D. G. Biddle & Associates Limited
consulting engineers and planners

FINAL STORMWATER MANAGEMENT AND FUNCTIONAL SERVICING REPORT

FOR

VILLAGES OF CENTRAL PARK PHASE 1 – 14T-06001-R

TOWN OF COBOURG COUNTY OF NORTHUMBERLAND

PROJECT NO. 114057 **DATE: JUNE 2019**

\\FSHR\Staff\Job Files\114000\114057 Rondeau Cobourg\114057 Reports\Phase 1\114057 Stormwater Management & Servicing Report–Phase 1.do

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June 27, 2019

Rondeau (Cobourg) Ltd.
513 Westney Road South, Unit 4
Ajax, ON L1S 6W8

Attention: Mr. R. Rondeau

Re: Stormwater Management and Functional Servicing Report
Villages of Central Park – 14T-06001-R, Phase 1
Town of Cobourg
Our File: 114057

Dear Sir:

The following Final Stormwater Management and Functional Servicing Report has been prepared to satisfy the Conditions of Draft Approval for Phase 1 of the proposed Plan of Subdivision 14T-06001-R. This report describes the infrastructure required to fully service the subdivision as well as meet GRCA stormwater drainage objectives and address impacts to the receiving watercourses, specifically Brook Creek.

The GRCA had provided comments when the preliminary design was submitted in support of the Draft Plan Application. A copy of the comments dated May 30, 2018 are attached. They have required comments 2 to 7 be addressed before Draft Approval is given for Phase 1. The remaining comments have also been addressed here.

1) Comment noted.

2) The pre-development drainage area from Phase 1 has been reduced from 8.69ha to 4.91ha in post-development conditions. However, due to the slightly increased imperviousness, the peak flows were only moderately reduced in the larger storm events and effectively matched in the minor storm events. Furthermore, an additional 5.657ha of land, north of Phase 1, where Pond F is proposed, will also drain to Midtown Creek in post development conditions.

3) -Post-development uncontrolled flows have been reported from Phase 1 development.
-Refer to Figure 2 in the Stormwater management and Functional Servicing Report for further clarification.
-Post-development flows are effectively matched or have been reduced to below pre-development levels.

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-Two hydrologic points have been assessed. Hydrologic Point A is located north of the Elgin Street crossing of Brook Creek. Hydrologic Point B is located further downstream as seen in Figure 2.

4) The GRCA guidelines have been adhered to for the detailed design of Pond D. Side slopes have been adjusted to meet GRCA's minimum criteria.

5) A channel has been designed by Geomorphix and has been incorporated into the detailed design for Phase 1.

6) The outlet for Pond D has been revised to discharge north of Elgin Street into Brook Creek.

7) The detailed design of Pond D shows the inlet and outlet are separated a sufficient distance to allow sediment to settle.

8) Comment noted.

9) Further grading detail will be provided at detailed design for each phase.

This report is intended to be reviewed by the Town of Cobourg, Lakefront Utilities and Ganaraska Region Conservation to confirm that the necessary infrastructure is available to service the subject lands. We believe that the appropriate approval authorities can issue positive comments and provide clearance on the appropriate Conditions of Approval.

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

Yours truly,

D.G. BIDDLE & ASSOCIATES LIMITED

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Civil Design Engineer

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100174691
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Senior Project Engineer, President

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MEMBER OF
CONSERVATION ONTARIO

May 30, 2018

Desta McAdam, Planner I
Town of Cobourg
55 King Street West
Cobourg, ON K9A 2M2

Dear Ms. McAdam:

Re: East Cobourg Rondeau Lands, Elgin Street East, Cobourg
File: OPA-02-16 Z-07-16 T14-16001-R

A submission for the Rondeau (Elgin Street East) lands has been made to the Town for an OPA and rezoning of all the lands, as well as a red-line revision of the plan of subdivision for Phase 1 only (confirmed by Glenn McGlashon in a May 24th email). Red-line revisions for the subsequent phases will be made at later dates as those phases proceed.

While the Ganaraska Region Conservation Authority (GRCA) has no issues with the OPA and the rezoning, we do have comments on the Conceptual Servicing Report for Rondeau (Cobourg) Ltd. Lands Draft Plan (rev. March, 2018, received April 20, 2108) for the entire lands. The latest submission has been fully reviewed and, in particular, in the context of GRCA's comments to the Town dated November 29, 2017.

We offer the following comments:

1) Pond "F" should be identified on all drawings.

2) The area contributing to Midtown Creek has reduced from 14.09 ha to 5.65 ha, the difference now flowing to Brook Creek. Every effort should be made to maintain the same contributing areas pre and post-development (as per Comment #13 in our November, 2017 comments).

3) In Table 4:

- Post-development uncontrolled flows are not listed. It appears that only the post-development controlled flows are listed.
- Point B is simply stated as being "south of Elgin St.". It is not clear where.
- Some post-development flows at Point B are higher than pre-development and some are lower than pre-development. The flows listed in the Table should be reviewed.
- Pre and post-development flows should be compared at Brook Rd. north of and Elgin St. E., the Elgin St. E. crossing west of Brook Rd. and Brook Rd. south of Elgin St. E. (as per Comment #7 in our November, 2017 comments).

4) The preliminary drawings of each pond do not meet Sect. 8 of GRCA's Technical and Engineering Guidelines. Specifically, the side slopes are too steep (as per Comment #15 in our November, 2017 comments). The current design may be acceptable if the Town is amenable to fencing the ponds. It is my understanding, however, that they were intended to be "features" in the neighbourhood.

5) Staff previously identified that the EIS recommended that a natural channel design be incorporated to convey flow from the east part of the subdivision to Brook Creek as the outflow from the three upstream ponds have no defined connection to Brook Creek without the channel. The consultant has responded that "a note has been added to the plan which recognizes the inclusion of a natural channel being needed ..." There does not appear to be any note on the plan, and this channel will likely be required to be constructed on a separate block which will affect the draft plan.

6) We request that the Town ask the environmental consultant to comment on the location and design of the outlet from Pond D. The EIS states that no outfall can discharge to the amphibian breeding ground south of Elgin St.

7) Pond "D"- both the inlet and the outlet are to and from the forebay, respectively. There will be no opportunity for the sediment to settle in the forebay.

8) Some road grades are very steep and steeper than shown on the drawing in the east part of the proposed subdivision. If the Town requires a change, it may affect the contributing areas to each pond.

9) There is very little information on the Preliminary Grading Plan particularly adjacent to existing development.

With respect to Phase 1, which is the subject of the red-line revision, Comments 2, 3, 4, 5, 6 and 7 should be addressed before approval. In an email from Glenn McGlashon on May 24, 2018, he stated:

The OPA and re-zoning applies to the entire lands, while the draft approval is for Phase 1 only. We can structure the draft conditions to clearly specify that the Phase 1 draft plan may need to be modified post-draft approval at the Town/GRCA's sole and absolute discretion in the event that circumstances dictate during detailed engineering review, such as if pond sizing is to be changed and re-lotting is required. Future phases can be dealt with prior to draft approval or as conditions to draft approval, where necessary.

This statement is acceptable to the GRCA; however, the proponent should be made aware that there may be changes at the detailed design stage which could affect the lotting in the subdivision.

Yours truly,

Leslie Benson, P.Eng.
Watershed Services - Plan Review

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1.0 INTRODUCTION

1.1 Purpose

This Final Stormwater Drainage and Functional Servicing Report has been prepared to review the infrastructure requirements to provide services for Phase 1 of the proposed Plan of Subdivision 14T-06001-R. It will address sanitary sewer services, watermain services and storm water drainage works required to proceed with Phase 1 of the development. This report will also discuss the storm water quality and quantity control objectives for Brook Creek in accordance with the requirements of the Ganaraska Region Conservation Authority.

1.2 Site Location and Description

The study area forms part of Lot 12 and 13, Concession 1 in the Town of Cobourg and County of Northumberland. The Draft Plan comprises part of Registered Plan 39M-821 and Part of Block D Registered Plan 227. The site location is shown on the attached Figure 1. The subject property to be developed encompasses Phase 1 of the parent Subdivision 14T-06001-R. A Draft Plan of Subdivision Plan was previously developed in consultation with the Town of Cobourg and various consultants to produce a plan that is respectful of existing land forms, environmental features and desired land use. Phase 1 of the development will consist of mainly residential units in various forms, a school, open space blocks and a stormwater management pond block.

Phase 1 of the plan is approximately 17.11 ha in size, with the main road access fronting Elgin Street East. The Phase is bounded on the South by Elgin Street East, on the west by existing residential properties and open fields, on the east by Brook Creek and on the north by future phases of the development. The current site consists primarily of a drumlin. The majority of the site presently drains in a southeasterly direction to Brook Creek (at approximately 10% slope) and the remaining drains northwest to Midtown Creek.

DRAFT PLAN OF SUBDIVISION 14T–06001

SITE LOCATION PLAN

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DESIGN	D.D.M.
CHECKED	M.B.C.
DATE	JUNE 2019

PROJECT 114057

DWG FIG 1

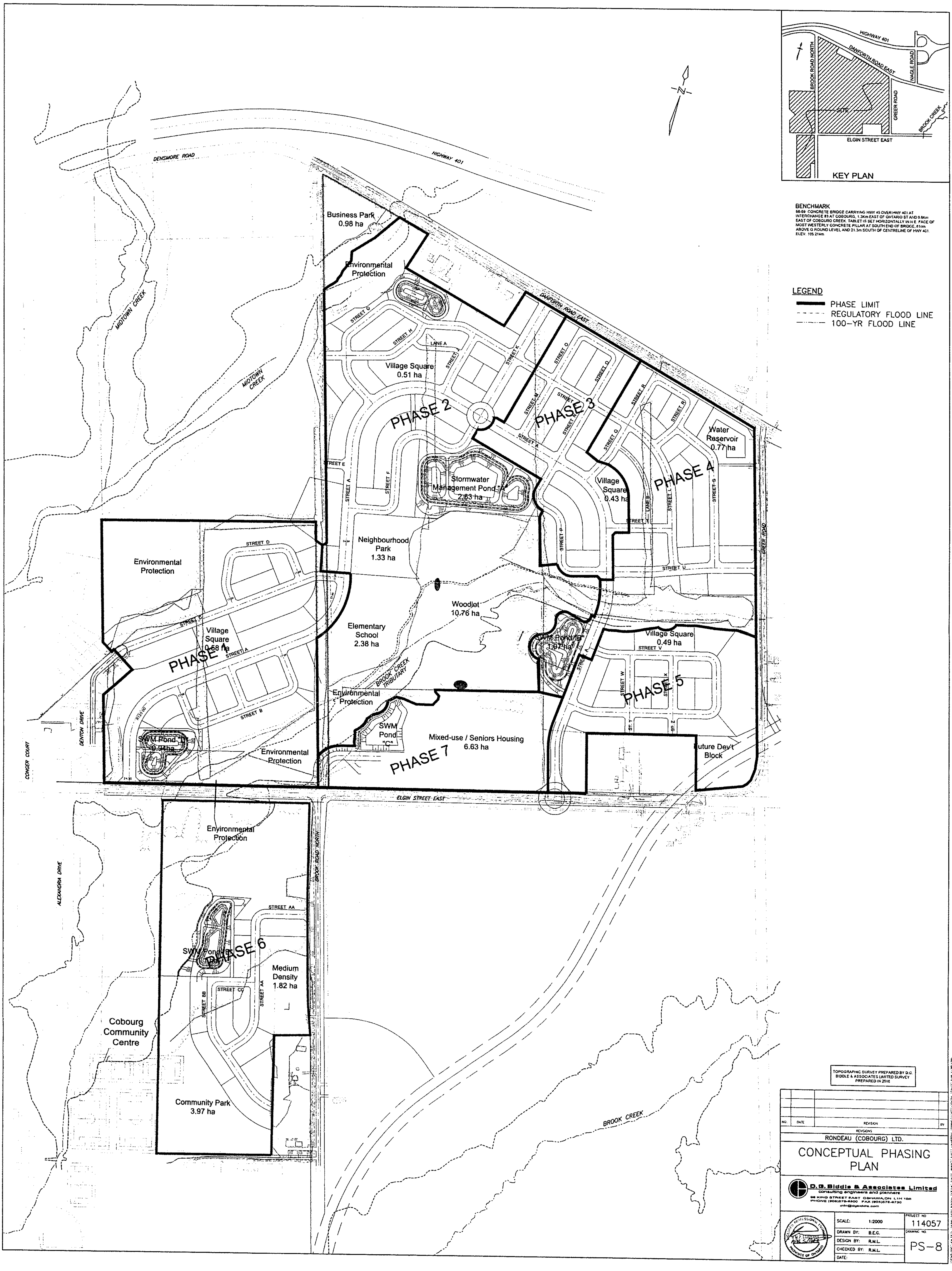
2.0 SANITARY SEWERAGE

A 250mm sanitary sewer service is available on Elgin Street, approximately 200m west of proposed Street A, at the intersection of Conger Avenue and Elgin Street. The sewer at this location has an invert elevation of 97.12m ASL. The proposal is to extend this 250mm sanitary sewer easterly on Elgin Street to the intersection of Street A to service the development of Phase 1.

The internal sanitary sewer has been sized in accordance with the Town of Cobourg design criteria, with consideration on minimum and maximum grades, depths and velocity. The minimum sewer diameter within Phase 1 development will be 200mm, with all terminal legs having a minimum grade of 1.00%. All service laterals will be 100mm diameter at 2.00% minimum grade. The proposed internal sanitary sewer network is illustrated on the General Services Plan, Drawing 114057 D-1, and the Sanitary Sewer Design Sheet is attached at the end of this report in Schedule 1.

The existing 250mm sanitary sewer on Elgin Street west of the development has a capacity of approximately 37.22 L/sec. With the development of Phase 1 and the existing flows currently draining to Elgin Street East, the total proposed flow will be 22.27L/sec. Therefore, this existing sanitary trunk can accommodate the anticipated flows from Phase 1. Sanitary flows from Phases 2 and 3 are proposed to be temporarily conveyed through Phase 1 to the Elgin Street East sewer. These developments will increase total flows to 43.94 L/sec. This projected flow will slightly exceed capacity in the existing sanitary sewer in Elgin Street East but is only temporary. Ultimately, with the extension of a trunk sewer north on Brook Road, only Phase 1 will utilize the Elgin Street East sewer, as described further below. The Sanitary Sewer Design Sheet and Sanitary Drainage Area Scheme for the sewer on Elgin Street are attached at the end of this report in Schedule 1.

As future phases are developed, including the lands south of Elgin Street, the existing sanitary trunk sewer on Brook Road will need to be extended north to Elgin Street East. The 375mm sanitary trunk sewer will ultimately connect into the internal


KEY PLAN
HIGHWAY 401
DANFORTH ROAD EAST
NAGLE ROAD
BROOK ROAD NORTH
GREER ROAD
SITE
BROOK CREEK
ELGIN STREET EAST
BENCHMARK
68-69 CONCRETE BRIDGE CARRYING HWY 45 OVER HWY 401 AT INTERCHANGE 83 AT COBOURG, 1.3Km EAST OF ONTARIO ST AND 0.8Km EAST OF COBOURG CREEK. TABLET IS SET HORIZONTALLY IN N.E. FACE OF MOST WESTERLY CONCRETE PILLAR AT SOUTH END OF BRIDGE, 81cm ABOVE GROUND LEVEL AND 21.3m SOUTH OF CENTRELINE OF HWY 401. ELEV. 105.214m
LEGEND
PHASE LIMIT
REGULATORY FLOOD LINE
100-YR FLOOD LINE
DENSMORE ROAD
MIDTOWN CREEK
Business Park 0.98 ha
Environmental Protection
Village Square 0.51 ha
PHASE 2
PHASE 3
PHASE 4
PHASE 5
PHASE 6
PHASE 7
Water Reservoir 0.77 ha
Stormwater Management Pond "A" 2.63 ha
Village Square 0.43 ha
Neighbourhood Park 1.33 ha
Woodlot 10.76 ha
Elementary School 2.38 ha
BROOK CREEK TRIBUTARY
SWM Pond "B" 1.67 ha
Village Square 0.49 ha
Village Square 0.68 ha
SWM Pond "D" 0.94ha
SWM Pond "C"
Mixed-use / Seniors Housing 6.63 ha
Future Dev't Block
ELGIN STREET EAST
CONGER COURT
DENTON DRIVE
ALEXANDRA DRIVE
Medium Density 1.82 ha
Cobourg Community Centre
Community Park 3.97 ha
BROOK CREEK
TOPOGRAPHIC SURVEY PREPARED BY D.G. BIDDLE & ASSOCIATES LIMITED SURVEY PREPARED IN 2016
NO. DATE REVISION BY
REVISIONS
RONDEAU (COBOURG) LTD.
CONCEPTUAL PHASING PLAN
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DATE:
PROJECT NO 114057
DRAWING NO. PS-8

sanitary sewer at MH SA-21 on Street B of Phase 1. This connection will allow all sanitary flows from future phases temporarily draining through Phase 1 (Phases 2 and 3), to be redirected south to the Brook Road sanitary trunk sewer. This will leave the majority of sanitary sewage from Phase 1 to permanently be conveyed to Elgin Street. The Phasing Plan developed during conceptual design can be seen in Drawing PS-8.

3.0 WATER DISTRIBUTION SYSTEM

There is an existing 400mm watermain on Elgin Street which that reduces to 200mm at Conger Avenue, and continues east on Elgin Street East to terminate approximately 95m west of the proposed intersection of Street A and Elgin Street. The proposal is to remove and replace the 200mm watermain on Elgin Street with a 400mm watermain and extend it easterly to Street A. This will allow Phase 1 of the subdivision to be serviced by extending a 300mm watermain northerly on Street A through the development. The proposed 400mm watermain on Elgin Street East will ultimately be extended further east to Brook Road and then south to service future phases and to loop the network. The proposed watermain network is illustrated on the General Services Plan, Drawing 114057 D-1, attached at the end of this report.

4.0 STORMWATER DRAINAGE

The majority of Phase 1 will drain to a stormwater management facility identified as Pond D in the Preliminary Stormwater Report submitted with Draft Plan Application. Pond D is located at the south/west corner of Phase 1, adjacent to Elgin Street East and Street A. This facility has been sized to attenuate post-development peak flows to be equal to or less than pre-development levels, discharging to Brook Creek. It should be noted that this pond is intended to work in conjunction with an additional 4 stormwater management facilities throughout the development, all attenuating flows to Brook Creek. The other ponds will be developed in subsequent phases and were sized accordingly in the preliminary design phase. Refer to the Conceptual Servicing last dated March 2018 prepared by this office for further details.

4.1 Minor Storm Sewer System

The proposed storm sewer system will be designed as per Town of Cobourg and GRCA Technical and Engineering Guidelines for Stromwater Management Submissions, based on a 5-year return frequency event. The storm sewer system has also be designed to accommodate the house foundation drains such that the 25 year hydraulic grade line (HGL) does not rise closer than 0.3m below the underside of the basement floor. The storm sewer drainage network indicates the location of manholes, pipe sizes, and pipe grades as illustrated on the General Services Plan, Drawing 114057 D-1

Due to grading constraints, it is not possible to convey minor flows from Street A south of Lot 49 to the proposed stormwater management facility. This area is proposed to discharge uncontrolled to a proposed ditch on Elgin Street. The controlled discharge from the proposed pond and the uncontrolled flow from the remaining development will drain to Brook Creek north of the Elgin street cross culvert. The Storm Sewer Design Sheet is attached at the end of this report in Schedule 1.

4.2 Major Storm Drainage System

In addition to providing a minor storm sewer system to convey frequent storm sewer events, the Town of Cobourg and GRCA Design Criteria requires that overland flows from major storm events, including the 100-year storm, be contained within the road right-of-way or conveyance routes. Consequently, road grades and lot grades are designed to positively convey the major storm system to an acceptable outfall.

Flows in excess of the 5-year storm will be conveyed to two low points. Approximately 8.846ha of major flow will be conveyed to a low point on Street B, where it will spill into the proposed stormwater management facility from the north. The weir at the low road point and reinforced pond slope will convey 2.458m^3/s to the main cell of the facility. Supporting calculations for the weir sizing are attached in Schedule 4. The remaining overland flows, approximately 1.840ha, will be conveyed to a second low point at the intersection of Street A and Elgin Street where it will flow uncontrolled to the aforementioned ditch on Elgin Street on the south side of the facility.

5.0 PERMANENT STORMWATER QUALITY CONTROLS

As previously mentioned, a Stormwater Management Pond is proposed to provide quality, erosion and quantity controls at the end of the proposed storm sewer system as required by Ganaraska Region Conservation Authority's Technical and Engineering Guidelines for Stormwater Management Submissions.

Enhanced detention wet ponds have been selected as the end of pipe facility to provide water quality control for the development. Engineering drawings illustrating the details of the Stormwater Management Facility D are provided on Drawing 114057 C-12, C-13, and C-14.

The minor storm sewer drainage area tributary to the pond is 11.417ha, including the pond block. This tributary mainly consist of low density and medium density residential lots and park and school blocks. According to the GRCA guidelines, low and medium density residential lots should have an impervious level of 60% and 75% respectively. A conservative average imperviousness of 65% was used in sizing the facility. Supporting calculations are attached in Schedule 3. Quality control volume requirements for Level 1 Enhanced fisheries protection were extracted from the Stormwater Management Practices Planning and Design Manual (MOEE, March 2003). Given the above information, the permanent and active (fluctuating) water quality storage requirements are tabulated below:

TABLE 1 – PERMANENT POOL STORAGE VOLUME REQUIREMENTS

IMPERVIOUS LEVEL (%)	PERMANENT STORAGRE VOLUME REQUIRED (m^3/ha)	FLUCTUATING STORAGRE VOLUME REQUIRED (m^3/ha)	TOTAL DRAINAGE AREA (ha)	PERMANENT VOLUME REQUIRED (m^3)	FLUCTUATING VOLUME REQUIRED (m^3)
80	200	40	0.970	194	39
70	185	40	0.877	162	35
65	175	40	8.846	1580	361
65	175	40	1.081	189	43
			11.774	2093	471

In addition to the above requirements for quality controls, additional fluctuating volume is recommended within the stormwater facilities to minimize further erosion in the Brook Creek. The active (fluctuating) storage volume has been extended to include the runoff generated by a 25mm storm event. This volume will be detained for a minimum duration of 24 hours. The required volumes for erosion control are as follows:

TABLE 2 – PERMANENT POOL STORAGE VOLUME REQUIREMENTS

IMPERVIOUS LEVEL (%)	TOTAL RAINFALL (mm)	RUN-OFF DEPTH (mm)	TOTAL DRAINAGE AREA (ha)	VOLUME REQUIRED (m^3)
80	25	20.75	0.970	201
70	25	19.12	0.877	168
65	25	17.44	8.846	1574
65	25	17.43	1.081	188
			11.774	2100

The Visual Otthymo Summary Files for determining the erosion control volume are attached in Schedule 3 of this report.

5.1 Extended Detention Wet Pond Design Characteristics – Pond D

The proposed design for the wet pond, shown on drawing 114057 C-12, has the following characteristics:

- 7:1 side slopes above active (fluctuating) water surface elevation;
- 4:1 side slopes below permanent pool water surface elevation;
- 6:1 bench at permanent pool water surface elevation;
- 3:1 side slopes above the 100year water surface elevation;
- 102.25m permanent pool elevation;
- 1.75m permanent pool depth;
- 2287m^3 permanent volume provided;
- 0.75m water surface fluctuation;
- 103.00m maximum water quality fluctuating elevation;
- 2221m^3 water quality fluctuating volume provided;
- sediment forebay at inlet location;
- detention time between 24-48 hours;
- 4.0m maintenance access;
- 103.75m maximum 100-year water surface elevation;
- 5484m^3 maximum fluctuating volume provided;

The pond discharges to Brook Creek tributary via a proposed 600mm storm sewer outfall and outfall channel. Given the above characteristics, the proposed stormwater management pond will provide the permanent and fluctuating volumes required to obtain Level 1 fisheries habitat protection in addition to minimizing downstream erosion.

5.2 Sediment Forebay

One storm sewer outfall is proposed for the stormwater management facility. The sediment forebay is proposed with a hard bottom surface consisting of cable concrete blocks to facilitate maintenance. The forebay will be separated from the rest of the pond by a submerged earth berm which is set at the permanent water surface level. A 300mm flow through culvert has also been proposed as per GRCA guidelines. In

addition to the above, the sediment forebay has been designed with the following characteristics:

- the forebay will be designed to settle out 150 µm particles·
- the forebay will not exceed 1/3 of the pond surface area
- the forebay length will be such that the dispersion velocity will be 0.5m/s at the forebay berm

Calculations for the sediment forebay designs for the stormwater management facility can be found in Schedule 3.

5.3 Mitigating Thermal Impacts

In accordance with Section 4.4 of the MOE Stormwater Management Planning and Design Manual, the following mitigation measures were reviewed with the design to minimize increased temperature of the stormwater effluent.

5.3.1 Pond Configuration

The proposed pond has been configured with a length to width ratio of approximately 2:1 to prevent the occurrence of large open areas of water which cannot be shaded with the planting strategy. In addition, the location of the pond outlet is proposed at the opposite end of the facility from the inlet to ensure conveyance of stormwater through the facility and minimize the occurrence of 'dead-zones'.

5.3.2 Riparian Planting Strategy

The purpose of providing planting for a wet pond facility is to provide shading, aesthetics, safety and enhanced pollutant removal. In wet ponds there are varying zones for plantings based on water depths and the expected frequency of wetting. A planting strategy for the pond has been prepared by a Henry Kortekaas & Associates and is attached at the end of this report.

5.3.3 Bottom Draw Outlet

The design proposed for the water quality pond discharge structure for the stormwater management pond will be a combination of a reverse slope outlet pipe and an internal perforated riser with a control discharge orifice plate. This discharge structure is detailed on drawing 114057 C-14 and is located in Manhole A in the pond embankment for ease of operations and maintenance. The reverse slope pipe allows flows to discharge the pond from the lower permanent pool, while the perforated riser with a 130mm control discharge orifice plate provides the 24 hour drawdown time to allow sediment removal. Calculations for the water quality discharge structure orifice sizing can be found in Schedule 3.

The discharge structure is proposed with a 300mm gate valve to assist in pond draw down for maintenance of the facility. Pumps are required to completely draw down the facility during infrequent maintenance requirements. Pump lines for maintenance should discharge to CBMH C.

5.3.4 Night-time Release

The outlet of the facility has been designed to operate hydraulically, to minimize monitoring and maintenance requirements. Therefore, the implementation of electrical and mechanical devices to provide real time outlet controls is not recommended.

5.3.5 Outlet Channel Design

The outfall for the proposed facility will be located in close proximity to the existing watercourse. The proposed outfall includes a 75m natural channel design prepared by Geomorphix. A planting strategy for the outfall channel has also been prepared by Henry Kortekaas and Associates to provide shading and further reduce the discharge water temperature prior to connecting to Brook Creek.

5.4 Monitoring and Maintenance

In order to ensure that the stormwater management pond will function and operate as intended, a monitoring and maintenance plan must be developed. The following monitoring and inspection program is recommended for the wet pond facility. The monitoring program described below is recommended for the Town of Cobourg Maintenance Staff once the facilities have been assumed by the Town.

- Monitoring and inspection after every significant rainfall event during the first two years of operation (approximately 4 inspections per year). Annual inspections after the initial two years.
- The monitoring and inspections should include observations of the hydraulic operation (draw down time, inlet and outlet function); condition of vegetation in all zones of the pond (wet and dry); evidence of grease/oil contamination; trash build-up. Table 6.1 of the MOE Stormwater Management Practices Manual, attached in Schedule 6, describes how to assess the facility's hydraulic operation.

The following maintenance program is recommended for the wet pond facility:

- Grass cutting and weed control is not recommended.
- Once the upland plantings are stabilized there will be little need of maintenance in this area. Shoreline plantings and aquatic plantings may require re-establishment every 2-5 years as observation dictates.
- Sediment removal frequency is dependent on a number of factors from upstream land use and development activities to municipal street sanding practices. We have recommended an annual measurement of sediment depth accumulation and removal frequency should be based on this observation with a suggested removal frequency of every 10 years.
- Inlet and outlet structures should be maintained to clear blockage as required by observation. Maintenance replacement of these structures is based on life span of the materials.
- Trash removal is recommended on a yearly basis or as observation requires based on surrounding airborne trash accumulation.

Monitoring and maintenance of the facility prior to being assumed by the Town of Cobourg is the responsibility of the Developer. The same schedule described above is recommended.

5.5 Bio Retention Swales

Additional measures have been proposed to further enhance the quality of the stormwater by implementing Low Impact Development practises in the form of bio-retention swales. Theses swales have been sized to capture a 10mm rainfall event which would then percolate into the native soil to facility groundwater recharge. Excess rainfall would drain overland into the storm sewer network. Supporting sizing calculations are found at the end of this report in Schedule 4.

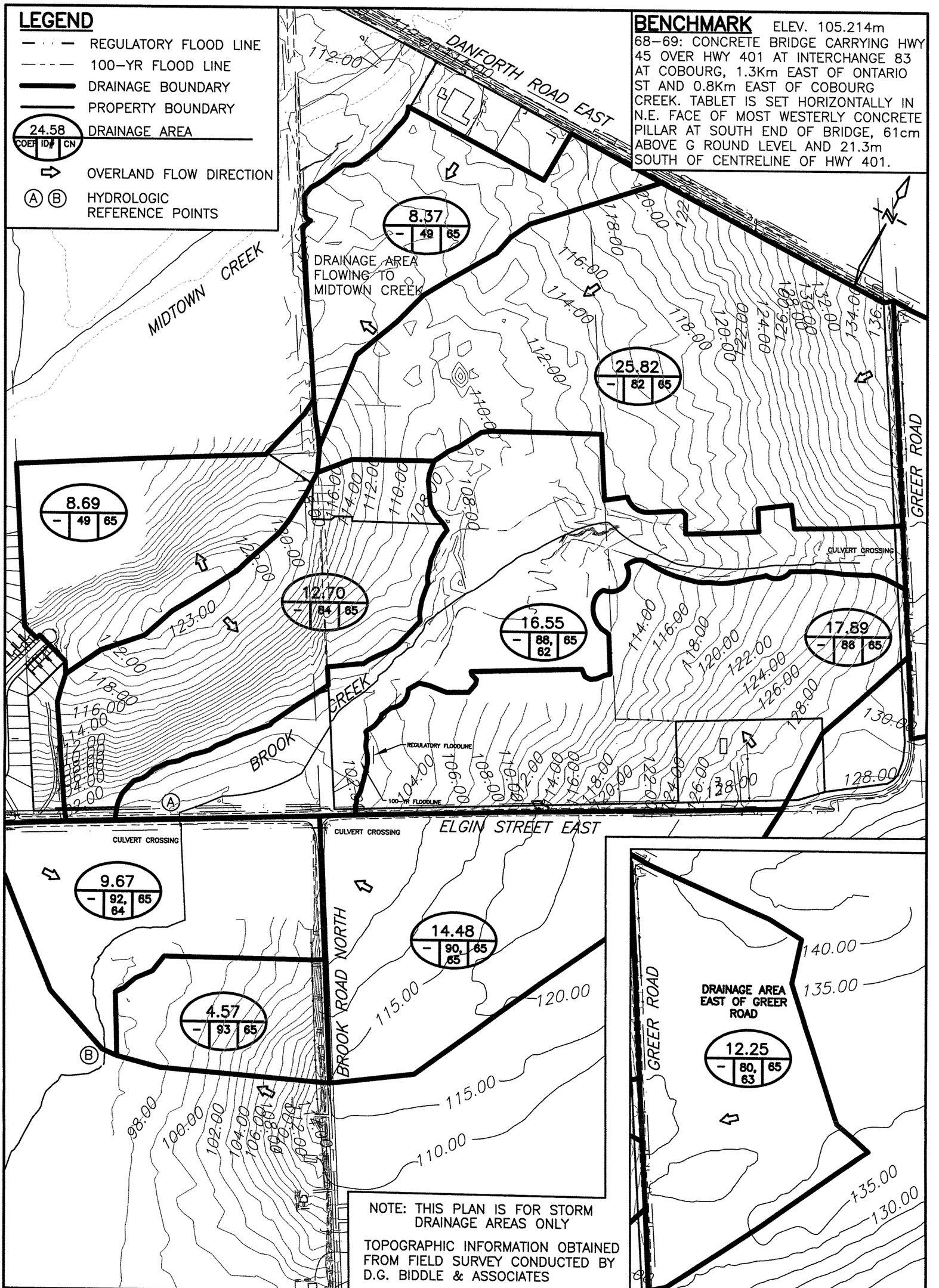
6.0 STORMWATER QUANTITY CONTROLS

6.1 Pre-Development Conditions to Brook Creek

Pre-Development conditions were assessed at two locations along Brook Creek, as illustrated on Figure 2, Pre-Development Drainage Scheme. The first point, hydrologic reference Point A, is located at the Elgin Street cross culvert. The tributary drainage area at this location is 85.21ha. The second point, hydrologic reference point B, is south of Elgin Street at the future outfall location for Pond E in Phase 6. This reference point was utilized to provide a direct comparison with post-development conditions. The pre-development tributary area at this location is 113.93ha.

The subject property consists of a fine to medium sandy loam with poor to good soil moisture according to the Hydrogeological Assessment prepared by GOFFCO Limited (July 2006). Based on Design Chart 1.09 from the MTO Drainage Manual a CN value of 65 was used to simulate pre-development conditions. The Hydrogeological Assessment can also be found in the Conceptual Servicing Report submitted with the Draft Plan Application (March 2018).

The time of concentration travel paths tributary to Points A and B along Brook Creek were determined using the Upland Method. Supporting calculations are included in Schedule 2. Using the computer program Visual Otthymo 3.0, pre-development flows were computed using a 24-hour Chicago distribution rainfall event for the 2 to 100-year events. The NASH HYD sub-routine was used to simulate the performance of each drainage area with the appropriate time to peak value. The SHIFT HYD sub-routine was used to simulate lag time for distant drainage areas relative to the hydrologic reference point. Tabulated below in Table 3 are the anticipated pre-development peak flows at the reference points of Brook Creek. Supporting calculations are attached at the end of this report in Schedule 2.



RONDEAU (COBOURG) LTD.

PRE-DEVELOPMENT DRAINAGE SCHEME

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DATE	6/27/19

PROJECT 114057

DWG FIG 2

\\FSHR\STAFF\JOB FILES\114000\114057 RONDEAU COBOURG\114057 DRAWINGS CIVIL\114057 FIGURES\114057 - FIGURE 1 AND 2.DWG

TABLE 3 – Pre-development Peak Flows to Brook Creek

RETURN PERIOD years	24hr CHICAGO PRE-DEVLOPMENT PEAK FLOW (m^3/s)	
	POINT A (ELGIN CROSSING)	POINT B (SOUTH OF ELGIN)
2	0.534	0.702
5	1.037	1.365
10	1.368	1.797
25	2.484	3.259
50	3.321	4.382
100	4.420	5.746

6.2 Pre-Development Conditions to Midtown Creek (Phase 1)

The pre-development drainage area flowing from the property to Midtown Creek in Phase 1 was determined to be 8.69ha as seen in Figure 2. Using the computer program Visual Otthymo 3.0, pre-development flows were computed using a 24-hour Chicago distribution rainfall event for the 2 to 100-year events. The NASH HYD sub-routine was used to simulate the peak flows. Tabulated below in Table 4 are the anticipated pre-development peak flows draining from the Phase 1 development towards Midtown Creek. The Visual Otthymo output files are attached in Schedule 3.

TABLE 4 – Pre-development Peak Flows from Phase 1 to Midtown Creek

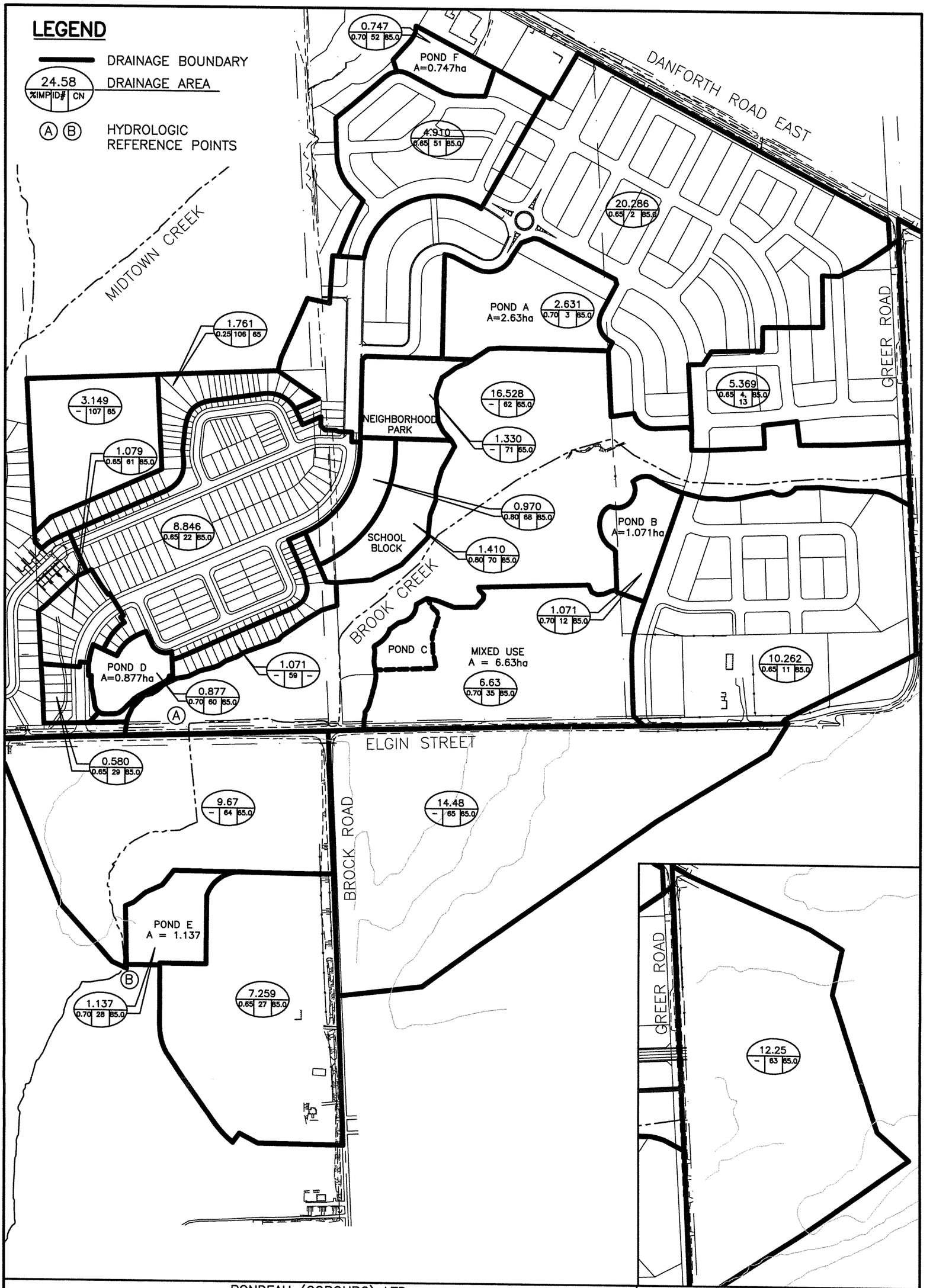
RETURN PERIOD years	24hr CHICAGO PRE-DEVLOPMENT PEAK FLOW (m^3/s)
2	124
5	233
10	309
25	552
50	688
100	1.068

6.3 Post Development Conditions to Brook Creek

We have reviewed the post-development watershed using the STANDHYD sub-routines of the computer modelling software Visual Otthymo 3.0. For a direct comparison with pre-development, the post development watershed for the development has been modelled using a 24-hour Chicago distribution rainfall event for the 2, 5, 10, 25, 50 and 100 year events. A total impervious ratio of 65% was used along with a total directly connected ratio of 55%. As with pre-development, the 24-hour Chicago storm generated the greatest post-development runoff peak flows and volumes.

As previously mentioned in Section 4.0, the post-development flows from Phase 1 were assessed in conjunction with the remaining lands of the Parent Subdivision draining to Brook Creek in post-development conditions. There are four additional stormwater management facilities that will attenuate post-development flows to Brook Creek and will be constructed in subsequent phases of construction. These ponds were previously simulated and designed in the preliminary design stage. Therefore, the preliminary stage-storage relationships for the remaining four ponds were used in the overall post development flow analysis with the detailed design of Phase 1. The overall hydrologic model for the drainage area will need to be updated as each phase and pond is developed through detail design to ensure pre-development peak flows in Brook Creek are met. The overall post-development drainage boundaries for the Parent Subdivision, including Phase 1, can be seen on Figure 3. The preliminary design of the remaining four ponds can be found in the Conceptual Servicing Report (March 2018).

The quantity control storage for Stormwater Management Pond D in Phase 1 is achieved through the excavation and berming of the facility, providing 300mm freeboard above the maximum 100year water surface elevation. The ROUTE RESERVOIR sub-routine was used to simulate the performance of the facility. A comparison of the post and routed post development peak flows is tabulated below in Table 4 for the 24-hour Chicago design storm. Standard values were used in the



RONDEAU (COBOURG) LTD.

POST–DEVELOPMENT DRAINAGE SCHEME

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST OSHAWA,ON L1H 1B6
PHONE (905)576-8500 FAX (905)576-9730
info@dgbiddle.com

SCALE	1:5000
DRAWN	D.D.M.
DESIGN	D.D.M.
CHECKED	M.B.C.
DATE	6/27/19

PROJECT 114057

DWG FIG 3

\\FSHR\STAFF\JOB FILES\114000\114057 RONDEAU COBOURG\114057 DRAWINGS CIVIL\114057 FIGURES\114057 – FIGURE 3 POST–DEVELOPMENT DRAINAGE SCHEME.DWG

model as outlined in the "Technical and Engineering Guidelines for Stormwater Management for Submissions" prepared by GRCA (December 2014). Appendix C of the Guideline is attached at the end of the report in Schedule 3. The Visual Otthymo output files are also attached in Schedule 3. Table 4 compares pre-development, post-development, and controlled flow releases for the 2 through 100 year storm return periods for the Brook Creek watershed.

TABLE 5 – Pre-development vs Post-development Peak Flows to Brook Creek

RETURN PERIOD years	PRE-DEVELOPMENT FLOW @ POINT A (m^3/s)	ROUTED POST-DEVELOPMENT FLOW @ POINT A (m^3/s)				PRE-DEVELOPMENT FLOW @ POINT B (m^3/s)	ROUTED POST-DEVELOPMENT FLOW @ POINT B (m^3/s)
		[1]UNCONTRO-LLED FLOW (m^3/s)	POND D DISCHARGE (m^3/s)	WSE (m)	[2]TOTAL (m^3/s)		
2	0.534	0.348	0.029	103.00	0.503	0.702	0.545
5	1.037	0.456	0.256	103.10	1.002	1.365	1.209
10	1.368	0.612	0.380	103.20	1.377	1.797	1.608
25	2.484	0.974	0.528	103.40	2.313	3.259	2.684
50	3.321	1.032	0.555	103.50	2.762	4.382	3.286
100	4.420	1.799	0.579	103.75	4.024	5.746	4.328

[1] Pertains only to uncontrolled flows from Phase 1 to Brook Creek - VH Nodes 26 + 74.
[2] Pertains to total flows from Parent Subdivision draining to Hydraulic Point A.

As reported above, all post development flows up to and including the 100-year return frequency, will be effectively be attenuated to the pre-development levels for the Brook Creek watershed. Therefore, no adverse impact to the downstream drainage system is anticipated.

6.4 Post Development Conditions to Midtown Creek (Phase 1)

We have reviewed the post-development drainage boundary flowing to Midtown Creek. The STANDHYD and NASHYD sub-routines of the computer modelling software Visual Otthymo 3.0 was used to determine the total peak flows. The post drainage area for the development has been modelled using a 24-hour Chicago distribution rainfall event for the 2, 5, 10, 25, 50 and 100 year events. This area will be pervious as it will mainly consist of the rear yards and half the roof drainage. Therefore, a total impervious ratio of 25% was used for the area that is being developed along with a total directly connected ratio of 25%. As with pre-development, the 24-hour Chicago storm generated the greatest post-development runoff peak flows and volumes.

TABLE 4 – Post-development Peak Flows - Midtown Creek

RETURN PERIOD years	PRE-DEVLOPMENT PEAK FLOW (m^3/s)	ROUTED POST-DEVELOPMENT FLOW @ POINT A (m^3/s)
2	124	122
5	233	175
10	309	215
25	552	353
50	688	436
100	1.068	720

As reported above, all post development flows up to and including the 100-year return frequency, will be attenuated to the pre-development levels for the Midtown Creek watershed. Therefore, no adverse impact to the downstream drainage system is anticipated.

6.5 Emergency Overflow

In the event the quantity control structures and orifice become blocked, a 14.0m wide emergency overflow weir has been proposed to convey flows up to the 100 year post-development storm event without overtopping the top of bank of the pond. The storage provided is the volume of water between the 100 year WSE and the top of bank (103.75m to 104.05m). The results from the 100 year event are tabulated below in Table 5. The Visual Otthymo Summary files and calculations for the emergency flow weir are attached in Schedule 3.

TABLE 5 – STORAGE VOLUMES

RETURN PERIOD years	INFLOW (m^3/s)	OUTFLOW (m^3/s)	STORAGE PROVIDED (m^3)	STORAGE USED (m^3)
100	5.021	3.957	1524	1506

As reported above, the top of bank should not be overtopped in the event the orifices become blocked.

7.0 TEMPORARY EROSION AND SEDIMENT CONTROLS

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

1. Perimeter Enviro Fence
2. Controlled Construction Vehicle Access Routes
3. Rip-Rap Check Dams
4. Temporary Sediment Traps
5. Sediment Control Pond
6. Good Housekeeping Practices

Details on the above measures are illustrated on the Erosion and Sediment Control Plan, drawings 114057 ES-1 of the engineering drawings.

8.0 CONCLUSION

The above Final Stormwater Drainage and Functional Servicing Report has been prepared in support of the Phase 1 development of the Villages of Central Park Subdivision to identify the servicing requirements to proceed. The following is a summary of the servicing investigation which has been prepared in the preceding text.

- This report is to be read in conjunction with the Conceptual Servicing Report for the parent Subdivision prepared by this office most recently revised March 2018.

- The existing 250mm sanitary sewer on Elgin Street will be extended easterly to the intersection of Street A to service Phase 1 of the development. This sewer will also be utilized to temporarily service Phases 2 and 3 until the 375mm trunk sewer is extended north on Brook Road.

- Watermain infrastructure will be provided with the extension of the existing 400mm watermain on Elgin Street to the intersection of Street A. A 300mm watermain network will tee into the 400mm watermain extension to service the development.

- On-site storm sewers have been sized to accommodate a 5-year return frequency post-development event as per Town of Cobourg and GRCA Design Criteria;

- The implementation of a Stormwater Management Facility (Pond D) will provide Level 1 Enhanced quality control for Brook Creek in addition to providing cooling of urban stormwater discharges;

- The detention of runoff from a 25mm storm event for 24 to 48 hours will minimize further erosion of the receiving watercourse;

- The Stormwater Management Pond allows for all storm events, up to and including the 100-year return frequency, to be attenuated to pre-development flows at the outfall to the existing tributary of Brook Creek;

- Temporary sediment controls during construction can be managed by the use of perimeter enviro fence, temporary sediment ponds/traps, construction vehicle access route, rip-rap check dams and good engineering practices.

SCHEDULE 1

- SANITARY SEWER DESIGN SHEET
INTERIM CONDITIONS – PHASE 1

- SANITARY SEWER DESIGN SHEET
FUTURE INTERIM CONDITIONS – PHASE 1, 2, 3

- SANITARY SEWER SCHEME D-3 (JUNE 1988)

- SANITARY SEWER SCHEME D-3 (SEPT 2002)

- UNDERGROUND SERVICES C-3 (MAY 1988)

- STORM SEWER DESIGN SHEET

SANITARY SEWER DESIGN SHEET

INTERIM CONDITIONS - PHASE 1

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY TOWN OF COBOURG
PROJECT RONDEAU (COBOURG) LTD.
PROJECT # 114057

DESIGN BY H.R.
CHK'D BY M.B.C.
DATE JUNE 2019

CRITERIA
n 0.013

SINGLE FAMILY 3.23 persons/unit
TOWNHOUSE 2.68 persons/unit

LOCATION			RESIDENTIAL						COMMERCIAL			INDUS TRIAL	INSTITUT'N	FLOW (l/s)						PIPE DATA			
STREET	FROM MH	TO MH	GROSS AREA (ha)	DEN-SITY	POPU-LATION	PFF	TOTAL POPU-LATION	TOTAL AREA (ha)	LOT AREA (ha)	FLOOR SPACE INDEX	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RES INFIL 0.26	SEWAGE 0.0042	COMM 2.08	INDUS 1.04	INST 1.30	TOTAL FLOW l/s	SIZE mm	GRADE %	CAPACITY l/s	VELOCITY m/s
				3.23						0.50													
DENTON DRIVE	SA-1	SA-2	0.80		42	3.80	42	0.80						0.21	0.67	0.00	0.00	0.00	0.88	200	1.00	34.21	1.06
	SA-2	SA-3	0.65		39	3.80	81	1.45						0.38	1.29	0.00	0.00	0.00	1.67	200	0.80	30.60	0.94
	SA-3	SA-4	0.26		10	3.80	91	1.71						0.44	1.45	0.00	0.00	0.00	1.90	200	1.50	41.90	1.29
STREET E	SA-27	SA-26	0.41		23	3.80	23	0.41						0.11	0.37	0.00	0.00	0.00	0.47	200	1.00	34.21	1.06
	SA-26	SA-4	0.13		3	3.80	26	0.54						0.14	0.41	0.00	0.00	0.00	0.56	200	1.00	34.21	1.06
DENTON DRIVE	SA-4	SA-5	0.58		32	3.80	149	2.83						0.74	2.38	0.00	0.00	0.00	3.11	200	1.00	34.21	1.06
	SA-5	SA-6	0.46		26	3.80	175	3.29						0.86	2.79	0.00	0.00	0.00	3.65	200	0.50	24.19	0.75
STREET E	SA-27	SA-28	0.23		7	3.80	7	0.23						0.06	0.11	0.00	0.00	0.00	0.17	200	1.00	34.21	1.06
	SA-28	SA-28A	0.86		50	3.80	57	1.09						0.28	0.91	0.00	0.00	0.00	1.19	200	0.50	24.19	0.75
	SA-28A	SA-29	0.17		10	3.80	67	1.26						0.33	1.07	0.00	0.00	0.00	1.40	200	1.00	34.21	1.06
	SA-29	SA-6	0.56		33	3.80	100	1.82						0.47	1.60	0.00	0.00	0.00	2.07	200	2.20	50.75	1.56
DENTON DRIVE	SA-6	SA-7	0.10		3	3.80	278	5.21						1.35	4.44	0.00	0.00	0.00	5.79	200	1.30	39.01	1.20
	SA-7	SA-8				3.80	278	5.21						1.35	4.44	0.00	0.00	0.00	5.79	200	2.40	53.00	1.63
	*STUB	SA-8				3.80	0	0.00						0.00	0.00	0.00	0.00	0.00	0.00	375	0.50	129.33	1.13
STREET A	SA-8	SA-9	0.13		3	3.80	281	5.34						1.39	4.48	0.00	0.00	0.00	5.87	375	0.80	163.59	1.43
	SA-9	SA-10	0.30		10	3.80	291	5.64						1.47	4.64	0.00	0.00	0.00	6.11	375	0.90	173.52	1.52
	SA-10	SA-11	0.31		10	3.80	301	5.95						1.55	4.80	0.00	0.00	0.00	6.35	375	0.90	173.52	1.52
	SA-11	SA-12	0.33		13	3.80	314	6.28					2.63	1.63	5.01	0.00	0.00	3.42	10.06	375	0.50	129.33	1.13

* Sanitary flows from future phases

SANITARY SEWER DESIGN SHEET

INTERIM CONDITIONS - PHASE 1

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DESIGN BY H.R.
CHK'D BY M.B.C.
DATE JUNE 2019

CRITERIA
n 0.013

SINGLE FAMILY 3.23 persons/unit
TOWNHOUSE 2.68 persons/unit

LOCATION			RESIDENTIAL						COMMERCIAL			INDUS TRIAL	INSTITUT'N	FLOW (l/s)						PIPE DATA			
STREET	FROM MH	TO MH	GROSS AREA (ha)	DEN-SITY	POPU-LATION	PFF	TOTAL POPU-LATION	TOTAL AREA (ha)	LOT AREA (ha)	FLOOR SPACE INDEX	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RES INFIL 0.26	SEWAGE 0.0042	COMM 2.08	INDUS 1.04	INST 1.30	TOTAL FLOW l/s	SIZE mm	GRADE %	CAPACITY l/s	VELOCITY m/s
				3.23						0.50													
STREET B	SA-12	SA-21	0.68		39	3.80	353	6.96					2.63	1.81	5.63	0.00	0.00	3.42	10.86	375	1.00	182.90	1.60
	SA-21	SA-22	0.62		32	3.80	385	7.58					2.63	1.97	6.14	0.00	0.00	3.42	11.53	250	1.00	62.04	1.22
STREET C	SA-25	SA-22	0.65		32	3.80	32	0.65						0.17	0.51	0.00	0.00	0.00	0.68	200	1.00	34.21	1.06
STREET B	SA-22	SA-23	0.55		26	3.80	443	8.78					2.63	2.28	7.07	0.00	0.00	3.42	12.77	250	0.80	55.49	1.09
	SA-23	SA-24				3.80	443	8.78					2.63	2.28	7.07	0.00	0.00	3.42	12.77	250	0.50	43.87	0.87
	SA-24	SA-14	0.39		16	3.80	459	9.17					2.63	2.38	7.33	0.00	0.00	3.42	13.13	250	1.00	62.04	1.22
STREET A	SA-12	SA-13	0.49		16	3.80	16	0.49						0.13	0.26	0.00	0.00	0.00	0.38	200	2.00	48.39	1.49
	SA-13	SA-14	0.57		19	3.80	35	1.06						0.28	0.56	0.00	0.00	0.00	0.83	200	2.70	56.22	1.73
	SA-14	SA-15	0.40		16	3.80	510	10.63					2.63	2.76	8.14	0.00	0.00	3.42	14.32	250	2.50	98.09	1.94
	SA-15	SA-16	0.81		29	3.80	539	11.44					2.63	2.97	8.60	0.00	0.00	3.42	15.00	250	2.00	87.73	1.73
	SA-16	SA-17	0.28		10	3.80	549	11.72					2.63	3.05	8.76	0.00	0.00	3.42	15.23	250	3.00	107.45	2.12
	SA-17	SA-18	0.26		10	3.80	559	11.98					2.63	3.11	8.92	0.00	0.00	3.42	15.46	250	1.60	78.47	1.55
	SA-18	SA-19	0.32		10	3.80	569	12.30					2.63	3.20	9.08	0.00	0.00	3.42	15.70	250	0.50	43.87	0.87
ELGIN STREET EAST	SA-19	SA-20	0.30		0	3.80	569	12.60					2.63	3.28	9.08	0.00	0.00	3.42	15.78	250	0.50	43.87	0.87
	SA-20	EX MH (*MH 5*)	0.29		0	3.80	569	12.89					2.63	3.35	9.08	0.00	0.00	3.42	15.85	250	0.50	43.87	0.87

SANITARY SEWER DESIGN SHEET

INTERIM CONDITIONS - PHASE 1

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										0.50													
EXISTING INFRASTRUCTURE																							
DENTON DRIVE	*MH C*	*MH 1*	*1.31*		*62*	*3.80*	*62*	*1.31*						*0.34*	*0.99*	*0.00*	*0.00*	*0.00*	*1.33*	*200*	*2.80*	*57.25*	*1.77*
DENTON DRIVE / CONGER AVENUE	*MH 1*	*MH 5*	*2.48*		*95*	*3.80*	*157*	*3.79*						*0.99*	*2.51*	*0.00*	*0.00*	*0.00*	*3.49*	*200*	*0.75*	*29.63*	*0.91*
ELGIN STREET EAST / D'ARCY STREET	*TOWNHOUSES*		*0.44*	*2.68*	*43*	*3.80*	*43*	*0.44*															
	MH 5	*EX MH*	*2.16*	*3.80*	*80*	*3.80*	*849*	*19.28*	*0.14*		*0.07*		*2.63*	*5.01*	*13.55*	*0.15*	*0.00*	*3.42*	*22.13*	*250*	*0.36*	*37.22*	*0.73*

SANITARY SEWER DESIGN SHEET

FUTURE INTERIM CONDITIONS - PHASE 1, 2, 3

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				3.23						0.50													
DENTON DRIVE	SA-1	SA-2	0.80		42	3.80	42	0.80						0.21	0.67	0.00	0.00	0.00	0.88	200	1.00	34.21	1.06
	SA-2	SA-3	0.65		39	3.80	81	1.45						0.38	1.29	0.00	0.00	0.00	1.67	200	0.80	30.60	0.94
	SA-3	SA-4	0.26		10	3.80	91	1.71						0.44	1.45	0.00	0.00	0.00	1.90	200	1.50	41.90	1.29
STREET E	SA-27	SA-26	0.41		23	3.80	23	0.41						0.11	0.37	0.00	0.00	0.00	0.47	200	1.00	34.21	1.06
	SA-26	SA-4	0.13		3	3.80	26	0.54						0.14	0.41	0.00	0.00	0.00	0.56	200	1.00	34.21	1.06
DENTON DRIVE	SA-4	SA-5	0.58		32	3.80	149	2.83						0.74	2.38	0.00	0.00	0.00	3.11	200	1.00	34.21	1.06
	SA-5	SA-6	0.46		26	3.80	175	3.29						0.86	2.79	0.00	0.00	0.00	3.65	200	0.50	24.19	0.75
STREET E	SA-27	SA-28	0.23		7	3.80	7	0.23						0.06	0.11	0.00	0.00	0.00	0.17	200	1.00	34.21	1.06
	SA-28	SA-28A	0.86		50	3.80	57	1.09						0.28	0.91	0.00	0.00	0.00	1.19	200	0.50	24.19	0.75
	SA-28A	SA-29	0.17		10	3.80	67	1.26						0.33	1.07	0.00	0.00	0.00	1.40	200	1.00	34.21	1.06
	SA-29	SA-6	0.56		33	3.80	100	1.82						0.47	1.60	0.00	0.00	0.00	2.07	200	2.20	50.75	1.56
DENTON DRIVE	SA-6	SA-7	0.10		3	3.80	278	5.21						1.35	4.44	0.00	0.00	0.00	5.79	200	1.30	39.01	1.20
	SA-7	SA-8				3.80	278	5.21						1.35	4.44	0.00	0.00	0.00	5.79	200	2.40	53.00	1.63
	STUB	SA-8	21.27		1130	3.77	1130	21.27						5.53	17.87	0.00	0.00	0.00	23.40	375	0.50	129.33	1.13
STREET A	SA-8	SA-9	0.13		3	3.70	1411	26.61						6.92	21.92	0.00	0.00	0.00	28.84	375	0.80	163.59	1.43
	SA-9	SA-10	0.30		10	3.70	1421	26.91						7.00	22.06	0.00	0.00	0.00	29.06	375	0.90	173.52	1.52
	SA-10	SA-11	0.31		10	3.69	1431	27.22						7.08	22.20	0.00	0.00	0.00	29.28	375	0.90	173.52	1.52
	SA-11	SA-12	0.33		13	3.69	1444	27.55					2.63	7.16	22.39	0.00	0.00	3.42	32.97	375	0.50	129.33	1.13

SANITARY SEWER DESIGN SHEET

FUTURE INTERIM CONDITIONS - PHASE 1, 2, 3

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY	TOWN OF COBOURG	**DESIGN BY**	H.R.	**CRITERIA**	
PROJECT	RONDEAU (COBOURG) LTD.	**CHK'D BY**	M.B.C.	n 0.013	SINGLE FAMILY 3.23 persons/unit
PROJECT #	114057	**DATE**	JUNE 2019		TOWNHOUSE 2.68 persons/unit

LOCATION			RESIDENTIAL						COMMERCIAL			INDUS TRIAL	INSTITUT'N	FLOW (l/s)						PIPE DATA			
STREET	FROM MH	TO MH	GROSS AREA (ha)	DEN-SITY	POPU-LATION	PFF	TOTAL POPU-LATION	TOTAL AREA (ha)	LOT AREA (ha)	FLOOR SPACE INDEX	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RES INFIL 0.26	SEWAGE 0.0042	COMM 2.08	INDUS 1.04	INST 1.30	TOTAL FLOW l/s	SIZE mm	GRADE %	CAPACITY l/s	VELOCITY m/s
				3.23						0.50													
STREET B	SA-12	SA-21	0.68		39	3.68	1483	28.23					2.63	7.34	22.94	0.00	0.00	3.42	33.70	375	1.00	182.90	1.60
	SA-21	SA-22	0.62		32	3.68	1515	28.85					2.63	7.50	23.39	0.00	0.00	3.42	34.31	250	1.00	62.04	1.22
STREET C	SA-25	SA-22	0.65		32	3.80	32	0.65						0.17	0.51	0.00	0.00	0.00	0.68	200	1.00	34.21	1.06
STREET B	SA-22	SA-23	0.55		26	3.66	1573	30.05					2.63	7.81	24.21	0.00	0.00	3.42	35.44	250	0.50	43.87	0.87
	SA-23	SA-24				3.66	1573	30.05					2.63	7.81	24.21	0.00	0.00	3.42	35.44	250	0.50	43.87	0.87
	SA-24	SA-14	0.39		16	3.66	1589	30.44					2.63	7.91	24.43	0.00	0.00	3.42	35.77	250	0.80	55.49	1.09
STREET A	SA-12	SA-13	0.49		16	3.80	16	0.49						0.13	0.26	0.00	0.00	0.00	0.38	200	2.00	48.39	1.49
	SA-13	SA-14	0.57		19	3.80	35	1.06						0.28	0.56	0.00	0.00	0.00	0.83	200	2.25	51.32	1.58
	SA-14	SA-15	0.40		16	3.65	1640	31.90					2.63	8.29	25.15	0.00	0.00	3.42	36.86	250	1.00	62.04	1.22
	SA-15	SA-16	0.81		29	3.65	1669	32.71					2.63	8.50	25.55	0.00	0.00	3.42	37.48	250	0.50	43.87	0.87
	SA-16	SA-17	0.28		10	3.64	1679	32.99					2.63	8.58	25.69	0.00	0.00	3.42	37.69	250	0.50	43.87	0.87
	SA-17	SA-18	0.26		10	3.64	1689	33.25					2.63	8.65	25.83	0.00	0.00	3.42	37.90	250	1.00	62.04	1.22
	SA-18	SA-19	0.32		10	3.64	1699	33.57					2.63	8.73	25.97	0.00	0.00	3.42	38.12	250	0.50	43.87	0.87
ELGIN STREET EAST	SA-19	SA-20	0.30		0	3.64	1699	33.87					2.63	8.81	25.97	0.00	0.00	3.42	38.20	250	0.50	43.87	0.87
	SA-20	EX MH (*MH 5*)	0.29		0	3.64	1699	34.16					2.63	8.88	25.97	0.00	0.00	3.42	38.27	250	0.50	43.87	0.87

SANITARY SEWER DESIGN SHEET

FUTURE INTERIM CONDITIONS - PHASE 1, 2, 3

D.G.BIDDLE & ASSOCIATES LTD.

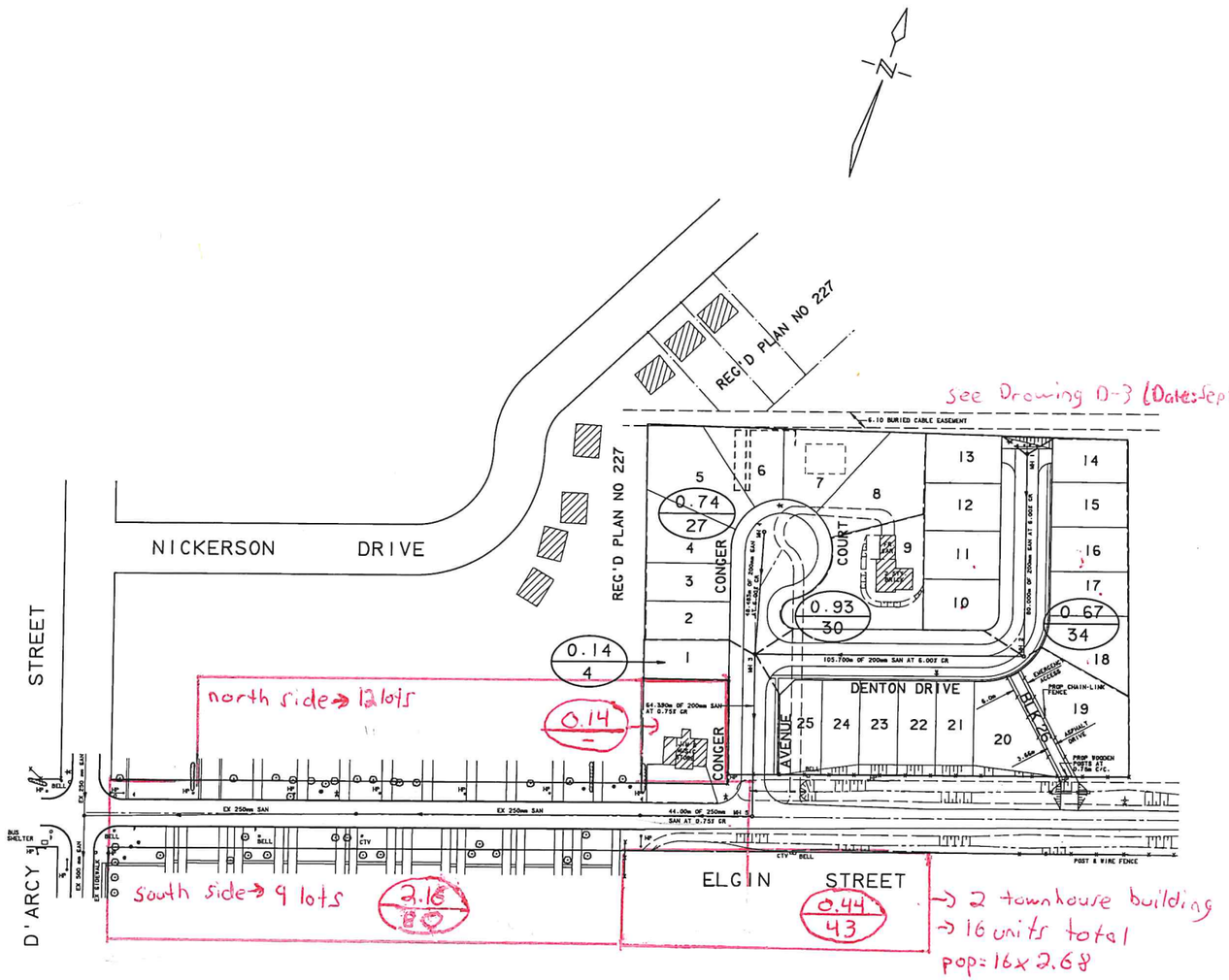
consulting engineers

MUNICPALITY TOWN OF COBOURG
PROJECT RONDEAU (COBOURG) LTD.
PROJECT # 114057

DESIGN BY H.R.
CHK'D BY M.B.C.
DATE JUNE 2019

CRITERIA
n 0.013
SINGLE FAMILY 3.23 persons/unit
TOWNHOUSE 2.68 persons/unit

LOCATION			RESIDENTIAL						COMMERCIAL			INDUS TRIAL	INSTITUT'N	FLOW (l/s)						PIPE DATA			
STREET	FROM MH	TO MH	GROSS AREA (ha)	DEN-SITY	POPU-LATION	PFF	TOTAL POPU-LATION	TOTAL AREA (ha)	LOT AREA (ha)	FLOOR SPACE INDEX	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RES INFIL 0.26	SEWAGE 0.0042	COMM 2.08	INDUS 1.04	INST 1.30	TOTAL FLOW l/s	SIZE mm	GRADE %	CAPACITY l/s	VELOCITY m/s
										0.50													
EXISTING INFRASTRUCTURE																							
DENTON DRIVE	*MH C*	*MH 1*	*1.31*		*62*	*3.80*	*62*	*1.31*						*0.34*	*0.99*	*0.00*	*0.00*	*0.00*	*1.33*	*200*	*2.80*	*57.25*	*1.77*
DENTON DRIVE / CONGER AVENUE	*MH 1*	*MH 5*	*2.48*		*95*	*3.80*	*157*	*3.79*						*0.99*	*2.51*	*0.00*	*0.00*	*0.00*	*3.49*	*200*	*0.75*	*29.63*	*0.91*
ELGIN STREET EAST / D'ARCY STREET	*TOWNHOUSES*		*0.44*	*2.68*	*43*	*3.80*	*43*	*0.44*															
	MH 5	*EX MH*	*2.16*	*3.80*	*80*	*3.59*	*1979*	*40.55*	*0.14*		*0.07*		*2.63*	*10.54*	*29.83*	*0.15*	*0.00*	*3.42*	*43.94*	*250*	*0.36*	*37.22*	*0.73*



NOTE:
THIS PLAN IS FOR SANITARY DRAINAGE AREAS ONLY

0.67 / 34 — AREA IN HECTARES / POPULATION AT 3.8 PEOPLE PER UNIT

Nº	Revision	Date	By	Approved

REVISIONS

APPROVED	APPROVED
DIRECTOR, PUBLIC WORKS DEPARTMENT TOWN OF COBOURG Date:	Works Department Region of Durham Date:

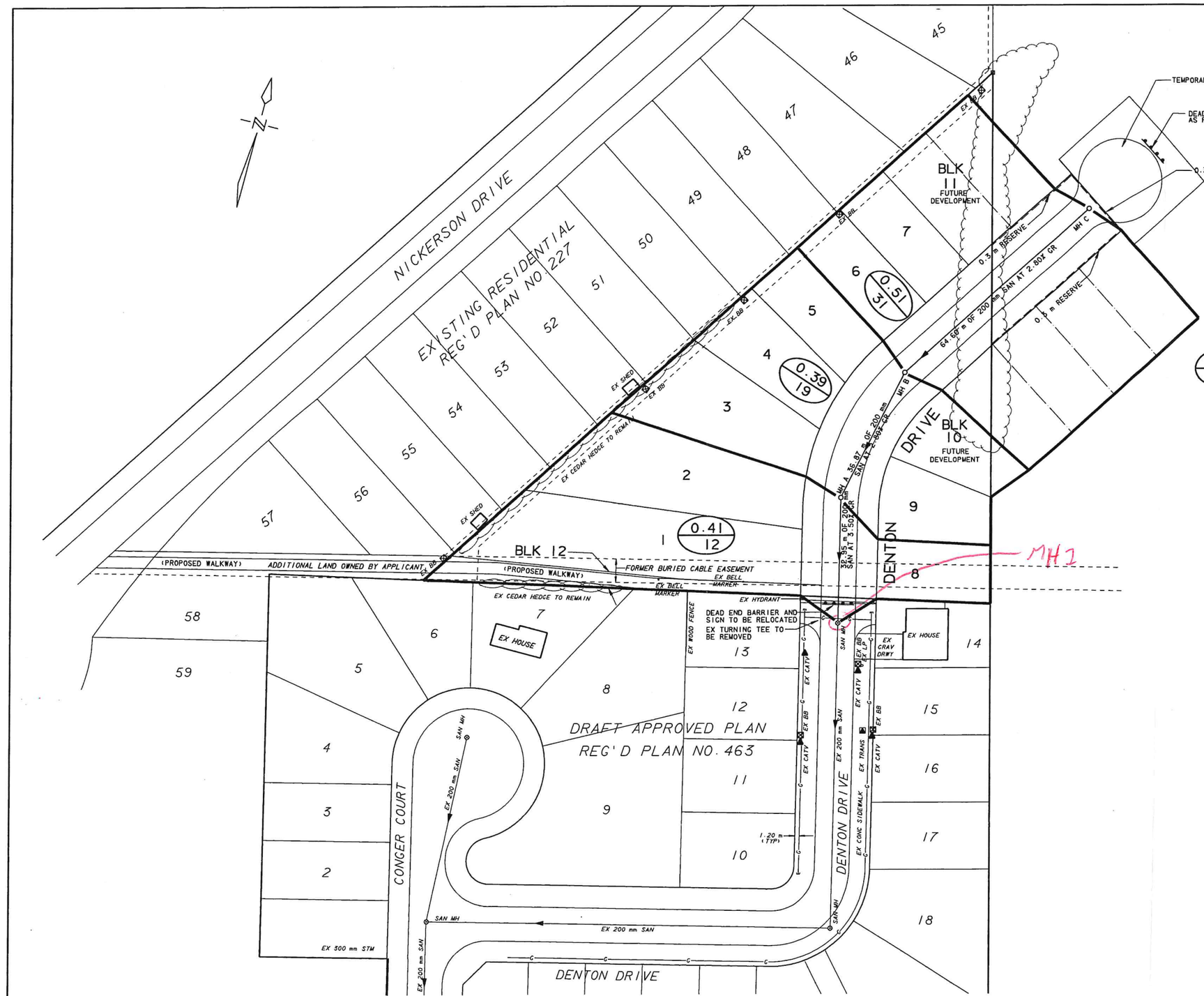
CORPORATION OF THE TOWN OF COBOURG
DEPARTMENT OF PUBLIC WORKS

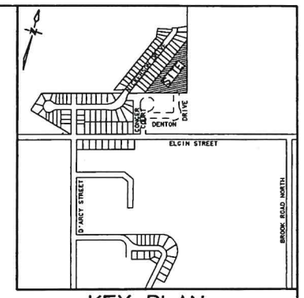
SANITARY SEWER SCHEME

D.G. Biddle & Associates Ltd.
consulting engineers & architect
oshawa (416) 576-8500
cobourg

REGISTERED PROFESSIONAL ENGINEER D. G. BIDDLE PROVINCE OF ONTARIO

Scale:	HORZ 1:1000	Project Nº	86270
Drawn By:	R.C.B.	Drawing Nº	D-3
Design By:	D.C.C.		
Checked By:	D.G.B.		
Date:	JUNE 1988		





KEY PLAN
1:10 000

0.16 / 8 AREA IN HECTARES
POPULATION AT 3.8 PEOPLE/UNIT

NOTE: THIS PLAN IS FOR SANITARY SEWER DRAINAGE AREAS ONLY

BENCH MARK
TOWN OF COBOURG BENCH MARK NO.234
NAIL AND WASHER IN EAST FACE OF HYDRO POLE
N/W CORNER OF ELGIN AND DARCY ST.
ELEVATION: 100.197m

NOTES
1) ALL DISTURBED AREAS WITHIN DENTON DRIVE RIGHT OF WAY TO BE RESTORED IN KIND TO THE SATISFACTION OF THE DIRECTOR OF PUBLIC WORKS.

—c— EXISTING GAS MAIN

NO.	REVISION	DATE	BY	APPROVED
4	AS PER LAKEFRONT UTILITY SERVICES	OCT/02	MBC	
3	AS PER MUNICIPAL COMMENTS	SEP/02	DAG	
2	EXTENDED DENTON DRIVE EASTERLY	APR/02	BB	
1	REVISED LOT STRUCTURE	DEC/97	RML	

REVISIONS

APPROVED
DIRECTOR PUBLIC WORKS DEPARTMENT
TOWN OF COBOURG
DATE: Nov 27/02

APPROVED
LAKEFRONT UTILITIES INC.
DATE: Dec 16/02

CORPORATION OF THE TOWN OF COBOURG
DEPARTMENT OF PUBLIC WORKS

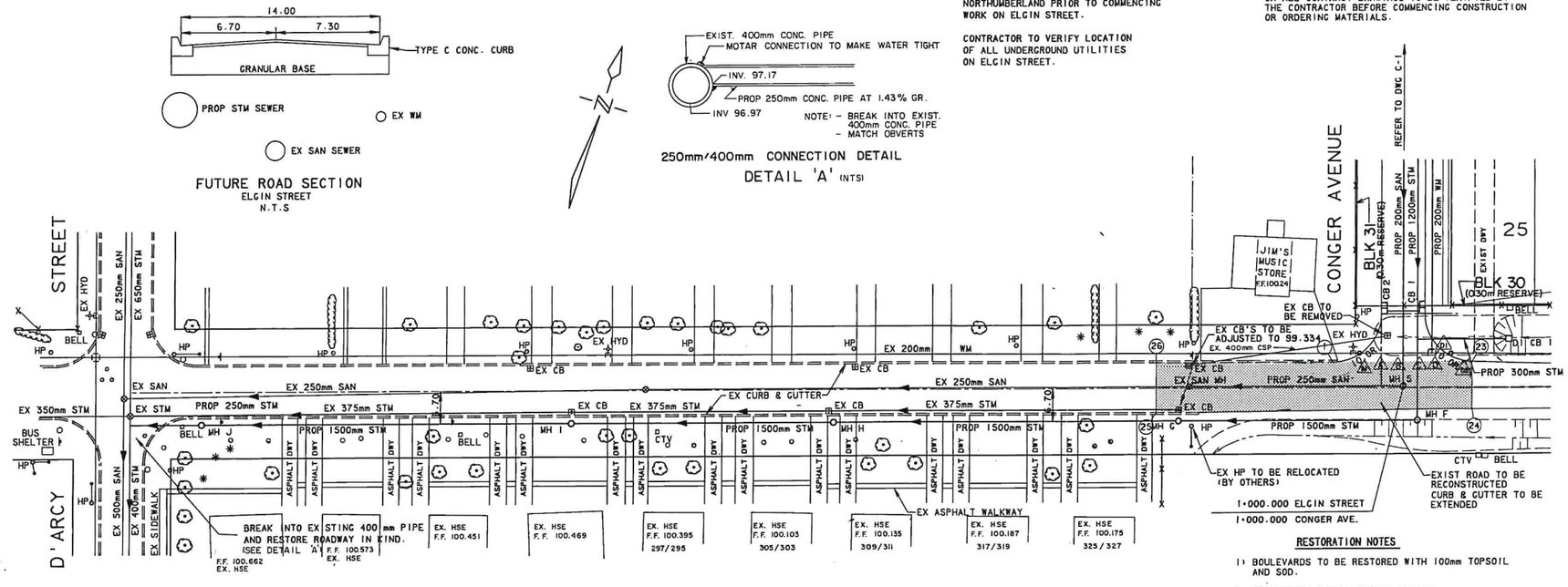
DENTON DRIVE EXTENSION 14T-89020

SANITARY SEWER DRAINAGE SCHEME

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST · OSHAWA, ON L1H 1B6
PHONE (905)576-8500 · FAX (905)576-9730
dgbiddle@idirect.com

LICENSED PROFESSIONAL ENGINEER R.M.P. LAROCQUE PROVINCE OF ONTARIO

SCALE:	HORZ 1:500	PROJECT NO.	88104
DRAWN BY:	B.B.	DRAWING NO.	D-3
DESIGN BY:	F.H.V.	CAD FILE: 88104D1	
CHECKED BY:	R.M.L.	PLOT DATE: NOV 11/02	
DATE:	SEP. 2002	SUBMISSION: FINAL	



RESTORATION NOTES

1) BOULEVARDS TO BE RESTORED WITH 100mm TOPSOIL AND SOD.

2) DRIVEWAYS TO BE RESTORED IN KIND.
- 200 mm OF 19 mm CRUSHED LIMESTONE
- 50 mm OF HL3 ASPHALT

CATCH BASIN DATA					CONNECTION DATA		
NO.	CHAINAGE	RIM ELEVATIONS FINAL	RIM ELEVATIONS PROP.	INV.EL. PROP	LEN. (m)	DIA. (mm)	GRADE %

GUTTER DATA					
NO.	DESC.	CHAINAGE	ELEV.	LENGTH	GR.%
26	W/LIMIT	1+051.000	99.321		
1	PC	1+014.550	99.417		
23	E/LIMIT	0+985.450	99.611		
24	E/LIMIT	0+985.450	99.611		
25	W/LIMIT	1+051.000	99.321		

D2	97.71	200mm GATE VALVE	0+990.000
D1	97.66	200x200x200 TEE	0+994.000
D	97.66	45°VERTICAL BEND	0+994.500
C	96.56	45°VERTICAL BEND	0+995.600
B	96.56	45°VERTICAL BEND	1+001.100
A	97.75	CUT EXISTING 200 mm WM 45°VERTICAL BEND 200mm GATE VALVE	1+003.300
A1	97.74		1+010.000
△ MARK	ELEVATION	DESCRIPTION	CHAINAGE

WATERMAIN DATA

NOTE: ROAD RECONSTRUCTION TO CONSIST OF THE FOLLOWING
300mm GRAN 'B'
150mm GRAN 'A'
40mm HLBBINDER ASPHALT
40mm HL3SURFACE ASPHALT

No.	Revision	Date	By	Approved
3	AS CONSTRUCTED	DEC/89	FMW	
2	ADDED DETAIL A	DEC/89	KNW	
1	REVISION TO ELGIN ROAD GRADE	OCT/89	FMW	

REVISIONS

APPROVED
DIRECTOR, PUBLIC WORKS DEPARTMENT TOWN OF COBOURG
Date:

APPROVED
Works Department Region of Durham
Date:

CORPORATION OF THE TOWN OF COBOURG
DEPARTMENT OF PUBLIC WORKS

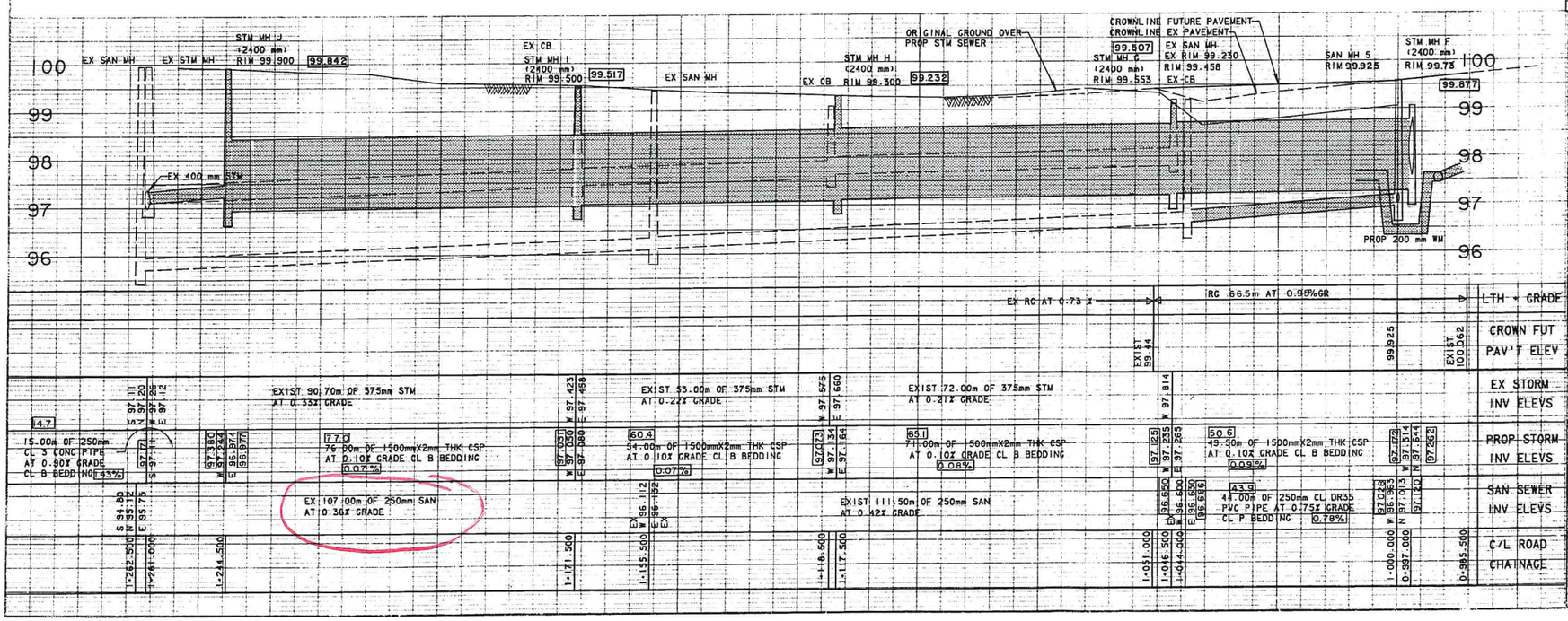
UNDERGROUND SERVICES & ROADWORK
ELGIN STREET
FROM: CONGER AVENUE TO: DARCY STREET

D.G. Biddle & Associates Ltd.
consulting engineers & architect
oshawa (416) 571-8500
cobourg (416) 372-4886

REGISTERED PROFESSIONAL ENGINEER D. G. BIDDLE PROVINCE OF ONTARIO

Scale:	HORZ 1:500 VERT 1:50
Drawn By:	R.C.B.
Design By:	R.C.A.
Checked By	D.C.C.
Date:	MAY 1988

Project No. 86270
Drawing No. C-3



STORM SEWER DESIGN SHEET

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

CRITERIA

n 0.013

STORM 5 YEAR

RUN OFF CO-EFFICIENTS

PARK	I=0.25
SINGLE,SEMI	I=0.45
TOWNHOUSES,SCHOOL	I=0.75
APARTMENTS	I=0.75
COMMERCIAL	I=0.90

MUNICPALITY TOWN OF COBOURG
PROJECT RONDEAU DEVELOPMENTS
PROJECT # 114057

DESIGN BY H.R.
CHK'D BY M.B.C.
DATE 17-May-19

LOCATION			DRAINAGE DATA				RATIONAL DESIGN			PIPE DATA							
STREET	FROM MH	TO MH	AREA (ha)	I	AxI	ACCUM AxI	T.C min	R mm/hr	FLOW L/sec	SIZE mm	GRADE %	CAPACITY L/sec	VELOCITY m/s	LENGTH m	TIME min	TOTAL TIME	% LOAD
																15.00	
DENTON DRIVE	ST-1	ST-2			0.00	0.00	15.00	79.48	0.00	300	1.00	100.87	1.38	59.40	0.72	15.72	0.00
	ST-2	CBMH 3			0.00	0.00	15.72	77.69	0.00	300	2.00	142.66	1.96	66.50	0.57	16.28	0.00
	CBMH 3	ST-4	0.40	0.60	0.24	0.24	16.28	76.33	50.92	300	3.00	174.72	2.39	54.99	0.38	16.67	29.15
E	ST-41	ST-40			0.00	0.00	15.00	79.48	0.00	300	1.00	100.87	1.38	51.11	0.62	15.62	0.00
	ST-40	CBMH 39			0.00	0.00	15.62	77.93	0.00	300	1.00	100.87	1.38	27.31	0.33	15.95	0.00
	CBMH 39	ST-6	0.33	0.60	0.20	0.20	15.95	77.13	42.89	300	1.00	100.87	1.38	10.19	0.12	16.07	42.51
DENTON DRIVE	ST-6	CBMH 5			0.00	0.20	16.07	76.84	42.72	300	1.20	110.50	1.51	17.06	0.19	16.26	38.66
	CBMH 5	ST-4	0.39	0.60	0.23	0.43	16.26	76.39	91.32	375	1.30	208.53	1.83	41.96	0.38	16.64	43.79
BLK 148	ST-4	ST-46			0.00	0.67	16.67	75.43	140.50	375	2.20	271.28	2.38	87.07	0.61	17.28	51.79
	RLCB 1	CBMH 46	0.22	0.50	0.11	0.11	15.00	79.48	24.31	300	6.00	247.09	3.39	42.43	0.21	15.21	9.84
	CBMH 46	ST-46	0.15	0.25	0.04	0.15	15.21	78.95	32.92	300	4.10	204.25	2.80	23.27	0.14	15.35	16.12
	CB 21	ST-46	0.35	0.25	0.09	0.09	15.00	79.48	19.89	300	2.20	149.62	2.05	28.75	0.23	15.23	13.29
	ST-46	ST-20			0.00	0.91	17.28	74.05	187.33	375	2.70	300.53	2.64	23.84	0.15	17.43	62.33
E	ST-41	ST-42			0.00	0.00	15.00	79.48	0.00	300	1.00	100.87	1.38	10.29	0.12	15.12	0.00
	ST-42	CBMH 43			0.00	0.00	15.12	79.17	0.00	300	0.50	71.33	0.98	55.94	0.95	16.08	0.00
	CBMH 43	ST-43A	0.39	0.75	0.29	0.29	16.08	76.81	61.93	375	0.50	129.33	1.13	33.47	0.49	16.57	47.88
	ST-43A	ST-44			0.00	0.29	16.57	75.65	60.99	375	0.50	129.33	1.13	10.14	0.15	16.72	47.16
	ST-44	CBMH 45			0.00	0.29	16.72	75.31	60.71	375	0.50	129.33	1.13	44.21	0.65	17.37	46.95
	CBMH 45	ST-9	0.75	0.75	0.56	0.85	17.37	73.84	174.49	525	0.50	317.23	1.42	9.09	0.11	17.47	55.00
DENTON DRIVE	ST-6	CBMH 7			0.00	0.00	15.00	79.48	0.00	300	1.00	100.87	1.38	57.59	0.69	15.69	0.00
	CBMH 7	ST-8	0.36	0.50	0.18	0.18	15.69	77.74	38.90	300	0.50	71.33	0.98	38.36	0.65	16.35	54.54

STORM SEWER DESIGN SHEET

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY TOWN OF COBOURG
PROJECT RONDEAU DEVELOPMENTS
PROJECT # 114057

DESIGN BY H.R.
CHK'D BY M.B.C.
DATE 17-May-19

CRITERIA
n 0.013
STORM 5 YEAR

RUN OFF CO-EFFICIENTS

PARK	I=0.25
SINGLE,SEMI	I=0.45
TOWNHOUSES,SCHOOL	I=0.75
APARTMENTS	I=0.75
COMMERCIAL	I=0.90

LOCATION			DRAINAGE DATA				RATIONAL DESIGN			PIPE DATA							
STREET	FROM MH	TO MH	AREA (ha)	I	AxI	ACCUM AxI	T.C min	R mm/hr	FLOW L/sec	SIZE mm	GRADE %	CAPACITY L/sec	VELOCITY m/s	LENGTH m	TIME min	TOTAL TIME	% LOAD
DENTON DRIVE	RLCB 3	ST-8	0.10	0.60	0.06	0.06	15.00	79.48	13.26	300	1.50	123.54	1.69	51.21	0.50	15.50	10.73
	ST-8	ST-9			0.00	0.24	16.35	76.17	50.82	375	0.50	129.33	1.13	31.62	0.46	16.81	39.30
	ST-9	ST-10	0.13	0.50	0.07	1.16	17.47	73.61	237.37	525	0.70	375.35	1.68	33.83	0.34	17.81	63.24
	ST-10	CBMH 11			0.00	1.16	17.81	72.88	235.01	525	0.70	375.35	1.68	36.73	0.36	18.17	62.61
	CBMH 11	ST-12	0.30	0.60	0.18	1.34	18.17	72.10	268.59	525	0.80	401.26	1.80	21.30	0.20	18.37	66.93
	DICB 1	ST-12	0.39	0.75	0.29	0.29	15.00	79.48	64.08	300	1.00	100.87	1.38	11.19	0.13	15.13	63.53
	ST-12	ST-13			0.00	1.63	18.37	71.68	324.83	600	0.80	572.90	1.96	30.04	0.26	18.63	56.70
	ST-13	CBMH 14	0.20	0.50	0.10	1.73	18.63	71.16	342.22	600	0.90	607.65	2.08	59.18	0.47	19.10	56.32
	CBMH 14	ST-15	0.12	0.75	0.09	1.82	19.10	70.20	355.17	600	0.90	607.65	2.08	56.10	0.45	19.55	58.45
	BLK 145	ST-15	0.97	0.75	0.73	0.73	15.00	79.48	161.30	525	0.50	317.23	1.42	8.69	0.10	15.10	50.85
	ST-15	CBMH 16	0.29	0.50	0.15	2.70	19.55	69.31	520.24	675	0.70	733.65	1.99	44.72	0.38	19.93	70.91
	CBMH 16	ST-17	0.18	0.75	0.14	2.84	19.93	68.59	541.50	675	1.20	960.58	2.60	27.89	0.18	20.10	56.37
A	RLCB 2	CBMH 18	0.32	0.50	0.16	0.16	15.00	79.48	35.35	300	3.00	174.72	2.39	48.40	0.34	15.34	20.24
	CBMH 18	ST-17	0.33	0.50	0.17	0.33	15.34	78.63	72.13	300	3.30	183.25	2.51	11.23	0.07	15.41	39.37
	ST-17	CBMH 19			0.00	3.17	20.10	68.25	601.43	675	1.70	1143.32	3.10	74.71	0.40	20.51	52.60
	CBMH 19	ST-20	0.19	0.60	0.11	3.28	20.51	67.49	615.44	675	2.40	1358.46	3.68	17.75	0.08	20.59	45.30
	ST-20	CBMH 21	0.50	0.50	0.25	4.44	20.59	67.35	831.26	675	1.70	1143.32	3.10	11.95	0.06	20.65	72.71
	CBMH 21	ST-22	0.59	0.50	0.30	4.74	20.65	67.23	885.87	750	1.10	1218.03	2.67	90.20	0.56	21.21	72.73

STORM SEWER DESIGN SHEET

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY TOWN OF COBOURG
PROJECT RONDEAU DEVELOPMENTS
PROJECT # 114057

DESIGN BY H.R.
CHK'D BY M.B.C.
DATE 17-May-19

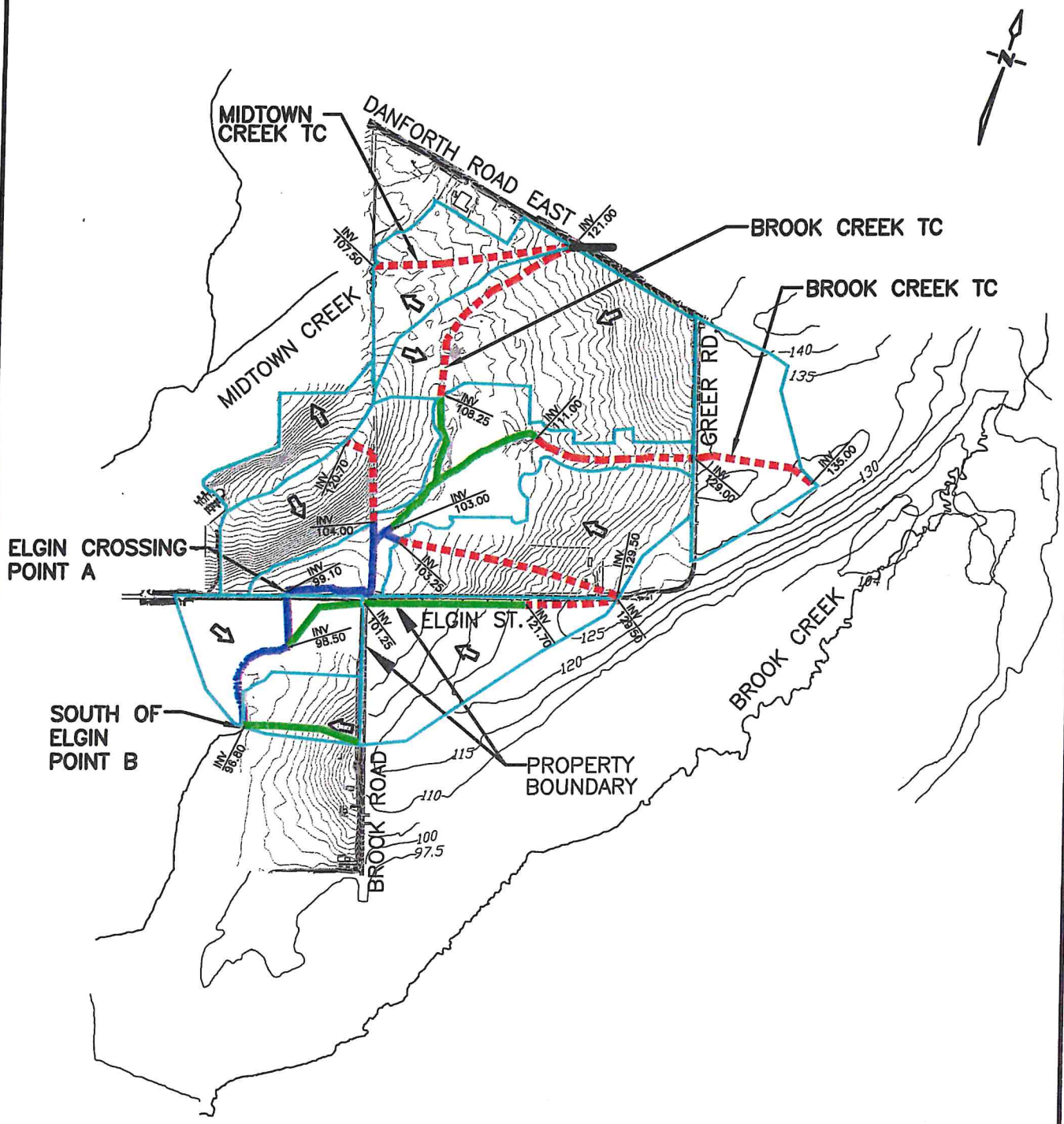
CRITERIA
n 0.013
STORM 5 YEAR

RUN OFF CO-EFFICIENTS
PARK I=0.25
SINGLE,SEMI I=0.45
TOWNHOUSES,SCHOOL I=0.75
APARTMENTS I=0.75
COMMERCIAL I=0.90

LOCATION			DRAINAGE DATA				RATIONAL DESIGN			PIPE DATA							
STREET	FROM MH	TO MH	AREA (ha)	I	AxI	ACCUM AxI	T.C min	R mm/hr	FLOW L/sec	SIZE mm	GRADE %	CAPACITY L/sec	VELOCITY m/s	LENGTH m	TIME min	TOTAL TIME	% LOAD
B	ST-29	CBMH 30	0.13	0.75	0.10	0.10	15.00	79.48	22.10	300	1.00	100.87	1.38	57.40	0.69	15.69	21.91
	CBMH 30	ST-31	0.14	0.60	0.08	0.18	15.69	77.75	38.91	300	0.50	71.33	0.98	9.60	0.16	15.86	54.54
	ST-31	CBMH 32	0.26	0.60	0.16	0.34	15.86	77.35	73.11	375	0.50	129.33	1.13	86.00	1.26	17.12	56.53
	CBMH 32	ST-33	0.26	0.60	0.16	0.50	17.12	74.40	103.41	450	0.50	210.30	1.28	16.60	0.22	17.34	49.17
C	ST-37	CBMH 38			0.00	0.00	15.00	79.48	0.00	300	1.00	100.87	1.38	58.81	0.71	15.71	0.00
	CBMH 38	ST-33	0.55	0.60	0.33	0.33	15.71	77.71	71.29	375	0.50	129.33	1.13	9.09	0.13	15.84	55.12
B	ST-33	CBMH 34			0.00	0.83	17.34	73.92	170.55	525	0.40	283.74	1.27	40.37	0.53	17.87	60.11
	CBMH 34	ST 35	0.19	0.60	0.11	0.94	17.87	72.76	190.13	525	0.40	283.74	1.27	60.93	0.80	18.66	67.01
	ST 35	DCBMH 36			0.00	0.94	18.66	71.08	185.75	525	0.50	317.23	1.42	9.60	0.11	18.78	58.55
	DCBMH 36	ST-22	0.64	0.60	0.38	1.32	18.78	70.85	259.99	525	0.80	401.26	1.80	64.07	0.59	19.37	64.79
A	ST-22	ST-23			0.00	6.06	21.21	66.21	1115.44	975	0.50	1653.11	2.14	44.58	0.35	21.56	67.48
	ST-23	CBMH 24			0.00	6.06	21.56	65.60	1105.15	975	0.50	1653.11	2.14	30.58	0.24	21.80	66.85
	CBMH 24	ST-25	0.56	0.50	0.28	6.34	21.80	65.19	1148.95	975	0.50	1653.11	2.14	25.08	0.19	21.99	69.50
	ST-25	CBMH 26			0.00	6.34	21.99	64.85	1143.05	975	0.50	1653.11	2.14	24.13	0.19	22.18	69.15
	CBMH 26	OUTFALL	0.55	0.50	0.28	6.62	22.18	64.53	1187.68	975	0.50	1653.11	2.14	24.29	0.19	22.37	71.85

SCHEDULE 2

- TIME OF CONCENTRATION CALCUALTIONS



LEGEND

- TIME OF CONC. PATH – PASTURE
- TIME OF CONC. PATH – WOODLAND
- TIME OF CONC. PATH – GRASSED WATERWAY
- DRAINAGE BOUNDARY

NO.	DATE	REVISION	BY

REVISIONS

STORMWATER MANGEMENT REPORT

TIME OF CONCENTRATION PLAN

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST, OSHAWA, ON L1H 1B6
PHONE (905)576-8500. FAX (905)576-8730
dgbiddle@idirect.com

SCALE:	N.T.S.
DRAWN BY:	D.D.M.
DESIGN BY:	D.D.M.
CHECKED BY:	M.B.C.
DATE:	MAY2019

PROJECT NO. 114057

DRAWING NO. FIGURE 4

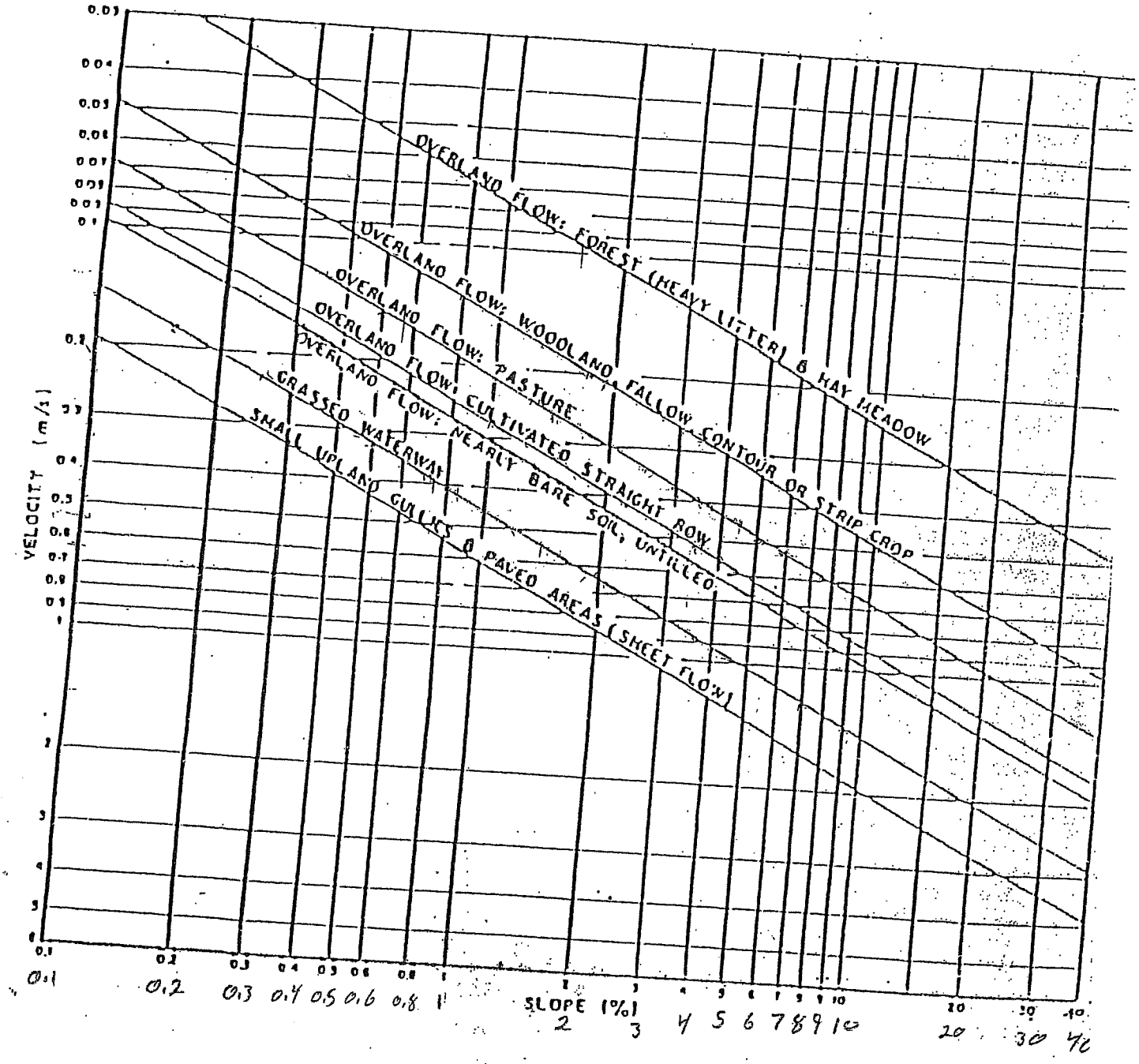


Figure A.5.2: Upland Method for Estimating Time of Concentration (SCS National Engineering Handbook, 1971)

Time to Peak Calculations

Elgin Crossing - Point A Refer to Figure 3

NHYD 80 - East of Greer

$D = 305m$

$S = \frac{135-129}{305}$

$S = 1.97\%$

$V = 0.30m/sec$ (Pasture)

$t = \frac{305}{0.30}$

$t = 1,016.7 sec$

$t = 0.28 hrs$

$t_p = 2/3\ t_c$

$t_p = 0.19 hrs$

NHYD 81 - Travel time for Drainage east of Greer to reach Elgin Crossing - Point A.

$D_1 = 418m$

$S_1 = \frac{129-111}{418}$

$S_1 = 4.3\%$

$V_1 = 0.43m/sec$ (Pasture)

$t_{c_1} = \frac{418}{0.43}$

$t_{c_1} = 991 sec$

$t_{c_1} = 0.28 hrs$

$D_2 = 451m$

$S_2 = \frac{111-103}{451m}$

$S_2 = 1.80\%$

$V_2 = 0.19m/sec$ (Woodland)

$t_{c_2} = \frac{451}{0.19}$

$t_{c_2} = 2,373.7 sec$

$t_{c_2} = 0.66 hrs$

$D_3 = 406m$

$S_3 = \frac{103-99.10}{406}$

$S_3 = 1.0\%$ (Grassed Waterway)

$V_3 = 0.55m/sec$

$t_{c_3} = \frac{406}{0.55}$

$t_{c_3} = 738.1 sec$

$t_{c_3} = 0.21 hrs$

$t_{c\,TOT} = 0.28 + 0.66 + 0.21$

$t_{c\,TOT} = 1.15 hrs \rightarrow \underline{69 min}$

NHYD 82 - North Drainage Area.

$D_1 = 539$

$S_1 = \frac{121 - 108.25}{539}$

$S_1 = 2.4\%$

$V_1 = 0.32 m/sec$ (Pasture)

$t_{c_1} = \frac{539}{0.32}$

$t_{c_1} = 1684 sec$

$t_{c_1} = 0.47 hrs.$

$t_p = 0.31 hrs.$

NHYD 83 - Travel time for North Drainage Area to reach Elgin Crossing.

$D_1 = 388m$

$S_1 = \frac{108.25 - 103.00}{388}$

$S_1 = 1.4\%$

$V_1 = 0.18 m/sec$ (Wood Fallow)

$t_{c_1} = \frac{388}{0.18}$

$t_{c_1} = 2156 sec$

$t_{c_1} = 0.60 hrs.$

$D_2 = 406m \rightarrow t_c = 0.21 hrs$ - refer to previous page under 'NHYD 81'

$t_{c\,TOT} = 0.60 + 0.21$

$t_{c\,TOT} = 0.81 hrs$

$t_{c\,TOT} = 48.6 min.$

NHYD 88

$D_1 = 418m$ $t_c = 0.28 hrs \rightarrow$ Refer to previous page under 'NHYD 81'

$D_2 = 451m$ $t_c = 0.66 hrs$

$D_3 = 406m$ $t_c = 0.21 hrs$

$t_{c\,TOT} = 0.69 min$

$t_p = 2/3\, t_c$

$t_p = 0.46 hrs$

NHYD 84

$D_1 = 253m$

$S_1 = \frac{120.70 - 104.00}{253m}$

$S_1 = 6.6\%$

$V_1 = 0.56 m/s$ (Pasture)

$t_{c_1} = \frac{253m}{0.56 m/sec}$

$t_{c_1} = 452 sec$

$t_{c_1} = 0.13 hrs.$ $\quad t_p = 0.09$

NHYD 85 - Travel time for Drainage Area (NHYD84) to Elgin Crossing

$D_2 = 398m$

$S_2 = \frac{104.00 - 99.10}{398}$

$S_2 = 1.2\%$

$V_2 = 0.5 m/sec$

$t_{c_2} = \frac{398}{0.5}$

$t_{c_2} = 796 sec$

$t_{c_2} = 13.3 min$

NHYD 86

$D_2 = 574m$

$S_1 = \frac{129.5 - 103.25}{574}$

$S_1 = 4.6\%$

$V_1 = 0.46 m/sec$ (Pasture)

$t_{c_1} = \frac{574}{0.46}$

$t_{c_1} = 1248 sec$

$t_{c_1} = 0.35 hrs$ $\quad t_{p_1} = 0.23 hrs$

NHYD 87 - Travel time for Drainage Area (NHYD 86) to Elgin Crossing

$D_2 = 426m$

$S_1 = \frac{103.25 - 99.10}{426}$

$S_1 = 1.00\%$

$V_1 = 0.55 m/sec$ (Grassed Waterway)

$t_{c_1} = \frac{426}{0.55}$

$t_{c_1} = 775 sec$

$t_{c_1} = 12.9 min$

South of Elgin - Point B

NHYD 90

$D_1 = 235m$

$S_1 = \frac{129.5m - 121.70m}{235}$

$S_1 = 3.3\%$

$V_1 = 0.39m/sec$ (Pasture)

$t_{c_1} = \frac{235}{0.39}$

$t_{c_1} = 631 sec$

$t_{c_1} = 0.18 hrs$ $\quad t_p = 0.12 hrs.$

$D_2 = 416m$

$S_2 = \frac{121.70 - 101.25}{416}$

$S_2 = 4.9\%$

$V_2 = 0.33m/sec$ (Woodland Fallow)

$t_{c_2} = \frac{416}{0.33}$

$t_{c_2} = 1261 sec$

$t_{c_2} = 0.35 hrs$ $\quad t_p = 0.23 hrs.$

$t_{p\,TOT} = 0.12 + 0.23$

$t_{p\,TOT} = 0.35 hrs.$

NHYD 91 - Travel time for Drainage Area (NHYD 90) to Point B South of Elgin Crossing

$D_1 = 234m$

$S_1 = \frac{101.25 - 98.50}{234}$

$S_1 = 1.20\%$

$V_1 = 0.18 m/sec$ (Woodland Fallow)

$t_{c_1} = \frac{234}{0.18}$

$t_{c_1} = 1300 sec$

$t_{c_1} = 21.7 min$

$D_2 = 302m$

$S_2 = \frac{98.50 - 96.80}{302}$

$S_2 = 0.55\%$

$V_2 = 0.34 m/sec$ (Grassed Waterway.)

$t_{c_2} = \frac{302}{0.34}$

$t_{c_2} = 888 sec$

$t_{c_2} = 14.8 min$

$t_{c\,TOT} = 14.8 + 21.7$

$t_{c\,TOT} = 36.5 min.$

NHYD 92:
t_c = 36.5 min (Refer to NHYD 91)
t_c = 0.61 hrs
t_p = 0.41 hrs

NHYD 93

D = 298 m
S = $\frac{112.5 - 96.80}{298\,m}$
S = 5.3%
V = 0.34 m/sec (Woodland Fallow)

$t_c = \frac{298}{0.34}$
t_c = 876 sec
t_c = 0.24 hrs t_p = 0.16 hrs

Midtown Creek

NHYD 49

D = 534 m
S = $\frac{121 - 107}{534}$
S = 2.6%
V = 0.35 m/sec (Pasture)

$t_c = \frac{534}{0.35}$
t_c = 1526 sec
t_c = 0.42 hrs t_p = 0.28 hrs

SCHEDULE 3

- POND DESIGN CALCULATIONS (STAGE / STORAGE / DISCHARGE)

- APPENDIX C OF "TECHNICAL ENGINEERING GUIDELINES FOR STORMWATER MANAGEMENT SUBMISSIONS"

- DESIGN CHART 1.09 (MTO DRAINAGE MANAGEMENT MANUAL)

- VISUAL OTTHYMO PARAMETERS

- VISUAL OTTHYMO OUTPUT (25mm, PRE-DEVELOPMENT, POST-DEVELOPMENT, BLOCKED CONDITIONS)

PROJECT Rondeau (Cobourg) Ltd.
PROJECT # 114057
DATE Jun-19

POND D VOLUME REQUIREMENTS

IMPERVIOUS LEVEL	PERMANENT STORAGE VOLUME REQUIRED(m^3/ha)	FLUCTUATING STORAGE VOLUME REQUIRED (m^3/ha)	TOTAL DRAINAGE AREA (ha)	PERMANENT VOLUME REQUIRED (m^3)	FLUCTUATING VOLUME REQUIRED (m^3)
80%	200	40	0.970	194	39
70%	185	40	0.877	162	35
65%	175	40	8.846	1548	354
65%	175	40	1.081	189	43
Total			11.774	2093	471

IMPERVIOUS LEVEL	TOTAL RAINFALL (mm)	RUN-OFF DEPTH (mm)	TOTAL DRAINAGE AREA (ha)	VOLUME REQUIRED (m^3)
80%	25	20.75	0.970	201
70%	25	19.12	0.877	168
65%	25	17.44	8.846	1543
65%	25	17.43	1.081	188
Total			11.774	2100

PROJECT Rondeau (Cobourg) Ltd.
PROJECT # 114057
DATE Jun-19

POND D FOREBAY CALCULATIONS

CONTRIBUTING AREA= 11.774 ha

Permanent Pool Required 2093 m^3/ha

Active Pool Required 471 m^3/ha

Pond Characteristics

Permanent Pool Elevation= 102.25 m
Pond Invert Elevation= 100.50 m
Active Pool Elevation= 103.00 m

Permanent Pool Volume Provided 2287.09 m^3

Active Pool Volume Provided 2221.11 m^3

Orifice Sizing Calculations
From MOE Stormwater Management Practices Manual

$$t = \frac{2xA_p}{CxA_o(2g)^{0.5}} \times (h_1^{0.5}-h_2^{0.5})$$

$$172800 \frac{2x2628.82}{0.61xA_o(2x9.81)^{0.5}} \times (0.75^{0.5}-0.0^{0.5})$$

$$A_o = \frac{5887.39}{172800x\ 2.70196}$$

A_o= 0.01261 m^2

t=Drawdown Time(s)			172800 s
A_p= Pond Area(@ Max WSE)=			5097.06 m^2
C= Discharge Coefficient=			0.61
h_1=Max. head(m)			
=	103.00	102.12	0.88 m
h_2=Min. head(m)			
=	102.25	102.12	0.13 m
C/L Orifice=			102.12 m
g=Gravity=			9.81 m/s^2

Orifice Diameter

$$Dia = \frac{4xA_o}{PI}$$

Dia= 0.12671 m

Check Drawdown time

Ave Q= $CxA_ox(2gh)^{0.5}$

= 0.02172 m^3/s

D= Orifice Diameter	0.12 m
A_o= Orifice Area	0.01131 m^2
g=Gravity=	9.81 m/s^2
Average Head=	0.505 m
C= Discharge Coefficient=	0.61

$$t = \frac{Vol}{Q}$$

$$= \frac{2221.11}{0.022} = 102280 \text{ s} \quad 28.4112 \text{ hrs}$$

Maximum Discharge

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

= 0.0287 m^3/s

D= Orifice Diameter	0.12 m
A_o= Orifice Area	0.0113 m^2
g=Gravity=	9.81 m/s^2
Maximum Head(h)=	0.88 m
C= Discharge Coefficient=	0.61

Equation 4.5 - Forebay Settling Length

$$\text{Distance} = \sqrt{\frac{rxQ_p}{V_s}}$$

$$= \sqrt{\frac{0.05733}{0.0003}}$$

= 13.8 m

r=Length:Width Ratio	2 :1
Qp=Orifice Peak Discharge=	0.0287 m^3/s
V_s=Settling Velocity	0.0003 m/s

Equation 4.6 - Forebay Dispersion Length

$$\text{Distance} = \frac{8xQ}{dxV_p}$$

$$= \frac{7.88}{0.625}$$

= 9.2 m

d=Depth of Forebay	1.25 m
Vp=Velocity in Forebay	0.5 m/s
Q= CiA / 360 m^3/s	0.719604 m^3/s
Q (25mm4hr) =	0.985 m^3/s
C=Runoff Coefficient	0.65
i=43xC+5.9	33.85 mm/hr
A=Area(ha)	11.774 ha

Equation 4.7 - Minimum Bottom Width

$$\text{Width} = \frac{\text{Distance}}{8}$$

= 1.15 m

PROJECT	Rondeau (Cobourg) Ltd.
PROJECT #	114057
DATE	Jun-19

Pond D Volmes and Discharge

Orifice 1
Q=CA(2gh)^0.5
Diameter= 0.120 m
Area= 0.0113 m2
C= 0.61
C/L Elev= 102.12 m

Orifice 2
Q=CA(2gh)^0.5
Diameter= 0.425 m
Area= 0.1419 m2
C= 0.61 (PLATE)
C/L Elev= 101.75 m

	ELEV	AREA	AVERAGE AREA	DEPTH	VOLUME	TOTAL VOLUME	ORIFCE 1		ORIFICE 2		WEIR 1		TOTAL
							HEAD	FLOW	HEAD	FLOW	HEAD	FLOW	FLOW
	m	m2	m2	m	m3	m3	m	cms	m	cms	m	cms	cms
Permanent Pool	100.50	610.59				0.00							
			687.21	0.25	171.80								
	100.75	763.83				171.80							
			865.52	0.25	216.38								
	101.00	967.21				388.18							
			1064.74	0.25	266.18								
	101.25	1162.27				654.37							
			1265.89	0.25	316.47								
	101.50	1369.51				970.84							
			1479.41	0.25	369.85								
	101.75	1589.32				1340.69							
			1705.52	0.25	426.38								
	102.00	1821.72				1767.07							
			2080.07	0.25	520.02								
	102.25	2338.42				2287.09							
Fluctuating Pool	102.25	2338.42				0.00	0.13	0.0110					0.0110
			2532.79	0.25	633.20								
	102.50	2727.17				633.20	0.38	0.0188					0.0188
			2950.58	0.25	737.65								
	102.75	3174.00				1370.84	0.63	0.0243					0.0243
			3401.06	0.25	850.26								
	103.00	3628.11				2221.11	0.88	0.0287					0.0287
			3863.12	0.25	965.78								
	103.25	4098.13				3186.89	1.13	0.0325	1.50	0.4695			0.5019
			4345.43	0.25	1086.36								
	103.50	4592.74				4273.25	1.38	0.0359	1.75	0.5071			0.5430
			4844.90	0.25	1211.22								
	103.75	5097.06				5484.47	1.63	0.0390	2.00	0.5421			0.5811

PROJECT Rondeau (Cobourg) Ltd.
PROJECT # 114057
DATE Jun-19

Pond D Volmes and Discharge (Blocked Conditions)

Orifice 1
Q=CA(2gh)^0.5
Diameter= 0.12 m
Area= 0.0113 m2
C= 0.61
C/L Elev= 102.12 m

Orifice 2
Q=CA(2gh)^0.5
Diameter= 0.425 m
Area= 0.1419 m2
C= 0.61 (PLATE)
C/L Elev= 101.75 m

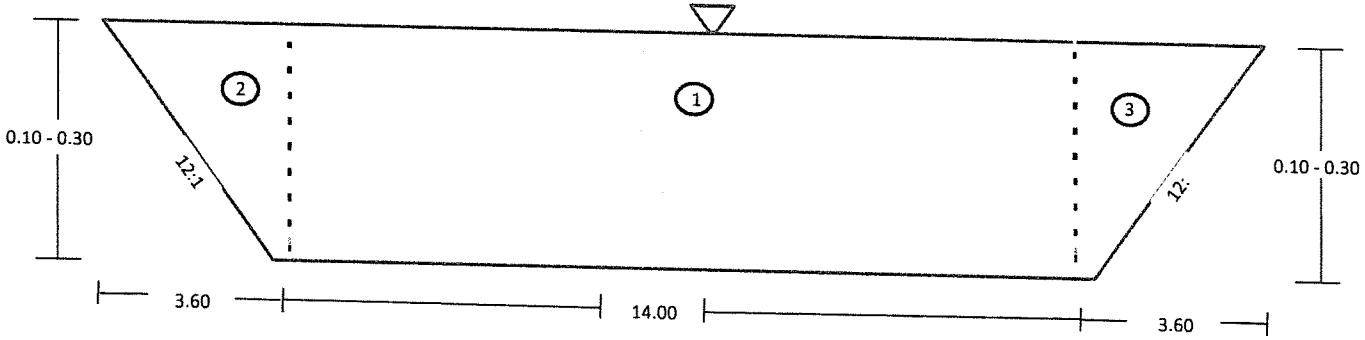
Weir 1 - See diagram on following page

Section 1 (rectangular portion)
Q=(2/3)C_wB(2g)^0.5*(h)^(3/2)
C_w= 0.577
B (width)= 14.00 m
Weir 1 103.75 m

Section 2 & 3 (triangular portion)
Q=(2/3)C_wB(2g)^0.5*((2/3)h)^(3/2)
C_w= 0.577
B (width)= d / (1/12) m

	ELEV	AREA	AVERAGE AREA	DEPTH	VOLUME	TOTAL VOLUME	ORIFCE 1		ORIFICE 2		WEIR 1		TOTAL FLOW
							HEAD	FLOW	HEAD	FLOW	HEAD	FLOW	
	m	m2	m2	m	m3	m3	m	cms	m	cms	m	cms	cms
Permanent Pool	100.50	41.00				0.00							
			336.25	0.25	84.06								
	100.75	631.51				0.00							
			730.52	0.25	182.63								
	101.00	829.54				0.00							
			963.74	0.25	240.94								
	101.25	1097.95				0.00							
			1229.14	0.25	307.29								
	101.50	1360.34				0.00							
			1501.30	0.25	375.33								
	101.75	1642.27				0.00							
			1793.05	0.25	448.26								
	102.00	1943.83				0.00							
			2273.50	0.25	568.38								
	102.25	2603.18				0.00							
Fluctuating Pool (Blocked)	102.25	2603.18				0.00							0.0000
			2829.36	0.25	707.34								
	102.50	3055.53				0.00							0.0000
			3230.12	0.25	807.53								
	102.75	3404.72				0.00							0.0000
			3583.96	0.25	895.99								
	103.00	3763.20				0.00							0.0000
			3939.28	0.25	984.82								
	103.25	4115.37				0.00							0.0000
			4297.70	0.25	1074.42								
	103.50	4480.03				0.00							0.0000
			4666.94	0.25	1166.74								
	103.75	4853.86				0.00							0.0000
			4853.86	0.00	0.00								
Fluctuating Pool (Blocked)	103.75	4853.86				0.00					0.00	0.000	0.0000
			4925.25	0.10	492.53								
	103.85	4996.64				492.53					0.10	0.825	0.8247
			5076.89	0.10	507.69								
	103.95	5157.13				1000.21					0.20	2.532	2.5318
			5237.91	0.10	523.79								
	104.05	5318.68				1524.00					0.30	5.017	5.0169

Weir Diagram



APPENDIX C

Hydrological Values
And
Recommended Modeling Parameters

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VO_2 Hydrology Modeling Parameters Selection

<table>
<tr><th>COMMAND</th><th>PARAMETER</th><th>PARAMETER VALUE RECOMMENDATIONS</th></tr>
<tr><td rowspan="2">STANDHYD when catchment area T_{imp}>20%</td><td>AREA</td><td>Digital delineation using software such as GIS or AutoCAD must be used to delineate subcatchment areas.</td></tr>
<tr><td>X_{imp}</td><td>Directly connected imperviousness shall be measured, if possible. Otherwise, use:
<table>
<tr><th>Land use</th><th>X_{IMP}[1] (Roof Leaders to Road)</th><th>X_{IMP}[2] (Roof Leaders to Lawn)</th></tr>
<tr><td>Estate Residential (>3/4 Acre Lot)</td><td>0.14</td><td>0.09</td></tr>
<tr><td>2 Acre Lot (180 ft wide)</td><td>0.11</td><td>0.08</td></tr>
<tr><td>1½Acre Lot (150 ft wide)</td><td>0.14</td><td>0.09</td></tr>
<tr><td>1 Acre Lot (130 ft wide)</td><td>0.17</td><td>0.10</td></tr>
<tr><td>Low Density Residential (1/3 to 3/4 Acre Lot)</td><td>0.23</td><td>0.15</td></tr>
<tr><td>¾ Acre Lot (110 ft wide)</td><td>0.18</td><td>0.13</td></tr>
<tr><td>½ Acre Lot (90 ft wide)</td><td>0.23</td><td>0.15</td></tr>
<tr><td>1/3 Acre Lot (70 ft wide)</td><td>0.29</td><td>0.18</td></tr>
<tr><td>Medium Density Residential (1/10 to 1/4 Acre Lot)</td><td>0.47</td><td>0.24</td></tr>
<tr><td>¼ Acre Lot (60 ft wide)</td><td>0.35</td><td>0.20</td></tr>
<tr><td>1/8 Acre Lot (50 ft wide)</td><td>0.52</td><td>0.25</td></tr>
<tr><td>1/10 Acre Lot (40 ft wide)</td><td>0.55</td><td>0.28</td></tr>
<tr><td>High Density Residential (<1/10 Acre Lot)</td><td>0.65</td><td>0.35</td></tr>
<tr><td>Institutional (e.g. school, religious centre)</td><td>0.55</td><td>0.30</td></tr>
<tr><td>Industrial</td><td>0.80</td><td>0.70</td></tr>
<tr><td>Commercial/ Business</td><td>0.90</td><td>0.90</td></tr>
<tr><td>Park</td><td>0.01</td><td>0.01</td></tr>
</table>
1. Roof leaders connected to impervious area (e.g. driveway) and to storm sewer for X_{imp} calculations.
2. Roof leaders are connected to pervious area (e.g. lawn) for X_{imp} calculations,

Public roads are included in all reported X_{imp} values.</td></tr>
</table>

<table>
<tr>
<td rowspan="2">STANDHYD
(con't)</td>
<td>T_{imp}</td>
<td>Total imperviousness shall be measured, if possible. Otherwise, T_{imp} based on:
<table>
<tr><th>Land use</th><th>T_{imp}
(Roof Leaders to Road)</th><th>Corresponding C</th></tr>
<tr><td>Estate Residential (>3/4 Acre Lot)</td><td>0.14</td><td>.3</td></tr>
<tr><td>2 Acre Lot (180 ft wide)</td><td>0.11</td><td>.28</td></tr>
<tr><td>1½Acre Lot (150 ft wide)</td><td>0.14</td><td>.3</td></tr>
<tr><td>1 Acre Lot (130 ft wide)</td><td>0.17</td><td>.32</td></tr>
<tr><td>Low Density Residential (1/3 to 3/4 Acre Lot)</td><td>0.23</td><td>.36</td></tr>
<tr><td>¾ Acre Lot (110 ft wide)</td><td>0.18</td><td>.32</td></tr>
<tr><td>½ Acre Lot (90 ft wide)</td><td>0.23</td><td>.36</td></tr>
<tr><td>1/3 Acre Lot (70 ft wide)</td><td>0.29</td><td>.40</td></tr>
<tr><td>Medium Density Residential (1/10 to ¼ Acre Lot)</td><td>0.47</td><td>.53</td></tr>
<tr><td>¼ Acre Lot (60 ft wide)</td><td>0.35</td><td>.45</td></tr>
<tr><td>1/8 Acre Lot (50 ft wide)</td><td>0.52</td><td>.56</td></tr>
<tr><td>1/10 Acre Lot (40 ft wide)</td><td>0.55</td><td>.59</td></tr>
<tr><td>High Density Residential (<1/10 Acre Lot)</td><td>0.65</td><td>.65 - .6</td></tr>
<tr><td>Institutional (e.g. school, religious centre)</td><td>0.55</td><td>.59 - .75</td></tr>
<tr><td>Industrial</td><td>0.80</td><td>.75 - .90</td></tr>
<tr><td>Commercial/ Business</td><td>0.90</td><td>.84 - .90</td></tr>
<tr><td>Park</td><td>0.01</td><td>.21 - .2</td></tr>
</table>
STANDHYD command shall only be used for catchments with a T_{imp}>20%. In case where T_{imp} is <20% and there is a sizeable development area, split the catchment into two using both NASHYD and STANDHYD.</td>
</tr>
<tr>
<td>LOSS</td>
<td>VO2 uses Horton's, SCS Modified Curve Number, or Proportional Loss Coefficient Method. The preferred method is SCS Modified Curve Number Method to calculate pervious area losses due to the following reasons:

Horton is not recommended for storm durations ≥ 12 hours as predicted flows are often erroneous (may under estimate runoff if rainfall intensity is < sol infiltration capacity rate);
Horton's not recommended if there is significant soil variability;
Horton's typically used for urban conditions with short duration, high intensity storms (e.g. Chicago distribution) and not much soil variability; and
SCS Modified CN Method is generally more suitable for subwatershed studies and master drainage plans.
</td>
</tr>
</table>

<table>
<tr><td rowspan="8">STANDHYD
(con't)</td><td>CN</td><td>Same approach as NASHYD. Typically, the pervious component within STANDHYD represents lawn or other grassed area. The pervious area curve number value shall be determined as per Attachment 1. If the assumed pervious area is lawn, the following CN values are recommended:
<table>
<tr><th rowspan="2">Land Use</th><th colspan="7">Hydrologic Soil Group (HSG)</th></tr>
<tr><th>A</th><th>AB</th><th>B</th><th>BC</th><th>C</th><th>CD</th><th>D</th></tr>
<tr><td>Lawn, other open grassed area in good condition (covering > 75% of the area)</td><td>39</td><td>50</td><td>61</td><td>68</td><td>74</td><td>77</td><td>80</td></tr>
<tr><td>Lawn, other open grassed area in fair condition (covering 50-75% of the area)</td><td>49</td><td>59</td><td>69</td><td>74</td><td>79</td><td>82</td><td>84</td></tr>
</table></td></tr>
<tr><td>I_a</td><td>
<table>
<tr><th>Land Use</th><th>I_a</th></tr>
<tr><td>Commercial</td><td>2</td></tr>
<tr><td>Residential High Density</td><td>2</td></tr>
<tr><td>Residential Medium/Low Density</td><td>2</td></tr>
<tr><td>Residential Estate</td><td>2</td></tr>
<tr><td>Major Roads</td><td>2</td></tr>
<tr><td>Crop</td><td>7</td></tr>
<tr><td>Pasture</td><td>8</td></tr>
<tr><td>Woodlot</td><td>10</td></tr>
<tr><td>Open Space, Green space</td><td>5</td></tr>
</table></td></tr>
<tr><td>SLPP</td><td>Pervious surface slope, preferably measured digitally, other wise assume 2%.</td></tr>
<tr><td>LGP</td><td>Length of pervious overland flow typically set to 40 m, unless can be calculated otherwise.</td></tr>
<tr><td>MNP</td><td>Manning's pervious "n" value determined by looking at tables, otherwise assume 0.25</td></tr>
<tr><td>DPSI</td><td>For roads, driveways and roofs typically use value between 0.8 and 1.5 mm, otherwise assume 2.0 mm</td></tr>
<tr><td>SLPI</td><td>Impervious surface slope preferably measured digitally, otherwise assume 1%.</td></tr>
<tr><td>LGI</td><td>Length of impervious overland flow can be measured if subdivision plans available, however, typically best to use $A= 1.5 (LGI)^2$</td></tr>
<tr><td>MNI</td><td>Manning's impervious "n" value determined using tables if nature of impervious surface is known, otherwise assume 0.013.</td></tr>
</table>

NASHYD	**AREA**	Digital delineation (GIS, AutoCAD) will be used to delineate subcatchment areas.
	CN	CN values are a function of land use and HSG. Use the same table as STANDHYD CN based on the following approach: 1. Area-weighted land use and soils data to be calculated using digital measurements. Soils information must be transformed to hydrologic soil group (HSG) classification using Chart 1.09 MTO Drainage Manual 2. CN values to be calculated on an area-weighted basis using Attachment1. 3. CN to be transformed to CN* using procedure outlined in the VO_2 Reference Manual.
	I_a	Same as STANDHYD (typically set between 1.0 and 5.0 if using CN*)
	N	Number of linear reservoir typically set to 3.0.
	T_p	Time to peak (T_p) is calculated based on time of concentration (T_c). Refer to Tc Calculations T_p is estimated based on $T_p=(N-1)/N*T_c$ or $T_p=0.67Tc$ The airport method is to be used when C<0.4 and the Bransby-Williams Method is to be used when c>0.4

ATTACHMENT 1
PROPOSED CN AND C-VALUE TABLES

Land Use	CN (AMC II) Values for Hydrologic Soil Group						
	A	AB	B	BC	C	CD	D
Commercial (> 85% impervious)	89	91	92	93	94	95	95
Commercial (75%-85% impervious)	81	85	88	90	91	92	93
Residential (<1/8 acre lot size)	77	81	85	88	90	91	92
Residential (1/4 acre lot size)	61	68	75	79	83	85	87
Residential (1/4 acre lot size)	54	62	70	75	80	83	85
Residential (1 acre lot size)	51	60	68	74	79	82	84
Paved Areas	98	98	98	98	98	98	98
Cultivated, fallow	77	82	86	89	91	93	94
Cultivated, row crops	66	72	77	81	85	87	89
Pasture, good condition	39	50	61	68	74	77	80
Pasture, poor condition	68	74	79	83	86	88	89
Meadow	30	44	58	65	71	75	78
Wood, good cover	25	40	55	63	70	74	77
Wood, poor cover	45	56	66	72	77	80	83

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

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

Notes

(i) All values are based on AMC II except those marked by * (AMC III) or ** (mean of AMC II and AMC III).

(ii) Values in brackets are AMC II and are to be used only for special cases.

(iii) Table is not applicable to frozen soils or to periods in which snowmelt contributes to runoff.

VISUAL OTTHYMO PARAMETERS FOR PHASE 1

PARAMETER	VALUE				
	STANDHYD (Node 22, 29, 61, 101)	STANDHYD (Node 68)	STANDHYD (Node 60)	STANDHYD (Node 106)	NASHYD (Node 59, 107)
CN	85	85	85	65	65
IA	2	2	2	2	5
N	-	-	-	-	3
Tc	-	-	-	-	0.27
Tp	-	-	-	-	0.18
Timp	0.65	0.80	0.70	0.25	-
Ximp	0.55	0.80	0.70	0.25	-
SLPP	2.0	2.0	2.0	2.0	-
LGP	40.0	40.0	40.0	40.0	-
MNP	0.25	0.25	0.25	0.25	-
SCP	0.0	0.0	0.0	0.0	-
DPSI	1.0	1.0	1.0	1.0	-
SLPI	3.0 – 5.0	3.0	1.0	3.0	-
MNI	0.013	0.013	0.013	0.013	-
SCI	0.0	0.0	0.0	0.0	-

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

  OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
 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\david.mcnaull\AppData\Local\Temp\286de8c4-45d9-488d-bdda-06c8e372cab4\Scenario.

DATE: 06/26/2019 TIME: 11:04:23

USER:

COMMENTS: 25mm Event

****
** SIMULATION NUMBER: 1 ** 25mm
****

READ STORM	Filename: C:\Users\david.mcnaull\AppData\Local\Temp\286de8c4-45d9-488d-bdda-06c8e372cab4\3914cff5
Ptotal= 25.00 mm	Comments: Twenty five mm Four Hour Chicago Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.07	1.17	5.70	2.17	5.19	3.17	2.80
0.33	2.27	1.33	10.78	2.33	4.47	3.33	2.62
0.50	2.52	1.50	50.21	2.50	3.95	3.50	2.48
0.67	2.88	1.67	13.37	2.67	3.56	3.67	2.35
0.83	3.38	1.83	8.29	2.83	3.25	3.83	2.23
1.00	4.18	2.00	6.30	3.00	3.01	4.00	2.14

CALIB STANDHYD (0022)	Area (ha)= 8.85
ID= 1 DT= 5.0 min	Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.75	3.10
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	3.00	2.00
Length	(m)=	242.84	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.07	1.083	5.70	2.083	5.19	3.08	2.80
0.167	2.07	1.167	5.70	2.167	5.19	3.17	2.80
0.250	2.27	1.250	10.78	2.250	4.47	3.25	2.62
0.333	2.27	1.333	10.78	2.333	4.47	3.33	2.62
0.417	2.52	1.417	50.21	2.417	3.95	3.42	2.48
0.500	2.52	1.500	50.21	2.500	3.95	3.50	2.48
0.583	2.88	1.583	13.37	2.583	3.56	3.58	2.35
0.667	2.88	1.667	13.37	2.667	3.56	3.67	2.35
0.750	3.38	1.750	8.29	2.750	3.25	3.75	2.23

0.833	3.38	1.833	8.29	2.833	3.25	3.83	2.23
0.917	4.18	1.917	6.30	2.917	3.01	3.92	2.14
1.000	4.18	2.000	6.30	3.000	3.01	4.00	2.14

Max.Eff.Inten.(mm/hr)=	50.21	17.33	
over (min)	5.00	20.00	
Storage Coeff. (min)=	4.12 (ii)	18.35 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.24	0.06	
			TOTALS
PEAK FLOW (cms)=	0.63	0.08	0.662 (iii)
TIME TO PEAK (hrs)=	1.50	1.75	1.50
RUNOFF VOLUME (mm)=	24.00	9.42	17.44
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.96	0.38	0.70

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0060)
ID= 1 DT= 5.0 min

Area (ha)= 0.88
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.61	0.26	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	76.46	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		50.21	9.47	
over (min)		5.00	25.00	
Storage Coeff. (min)=		2.86 (ii)	20.99 (ii)	
Unit Hyd. Tpeak (min)=		5.00	25.00	
Unit Hyd. peak (cms)=		0.28	0.05	
				TOTALS
PEAK FLOW	(cms)=	0.08	0.00	0.085 (iii)
TIME TO PEAK	(hrs)=	1.50	1.83	1.50
RUNOFF VOLUME	(mm)=	24.00	7.80	19.12
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.31	0.76

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0061)
ID= 1 DT= 5.0 min

Area (ha)= 1.08
Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.70	0.38	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	5.00	2.00	
Length	(m)=	84.81	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		50.21	17.33	
over (min)		5.00	20.00	
Storage Coeff. (min)=		1.88 (ii)	16.11 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		0.32	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.08	0.01	0.087 (iii)
TIME TO PEAK	(hrs)=	1.50	1.75	1.50
RUNOFF VOLUME	(mm)=	24.00	9.42	17.43
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.38	0.70

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0068) ID= 1 DT= 5.0 min	Area (ha)= 0.97 Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

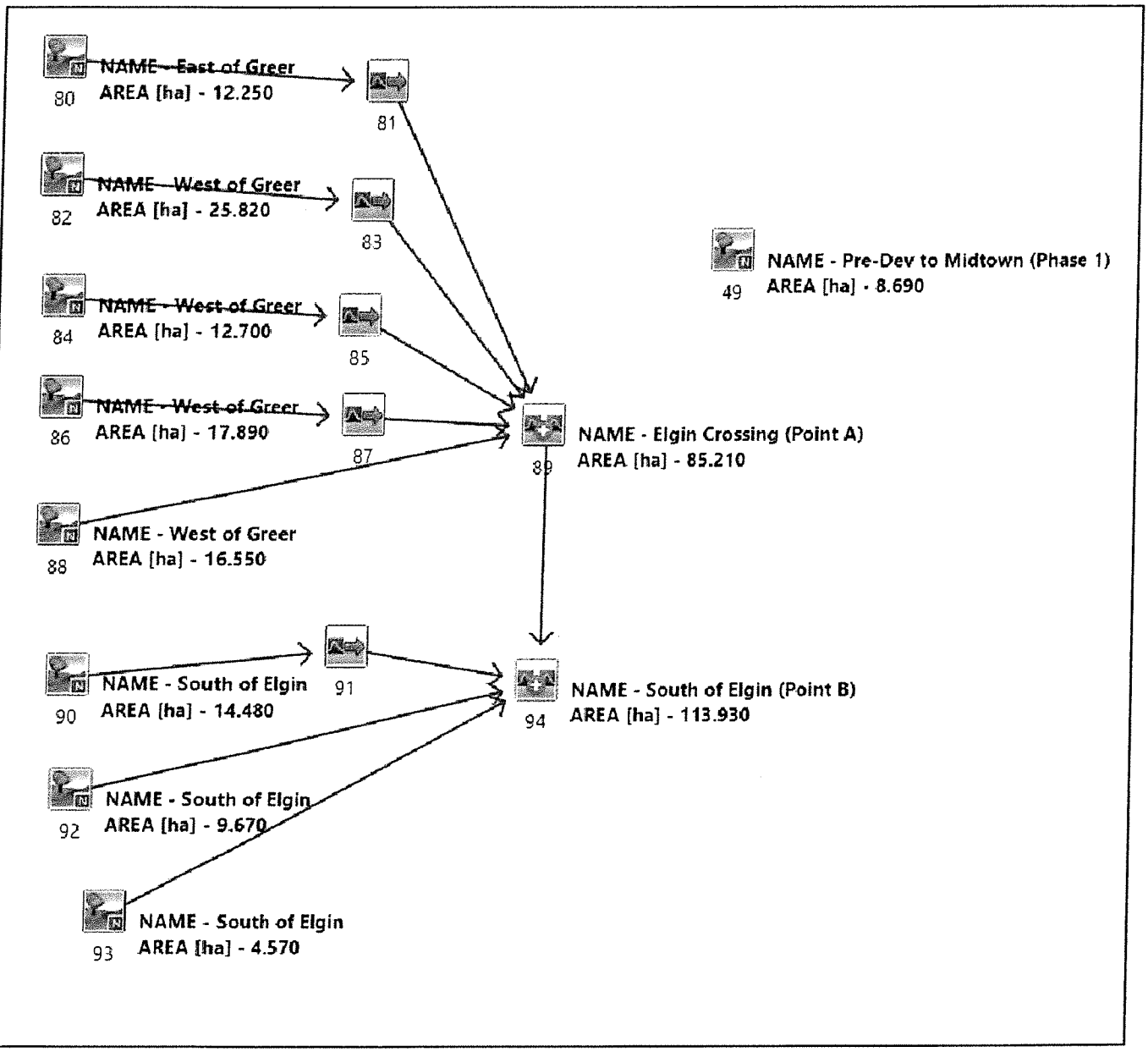
		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.78	0.19	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	3.00	2.00	
Length	(m)=	80.42	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		50.21	9.47	
over (min)		5.00	25.00	
Storage Coeff. (min)=		2.12 (ii)	20.25 (ii)	
Unit Hyd. Tpeak (min)=		5.00	25.00	
Unit Hyd. peak (cms)=		0.31	0.05	
				TOTALS
PEAK FLOW	(cms)=	0.11	0.00	0.108 (iii)
TIME TO PEAK	(hrs)=	1.50	1.83	1.50
RUNOFF VOLUME	(mm)=	24.00	7.80	20.75
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.96	0.31	0.83

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

FINISH

==========



PRE-DEVELOPMENT DRAINAGE SCHEME

RONDEAU (COBURG) LTD.

VISUAL OTTHYMO SCHEME

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST • OSHAWA,ON • L1H 1B6
PHONE (905)576-8500 • FAX (905)576-9730
info@dgbiddle.com

SCALE	N.T.S.
DRAWN	D.D.M.
DESIGN	D.D.M.
CHECKED	M.B.C.
DATE	JUNE 2019

PROJECT 114057

DWG FIG 5

```
V    V   I    SSSSS  U   U    A    L
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
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  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\david.mcnaull\AppData\Local\Temp\ee8017b7-1ae5-4d97-8164-d2b3f77c5910\Scenario.

DATE: 06/26/2019 TIME: 11:23:39

USER:

COMMENTS: Pre development - 100yr Detailed Output

****
** SIMULATION NUMBER: 0 ** 100 yr
****

| CHICAGO STORM |
| Ptotal=108.98 mm |

IDF curve parameters: A=1770.000
B= 4.000
C= 0.820
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.84	6.17	2.90	12.17	2.55	18.17	1.21
0.33	0.86	6.33	3.15	12.33	2.47	18.33	1.19
0.50	0.88	6.50	3.46	12.50	2.39	18.50	1.17
0.67	0.89	6.67	3.85	12.67	2.32	18.67	1.16
0.83	0.91	6.83	4.34	12.83	2.25	18.83	1.14
1.00	0.93	7.00	5.00	13.00	2.19	19.00	1.13
1.17	0.95	7.17	5.92	13.17	2.13	19.17	1.11
1.33	0.97	7.33	7.33	13.33	2.07	19.33	1.10
1.50	0.99	7.50	9.77	13.50	2.02	19.50	1.09
1.67	1.01	7.67	15.10	13.67	1.97	19.67	1.07
1.83	1.03	7.83	38.21	13.83	1.92	19.83	1.06
2.00	1.05	8.00	203.31	14.00	1.87	20.00	1.05
2.17	1.08	8.17	50.96	14.17	1.83	20.17	1.04
2.33	1.11	8.33	25.51	14.33	1.79	20.33	1.03
2.50	1.13	8.50	17.18	14.50	1.75	20.50	1.01
2.67	1.16	8.67	13.06	14.67	1.72	20.67	1.00
2.83	1.20	8.83	10.60	14.83	1.68	20.83	0.99
3.00	1.23	9.00	8.96	15.00	1.65	21.00	0.98
3.17	1.26	9.17	7.78	15.17	1.61	21.17	0.97
3.33	1.30	9.33	6.90	15.33	1.58	21.33	0.96
3.50	1.34	9.50	6.21	15.50	1.55	21.50	0.95
3.67	1.39	9.67	5.65	15.67	1.53	21.67	0.94
3.83	1.43	9.83	5.19	15.83	1.50	21.83	0.93
4.00	1.48	10.00	4.81	16.00	1.47	22.00	0.92
4.17	1.54	10.17	4.48	16.17	1.45	22.17	0.91
4.33	1.60	10.33	4.20	16.33	1.42	22.33	0.91
4.50	1.66	10.50	3.96	16.50	1.40	22.50	0.90
4.67	1.73	10.67	3.74	16.67	1.38	22.67	0.89
4.83	1.81	10.83	3.55	16.83	1.36	22.83	0.88
5.00	1.89	11.00	3.38	17.00	1.33	23.00	0.87
5.17	1.99	11.17	3.23	17.17	1.31	23.17	0.86
5.33	2.10	11.33	3.09	17.33	1.29	23.33	0.86
5.50	2.22	11.50	2.96	17.50	1.28	23.50	0.85

5.67	2.35	11.67	2.85	17.67	1.26	23.67	0.84
5.83	2.51	11.83	2.74	17.83	1.24	23.83	0.83
6.00	2.69	12.00	2.64	18.00	1.22	24.00	0.83

CALIB NASHYD (0093) ID= 1 DT= 5.0 min	Area (ha)= 4.57	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.16	

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	0.84	6.083	2.90	12.083	2.55	18.08	1.21
0.167	0.84	6.167	2.90	12.167	2.55	18.17	1.21
0.250	0.86	6.250	3.15	12.250	2.47	18.25	1.19
0.333	0.86	6.333	3.15	12.333	2.47	18.33	1.19
0.417	0.88	6.417	3.46	12.417	2.39	18.42	1.17
0.500	0.88	6.500	3.46	12.500	2.39	18.50	1.17
0.583	0.89	6.583	3.85	12.583	2.32	18.58	1.16
0.667	0.89	6.667	3.85	12.667	2.32	18.67	1.16
0.750	0.91	6.750	4.34	12.750	2.25	18.75	1.14
0.833	0.91	6.833	4.34	12.833	2.25	18.83	1.14
0.917	0.93	6.917	5.00	12.917	2.19	18.92	1.13
1.000	0.93	7.000	5.00	13.000	2.19	19.00	1.13
1.083	0.95	7.083	5.92	13.083	2.13	19.08	1.11
1.167	0.95	7.167	5.92	13.167	2.13	19.17	1.11
1.250	0.97	7.250	7.33	13.250	2.07	19.25	1.10
1.333	0.97	7.333	7.33	13.333	2.07	19.33	1.10
1.417	0.99	7.417	9.77	13.417	2.02	19.42	1.09
1.500	0.99	7.500	9.77	13.500	2.02	19.50	1.09
1.583	1.01	7.583	15.10	13.583	1.97	19.58	1.07
1.667	1.01	7.667	15.11	13.667	1.97	19.67	1.07
1.750	1.03	7.750	38.21	13.750	1.92	19.75	1.06
1.833	1.03	7.833	38.22	13.833	1.92	19.83	1.06
1.917	1.05	7.917	203.31	13.917	1.87	19.92	1.05
2.000	1.05	8.000	203.30	14.000	1.87	20.00	1.05
2.083	1.08	8.083	50.96	14.083	1.83	20.08	1.04
2.167	1.08	8.167	50.96	14.167	1.83	20.17	1.04
2.250	1.11	8.250	25.51	14.250	1.79	20.25	1.03
2.333	1.11	8.333	25.51	14.333	1.79	20.33	1.03
2.417	1.13	8.417	17.18	14.417	1.75	20.42	1.01
2.500	1.13	8.500	17.18	14.500	1.75	20.50	1.01
2.583	1.16	8.583	13.06	14.583	1.72	20.58	1.00
2.667	1.16	8.667	13.06	14.667	1.72	20.67	1.00
2.750	1.20	8.750	10.60	14.750	1.68	20.75	0.99
2.833	1.20	8.833	10.60	14.833	1.68	20.83	0.99
2.917	1.23	8.917	8.96	14.917	1.65	20.92	0.98
3.000	1.23	9.000	8.96	15.000	1.65	21.00	0.98
3.083	1.26	9.083	7.78	15.083	1.61	21.08	0.97
3.167	1.26	9.167	7.78	15.167	1.61	21.17	0.97
3.250	1.30	9.250	6.90	15.250	1.58	21.25	0.96
3.333	1.30	9.333	6.90	15.333	1.58	21.33	0.96
3.417	1.34	9.417	6.21	15.417	1.55	21.42	0.95
3.500	1.34	9.500	6.21	15.500	1.55	21.50	0.95
3.583	1.39	9.583	5.65	15.583	1.53	21.58	0.94
3.667	1.39	9.667	5.65	15.667	1.53	21.67	0.94
3.750	1.43	9.750	5.19	15.750	1.50	21.75	0.93
3.833	1.43	9.833	5.19	15.833	1.50	21.83	0.93
3.917	1.48	9.917	4.81	15.917	1.47	21.92	0.92
4.000	1.48	10.000	4.81	16.000	1.47	22.00	0.92
4.083	1.54	10.083	4.48	16.083	1.45	22.08	0.91
4.167	1.54	10.167	4.48	16.167	1.45	22.17	0.91
4.250	1.60	10.250	4.20	16.250	1.42	22.25	0.91
4.333	1.60	10.333	4.20	16.333	1.42	22.33	0.91
4.417	1.66	10.417	3.96	16.417	1.40	22.42	0.90
4.500	1.66	10.500	3.96	16.500	1.40	22.50	0.90
4.583	1.73	10.583	3.74	16.583	1.38	22.58	0.89
4.667	1.73	10.667	3.74	16.667	1.38	22.67	0.89
4.750	1.81	10.750	3.55	16.750	1.36	22.75	0.88
4.833	1.81	10.833	3.55	16.833	1.36	22.83	0.88
4.917	1.89	10.917	3.38	16.917	1.33	22.92	0.87
5.000	1.89	11.000	3.38	17.000	1.33	23.00	0.87
5.083	1.99	11.083	3.23	17.083	1.31	23.08	0.86
5.167	1.99	11.167	3.23	17.167	1.31	23.17	0.86
5.250	2.10	11.250	3.09	17.250	1.29	23.25	0.86
5.333	2.10	11.333	3.09	17.333	1.29	23.33	0.86
5.417	2.22	11.417	2.96	17.417	1.28	23.42	0.85
5.500	2.22	11.500	2.96	17.500	1.28	23.50	0.85

5.583	2.35	11.583	2.85	17.583	1.26	23.58	0.84
5.667	2.35	11.667	2.85	17.667	1.26	23.67	0.84
5.750	2.51	11.750	2.74	17.750	1.24	23.75	0.83
5.833	2.51	11.833	2.74	17.833	1.24	23.83	0.83
5.917	2.69	11.917	2.64	17.917	1.22	23.92	0.83
6.000	2.69	12.000	2.64	18.000	1.22	24.00	0.83

Unit Hyd Qpeak (cms)= 1.091

PEAK FLOW (cms)= 0.584 (i)
TIME TO PEAK (hrs)= 8.083
RUNOFF VOLUME (mm)= 44.705
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.410

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

CALIB NASHYD (0082) ID= 1 DT= 5.0 min	Area (ha)= 25.82	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.31	

Unit Hyd Qpeak (cms)= 3.181

PEAK FLOW (cms)= 2.159 (i)
TIME TO PEAK (hrs)= 8.250
RUNOFF VOLUME (mm)= 44.892
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

SHIFT HYD (0083)
IN= 2---> OUT= 1
SHIFT= 48.6 min

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID= 2 (0082):	25.82	2.16	8.25	44.89
SHIFT ID= 1 (0083):	25.82	2.16	9.00	44.89

CALIB NASHYD (0080) ID= 1 DT= 5.0 min	Area (ha)= 12.25	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.19	

Unit Hyd Qpeak (cms)= 2.463

PEAK FLOW (cms)= 1.385 (i)
TIME TO PEAK (hrs)= 8.167
RUNOFF VOLUME (mm)= 44.803
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.411

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

SHIFT HYD (0081)
IN= 2---> OUT= 1
SHIFT= 69.0 min

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID= 2 (0080):	12.25	1.38	8.17	44.80
SHIFT ID= 1 (0081):	12.25	1.38	9.25	44.80

CALIB NASHYD (0084) ID= 1 DT= 5.0 min	Area (ha)= 12.70	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.09	

Unit Hyd Qpeak (cms)= 5.390

PEAK FLOW (cms)= 2.297 (i)
TIME TO PEAK (hrs)= 8.000
RUNOFF VOLUME (mm)= 43.212
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.397

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

SHIFT HYD (0085)		AREA	QPEAK	TPEAK	R.V.
IN= 2---> OUT= 1		(ha)	(cms)	(hrs)	(mm)
SHIFT= 13.3 min	ID= 2 (0084):	12.70	2.30	8.00	43.21
	SHIFT ID= 1 (0085):	12.70	2.30	8.17	43.21

CALIB NASHYD (0088) ID= 1 DT= 5.0 min				
	Area (ha)= 16.55	Curve Number (CN)= 65.0		
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.46			

Unit Hyd Qpeak (cms)= 1.374

PEAK FLOW (cms)= 1.048 (i)
TIME TO PEAK (hrs)= 8.500
RUNOFF VOLUME (mm)= 44.904
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

CALIB NASHYD (0086) ID= 1 DT= 5.0 min				
	Area (ha)= 17.89	Curve Number (CN)= 65.0		
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.23			

Unit Hyd Qpeak (cms)= 2.971

PEAK FLOW (cms)= 1.830 (i)
TIME TO PEAK (hrs)= 8.167
RUNOFF VOLUME (mm)= 44.858
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

SHIFT HYD (0087)		AREA	QPEAK	TPEAK	R.V.
IN= 2---> OUT= 1		(ha)	(cms)	(hrs)	(mm)
SHIFT= 12.9 min	ID= 2 (0086):	17.89	1.83	8.17	44.86
	SHIFT ID= 1 (0087):	17.89	1.83	8.33	44.86

ADD HYD (0089) 1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0081):	12.25	1.385	9.25	44.80
	+ ID2= 2 (0083):	25.82	2.159	9.00	44.89
	ID = 3 (0089):	38.07	3.352	9.17	44.86

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0089) 3 + 2 = 1		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0089):	38.07	3.352	9.17	44.86
	+ ID2= 2 (0085):	12.70	2.297	8.17	43.21
	ID = 1 (0089):	50.77	3.533	9.17	44.45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0089)

1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0089):	50.77	3.533	9.17	44.45
	+ ID2= 2 (0087):	17.89	1.830	8.33	44.86
	ID = 3 (0089):	68.66	3.894	9.17	44.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0089)						
3 + 2 = 1		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 3 (0089):	68.66	3.894	9.17	44.56
	+ ID2= 2 (0088):	16.55	1.048	8.50	44.90
	ID = 1 (0089):	85.21	4.420	9.17	44.62

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (0092) ID= 1 DT= 5.0 min					
	Area (ha)=	9.67	Curve Number (CN)=	65.0
	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	0.41		

Unit Hyd Qpeak (cms)= 0.901

PEAK FLOW (cms)= 0.667 (i)
TIME TO PEAK (hrs)= 8.417
RUNOFF VOLUME (mm)= 44.902
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

CALIB NASHYD (0090) ID= 1 DT= 5.0 min					
	Area (ha)=	14.48	Curve Number (CN)=	65.0
	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	0.35		

Unit Hyd Qpeak (cms)= 1.580

PEAK FLOW (cms)= 1.117 (i)
TIME TO PEAK (hrs)= 8.333
RUNOFF VOLUME (mm)= 44.898
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

SHIFT HYD (0091) IN= 2---> OUT= 1 SHIFT= 36.5 min		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID= 2 (0090):	14.48	1.12	8.33	44.90
	SHIFT ID= 1 (0091):	14.48	1.12	8.92	44.90

ADD HYD (0094)						
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0089):	85.21	4.420	9.17	44.62
	+ ID2= 2 (0091):	14.48	1.117	8.92	44.90
	ID = 3 (0094):	99.69	5.367	9.08	44.66

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0094)					
3 + 2 = 1		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)

```
          ID1= 3 (0094):    99.69   5.367     9.08    44.66
        + ID2= 2 (0092):     9.67   0.667     8.42    44.90
          ==========================================================
          ID = 1 (0094):   109.36   5.677     9.08    44.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0094) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (0094):   109.36   5.677     9.08    44.68
        + ID2= 2 (0093):     4.57   0.584     8.08    44.70
          ==========================================================
          ID = 3 (0094):   113.93   5.746     9.08    44.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0049) |   Area     (ha)=   8.69   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.17

     Unit Hyd Qpeak  (cms)=   1.952

     PEAK FLOW       (cms)=   1.068 (i)
     TIME TO PEAK    (hrs)=   8.083
     RUNOFF VOLUME    (mm)=  44.747
     TOTAL RAINFALL   (mm)= 108.977
     RUNOFF COEFFICIENT    =   0.411

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

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

  OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
 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
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
Output filename: C:\Users\david.mcnaull\AppData\Local\Temp\dc384e3a-b57e-49df-a661-0171b945bc2f\Scenario.
Summary filename: C:\Users\david.mcnaull\AppData\Local\Temp\dc384e3a-b57e-49df-a661-0171b945bc2f\Scenario.

DATE: 06/26/2019 TIME: 11:23:54

USER:

COMMENTS: Pre development - Summary Output - 2yr to 100yr

****
** SIMULATION NUMBER: 0 ** 2yr
****

W/E	COMMAND	HYD ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ 0.00 hrs								
	CHIC STORM		10.0						
	[Ptot= 29.37 mm]								
*									
**	CALIB NASHYD	0093 1	5.0	4.57	0.07	8.17	3.67	0.12	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.16]								
*									
**	CALIB NASHYD	0082 1	5.0	25.82	0.26	8.33	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.31]								
*									
	SHIFT [2 : 0082]	0083 1	5.0	25.82	0.26	9.08	3.68	n/a	0.000
	[SHIFT= 48.6 min]								
*									
**	CALIB NASHYD	0080 1	5.0	12.25	0.16	8.17	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.19]								
*									
	SHIFT [2 : 0080]	0081 1	5.0	12.25	0.16	9.25	3.68	n/a	0.000
	[SHIFT= 69.0 min]								
*									
**	CALIB NASHYD	0084 1	5.0	12.70	0.22	8.00	3.55	0.12	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.09]								
*									
	SHIFT [2 : 0084]	0085 1	5.0	12.70	0.22	8.17	3.55	n/a	0.000
	[SHIFT= 13.3 min]								
*									
**	CALIB NASHYD	0088 1	5.0	16.55	0.13	8.58	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.46]								
*									
**	CALIB NASHYD	0086 1	5.0	17.89	0.22	8.25	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.23]								
*									
	SHIFT [2 : 0086]	0087 1	5.0	17.89	0.22	8.42	3.68	n/a	0.000
	[SHIFT= 12.9 min]								
*									
	ADD [0081 + 0083]	0089 3	5.0	38.07	0.41	9.25	3.68	n/a	0.000
*									

	ADD [0089 + 0085]	0089	1	5.0	50.77	0.42	9.25	3.65	n/a	0.000
*										
	ADD [0089 + 0087]	0089	3	5.0	68.66	0.46	9.25	3.66	n/a	0.000
*										
	ADD [0089 + 0088]	0089	1	5.0	85.21	0.53	9.17	3.66	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.41]	0092	1	5.0	9.67	0.08	8.50	3.68	0.13	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.35]	0090	1	5.0	14.48	0.14	8.42	3.68	0.13	0.000
*										
	SHIFT [2 : 0090] [SHIFT= 36.5 min]	0091	1	5.0	14.48	0.14	9.00	3.68	n/a	0.000
*										
	ADD [0089 + 0091]	0094	3	5.0	99.69	0.66	9.17	3.67	n/a	0.000
*										
	ADD [0094 + 0092]	0094	1	5.0	109.36	0.70	9.17	3.67	n/a	0.000
*										
	ADD [0094 + 0093]	0094	3	5.0	113.93	0.70	9.17	3.67	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.17]	0049	1	5.0	8.69	0.12	8.17	3.67	0.13	0.000
*										

****
** SIMULATION NUMBER: 0 ** 54
****

W/E	COMMAND	HYD ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ 0.00 hrs								

	CHIC STORM [Ptot= 40.62 mm]		10.0						
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.16]	0093	1 5.0	4.57	0.13	8.17	7.33	0.18	0.000
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.31]	0082	1 5.0	25.82	0.50	8.33	7.36	0.18	0.000
*									
	SHIFT [2 : 0082] [SHIFT= 48.6 min]	0083	1 5.0	25.82	0.50	9.08	7.36	n/a	0.000
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.19]	0080	1 5.0	12.25	0.31	8.17	7.34	0.18	0.000
*									
	SHIFT [2 : 0080] [SHIFT= 69.0 min]	0081	1 5.0	12.25	0.31	9.25	7.34	n/a	0.000
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.09]	0084	1 5.0	12.70	0.42	8.00	7.08	0.17	0.000
*									
	SHIFT [2 : 0084] [SHIFT= 13.3 min]	0085	1 5.0	12.70	0.42	8.17	7.08	n/a	0.000
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.46]	0088	1 5.0	16.55	0.25	8.58	7.36	0.18	0.000
*									
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.23]	0086	1 5.0	17.89	0.41	8.25	7.35	0.18	0.000
*									
	SHIFT [2 : 0086] [SHIFT= 12.9 min]	0087	1 5.0	17.89	0.41	8.42	7.35	n/a	0.000
*									
	ADD [0081 + 0083]	0089	3 5.0	38.07	0.77	9.25	7.35	n/a	0.000
*									
	ADD [0089 + 0085]	0089	1 5.0	50.77	0.81	9.25	7.28	n/a	0.000
*									
	ADD [0089 + 0087]	0089	3 5.0	68.66	0.90	9.17	7.30	n/a	0.000
*									
	ADD [0089 + 0088]	0089	1 5.0	85.21	1.04	9.17	7.31	n/a	0.000
*									
**	CALIB NASHYD	0092	1 5.0	9.67	0.16	8.50	7.36	0.18	0.000

```
        [CN=65.0          ]
        [ N = 3.0:Tp 0.41]
  *
    **  CALIB NASHYD       0090  1  5.0   14.48    0.26  8.42   7.36 0.18   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.35]
  *
        SHIFT  [ 2 : 0090] 0091  1  5.0   14.48    0.26  9.00   7.36  n/a   0.000
        [SHIFT= 36.5 min]
  *
        ADD [0089 + 0091]  0094  3  5.0   99.69    1.28  9.17   7.32  n/a   0.000
  *
        ADD [0094 + 0092]  0094  1  5.0  109.36    1.35  9.17   7.32  n/a   0.000
  *
        ADD [0094 + 0093]  0094  3  5.0  113.93    1.36  9.17   7.32  n/a   0.000
  *
    **  CALIB NASHYD       0049  1  5.0    8.69    0.23  8.17   7.33 0.18   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.17]
  *
    ****************************
    ** SIMULATION NUMBER:   9 **
    ****************************

   W/E COMMAND                HYD ID   DT     AREA     Qpeak  Tpeak   R.V.  R.C.   Qbase
                                       min     ha       cms    hrs     mm             cms

        START @  0.00 hrs
        --------------------
        CHIC STORM                     10.0
        [ Ptot= 46.47 mm ]
  *
    **  CALIB NASHYD       0093  1  5.0    4.57    0.17  8.17   9.60 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.16]
  *
    **  CALIB NASHYD       0082  1  5.0   25.82    0.66  8.33   9.64 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.31]
  *
        SHIFT  [ 2 : 0082] 0083  1  5.0   25.82    0.66  9.08   9.64  n/a   0.000
        [SHIFT= 48.6 min]
  *
    **  CALIB NASHYD       0080  1  5.0   12.25    0.41  8.17   9.62 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.19]
  *
        SHIFT  [ 2 : 0080] 0081  1  5.0   12.25    0.41  9.25   9.62  n/a   0.000
        [SHIFT= 69.0 min]
  *
    **  CALIB NASHYD       0084  1  5.0   12.70    0.56  8.00   9.28 0.20   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.09]
  *
        SHIFT  [ 2 : 0084] 0085  1  5.0   12.70    0.56  8.17   9.28  n/a   0.000
        [SHIFT= 13.3 min]
  *
    **  CALIB NASHYD       0088  1  5.0   16.55    0.33  8.58   9.65 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.46]
  *
    **  CALIB NASHYD       0086  1  5.0   17.89    0.55  8.25   9.64 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.23]
  *
        SHIFT  [ 2 : 0086] 0087  1  5.0   17.89    0.55  8.42   9.64  n/a   0.000
        [SHIFT= 12.9 min]
  *
        ADD [0081 + 0083]  0089  3  5.0   38.07    1.02  9.25   9.64  n/a   0.000
  *
        ADD [0089 + 0085]  0089  1  5.0   50.77    1.07  9.25   9.55  n/a   0.000
  *
        ADD [0089 + 0087]  0089  3  5.0   68.66    1.18  9.17   9.57  n/a   0.000
  *
        ADD [0089 + 0088]  0089  1  5.0   85.21    1.37  9.17   9.59  n/a   0.000
  *
    **  CALIB NASHYD       0092  1  5.0    9.67    0.21  8.50   9.65 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.41]
  *
    **  CALIB NASHYD       0090  1  5.0   14.48    0.35  8.42   9.65 0.21   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.35]
  *
```

	SHIFT [2 : 0090]	0091	1	5.0	14.48	0.35	9.00	9.65	n/a	0.000
	[SHIFT= 36.5 min]									
*										
	ADD [0089 + 0091]	0094	3	5.0	99.69	1.68	9.17	9.60	n/a	0.000
*										
	ADD [0094 + 0092]	0094	1	5.0	109.36	1.78	9.17	9.60	n/a	0.000
*										
	ADD [0094 + 0093]	0094	3	5.0	113.93	1.80	9.17	9.60	n/a	0.000
*										
**	CALIB NASHYD	0049	1	5.0	8.69	0.31	8.17	9.61	0.21	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.17]									
*										

****
** SIMULATION NUMBER: 0 ** 254
****

W/E	COMMAND	HYD ID		DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ 0.00 hrs									

	CHIC STORM			10.0						
	[Ptot= 63.97 mm]									
*										
**	CALIB NASHYD	0093	1	5.0	4.57	0.30	8.17	17.68	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.16]									
*										
**	CALIB NASHYD	0082	1	5.0	25.82	1.19	8.33	17.76	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.31]									
*										
	SHIFT [2 : 0082]	0083	1	5.0	25.82	1.19	9.08	17.76	n/a	0.000
	[SHIFT= 48.6 min]									
*										
**	CALIB NASHYD	0080	1	5.0	12.25	0.73	8.17	17.72	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.19]									
*										
	SHIFT [2 : 0080]	0081	1	5.0	12.25	0.73	9.25	17.72	n/a	0.000
	[SHIFT= 69.0 min]									
*										
**	CALIB NASHYD	0084	1	5.0	12.70	1.01	8.00	17.09	0.27	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.09]									
*										
	SHIFT [2 : 0084]	0085	1	5.0	12.70	1.01	8.17	17.09	n/a	0.000
	[SHIFT= 13.3 min]									
*										
**	CALIB NASHYD	0088	1	5.0	16.55	0.60	8.58	17.76	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.46]									
*										
**	CALIB NASHYD	0086	1	5.0	17.89	0.98	8.25	17.74	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.23]									
*										
	SHIFT [2 : 0086]	0087	1	5.0	17.89	0.98	8.42	17.74	n/a	0.000
	[SHIFT= 12.9 min]									
*										
	ADD [0081 + 0083]	0089	3	5.0	38.07	1.84	9.25	17.75	n/a	0.000
*										
	ADD [0089 + 0085]	0089	1	5.0	50.77	1.92	9.25	17.58	n/a	0.000
*										
	ADD [0089 + 0087]	0089	3	5.0	68.66	2.15	9.17	17.63	n/a	0.000
*										
	ADD [0089 + 0088]	0089	1	5.0	85.21	2.48	9.17	17.65	n/a	0.000
*										
**	CALIB NASHYD	0092	1	5.0	9.67	0.38	8.50	17.76	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.41]									
*										
**	CALIB NASHYD	0090	1	5.0	14.48	0.62	8.42	17.76	0.28	0.000
	[CN=65.0]									
	[N = 3.0:Tp 0.35]									
*										
	SHIFT [2 : 0090]	0091	1	5.0	14.48	0.62	9.00	17.76	n/a	0.000
	[SHIFT= 36.5 min]									
	ADD [0089 + 0091]	0094	3	5.0	99.69	3.05	9.17	17.67	n/a	0.000
	ADD [0094 + 0092]	0094	1	5.0	109.36	3.23	9.17	17.68	n/a	0.000

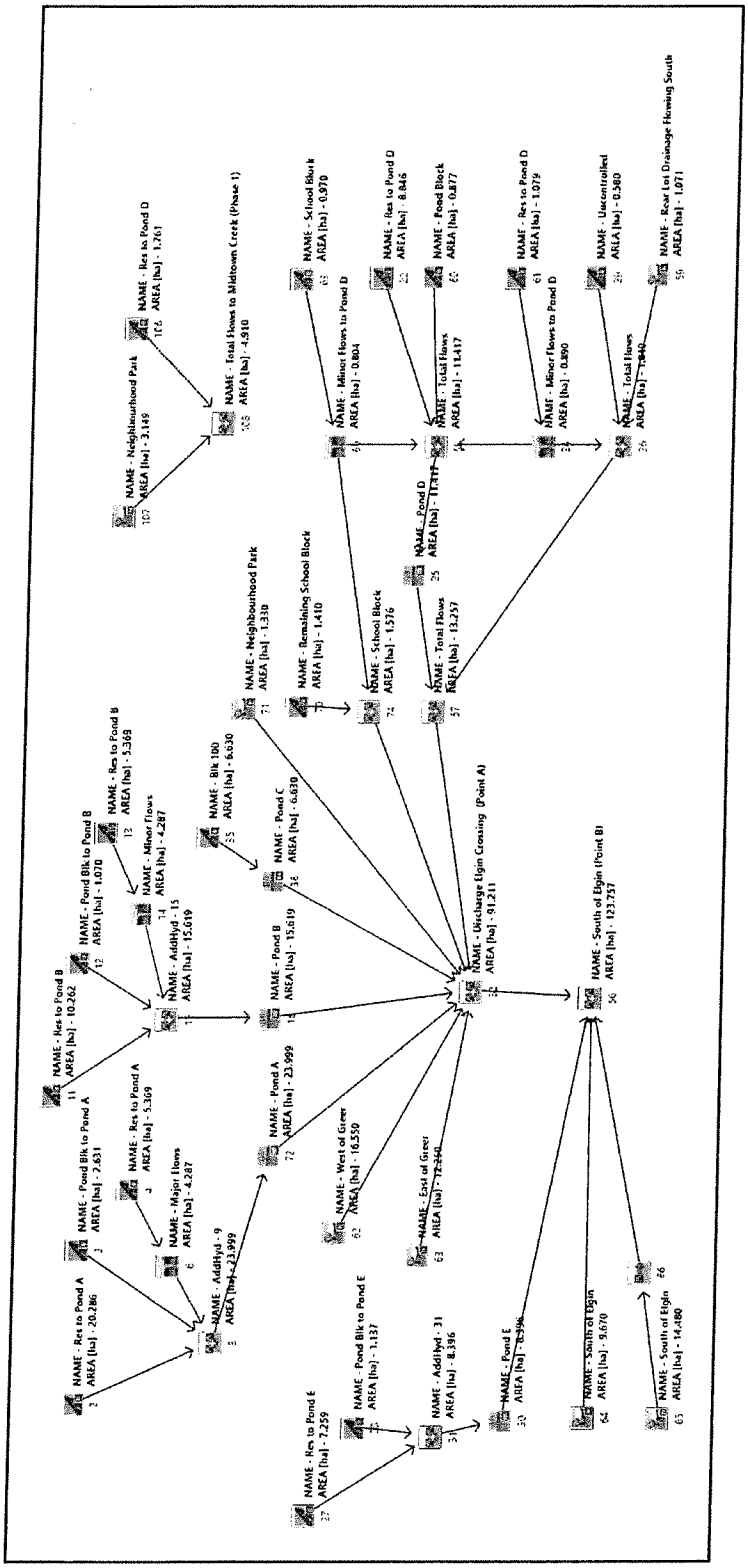
```
      ADD [0094 + 0093]  0094  3  5.0  113.93    3.26  9.17  17.68  n/a   0.000
*
   **  CALIB NASHYD       0049  1  5.0    8.69    0.55  8.17  17.70 0.28   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.17]
*
   ****************************
   ** SIMULATION NUMBER:   0 **  50yr
   ****************************

   W/E COMMAND              HYD ID   DT     AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                     min     ha      cms   hrs     mm          cms

       START @  0.00 hrs
       --------------------
       CHIC STORM                   10.0
       [ Ptot= 77.87 mm ]
*
   **  CALIB NASHYD       0093  1  5.0    4.57    0.37  8.17  25.21 0.32   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.16]
*
   **  CALIB NASHYD       0082  1  5.0   25.82    1.53  8.33  25.32 0.33   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.31]
*
       SHIFT  [ 2 : 0082] 0083  1  5.0   25.82    1.53  9.08  25.32  n/a   0.000
       [SHIFT= 48.6 min]
*
   **  CALIB NASHYD       0080  1  5.0   12.25    0.92  8.17  25.27 0.32   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.19]
*
       SHIFT  [ 2 : 0080] 0081  1  5.0   12.25    0.92  9.25  25.27  n/a   0.000
       [SHIFT= 69.0 min]
*
   **  CALIB NASHYD       0084  1  5.0   12.70    1.20  8.00  24.37 0.31   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.09]
*
       SHIFT  [ 2 : 0084] 0085  1  5.0   12.70    1.20  8.17  24.37  n/a   0.000
       [SHIFT= 13.3 min]
*
   **  CALIB NASHYD       0088  1  5.0   16.55    0.78  8.58  25.33 0.33   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.46]
*
   **  CALIB NASHYD       0086  1  5.0   17.89    1.24  8.25  25.30 0.32   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.23]
*
       SHIFT  [ 2 : 0086] 0087  1  5.0   17.89    1.24  8.42  25.30  n/a   0.000
       [SHIFT= 12.9 min]
*
       ADD [0081 + 0083]  0089  3  5.0   38.07    2.37  9.25  25.30  n/a   0.000
*
       ADD [0089 + 0085]  0089  1  5.0   50.77    2.51  9.25  25.07  n/a   0.000
*
       ADD [0089 + 0087]  0089  3  5.0   68.66    2.84  9.17  25.13  n/a   0.000
*
       ADD [0089 + 0088]  0089  1  5.0   85.21    3.32  9.17  25.17  n/a   0.000
*
   **  CALIB NASHYD       0092  1  5.0    9.67    0.49  8.50  25.33 0.33   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.41]
*
   **  CALIB NASHYD       0090  1  5.0   14.48    0.81  8.42  25.32 0.33   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.35]
*
       SHIFT  [ 2 : 0090] 0091  1  5.0   14.48    0.81  9.00  25.32  n/a   0.000
       [SHIFT= 36.5 min]
*
       ADD [0089 + 0091]  0094  3  5.0   99.69    4.07  9.17  25.19  n/a   0.000
*
       ADD [0094 + 0092]  0094  1  5.0  109.36    4.33  9.17  25.20  n/a   0.000
*
       ADD [0094 + 0093]  0094  3  5.0  113.93    4.38  9.17  25.20  n/a   0.000
*
   **  CALIB NASHYD       0049  1  5.0    8.69    0.69  8.17  25.24 0.32   0.000
       [CN=65.0         ]
       [ N = 3.0:Tp 0.17]
*
   ****************************
```

** SIMULATION NUMBER: 0 ** 100yr
****

W/E	COMMAND	HYD	ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ 0.00 hrs									
	CHIC STORM [Ptot=108.98 mm]			10.0						
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.16]	0093	1	5.0	4.57	0.58	8.08	44.70	0.41	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.31]	0082	1	5.0	25.82	2.16	8.25	44.89	0.41	0.000
*										
	SHIFT [2 : 0082] [SHIFT= 48.6 min]	0083	1	5.0	25.82	2.16	9.00	44.89	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.19]	0080	1	5.0	12.25	1.38	8.17	44.80	0.41	0.000
*										
	SHIFT [2 : 0080] [SHIFT= 69.0 min]	0081	1	5.0	12.25	1.38	9.25	44.80	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.09]	0084	1	5.0	12.70	2.30	8.00	43.21	0.40	0.000
*										
	SHIFT [2 : 0084] [SHIFT= 13.3 min]	0085	1	5.0	12.70	2.30	8.17	43.21	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.46]	0088	1	5.0	16.55	1.05	8.50	44.90	0.41	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.23]	0086	1	5.0	17.89	1.83	8.17	44.86	0.41	0.000
*										
	SHIFT [2 : 0086] [SHIFT= 12.9 min]	0087	1	5.0	17.89	1.83	8.33	44.86	n/a	0.000
*										
	ADD [0081 + 0083]	0089	3	5.0	38.07	3.35	9.17	44.86	n/a	0.000
*										
	ADD [0089 + 0085]	0089	1	5.0	50.77	3.53	9.17	44.45	n/a	0.000
*										
	ADD [0089 + 0087]	0089	3	5.0	68.66	3.89	9.17	44.56	n/a	0.000
*										
	ADD [0089 + 0088]	0089	1	5.0	85.21	4.42	9.17	44.62	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.41]	0092	1	5.0	9.67	0.67	8.42	44.90	0.41	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.35]	0090	1	5.0	14.48	1.12	8.33	44.90	0.41	0.000
*										
	SHIFT [2 : 0090] [SHIFT= 36.5 min]	0091	1	5.0	14.48	1.12	8.92	44.90	n/a	0.000
*										
	ADD [0089 + 0091]	0094	3	5.0	99.69	5.37	9.08	44.66	n/a	0.000
*										
	ADD [0094 + 0092]	0094	1	5.0	109.36	5.68	9.08	44.68	n/a	0.000
*										
	ADD [0094 + 0093]	0094	3	5.0	113.93	5.75	9.08	44.69	n/a	0.000
*										
**	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.17]	0049	1	5.0	8.69	1.07	8.08	44.75	0.41	0.000

FINISH

==========



POST–DEVELOPMENT DRAINAGE SCHEME
RONDEAU (COBURG) LTD.
VISUAL OTTHYMO SCHEME

D.G. Biddle & Associates Limited
consulting engineers and planners
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info@dgbiddle.com

SCALE	N.T.S.
DRAWN	D.D.M.
DESIGN	D.D.M.
CHECKED	M.B.C.
DATE	JUNE 2019

PROJECT 114057

DWG FIG 6

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

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
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
```


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

Input filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
Output filename: C:\Users\david.mcnaull\AppData\Local\Temp\664a0938-d51a-45a7-a0bb-2998a34ef4cd\Scenario.
Summary filename: C:\Users\david.mcnaull\AppData\Local\Temp\664a0938-d51a-45a7-a0bb-2998a34ef4cd\Scenario.

DATE: 06/26/2019 TIME: 11:28:04

USER:

COMMENTS: Part Development -100yr Detailed Output

****
** SIMULATION NUMBER: 0** 100 yr
****

| CHICAGO STORM |
| Ptotal=108.98 mm |

IDF curve parameters: A=1770.000
B= 4.000
C= 0.820
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.84	6.17	2.90	12.17	2.55	18.17	1.21
0.33	0.86	6.33	3.15	12.33	2.47	18.33	1.19
0.50	0.88	6.50	3.46	12.50	2.39	18.50	1.17
0.67	0.89	6.67	3.85	12.67	2.32	18.67	1.16
0.83	0.91	6.83	4.34	12.83	2.25	18.83	1.14
1.00	0.93	7.00	5.00	13.00	2.19	19.00	1.13
1.17	0.95	7.17	5.92	13.17	2.13	19.17	1.11
1.33	0.97	7.33	7.33	13.33	2.07	19.33	1.10
1.50	0.99	7.50	9.77	13.50	2.02	19.50	1.09
1.67	1.01	7.67	15.10	13.67	1.97	19.67	1.07
1.83	1.03	7.83	38.21	13.83	1.92	19.83	1.06
2.00	1.05	8.00	203.31	14.00	1.87	20.00	1.05
2.17	1.08	8.17	50.96	14.17	1.83	20.17	1.04
2.33	1.11	8.33	25.51	14.33	1.79	20.33	1.03
2.50	1.13	8.50	17.18	14.50	1.75	20.50	1.01
2.67	1.16	8.67	13.06	14.67	1.72	20.67	1.00
2.83	1.20	8.83	10.60	14.83	1.68	20.83	0.99
3.00	1.23	9.00	8.96	15.00	1.65	21.00	0.98
3.17	1.26	9.17	7.78	15.17	1.61	21.17	0.97
3.33	1.30	9.33	6.90	15.33	1.58	21.33	0.96
3.50	1.34	9.50	6.21	15.50	1.55	21.50	0.95
3.67	1.39	9.67	5.65	15.67	1.53	21.67	0.94
3.83	1.43	9.83	5.19	15.83	1.50	21.83	0.93
4.00	1.48	10.00	4.81	16.00	1.47	22.00	0.92
4.17	1.54	10.17	4.48	16.17	1.45	22.17	0.91
4.33	1.60	10.33	4.20	16.33	1.42	22.33	0.91
4.50	1.66	10.50	3.96	16.50	1.40	22.50	0.90
4.67	1.73	10.67	3.74	16.67	1.38	22.67	0.89
4.83	1.81	10.83	3.55	16.83	1.36	22.83	0.88
5.00	1.89	11.00	3.38	17.00	1.33	23.00	0.87
5.17	1.99	11.17	3.23	17.17	1.31	23.17	0.86
5.33	2.10	11.33	3.09	17.33	1.29	23.33	0.86
5.50	2.22	11.50	2.96	17.50	1.28	23.50	0.85

5.67	2.35	11.67	2.85	17.67	1.26	23.67	0.84
5.83	2.51	11.83	2.74	17.83	1.24	23.83	0.83
6.00	2.69	12.00	2.64	18.00	1.22	24.00	0.83

CALIB NASHYD (0062) ID= 1 DT= 5.0 min	Area (ha)= 16.55	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.46	

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	0.84	6.083	2.90	12.083	2.55	18.08	1.21
0.167	0.84	6.167	2.90	12.167	2.55	18.17	1.21
0.250	0.86	6.250	3.15	12.250	2.47	18.25	1.19
0.333	0.86	6.333	3.15	12.333	2.47	18.33	1.19
0.417	0.88	6.417	3.46	12.417	2.39	18.42	1.17
0.500	0.88	6.500	3.46	12.500	2.39	18.50	1.17
0.583	0.89	6.583	3.85	12.583	2.32	18.58	1.16
0.667	0.89	6.667	3.85	12.667	2.32	18.67	1.16
0.750	0.91	6.750	4.34	12.750	2.25	18.75	1.14
0.833	0.91	6.833	4.34	12.833	2.25	18.83	1.14
0.917	0.93	6.917	5.00	12.917	2.19	18.92	1.13
1.000	0.93	7.000	5.00	13.000	2.19	19.00	1.13
1.083	0.95	7.083	5.92	13.083	2.13	19.08	1.11
1.167	0.95	7.167	5.92	13.167	2.13	19.17	1.11
1.250	0.97	7.250	7.33	13.250	2.07	19.25	1.10
1.333	0.97	7.333	7.33	13.333	2.07	19.33	1.10
1.417	0.99	7.417	9.77	13.417	2.02	19.42	1.09
1.500	0.99	7.500	9.77	13.500	2.02	19.50	1.09
1.583	1.01	7.583	15.10	13.583	1.97	19.58	1.07
1.667	1.01	7.667	15.11	13.667	1.97	19.67	1.07
1.750	1.03	7.750	38.21	13.750	1.92	19.75	1.06
1.833	1.03	7.833	38.22	13.833	1.92	19.83	1.06
1.917	1.05	7.917	203.31	13.917	1.87	19.92	1.05
2.000	1.05	8.000	203.30	14.000	1.87	20.00	1.05
2.083	1.08	8.083	50.96	14.083	1.83	20.08	1.04
2.167	1.08	8.167	50.96	14.167	1.83	20.17	1.04
2.250	1.11	8.250	25.51	14.250	1.79	20.25	1.03
2.333	1.11	8.333	25.51	14.333	1.79	20.33	1.03
2.417	1.13	8.417	17.18	14.417	1.75	20.42	1.01
2.500	1.13	8.500	17.18	14.500	1.75	20.50	1.01
2.583	1.16	8.583	13.06	14.583	1.72	20.58	1.00
2.667	1.16	8.667	13.06	14.667	1.72	20.67	1.00
2.750	1.20	8.750	10.60	14.750	1.68	20.75	0.99
2.833	1.20	8.833	10.60	14.833	1.68	20.83	0.99
2.917	1.23	8.917	8.96	14.917	1.65	20.92	0.98
3.000	1.23	9.000	8.96	15.000	1.65	21.00	0.98
3.083	1.26	9.083	7.78	15.083	1.61	21.08	0.97
3.167	1.26	9.167	7.78	15.167	1.61	21.17	0.97
3.250	1.30	9.250	6.90	15.250	1.58	21.25	0.96
3.333	1.30	9.333	6.90	15.333	1.58	21.33	0.96
3.417	1.34	9.417	6.21	15.417	1.55	21.42	0.95
3.500	1.34	9.500	6.21	15.500	1.55	21.50	0.95
3.583	1.39	9.583	5.65	15.583	1.53	21.58	0.94
3.667	1.39	9.667	5.65	15.667	1.53	21.67	0.94
3.750	1.43	9.750	5.19	15.750	1.50	21.75	0.93
3.833	1.43	9.833	5.19	15.833	1.50	21.83	0.93
3.917	1.48	9.917	4.81	15.917	1.47	21.92	0.92
4.000	1.48	10.000	4.81	16.000	1.47	22.00	0.92
4.083	1.54	10.083	4.48	16.083	1.45	22.08	0.91
4.167	1.54	10.167	4.48	16.167	1.45	22.17	0.91
4.250	1.60	10.250	4.20	16.250	1.42	22.25	0.91
4.333	1.60	10.333	4.20	16.333	1.42	22.33	0.91
4.417	1.66	10.417	3.96	16.417	1.40	22.42	0.90
4.500	1.66	10.500	3.96	16.500	1.40	22.50	0.90
4.583	1.73	10.583	3.74	16.583	1.38	22.58	0.89
4.667	1.73	10.667	3.74	16.667	1.38	22.67	0.89
4.750	1.81	10.750	3.55	16.750	1.36	22.75	0.88
4.833	1.81	10.833	3.55	16.833	1.36	22.83	0.88
4.917	1.89	10.917	3.38	16.917	1.33	22.92	0.87
5.000	1.89	11.000	3.38	17.000	1.33	23.00	0.87
5.083	1.99	11.083	3.23	17.083	1.31	23.08	0.86
5.167	1.99	11.167	3.23	17.167	1.31	23.17	0.86
5.250	2.10	11.250	3.09	17.250	1.29	23.25	0.86
5.333	2.10	11.333	3.09	17.333	1.29	23.33	0.86
5.417	2.22	11.417	2.96	17.417	1.28	23.42	0.85
5.500	2.22	11.500	2.96	17.500	1.28	23.50	0.85

5.583	2.35	11.583	2.85	17.583	1.26	23.58	0.84
5.667	2.35	11.667	2.85	17.667	1.26	23.67	0.84
5.750	2.51	11.750	2.74	17.750	1.24	23.75	0.83
5.833	2.51	11.833	2.74	17.833	1.24	23.83	0.83
5.917	2.69	11.917	2.64	17.917	1.22	23.92	0.83
6.000	2.69	12.000	2.64	18.000	1.22	24.00	0.83

Unit Hyd Qpeak (cms)= 1.374

PEAK FLOW (cms)= 1.048 (i)
TIME TO PEAK (hrs)= 8.500
RUNOFF VOLUME (mm)= 44.904
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

CALIB NASHYD (0063) ID= 1 DT= 5.0 min	Area (ha)= 12.25	Curve Number (CN)= 65.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.19	

Unit Hyd Qpeak (cms)= 2.463

PEAK FLOW (cms)= 1.385 (i)
TIME TO PEAK (hrs)= 8.167
RUNOFF VOLUME (mm)= 44.803
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.411

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

CALIB NASHYD (0059) ID= 1 DT= 5.0 min	Area (ha)= 1.07	Curve Number (CN)= 85.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.18	

Unit Hyd Qpeak (cms)= 0.227

PEAK FLOW (cms)= 0.231 (i)
TIME TO PEAK (hrs)= 8.083
RUNOFF VOLUME (mm)= 72.448
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.665

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

CALIB STANDHYD (0029) ID= 1 DT= 5.0 min	Area (ha)= 0.58	Total Imp(%)= 65.00	Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.38	0.20	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	5.00	2.00	
Length	(m)=	62.18	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	NaN	
over (min)		5.00	10.00	
Storage Coeff. (min)=		0.89 (ii)	5.33 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.34	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.18	0.09	0.263 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

Rear Lot Drainage

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Residential to Pond D

CALIB STANDHYD (0061) ID= 1 DT= 5.0 min	Area (ha)= 1.08 Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00			
		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.70	0.38	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	5.00	2.00	
Length	(m)=	84.81	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	202.15	
over (min)		5.00	10.00	
Storage Coeff.	(min)=	1.08 (ii)	5.51 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.34	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.34	0.16	0.487 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Residential to Pond D

DUHYD (0024) Inlet Cap.=0.177 #of Inlets= 1 Total(cms)= 0.2	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	1.08	0.49	8.00	95.88
MAJOR SYS.(ID= 2):	0.19	0.31	8.00	95.88
MINOR SYS.(ID= 3):	0.89	0.18	7.92	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0026) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0024):	0.19	0.310	8.00	95.88
+ ID2= 2 (0029):	0.58	0.263	8.00	95.88
ID = 3 (0026):	0.77	0.572	8.00	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0026) 3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0026):	0.77	0.572	8.00	95.88
+ ID2= 2 (0059):	1.07	0.231	8.08	72.45
ID = 1 (0026):	1.84	0.761	8.00	82.24

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0022) ID= 1 DT= 5.0 min	Area (ha)= 8.85 Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00		
		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.75	3.10
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	3.00	2.00
Length	(m)=	242.84	40.00

Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		203.31	202.15
over (min)		5.00	10.00
Storage Coeff. (min)=		2.36 (ii)	6.79 (ii)
Unit Hyd. Tpeak (min)=		5.00	10.00
Unit Hyd. peak (cms)=		0.30	0.14

				TOTALS
PEAK FLOW	(cms)=	2.72	1.23	3.852 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0060)
ID= 1 DT= 5.0 min

Area (ha)= 0.88
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

Pond Block

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.61	0.26
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	76.46	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		203.31	143.97
over (min)		5.00	10.00
Storage Coeff. (min)=		1.64 (ii)	5.42 (ii)
Unit Hyd. Tpeak (min)=		5.00	10.00
Unit Hyd. peak (cms)=		0.32	0.16

				TOTALS
PEAK FLOW	(cms)=	0.35	0.08	0.421 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	75.39	98.20
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.69	0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0068)
ID= 1 DT= 5.0 min

Area (ha)= 0.97
Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

School Block

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.78	0.19
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	3.00	2.00
Length	(m)=	80.42	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		203.31	143.97
over (min)		5.00	5.00
Storage Coeff. (min)=		1.21 (ii)	4.27 (ii)
Unit Hyd. Tpeak (min)=		5.00	5.00
Unit Hyd. peak (cms)=		0.33	0.23

				TOTALS
PEAK FLOW	(cms)=	0.44	0.07	0.512 (iii)
TIME TO PEAK	(hrs)=	8.00	8.00	8.00
RUNOFF VOLUME	(mm)=	107.98	75.39	101.46
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.69	0.93

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0069)
Inlet Cap.=0.218
#of Inlets= 1
Total(cms)= 0.2

School Block
Maj / Min
Split

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.97	0.51	8.00	101.46
MAJOR SYS.(ID= 2):	0.17	0.29	8.00	101.46
MINOR SYS.(ID= 3):	0.80	0.22	7.92	101.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0022):	8.85	3.852	8.00	95.88
+ ID2= 2 (0024):	0.89	0.177	7.92	95.88
ID = 3 (0058):	9.74	4.029	8.00	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0058):	9.74	4.029	8.00	95.88
+ ID2= 2 (0060):	0.88	0.421	8.00	98.20
ID = 1 (0058):	10.61	4.450	8.00	96.07

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0058):	10.61	4.450	8.00	96.07
+ ID2= 2 (0069):	0.80	0.218	7.92	101.46
ID = 3 (0058):	11.42	4.668	8.00	96.45

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0025)
IN= 2---> OUT= 1
DT= 5.0 min

Pond D

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0287	0.2221
0.0110	0.0000	0.5019	0.3187
0.0188	0.0632	0.5430	0.4273
0.0243	0.1371	0.5811	0.5484

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0058)	11.417	4.668	8.00	96.45
OUTFLOW: ID= 1 (0025)	11.417	0.579	8.50	96.46

PEAK FLOW REDUCTION [Qout/Qin](%)= 12.41
TIME SHIFT OF PEAK FLOW (min)= 30.00
MAXIMUM STORAGE USED (ha.m.)= 0.5437

ADD HYD (0057)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0025):	11.42	0.579	8.50	96.46

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          + ID2= 2 (0026):     1.84   0.761     8.00     82.24
            ==============================================
            ID = 3 (0057):    13.26   1.269     8.00     94.49

       NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

  ------------------------------------------------------------------------------
  --------------------
  | CALIB            |
  | NASHYD    (0071) |   Area     (ha)=   1.33   Curve Number    (CN)= 65.0
  |ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
  --------------------   U.H. Tp(hrs)=   0.17

       Unit Hyd Qpeak  (cms)=   0.299

       PEAK FLOW       (cms)=   0.163 (i)
       TIME TO PEAK    (hrs)=   8.083
       RUNOFF VOLUME    (mm)=  44.747
       TOTAL RAINFALL   (mm)= 108.977
       RUNOFF COEFFICIENT   =   0.411

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

  ------------------------------------------------------------------------------
  --------------------
  | CALIB            |
  | STANDHYD  (0002) |   Area     (ha)=  20.29
  |ID= 1 DT= 5.0 min |   Total Imp(%)=  65.00   Dir. Conn.(%)=  55.00
  --------------------

                             IMPERVIOUS    PERVIOUS (i)
       Surface Area     (ha)=     13.19          7.10
       Dep. Storage     (mm)=      1.00          2.00
       Average Slope     (%)=      1.00          2.00
       Length            (m)=    367.75         40.00
       Mannings n           =     0.013         0.250

       Max.Eff.Inten.(mm/hr)=    203.31           NaN
                 over (min)        5.00         10.00
       Storage Coeff.  (min)=      4.20 (ii)     8.64 (ii)
       Unit Hyd. Tpeak (min)=      5.00         10.00
       Unit Hyd. peak  (cms)=      0.24          0.12
                                                          *TOTALS*
       PEAK FLOW       (cms)=      5.82          2.60          8.138 (iii)
       TIME TO PEAK    (hrs)=      8.00          8.08           8.00
       RUNOFF VOLUME    (mm)=    107.98         81.10          95.88
       TOTAL RAINFALL   (mm)=    108.98        108.98         108.98
       RUNOFF COEFFICIENT   =      0.99          0.74           0.88

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

         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
               CN*  =  85.0     Ia = Dep. Storage  (Above)
        (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
             THAN THE STORAGE COEFFICIENT.
       (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

  ------------------------------------------------------------------------------
  --------------------
  | CALIB            |
  | STANDHYD  (0003) |   Area     (ha)=   2.63
  |ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
  --------------------

                             IMPERVIOUS    PERVIOUS (i)
       Surface Area     (ha)=      1.84          0.79
       Dep. Storage     (mm)=      1.00          2.00
       Average Slope     (%)=      1.00          2.00
       Length            (m)=    132.44         40.00
       Mannings n           =     0.013         0.250

       Max.Eff.Inten.(mm/hr)=    203.31           NaN
                 over (min)        5.00         10.00
       Storage Coeff.  (min)=      2.28 (ii)     6.06 (ii)
       Unit Hyd. Tpeak (min)=      5.00         10.00
       Unit Hyd. peak  (cms)=      0.30          0.15
                                                          *TOTALS*
       PEAK FLOW       (cms)=      1.03          0.23          1.245 (iii)
       TIME TO PEAK    (hrs)=      8.00          8.08           8.00
       RUNOFF VOLUME    (mm)=    107.98         75.39          98.20
       TOTAL RAINFALL   (mm)=    108.98        108.98         108.98
       RUNOFF COEFFICIENT   =      0.99          0.69           0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0004) ID= 1 DT= 5.0 min	Area (ha)= 5.37 Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.49	1.88	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	189.19	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	202.15	
over (min)		5.00	10.00	
Storage Coeff.	(min)=	2.82 (ii)	7.25 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.28	0.14	
				TOTALS
PEAK FLOW	(cms)=	1.63	0.73	2.297 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0006) Inlet Cap.=0.724 #of Inlets= 1 Total(cms)= 0.7	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	5.37	2.30	8.00	95.88
MAJOR SYS.(ID= 2):	1.08	1.57	8.00	95.88
MINOR SYS.(ID= 3):	4.29	0.72	7.92	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0008) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0002):	20.29	8.138	8.00	95.88
+ ID2= 2 (0003):	2.63	1.245	8.00	98.20
ID = 3 (0008):	22.92	9.382	8.00	96.15

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0008) 3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0008):	22.92	9.382	8.00	96.15
+ ID2= 2 (0006):	1.08	1.573	8.00	95.88
ID = 1 (0008):	24.00	10.955	8.00	96.14

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0072) IN= 2---> OUT= 1 DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)

0.0000	0.0000	0.1092	1.4110
0.0294	0.3280	0.1193	1.8005
0.0379	0.6747	0.1320	2.3703
0.0982	1.0358	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0008)	23.999	10.955	8.00	96.14
OUTFLOW: ID= 1 (0072)	23.999	0.119	13.83	95.19

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.08
TIME SHIFT OF PEAK FLOW (min)=350.00
MAXIMUM STORAGE USED (ha.m.)= 1.7708

CALIB STANDHYD (0011) ID= 1 DT= 5.0 min | Area (ha)= 10.26 Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	6.67	3.59	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	261.56	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	NaN	
over (min)		5.00	10.00	
Storage Coeff.	(min)=	3.42 (ii)	7.86 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.26	0.13	
				TOTALS
PEAK FLOW	(cms)=	3.05	1.36	4.276 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0012) ID= 1 DT= 5.0 min | Area (ha)= 1.07 Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.75	0.32	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	84.46	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	NaN	
over (min)		5.00	10.00	
Storage Coeff.	(min)=	1.74 (ii)	5.52 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.32	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.42	0.10	0.513 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	75.39	98.20
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.69	0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0013) | Area (ha)= 5.37

|ID= 1 DT= 5.0 min | Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.49	1.88	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	189.19	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	202.15	
over (min)		5.00	10.00	
Storage Coeff. (min)=		2.82 (ii)	7.25 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.28	0.14	
				TOTALS
PEAK FLOW	(cms)=	1.63	0.73	2.297 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0014)
Inlet Cap.=0.724
#of Inlets= 1
Total(cms)= 0.7

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	5.37	2.30	8.00	95.88
MAJOR SYS.(ID= 2):	1.08	1.57	8.00	95.88
MINOR SYS.(ID= 3):	4.29	0.72	7.92	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0015)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0011):	10.26	4.276	8.00	95.88
+ ID2= 2 (0012):	1.07	0.513	8.00	98.20
ID = 3 (0015):	11.33	4.789	8.00	96.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0015)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0015):	11.33	4.789	8.00	96.10
+ ID2= 2 (0014):	4.29	0.724	7.92	95.88
ID = 1 (0015):	15.62	5.513	8.00	96.04

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0016)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.1657	0.4612
0.0084	0.0680	0.1790	0.5805
0.0108	0.1541	0.1915	0.7082
0.0127	0.2482	0.2032	0.8444
0.1511	0.3505	0.2142	0.9890

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0015)	15.619	5.513	8.00	96.04

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OUTFLOW: ID= 1 (0016)     15.619      0.211     10.08      95.91

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.84
                  TIME SHIFT OF PEAK FLOW          (min)=125.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.9532

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| CALIB            |
| STANDHYD  (0035) |   Area    (ha)=   6.63
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------

                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.64          1.99
     Dep. Storage     (mm)=       1.00          2.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     210.24         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     203.31        143.97
               over (min)         5.00         10.00
     Storage Coeff.  (min)=       3.00 (ii)     6.79 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.28          0.14
                                                        *TOTALS*
     PEAK FLOW       (cms)=       2.54          0.56          3.059 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.08           8.00
     RUNOFF VOLUME    (mm)=     107.98         75.39          98.20
     TOTAL RAINFALL   (mm)=     108.98        108.98         108.98
     RUNOFF COEFFICIENT    =      0.99          0.69           0.90

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (0036) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000     |  0.0925      0.6716
                          0.0199     0.2020     |  0.1221      0.9409
                          0.0269     0.4256     |  0.1454      1.2343

                                AREA      QPEAK     TPEAK       R.V.
                                (ha)      (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0035)      6.630     3.059      8.00       98.20
     OUTFLOW: ID= 1 (0036)      6.630     0.043     12.42       97.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.41
                  TIME SHIFT OF PEAK FLOW          (min)=265.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.4863

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--------------------
| CALIB            |
| STANDHYD  (0070) |   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------

                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.13          0.28
     Dep. Storage     (mm)=       1.00          2.00
     Average Slope     (%)=       3.00          2.00
     Length            (m)=      96.95         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     203.31        143.97
               over (min)         5.00          5.00
     Storage Coeff.  (min)=       1.36 (ii)     4.41 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.23
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.64          0.11          0.744 (iii)
     TIME TO PEAK    (hrs)=       8.00          8.00           8.00
     RUNOFF VOLUME    (mm)=     107.98         75.39         101.46
     TOTAL RAINFALL   (mm)=     108.98        108.98         108.98
     RUNOFF COEFFICIENT    =      0.99          0.69           0.93

**** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
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(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0074)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0069):	0.17	0.294	8.00	101.46
	+ ID2= 2 (0070):	1.41	0.744	8.00	101.46
	ID = 3 (0074):	1.58	1.038	8.00	101.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0016):	15.62	0.211	10.08	95.91
	+ ID2= 2 (0036):	6.63	0.043	12.42	97.69
	ID = 3 (0032):	22.25	0.253	11.08	96.44

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0032):	22.25	0.253	11.08	96.44
	+ ID2= 2 (0057):	13.26	1.269	8.00	94.49
	ID = 1 (0032):	35.51	1.455	8.00	95.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0032):	35.51	1.455	8.00	95.71
	+ ID2= 2 (0062):	16.55	1.048	8.50	44.90
	ID = 3 (0032):	52.06	1.992	8.42	79.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0032):	52.06	1.992	8.42	79.56
	+ ID2= 2 (0063):	12.25	1.385	8.17	44.80
	ID = 1 (0032):	64.31	3.215	8.17	72.94

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0032):	64.31	3.215	8.17	72.94
	+ ID2= 2 (0071):	1.33	0.163	8.08	44.75
	ID = 3 (0032):	65.64	3.369	8.17	72.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0032):	65.64	3.369	8.17	72.37
	+ ID2= 2 (0072):	24.00	0.119	13.83	95.19
	ID = 1 (0032):	89.64	3.471	8.17	78.48

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0032)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0032):	89.64	3.471	8.17	78.48
	+ ID2= 2 (0074):	1.58	1.038	8.00	101.46
	ID = 3 (0032):	91.21	4.024	8.00	78.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (0064) ID= 1 DT= 5.0 min

Area (ha)= 9.67 Curve Number (CN)= 65.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.41

Unit Hyd Qpeak (cms)= 0.901

PEAK FLOW (cms)= 0.667 (i)
TIME TO PEAK (hrs)= 8.417
RUNOFF VOLUME (mm)= 44.902
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

CALIB NASHYD (0065) ID= 1 DT= 5.0 min

Area (ha)= 14.48 Curve Number (CN)= 65.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.35

Unit Hyd Qpeak (cms)= 1.580

PEAK FLOW (cms)= 1.117 (i)
TIME TO PEAK (hrs)= 8.333
RUNOFF VOLUME (mm)= 44.898
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.412

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

SHIFT HYD (0066) | IN= 2---> OUT= 1 | SHIFT= 36.5 min

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID= 2 (0065):	14.48	1.12	8.33	44.90
SHIFT ID= 1 (0066):	14.48	1.12	8.92	44.90

CALIB STANDHYD (0027) ID= 1 DT= 5.0 min

Area (ha)= 7.26
Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	4.72	2.54
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	219.98	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		203.31	202.15

over (min)		5.00	10.00	
Storage Coeff. (min)=		3.09 (ii)	7.52 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.27	0.13	
				TOTALS
PEAK FLOW	(cms)=	2.18	0.98	3.071 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0028)
ID= 1 DT= 5.0 min

Area (ha)= 1.14
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.80	0.34	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	87.06	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	143.97	
over (min)		5.00	10.00	
Storage Coeff. (min)=		1.77 (ii)	5.56 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.32	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.45	0.10	0.545 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	75.39	98.20
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.69	0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0031)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0027):	7.26	3.071	8.00	95.88
+ ID2= 2 (0028):	1.14	0.545	8.00	98.20
ID = 3 (0031):	8.40	3.616	8.00	96.20

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0030)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0665	0.3483
0.0131	0.0730	0.0724	0.4575
0.0168	0.1566	0.0778	0.5759
0.0600	0.2483	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0031)	8.396	3.616	8.00	96.20
OUTFLOW: ID= 1 (0030)	8.396	0.077	11.00	96.03

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.13
TIME SHIFT OF PEAK FLOW (min)=180.00
MAXIMUM STORAGE USED (ha.m.)= 0.5554

ADD HYD (0056)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0030):	8.40	0.077	11.00	96.03
	+ ID2= 2 (0032):	91.21	4.024	8.00	78.87
	ID = 3 (0056):	99.61	4.085	8.00	80.32

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0056)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0056):	99.61	4.085	8.00	80.32
	+ ID2= 2 (0064):	9.67	0.667	8.42	44.90
	ID = 1 (0056):	109.28	4.306	8.00	77.19

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0056)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0056):	109.28	4.306	8.00	77.19
	+ ID2= 2 (0066):	14.48	1.117	8.92	44.90
	ID = 3 (0056):	123.76	4.328	8.00	73.41

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0052) | ID= 1 DT= 5.0 min

Area (ha)= 0.75
Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.52	0.22	
Dep. Storage	(mm)=	1.00	1.50	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	70.57	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	144.70	
over (min)		5.00	10.00	
Storage Coeff. (min)=		1.56 (ii)	5.35 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.33	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.29	0.07	0.360 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	75.85	98.33
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.70	0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0051) | ID= 1 DT= 5.0 min

Area (ha)= 4.91
Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.19	1.72
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	180.92	40.00

Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)	=	203.31	202.79	
over (min)		5.00	10.00	
Storage Coeff. (min)	=	2.75 (ii)	7.18 (ii)	
Unit Hyd. Tpeak (min)	=	5.00	10.00	
Unit Hyd. peak (cms)	=	0.28	0.14	
				TOTALS
PEAK FLOW (cms)	=	1.49	0.67	2.110 (iii)
TIME TO PEAK (hrs)	=	8.00	8.08	8.00
RUNOFF VOLUME (mm)	=	107.98	81.47	96.05
TOTAL RAINFALL (mm)	=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.75	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0053)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0051):	4.91	2.110	8.00	96.05
+ ID2= 2 (0052):	0.75	0.360	8.00	98.33
ID = 3 (0053):	5.66	2.469	8.00	96.35

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0054)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.3017	0.1533
0.0074	0.0586	0.3166	0.2772

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0053)	5.657	2.469	8.00	96.35
OUTFLOW: ID= 1 (0054)	5.657	0.316	8.50	95.99

PEAK FLOW REDUCTION [Qout/Qin](%)= 12.79
TIME SHIFT OF PEAK FLOW (min)= 30.00
MAXIMUM STORAGE USED (ha.m.)= 0.2709

CALIB
NASHYD (0107)
ID= 1 DT= 5.0 min

Area (ha)= 3.15 Curve Number (CN)= 65.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.17

To Midtown Creek

Unit Hyd Qpeak (cms)= 0.708

PEAK FLOW (cms)= 0.387 (i)
TIME TO PEAK (hrs)= 8.083
RUNOFF VOLUME (mm)= 44.747
TOTAL RAINFALL (mm)= 108.977
RUNOFF COEFFICIENT = 0.411

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

CALIB
STANDHYD (0106)
ID= 1 DT= 5.0 min

Area (ha)= 1.76
Total Imp(%)= 25.00 Dir. Conn.(%)= 25.00

Midtown Creek

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.44	1.32
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	3.00	2.00
Length	(m)=	108.35	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)	=	203.31	80.28

over (min)		5.00	10.00	
Storage Coeff. (min)=		1.45 (ii)	9.16 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.33	0.12	
				TOTALS
PEAK FLOW	(cms)=	0.25	0.19	0.407 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	46.95	62.21
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.43	0.57

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 65.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0108)
1 + 2 = 3

To Mid town Creek

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0106):	1.76	0.407	8.00	62.21
+ ID2= 2 (0107):	3.15	0.387	8.08	44.75
ID = 3 (0108):	4.91	0.720	8.00	51.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

==========

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

  OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
 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
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
Output filename: C:\Users\david.mcnaull\AppData\Local\Temp\5194bec8-9a38-4e86-b9d7-6e908d3978f8\Scenario.
Summary filename: C:\Users\david.mcnaull\AppData\Local\Temp\5194bec8-9a38-4e86-b9d7-6e908d3978f8\Scenario.

DATE: 06/26/2019 TIME: 11:28:30

USER:

COMMENTS: Post-Development - 2yr - 100yr 0 Summary Output

****
** SIMULATION NUMBER: 0 ** 2yr
****

W/E	COMMAND	HYD ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ 0.00 hrs								
	CHIC STORM		10.0						
	[Ptot= 29.37 mm]								
*									
**	CALIB NASHYD	0062	1 5.0	16.55	0.13	8.58	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.46]								
*									
**	CALIB NASHYD	0063	1 5.0	12.25	0.16	8.17	3.68	0.13	0.000
	[CN=65.0]								
	[N = 3.0:Tp 0.19]								
*									
**	CALIB NASHYD	0059	1 5.0	1.07	0.04	8.17	8.56	0.29	0.000
	[CN=85.0]								
	[N = 3.0:Tp 0.18]								
*									
*	CALIB STANDHYD	0029	1 5.0	0.58	0.07	8.00	20.92	0.71	0.000
	[I%=55.0:S%= 2.00]								
*									
*	CALIB STANDHYD	0061	1 5.0	1.08	0.14	8.00	21.02	0.72	0.000
	[I%=55.0:S%= 2.00]								
*									
	DUHYD	0024	1 5.0	1.08	0.14	8.00	21.02	n/a	0.000
	MAJOR SYSTEM:	0024	2 5.0	0.00	0.00	0.00	0.00	n/a	0.000
	MINOR SYSTEM:	0024	3 5.0	1.08	0.14	8.00	21.02	n/a	0.000
*									
	ADD [0024 + 0029]	0026	3 5.0	0.58	0.07	8.00	20.92	n/a	0.000
*									
	ADD [0026 + 0059]	0026	1 5.0	1.65	0.09	8.00	12.90	n/a	0.000
*									
*	CALIB STANDHYD	0022	1 5.0	8.85	1.08	8.00	21.16	0.72	0.000
	[I%=55.0:S%= 2.00]								
*									
*	CALIB STANDHYD	0060	1 5.0	0.88	0.13	8.00	22.80	0.78	0.000
	[I%=70.0:S%= 2.00]								
*									
*	CALIB STANDHYD	0068	1 5.0	0.97	0.17	8.00	24.62	0.84	0.000
	[I%=80.0:S%= 2.00]								
*									
	DUHYD	0069	1 5.0	0.97	0.17	8.00	24.62	n/a	0.000
	MAJOR SYSTEM:	0069	2 5.0	0.00	0.00	0.00	0.00	n/a	0.000
	MINOR SYSTEM:	0069	3 5.0	0.97	0.17	8.00	24.62	n/a	0.000

```
*
      ADD [0022 + 0024]  0058  3  5.0    9.92    1.22  8.00  21.14  n/a   0.000
*
      ADD [0058 + 0060]  0058  1  5.0   10.80    1.35  8.00  21.28  n/a   0.000
*
      ADD [0058 + 0069]  0058  3  5.0   11.77    1.53  8.00  21.55  n/a   0.000
*
      RESRVR [ 2 : 0058] 0025  1  5.0   11.77    0.03  9.67  21.55  n/a   0.000
      {ST=  0.22 ha.m }
*
      ADD [0025 + 0026]  0057  3  5.0   13.42    0.12  8.00  20.49  n/a   0.000
*
   **  CALIB NASHYD       0071  1  5.0    1.33    0.02  8.17   3.67 0.13   0.000
      [CN=65.0       ]
      [ N = 3.0:Tp 0.17]
*
    *  CALIB STANDHYD     0002  1  5.0   20.29    2.14  8.00  21.16 0.72   0.000
      [I%=55.0:S%= 2.00]
*
    *  CALIB STANDHYD     0003  1  5.0    2.63    0.39  8.00  22.94 0.78   0.000
      [I%=70.0:S%= 2.00]
*
    *  CALIB STANDHYD     0004  1  5.0    5.37    0.62  8.00  21.15 0.72   0.000
      [I%=55.0:S%= 2.00]
*
      DUHYD              0006  1  5.0    5.37    0.62  8.00  21.15  n/a   0.000
         MAJOR SYSTEM:   0006  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0006  3  5.0    5.37    0.62  8.00  21.15  n/a   0.000
*
      ADD [0002 + 0003]  0008  3  5.0   22.92    2.52  8.00  21.36  n/a   0.000
*
      ADD [0008 + 0006]  0008  1  5.0   22.92    2.52  8.00  21.36  n/a   0.000
*
      RESRVR [ 2 : 0008] 0072  1  5.0   22.92    0.03 10.25  21.22  n/a   0.000
      {ST=  0.44 ha.m }
*
    *  CALIB STANDHYD     0011  1  5.0   10.26    1.14  8.00  21.16 0.72   0.000
      [I%=55.0:S%= 2.00]
*
    *  CALIB STANDHYD     0012  1  5.0    1.07    0.16  8.00  22.83 0.78   0.000
      [I%=70.0:S%= 2.00]
*
    *  CALIB STANDHYD     0013  1  5.0    5.37    0.62  8.00  21.15 0.72   0.000
      [I%=55.0:S%= 2.00]
*
      DUHYD              0014  1  5.0    5.37    0.62  8.00  21.15  n/a   0.000
         MAJOR SYSTEM:   0014  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
         MINOR SYSTEM:   0014  3  5.0    5.37    0.62  8.00  21.15  n/a   0.000
*
      ADD [0011 + 0012]  0015  3  5.0   11.33    1.31  8.00  21.31  n/a   0.000
*
      ADD [0015 + 0014]  0015  1  5.0   16.70    1.93  8.00  21.26  n/a   0.000
*
      RESRVR [ 2 : 0015] 0016  1  5.0   16.70    0.08  9.25  21.14  n/a   0.000
      {ST=  0.30 ha.m }
*
    *  CALIB STANDHYD     0035  1  5.0    6.63    0.94  8.00  22.97 0.78   0.000
      [I%=70.0:S%= 2.00]
*
      RESRVR [ 2 : 0035] 0036  1  5.0    6.63    0.01  9.83  22.58  n/a   0.000
      {ST=  0.14 ha.m }
*
    *  CALIB STANDHYD     0070  1  5.0    1.41    0.25  8.00  24.67 0.84   0.000
      [I%=80.0:S%= 2.00]
*
      ADD [0069 + 0070]  0074  3  5.0    1.41    0.25  8.00  24.67  n/a   0.000
*
      ADD [0016 + 0036]  0032  3  5.0   23.33    0.10  9.25  21.55  n/a   0.000
*
      ADD [0032 + 0057]  0032  1  5.0   36.75    0.13  9.17  21.16  n/a   0.000
*
      ADD [0032 + 0062]  0032  3  5.0   53.30    0.25  8.67  15.74  n/a   0.000
*
      ADD [0032 + 0063]  0032  1  5.0   65.55    0.36  8.25  13.48  n/a   0.000
*
      ADD [0032 + 0071]  0032  3  5.0   66.88    0.37  8.25  13.29  n/a   0.000
*
      ADD [0032 + 0072]  0032  1  5.0   89.80    0.40  8.25  15.31  n/a   0.000
*
      ADD [0032 + 0074]  0032  3  5.0   91.21    0.50  8.00  15.46  n/a   0.000
*
    *  CALIB NASHYD       0064  1  5.0    9.67    0.08  8.50   3.68 0.13   0.000
      [CN=65.0       ]
      [ N = 3.0:Tp 0.41]
```

```
*
  *  CALIB NASHYD       0065  1  5.0   14.48    0.14  8.42   3.68 0.13   0.000
     [CN=65.0          ]
     [ N = 3.0:Tp 0.35]
*
     SHIFT  [ 2 : 0065] 0066  1  5.0   14.48    0.14  9.00   3.68  n/a   0.000
     [SHIFT= 36.5 min]
*
  *  CALIB STANDHYD     0027  1  5.0    7.26    0.83  8.00  21.16 0.72   0.000
     [I%=55.0:S%= 2.00]
*
  *  CALIB STANDHYD     0028  1  5.0    1.14    0.17  8.00  22.84 0.78   0.000
     [I%=70.0:S%= 2.00]
*
     ADD [0027 + 0028]  0031  3  5.0    8.40    1.00  8.00  21.38  n/a   0.000
*
     RESRVR [ 2 : 0031] 0030  1  5.0    8.40    0.02  9.83  21.22  n/a   0.000
     {ST=  0.16 ha.m }
*
     ADD [0030 + 0032]  0056  3  5.0   99.61    0.51  8.00  15.94  n/a   0.000
*
     ADD [0056 + 0064]  0056  1  5.0  109.28    0.55  8.17  14.86  n/a   0.000
*
     ADD [0056 + 0066]  0056  3  5.0  123.76    0.55  8.17  13.55  n/a   0.000
*
  *  CALIB STANDHYD     0052  1  5.0    0.75    0.11  8.00  22.87 0.78   0.000
     [I%=70.0:S%= 2.00]
*
  *  CALIB STANDHYD     0051  1  5.0    4.91    0.57  8.00  21.28 0.72   0.000
     [I%=55.0:S%= 2.00]
*
     ADD [0051 + 0052]  0053  3  5.0    5.66    0.69  8.00  21.49  n/a   0.000
*
     RESRVR [ 2 : 0053] 0054  1  5.0    5.66    0.09  8.67  21.13  n/a   0.000
     {ST=  0.09 ha.m }
*
  *  CALIB NASHYD       0107  1  5.0    3.15    0.04  8.17   3.67 0.13   0.000
     [CN=65.0          ]
     [ N = 3.0:Tp 0.17]
*
  *  CALIB STANDHYD     0106  1  5.0    1.76    0.10  8.00  10.43 0.36   0.000
     [I%=25.0:S%= 2.00]
*
     ADD [0106 + 0107]  0108  3  5.0    4.91    0.12  8.00   6.10  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   0 **
  ****************************

  W/E COMMAND                HYD ID   DT     AREA    Qpeak  Tpeak   R.V.  R.C.    Qbase
                                      min     ha      cms    hrs     mm             cms

     START @  0.00 hrs
     --------------------
     CHIC STORM                    10.0
     [ Ptot= 40.62 mm ]
*
 **  CALIB NASHYD       0062  1  5.0   16.55    0.25  8.58   7.36 0.18   0.000
     [CN=65.0          ]
     [ N = 3.0:Tp 0.46]
*
 **  CALIB NASHYD       0063  1  5.0   12.25    0.31  8.17   7.34 0.18   0.000
     [CN=65.0          ]
     [ N = 3.0:Tp 0.19]
*
 **  CALIB NASHYD       0059  1  5.0    1.07    0.06  8.17  15.72 0.39   0.000
     [CN=85.0          ]
     [ N = 3.0:Tp 0.18]
*
  *  CALIB STANDHYD     0029  1  5.0    0.58    0.10  8.00  30.82 0.76   0.000
     [I%=55.0:S%= 2.00]
*
  *  CALIB STANDHYD     0061  1  5.0    1.08    0.18  8.00  30.96 0.76   0.000
     [I%=55.0:S%= 2.00]
*
     DUHYD              0024  1  5.0    1.08    0.18  8.00  30.96  n/a   0.000
        MAJOR SYSTEM:   0024  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
        MINOR SYSTEM:   0024  3  5.0    1.08    0.18  8.00  30.96  n/a   0.000
*
     ADD [0024 + 0029]  0026  3  5.0    0.58    0.10  8.00  30.82  n/a   0.000
*
     ADD [0026 + 0059]  0026  1  5.0    1.65    0.14  8.00  21.03  n/a   0.000
*
  *  CALIB STANDHYD     0022  1  5.0    8.85    1.39  8.00  31.08 0.77   0.000
```

```
      [I%=55.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0060  1  5.0    0.88    0.17  8.00  32.94 0.81   0.000
       [I%=70.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0068  1  5.0    0.97    0.22  8.00  35.13 0.87   0.000
       [I%=80.0:S%= 2.00]
  *
       DUHYD               0069  1  5.0    0.97    0.22  8.00  35.13  n/a   0.000
          MAJOR SYSTEM:    0069  2  5.0    0.00    0.00  0.00   0.00  n/a   0.000
          MINOR SYSTEM:    0069  3  5.0    0.97    0.22  8.00  35.13  n/a   0.000
  *
       ADD [0022 + 0024]   0058  3  5.0    9.92    1.57  8.00  31.06  n/a   0.000
  *
       ADD [0058 + 0060]   0058  1  5.0   10.80    1.74  8.00  31.22  n/a   0.000
  *
       ADD [0058 + 0069]   0058  3  5.0   11.77    1.96  8.00  31.54  n/a   0.000
  *
       RESRVR [ 2 : 0058]  0025  1  5.0   11.77    0.26  8.67  31.55  n/a   0.000
       {ST=  0.27 ha.m }
  *
       ADD [0025 + 0026]   0057  3  5.0   13.42    0.29  8.58  30.25  n/a   0.000
  *
    ** CALIB NASHYD        0071  1  5.0    1.33    0.04  8.17   7.33 0.18   0.000
       [CN=65.0        ]
       [ N = 3.0:Tp 0.17]
  *
    *  CALIB STANDHYD      0002  1  5.0   20.29    2.87  8.00  31.08 0.77   0.000
       [I%=55.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0003  1  5.0    2.63    0.49  8.00  33.09 0.81   0.000
       [I%=70.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0004  1  5.0    5.37    0.83  8.00  31.07 0.77   0.000
       [I%=55.0:S%= 2.00]
  *
       DUHYD               0006  1  5.0    5.37    0.83  8.00  31.07  n/a   0.000
          MAJOR SYSTEM:    0006  2  5.0    0.10    0.10  8.00  31.07  n/a   0.000
          MINOR SYSTEM:    0006  3  5.0    5.27    0.72  8.00  31.07  n/a   0.000
  *
       ADD [0002 + 0003]   0008  3  5.0   22.92    3.36  8.00  31.31  n/a   0.000
  *
       ADD [0008 + 0006]   0008  1  5.0   23.02    3.47  8.00  31.31  n/a   0.000
  *
       RESRVR [ 2 : 0008]  0072  1  5.0   23.02    0.04 10.67  31.06  n/a   0.000
       {ST=  0.65 ha.m }
  *
    *  CALIB STANDHYD      0011  1  5.0   10.26    1.52  8.00  31.08 0.77   0.000
       [I%=55.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0012  1  5.0    1.07    0.20  8.00  32.98 0.81   0.000
       [I%=70.0:S%= 2.00]
  *
    *  CALIB STANDHYD      0013  1  5.0    5.37    0.83  8.00  31.07 0.77   0.000
       [I%=55.0:S%= 2.00]
  *
       DUHYD               0014  1  5.0    5.37    0.83  8.00  31.07  n/a   0.000
          MAJOR SYSTEM:    0014  2  5.0    0.10    0.10  8.00  31.07  n/a   0.000
          MINOR SYSTEM:    0014  3  5.0    5.27    0.72  8.00  31.07  n/a   0.000
  *
       ADD [0011 + 0012]   0015  3  5.0   11.33    1.73  8.00  31.26  n/a   0.000
  *
       ADD [0015 + 0014]   0015  1  5.0   16.60    2.45  8.00  31.20  n/a   0.000
  *
       RESRVR [ 2 : 0015]  0016  1  5.0   16.60    0.16  9.08  31.07  n/a   0.000
       {ST=  0.41 ha.m }
  *
    *  CALIB STANDHYD      0035  1  5.0    6.63    1.18  8.00  33.09 0.81   0.000
       [I%=70.0:S%= 2.00]
  *
       RESRVR [ 2 : 0035]  0036  1  5.0    6.63    0.02 10.00  32.70  n/a   0.000
       {ST=  0.19 ha.m }
  *
    *  CALIB STANDHYD      0070  1  5.0    1.41    0.32  8.00  35.21 0.87   0.000
       [I%=80.0:S%= 2.00]
  *
       ADD [0069 + 0070]   0074  3  5.0    1.41    0.32  8.00  35.21  n/a   0.000
  *
       ADD [0016 + 0036]   0032  3  5.0   23.23    0.18  9.17  31.54  n/a   0.000
  *
       ADD [0032 + 0057]   0032  1  5.0   36.66    0.46  8.58  31.07  n/a   0.000
  *
       ADD [0032 + 0062]   0032  3  5.0   53.21    0.71  8.58  23.69  n/a   0.000
```

```
      ADD [0032 + 0063]  0032  1  5.0   65.46    0.90  8.42  20.63  n/a   0.000
*
      ADD [0032 + 0071]  0032  3  5.0   66.79    0.93  8.42  20.37  n/a   0.000
*
      ADD [0032 + 0072]  0032  1  5.0   89.80    0.96  8.42  23.11  n/a   0.000
*
      ADD [0032 + 0074]  0032  3  5.0   91.21    1.00  8.42  23.30  n/a   0.000
*
   *  CALIB NASHYD       0064  1  5.0    9.67    0.16  8.50   7.36 0.18   0.000
      [CN=65.0        ]
      [ N = 3.0:Tp 0.41]
*
   *  CALIB NASHYD       0065  1  5.0   14.48    0.26  8.42   7.36 0.18   0.000
      [CN=65.0        ]
      [ N = 3.0:Tp 0.35]
*
      SHIFT  [ 2 : 0065] 0066  1  5.0   14.48    0.26  9.00   7.36  n/a   0.000
      [SHIFT= 36.5 min]
*
   *  CALIB STANDHYD     0027  1  5.0    7.26    1.10  8.00  31.07 0.77   0.000
      [I%=55.0:S%= 2.00]
*
   *  CALIB STANDHYD     0028  1  5.0    1.14    0.22  8.00  32.99 0.81   0.000
      [I%=70.0:S%= 2.00]
*
      ADD [0027 + 0028]  0031  3  5.0    8.40    1.32  8.00  31.33  n/a   0.000
*
      RESRVR [ 2 : 0031] 0030  1  5.0    8.40    0.05  9.42  31.17  n/a   0.000
      {ST=  0.22 ha.m }
*
      ADD [0030 + 0032]  0056  3  5.0   99.61    1.03  8.42  23.96  n/a   0.000
*
      ADD [0056 + 0064]  0056  1  5.0  109.28    1.19  8.42  22.49  n/a   0.000
*
      ADD [0056 + 0066]  0056  3  5.0  123.76    1.21  8.67  20.72  n/a   0.000
*
   *  CALIB STANDHYD     0052  1  5.0    0.75    0.14  8.00  33.01 0.81   0.000
      [I%=70.0:S%= 2.00]
*
   *  CALIB STANDHYD     0051  1  5.0    4.91    0.76  8.00  31.21 0.77   0.000
      [I%=55.0:S%= 2.00]
*
      ADD [0051 + 0052]  0053  3  5.0    5.66    0.91  8.00  31.45  n/a   0.000
*
      RESRVR [ 2 : 0053] 0054  1  5.0    5.66    0.18  8.50  31.09  n/a   0.000
      {ST=  0.11 ha.m }
*
   *  CALIB NASHYD       0107  1  5.0    3.15    0.08  8.17   7.33 0.18   0.000
      [CN=65.0        ]
      [ N = 3.0:Tp 0.17]
*
   *  CALIB STANDHYD     0106  1  5.0    1.76    0.12  8.00  16.21 0.40   0.000
      [I%=25.0:S%= 2.00]
*
      ADD [0106 + 0107]  0108  3  5.0    4.91    0.18  8.00  10.52  n/a   0.000
*
  ****************************
  ** SIMULATION NUMBER:   0 **  104
  ****************************

  W/E COMMAND              HYD ID   DT    AREA    Qpeak  Tpeak   R.V.  R.C.   Qbase
                                    min     ha      cms    hrs     mm             cms

      START @  0.00 hrs
      --------------------
      CHIC STORM                   10.0
      [ Ptot= 46.47 mm ]
*
  **  CALIB NASHYD       0062  1  5.0   16.55    0.33  8.58   9.65 0.21   0.000
      [CN=65.0        ]
      [ N = 3.0:Tp 0.46]
*
  **  CALIB NASHYD       0063  1  5.0   12.25    0.41  8.17   9.62 0.21   0.000
      [CN=65.0        ]
      [ N = 3.0:Tp 0.19]
*
  **  CALIB NASHYD       0059  1  5.0    1.07    0.08  8.17  19.87 0.43   0.000
      [CN=85.0        ]
      [ N = 3.0:Tp 0.18]
*
   *  CALIB STANDHYD     0029  1  5.0    0.58    0.12  8.00  36.14 0.78   0.000
      [I%=55.0:S%= 2.00]
*
   *  CALIB STANDHYD     0061  1  5.0    1.08    0.22  8.00  36.29 0.78   0.000
```

```
        [I%=55.0:S%= 2.00]
  *
        DUHYD                0024  1  5.0    1.08    0.22  8.00  36.29  n/a   0.000
           MAJOR SYSTEM:     0024  2  5.0    0.05    0.04  8.00  36.29  n/a   0.000
           MINOR SYSTEM:     0024  3  5.0    1.03    0.18  7.92  36.29  n/a   0.000
  *
        ADD [0024 + 0029]    0026  3  5.0    0.63    0.16  8.00  36.15  n/a   0.000
  *
        ADD [0026 + 0059]    0026  1  5.0    1.70    0.21  8.00  25.89  n/a   0.000
  *
     *  CALIB STANDHYD       0022  1  5.0    8.85    1.63  8.00  36.38 0.78   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0060  1  5.0    0.88    0.21  8.00  38.33 0.82   0.000
        [I%=70.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0068  1  5.0    0.97    0.25  8.00  40.68 0.88   0.000
        [I%=80.0:S%= 2.00]
  *
        DUHYD                0069  1  5.0    0.97    0.25  8.00  40.68  n/a   0.000
           MAJOR SYSTEM:     0069  2  5.0    0.04    0.03  8.00  40.68  n/a   0.000
           MINOR SYSTEM:     0069  3  5.0    0.93    0.22  7.92  40.68  n/a   0.000
  *
        ADD [0022 + 0024]    0058  3  5.0    9.88    1.81  8.00  36.37  n/a   0.000
  *
        ADD [0058 + 0060]    0058  1  5.0   10.75    2.01  8.00  36.53  n/a   0.000
  *
        ADD [0058 + 0069]    0058  3  5.0   11.69    2.23  8.00  36.86  n/a   0.000
  *
        RESRVR [ 2 : 0058]   0025  1  5.0   11.69    0.38  8.58  36.87  n/a   0.000
        {ST=  0.29 ha.m }
  *
        ADD [0025 + 0026]    0057  3  5.0   13.39    0.44  8.50  35.47  n/a   0.000
  *
    **  CALIB NASHYD         0071  1  5.0    1.33    0.05  8.17   9.61 0.21   0.000
        [CN=65.0       ]
        [ N = 3.0:Tp 0.17]
  *
     *  CALIB STANDHYD       0002  1  5.0   20.29    3.38  8.00  36.38 0.78   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0003  1  5.0    2.63    0.60  8.00  38.47 0.83   0.000
        [I%=70.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0004  1  5.0    5.37    0.97  8.00  36.38 0.78   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD                0006  1  5.0    5.37    0.97  8.00  36.38  n/a   0.000
           MAJOR SYSTEM:     0006  2  5.0    0.24    0.24  8.00  36.38  n/a   0.000
           MINOR SYSTEM:     0006  3  5.0    5.12    0.72  7.92  36.38  n/a   0.000
  *
        ADD [0002 + 0003]    0008  3  5.0   22.92    3.99  8.00  36.62  n/a   0.000
  *
        ADD [0008 + 0006]    0008  1  5.0   23.16    4.23  8.00  36.62  n/a   0.000
  *
        RESRVR [ 2 : 0008]   0072  1  5.0   23.16    0.05 10.42  36.32  n/a   0.000
        {ST=  0.77 ha.m }
  *
     *  CALIB STANDHYD       0011  1  5.0   10.26    1.79  8.00  36.38 0.78   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0012  1  5.0    1.07    0.25  8.00  38.37 0.83   0.000
        [I%=70.0:S%= 2.00]
  *
     *  CALIB STANDHYD       0013  1  5.0    5.37    0.97  8.00  36.38 0.78   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD                0014  1  5.0    5.37    0.97  8.00  36.38  n/a   0.000
           MAJOR SYSTEM:     0014  2  5.0    0.24    0.24  8.00  36.38  n/a   0.000
           MINOR SYSTEM:     0014  3  5.0    5.12    0.72  7.92  36.38  n/a   0.000
  *
        ADD [0011 + 0012]    0015  3  5.0   11.33    2.04  8.00  36.57  n/a   0.000
  *
        ADD [0015 + 0014]    0015  1  5.0   16.46    2.77  8.00  36.51  n/a   0.000
  *
        RESRVR [ 2 : 0015]   0016  1  5.0   16.46    0.17  9.17  36.39  n/a   0.000
        {ST=  0.48 ha.m }
  *
     *  CALIB STANDHYD       0035  1  5.0    6.63    1.47  8.00  38.47 0.83   0.000
        [I%=70.0:S%= 2.00]
  *
        RESRVR [ 2 : 0035]   0036  1  5.0    6.63    0.02 10.00  38.08  n/a   0.000
        {ST=  0.23 ha.m }
```

```
   *   CALIB STANDHYD      0070  1  5.0    1.41    0.36  8.00  40.76 0.88   0.000
       [I%=80.0:S%= 2.00]
   *
       ADD [0069 + 0070]   0074  3  5.0    1.45    0.40  8.00  40.76  n/a   0.000
   *
       ADD [0016 + 0036]   0032  3  5.0   23.09    0.19  9.17  36.87  n/a   0.000
   *
       ADD [0032 + 0057]   0032  1  5.0   36.47    0.62  8.50  36.36  n/a   0.000
   *
       ADD [0032 + 0062]   0032  3  5.0   53.02    0.95  8.50  28.02  n/a   0.000
   *
       ADD [0032 + 0063]   0032  1  5.0   65.27    1.23  8.42  24.57  n/a   0.000
   *
       ADD [0032 + 0071]   0032  3  5.0   66.60    1.27  8.33  24.27  n/a   0.000
   *
       ADD [0032 + 0072]   0032  1  5.0   89.76    1.30  8.33  27.38  n/a   0.000
   *
       ADD [0032 + 0074]   0032  3  5.0   91.21    1.38  8.33  27.59  n/a   0.000
   *
   *   CALIB NASHYD        0064  1  5.0    9.67    0.21  8.50   9.65 0.21   0.000
       [CN=65.0       ]
       [ N = 3.0:Tp 0.41]
   *
   *   CALIB NASHYD        0065  1  5.0   14.48    0.35  8.42   9.65 0.21   0.000
       [CN=65.0       ]
       [ N = 3.0:Tp 0.35]
   *
       SHIFT  [ 2 : 0065] 0066  1  5.0   14.48    0.35  9.00   9.65  n/a   0.000
       [SHIFT= 36.5 min]
   *
   *   CALIB STANDHYD      0027  1  5.0    7.26    1.29  8.00  36.38 0.78   0.000
       [I%=55.0:S%= 2.00]
   *
   *   CALIB STANDHYD      0028  1  5.0    1.14    0.27  8.00  38.38 0.83   0.000
       [I%=70.0:S%= 2.00]
   *
       ADD [0027 + 0028]   0031  3  5.0    8.40    1.56  8.00  36.65  n/a   0.000
   *
       RESRVR [ 2 : 0031] 0030  1  5.0    8.40    0.06  9.33  36.49  n/a   0.000
       {ST=  0.26 ha.m }
   *
       ADD [0030 + 0032]   0056  3  5.0   99.61    1.42  8.33  28.34  n/a   0.000
   *
       ADD [0056 + 0064]   0056  1  5.0  109.28    1.61  8.33  26.69  n/a   0.000
   *
       ADD [0056 + 0066]   0056  3  5.0  123.76    1.61  8.33  24.69  n/a   0.000
   *
   *   CALIB STANDHYD      0052  1  5.0    0.75    0.18  8.00  38.40 0.83   0.000
       [I%=70.0:S%= 2.00]
   *
   *   CALIB STANDHYD      0051  1  5.0    4.91    0.89  8.00  36.53 0.79   0.000
       [I%=55.0:S%= 2.00]
   *
       ADD [0051 + 0052]   0053  3  5.0    5.66    1.07  8.00  36.77  n/a   0.000
   *
       RESRVR [ 2 : 0053] 0054  1  5.0    5.66    0.23  8.50  36.42  n/a   0.000
       {ST=  0.13 ha.m }
   *
   *   CALIB NASHYD        0107  1  5.0    3.15    0.11  8.17   9.61 0.21   0.000
       [CN=65.0       ]
       [ N = 3.0:Tp 0.17]
   *
   *   CALIB STANDHYD      0106  1  5.0    1.76    0.15  8.00  19.49 0.42   0.000
       [I%=25.0:S%= 2.00]
   *
       ADD [0106 + 0107]   0108  3  5.0    4.91    0.22  8.00  13.16  n/a   0.000
   *
  ****************************
  ** SIMULATION NUMBER:   0 **  254
  ****************************

  W/E COMMAND                HYD ID   DT     AREA    Qpeak  Tpeak   R.V.  R.C.   Qbase
                                      min     ha      cms    hrs     mm             cms

      START @  0.00 hrs
      --------------------
      CHIC STORM                    10.0
      [ Ptot= 63.97 mm ]

  **  CALIB NASHYD          0062  1  5.0   16.55    0.60  8.58  17.76 0.28   0.000
      [CN=65.0       ]
      [ N = 3.0:Tp 0.46]

  **  CALIB NASHYD          0063  1  5.0   12.25    0.73  8.17  17.72 0.28   0.000
```

```
        [CN=65.0          ]
        [ N = 3.0:Tp 0.19]
  *
    **  CALIB NASHYD       0059  1  5.0    1.07    0.13  8.17  33.40 0.52   0.000
        [CN=85.0          ]
        [ N = 3.0:Tp 0.18]
  *
    *   CALIB STANDHYD     0029  1  5.0    0.58    0.16  8.00  52.44 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0061  1  5.0    1.08    0.30  8.00  52.63 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD              0024  1  5.0    1.08    0.30  8.00  52.63  n/a   0.000
           MAJOR SYSTEM:   0024  2  5.0    0.12    0.12  8.00  52.63  n/a   0.000
           MINOR SYSTEM:   0024  3  5.0    0.96    0.18  7.92  52.63  n/a   0.000
  *
        ADD [0024 + 0029]  0026  3  5.0    0.70    0.28  8.00  52.47  n/a   0.000
  *
        ADD [0026 + 0059]  0026  1  5.0    1.77    0.38  8.00  40.94  n/a   0.000
  *
    *   CALIB STANDHYD     0022  1  5.0    8.85    2.37  8.00  52.65 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0060  1  5.0    0.88    0.27  8.00  54.79 0.86   0.000
        [I%=70.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0068  1  5.0    0.97    0.34  8.00  57.52 0.90   0.000
        [I%=80.0:S%= 2.00]
  *
        DUHYD              0069  1  5.0    0.97    0.34  8.00  57.52  n/a   0.000
           MAJOR SYSTEM:   0069  2  5.0    0.11    0.12  8.00  57.52  n/a   0.000
           MINOR SYSTEM:   0069  3  5.0    0.86    0.22  7.92  57.52  n/a   0.000
  *
        ADD [0022 + 0024]  0058  3  5.0    9.80    2.55  8.00  52.65  n/a   0.000
  *
        ADD [0058 + 0060]  0058  1  5.0   10.68    2.82  8.00  52.82  n/a   0.000
  *
        ADD [0058 + 0069]  0058  3  5.0   11.54    3.04  8.00  53.17  n/a   0.000
  *
        RESRVR [ 2 : 0058] 0025  1  5.0   11.54    0.53  8.58  53.18  n/a   0.000
        {ST=  0.39 ha.m }
  *
        ADD [0025 + 0026]  0057  3  5.0   13.31    0.73  8.17  51.55  n/a   0.000
  *
    **  CALIB NASHYD       0071  1  5.0    1.33    0.08  8.17  17.70 0.28   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.17]
  *
    *   CALIB STANDHYD     0002  1  5.0   20.29    4.63  8.00  52.65 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0003  1  5.0    2.63    0.80  8.00  54.86 0.86   0.000
        [I%=70.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0004  1  5.0    5.37    1.31  8.00  52.65 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD              0006  1  5.0    5.37    1.31  8.00  52.65  n/a   0.000
           MAJOR SYSTEM:   0006  2  5.0    0.74    0.59  8.00  52.65  n/a   0.000
           MINOR SYSTEM:   0006  3  5.0    4.63    0.72  7.92  52.65  n/a   0.000
  *
        ADD [0002 + 0003]  0008  3  5.0   22.92    5.44  8.00  52.91  n/a   0.000
  *
        ADD [0008 + 0006]  0008  1  5.0   23.66    6.02  8.00  52.90  n/a   0.000
  *
        RESRVR [ 2 : 0008] 0072  1  5.0   23.66    0.10 10.17  52.47  n/a   0.000
        {ST=  1.11 ha.m }
  *
    *   CALIB STANDHYD     0011  1  5.0   10.26    2.44  8.00  52.65 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0012  1  5.0    1.07    0.33  8.00  54.84 0.86   0.000
        [I%=70.0:S%= 2.00]
  *
    *   CALIB STANDHYD     0013  1  5.0    5.37    1.31  8.00  52.65 0.82   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD              0014  1  5.0    5.37    1.31  8.00  52.65  n/a   0.000
           MAJOR SYSTEM:   0014  2  5.0    0.74    0.59  8.00  52.65  n/a   0.000
           MINOR SYSTEM:   0014  3  5.0    4.63    0.72  7.92  52.65  n/a   0.000
  *
        ADD [0011 + 0012]  0015  3  5.0   11.33    2.77  8.00  52.86  n/a   0.000
```

	ADD [0015 + 0014]	0015	1	5.0	15.96	3.49	8.00	52.80	n/a	0.000
*										
	RESRVR [2 : 0015] {ST= 0.67 ha.m }	0016	1	5.0	15.96	0.19	9.33	52.67	n/a	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0035	1	5.0	6.63	1.97	8.00	54.86	0.86	0.000
*										
	RESRVR [2 : 0035] {ST= 0.33 ha.m }	0036	1	5.0	6.63	0.02	10.33	54.47	n/a	0.000
*										
*	CALIB STANDHYD [I%=80.0:S%= 2.00]	0070	1	5.0	1.41	0.48	8.00	57.56	0.90	0.000
*										
	ADD [0069 + 0070]	0074	3	5.0	1.52	0.60	8.00	57.56	n/a	0.000
*										
	ADD [0016 + 0036]	0032	3	5.0	22.59	0.21	9.33	53.20	n/a	0.000
*										
	ADD [0032 + 0057]	0032	1	5.0	35.90	0.91	8.17	52.59	n/a	0.000
*										
	ADD [0032 + 0062]	0032	3	5.0	52.45	1.42	8.50	41.60	n/a	0.000
*										
	ADD [0032 + 0063]	0032	1	5.0	64.70	2.04	8.25	37.08	n/a	0.000
*										
	ADD [0032 + 0071]	0032	3	5.0	66.03	2.12	8.25	36.69	n/a	0.000
*										
	ADD [0032 + 0072]	0032	1	5.0	89.69	2.17	8.25	40.85	n/a	0.000
*										
	ADD [0032 + 0074]	0032	3	5.0	91.21	2.31	8.17	41.13	n/a	0.000
*										
*	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.41]	0064	1	5.0	9.67	0.38	8.50	17.76	0.28	0.000
*										
*	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.35]	0065	1	5.0	14.48	0.62	8.42	17.76	0.28	0.000
*										
	SHIFT [2 : 0065] [SHIFT= 36.5 min]	0066	1	5.0	14.48	0.62	9.00	17.76	n/a	0.000
*										
*	CALIB STANDHYD [I%=55.0:S%= 2.00]	0027	1	5.0	7.26	1.75	8.00	52.65	0.82	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0028	1	5.0	1.14	0.35	8.00	54.86	0.86	0.000
*										
	ADD [0027 + 0028]	0031	3	5.0	8.40	2.10	8.00	52.95	n/a	0.000
*										
	RESRVR [2 : 0031] {ST= 0.37 ha.m }	0030	1	5.0	8.40	0.07	9.58	52.78	n/a	0.000
*										
	ADD [0030 + 0032]	0056	3	5.0	99.61	2.37	8.17	42.11	n/a	0.000
*										
	ADD [0056 + 0064]	0056	1	5.0	109.28	2.68	8.33	39.96	n/a	0.000
*										
	ADD [0056 + 0066]	0056	3	5.0	123.76	2.68	8.33	37.36	n/a	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0052	1	5.0	0.75	0.23	8.00	54.87	0.86	0.000
*										
*	CALIB STANDHYD [I%=55.0:S%= 2.00]	0051	1	5.0	4.91	1.30	8.00	52.80	0.83	0.000
*										
	ADD [0051 + 0052]	0053	3	5.0	5.66	1.53	8.00	53.08	n/a	0.000
*										
	RESRVR [2 : 0053] {ST= 0.18 ha.m }	0054	1	5.0	5.66	0.30	8.50	52.72	n/a	0.000
*										
*	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.17]	0107	1	5.0	3.15	0.20	8.17	17.70	0.28	0.000
*										
*	CALIB STANDHYD [I%=25.0:S%= 2.00]	0106	1	5.0	1.76	0.21	8.00	30.23	0.47	0.000
*										
	ADD [0106 + 0107]	0108	3	5.0	4.91	0.35	8.17	22.19	n/a	0.000
*										

****
** SIMULATION NUMBER: 0 ** 504
****

W/E	COMMAND	HYD ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms

```
        START @  0.00 hrs
        ----------------------
        CHIC STORM                  10.0
        [ Ptot= 77.87 mm ]
  *
    **  CALIB NASHYD        0062  1  5.0   16.55    0.78  8.58  25.33 0.33   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.46]
  *
    **  CALIB NASHYD        0063  1  5.0   12.25    0.92  8.17  25.27 0.32   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.19]
  *
    **  CALIB NASHYD        0059  1  5.0    1.07    0.16  8.17  44.99 0.58   0.000
        [CN=85.0          ]
        [ N = 3.0:Tp 0.18]
  *
     *  CALIB STANDHYD      0029  1  5.0    0.58    0.17  8.00  65.76 0.84   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0061  1  5.0    1.08    0.31  8.00  65.85 0.85   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD               0024  1  5.0    1.08    0.31  8.00  65.85  n/a   0.000
           MAJOR SYSTEM:    0024  2  5.0    0.13    0.14  8.00  65.85  n/a   0.000
           MINOR SYSTEM:    0024  3  5.0    0.95    0.18  7.92  65.85  n/a   0.000
  *
        ADD [0024 + 0029]   0026  3  5.0    0.71    0.31  8.00  65.77  n/a   0.000
  *
        ADD [0026 + 0059]   0026  1  5.0    1.78    0.42  8.00  53.28  n/a   0.000
  *
     *  CALIB STANDHYD      0022  1  5.0    8.85    2.48  8.00  65.85 0.85   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0060  1  5.0    0.88    0.28  8.00  68.11 0.87   0.000
        [I%=70.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0068  1  5.0    0.97    0.34  8.00  71.03 0.91   0.000
        [I%=80.0:S%= 2.00]
  *
        DUHYD               0069  1  5.0    0.97    0.34  8.00  71.03  n/a   0.000
           MAJOR SYSTEM:    0069  2  5.0    0.10    0.13  8.00  71.03  n/a   0.000
           MINOR SYSTEM:    0069  3  5.0    0.87    0.22  7.92  71.03  n/a   0.000
  *
        ADD [0022 + 0024]   0058  3  5.0    9.79    2.66  8.00  65.85  n/a   0.000
  *
        ADD [0058 + 0060]   0058  1  5.0   10.67    2.94  8.00  66.04  n/a   0.000
  *
        ADD [0058 + 0069]   0058  3  5.0   11.54    3.16  8.00  66.41  n/a   0.000
  *
        RESRVR [ 2 : 0058] 0025  1  5.0   11.54    0.56  8.67  66.42  n/a   0.000
        {ST=  0.47 ha.m }
  *
        ADD [0025 + 0026]   0057  3  5.0   13.32    0.81  8.17  64.67  n/a   0.000
  *
    **  CALIB NASHYD        0071  1  5.0    1.33    0.11  8.17  25.24 0.32   0.000
        [CN=65.0          ]
        [ N = 3.0:Tp 0.17]
  *
     *  CALIB STANDHYD      0002  1  5.0   20.29    4.87  8.00  65.85 0.85   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0003  1  5.0    2.63    0.83  8.00  68.11 0.87   0.000
        [I%=70.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0004  1  5.0    5.37    1.48  8.00  65.85 0.85   0.000
        [I%=55.0:S%= 2.00]
  *
        DUHYD               0006  1  5.0    5.37    1.48  8.00  65.85  n/a   0.000
           MAJOR SYSTEM:    0006  2  5.0    0.87    0.76  8.00  65.85  n/a   0.000
           MINOR SYSTEM:    0006  3  5.0    4.50    0.72  7.92  65.85  n/a   0.000
  *
        ADD [0002 + 0003]   0008  3  5.0   22.92    5.70  8.00  66.11  n/a   0.000
  *
        ADD [0008 + 0006]   0008  1  5.0   23.78    6.46  8.00  66.10  n/a   0.000
  *
        RESRVR [ 2 : 0008] 0072  1  5.0   23.78    0.11 10.58  65.55  n/a   0.000
        {ST=  1.38 ha.m }
  *
     *  CALIB STANDHYD      0011  1  5.0   10.26    2.56  8.00  65.85 0.85   0.000
        [I%=55.0:S%= 2.00]
  *
     *  CALIB STANDHYD      0012  1  5.0    1.07    0.34  8.00  68.11 0.87   0.000
```

```
      [I%=70.0:S%= 2.00]
  *
    *  CALIB STANDHYD     0013  1  5.0    5.37    1.48  8.00  65.85 0.85   0.000
       [I%=55.0:S%= 2.00]
  *
       DUHYD              0014  1  5.0    5.37    1.48  8.00  65.85  n/a   0.000
          MAJOR SYSTEM:   0014  2  5.0    0.87    0.76  8.00  65.85  n/a   0.000
          MINOR SYSTEM:   0014  3  5.0    4.50    0.72  7.92  65.85  n/a   0.000
  *
       ADD [0011 + 0012]  0015  3  5.0   11.33    2.90  8.00  66.06  n/a   0.000
  *
       ADD [0015 + 0014]  0015  1  5.0   15.84    3.62  8.00  66.00  n/a   0.000
  *
       RESRVR [ 2 : 0015] 0016  1  5.0   15.84    0.20  9.58  65.87  n/a   0.000
       {ST=  0.82 ha.m }
  *
    *  CALIB STANDHYD     0035  1  5.0    6.63    2.03  8.00  68.12 0.87   0.000
       [I%=70.0:S%= 2.00]
  *
       RESRVR [ 2 : 0035] 0036  1  5.0    6.63    0.03 10.83  67.73  n/a   0.000
       {ST=  0.40 ha.m }
  *
    *  CALIB STANDHYD     0070  1  5.0    1.41    0.49  8.00  71.03 0.91   0.000
       [I%=80.0:S%= 2.00]
  *
       ADD [0069 + 0070]  0074  3  5.0    1.51    0.61  8.00  71.03  n/a   0.000
  *
       ADD [0016 + 0036]  0032  3  5.0   22.47    0.23  9.67  66.42  n/a   0.000
  *
       ADD [0032 + 0057]  0032  1  5.0   35.79    1.00  8.17  65.77  n/a   0.000
  *
       ADD [0032 + 0062]  0032  3  5.0   52.34    1.67  8.50  52.98  n/a   0.000
  *
       ADD [0032 + 0063]  0032  1  5.0   64.59    2.44  8.33  47.72  n/a   0.000
  *
       ADD [0032 + 0071]  0032  3  5.0   65.92    2.53  8.33  47.27  n/a   0.000
  *
       ADD [0032 + 0072]  0032  1  5.0   89.70    2.62  8.33  52.12  n/a   0.000
  *
       ADD [0032 + 0074]  0032  3  5.0   91.21    2.76  8.17  52.43  n/a   0.000
  *
    *  CALIB NASHYD       0064  1  5.0    9.67    0.49  8.50  25.33 0.33   0.000
       [CN=65.0          ]
       [ N = 3.0:Tp 0.41]
  *
    *  CALIB NASHYD       0065  1  5.0   14.48    0.81  8.42  25.32 0.33   0.000
       [CN=65.0          ]
       [ N = 3.0:Tp 0.35]
  *
       SHIFT  [ 2 : 0065] 0066  1  5.0   14.48    0.81  9.00  25.32  n/a   0.000
       [SHIFT= 36.5 min]
  *
    *  CALIB STANDHYD     0027  1  5.0    7.26    1.83  8.00  65.85 0.85   0.000
       [I%=55.0:S%= 2.00]
  *
    *  CALIB STANDHYD     0028  1  5.0    1.14    0.36  8.00  68.11 0.87   0.000
       [I%=70.0:S%= 2.00]
  *
       ADD [0027 + 0028]  0031  3  5.0    8.40    2.20  8.00  66.16  n/a   0.000
  *
       RESRVR [ 2 : 0031] 0030  1  5.0    8.40    0.07  9.83  65.99  n/a   0.000
       {ST=  0.46 ha.m }
  *
       ADD [0030 + 0032]  0056  3  5.0   99.61    2.83  8.33  53.57  n/a   0.000
  *
       ADD [0056 + 0064]  0056  1  5.0  109.28    3.27  8.33  51.07  n/a   0.000
  *
       ADD [0056 + 0066]  0056  3  5.0  123.76    3.29  8.33  48.06  n/a   0.000
  *
    *  CALIB STANDHYD     0052  1  5.0    0.75    0.24  8.00  68.24 0.88   0.000
       [I%=70.0:S%= 2.00]
  *
    *  CALIB STANDHYD     0051  1  5.0    4.91    1.36  8.00  66.01 0.85   0.000
       [I%=55.0:S%= 2.00]
  *
       ADD [0051 + 0052]  0053  3  5.0    5.66    1.60  8.00  66.30  n/a   0.000
  *
       RESRVR [ 2 : 0053] 0054  1  5.0    5.66    0.31  8.58  65.95  n/a   0.000
       {ST=  0.22 ha.m }
  *
    *  CALIB NASHYD       0107  1  5.0    3.15    0.25  8.17  25.24 0.32   0.000
       [CN=65.0          ]
       [ N = 3.0:Tp 0.17]
```

```
   *   CALIB STANDHYD     0106  1  5.0    1.76    0.22  8.00  39.52 0.51   0.000
       [I%=25.0:S%= 2.00]
   *
       ADD [0106 + 0107]  0108  3  5.0    4.91    0.44  8.17  30.36  n/a   0.000
   *
       ****************************
       ** SIMULATION NUMBER:   0 ** 100-yr
       ****************************

   W/E COMMAND                HYD ID   DT     AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                       min     ha      cms   hrs     mm          cms

       START @  0.00 hrs
       --------------------
       CHIC STORM                    10.0
       [ Ptot=108.98 mm ]
   *
  **   CALIB NASHYD       0062  1  5.0   16.55    1.05  8.50  44.90 0.41   0.000
       [CN=65.0           ]
       [ N = 3.0:Tp 0.46]
   *
  **   CALIB NASHYD       0063  1  5.0   12.25    1.38  8.17  44.80 0.41   0.000
       [CN=65.0           ]
       [ N = 3.0:Tp 0.19]
   *
  **   CALIB NASHYD       0059  1  5.0    1.07    0.23  8.08  72.45 0.66   0.000
       [CN=85.0           ]
       [ N = 3.0:Tp 0.18]
   *
   *   CALIB STANDHYD     0029  1  5.0    0.58    0.26  8.00  95.88 0.88   0.000
       [I%=55.0:S%= 2.00]
   *
   *   CALIB STANDHYD     0061  1  5.0    1.08    0.49  8.00  95.88 0.88   0.000
       [I%=55.0:S%= 2.00]
   *
       DUHYD              0024  1  5.0    1.08    0.49  8.00  95.88  n/a   0.000
          MAJOR SYSTEM:   0024  2  5.0    0.19    0.31  8.00  95.88  n/a   0.000
          MINOR SYSTEM:   0024  3  5.0    0.89    0.18  7.92  95.88  n/a   0.000
   *
       ADD [0024 + 0029]  0026  3  5.0    0.77    0.57  8.00  95.88  n/a   0.000
   *
       ADD [0026 + 0059]  0026  1  5.0    1.84    0.76  8.00  82.24  n/a   0.000
   *
   *   CALIB STANDHYD     0022  1  5.0    8.85    3.85  8.00  95.88 0.88   0.000
       [I%=55.0:S%= 2.00]
   *
   *   CALIB STANDHYD     0060  1  5.0    0.88    0.42  8.00  98.20 0.90   0.000
       [I%=70.0:S%= 2.00]
   *
   *   CALIB STANDHYD     0068  1  5.0    0.97    0.51  8.00 101.46 0.93   0.000
       [I%=80.0:S%= 2.00]
   *
       DUHYD              0069  1  5.0    0.97    0.51  8.00 101.46  n/a   0.000
          MAJOR SYSTEM:   0069  2  5.0    0.17    0.29  8.00 101.46  n/a   0.000
          MINOR SYSTEM:   0069  3  5.0    0.80    0.22  7.92 101.46  n/a   0.000
   *
       ADD [0022 + 0024]  0058  3  5.0    9.74    4.03  8.00  95.88  n/a   0.000
   *
       ADD [0058 + 0060]  0058  1  5.0   10.61    4.45  8.00  96.07  n/a   0.000
   *
       ADD [0058 + 0069]  0058  3  5.0   11.42    4.67  8.00  96.45  n/a   0.000
   *
       RESRVR [ 2 : 0058] 0025  1  5.0   11.42    0.58  8.50  96.46  n/a   0.000
       {ST=  0.54 ha.m }
   *
       ADD [0025 + 0026]  0057  3  5.0   13.26    1.27  8.00  94.49  n/a   0.000
   *
  **   CALIB NASHYD       0071  1  5.0    1.33    0.16  8.08  44.75 0.41   0.000
       [CN=65.0           ]
       [ N = 3.0:Tp 0.17]
   *
   *   CALIB STANDHYD     0002  1  5.0   20.29    8.14  8.00  95.88 0.88   0.000
       [I%=55.0:S%= 2.00]
   *
   *   CALIB STANDHYD     0003  1  5.0    2.63    1.24  8.00  98.20 0.90   0.000
       [I%=70.0:S%= 2.00]
   *
   *   CALIB STANDHYD     0004  1  5.0    5.37    2.30  8.00  95.88 0.88   0.000
       [I%=55.0:S%= 2.00]
   *
       DUHYD              0006  1  5.0    5.37    2.30  8.00  95.88  n/a   0.000
          MAJOR SYSTEM:   0006  2  5.0    1.08    1.57  8.00  95.88  n/a   0.000
          MINOR SYSTEM:   0006  3  5.0    4.29    0.72  7.92  95.88  n/a   0.000
```

	ADD [0002 + 0003]	0008	3	5.0	22.92	9.38	8.00	96.15	n/a	0.000
*										
	ADD [0008 + 0006]	0008	1	5.0	24.00	10.96	8.00	96.14	n/a	0.000
*										
	RESRVR [2 : 0008] {ST= 1.77 ha.m }	0072	1	5.0	24.00	0.12	13.83	95.19	n/a	0.000
*										
*	CALIB STANDHYD [I%=55.0:S%= 2.00]	0011	1	5.0	10.26	4.28	8.00	95.88	0.88	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0012	1	5.0	1.07	0.51	8.00	98.20	0.90	0.000
*										
*	CALIB STANDHYD [I%=55.0:S%= 2.00]	0013	1	5.0	5.37	2.30	8.00	95.88	0.88	0.000
*										
	DUHYD	0014	1	5.0	5.37	2.30	8.00	95.88	n/a	0.000
	MAJOR SYSTEM:	0014	2	5.0	1.08	1.57	8.00	95.88	n/a	0.000
	MINOR SYSTEM:	0014	3	5.0	4.29	0.72	7.92	95.88	n/a	0.000
*										
	ADD [0011 + 0012]	0015	3	5.0	11.33	4.79	8.00	96.10	n/a	0.000
*										
	ADD [0015 + 0014]	0015	1	5.0	15.62	5.51	8.00	96.04	n/a	0.000
*										
	RESRVR [2 : 0015] {ST= 0.95 ha.m }	0016	1	5.0	15.62	0.21	10.08	95.91	n/a	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0035	1	5.0	6.63	3.06	8.00	98.20	0.90	0.000
*										
	RESRVR [2 : 0035] {ST= 0.49 ha.m }	0036	1	5.0	6.63	0.04	12.42	97.69	n/a	0.000
*										
*	CALIB STANDHYD [I%=80.0:S%= 2.00]	0070	1	5.0	1.41	0.74	8.00	101.46	0.93	0.000
*										
	ADD [0069 + 0070]	0074	3	5.0	1.58	1.04	8.00	101.46	n/a	0.000
*										
	ADD [0016 + 0036]	0032	3	5.0	22.25	0.25	11.08	96.44	n/a	0.000
*										
	ADD [0032 + 0057]	0032	1	5.0	35.51	1.46	8.00	95.71	n/a	0.000
*										
	ADD [0032 + 0062]	0032	3	5.0	52.06	1.99	8.42	79.56	n/a	0.000
*										
	ADD [0032 + 0063]	0032	1	5.0	64.31	3.21	8.17	72.94	n/a	0.000
*										
	ADD [0032 + 0071]	0032	3	5.0	65.64	3.37	8.17	72.37	n/a	0.000
*										
	ADD [0032 + 0072]	0032	1	5.0	89.64	3.47	8.17	78.48	n/a	0.000
*										
	ADD [0032 + 0074]	0032	3	5.0	91.21	4.02	8.00	78.87	n/a	0.000
*										
*	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.41]	0064	1	5.0	9.67	0.67	8.42	44.90	0.41	0.000
*										
*	CALIB NASHYD [CN=65.0] [N = 3.0:Tp 0.35]	0065	1	5.0	14.48	1.12	8.33	44.90	0.41	0.000
*										
	SHIFT [2 : 0065] [SHIFT= 36.5 min]	0066	1	5.0	14.48	1.12	8.92	44.90	n/a	0.000
*										
*	CALIB STANDHYD [I%=55.0:S%= 2.00]	0027	1	5.0	7.26	3.07	8.00	95.88	0.88	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0028	1	5.0	1.14	0.54	8.00	98.20	0.90	0.000
*										
	ADD [0027 + 0028]	0031	3	5.0	8.40	3.62	8.00	96.20	n/a	0.000
*										
	RESRVR [2 : 0031] {ST= 0.56 ha.m }	0030	1	5.0	8.40	0.08	11.00	96.03	n/a	0.000
*										
	ADD [0030 + 0032]	0056	3	5.0	99.61	4.08	8.00	80.32	n/a	0.000
*										
	ADD [0056 + 0064]	0056	1	5.0	109.28	4.31	8.00	77.19	n/a	0.000
*										
	ADD [0056 + 0066]	0056	3	5.0	123.76	4.33	8.00	73.41	n/a	0.000
*										
*	CALIB STANDHYD [I%=70.0:S%= 2.00]	0052	1	5.0	0.75	0.36	8.00	98.33	0.90	0.000
*										
*	CALIB STANDHYD	0051	1	5.0	4.91	2.11	8.00	96.05	0.88	0.000

```
       [I%=55.0:S%= 2.00]
*
       ADD [0051 + 0052]  0053  3  5.0    5.66    2.47  8.00  96.35  n/a   0.000
*
       RESRVR [ 2 : 0053] 0054  1  5.0    5.66    0.32  8.50  95.99  n/a   0.000
       {ST=  0.27 ha.m }
*
   *   CALIB NASHYD       0107  1  5.0    3.15    0.39  8.08  44.75 0.41   0.000
       [CN=65.0           ]
       [ N = 3.0:Tp 0.17]
*
   *   CALIB STANDHYD     0106  1  5.0    1.76    0.41  8.00  62.21 0.57   0.000
       [I%=25.0:S%= 2.00]
*
       ADD [0106 + 0107]  0108  3  5.0    4.91    0.72  8.00  51.01  n/a   0.000
*
 FINISH
```

==========

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

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
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
```


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

Input filename: C:\Program Files (x86)\VH Suite 3.0\VO2\voin.dat
Output filename: C:\Users\david.mcnaull\AppData\Local\Temp\2429c869-e7d6-46bc-b497-4d920f7f2a3d\Scenario.
Summary filename: C:\Users\david.mcnaull\AppData\Local\Temp\2429c869-e7d6-46bc-b497-4d920f7f2a3d\Scenario.

DATE: 06/06/2019 TIME: 01:40:16

USER:

COMMENTS: Blocked Condition

****
** SIMULATION NUMBER: -5 ** 100yr
****

| CHICAGO STORM |
| Ptotal=108.98 mm |

IDF curve parameters: A=1770.000
B= 4.000
C= 0.820
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.84	6.17	2.90	12.17	2.55	18.17	1.21
0.33	0.86	6.33	3.15	12.33	2.47	18.33	1.19
0.50	0.88	6.50	3.46	12.50	2.39	18.50	1.17
0.67	0.89	6.67	3.85	12.67	2.32	18.67	1.16
0.83	0.91	6.83	4.34	12.83	2.25	18.83	1.14
1.00	0.93	7.00	5.00	13.00	2.19	19.00	1.13
1.17	0.95	7.17	5.92	13.17	2.13	19.17	1.11
1.33	0.97	7.33	7.33	13.33	2.07	19.33	1.10
1.50	0.99	7.50	9.77	13.50	2.02	19.50	1.09
1.67	1.01	7.67	15.10	13.67	1.97	19.67	1.07
1.83	1.03	7.83	38.21	13.83	1.92	19.83	1.06
2.00	1.05	8.00	203.31	14.00	1.87	20.00	1.05
2.17	1.08	8.17	50.96	14.17	1.83	20.17	1.04
2.33	1.11	8.33	25.51	14.33	1.79	20.33	1.03
2.50	1.13	8.50	17.18	14.50	1.75	20.50	1.01
2.67	1.16	8.67	13.06	14.67	1.72	20.67	1.00
2.83	1.20	8.83	10.60	14.83	1.68	20.83	0.99
3.00	1.23	9.00	8.96	15.00	1.65	21.00	0.98
3.17	1.26	9.17	7.78	15.17	1.61	21.17	0.97
3.33	1.30	9.33	6.90	15.33	1.58	21.33	0.96
3.50	1.34	9.50	6.21	15.50	1.55	21.50	0.95
3.67	1.39	9.67	5.65	15.67	1.53	21.67	0.94
3.83	1.43	9.83	5.19	15.83	1.50	21.83	0.93
4.00	1.48	10.00	4.81	16.00	1.47	22.00	0.92
4.17	1.54	10.17	4.48	16.17	1.45	22.17	0.91
4.33	1.60	10.33	4.20	16.33	1.42	22.33	0.91
4.50	1.66	10.50	3.96	16.50	1.40	22.50	0.90
4.67	1.73	10.67	3.74	16.67	1.38	22.67	0.89
4.83	1.81	10.83	3.55	16.83	1.36	22.83	0.88
5.00	1.89	11.00	3.38	17.00	1.33	23.00	0.87
5.17	1.99	11.17	3.23	17.17	1.31	23.17	0.86
5.33	2.10	11.33	3.09	17.33	1.29	23.33	0.86
5.50	2.22	11.50	2.96	17.50	1.28	23.50	0.85

5.67	2.35	11.67	2.85	17.67	1.26	23.67	0.84
5.83	2.51	11.83	2.74	17.83	1.24	23.83	0.83
6.00	2.69	12.00	2.64	18.00	1.22	24.00	0.83

CALIB STANDHYD (0022)	Area (ha)= 9.03
ID= 1 DT= 5.0 min	Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.87	3.16
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	3.00	2.00
Length	(m)=	245.30	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.84	6.083	2.90	12.083	2.55	18.08	1.21
0.167	0.84	6.167	2.90	12.167	2.55	18.17	1.21
0.250	0.86	6.250	3.15	12.250	2.47	18.25	1.19
0.333	0.86	6.333	3.15	12.333	2.47	18.33	1.19
0.417	0.88	6.417	3.46	12.417	2.39	18.42	1.17
0.500	0.88	6.500	3.46	12.500	2.39	18.50	1.17
0.583	0.89	6.583	3.85	12.583	2.32	18.58	1.16
0.667	0.89	6.667	3.85	12.667	2.32	18.67	1.16
0.750	0.91	6.750	4.34	12.750	2.25	18.75	1.14
0.833	0.91	6.833	4.34	12.833	2.25	18.83	1.14
0.917	0.93	6.917	5.00	12.917	2.19	18.92	1.13
1.000	0.93	7.000	5.00	13.000	2.19	19.00	1.13
1.083	0.95	7.083	5.92	13.083	2.13	19.08	1.11
1.167	0.95	7.167	5.92	13.167	2.13	19.17	1.11
1.250	0.97	7.250	7.33	13.250	2.07	19.25	1.10
1.333	0.97	7.333	7.33	13.333	2.07	19.33	1.10
1.417	0.99	7.417	9.77	13.417	2.02	19.42	1.09
1.500	0.99	7.500	9.77	13.500	2.02	19.50	1.09
1.583	1.01	7.583	15.10	13.583	1.97	19.58	1.07
1.667	1.01	7.667	15.11	13.667	1.97	19.67	1.07
1.750	1.03	7.750	38.21	13.750	1.92	19.75	1.06
1.833	1.03	7.833	38.22	13.833	1.92	19.83	1.06
1.917	1.05	7.917	203.31	13.917	1.87	19.92	1.05
2.000	1.05	8.000	203.30	14.000	1.87	20.00	1.05
2.083	1.08	8.083	50.96	14.083	1.83	20.08	1.04
2.167	1.08	8.167	50.96	14.167	1.83	20.17	1.04
2.250	1.11	8.250	25.51	14.250	1.79	20.25	1.03
2.333	1.11	8.333	25.51	14.333	1.79	20.33	1.03
2.417	1.13	8.417	17.18	14.417	1.75	20.42	1.01
2.500	1.13	8.500	17.18	14.500	1.75	20.50	1.01
2.583	1.16	8.583	13.06	14.583	1.72	20.58	1.00
2.667	1.16	8.667	13.06	14.667	1.72	20.67	1.00
2.750	1.20	8.750	10.60	14.750	1.68	20.75	0.99
2.833	1.20	8.833	10.60	14.833	1.68	20.83	0.99
2.917	1.23	8.917	8.96	14.917	1.65	20.92	0.98
3.000	1.23	9.000	8.96	15.000	1.65	21.00	0.98
3.083	1.26	9.083	7.78	15.083	1.61	21.08	0.97
3.167	1.26	9.167	7.78	15.167	1.61	21.17	0.97
3.250	1.30	9.250	6.90	15.250	1.58	21.25	0.96
3.333	1.30	9.333	6.90	15.333	1.58	21.33	0.96
3.417	1.34	9.417	6.21	15.417	1.55	21.42	0.95
3.500	1.34	9.500	6.21	15.500	1.55	21.50	0.95
3.583	1.39	9.583	5.65	15.583	1.53	21.58	0.94
3.667	1.39	9.667	5.65	15.667	1.53	21.67	0.94
3.750	1.43	9.750	5.19	15.750	1.50	21.75	0.93
3.833	1.43	9.833	5.19	15.833	1.50	21.83	0.93
3.917	1.48	9.917	4.81	15.917	1.47	21.92	0.92
4.000	1.48	10.000	4.81	16.000	1.47	22.00	0.92
4.083	1.54	10.083	4.48	16.083	1.45	22.08	0.91
4.167	1.54	10.167	4.48	16.167	1.45	22.17	0.91
4.250	1.60	10.250	4.20	16.250	1.42	22.25	0.91
4.333	1.60	10.333	4.20	16.333	1.42	22.33	0.91
4.417	1.66	10.417	3.96	16.417	1.40	22.42	0.90
4.500	1.66	10.500	3.96	16.500	1.40	22.50	0.90
4.583	1.73	10.583	3.74	16.583	1.38	22.58	0.89
4.667	1.73	10.667	3.74	16.667	1.38	22.67	0.89
4.750	1.81	10.750	3.55	16.750	1.36	22.75	0.88
4.833	1.81	10.833	3.55	16.833	1.36	22.83	0.88
4.917	1.89	10.917	3.38	16.917	1.33	22.92	0.87
5.000	1.89	11.000	3.38	17.000	1.33	23.00	0.87

5.083	1.99	11.083	3.23	17.083	1.31	23.08	0.86
5.167	1.99	11.167	3.23	17.167	1.31	23.17	0.86
5.250	2.10	11.250	3.09	17.250	1.29	23.25	0.86
5.333	2.10	11.333	3.09	17.333	1.29	23.33	0.86
5.417	2.22	11.417	2.96	17.417	1.28	23.42	0.85
5.500	2.22	11.500	2.96	17.500	1.28	23.50	0.85
5.583	2.35	11.583	2.85	17.583	1.26	23.58	0.84
5.667	2.35	11.667	2.85	17.667	1.26	23.67	0.84
5.750	2.51	11.750	2.74	17.750	1.24	23.75	0.83
5.833	2.51	11.833	2.74	17.833	1.24	23.83	0.83
5.917	2.69	11.917	2.64	17.917	1.22	23.92	0.83
6.000	2.69	12.000	2.64	18.000	1.22	24.00	0.83

Max.Eff.Inten.(mm/hr)=	203.31	202.15	
over (min)	5.00	10.00	
Storage Coeff. (min)=	2.37 (ii)	6.81 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.30	0.14	
			TOTALS
PEAK FLOW (cms)=	2.77	1.25	3.928 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	107.98	81.10	95.88
TOTAL RAINFALL (mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT =	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0060) ID= 1 DT= 5.0 min | Area (ha)= 0.88 Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.61	0.26
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	76.46	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.(mm/hr)=	203.31	143.97	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.64 (ii)	5.42 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.32	0.16	
			TOTALS
PEAK FLOW (cms)=	0.35	0.08	0.421 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	107.98	75.39	98.20
TOTAL RAINFALL (mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT =	0.99	0.69	0.90

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0061) ID= 1 DT= 5.0 min | Area (ha)= 1.08 Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.70	0.38
Dep. Storage	(mm)=	1.00	2.00
Average Slope	(%)=	5.00	2.00
Length	(m)=	84.89	40.00
Mannings n	=	0.013	0.250

Max.Eff.Inten.(mm/hr)=	203.31	202.15	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.08 (ii)	5.51 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.34	0.16	

				TOTALS
PEAK FLOW	(cms)=	0.34	0.16	0.488 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0024)
Inlet Cap.=0.177
#of Inlets= 1
Total(cms)= 0.2

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	1.08	0.49	8.00	95.88
MAJOR SYS.(ID= 2):	0.19	0.31	8.00	95.88
MINOR SYS.(ID= 3):	0.89	0.18	7.92	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0068) ID= 1 DT= 5.0 min

Area (ha)= 0.97
Total Imp(%)= 80.00 Dir. Conn.(%)= 80.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.78	0.19	
Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	3.00	2.00	
Length	(m)=	80.42	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	143.97	
over (min)		5.00	5.00	
Storage Coeff. (min)=		1.21 (ii)	4.27 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.33	0.23	
				TOTALS
PEAK FLOW	(cms)=	0.44	0.07	0.512 (iii)
TIME TO PEAK	(hrs)=	8.00	8.00	8.00
RUNOFF VOLUME	(mm)=	107.98	75.39	101.46
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.69	0.93

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0069)
Inlet Cap.=0.218
#of Inlets= 1
Total(cms)= 0.2

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	0.97	0.51	8.00	101.46
MAJOR SYS.(ID= 2):	0.17	0.29	8.00	101.46
MINOR SYS.(ID= 3):	0.80	0.22	7.92	101.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0101) ID= 1 DT= 5.0 min

Area (ha)= 0.38
Total Imp(%)= 65.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.25	0.13

Dep. Storage	(mm)=	1.00	2.00	
Average Slope	(%)=	3.00	2.00	
Length	(m)=	50.46	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		203.31	202.15	
over (min)		5.00	10.00	
Storage Coeff. (min)=		0.92 (ii)	5.35 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.34	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.12	0.06	0.173 (iii)
TIME TO PEAK	(hrs)=	8.00	8.08	8.00
RUNOFF VOLUME	(mm)=	107.98	81.10	95.88
TOTAL RAINFALL	(mm)=	108.98	108.98	108.98
RUNOFF COEFFICIENT	=	0.99	0.74	0.88

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0102)		AREA	QPEAK	TPEAK	R.V.
Inlet Cap.=0.067		(ha)	(cms)	(hrs)	(mm)
#of Inlets= 1					
Total(cms)= 0.1	TOTAL HYD.(ID= 1):	0.38	0.17	8.00	95.88
	MAJOR SYS.(ID= 2):	0.06	0.11	8.00	95.88
	MINOR SYS.(ID= 3):	0.32	0.07	7.92	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0102):	0.32	0.067	7.92	95.88
	+ ID2= 2 (0022):	9.03	3.928	8.00	95.88
	ID = 3 (0058):	9.35	3.995	8.00	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0058):	9.35	3.995	8.00	95.88
	+ ID2= 2 (0024):	0.19	0.311	8.00	95.88
	ID = 1 (0058):	9.54	4.306	8.00	95.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0058):	9.54	4.306	8.00	95.88
	+ ID2= 2 (0060):	0.88	0.421	8.00	98.20
	ID = 3 (0058):	10.41	4.727	8.00	96.08

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0058)	AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1	(ha)	(cms)	(hrs)	(mm)

```
          ID1= 3 (0058):     10.41    4.727      8.00     96.08
        + ID2= 2 (0069):      0.17    0.294      8.00    101.46
          ==========================================================
          ID = 1 (0058):     10.58    5.021      8.00     96.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (0025) |
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW     STORAGE    |  OUTFLOW     STORAGE
 --------------------       (cms)      (ha.m.)    |    (cms)      (ha.m.)
                           0.0000      0.0000     |   1.9222       0.1000
                           0.6092      0.0493     |   5.0000       0.1524

                                    AREA      QPEAK      TPEAK       R.V.
                                    (ha)      (cms)      (hrs)       (mm)
     INFLOW : ID= 2 (0058)        10.578      5.021       8.00      96.16
     OUTFLOW: ID= 1 (0025)        10.578      3.957       8.00      96.16

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 78.82
                   TIME SHIFT OF PEAK FLOW          (min)=  0.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=  0.1506

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 FINISH
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SCHEDULE 4

-OVERLAND FLOW CALCULATIONS

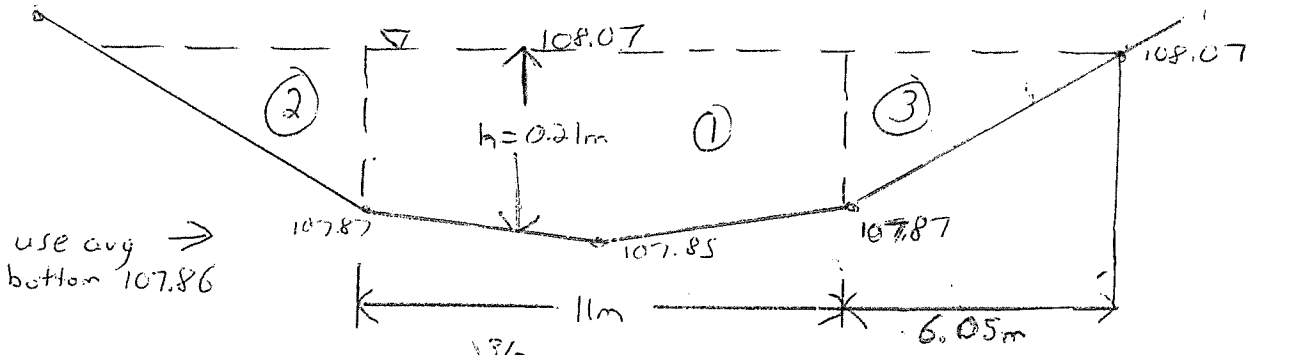
-BIO-RETENTION SWALE SIZING

Overland Flow Calculations

$Q_{major} = Q_{roof} - Q_{str}$

$Q_{major} = 3.852 - 1.394$
$Q_{major} = 2.458 m^3/sec$ - VH node 22

Maximum ponding elevation not to exceed 0.30m above L/P of road.
L/P = 107.87, therefore, ponding should not exceed 108.17m
Assess ponding elevation at 108.07.



$Q_{capacity} = \frac{2}{3} C_w B \sqrt{2g} (h)^{3/2}$ $C_w = 0.577$

$Q_{capacity} = \frac{2}{3} (0.577) \sqrt{2g} B (h)^{3/2}$
$Q_{cap} = 1.70386 B (h)^{3/2}$

$Q_1 = 1.70386 (11)(0.21)^{3/2}$
$Q_1 = 1.804 m^3/sec$

$Q_2 = 1.70386 (6.05)(\frac{2}{3} 0.21)^{3/2}$
$Q_2 = 0.54 m^3/sec$
$Q_2 = Q_3$
$Q_{cap} = Q_1 + Q_2 + Q_3$

$Q_{cap} = 2.88 m^3/sec > Q_{maj}$

Therefore, the proposed weir has sufficient capacity to convey major flows to the pond.

PROJECT	Rondeau (Cobourg) Ltd.
PROJECT #	114057
DATE	Jun-19

Infiltration Galleries

Figure XXX

	Lots 19-22	Lots 97-104	Lots 84-87	
Drainage Area	1400	1830	975	m2
Storm event	10	10	10	mm
Porosity	0.4	0.4	0.4	
Volume of Water	14.0	18.3	9.8	m3
Volume of Water and Stone Needed	**35.0**	**45.8**	**24.4**	**m3**
Infiltration Rate	12	12	12	mm/hr
Drainage Time	48	48	48	hr

Max Stone Depth= $\frac{infiltration\ rate \times drainage\ time}{porosity}$

Max Stone Depth	1400	1400	1400	mm
Dimensions				
Depth	1.00	1.00	1.00	m
Length	35.0	46.0	25.0	m
Width	1.0	1.0	1.0	m
Volume Provided	**35.0**	**46.0**	**25.0**	**m3**

LEGEND

---- DRAINAGE BOUNDARY

920 DRAINAGE AREA (m^2)

BLK 149

DENTON DRIVE

BLK 148 (PARK)

STREET A

STREET B

STREET C

BLK 144

BLK 146

955

1830

1340

RONDEAU (COBOURG) LTD.

BIO-RETENTION SWALES

SCALE	1:1000
DRAWN	D.D.M.
DESIGN	D.D.M.
CHECKED	M.B.C.
DATE	6/9/19
PROJECT	114057
DWG	FIG 7

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST · OSHAWA, ON · L1H 1B6
PHONE (905)576-8500 · FAX (905)576-9730
info@dgbiddle.com

\\FSHR\STAFF\JOB FILES\114000\114057 RONDEAU COBOURG\114057 DRAWINGS CIVIL\114057 FIGURES\114057 - FIGURE 7 BIO-RETENTION SWALES.DWG