GREER GALLOWAY
CONSULTING ENGINEERS

# Brighthouse Farm Preliminary Stormwater Management Report September 2020

**Prepared for:**

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**Submitted by:**

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**Project # 18-3-6383**

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# 1. Introduction

The Greer Galloway Group (GGG) has been retained to provide engineering services to support the development of a parking lot and cabins for an existing barn structure proposed to be used as a future event venue at 1244 County Road 2, Prince Edward County. This report has been prepared in consideration of Stormwater Management (SWM) to support the engineering design submission.

## 1.1 Scope of Report

This SWM Report addresses the potential effects of the proposed development on stormwater quality and describes the proposed measures necessary to mitigate post-development impacts through the use of various control systems and/or best management practices.

## 1.2 Standards and Guidelines

The following standards and guidelines were consulted in the preparation of the SWMD:

- Low Impact Development Stormwater Management Planning and Design Guide – Credit Valley Conservation & Toronto and Region Conservation, 2010;
- Stormwater Management Planning and Design Manual - Ministry of the Environment, 2003; and
- MTO Drainage Management Manual – Ministry of Transportation, 1997.

## 1.3 Design Criteria

The design criteria for the stormwater management system are based on the requirements of Quinte Conservation, Ministry of the Environment, Conservation and Parks (MECP), and the County of Prince Edward. Based on conversations with Quinte Conservation if development on site stays under 1 hectare, stormwater design for the site can follow best management practices and provide quality and quantity treatment as feasible. The key design criteria are listed below:

- Enhanced (Level 1) quality treatment as defined by the MOECP is required.
- All stormwater from new development areas is to drain towards an existing low lying wetland. As it is expected to take a long time for runoff to work its way out of the wetland no quantity treatment is to be provided.
- Sediment transference and erosion is to be mitigated during and after construction.

# 2. Hydrologic Modelling and Stormwater Controls

Hydrologic modelling has been completed using Visual OTTHYMO software. Visual OTTHYMO is a widely accepted modelling software that is able to model both urban and rural watersheds.

The design storm was synthesized using a ten minute time step as per standard practice and based on intensity-duration-frequency (IDF) data provided by the MTO. The resulting rainfall hyetographs were used as storm files in the Visual OTTHYMO 5.0 hydrological models. Modeling was performed for the SCS, AES and CHC storm distributions. Further information regarding the design storms can be found within the OTTHYMO summary outputs in Appendix B.

# 3. Existing Conditions

The development site is located in Prince Edward County, at 1244 County Road 2 and has an area of 37.35 ha. The Proposed developments onsite can be divided into two separate catchments, one by the existing barn in the north where a 53 space parking lot and new entrance is to be installed and a second in the east where new guest cabins are to be located.

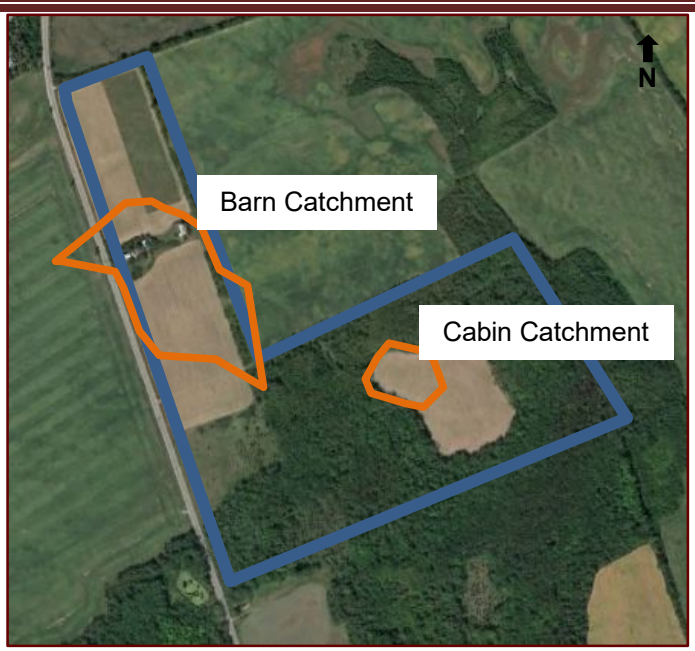



**Figure 3-1: Project Site**

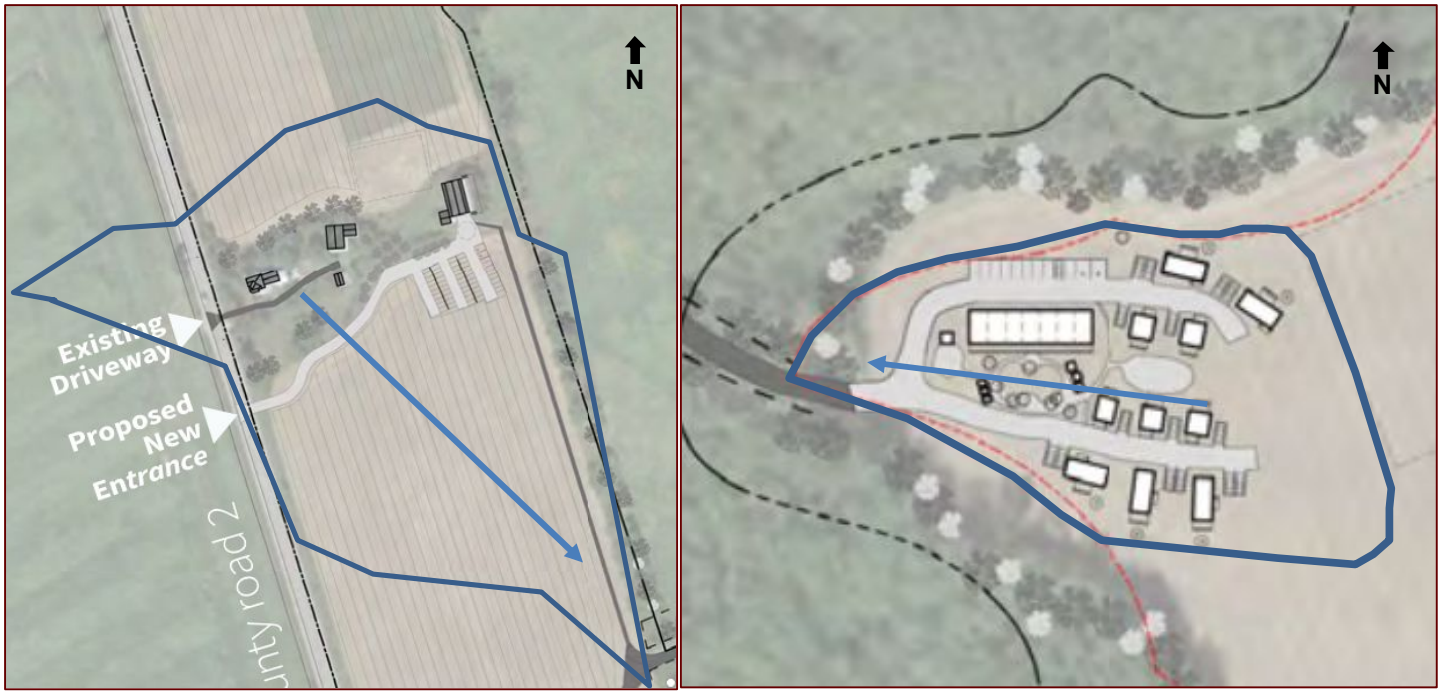



**Figure 3-2: Site Watersheds (Barn Catchment Left, Cabin Catchment Right)**

The existing barn catchment includes several buildings a driveway and a portion of County road 2 amounting to 2,200 $m^2$ of existing impervious area in the catchment. Development in the barn parking catchment is to include the addition of a new 53 space parking lot and entrance road amounting to 3,200 $m^2$ of new impervious ground cover making a total of 5,400 $m^2$ impervious cover in the 6.38 ha catchment.

The cabin catchment is located at the northwest corner of an existing farmers field surrounded by wetland. The cabin catchment has an area of 0.93 ha and within the catchment runoff drains northwest towards the wetland. Development in the

cabin area will include 9 new cabins, a larger reception/inn building with 6 suites, a new roadway and parking, this adds up to approximately 2,600 m$^2$ of new impervious surface cover.

According to the Ontario Soil Survey, the soil throughout the site consists of Clay loam as shown in Figure 3-3, therefore the soil on site has been assigned to hydrologic group D. The site is covered with a mixture of grass, weeds and bush. Based on soil and cover conditions the site has been assigned an SCS curve number of 82.

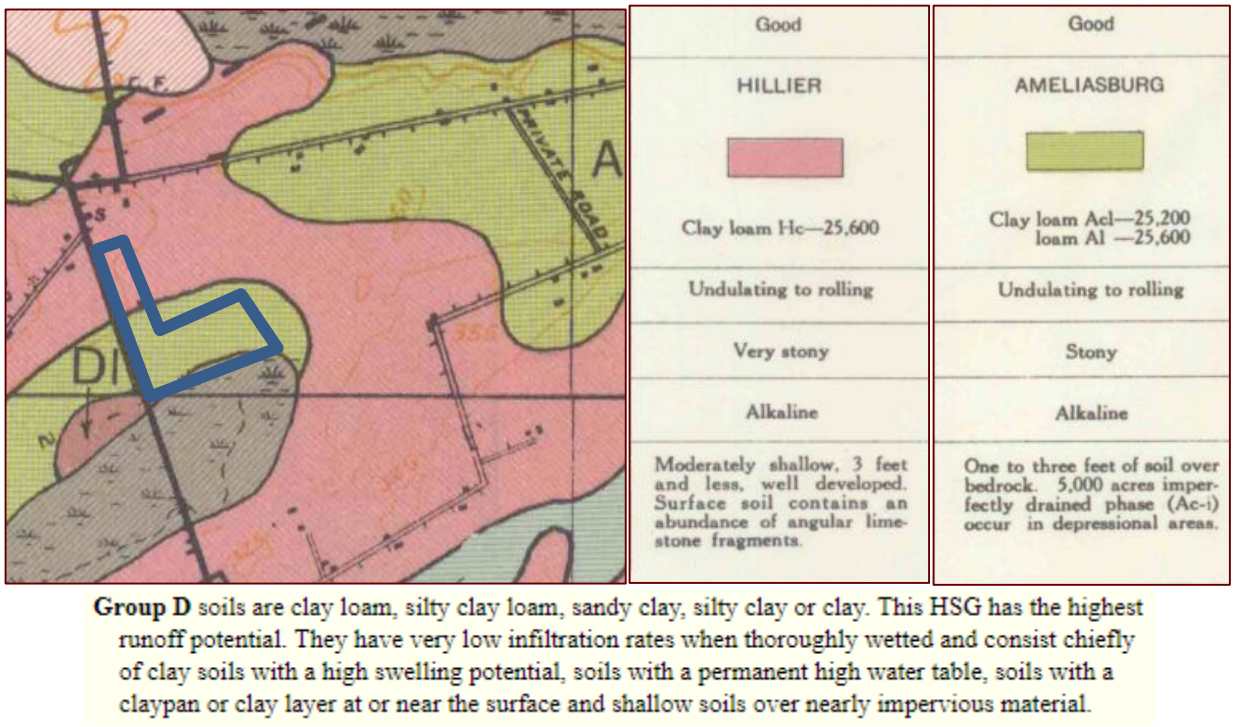



**Figure 3-3: Site Soil Type**

## 3.1 Pre-Development Model

Pre-development models were created for both the barn parking and cabin catchments to provide a comparison of pre and post development storm flows, even though no quantity control is to be provided. Time to peak values were calculated for the Barn Parking and Cabin watershed using the airport formula shown below.

Barn: $T_c = \frac{3.26*(1.1-C)*L^{0.5}}{S_w^{0.33}} = \frac{3.26*(1.1-0.2)*530^{0.5}}{0.94^{0.33}} = 46.13\ min,\ T_p = T_c * 0.67 = 68.86\ min * 0.67 * \frac{1\ hr}{60\ min} = 0.77\ hr$

Cabins: $T_c = \frac{3.26*(1.1-C)*L^{0.5}}{S_w^{0.33}} = \frac{3.26*(1.1-0.2)*150^{0.5}}{1.82^{0.33}} = 29.49\ min,\ T_p = T_c * 0.67 = 29.49\ min * 0.67 * \frac{1\ hr}{60\ min} = 0.33\ hr$

The pre-development catchment OTTHYMO characteristics are summarized in Table 3-1 and Figure 3-4 below represents the catchments.

**Table 3-1: Pre-Development Catchment Properties**

| Catchment | Catchment Type | Area (ha.) | Initial Loss (mm) | CN | Tp (hrs.) |
|---|---|---|---|---|---|
| Barn | NasHyd | 6.38 | 5 | 82.66 | 0.77 |
| Cabins | NasHyd | 0.93 | 5 | 82 | 0.33 |

The predevelopment Barn Catchment has 3.5% percent impervious cover, because of the low impervious level the catchment was modeled as a NasHyd catchment. The catchment was assigned a CN number based on a weighted average of the impervious and pervious areas with the pervious area having a CN of 82 and the impervious area having a CN of 100.


**Figure 3-4: Pre Development VO Schematic**

## 4. Barn Catchment Stormwater Management

### 4.1 Summary of Post-Development Barn Catchment

Table 4-1 below summarizes the post-development barn catchment and Figure 4-1 shows a schematic of the catchment.

**Table 4-1: Post-Development Catchment Properties**

| Catchment | Catchment Type | Area (ha.) | CN | Tp (hrs.) |
|---|---|---|---|---|
| Barn | NasHyd | 6.38 | 83.4 | 0.77 |

The post development Barn Catchment has 8.5 % percent impervious cover, because of the low impervious level the catchment was modeled as a NasHyd catchment. The catchment was assigned a CN number based on a weighted average of the impervious and pervious areas with the pervious area having a CN of 82 and the impervious area having a CN of 100.

Post-Development all runoff from the barn catchment will be collected and conveyed by a 225 m long swale stretching the length of the catchment from the parking area to the wetland in the southeast corner of the property. The swale is to serve the purpose of conveyance and quality treatment by functioning as an enhanced grass swale. The swale is to be 0.3 m deep, have a bottom width of 1.5 m, side slopes of 3:1, a top width of 3.30 m and have a channel slope of 0.8%.

Post-development quantity control is not to be provided for the catchment as runoff from the catchment will travel immediately downstream to the wetland and is to be detained there. The swale will outlet directly to the wetland in the southeast of the property. To prevent erosion at the outlet the last 20 m of the swale is to be protected with rip rap. As the wetland does not have an immediate outlet, stormwater from the proposed development will attenuate within the wetland.

The post development OTTHYMO schematic is shown in Figure 4-1 below. A comparison of peak runoff flows for the pre development and post development scenarios is presented in Table 4-2 below and the detailed output is available in Appendix B.

Because the slopes of the existing field falls within acceptable ranges, the proposed areas for grading the ditch will not take away from the total cultivated land on the property.


**Figure 4-1: Post Development Controlled OTTHYMO Schematic**

| Table 4-2: Comparison of Storm Flows | | |
|---|---|---|
| **Storm** | **Pre-Development Flow ($m^3/s$)** | **Post-Development Flow Uncontrolled ($m^3/s$)** |
| **4 hr 25 mm CHC** | 0.0469 | 0.0488 |
| **10 yr 6 hr aes** | 0.1672 | 0.1716 |
| **10 yr 12 hr aes** | 0.1306 | 0.1340 |
| **10 yr 4 hr chc** | 0.1585 | 0.1636 |
| **10 yr 24 hr scs** | 0.3019 | 0.3089 |
| **25 yr 6 hr aes** | 0.2156 | 0.2208 |
| **25 yr 12 hr aes** | 0.1680 | 0.1721 |
| **25 yr 4 hr chc** | 0.2100 | 0.2162 |
| **25 yr 24 hr scs** | 0.3834 | 0.3914 |
| **50 yr 6 hr aes** | 0.2528 | 0.2584 |
| **50 yr 12 hr aes** | 0.1970 | 0.2014 |
| **50 yr 4 hr chc** | 0.2524 | 0.2594 |
| **50 yr 24 hr scs** | 0.4457 | 0.4542 |
| **100 yr 6 hr aes** | 0.2908 | 0.2968 |
| **100 yr 12 hr aes** | 0.2268 | 0.2316 |
| **100 yr 4 hr chc** | 0.2942 | 0.3019 |
| **100 yr 24 hr scs** | 0.5081 | 0.5170 |

Using the program Flow Master the swale has been estimated to have a capacity of 0.7630 $m^3/s$ exceeding the 100 year storm flow. All post-development storm events up to and including the 100 year storm are to be contained within the swale without overtopping. All Flow Master outputs are available in Appendix C.

### 4.2 Quality Control

The swale has been designed as an enhanced grass swale to provide quality treatment as described by the TRCA and CVC's Low Impact Design Guidelines and the MOE's Stormwater Management Manual. To ensure the function of the enhanced grass swale is not affected by sediment pretreatment of runoff from impervious areas will be provided by a grass filter strip upstream of the main entrance of the swale. The grass filter strip is to be immediately east of the proposed parking lot, runoff will sheet flow south across filter strip and enter the enhanced grass swale. The filter strip will have a width ranging from 1.5 to 8 m and a length of 35 m.

Typical ratios of impervious drainage area to swale area range between 5:1 to 10:1. Within the barn catchment there is 5,400 $m^2$ of impervious surface cover. The swale is to have a top width of 3.3 m and a length of 225 m this gives a total swale area of 742.5 $m^2$. The barn catchment therefore has an impervious drainage area to swale an area ratio of 8.625:1 which is below the maximum of 10:1.

Other key criteria for enhanced grass swales include side slopes greater than 2.5H:1V, a channel slope between 0.5% to 6%, a bottom width between 0.75 and 3.0 m, a maximum flow depth of 100 mm and maximum flow velocity of 0.5 m/s during the 4 hour 25 mm Chicago storm event. The barn catchment enhanced grass swale is to have side slopes of 3H:1V, a channel slope of 0.8%, a bottom width of 1.5 m, a flow depth of 65 mm and flow velocity of 0.44 m/s during the 4 hour 25 mm Chicago

storm event. Additionally, the maximum velocity during the 100 year storm event is 0.94 $m^3/s$ below what is considered an erosive velocity at 1.0 m/s.

### 4.3 Internal Conveyance

The installation of the new driveway leading to the parking lot will affect the natural conveyance of drainage south through the barn catchment. To ensure there are no ponding issues on the driveway, a pair of twin culverts capable of conveying the 5 year flow is to be installed at the existing topographical low point crossing the driveway. The drainage catchment for the culvert is shown in Figure 4-2 below.

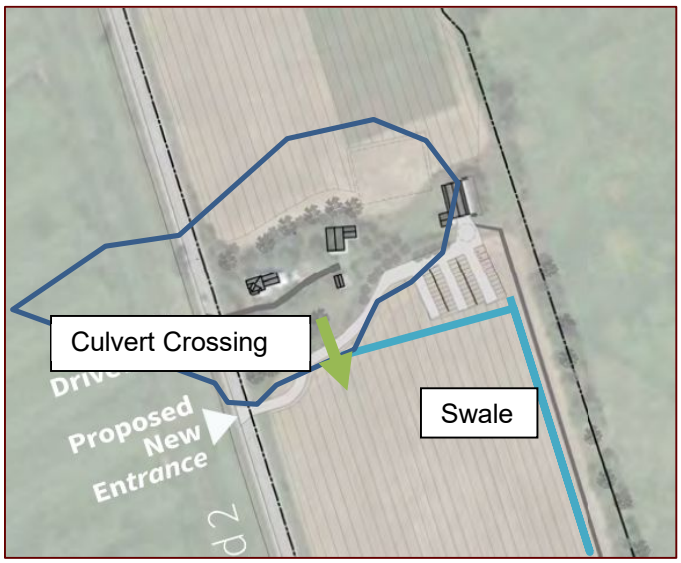



**Figure 4-2: Driveway Culvert Catchment**

The driveway will also be graded to dip over the 20 m immediately east of the culvert. This will convey any flows exceeding a 5 year return period across the road and limiting flooding to a small portion of the road. A visual OTTHYMO Drainage catchment was created to model storm flows at this location, the catchment properties are listed below in Table 4-3 and the Visual OTTHYMO catchment is shown in Figure 4-3.

**Table 4-3: Parking Road Catchment Properties**

| Catchment | Catchment Type | Area (ha.) | CN | Tp (hrs.) |
|---|---|---|---|---|
| Parking Road | NasHyd | 6.38 | 82.7 | 0.48 |

The catchment has 3.7 % percent impervious cover, because of the low impervious level the catchment was modeled as a NasHyd catchment. The catchment was assigned a CN number based on a weighted average of impervious and pervious area with the pervious area having a CN of 82 and the impervious area having a CN of 100. Calculation for Catchment time to peak is shown below.

$$T_c = \frac{3.26*(1.1-C)*L^{0.5}}{S_w^{0.33}} = \frac{3.26*(1.1-0.2)*246^{0.5}}{1.22^{0.33}} = 43.10\ min,\ T_p = T_c * 0.67 = 43.10\ min * 0.67 * \frac{1\ hr}{60\ min} = 0.48\ hr$$

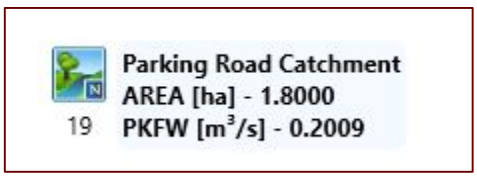


**Figure 4-3: Driveway Culvert Visual OTTHYMO Catchment**

| Table 4-4: Flows to Driveway Culvert | |
|---|---|
| **Storm** | **Flow ($m^3/s$)** |
| **5 yr 6 hr aes** | 0.0401 |
| **5 yr 12 hr aes** | 0.0311 |
| **5 yr 4 hr chc** | 0.0464 |
| **5 yr 24 hr scs** | 0.0949 |

Table 4-4 lists the flows to the culverts for all 5-year storm events. The twin culverts are designed to have diameters of 250 mm and slopes of 2.5%. Using the program Flow Master each culvert was calculated to have a capacity of 0.0533 $m^3/s$, providing a combined capacity of 0.1066 $m^3/s$. Together these culverts provided adequate capacity to convey the 5 year event. The Flow Master calculations are included in Appendix C.

Immediately downstream of the twin culverts runoff will enter an upstream arm of the main barn catchment swale. From here all runoff will continue into the main swale. The upstream arm is to have the same dimensions as the main swale (width, slope, depth, etc.) and therefore will have adequate capacity to convey storm flows.

## 5. Cabin Catchment Stormwater Management

### 5.1 Summary of Post-Development Cabin catchment

The post-development cabin catchment is to include 9 cabins, an inn building, roadway and parking amounting to 2,600 $m^2$ of impervious area approximately 28% of the catchment. The new catchment is represented in the Visual OTTHYMO model by an impervious (StandHyd) catchment summarized in table 5-1 below.

| Table 5-1: Post-Development Catchment Properties | | | | | |
|---|---|---|---|---|---|
| **Catchment** | **Catchment Type** | **Area (ha.)** | **CN** | **TIMP ($m^2/m^2$)** | **XIMP ($m^2/m^2$)** |
| Cabins | StandHyd | 0.93 | 82 | 0.28 | 0.2 |


**Figure 5-1: Post-Development OTTHYMO Cabin Schematic**

Post-development quantity control is not provided for the cabin catchment as runoff from the small (less than 1 ha) catchment will travel immediately downstream to the wetland and is expected to be detained there. Quality control and conveyance to the wetland will be provided by an enhanced grass swale immediately west of the cabin area, shown in Figure 5-2 below.

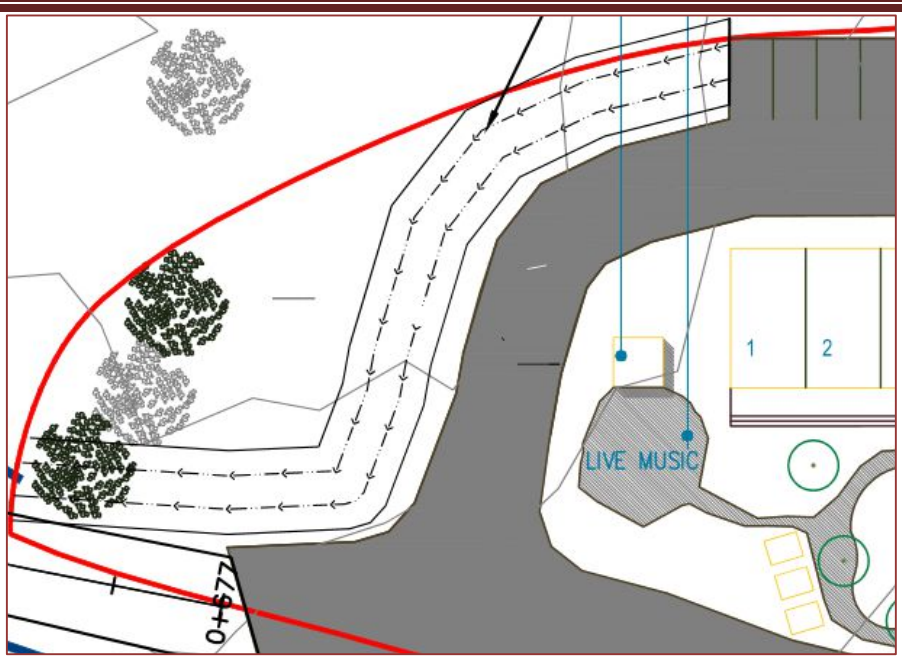



**Figure 5-2: Cabin Enhanced Grass Swale**

## 5.2 Pre and Post-Development Runoff

A comparison of peak runoff flows for the pre-development and post-development scenarios is presented in Table 5-2 below and the detailed output is available in Appendix B. The proposed enhanced grass swale will have a bottom width of 1.4 m, side slopes of 6:1 and a top width of 5.0 m and a conveyance capacity of 0.7481 $m^3/s$ well above the peak 100 year flow of 0.16 $m^3/s$.

| Table 5-2: Comparison of Storm Flows | | |
|---|---|---|
| **Storm** | **Pre-Development Flow ($m^3/s$)** | **Post-Development Flow ($m^3/s$)** |
| **4 hr 25 mm CHC** | 0.0112 | 0.0159 |
| **10 yr 6 hr aes** | 0.0269 | 0.0276 |
| **10 yr 12 hr aes** | 0.0207 | 0.0211 |
| **10 yr 4 hr chc** | 0.0399 | 0.0635 |
| **10 yr 24 hr scs** | 0.0785 | 0.0887 |
| **25 yr 6 hr aes** | 0.0353 | 0.0355 |
| **25 yr 12 hr aes** | 0.0265 | 0.0274 |
| **25 yr 4 hr chc** | 0.0534 | 0.0769 |
| **25 yr 24 hr scs** | 0.0998 | 0.1110 |
| **50 yr 6 hr aes** | 0.0418 | 0.0422 |
| **50 yr 12 hr aes** | 0.0310 | 0.0323 |
| **50 yr 4 hr chc** | 0.0645 | 0.0902 |
| **50 yr 24 hr scs** | 0.1161 | 0.1409 |
| **100 yr 6 hr aes** | 0.0485 | 0.0486 |
| **100 yr 12 hr aes** | 0.0355 | 0.0370 |
| **100 yr 4 hr chc** | 0.0755 | 0.1019 |
| **100 yr 24 hr scs** | 0.1325 | 0.1605 |

### 5.3 Quality Control

The swale has been designed as an enhanced grass swale to provide quality treatment as described by the TRCA and CVC's Low Impact Design Guidelines and the MOE's Stormwater Management Manual. To ensure the function of the enhanced grass swale is not affected by sediment pretreatment of runoff from impervious areas will be provided by a grass filter strip upstream of the swale. The grass filter strip is to be immediately west of the enhanced grass swale, runoff will sheet flow south across filter strip and enter the enhanced grass swale.

Typical ratios of impervious drainage area to swale area range between 5:1 to 10:1. Within the cabin catchment there is 2,600 $m^2$ of impervious surface cover. The swale is to have a top width of 5 m and a length of 52 m this gives a total swale area of 260 $m^2$. The cabin catchment therefore has an impervious drainage area to swale an area ratio of 10:1 which is within the acceptable range.

Other key criteria for enhanced grass swales include side slopes greater than 2.5H:1V, a channel slope between 0.5% to 6%, a bottom width between 0.75 and 3.0 m, a maximum flow depth of 100 mm and maximum flow velocity of 0.5 m/s during the 4 hour 25 mm Chicago storm event. The cabin catchment enhanced grass swale is to have side slopes of 3H:1V, a channel slope of 0.5%, a bottom width of 1.5 m, a flow depth of 39 mm and flow velocity of 0.25 m/s during the 4 hour 25 mm Chicago storm event. Additionally, the maximum velocity during the 100 year storm event is 0.51 $m^3/s$ below what is considered an erosive velocity at 1.0 m/s.

## 6. Erosion and Sediment Control

Erosion and sediment control during the construction stage will be provided by the following measures:

- Control/limit vehicle access to and around the construction site to reduce the amount of disturbance of natural vegetation;
- Mud mats to be installed at all points of access/egress from existing roads to the construction site prior to site grading/construction activities. Mats to be maintained until final road grading and asphalt placement;
- Access roadways to be swept and cleaned frequently to prevent the tracking of mud and debris from site;
- Limit the extent of exposed soils at any given time. Contractor is to minimize areas to be cleared/grubbed/stripped where possible;
- All disturbed areas on and off site to be restored to original condition or better unless otherwise specified. Re-vegetation of disturbed areas is to be completed as soon as possible and not greater than 30 days following disturbance;
- Exposed slopes to be protected with natural or synthetic mulches/blankets, where slopes exceed 2:1;
- Light duty silt fence (OPSD 219.110) and check dams are to be installed on the downstream perimeter of all disturbed areas and stockpiles to ensure that sediment does not migrate from the site;
- All erosion control measures to be maintained until the contributing surfaces have been adequately stabilized i.e. asphalt, sod, or 80% grass covered;
- A visual inspection is to be completed daily and sediment control measures are to be cleaned of any accumulated silt as required; and,
- The suitable erosion and sediment control measures will be constructed prior to any other construction, in order to provide water treatment and detention.

## 7. Conclusions

Based on the investigations and analysis conducted as part of this study, it is concluded that it is possible to provide the necessary stormwater management measures to mitigate any adverse effects of the proposed development relating to stormwater quality. It can also be concluded that:

1. Adequate quality treatment and safe conveyance to the wetland will be provided for all runoff from the Barn Catchment.
2. Adequate quality treatment and safe conveyance to the wetland will be provided for all runoff from the Cabin Catchment.
3. Both catchments outlet to a low-lying wetland, which is expected to retain and attenuate stormwater flows making quantity control unnecessary.
4. As the new driveway to the is expected to impact sheet flow from the north of site twin that will successfully convey the 5 year flows are to be installed. Any flows with return periods exceeding 5 years will flow through a dip in the driveway directly east of the culverts, this will allow flow events to pass over the driveway and limit flooding to a small portion of the driveway. From here a runoff will be conveyed to the main Barn Catchment swale by a swale of the same dimensions.

Respectfully submitted,

Written by,

John Birchard, EIT

Reviewed by,


Kyle Haley, P.Eng

# Appendix A
# Drawings

PROPERTY LINES ARE APPROXIMATE ONLY AND ARE
BASED ON OLS SURVEY BY STEWART W ALLEN LTD 1989

EXISTING HYDRO POLE(TYP)

EXISTING SHED 1
150m2

EXISTING HOUSE
225m2

EXISTING SHED 2
27m2

EXISTING GRAVEL DRIVEWAY

EXISTING DRIVEWAY 1

EXISTING RESIDENTIAL LOT
APPROXIMATELY
1.0ha

COUNTY ROAD 2

NEW 250mmØ TWIN
CSP CULVERTS
N INV = 104.40
S INV = 104.20

1.5m WIDE FLAT
BOTTOM SWALE TO
CONVEY UP TO
100YR FLOWS UP TO
CSB CULVERTS

PROPOSED NORTH DRIVEWAY & GENERAL
CIRCULATION 1835m2

EXISTING 250m2 BARN

EXISTING MECH. ROOM

EMERGENCY ACCESS

VEGETATED FILTER STRIP

PROPOSED ACCESS ROAD ON PROPERTY

EXISTING PROPERTY LINE

EXISTING LANEWAY 1
510m2

GRAVEL PARKING AREA

VENUE PARKING
ALL SPACES 2.75M X 6.0M
(UNLESS OTHERWISE NOTED)

AGRICULTURAL LAND

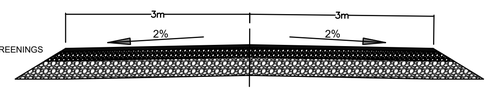
PROPOSED CONNECTION TO EXISTING WELL

RIPRAP TREATMENT @ SWALE OUTLET

SWALE TO OUTLET INTO EXISTING WETLAND

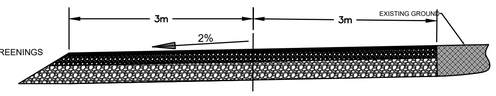
1:500(A1 PLOT) 0 10 30m

PAVEMENT DESIGN
50mm 100% CRUSHED STONE OR SCREENINGS
150mm GRANULAR 'A'
300mm GRANULAR 'B'

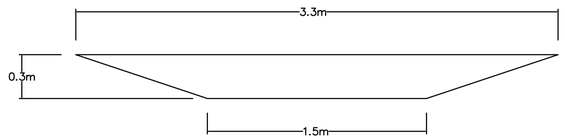



103 G1 TYPICAL DRIVEWAY CROSS SECTION
STA 0+000.00 - 0+210.00
NTS

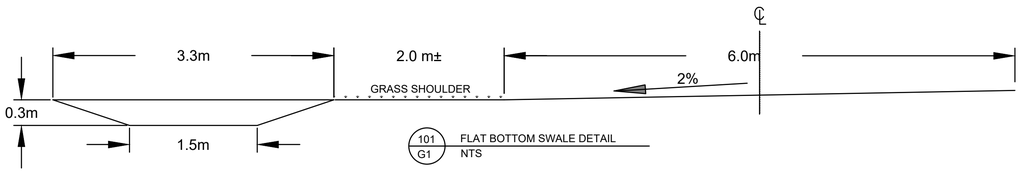
PAVEMENT DESIGN
50mm 100% CRUSHED STONE OR SCREENINGS
150mm GRANULAR 'A'
300mm GRANULAR 'B'




104 G1 TYPICAL DRIVEWAY CROSS SECTION
STA 0+210.00 - 0+410.00
NTS




102 G1 FLAT BOTTOM SWALE DETAIL
NTS




101 G1 FLAT BOTTOM SWALE DETAIL
NTS

(METRIC SCALE – ALL DIMS IN MILLIMETERS U.N.O.)


GREER GALLOWAY
CONSULTING ENGINEERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
PHONE: 613-966-3068
FAX: 613-966-3087


NOTES:
1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A/B A DETAIL NO.
B DRAWING NO. – WHERE DETAILED

| REVISION | DESCRIPTION | DATE |
|---|---|---|
| 02 | REVISED PER COMMENTS | 20/09/25 |
| 01 | SITE PLAN APPROVAL | 20/08/13 |

NORTH

STAMP
LICENSED PROFESSIONAL ENGINEER
A. R. VOLDOCK
100170765
Sept. 25/20
18-3-6383
PROVINCE OF ONTARIO

PROJECT
SCHNURR PROPERTY DEVELOPMENT
1244 COUNTY ROAD 2
PARTS 1 AND 2 OF LOT 18, PLAN 33
HALLOWELL TOWNSHIP
PRINCE EDWARD COUNTY

JESSICA SCHNURR

DRAWING TITLE
GRADING PLAN

DESIGNED BY: JB
DRAWN BY: SA/NW
REVIEWED BY: JB
APPROVED BY: AV
PROJECT DATE: 2019/03/15 (YYYY/MM/DD)
PROJECT #: 18-3-6383
DRAWING #: G1
DRAWING SCALE (ISO A1)
HOR: 1:500 (A1 PLOT)
VER: X : XXX


FILE PATH: P:\Belleville Project\6000\18363383 – PEC Property Studies\Drawings\Working Drawings\18-3-6383 – PEC PROPERTY STUDY – ISSUED TO CLIENT.dwg
PLOT SCALE: 1:1
DATE PLOTTED: 2020 / 09 / 25 @ 10:35 AM
BORDER SIZE: ISO A1 (841mm x 594mm)
PLOT PLOTTED BY: Nicole Whitman

PROPERTY LINES ARE APPROXIMATE ONLY AND ARE
BASED ON OLS SURVEY BY STEWART W ALLEN LTD 1989

WETLAND BOUNDARY

PROPERTY LINE

208.63

EXISTING DRIVEWAY 2
1700m2

PROPOSED
CONNECTION
TO EXISTING WELL

RIPRAP
TREATMENT @
SWALE OUTLET

SWALE TO OUTLET
INTO EXISTING
WETLAND

EXISTING
WELL
LOCATION

EXISTING DRAINAGE
CULVERT TO BE REPLACED
(SIZE TO BE DETERMINED AT
TIME OF CONSTRUCTION)

INN 6x SUITES +
255m2

CABIN SITE CLEARING
345m2

BANDSTAND
9m2

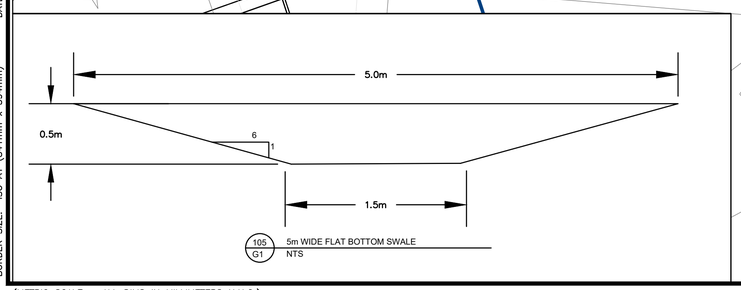
30m SETBACK ZONE

BATHING POND
125m2

OWNERS CABIN
50m2

WETLAND BOUNDARY

EXISTING LANDS OWNED BY
APPLICANT APPROXIMATELY
40.1 ha




105
G1 5m WIDE FLAT BOTTOM SWALE
NTS

(METRIC SCALE – ALL DIMS IN MILLIMETERS U.N.O.)

GREER GALLOWAY
CONSULTING ENGINEERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
PHONE: 613-966-3068
FAX: 613-966-3087

NOTES:
1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A/B A DETAIL NO.
B DRAWING NO. – WHERE DETAILED

| REVISION | DESCRIPTION | DATE |
|---|---|---|
| 02 | REVISED PER COMMENTS | 20/09/25 |
| 01 | SITE PLAN APPROVAL | 20/08/13 |

NORTH

STAMP
LICENSED PROFESSIONAL ENGINEER
R. R. VOLDOCK
100170785
Sept 13/20
18-3-6383
PROVINCE OF ONTARIO

PROJECT
SCHNURR PROPERTY DEVELOPMENT
1244 COUNTY ROAD 2
PARTS 1 AND 2 OF LOT 18, PLAN 33
HALLOWELL TOWNSHIP
PRINCE EDWARD COUNTY

JESSICA SCHNURR

DRAWING TITLE
GRADING PLAN

DESIGNED BY: JB
DRAWN BY: SA/NW
REVIEWED BY: JB
APPROVED BY: AV
PROJECT DATE: 2019/03/15 (YYYY/MM/DD)
PROJECT #: 18-3-6383
DRAWING #: G2
DRAWING SCALE (ISO A1): HOR: 1:2000(A1 PLOT) VER: X : XXX

FILE PATH: P:\Belleville Project\60001836383 – PEC Property Studies\Drawings\Working Drawings\18-3-6383 – PEC PROPERTY STUDY – ISSUED TO CLIENT.dwg PLOTTER: Nicole Whitman
PLOT SCALE: 1:1
DATE PLOTTED: 2020 / 09 / 25 @ 10:36 AM
BORDER SIZE: ISO A1 (841mm x 594mm)

# Appendix B
# Hydrologic Calculations

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

       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

  ***********************************************
  ** SIMULATION : 10 yr 12 hr                  **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 68.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\3dddbd71-c85e-
    remark: 10yr 12hr

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.01  2.00  51.41 0.75   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.13  3.75  34.69 0.50   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 10 yr 24 hr scs              **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
```

```
    [ Ptot= 84.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\8ed72908-cb29-
    remark: 10yr scs

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.08 12.00  65.90 0.78   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.30 12.67  47.68 0.56   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
 FINISH
================================================================================
========================
  ***********************************************
  ** SIMULATION : 10 yr 4 hr chc                **
  ***********************************************
  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= 49.87 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.08  1.33  34.86 0.70   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.16  2.25  20.51 0.41   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
========================
  ***********************************************
  ** SIMULATION : 10 yr 6 hr                    **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms
      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 55.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
```

```
a\7d14154e-775d-
    remark: 10yr 6hr

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  1.00  39.89 0.72   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.17  2.75  24.72 0.44   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ********************************************
  ** SIMULATION : 100 yr 12 hr                **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 98.52 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\45eb9bf1-3e11-
    remark: 100yr 12hr

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  2.00  78.82 0.80   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.23  3.50  59.58 0.60   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ********************************************
  ** SIMULATION : 100 yr 24 hr scs            **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=121.30 mm ]
    fname :
```

C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4a\3348add8-7a29-

remark: 100yr scs

```
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.13 12.00 100.36 0.83   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.51 12.67  79.76 0.66   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
========================
  ***********************************************
  ** SIMULATION : 100 yr 4 hr chc               **
  ***********************************************
  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= 71.48 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.12  1.33  53.93 0.75   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.29  2.25  36.90 0.52   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
========================
  ***********************************************
  ** SIMULATION : 100 yr 6 hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 79.90 mm ]
    fname :
```

C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4a\84e49a8a-f8a5-

remark: 100 6hr

```
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.03  1.00  61.58 0.77   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.29  2.67  43.77 0.55   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 12 hr                  **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 80.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\c3999eb5-836e-
    remark: 25y 12h

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  2.00  62.31 0.77   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.17  3.58  44.44 0.55   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 24 hr scs              **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 99.37 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
```

```
a\72b51774-a495-
    remark: 25yr scs

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.10 12.00  79.64 0.80   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.38 12.67  60.32 0.61   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 4 hr chc                **
  ***********************************************
  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= 58.39 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.09  1.33  42.26 0.72   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.21  2.25  26.72 0.46   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 6 hr                    **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 65.50 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\ce4c1ad2-5bf2-
    remark: 25yr 6hr
```

```
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  1.00  48.54 0.74   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.22  2.67  32.17 0.49   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
========================
  ***********************************************
  ** SIMULATION : 50 yr 12 hr                  **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 89.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\606804f8-0acd-
    remark: 50yr 12hr

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  2.00  70.51 0.79   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.20  3.50  51.91 0.58   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
========================
  ***********************************************
  ** SIMULATION : 50 yr 24 hr scs              **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot=110.40 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\90886ab9-cd76-
```

```
    remark: 50yr scs

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.11 12.00  90.01 0.82   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.45 12.67  70.00 0.63   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 50 yr 4 hr chc               **
  ********************************************
  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= 65.15 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.11  1.33  48.25 0.74   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.25  2.25  31.90 0.49   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 50 yr 6 hr aes               **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 72.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\1f3caf8f-877c-
    remark: 50yr 6hr

*
```

```
                                      pre barn
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.03  1.50  55.02 0.76   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.25  2.67  37.88 0.52   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ********************************************
  ** SIMULATION : Quality Event               **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                20.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\62a8ef86-f2fa-4af2-a47f-5491cc0edd4
a\0dc161f2-0018-
    remark: Quality Event

*
 *  CALIB STANDHYD       0005  1  5.0    0.48    0.02  2.67  14.78 0.59   0.000
    [I%=50.0:S%= 1.00]
*
 *  CALIB NASHYD         0024  1  5.0    6.38    0.05  3.50   5.46 0.22   0.000
    [CN=82.7         ]
    [ N = 3.0:Tp 0.77]
*
```

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

       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
```

**********
** SIMULATION : 10 yr 12 hr aes **
**********

| W/E | COMMAND | HYD ID | DT min | AREA ha | ' Qpeak ' cms | Tpeak hrs | R.V. mm | R.C. | Qbase cms |
|---|---|---|---|---|---|---|---|---|---|
| | START @ 0.00 hrs | | | | | | | | |
| | READ STORM | 10.0 | | | | | | | |
| | [ Ptot= 68.71 mm ] | | | | | | | | |
| | fname : C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2ac\3dddbd71-c85e- | | | | | | | | |
| | remark: 10yr 12hr | | | | | | | | |
| * | | | | | | | | | |
| ** | CALIB NASHYD | 0018 | 1 | 5.0 | 6.38 | 0.13 | 3.67 | 35.52 0.52 | 0.000 |
| | [CN=83.4 ] | | | | | | | | |
| | [ N = 3.0:Tp 0.77] | | | | | | | | |
| * | | | | | | | | | |

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

**********
** SIMULATION : 10 yr 24 hr scs **
**********

| W/E | COMMAND | HYD ID | DT min | AREA ha | ' Qpeak ' cms | Tpeak hrs | R.V. mm | R.C. | Qbase cms |
|---|---|---|---|---|---|---|---|---|---|
| | START @ 0.00 hrs | | | | | | | | |
| | READ STORM | 10.0 | | | | | | | |
| | [ Ptot= 84.60 mm ] | | | | | | | | |

```
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\8ed72908-cb29-
    remark: 10yr scs

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.31 12.67  48.68 0.58   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 10 yr 4 hr chc                **
  ***********************************************

  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= 49.87 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.16  2.25  21.10 0.42   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 10 yr 6 hr aes                **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 55.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\7d14154e-775d-
    remark: 10yr 6hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.17  2.75  25.39 0.46   0.000
```

```
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 12hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 98.52 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\45eb9bf1-3e11-
    remark: 100yr 12hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.23  3.50  60.70 0.62   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 24 hr scs              **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=121.30 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\3348add8-7a29-
    remark: 100yr scs

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.52 12.67  81.06 0.67   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
```

```
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 4 hr chc               **
  ***********************************************

  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= 71.48 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.30  2.25  37.76 0.53   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 6 hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 79.90 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\84e49a8a-f8a5-
    remark: 100 6hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.30  2.67  44.72 0.56   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : 25 yr 12 hr aes               **
  ***********************************************
```

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 80.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\c3999eb5-836e-
    remark: 25y 12h

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.17  3.58  45.40 0.56   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 24 hr scs               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 99.37 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\72b51774-a495-
    remark: 25yr scs

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.39 12.67  61.45 0.62   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 4 hr chc                **
  ***********************************************

  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= 58.39 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.22  2.25  27.42 0.47   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 6 hr aes                **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 65.50 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\ce4c1ad2-5bf2-
    remark: 25yr 6hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.22  2.67  32.96 0.50   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 50 yr 12 hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 89.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
```

```
c\606804f8-0acd-
    remark: 50yr 12hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.20  3.50  52.95 0.59   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 24 hr scs               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=110.40 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\90886ab9-cd76-
    remark: 50yr scs

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.45 12.67  71.23 0.65   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 4 hr chc                **
  ***********************************************

  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= 65.15 mm ]
*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.26  2.25  32.68 0.50   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
```

```
*
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======================
  ***********************************************
  ** SIMULATION : 50 yr 6 hr aes                **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 72.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\1f3caf8f-877c-
    remark: 50yr 6hr

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.26  2.67  38.76 0.53   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
==========================================================================================
======================
  ***********************************************
  ** SIMULATION : Quality Event                 **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 20.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\95b299f1-6bc8-4d6b-ad99-d6533925f2a
c\0dc161f2-0018-
    remark: Quality Event

*
 ** CALIB NASHYD         0018  1  5.0    6.38    0.05  3.50   5.67 0.23   0.000
    [CN=83.4         ]
    [ N = 3.0:Tp 0.77]
*
 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)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\026a0d92-7c84-43eb-96aa-fd28
  Summary filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\026a0d92-7c84-43eb-96aa-fd28


DATE: 08/08/2019                          TIME: 03:35:29




  ***********************************************
  ** SIMULATION : 10 yr 12 hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 68.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\3dddbd71-c85e-
    remark: 10yr 12hr
```

```
*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.02  3.08  33.97 0.49   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 24 hr scs              **
  ********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 84.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\8ed72908-cb29-
    remark: 10yr scs

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.08 12.17  46.80 0.55   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 4 hr chc               **
  ********************************************

  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= 49.87 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.04  1.67  20.00 0.40   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
```

```
=======================
  ***********************************************
  ** SIMULATION : 10 yr 6 hr aes                **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 55.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\7d14154e-775d-
    remark: 10yr 6hr

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.03  1.75  24.14 0.43   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 100 yr 12hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 98.52 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\45eb9bf1-3e11-
    remark: 100yr 12hr

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.04  3.08  58.57 0.59   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
```

```
  ** SIMULATION : 100 yr 24 hr scs              **
  ************************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=121.30 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\3348add8-7a29-
    remark: 100yr scs

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.13 12.17  78.59 0.65   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
 FINISH
================================================================================
======================
  ************************************************
  ** SIMULATION : 100 yr 4 hr chc               **
  ************************************************

  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= 71.48 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.08  1.67  36.15 0.51   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ************************************************
  ** SIMULATION : 100 yr 6 hr aes               **
  ************************************************

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

```
      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 79.90 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\84e49a8a-f8a5-
    remark: 100 6hr

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.05  1.67  42.93 0.54   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 12 hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 80.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\c3999eb5-836e-
    remark: 25y 12h

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.03  3.08  43.59 0.54   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 24 hr scs               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha    '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
```

```
    [ Ptot= 99.37 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\72b51774-a495-
    remark: 25yr scs

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.10 12.17  59.31 0.60   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 25 yr 4 hr chc                **
  ********************************************

  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= 58.39 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.05  1.67  26.11 0.45   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 25 yr 6 hr aes                **
  ********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 65.50 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\ce4c1ad2-5bf2-
    remark: 25yr 6hr

*
```

```
 ** CALIB NASHYD         0013  1  5.0    0.93    0.04  1.75  31.48 0.48   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 50 yr 12 hr aes               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 89.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\606804f8-0acd-
    remark: 50yr 12hr

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.03  3.08  50.98 0.57   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 50 yr 24 hr scs               **
  ***********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot=110.40 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\90886ab9-cd76-
    remark: 50yr scs

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.12 12.17  68.91 0.62   0.000
    [CN=82.0         ]
```

```
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 4 hr chc                **
  ***********************************************

  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= 65.15 mm ]
*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.06  1.67  31.21 0.48   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 6 hr aes                **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 72.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\5ef9fc9a-fe86-4c04-9579-c9398525af7
d\1f3caf8f-877c-
    remark: 50yr 6hr

*
 ** CALIB NASHYD         0013  1  5.0    0.93    0.04  1.67  37.11 0.51   0.000
    [CN=82.0         ]
    [ N = 3.0:Tp 0.33]
*
================================================================================
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```

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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)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\ec971f56-65af-45da-9b8d-8e5e
  Summary filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\ec971f56-65af-45da-9b8d-8e5e


DATE: 08/08/2019                          TIME: 03:35:38




  ***********************************************
  ** SIMULATION : 10 yr 12 hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 68.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\3dddbd71-c85e-
    remark: 10yr 12hr
```

```
*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.02  3.00  42.35 0.62   0.000
    [I%=20.0:S%= 1.80]
*
 FINISH
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 24 hr scs            **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 84.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\8ed72908-cb29-
    remark: 10yr scs

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.09 12.00  56.10 0.66   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 4 hr chc             **
  ********************************************
  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= 49.87 mm ]
*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.06  1.33  26.99 0.54   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 6 hr aes             **
  ********************************************
```

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 55.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\7d14154e-775d-
    remark: 10yr 6hr

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.03  2.50  31.60 0.57   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 100 yr 12hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 98.52 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\45eb9bf1-3e11-
    remark: 100yr 12hr

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.04  3.00  68.52 0.70   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 100 yr 24 hr scs              **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
```

```
    [ Ptot=121.30 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\3348add8-7a29-
    remark: 100yr scs

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.16 12.00  89.41 0.74   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 4 hr chc               **
  ***********************************************
  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= 71.48 mm ]
*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.10  1.33  44.72 0.63   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 100 yr 6 hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 79.90 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\84e49a8a-f8a5-
    remark: 100 6hr

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.05  2.00  51.98 0.65   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
```

```
======================
  ********************************************
  ** SIMULATION : 25 yr 12 hr aes              **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 80.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\c3999eb5-836e-
    remark: 25y 12h

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.03  3.00  52.68 0.65   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 25 yr 24 hr scs              **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 99.37 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\72b51774-a495-
    remark: 25yr scs

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.11 12.00  69.30 0.70   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 25 yr 4 hr chc               **
  ********************************************
  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= 58.39 mm ]
*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.08  1.33  33.79 0.58   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 25 yr 6 hr aes                **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 65.50 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\ce4c1ad2-5bf2-
    remark: 25yr 6hr

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.04  2.00  39.65 0.61   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
=======================
  ***********************************************
  ** SIMULATION : 50 yr 12 hr aes               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 89.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\606804f8-0acd-
    remark: 50yr 12hr

*
```

```
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.03  3.00  60.52 0.68   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 24 hr scs               **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot=110.40 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\90886ab9-cd76-
    remark: 50yr scs

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.14 12.00  79.35 0.72   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 4 hr chc                **
  ***********************************************
  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= 65.15 mm ]
*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.09  1.33  39.37 0.60   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
======================
  ***********************************************
  ** SIMULATION : 50 yr 6 hr aes                **
  ***********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms
```

```
      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 72.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\f83aa448-41e7-40b2-8956-0d15daa7dab
b\1f3caf8f-877c-
    remark: 50yr 6hr

*
 *  CALIB STANDHYD       0013  1  5.0    0.93    0.04  2.00  45.75 0.63   0.000
    [I%=20.0:S%= 1.80]
*
================================================================================
=======================
```

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

       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)\Visual OTTHYMO 5.0\VO2\voin.dat

  Output  filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\c939e493-c955-4bd7-b01b-08c3
  Summary filename:
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Civica\VH5\574454fd-76ff-4efb-a266-5d94a
42e4489\c939e493-c955-4bd7-b01b-08c3


DATE: 08/08/2019                            TIME: 03:38:36

USER:


================================================================================
======================
  **********************************************
  ** SIMULATION : 10 yr 12 hr aes               **
  **********************************************

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

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 68.71 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\755f86c8-5ff2-42aa-8e14-a3ea1109aba
b\3dddbd71-c85e-
    remark: 10yr 12hr
```

```
*
 *  CALIB STANDHYD       0017  1  5.0    4.60    0.09  5.00  35.42 0.52   0.000
    [I%= 4.0:S%= 1.30]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 24 hr scs            **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 84.60 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\755f86c8-5ff2-42aa-8e14-a3ea1109aba
b\8ed72908-cb29-
    remark: 10yr scs

*
 *  CALIB STANDHYD       0017  1  5.0    4.60    0.26 12.50  48.39 0.57   0.000
    [I%= 4.0:S%= 1.30]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 4 hr chc             **
  ********************************************
  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= 49.87 mm ]
*
 *  CALIB STANDHYD       0017  1  5.0    4.60    0.11  2.17  21.23 0.43   0.000
    [I%= 4.0:S%= 1.30]
*
================================================================================
======================
  ********************************************
  ** SIMULATION : 10 yr 6 hr aes             **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
```

```
                                   Cabin Road
                                  min     ha    '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 55.70 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\755f86c8-5ff2-42aa-8e14-a3ea1109aba
b\7d14154e-775d-
    remark: 10yr 6hr

*
 *  CALIB STANDHYD       0017  1  5.0    4.60    0.10  3.00  25.44 0.46   0.000
    [I%= 4.0:S%= 1.30]
*
================================================================================
=======================
  ********************************************
  ** SIMULATION : Quality Event               **
  ********************************************
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha    '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                 20.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\jbirchard.GGINTERNAL\AppData\Local\Temp\755f86c8-5ff2-42aa-8e14-a3ea1109aba
b\0dc161f2-0018-
    remark: Quality Event

*
 *  CALIB STANDHYD       0017  1  5.0    4.60    0.02  4.25   6.05 0.24   0.000
    [I%= 4.0:S%= 1.30]
*
 FINISH
================================================================================
=======================
```

# Appendix C
# Hydraulic Calculations

# Worksheet for Twin Driveway Culvert

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.022 | |
| Channel Slope | 0.020 | m/m |
| Normal Depth | 0.230 | m |
| Diameter | 0.25 | m |

| Results | | |
|---|---|---|
| Discharge | 0.0533 | $m^3/s$ |
| Flow Area | 0.047 | $m^2$ |
| Wetted Perimeter | 0.6 | m |
| Hydraulic Radius | 0.074 | m |
| Top Width | 0.14 | m |
| Critical Depth | 0.188 | m |
| Percent Full | 92.0 | % |
| Critical Slope | 0.027 | m/m |
| Velocity | 1.13 | m/s |
| Velocity Head | 0.06 | m |
| Specific Energy | 0.29 | m |
| Froude Number | 0.611 | |
| Maximum Discharge | 0.0535 | $m^3/s$ |
| Discharge Full | 0.0497 | $m^3/s$ |
| Slope Full | 0.023 | m/m |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Average End Depth Over Rise | 0.0 | % |
| Normal Depth Over Rise | 66.7 | % |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.230 | m |
| Critical Depth | 0.188 | m |
| Channel Slope | 0.020 | m/m |
| Critical Slope | 0.027 | m/m |

# Worksheet for Quality Flow Barn Catchment

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope | 0.008 | m/m |
| Left Side Slope | 3.000 | H:V |
| Right Side Slope | 3.000 | H:V |
| Bottom Width | 1.50 | m |
| Discharge | 0.0488 | $m^3/s$ |

| Results | | |
|---|---|---|
| Normal Depth | 0.065 | m |
| Flow Area | 0.110 | $m^2$ |
| Wetted Perimeter | 1.9 | m |
| Hydraulic Radius | 0.058 | m |
| Top Width | 1.89 | m |
| Critical Depth | 0.046 | m |
| Critical Slope | 0.026 | m/m |
| Velocity | 0.44 | m/s |
| Velocity Head | 0.01 | m |
| Specific Energy | 0.07 | m |
| Froude Number | 0.588 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.065 | m |
| Critical Depth | 0.046 | m |
| Channel Slope | 0.008 | m/m |
| Critical Slope | 0.026 | m/m |

# Worksheet for 100 Year Flow Barn Catchment

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.025 | |
| Channel Slope | 0.005 | m/m |
| Normal Depth | 0.292 | m |
| Left Side Slope | 3.000 | H:V |
| Right Side Slope | 3.000 | H:V |
| Bottom Width | 1.00 | m |

| Results | | |
|---|---|---|
| Discharge | 0.5168 | $m^3/s$ |
| Flow Area | 0.548 | $m^2$ |
| Wetted Perimeter | 2.8 | m |
| Hydraulic Radius | 0.192 | m |
| Top Width | 2.75 | m |
| Critical Depth | 0.236 | m |
| Critical Slope | 0.012 | m/m |
| Velocity | 0.94 | m/s |
| Velocity Head | 0.05 | m |
| Specific Energy | 0.34 | m |
| Froude Number | 0.675 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.292 | m |
| Critical Depth | 0.236 | m |
| Channel Slope | 0.005 | m/m |
| Critical Slope | 0.012 | m/m |

# Worksheet for Barn Catchment Swale Capacity

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope | 0.008 | m/m |
| Normal Depth | 0.300 | m |
| Left Side Slope | 3.000 | H:V |
| Right Side Slope | 3.000 | H:V |
| Bottom Width | 1.50 | m |

| Results | | |
|---|---|---|
| Discharge | 0.7630 | $m^3/s$ |
| Flow Area | 0.720 | $m^2$ |
| Wetted Perimeter | 3.4 | m |
| Hydraulic Radius | 0.212 | m |
| Top Width | 3.30 | m |
| Critical Depth | 0.250 | m |
| Critical Slope | 0.016 | m/m |
| Velocity | 1.06 | m/s |
| Velocity Head | 0.06 | m |
| Specific Energy | 0.36 | m |
| Froude Number | 0.725 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | (N/A) | m/s |
| Upstream Velocity | (N/A) | m/s |
| Normal Depth | 0.300 | m |
| Critical Depth | 0.250 | m |
| Channel Slope | 0.008 | m/m |
| Critical Slope | 0.016 | m/m |

# Worksheet for Quality Cabin Swale

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope | 0.005 | m/m |
| Left Side Slope | 6.000 | H:V |
| Right Side Slope | 6.000 | H:V |
| Bottom Width | 1.40 | m |
| Discharge | 0.0159 | $m^3/s$ |

| Results | | |
|---|---|---|
| Normal Depth | 0.039 | m |
| Flow Area | 0.064 | $m^2$ |
| Wetted Perimeter | 1.9 | m |
| Hydraulic Radius | 0.034 | m |
| Top Width | 1.87 | m |
| Critical Depth | 0.023 | m |
| Critical Slope | 0.032 | m/m |
| Velocity | 0.25 | m/s |
| Velocity Head | 0.00 | m |
| Specific Energy | 0.04 | m |
| Froude Number | 0.429 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.039 | m |
| Critical Depth | 0.023 | m |
| Channel Slope | 0.005 | m/m |
| Critical Slope | 0.032 | m/m |

# Worksheet for 100 Year Cabin Swale

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope | 0.005 | m/m |
| Left Side Slope | 6.000 | H:V |
| Right Side Slope | 6.000 | H:V |
| Bottom Width | 1.40 | m |
| Discharge | 0.1605 | $m^3/s$ |

| Results | | |
|---|---|---|
| Normal Depth | 0.140 | m |
| Flow Area | 0.314 | $m^2$ |
| Wetted Perimeter | 3.1 | m |
| Hydraulic Radius | 0.101 | m |
| Top Width | 3.08 | m |
| Critical Depth | 0.096 | m |
| Critical Slope | 0.021 | m/m |
| Velocity | 0.51 | m/s |
| Velocity Head | 0.01 | m |
| Specific Energy | 0.15 | m |
| Froude Number | 0.512 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.140 | m |
| Critical Depth | 0.096 | m |
| Channel Slope | 0.005 | m/m |
| Critical Slope | 0.021 | m/m |

# Worksheet for Cabin Catchment Capacity

| Project Description | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Roughness Coefficient | 0.030 | |
| Channel Slope | 0.005 | m/m |
| Normal Depth | 0.300 | m |
| Left Side Slope | 6.000 | H:V |
| Right Side Slope | 6.000 | H:V |
| Bottom Width | 1.40 | m |

| Results | | |
|---|---|---|
| Discharge | 0.7481 | $m^3/s$ |
| Flow Area | 0.960 | $m^2$ |
| Wetted Perimeter | 5.0 | m |
| Hydraulic Radius | 0.190 | m |
| Top Width | 5.00 | m |
| Critical Depth | 0.224 | m |
| Critical Slope | 0.017 | m/m |
| Velocity | 0.78 | m/s |
| Velocity Head | 0.03 | m |
| Specific Energy | 0.33 | m |
| Froude Number | 0.568 | |
| Flow Type | Subcritical | |

| GVF Input Data | | |
|---|---|---|
| Downstream Depth | 0.000 | m |
| Length | 0.0 | m |
| Number Of Steps | 0 | |

| GVF Output Data | | |
|---|---|---|
| Upstream Depth | 0.000 | m |
| Profile Description | N/A | |
| Profile Headloss | 0.00 | m |
| Downstream Velocity | Infinity | m/s |
| Upstream Velocity | Infinity | m/s |
| Normal Depth | 0.300 | m |
| Critical Depth | 0.224 | m |
| Channel Slope | 0.005 | m/m |
| Critical Slope | 0.017 | m/m |