.38 | 3.250    3.75 |  4.75    2.23
                0.333    2.03 | 1.833   12.38 | 3.333    3.75 |  4.83    2.23
                0.417    2.18 | 1.917   71.73 | 3.417    3.46 |  4.92    2.14
                0.500    2.18 | 2.000   71.73 | 3.500    3.46 |  5.00    2.14
                0.583    2.38 | 2.083   15.19 | 3.583    3.22 |  5.08    2.06
                0.667    2.38 | 2.167   15.19 | 3.667    3.22 |  5.17    2.06
```

```
            0.750    2.62 | 2.250    9.58 | 3.750    3.01 |  5.25    1.99
            0.833    2.62 | 2.333    9.58 | 3.833    3.01 |  5.33    1.99
            0.917    2.92 | 2.417    7.30 | 3.917    2.84 |  5.42    1.93
            1.000    2.92 | 2.500    7.30 | 4.000    2.84 |  5.50    1.93
            1.083    3.33 | 2.583    6.02 | 4.083    2.68 |  5.58    1.87
            1.167    3.33 | 2.667    6.02 | 4.167    2.68 |  5.67    1.87
            1.250    3.93 | 2.750    5.17 | 4.250    2.55 |  5.75    1.81
            1.333    3.93 | 2.833    5.17 | 4.333    2.55 |  5.83    1.81
            1.417    4.86 | 2.917    4.57 | 4.417    2.43 |  5.92    1.76
            1.500    4.86 | 3.000    4.57 | 4.500    2.43 |  6.00    1.76

     Max.Eff.Inten.(mm/hr)=      71.73        44.68
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.96 (ii)    9.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.04             0.109 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08              2.00
     RUNOFF VOLUME    (mm)=      33.58         5.04             15.03
     TOTAL RAINFALL   (mm)=      35.15        35.15             35.15
     RUNOFF COEFFICIENT   =       0.96         0.14              0.43

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.109     2.00    15.03
      + ID2= 2 (  0009):     2.22   0.161     2.00    13.44
        ======================================================
        ID = 3 (  0010):     3.42   0.270     2.00    14.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===============================================================================
============================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       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 *****


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  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\70b7e8c2-85e3-4b0e-93e6-99142f31c3e2\scenari


DATE: 10-12-2023                           TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
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  ************************************************
  ** SIMULATION : 5 year 6 hr Chicago          **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 998.071
| Ptotal= 49.04 mm |                          B=   6.053
--------------------                          C=   0.814
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  6.00 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
                 0.00    1.78 |  1.50    9.61 |  3.00    4.87 |  4.50    2.31
                 0.17    1.94 |  1.67   24.17 |  3.17    4.30 |  4.67    2.19
                 0.33    2.13 |  1.83  104.19 |  3.33    3.86 |  4.83    2.08
                 0.50    2.37 |  2.00   32.04 |  3.50    3.51 |  5.00    1.99
                 0.67    2.68 |  2.17   16.34 |  3.67    3.22 |  5.17    1.90
                 0.83    3.10 |  2.33   10.96 |  3.83    2.98 |  5.33    1.82
                 1.00    3.68 |  2.50    8.29 |  4.00    2.77 |  5.50    1.75
                 1.17    4.58 |  2.67    6.69 |  4.17    2.60 |  5.67    1.68
                 1.33    6.15 |  2.83    5.63 |  4.33    2.44 |  5.83    1.62


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0001)|   Area    (ha)=   4.99   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

         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    1.78 | 1.583    9.61 | 3.083    4.87 | 4.58    2.31
          0.167    1.78 | 1.667    9.61 | 3.167    4.87 | 4.67    2.31
          0.250    1.94 | 1.750   24.17 | 3.250    4.30 | 4.75    2.19
          0.333    1.94 | 1.833   24.17 | 3.333    4.30 | 4.83    2.19
          0.417    2.13 | 1.917  104.19 | 3.417    3.86 | 4.92    2.08
          0.500    2.13 | 2.000  104.19 | 3.500    3.86 | 5.00    2.08
          0.583    2.37 | 2.083   32.04 | 3.583    3.51 | 5.08    1.99
          0.667    2.37 | 2.167   32.04 | 3.667    3.51 | 5.17    1.99
          0.750    2.68 | 2.250   16.34 | 3.750    3.22 | 5.25    1.90
          0.833    2.68 | 2.333   16.34 | 3.833    3.22 | 5.33    1.90
          0.917    3.10 | 2.417   10.96 | 3.917    2.98 | 5.42    1.82
          1.000    3.10 | 2.500   10.96 | 4.000    2.98 | 5.50    1.82
          1.083    3.68 | 2.583    8.29 | 4.083    2.77 | 5.58    1.75
          1.167    3.68 | 2.667    8.29 | 4.167    2.77 | 5.67    1.75
          1.250    4.58 | 2.750    6.69 | 4.250    2.60 | 5.75    1.68
          1.333    4.58 | 2.833    6.69 | 4.333    2.60 | 5.83    1.68
          1.417    6.15 | 2.917    5.63 | 4.417    2.44 | 5.92    1.62
          1.500    6.15 | 3.000    5.63 | 4.500    2.44 | 6.00    1.62

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.152 (i)
     TIME TO PEAK    (hrs)=   2.417
     RUNOFF VOLUME    (mm)=  16.153
     TOTAL RAINFALL   (mm)=  49.038
     RUNOFF COEFFICIENT   =   0.329

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700      0.1260
                          0.0500     0.0080   |   0.3010      0.1650
                          0.1030     0.0210   |   0.3260      0.2100
                          0.1520     0.0390   |   0.3470      0.2600
                          0.1960     0.0630   |   0.3640      0.3160
                          0.2350     0.0920   |   0.3760      0.3770

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990     0.152      2.42      16.15
   OUTFLOW: ID= 1 (  0011)      4.990     0.097      2.92      16.15

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 64.26
                    TIME SHIFT OF PEAK FLOW        (min)= 30.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0196

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0006)|   Area    (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.90   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.17

        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	1.78	1.583	9.61	3.083	4.87	4.58	2.31
0.167	1.78	1.667	9.61	3.167	4.87	4.67	2.31
0.250	1.94	1.750	24.17	3.250	4.30	4.75	2.19
0.333	1.94	1.833	24.17	3.333	4.30	4.83	2.19
0.417	2.13	1.917	104.19	3.417	3.86	4.92	2.08
0.500	2.13	2.000	104.19	3.500	3.86	5.00	2.08
0.583	2.37	2.083	32.04	3.583	3.51	5.08	1.99
0.667	2.37	2.167	32.04	3.667	3.51	5.17	1.99
0.750	2.68	2.250	16.34	3.750	3.22	5.25	1.90
0.833	2.68	2.333	16.34	3.833	3.22	5.33	1.90
0.917	3.10	2.417	10.96	3.917	2.98	5.42	1.82
1.000	3.10	2.500	10.96	4.000	2.98	5.50	1.82
1.083	3.68	2.583	8.29	4.083	2.77	5.58	1.75
1.167	3.68	2.667	8.29	4.167	2.77	5.67	1.75
1.250	4.58	2.750	6.69	4.250	2.60	5.75	1.68
1.333	4.58	2.833	6.69	4.333	2.60	5.83	1.68
1.417	6.15	2.917	5.63	4.417	2.44	5.92	1.62
1.500	6.15	3.000	5.63	4.500	2.44	6.00	1.62

```
     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.046 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  20.345
     TOTAL RAINFALL   (mm)=  49.038
     RUNOFF COEFFICIENT   =   0.415

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99   0.097     2.92    16.15
      + ID2= 2 (  0006):     0.72   0.046     2.17    20.34
        ===================================================
        ID = 3 (  0007):     5.71   0.108     2.83    16.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43         0.31
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      70.24        20.00
```

```
    Mannings n           =      0.013        0.300

        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	1.78	1.583	9.61	3.083	4.87	4.58	2.31
0.167	1.78	1.667	9.61	3.167	4.87	4.67	2.31
0.250	1.94	1.750	24.17	3.250	4.30	4.75	2.19
0.333	1.94	1.833	24.17	3.333	4.30	4.83	2.19
0.417	2.13	1.917	104.19	3.417	3.86	4.92	2.08
0.500	2.13	2.000	104.19	3.500	3.86	5.00	2.08
0.583	2.37	2.083	32.04	3.583	3.51	5.08	1.99
0.667	2.37	2.167	32.04	3.667	3.51	5.17	1.99
0.750	2.68	2.250	16.34	3.750	3.22	5.25	1.90
0.833	2.68	2.333	16.34	3.833	3.22	5.33	1.90
0.917	3.10	2.417	10.96	3.917	2.98	5.42	1.82
1.000	3.10	2.500	10.96	4.000	2.98	5.50	1.82
1.083	3.68	2.583	8.29	4.083	2.77	5.58	1.75
1.167	3.68	2.667	8.29	4.167	2.77	5.67	1.75
1.250	4.58	2.750	6.69	4.250	2.60	5.75	1.68
1.333	4.58	2.833	6.69	4.333	2.60	5.83	1.68
1.417	6.15	2.917	5.63	4.417	2.44	5.92	1.62
1.500	6.15	3.000	5.63	4.500	2.44	6.00	1.62

```
    Max.Eff.Inten.(mm/hr)=     104.19        79.92
               over (min)        5.00        10.00
    Storage Coeff.  (min)=       1.46 (ii)    6.43 (ii)
    Unit Hyd. Tpeak (min)=       5.00        10.00
    Unit Hyd. peak  (cms)=       0.33         0.14
                                                            *TOTALS*
    PEAK FLOW       (cms)=       0.10         0.05            0.135 (iii)
    TIME TO PEAK    (hrs)=       2.00         2.08             2.00
    RUNOFF VOLUME    (mm)=      47.47        13.41            28.73
    TOTAL RAINFALL   (mm)=      49.04        49.04            49.04
    RUNOFF COEFFICIENT   =       0.97         0.27             0.59

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.74   0.135     2.00    28.73
      + ID2= 2 (  0007):     5.71   0.108     2.83    16.68
        ==================================================
        ID = 3 (  0008):     6.45   0.172     2.00    18.06

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
------------------------------------------------------------------------------------------------------
| CALIB              |
| NASHYD   (  0005)|   Area     (ha)=    0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.17

         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     1.78 | 1.583     9.61 | 3.083     4.87 |  4.58     2.31
                0.167     1.78 | 1.667     9.61 | 3.167     4.87 |  4.67     2.31
                0.250     1.94 | 1.750    24.17 | 3.250     4.30 |  4.75     2.19
                0.333     1.94 | 1.833    24.17 | 3.333     4.30 |  4.83     2.19
                0.417     2.13 | 1.917   104.19 | 3.417     3.86 |  4.92     2.08
                0.500     2.13 | 2.000   104.19 | 3.500     3.86 |  5.00     2.08
                0.583     2.37 | 2.083    32.04 | 3.583     3.51 |  5.08     1.99
                0.667     2.37 | 2.167    32.04 | 3.667     3.51 |  5.17     1.99
                0.750     2.68 | 2.250    16.34 | 3.750     3.22 |  5.25     1.90
                0.833     2.68 | 2.333    16.34 | 3.833     3.22 |  5.33     1.90
                0.917     3.10 | 2.417    10.96 | 3.917     2.98 |  5.42     1.82
                1.000     3.10 | 2.500    10.96 | 4.000     2.98 |  5.50     1.82
                1.083     3.68 | 2.583     8.29 | 4.083     2.77 |  5.58     1.75
                1.167     3.68 | 2.667     8.29 | 4.167     2.77 |  5.67     1.75
                1.250     4.58 | 2.750     6.69 | 4.250     2.60 |  5.75     1.68
                1.333     4.58 | 2.833     6.69 | 4.333     2.60 |  5.83     1.68
                1.417     6.15 | 2.917     5.63 | 4.417     2.44 |  5.92     1.62
                1.500     6.15 | 3.000     5.63 | 4.500     2.44 |  6.00     1.62

     Unit Hyd Qpeak  (cms)=   0.142

     PEAK FLOW       (cms)=   0.030 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  16.098
     TOTAL RAINFALL   (mm)=  49.038
     RUNOFF COEFFICIENT   =   0.328

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

------------------------------------------------------------------------------------------------------
| CALIB              |
| STANDHYD (  0004)|   Area     (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.64
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=     102.96        20.00
     Mannings n           =      0.013        0.300

         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     1.78 | 1.583     9.61 | 3.083     4.87 |  4.58     2.31
                0.167     1.78 | 1.667     9.61 | 3.167     4.87 |  4.67     2.31
                0.250     1.94 | 1.750    24.17 | 3.250     4.30 |  4.75     2.19
                0.333     1.94 | 1.833    24.17 | 3.333     4.30 |  4.83     2.19
                0.417     2.13 | 1.917   104.19 | 3.417     3.86 |  4.92     2.08
                0.500     2.13 | 2.000   104.19 | 3.500     3.86 |  5.00     2.08
                0.583     2.37 | 2.083    32.04 | 3.583     3.51 |  5.08     1.99
                0.667     2.37 | 2.167    32.04 | 3.667     3.51 |  5.17     1.99
                0.750     2.68 | 2.250    16.34 | 3.750     3.22 |  5.25     1.90
                0.833     2.68 | 2.333    16.34 | 3.833     3.22 |  5.33     1.90
                0.917     3.10 | 2.417    10.96 | 3.917     2.98 |  5.42     1.82
                1.000     3.10 | 2.500    10.96 | 4.000     2.98 |  5.50     1.82
                1.083     3.68 | 2.583     8.29 | 4.083     2.77 |  5.58     1.75
                1.167     3.68 | 2.667     8.29 | 4.167     2.77 |  5.67     1.75
                1.250     4.58 | 2.750     6.69 | 4.250     2.60 |  5.75     1.68
                1.333     4.58 | 2.833     6.69 | 4.333     2.60 |  5.83     1.68
                1.417     6.15 | 2.917     5.63 | 4.417     2.44 |  5.92     1.62
                1.500     6.15 | 3.000     5.63 | 4.500     2.44 |  6.00     1.62

     Max.Eff.Inten.(mm/hr)=     104.19       125.22
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.84 (ii)    6.59 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.16             0.286 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08              2.00
     RUNOFF VOLUME    (mm)=      47.47        17.58             27.74
     TOTAL RAINFALL   (mm)=      49.04        49.04             49.04
     RUNOFF COEFFICIENT   =       0.97         0.36              0.57

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.59   0.286     2.00    27.74
      + ID2= 2 (  0005):     0.63   0.030     2.17    16.10
        ===================================================
        ID = 3 (  0009):     2.22   0.306     2.00    24.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area      (ha)=       0.67         0.53
     Dep. Storage      (mm)=       1.57         4.67
     Average Slope      (%)=       3.00         2.00
     Length             (m)=      89.33        20.00
     Mannings n           =      0.013        0.300

         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    1.78 | 1.583    9.61 | 3.083    4.87 |  4.58    2.31
                0.167    1.78 | 1.667    9.61 | 3.167    4.87 |  4.67    2.31
                0.250    1.94 | 1.750   24.17 | 3.250    4.30 |  4.75    2.19
                0.333    1.94 | 1.833   24.17 | 3.333    4.30 |  4.83    2.19
                0.417    2.13 | 1.917  104.19 | 3.417    3.86 |  4.92    2.08
                0.500    2.13 | 2.000  104.19 | 3.500    3.86 |  5.00    2.08
                0.583    2.37 | 2.083   32.04 | 3.583    3.51 |  5.08    1.99
                0.667    2.37 | 2.167   32.04 | 3.667    3.51 |  5.17    1.99
                0.750    2.68 | 2.250   16.34 | 3.750    3.22 |  5.25    1.90
                0.833    2.68 | 2.333   16.34 | 3.833    3.22 |  5.33    1.90
                0.917    3.10 | 2.417   10.96 | 3.917    2.98 |  5.42    1.82
                1.000    3.10 | 2.500   10.96 | 4.000    2.98 |  5.50    1.82
                1.083    3.68 | 2.583    8.29 | 4.083    2.77 |  5.58    1.75
                1.167    3.68 | 2.667    8.29 | 4.167    2.77 |  5.67    1.75
                1.250    4.58 | 2.750    6.69 | 4.250    2.60 |  5.75    1.68
                1.333    4.58 | 2.833    6.69 | 4.333    2.60 |  5.83    1.68
                1.417    6.15 | 2.917    5.63 | 4.417    2.44 |  5.92    1.62
                1.500    6.15 | 3.000    5.63 | 4.500    2.44 |  6.00    1.62

     Max.Eff.Inten.(mm/hr)=     104.19       101.13
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.69 (ii)    6.86 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.12         0.11            0.203 (iii)
     TIME TO PEAK    (hrs)=       2.00         2.08             2.00
     RUNOFF VOLUME    (mm)=      47.47        15.59            26.75
     TOTAL RAINFALL   (mm)=      49.04        49.04            49.04
     RUNOFF COEFFICIENT   =       0.97         0.32             0.55

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.203     2.00    26.75
      + ID2= 2 (  0009):     2.22   0.306     2.00    24.44
```

```
        ====================================================
        ID = 3 (  0010):      3.42   0.509     2.00    25.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
============================

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      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\voin.dat
  Output  filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\1bfc6c27-5fc1-40ff-9b6f-f69921be7eb0\scenari
  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\1bfc6c27-5fc1-40ff-9b6f-f69921be7eb0\scenari


DATE: 10-12-2023                          TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
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  ************************************************
  ** SIMULATION : Historical Aug 4 1988         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\hymo\AppD
|                  |              ata\Local\Temp\
|                  |              aa69df8c-5b6d-4b89-8c74-58ba9dc8fadc\2fa948a7
| Ptotal= 83.99 mm |    Comments: Historical Aug 4 1988
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    2.30 |  0.75   38.10 |  1.50   71.10 |  2.25    3.80
                 0.08    2.30 |  0.83   38.10 |  1.58   71.10 |  2.33    3.80
                 0.17    8.89 |  0.92   38.10 |  1.67   30.50 |  2.42    3.80
```

```
                  0.25    8.89 |  1.00   38.10 |  1.75   30.50 |  2.50    3.80
                  0.33    8.89 |  1.08   50.80 |  1.83   30.50 |  2.58    3.80
                  0.42    8.89 |  1.17   50.80 |  1.92   30.50 |  2.67    3.80
                  0.50   38.10 |  1.25   76.20 |  2.00    3.80 |  2.75    3.80
                  0.58   38.10 |  1.33  106.70 |  2.08    3.80 |  2.83    3.80
                  0.67   38.10 |  1.42  106.70 |  2.17    3.80 |  2.92    3.80

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

--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   4.99   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.539 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  41.860
     TOTAL RAINFALL   (mm)=  83.988
     RUNOFF COEFFICIENT   =   0.498

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700      0.1260
                          0.0500     0.0080   |   0.3010      0.1650
                          0.1030     0.0210   |   0.3260      0.2100
                          0.1520     0.0390   |   0.3470      0.2600
                          0.1960     0.0630   |   0.3640      0.3160
                          0.2350     0.0920   |   0.3760      0.3770

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990      0.539      1.83       41.86
   OUTFLOW: ID= 1 (  0011)      4.990      0.242      2.50       41.85

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 44.98
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0994

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0006)|   Area    (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.123 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  48.571
     TOTAL RAINFALL   (mm)=  83.988
```

```
     RUNOFF COEFFICIENT   =   0.578

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

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


--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99   0.242     2.50    41.85
      + ID2= 2 (  0006):     0.72   0.123     1.67    48.57
        ===================================================
        ID = 3 (  0007):     5.71   0.274     2.00    42.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43         0.31
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      70.24        20.00
     Mannings n           =      0.013        0.300

     Max.Eff.Inten.(mm/hr)=     106.70       125.38
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.45 (ii)    6.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.09           0.189 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.58            1.50
     RUNOFF VOLUME    (mm)=      82.42        49.33           64.22
     TOTAL RAINFALL   (mm)=      83.99        83.99           83.99
     RUNOFF COEFFICIENT   =       0.98         0.59            0.76

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.74   0.189     1.50    64.22
      + ID2= 2 (  0007):     5.71   0.274     2.00    42.70
        ===================================================
        ID = 3 (  0008):     6.45   0.401     1.67    45.17
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0005)|   Area     (ha)=    0.63   Curve Number    (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.17

     Unit Hyd Qpeak  (cms)=    0.142

     PEAK FLOW       (cms)=    0.095 (i)
     TIME TO PEAK    (hrs)=    1.667
     RUNOFF VOLUME    (mm)=   41.718
     TOTAL RAINFALL   (mm)=   83.988
     RUNOFF COEFFICIENT   =    0.497

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0004)|   Area     (ha)=    1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=   60.00   Dir. Conn.(%)=  34.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.64
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=     102.96        20.00
     Mannings n           =      0.013        0.300

     Max.Eff.Inten.(mm/hr)=     106.70       161.83
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       1.82 (ii)    6.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.24           0.402 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.58            1.50
     RUNOFF VOLUME    (mm)=      82.42        55.48           64.64
     TOTAL RAINFALL   (mm)=      83.99        83.99           83.99
     RUNOFF COEFFICIENT   =       0.98         0.66            0.77

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.59   0.402     1.50    64.64
```

```
      + ID2= 2 (  0005):      0.63   0.095     1.67    41.72
        ====================================================
        ID = 3 (  0009):      2.22   0.482     1.50    58.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.67         0.53
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      89.33        20.00
     Mannings n          =      0.013        0.300

     Max.Eff.Inten.(mm/hr)=     106.70       143.36
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.67 (ii)    6.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.12         0.18          0.301 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.58           1.50
     RUNOFF VOLUME    (mm)=      82.42        52.68          63.09
     TOTAL RAINFALL   (mm)=      83.99        83.99          83.99
     RUNOFF COEFFICIENT   =       0.98         0.63           0.75

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):      1.20   0.301     1.50    63.09
      + ID2= 2 (  0009):      2.22   0.482     1.50    58.14
        ====================================================
        ID = 3 (  0010):      3.42   0.783     1.50    59.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
============================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL
```

```
        OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
       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\voin.dat
  Output  filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\58d0461d-e8b2-42d2-a63e-cb564e333807\scenari
  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\58d0461d-e8b2-42d2-a63e-cb564e333807\scenari


DATE: 10-12-2023                           TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
----------------------------
  ************************************************
  ** SIMULATION : Historical July 1 1979        **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\hymo\AppD
|                  |              ata\Local\Temp\
|                  |              aa69df8c-5b6d-4b89-8c74-58ba9dc8fadc\f903cac0
| Ptotal= 12.50 mm |    Comments: Historical July 1 1979
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    2.07 |  1.00    5.70 |  2.00    5.19 |  3.00    2.80
                 0.08    0.00 |  1.08    0.00 |  2.08    0.00 |  3.08    0.00
                 0.17    2.27 |  1.17   10.78 |  2.17    4.47 |  3.17    2.62
                 0.25    0.00 |  1.25    0.00 |  2.25    0.00 |  3.25    0.00
                 0.33    2.52 |  1.33   50.21 |  2.33    3.95 |  3.33    2.48
                 0.42    0.00 |  1.42    0.00 |  2.42    0.00 |  3.42    0.00
                 0.50    2.88 |  1.50   13.37 |  2.50    3.56 |  3.50    2.35
                 0.58    0.00 |  1.58    0.00 |  2.58    0.00 |  3.58    0.00
                 0.67    3.38 |  1.67    8.29 |  2.67    3.25 |  3.67    2.23
                 0.75    0.00 |  1.75    0.00 |  2.75    0.00 |  3.75    0.00
                 0.83    4.18 |  1.83    6.30 |  2.83    3.01 |  3.83    2.14
                 0.92    0.00 |  1.92    0.00 |  2.92    0.00 |

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```

```
| CALIB              |
| NASHYD   (  0001)|   Area     (ha)=   4.99   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.37

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=   4.000
     RUNOFF VOLUME    (mm)=   0.205
     TOTAL RAINFALL   (mm)=  12.498
     RUNOFF COEFFICIENT   =   0.016

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2700     0.1260
                          0.0500     0.0080   |   0.3010     0.1650
                          0.1030     0.0210   |   0.3260     0.2100
                          0.1520     0.0390   |   0.3470     0.2600
                          0.1960     0.0630   |   0.3640     0.3160
                          0.2350     0.0920   |   0.3760     0.3770

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)     4.990      0.002      4.00       0.20
   OUTFLOW: ID= 1 (  0011)     4.990      0.001      4.08       0.20

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 92.32
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0002

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0006)|   Area     (ha)=   0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.001 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=   0.619
     TOTAL RAINFALL   (mm)=  12.498
     RUNOFF COEFFICIENT   =   0.050

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0011):     4.99   0.001     4.08     0.20
      + ID2= 2 (  0006):     0.72   0.001     2.25     0.62
        ====================================================
        ID = 3 (  0007):     5.71   0.002     3.92     0.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43         0.31
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      70.24        20.00
     Mannings n          =      0.013        0.300

     Max.Eff.Inten.(mm/hr)=      50.21         0.00
                over (min)        5.00       145.00
     Storage Coeff.  (min)=       1.96 (ii)  144.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00       145.00
     Unit Hyd. peak  (cms)=       0.31         0.01
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00           0.043 (iii)
     TIME TO PEAK    (hrs)=       1.42         0.00            1.42
     RUNOFF VOLUME    (mm)=      10.93         0.00            4.92
     TOTAL RAINFALL   (mm)=      12.50        12.50           12.50
     RUNOFF COEFFICIENT   =       0.87         0.00            0.39

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
           Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)      (mm)
        ID1= 1 (  0002):     0.74   0.043     1.42     4.92
      + ID2= 2 (  0007):     5.71   0.002     3.92     0.25
        ====================================================
        ID = 3 (  0008):     6.45   0.043     1.42     0.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0005)|   Area    (ha)=   0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17
```

```
     Unit Hyd Qpeak  (cms)=   0.142

     PEAK FLOW       (cms)=   0.000 (i)
     TIME TO PEAK    (hrs)=   3.917
     RUNOFF VOLUME    (mm)=   0.204
     TOTAL RAINFALL   (mm)=  12.498
     RUNOFF COEFFICIENT   =   0.016

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0004)|   Area    (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.95         0.64
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=     102.96        20.00
     Mannings n           =      0.013        0.300

     Max.Eff.Inten.(mm/hr)=      50.21         0.00
                over (min)        5.00       145.00
     Storage Coeff.  (min)=       2.46 (ii)  144.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00       145.00
     Unit Hyd. peak  (cms)=       0.30         0.01
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.00           0.066 (iii)
     TIME TO PEAK    (hrs)=       1.42         0.00            1.42
     RUNOFF VOLUME    (mm)=      10.93         0.00            3.71
     TOTAL RAINFALL   (mm)=      12.50        12.50           12.50
     RUNOFF COEFFICIENT   =       0.87         0.00            0.30

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo    (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc    (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):      1.59   0.066     1.42     3.71
      + ID2= 2 (  0005):      0.63   0.000     3.92     0.20
        ===================================================
        ID = 3 (  0009):      2.22   0.066     1.42     2.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.67         0.53
     Dep. Storage     (mm)=        1.57         4.67
     Average Slope     (%)=        3.00         2.00
     Length            (m)=       89.33        20.00
     Mannings n           =       0.013        0.300

     Max.Eff.Inten.(mm/hr)=       50.21         0.00
                over (min)         5.00       145.00
     Storage Coeff.  (min)=        2.26 (ii)  144.70 (ii)
     Unit Hyd. Tpeak (min)=        5.00       145.00
     Unit Hyd. peak  (cms)=        0.30         0.01
                                                            *TOTALS*
     PEAK FLOW       (cms)=        0.05         0.00          0.052 (iii)
     TIME TO PEAK    (hrs)=        1.42         0.00           1.42
     RUNOFF VOLUME    (mm)=       10.93         0.00           3.82
     TOTAL RAINFALL   (mm)=       12.50        12.50          12.50
     RUNOFF COEFFICIENT   =        0.87         0.00           0.31

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.052     1.42     3.82
      + ID2= 2 (  0009):     2.22   0.066     1.42     2.72
        ====================================================
        ID = 3 (  0010):     3.42   0.118     1.42     3.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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===============================================================================
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       V    V   I   SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I   SS     U   U   A A   L
        V  V    I    SS    U   U  AAAAA  L
        V  V    I     SS   U   U  A   A  L
         VV     I   SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       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\voin.dat
  Output  filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\0891ea6c-7ad2-496b-a8c1-10d1ee0aa326\scenari
  Summary filename: C:\Users\hymo\AppData\Local\Civica\VH5\c2bf54e4-3802-4a6a-
9554-80bbef5cd5c0\0891ea6c-7ad2-496b-a8c1-10d1ee0aa326\scenari


DATE: 10-12-2023                           TIME: 01:18:37

USER:


COMMENTS: ____________________________________________________________

--------------------------------------------------------------------------------
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  ************************************************
  ** SIMULATION : Quality 25mm 4hr Chicago      **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\hymo\AppD
|                  |              ata\Local\Temp\
|                  |              aa69df8c-5b6d-4b89-8c74-58ba9dc8fadc\dcb75742
| Ptotal=161.13 mm |    Comments: Quality 25mm 4hr Chicago
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.10 |  2.83   27.50 |  5.67   12.80 |  8.50    0.20
                 0.17    0.10 |  3.00   62.50 |  5.83   14.00 |  8.67    0.20
                 0.33    3.70 |  3.17   31.80 |  6.00   22.20 |  8.83    0.20
                 0.50    6.20 |  3.33   79.80 |  6.17   21.80 |  9.00    0.20
                 0.67  101.50 |  3.50   67.50 |  6.33    1.40 |  9.17    0.20
                 0.83   15.20 |  3.67  156.20 |  6.50    0.20 |  9.33    0.20
                 1.00   29.30 |  3.83    5.10 |  6.67    0.20 |  9.50    0.20
                 1.17   19.80 |  4.00    0.20 |  6.83    0.20 |  9.67    2.90
                 1.33    1.50 |  4.17    0.20 |  7.00    0.20 |  9.83    7.80
                 1.50    1.70 |  4.33    0.20 |  7.17    0.20 | 10.00   10.00
                 1.67    5.40 |  4.50    0.20 |  7.33    0.20 | 10.17    6.30
                 1.83   24.60 |  4.67    0.20 |  7.50    0.20 | 10.33    5.10
                 2.00   26.50 |  4.83    0.20 |  7.67    0.20 | 10.50    9.80
                 2.17   34.90 |  5.00    0.20 |  7.83    0.20 | 10.67    2.60
                 2.33   10.20 |  5.17    0.20 |  8.00    0.20 | 10.83    1.70
                 2.50   27.10 |  5.33    0.20 |  8.17    0.20 | 11.00    0.00
                 2.67  104.40 |  5.50    0.20 |  8.33    0.20 |

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

--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   4.99   Curve Number   (CN)= 81.0
```

```
|ID= 1 DT= 5.0 min |    Ia      (mm)=    8.90   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    0.37

         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    0.10 | 2.917   27.50 | 5.750   12.80 |  8.58    0.20
                0.167    0.10 | 3.000   27.50 | 5.833   12.80 |  8.67    0.20
                0.250    0.10 | 3.083   62.50 | 5.917   14.00 |  8.75    0.20
                0.333    0.10 | 3.167   62.50 | 6.000   14.00 |  8.83    0.20
                0.417    3.70 | 3.250   31.80 | 6.083   22.20 |  8.92    0.20
                0.500    3.70 | 3.333   31.80 | 6.167   22.20 |  9.00    0.20
                0.583    6.20 | 3.417   79.80 | 6.250   21.80 |  9.08    0.20
                0.667    6.20 | 3.500   79.80 | 6.333   21.80 |  9.17    0.20
                0.750  101.50 | 3.583   67.50 | 6.417    1.40 |  9.25    0.20
                0.833  101.50 | 3.667   67.50 | 6.500    1.40 |  9.33    0.20
                0.917   15.20 | 3.750  156.20 | 6.583    0.20 |  9.42    0.20
                1.000   15.20 | 3.833  156.20 | 6.667    0.20 |  9.50    0.20
                1.083   29.30 | 3.917    5.10 | 6.750    0.20 |  9.58    0.20
                1.167   29.30 | 4.000    5.10 | 6.833    0.20 |  9.67    0.20
                1.250   19.80 | 4.083    0.20 | 6.917    0.20 |  9.75    2.90
                1.333   19.80 | 4.167    0.20 | 7.000    0.20 |  9.83    2.90
                1.417    1.50 | 4.250    0.20 | 7.083    0.20 |  9.92    7.80
                1.500    1.50 | 4.333    0.20 | 7.167    0.20 | 10.00    7.80
                1.583    1.70 | 4.417    0.20 | 7.250    0.20 | 10.08   10.00
                1.667    1.70 | 4.500    0.20 | 7.333    0.20 | 10.17   10.00
                1.750    5.40 | 4.583    0.20 | 7.417    0.20 | 10.25    6.30
                1.833    5.40 | 4.667    0.20 | 7.500    0.20 | 10.33    6.30
                1.917   24.60 | 4.750    0.20 | 7.583    0.20 | 10.42    5.10
                2.000   24.60 | 4.833    0.20 | 7.667    0.20 | 10.50    5.10
                2.083   26.50 | 4.917    0.20 | 7.750    0.20 | 10.58    9.80
                2.167   26.50 | 5.000    0.20 | 7.833    0.20 | 10.67    9.80
                2.250   34.90 | 5.083    0.20 | 7.917    0.20 | 10.75    2.60
                2.333   34.90 | 5.167    0.20 | 8.000    0.20 | 10.83    2.60
                2.417   10.20 | 5.250    0.20 | 8.083    0.20 | 10.92    1.70
                2.500   10.20 | 5.333    0.20 | 8.167    0.20 | 11.00    1.70
                2.583   27.10 | 5.417    0.20 | 8.250    0.20 | 11.08    0.00
                2.667   27.10 | 5.500    0.20 | 8.333    0.20 | 11.17    0.00
                2.750  104.40 | 5.583    0.20 | 8.417    0.20 |
                2.833  104.40 | 5.667    0.20 | 8.500    0.20 |

     Unit Hyd Qpeak  (cms)=   0.515

     PEAK FLOW       (cms)=   0.914 (i)
     TIME TO PEAK    (hrs)=   4.000
     RUNOFF VOLUME    (mm)= 109.394
     TOTAL RAINFALL   (mm)= 161.133
     RUNOFF COEFFICIENT   =   0.679

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

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0011)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                    0.0000     0.0000   |   0.2700      0.1260
                    0.0500     0.0080   |   0.3010      0.1650
                    0.1030     0.0210   |   0.3260      0.2100
                    0.1520     0.0390   |   0.3470      0.2600
                    0.1960     0.0630   |   0.3640      0.3160
                    0.2350     0.0920   |   0.3760      0.3770

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      4.990      0.914      4.00      109.39
   OUTFLOW: ID= 1 (  0011)      4.990      0.334      4.50      109.39

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.53
                 TIME SHIFT OF PEAK FLOW         (min)= 30.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.2286

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0006)|   Area     (ha)=    0.72   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    6.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.17

         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	0.10	2.917	27.50	5.750	12.80	8.58	0.20
0.167	0.10	3.000	27.50	5.833	12.80	8.67	0.20
0.250	0.10	3.083	62.50	5.917	14.00	8.75	0.20
0.333	0.10	3.167	62.50	6.000	14.00	8.83	0.20
0.417	3.70	3.250	31.80	6.083	22.20	8.92	0.20
0.500	3.70	3.333	31.80	6.167	22.20	9.00	0.20
0.583	6.20	3.417	79.80	6.250	21.80	9.08	0.20
0.667	6.20	3.500	79.80	6.333	21.80	9.17	0.20
0.750	101.50	3.583	67.50	6.417	1.40	9.25	0.20
0.833	101.50	3.667	67.50	6.500	1.40	9.33	0.20
0.917	15.20	3.750	156.20	6.583	0.20	9.42	0.20
1.000	15.20	3.833	156.20	6.667	0.20	9.50	0.20
1.083	29.30	3.917	5.10	6.750	0.20	9.58	0.20
1.167	29.30	4.000	5.10	6.833	0.20	9.67	0.20
1.250	19.80	4.083	0.20	6.917	0.20	9.75	2.90
1.333	19.80	4.167	0.20	7.000	0.20	9.83	2.90
1.417	1.50	4.250	0.20	7.083	0.20	9.92	7.80
1.500	1.50	4.333	0.20	7.167	0.20	10.00	7.80
1.583	1.70	4.417	0.20	7.250	0.20	10.08	10.00
1.667	1.70	4.500	0.20	7.333	0.20	10.17	10.00
1.750	5.40	4.583	0.20	7.417	0.20	10.25	6.30
1.833	5.40	4.667	0.20	7.500	0.20	10.33	6.30
1.917	24.60	4.750	0.20	7.583	0.20	10.42	5.10
2.000	24.60	4.833	0.20	7.667	0.20	10.50	5.10
2.083	26.50	4.917	0.20	7.750	0.20	10.58	9.80
2.167	26.50	5.000	0.20	7.833	0.20	10.67	9.80
2.250	34.90	5.083	0.20	7.917	0.20	10.75	2.60
2.333	34.90	5.167	0.20	8.000	0.20	10.83	2.60
2.417	10.20	5.250	0.20	8.083	0.20	10.92	1.70
2.500	10.20	5.333	0.20	8.167	0.20	11.00	1.70
2.583	27.10	5.417	0.20	8.250	0.20	11.08	0.00

```
              2.667   27.10 | 5.500    0.20 | 8.333    0.20 | 11.17    0.00
              2.750  104.40 | 5.583    0.20 | 8.417    0.20 |
              2.833  104.40 | 5.667    0.20 | 8.500    0.20 |

     Unit Hyd Qpeak  (cms)=   0.162

     PEAK FLOW       (cms)=   0.195 (i)
     TIME TO PEAK    (hrs)=   3.833
     RUNOFF VOLUME    (mm)= 119.076
     TOTAL RAINFALL   (mm)= 161.133
     RUNOFF COEFFICIENT   =   0.739

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

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--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):     4.99   0.334     4.50   109.39
      + ID2= 2 (  0006):     0.72   0.195     3.83   119.08
        ====================================================
        ID = 3 (  0007):     5.71   0.474     3.92   110.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.74
|ID= 1 DT= 5.0 min |   Total Imp(%)=  58.00   Dir. Conn.(%)=  45.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.43        0.31
     Dep. Storage     (mm)=       1.57        4.67
     Average Slope     (%)=       3.00        2.00
     Length            (m)=      70.24       20.00
     Mannings n           =      0.013       0.300

         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    0.10 | 2.917   27.50 | 5.750   12.80 |  8.58    0.20
              0.167    0.10 | 3.000   27.50 | 5.833   12.80 |  8.67    0.20
              0.250    0.10 | 3.083   62.50 | 5.917   14.00 |  8.75    0.20
              0.333    0.10 | 3.167   62.50 | 6.000   14.00 |  8.83    0.20
              0.417    3.70 | 3.250   31.80 | 6.083   22.20 |  8.92    0.20
              0.500    3.70 | 3.333   31.80 | 6.167   22.20 |  9.00    0.20
              0.583    6.20 | 3.417   79.80 | 6.250   21.80 |  9.08    0.20
              0.667    6.20 | 3.500   79.80 | 6.333   21.80 |  9.17    0.20
              0.750  101.50 | 3.583   67.50 | 6.417    1.40 |  9.25    0.20
              0.833  101.50 | 3.667   67.50 | 6.500    1.40 |  9.33    0.20
              0.917   15.20 | 3.750  156.20 | 6.583    0.20 |  9.42    0.20
              1.000   15.20 | 3.833  156.20 | 6.667    0.20 |  9.50    0.20
              1.083   29.30 | 3.917    5.10 | 6.750    0.20 |  9.58    0.20
              1.167   29.30 | 4.000    5.10 | 6.833    0.20 |  9.67    0.20
              1.250   19.80 | 4.083    0.20 | 6.917    0.20 |  9.75    2.90
```

```
                1.333   19.80 | 4.167    0.20 | 7.000    0.20 |  9.83    2.90
                1.417    1.50 | 4.250    0.20 | 7.083    0.20 |  9.92    7.80
                1.500    1.50 | 4.333    0.20 | 7.167    0.20 | 10.00    7.80
                1.583    1.70 | 4.417    0.20 | 7.250    0.20 | 10.08   10.00
                1.667    1.70 | 4.500    0.20 | 7.333    0.20 | 10.17   10.00
                1.750    5.40 | 4.583    0.20 | 7.417    0.20 | 10.25    6.30
                1.833    5.40 | 4.667    0.20 | 7.500    0.20 | 10.33    6.30
                1.917   24.60 | 4.750    0.20 | 7.583    0.20 | 10.42    5.10
                2.000   24.60 | 4.833    0.20 | 7.667    0.20 | 10.50    5.10
                2.083   26.50 | 4.917    0.20 | 7.750    0.20 | 10.58    9.80
                2.167   26.50 | 5.000    0.20 | 7.833    0.20 | 10.67    9.80
                2.250   34.90 | 5.083    0.20 | 7.917    0.20 | 10.75    2.60
                2.333   34.90 | 5.167    0.20 | 8.000    0.20 | 10.83    2.60
                2.417   10.20 | 5.250    0.20 | 8.083    0.20 | 10.92    1.70
                2.500   10.20 | 5.333    0.20 | 8.167    0.20 | 11.00    1.70
                2.583   27.10 | 5.417    0.20 | 8.250    0.20 | 11.08    0.00
                2.667   27.10 | 5.500    0.20 | 8.333    0.20 | 11.17    0.00
                2.750  104.40 | 5.583    0.20 | 8.417    0.20 |
                2.833  104.40 | 5.667    0.20 | 8.500    0.20 |

     Max.Eff.Inten.(mm/hr)=     156.20       191.35
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.24 (ii)    5.47 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.13           0.279 (iii)
     TIME TO PEAK    (hrs)=       3.83         3.83            3.83
     RUNOFF VOLUME    (mm)=     159.56        94.27          123.65
     TOTAL RAINFALL   (mm)=     161.13       161.13          161.13
     RUNOFF COEFFICIENT   =       0.99         0.59            0.77

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0008)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):      0.74   0.279     3.83   123.65
      + ID2= 2 (  0007):      5.71   0.474     3.92   110.61
        ====================================================
        ID = 3 (  0008):      6.45   0.751     3.83   112.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0005)|   Area    (ha)=   0.63   Curve Number   (CN)= 81.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17
```

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	0.10	2.917	27.50	5.750	12.80	8.58	0.20
0.167	0.10	3.000	27.50	5.833	12.80	8.67	0.20
0.250	0.10	3.083	62.50	5.917	14.00	8.75	0.20
0.333	0.10	3.167	62.50	6.000	14.00	8.83	0.20
0.417	3.70	3.250	31.80	6.083	22.20	8.92	0.20
0.500	3.70	3.333	31.80	6.167	22.20	9.00	0.20
0.583	6.20	3.417	79.80	6.250	21.80	9.08	0.20
0.667	6.20	3.500	79.80	6.333	21.80	9.17	0.20
0.750	101.50	3.583	67.50	6.417	1.40	9.25	0.20
0.833	101.50	3.667	67.50	6.500	1.40	9.33	0.20
0.917	15.20	3.750	156.20	6.583	0.20	9.42	0.20
1.000	15.20	3.833	156.20	6.667	0.20	9.50	0.20
1.083	29.30	3.917	5.10	6.750	0.20	9.58	0.20
1.167	29.30	4.000	5.10	6.833	0.20	9.67	0.20
1.250	19.80	4.083	0.20	6.917	0.20	9.75	2.90
1.333	19.80	4.167	0.20	7.000	0.20	9.83	2.90
1.417	1.50	4.250	0.20	7.083	0.20	9.92	7.80
1.500	1.50	4.333	0.20	7.167	0.20	10.00	7.80
1.583	1.70	4.417	0.20	7.250	0.20	10.08	10.00
1.667	1.70	4.500	0.20	7.333	0.20	10.17	10.00
1.750	5.40	4.583	0.20	7.417	0.20	10.25	6.30
1.833	5.40	4.667	0.20	7.500	0.20	10.33	6.30
1.917	24.60	4.750	0.20	7.583	0.20	10.42	5.10
2.000	24.60	4.833	0.20	7.667	0.20	10.50	5.10
2.083	26.50	4.917	0.20	7.750	0.20	10.58	9.80
2.167	26.50	5.000	0.20	7.833	0.20	10.67	9.80
2.250	34.90	5.083	0.20	7.917	0.20	10.75	2.60
2.333	34.90	5.167	0.20	8.000	0.20	10.83	2.60
2.417	10.20	5.250	0.20	8.083	0.20	10.92	1.70
2.500	10.20	5.333	0.20	8.167	0.20	11.00	1.70
2.583	27.10	5.417	0.20	8.250	0.20	11.08	0.00
2.667	27.10	5.500	0.20	8.333	0.20	11.17	0.00
2.750	104.40	5.583	0.20	8.417	0.20		
2.833	104.40	5.667	0.20	8.500	0.20		

```
Unit Hyd Qpeak  (cms)=   0.142

PEAK FLOW       (cms)=   0.163 (i)
TIME TO PEAK    (hrs)=   3.833
RUNOFF VOLUME    (mm)= 109.021
TOTAL RAINFALL   (mm)= 161.133
RUNOFF COEFFICIENT   =   0.677

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0004)|   Area    (ha)=   1.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  34.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.95          0.64
    Dep. Storage     (mm)=       1.57          4.67
```

Average Slope	(%)=	3.00	2.00
Length	(m)=	102.96	20.00
Mannings n	=	0.013	0.300

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	0.10	2.917	27.50	5.750	12.80	8.58	0.20
0.167	0.10	3.000	27.50	5.833	12.80	8.67	0.20
0.250	0.10	3.083	62.50	5.917	14.00	8.75	0.20
0.333	0.10	3.167	62.50	6.000	14.00	8.83	0.20
0.417	3.70	3.250	31.80	6.083	22.20	8.92	0.20
0.500	3.70	3.333	31.80	6.167	22.20	9.00	0.20
0.583	6.20	3.417	79.80	6.250	21.80	9.08	0.20
0.667	6.20	3.500	79.80	6.333	21.80	9.17	0.20
0.750	101.50	3.583	67.50	6.417	1.40	9.25	0.20
0.833	101.50	3.667	67.50	6.500	1.40	9.33	0.20
0.917	15.20	3.750	156.20	6.583	0.20	9.42	0.20
1.000	15.20	3.833	156.20	6.667	0.20	9.50	0.20
1.083	29.30	3.917	5.10	6.750	0.20	9.58	0.20
1.167	29.30	4.000	5.10	6.833	0.20	9.67	0.20
1.250	19.80	4.083	0.20	6.917	0.20	9.75	2.90
1.333	19.80	4.167	0.20	7.000	0.20	9.83	2.90
1.417	1.50	4.250	0.20	7.083	0.20	9.92	7.80
1.500	1.50	4.333	0.20	7.167	0.20	10.00	7.80
1.583	1.70	4.417	0.20	7.250	0.20	10.08	10.00
1.667	1.70	4.500	0.20	7.333	0.20	10.17	10.00
1.750	5.40	4.583	0.20	7.417	0.20	10.25	6.30
1.833	5.40	4.667	0.20	7.500	0.20	10.33	6.30
1.917	24.60	4.750	0.20	7.583	0.20	10.42	5.10
2.000	24.60	4.833	0.20	7.667	0.20	10.50	5.10
2.083	26.50	4.917	0.20	7.750	0.20	10.58	9.80
2.167	26.50	5.000	0.20	7.833	0.20	10.67	9.80
2.250	34.90	5.083	0.20	7.917	0.20	10.75	2.60
2.333	34.90	5.167	0.20	8.000	0.20	10.83	2.60
2.417	10.20	5.250	0.20	8.083	0.20	10.92	1.70
2.500	10.20	5.333	0.20	8.167	0.20	11.00	1.70
2.583	27.10	5.417	0.20	8.250	0.20	11.08	0.00
2.667	27.10	5.500	0.20	8.333	0.20	11.17	0.00
2.750	104.40	5.583	0.20	8.417	0.20		
2.833	104.40	5.667	0.20	8.500	0.20		

				TOTALS
Max.Eff.Inten.	(mm/hr)=	156.20	244.53	
over	(min)	5.00	10.00	
Storage Coeff.	(min)=	1.56 (ii)	6.20 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.33	0.15	
PEAK FLOW	(cms)=	0.23	0.34	0.577 (iii)
TIME TO PEAK	(hrs)=	3.83	3.83	3.83
RUNOFF VOLUME	(mm)=	159.56	105.69	124.00
TOTAL RAINFALL	(mm)=	161.13	161.13	161.13
RUNOFF COEFFICIENT	=	0.99	0.66	0.77

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:

```
           Fo    (mm/hr)= 76.20           K  (1/hr)=  4.14
           Fc    (mm/hr)= 13.20     Cum.Inf.    (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     1.59   0.577     3.83   124.00
      + ID2= 2 (  0005):     0.63   0.163     3.83   109.02
        ====================================================
        ID = 3 (  0009):     2.22   0.740     3.83   119.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   1.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.67         0.53
     Dep. Storage     (mm)=       1.57         4.67
     Average Slope     (%)=       3.00         2.00
     Length            (m)=      89.33        20.00
     Mannings n          =      0.013        0.300

         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    0.10 | 2.917   27.50 | 5.750   12.80 |  8.58    0.20
               0.167    0.10 | 3.000   27.50 | 5.833   12.80 |  8.67    0.20
               0.250    0.10 | 3.083   62.50 | 5.917   14.00 |  8.75    0.20
               0.333    0.10 | 3.167   62.50 | 6.000   14.00 |  8.83    0.20
               0.417    3.70 | 3.250   31.80 | 6.083   22.20 |  8.92    0.20
               0.500    3.70 | 3.333   31.80 | 6.167   22.20 |  9.00    0.20
               0.583    6.20 | 3.417   79.80 | 6.250   21.80 |  9.08    0.20
               0.667    6.20 | 3.500   79.80 | 6.333   21.80 |  9.17    0.20
               0.750  101.50 | 3.583   67.50 | 6.417    1.40 |  9.25    0.20
               0.833  101.50 | 3.667   67.50 | 6.500    1.40 |  9.33    0.20
               0.917   15.20 | 3.750  156.20 | 6.583    0.20 |  9.42    0.20
               1.000   15.20 | 3.833  156.20 | 6.667    0.20 |  9.50    0.20
               1.083   29.30 | 3.917    5.10 | 6.750    0.20 |  9.58    0.20
               1.167   29.30 | 4.000    5.10 | 6.833    0.20 |  9.67    0.20
               1.250   19.80 | 4.083    0.20 | 6.917    0.20 |  9.75    2.90
               1.333   19.80 | 4.167    0.20 | 7.000    0.20 |  9.83    2.90
               1.417    1.50 | 4.250    0.20 | 7.083    0.20 |  9.92    7.80
               1.500    1.50 | 4.333    0.20 | 7.167    0.20 | 10.00    7.80
               1.583    1.70 | 4.417    0.20 | 7.250    0.20 | 10.08   10.00
               1.667    1.70 | 4.500    0.20 | 7.333    0.20 | 10.17   10.00
               1.750    5.40 | 4.583    0.20 | 7.417    0.20 | 10.25    6.30
               1.833    5.40 | 4.667    0.20 | 7.500    0.20 | 10.33    6.30
               1.917   24.60 | 4.750    0.20 | 7.583    0.20 | 10.42    5.10
```

```
                2.000   24.60 | 4.833    0.20 | 7.667    0.20 | 10.50    5.10
                2.083   26.50 | 4.917    0.20 | 7.750    0.20 | 10.58    9.80
                2.167   26.50 | 5.000    0.20 | 7.833    0.20 | 10.67    9.80
                2.250   34.90 | 5.083    0.20 | 7.917    0.20 | 10.75    2.60
                2.333   34.90 | 5.167    0.20 | 8.000    0.20 | 10.83    2.60
                2.417   10.20 | 5.250    0.20 | 8.083    0.20 | 10.92    1.70
                2.500   10.20 | 5.333    0.20 | 8.167    0.20 | 11.00    1.70
                2.583   27.10 | 5.417    0.20 | 8.250    0.20 | 11.08    0.00
                2.667   27.10 | 5.500    0.20 | 8.333    0.20 | 11.17    0.00
                2.750  104.40 | 5.583    0.20 | 8.417    0.20 |
                2.833  104.40 | 5.667    0.20 | 8.500    0.20 |

     Max.Eff.Inten.(mm/hr)=     156.20       217.55
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.44 (ii)    6.20 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.25            0.434 (iii)
     TIME TO PEAK    (hrs)=       3.83         3.83             3.83
     RUNOFF VOLUME    (mm)=     159.56       100.55           121.20
     TOTAL RAINFALL   (mm)=     161.13       161.13           161.13
     RUNOFF COEFFICIENT   =       0.99         0.62             0.75

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 76.20          K  (1/hr)=  4.14
            Fc   (mm/hr)= 13.20     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0010)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     1.20   0.434     3.83   121.20
      + ID2= 2 (  0009):     2.22   0.740     3.83   119.75
        ====================================================
        ID = 3 (  0010):     3.42   1.173     3.83   120.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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Appendix B - Preliminary Storm Sewer Design Sheet

STORMWATER MANAGEMENT MODEL
Preliminary Storm Sewer Design Sheet

Client: Westview Projects Inc.
Job No.: 210864
Location: Hilan Village, 38 Carss Street
Date: October 13, 2023

5-yr storm

LOCATION				PROPOSED SEWER									
			PEAK	TYPE	PIPE		PIPE		FULL FLOW	EXCESS		ACTUAL FLOW	
FROM	TO	Total Area	FLOW*	OF	SIZE	ROUGHNESS	SLOPE	CAPACITY	VELOCITY	CAPACITY	Q/Qfull	VELOCITY	V_p/V_f
		(ha)	Q (l/s)	PIPE	(mm)	C	(%)	(l/s)	(m/s)	(l/s)		(m/s)	
CA-1a	CA-1b	4.99	97	PVC									
CA-1b	Block 62	5.71	108	CON	525	0.013	0.35	255	1.18	147	0.42	1.13	0.96
CA-2	Block 62	0.74	135	CON	450	0.013	0.60	221	1.39	86	0.61	1.44	1.04
Block 62	Watercourse	6.45	172	CON	525	0.013	0.60	333	1.54	161	0.52	1.54	1.00
Watercourse	River	6.45	172	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							
CA5	Park Block	0.63	30	PVC	450	0.013	0.35	169	1.06	139	0.18	0.81	0.76
CA4	Park Block	0.80	143	CON	450	0.013	1.20	313	1.96	170	0.46	1.90	0.97
CA3	Park Block	0.60	102	CON	525	0.013	0.30	236	1.09	134	0.43	1.04	0.96
Park Block	Outlet	3.42	509	CON	675	0.013	1.00	841	2.35	332	0.60	2.44	1.04
Outlet	River	3.42	509	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							

* Peak flow was obtained from the OTTHYMO stormwater model for a 10 year design storm

10-yr storm

LOCATION				PROPOSED SEWER									
			PEAK	TYPE	PIPE		PIPE		FULL FLOW	EXCESS		ACTUAL FLOW	
FROM	TO	Total Area	FLOW*	OF	SIZE	ROUGHNESS	SLOPE	CAPACITY	VELOCITY	CAPACITY	Q/Qfull	VELOCITY	V_p/V_f
		(ha)	Q (l/s)	PIPE	(mm)	C	(%)	(l/s)	(m/s)	(l/s)		(m/s)	
CA-1a	CA-1b	4.99	124	PVC									
CA-1b	Park Block	5.71	137	CON	525	0.013	0.35	255	1.18	118	0.54	1.19	1.01
CA-2	Park Block	0.74	169	CON	450	0.013	0.60	221	1.39	52	0.76	1.49	1.07
Park Block	Watercourse	6.45	222	CON	525	0.013	0.60	333	1.54	111	0.67	1.62	1.05
Watercourse	River	6.45	222	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							
CA5	Park Block	0.63	42	PVC	450	0.013	0.35	169	1.06	127	0.25	0.88	0.83
CA4	Park Block	0.80	188	CON	450	0.013	1.20	313	1.96	125	0.60	2.02	1.03
CA3	Park Block	0.60	133	CON	525	0.013	0.30	236	1.09	103	0.56	1.11	1.02
Park Block	Outlet	3.42	666	CON	675	0.013	1.00	841	2.35	175	0.79	2.51	1.07
Outlet	River	3.42	666	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							

* Peak flow was obtained from the OTTHYMO stormwater model for a 10 year design storm

100-yr storm

LOCATION				PROPOSED SEWER									
			PEAK	TYPE	PIPE		PIPE		FULL FLOW	EXCESS		ACTUAL FLOW	
FROM	TO	Total Area	FLOW***	OF	SIZE	ROUGHNESS	SLOPE	CAPACITY	VELOCITY	CAPACITY	Q/Qfull	VELOCITY	V_p/V_f
		(ha)	Q (l/s)	PIPE	(mm)	C	(%)	(l/s)	(m/s)	(l/s)		(m/s)	
CA-1a	CA-1b	4.99	203	PVC									
CA-1b	Park Block	5.71	223	CON	525	0.013	0.35	255	1.18	32	0.88	1.26	1.07
CA-2	Park Block	0.74	293	CON	450	0.013	0.60	221	1.39	-72	1.33	1.84	
Park Block	Watercourse	6.45	407	CON	525	0.013	0.60	333	1.54	-74	1.22	1.88	
Watercourse	River	6.45	407	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							
CA5	Park Block	0.63	86	PVC	450	0.013	0.35	169	1.06	83	0.51	1.06	1.00
CA4	Park Block	0.80	303	CON	525	0.013	1.00	430	1.99	128	0.70	2.11	1.06
CA3	Park Block	0.60	225	CON	525	0.013	0.30	236	1.09	11	0.95	1.14	1.05
Park Block	Outlet	3.42	1121	CON	675	0.013	1.00	841	2.35	-280	1.33	3.13	
Watercourse	River	3.42	1121	Open Channel		upper 0.035	Trapazoidal - 0.5 m flat bottom 3H:1V side slopes						
						lower 0.05							

** Storm sewers within catchments CA-3 and CA-4 will convey runoff from less than half the catchment - Areas and flow adjusted accordingly
***Peak flow was obtained from the OTTHYMO stormwater model for a 100 year design storm