ROBERT E. DALE
LIMITED
CONSULTING ENGINEERS

DESIGN IT RIGHT- REAP THE REWARDS

FUNCTIONAL SERVICING REPORT

436/440 RIDGE ROAD NORTH, RIDGEWAY, ONTARIO

UPDATED OCTOBER 27, 2023

PREPARED FOR: PRIME CONSTRUCTION MANAGEMENT

Professional Engineers Ontario

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1.0 INTRODUCTION

Robert E. Dale Limited, Consulting Engineers has been retained by Prime Construction Management to prepare a site specific Stormwater Management Report (SWM) and functional servicing report for the proposed development located at 440 and 436 Ridge Road, Ridgeway, Ontario (**Appendix "A"**), in accordance with the engineering standard drawings provided by the Town of Fort Erie , and MOE Stormwater Management Planning and Design Manual 2003 (SWMPD).

This report is prepared in support of a Site Plan Application (SPA) to be submitted by the client. The purpose of this report is to provide site-specific information for the Town's review with respect to the infrastructure required to support the proposed development regarding storm drainage.

An inventory of the existing infrastructure in the area of the proposed development was carried out. This report discusses the existing services together with the servicing requirements for the proposed development.

2.0 SITE DESCRIPTION

The site is surrounded by a mixture of commercial and residential properties.

The 440 Ridge Road site is approximately 11940.4 square metres in size. The 436 Ridge Road site is approximately 1496.7 square metres in size. Currently both properties are developed, with a single residential building onsite. A copy of the Predevelopment Site Plan is included in the appendix. There is presently other development slated for the adjoining sites.

3.0 SITE PROPOSAL

The Site Plan Application proposes a multi storey apartment building, with commercial units proposed for the main floor, along with an associated covered parking area. A separate area is slated to be townhome style residences. The remainder of the site would be landscaped space. A reduced version of the site survey drawing and site plan is included in **Appendix "A"**. Please refer to the building and site statistics provided by the architects site plan. In the post-development condition, this application proposes new storm services and SWMM services as per the Town of Fort Erie Engineering Standards.

4.0 STORMWATER MANAGEMENT AND DRAINAGE

4.1 Design Criteria

The proposed development will meet the Province of Ontario standards as set out in the MOE Stormwater Management Planning and Design Manual 2003 (SWMPD), the Town of Fort Erie Design Criteria and local engineering standards. A brief summary of design criteria are as follows;

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- For this development, return frequency values for design shall be 5-year for the Minor System and 100--year for the Major System.
- Town of Fort Erie IDF Curves are to be used for analysis **(Appendix "B")**.
- The post-development peak flows for all events from the site should be controlled to the peak flow resulting from the target pre-development 2 year storm conditions during respective rainfall events, and storage up to and inclusive of the 100 year storm event.

4.2 Existing Conditions

Calculations completed by this Office have analyzed the predevelopment as a fully developed residential site, using a weighted runoff co-efficient of 0.40 (from the engineering standards for single family dwellings) for the initial pre-development condition.
The overall predevelopment area for 440 Ridge has been completed using the full 11940.4 m2 of site area, separated into Area #1 (multi story building area) and Area #2 (Townhome Area). Further predevelopment flows were calculated for CA6, CA7, and CA8, all of which have individual restrictors placed in them, do to localized grading.
For 436 Ridge, the full 1496.7m2 has been utilized.

For calculating the pre-development discharge rates and runoff for 2-Year, 5- Year and 100-Year storm events, Inlet time of Concentration (Tc) is based on the minimum TC recommended for small sites (10 minutes). The value for the weighted runoff coefficient (C) is calculated based on actual surface conditions per the Engineering Standards. Input parameters used to model the target pre-development condition are provided in **Table-1** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-1 Pre-development Input Parameters

Catchment Mark	Drainage Area (m2)	2 Year Runoff Co-efficient	100 Year Runoff Co-efficient	Time of Concentration
Pre-Dev Area 1	5413.7	0.40	0.40	10 minutes
Pre-Dev Area 2	2926	0.40	0.40	10 minutes
Pre-Dev CA6	954.6	0.40	0.40	10 minutes
Pre-Dev CA7	874.5	0.40	0.40	10 minutes
Pre-Dev CA8	1771.6	0.40	0.40	10 minutes
436 Ridge Pre	1496.7	0.40	0.40	10 minutes

The pre-development peak flow was calculated using the Town of Fort Erie Rainfall Intensity Curves using the Rational Method. Results of the pre-development peak flow calculations are provided in

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Table-2 below, and detailed pre-development flow calculations have been illustrated in **Appendix "B".**

Catchment #	Peak Flow (m^3/s)		
	2-year	**5-year**	**100 Year**
Pre-Dev Area 1	0.0396	0.0513	0.0812
Pre-Dev Area 2	0.0214	0.0277	0.0439
Pre-Dev CA6	0.007	0.0090	0.0143
Pre-Dev CA7	0.0064	0.0083	0.0143
Pre-Dev CA8	0.0129	0.0168	0.0266
Pre Dev 436 Ridge	0.0109	0.0142	0.0224

4.3 Stormwater Management

In the post-development condition, direction has been provided the entirety of the site shall be controlled to the existing 2 year pre-development flows. This will be achieved through orifice restrictors placed at the outlets of Area 1, Area 2, and flow control devices (due to orifices being too small to maintain) at the outlets of CA6,CA7, and CA8 for 440 Ridge, and a single orifice outlet for 436 Ridge.

4.3.1. Quantity Control

Stormwater quantity control is typically implemented to minimize the potential for downstream flooding, stream bank erosion and overflow infrastructure. As per minimum standards provided, the post-development peak flows for all events from the site area should be controlled in line with the respective peak flow resulting from the target pre-development condition during 2-year predevelopment to 5-year post development storm events. We note that calculations completed indicate storage available on site up to, and including 100 year storms, which exceeds the city requirement of a 5 year storm event. It is noted that roof top drainage will be collected through a series of rain water leaders to internal storm piping, outletting through storm pipe system located as per the plan.

Modified Rational Method calculations were undertaken to determine the peak flows and required storage volume from the proposed site during 2-Year through 100-Year storm events. This method calculates the storage volume using the composite runoff coefficient and the allowable release rate based on rainfall intensities over a three-hour storm event.

For calculating the post-development discharge rates and runoff for 2-Year, through 100-Year storm events, Inlet time of Concentration (Tc) and weighted runoff coefficient (C) is calculated similar to the

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pre-development calculations. Input parameters used to model the target pre-development condition are provided in **Table-3** below and detailed calculations have been illustrated in **Appendix "B"**.

Table 3- Post Development Input Parameters:

Catchment Mark	Drainage Area (m2)	2 Year Runoff Co-efficient	100 Year Runoff Co-efficient	Time of Concentration
Post-Dev Area 1	5413.7	0.70	0.70	10 minutes
Post -Dev Area 2	2926	0.70	0.70	10 minutes
Post -Dev CA6	954.6	0.70	0.70	10 minutes
Post -Dev CA7	874.5	0.70	0.70	10 minutes
Post -Dev CA8	1771.6	0.70	0.70	10 minutes
Post -Dev 436	1496.7	0.70	0.70	10 minutes

Results of the post-development peak flow calculations by considering minimum Tc and IDF data same as pre-development flow calculations are provided in **Table-4** below, and detailed post-development flow calculations have been illustrated in **Appendix "B".**

Table-4 Post Development Peak Flows

Catchment #	**Peak Flow** (m^3/s)		
	2-year	**5-year**	**100 Year**
Post-Dev Area 1	0.0692	0.0898	0.1420
Post -Dev Area 2	0.0211	0.0274	0.0433
Post -Dev CA6	0.0122	0.0158	0.0250
Post -Dev CA7	0.0112	0.0145	0.0229
Post -Dev CA8	0.0227	0.0294	0.0465
Post -Dev 436	0.0191	0.0248	0.0393

The post-development peak flow targets will be achieved for the development using parking lot storage, with additional available in the underground pipe. When the flow is greater than the allowable peak discharge rate through the outlet orifice, the system will surcharge and the excess

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runoff volume will be stored on the parking area. Storage is available onsite for up to, and including the 100 year storm.

The outlet pipe will all be sized with a restrictor plate in it, designed to suit the 2 year development for the individual outlets, sized per below. CA6, CA&, and CA8, as well as the 436 Ridge Road site will have flow restrictor devices installed into the outlets to limits the post development flows to the pre development flows for the individual catchments.

CALCULATION OF AREA 1 ORIFICE SIZE FOR DESIGN. STORM

RESTRICTED TO 2 YR. PRE-DEVELOPMENT RUNOFF:

RESTRICTED FLOW (cu.m./sec):	0.03960
GRAVITY HEAD (metres):	2.92
2 * (Q / 0.6 * 3.1428)E.5	0.28983
2 * (9.8 * H)E.25	2.75049
ORIFICE DIAMETER (millimeters):	105.37314

CALCULATION OF AREA 2 ORIFICE SIZE FOR DESIGN. STORM

RESTRICTED TO 2 YR. PRE-DEVELOPMENT RUNOFF:

RESTRICTED FLOW (cu.m./sec):	0.02140
GRAVITY HEAD (metres):	2.45
2 * (Q / 0.6 * 3.1428)E.5	0.21306
2 * (9.8 * H)E.25	2.63242
ORIFICE DIAMETER (millimeters):	80.93631

CALCULATION OF 436 RIDGE ROAD ORIFICE SIZE FOR DESIGN. STORM

RESTRICTED FLOW (cu.m./sec):	0.01290
GRAVITY HEAD (metres):	3.00
2 * (Q / 0.6 * 3.1428)E.5	0.16542
2 * (9.8 * H)E.25	2.76914
ORIFICE DIAMETER (millimeters):	59.73689

Table 5a- Ponding Requirements-

Area #1

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Storm Event	Storage Required/Provided	Ponding Elevation
2 Year	6.1 m3/274.6m3	191.695m
5 Year	14.8 m3/274.6m3	191.72m
100 Year	41.9 m3/274.6m3	191.767m

Area #2

Storm Event	Storage Required/Provided	Ponding Elevation
2 Year	0 m3/39.8m3	191.200m
5 Year	0.4 m3/39.8m3	191.23m
100 Year	5.6 m3/39.8m3	191.312m

Area #CA6

Storm Event	Storage Required/Provided	Ponding Elevation
2 Year	0.9 m3/48.1m3	191.537m
5 Year	2.3 m3/48.1m3	191.561m
100 Year	7.0 m3/48.1m3	191.607m

Area #CA7

Storm Event	Storage Required/Provided	Ponding Elevation
2 Year	0.8 m3/16 m3	191.444m
5 Year	2.1 m3/16 m3	191.473m
100 Year	6.4 m3/16 m3	191.527m

Area #CA8

Storm Event	Storage Required/Provided	Ponding Elevation
2 Year	1.7 m3/52.5 m3	190.954m
5 Year	4.5 m3/52.5 m3	190.987m
100 Year	13.2 m3/52.5 m3	191.050m

436 Ridge Road

Storm Event	Storage Required/Provided	Ponding Elevation

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2 Year	1.4 m3/22.2 m3	191.13m
5 Year	3.7 m3/22.2 m3	191.149m
100 Year	11.1 m3/22.2 m3	191.185m

The minor system has been designed using the 5 year return, with an initial time of concentration of 10 minutes. Detailed calculations are included in the appendix.

4.3.2. Quality Control

Quality control is being provided to the site by way of an oil grit separator, sized to suit a minimum 80% TSS removals rate. The unit selected is a HydroGuard Hs-8, with a design TSS removals rate of 86%. Detailed calculations are in the appendix.

Maintenance of System:

Purpose:
To provide a set of best practice site management procedures to control the severity and extent of soil erosion on this site.

Responsibility:
The owner of the property will be responsible for the implementation and maintenance of the Storm Water Management criteria and system throughout its lifetime. The construction contractor will be responsible for the implementation of the Stormwater Management Plan (SWMP) during the course of all construction activities.
Implementation Strategy:
Permanent and long term swales and ditches to be top soiled and vegetated with suitable vegetation as soon as possible.
Clean up of general site litter on a weekly basis, prior to anticipated heavy rainfall and after significant rainfall events (>25mm/24 hours).

Landscaping activities and revegetation to occur as soon as practical after completion of earthworks and construction activities within the design rea.
Only appropriate herbicides and fertilizers to be used.

Monitoring:
Erosion and sediment control (ESC) measures to be inspected on an ongoing basis by the site manager, or nominated representative, during periods of run off producing rainfall, and de-silted, repaired and amended as appropriate to maintain the quality standards.

Site inspections, during periods of runoff producing rainfall must include:
- All drainage, erosion and sediment control procedures and measures;

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- Occurrences of excessive sediment deposition (whether on site or off site)
- All site discharge points

Ongoing site inspections must include:

- All drainage, erosion and sediment control measures;
- Occurrences of excessive sediment deposition (whether on site or off site)
- All site discharge points
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements.
- Litter and waste receptors
- Oil, fuel and chemical storage facilities.

Site inspections immediately prior to anticipated runoff producing rainfall shall include:

- All drainage, erosion, and sediment control measures;
- All temporary (ie overnight) flow diversion and drainage works (if approved by engineering staff)

Identifications of an Incident or Failure shall include:
Non compliance with agreed performance criteria will be identified by :

- Visual inspections identifying:
  - buildup of sediment off the site;
  - excessive sediment buildup on the site;
  - excessive erosion on the site;
  - release of construction material from the site;
  - poor vegetation establishment;
  - poorly maintained, damaged or failed ESC devices;
  - deteriorated water quality identified by the consultant as being attributable to the construction activities.

Reporting Requirements:

Reports will be submitted as requested during the construction at each stage: This reporting shall include:
Construction Contractor site manager's report;
Water Quality monitoring report.

Reporting will follow the same criteria during the ongoing maintenance periods.

4.4 Down Stream Capacity

In the pre-development condition, this site contributes to the existing storm sewer infrastructure. Since the 100 year post-development peak flows for all events from the site are controlled in line with the respective 2 year peak flow resulting from the target pre-development condition during all storm

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events, the total release from the site will be equal to the existing pre-development condition. Hence, there will be no need to map downstream capacity of existing storm sewers.

5.0 Erosion and Sediment Control During Construction

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-- laden stormwater runoff into receiving watercourses, measures for erosion and sediment control are required for construction sites.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. "Erosion & Sediment Control Guidelines for Urban Construction" released by the Authority in December 2006, provides guidance for the preparation of effective erosion and sediment control plans.

Control measures must be selected in light of the erosion potential of the site. It is important to have site modifications and implementations on a staged basis to reflect the site's activities. Furthermore, the effectiveness of control measures decreases with sediment loading as a result inspection and maintenance is recommended. The selection, implementation, inspection, and maintenance of the control features are summarized as follows:

5.1 Control Measures

On relatively small sites, measures for erosion and sediment control typically include the use of silt fencing, mud mats and sediment traps. The description of the sediment controls to be implemented on the subject site is as follows.

Installation of ***Silt Fences*** adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.

Installation of ***Mud Mats*** at all construction entrances prior to commencing earthworks to minimize the tracking of mud onto municipal roads.

Installation of ***Sediment Traps*** at all catch basins and area drain locations once the storm sewer system has been constructed to prevent silt-laden runoff from entering the municipal storm sewer system.

5.2 Construction Sequencing

The schedule of construction activities with respect to sediment controls are as follows:

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Installation of the silt fences prior to any other activities on the site
Construction of temporary mud mats at all construction access.
Installation of site servicing and underground utilities.
Construction of building foundations and disposal of all the surplus excavated materials off site.
Construction of building, parking lot and driveways.
Restoration / re-vegetation of disturbed areas either with temporary measures such as mulch or seeding or with final landscape and paving materials.
Removal of the sediment controls following stabilization of disturbed areas.

5.3 Inspection and Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, regular monitoring together with periodic cleaning (e.g. removal of accumulated silt), maintenance and/or re-construction is strongly recommended. Inspections of all the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events
- Prior to forecasted rainfall events

If damaged control measures are found, they should be repaired and/or replaced within 48 hours.

6.0 Sanitary Service

6.1 Existing Sanitary Service

There is an existing 450mm sanitary service located within Ridge Road that we are proposing connecting into.

6.2 Sanitary Design Flow

The 440 Ridge Road sanitary service design flow is as calculated below:

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Sanitary sewage flows shall be estimated using the following formula:

$$Q = \frac{PqM}{86.4} + IA$$

Where: Q = Peak sewage flow including infiltration, liters/sec (l/s)
P = Population density, in thousands
q = Average daily domestic flow at 320 liters/capita/day (lpcd)
M = Peaking factor, $M = \frac{5}{P^{0.2}}$ minimum = 2.0, maximum = 4.5
I = Infiltration allowance, 0.15 l/sec/ha - for new subdivisions

0.28 l/sec/ha - for older tributary areas or as determined by field monitoring

A = Tributary area, hectares (ha)

The number of people has been calculated using the capacity of 4 persons per residential suite, plus a commercial rate of 65m3/ha/day which a design flow of 6.96 lps. Full design calculations are included in the appendix.

The proposed sanitary service is 200mm diamter pvc dr35 sanitary sloped at 0.4%, which has an allowable flow of 21.64 lps,far greater than the design flows of 6.96 lps.

The number of people for the 436 Ridge Road has been calculated using the capacity of 4 persons per residential suite, plus a commercial rate of 65m3/ha/day which a design flow of 0.59 lps. Full design calculations are included in the appendix.

The proposed sanitary service is 200mm diamter pvc dr35 sanitary sloped at 0.4%, which has an allowable flow of 21.64 lps,far greater than the design flows of 0.59 lps.

7.0 Water Service

7.1 Existing Water Service

There is an existing 200 diameter water main provided within Ridge Road.

7.2 Water Design Flow

The water service flow has been calculated in conformance with the requirements of the Ontario Building Code, and is indicated below:

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Domestic Flow-440 Ridge Road

Specified Data

l = length of pipe (m)	275
c = Hazen-Williams roughness constant	140
q = volume flow (liter/sec)	0.9676
dh = inside or hydraulic diameter (mm)	200

Calculated Pressure Loss

f = friction head loss in mm of water per 100 m of pipe (mm H20 per 100 m pipe)	0.76
f = friction head loss in kPa per 100 m of pipe (kPa per 100 m pipe)	0.01
Head loss (mm H20)	2.10
Head loss (kPa)	0.02

Calculated Flow Velocity

v = flow velocity (m/s)	0.03

Number of Apartments	91	
Apartment Flow Per Day	700	litres
Total Apartment Flow per Day	63700	litres
Design Apartment Flow	0.7373	lps
Number of Residences	12	
Residence Flow per Day	1600	litres
Total Apartment Flow per Day	19200	litres
Design Apartment Flow	0.2222	lps

Domestic Flow-436 Ridge Road

Specified Data

l = length of pipe (m)	50
c = Hazen-Williams roughness constant	140
q = volume flow (liter/sec)	0.2870
dh = inside or hydraulic diameter (mm)	200

Calculated Pressure Loss

f = friction head loss in mm of water per 100 m of pipe (mm H20 per 100 m pipe)	0.08
f = friction head loss in kPa per 100 m of pipe (kPa per 100 m pipe)	0.00
Head loss (mm H20)	0.04
Head loss (kPa)	0.00

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Calculated Flow Velocity

v = flow velocity (m/s)	0.01	
Number of Apartments	8	
Apartment Flow Per Day	700	litres
Total Apartment Flow per Day	5600	litres
Design Apartment Flow	0.0648	lps
Number of Residences	12	
Residence Flow per Day	1600	litres
Total Apartment Flow per Day	19200	litres
Design Apartment Flow	0.2222	lps

Fire Flow has also been calculated, at a rate of 28,208 l/min.

8.0 Conclusions:

This report is to be read in conjunction with the submission materials for the project proposal. Based on our investigation, we conclude and recommend the following:

The post-development peak flow targets will be achieved by controlling discharge from the site using the above noted storm water criteria. The site will be restricted to the allowable runoff generated from the 2 year pre-development storm. Storage on site is available for up to, and including, the 100 year storm.

Erosion and Sediment controls are to be implemented during construction to prevent silt-laden runoff from leaving the site in accordance with the "Erosion & Sediment Control Guidelines for Urban Construction".

Maintenance of the SWM items is the sole responsibility of the owner of the site. The maintenance shall be completed in accordance with the requirements as set out in this report.

Sanitary design flows for 440 Ridge have been calculated as 6.96 lps, and for 436 Ridge at 0.59 lps. The proposed design sanitary sewer has an allowable flow well above that.
As calculated in section 7.0, the water design flow has an approximate design requirement of 63,700 litres/day for the 440 Ridge building and 19200 litres/day for 436 Ridge.

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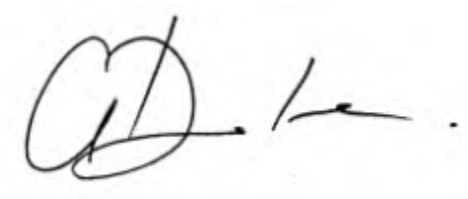
In summary, all elements of the design requirements as set out by the design Standards have been met or exceeded by the proposed design.
We trust that this report satisfies the requirements of the Town with respect to the subject development. Should you have any questions, please feel free to contact the undersigned.

Yours truly,



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Appendix "A" Plans

- Location Map
- Town of Fort Erie IDF Curves
- Pre-Development Drawings
- Post Development Drawings
- Sanitary Servicing Calculations
- Storm Servicing Calculations
- SWMM Modelling Data and Results

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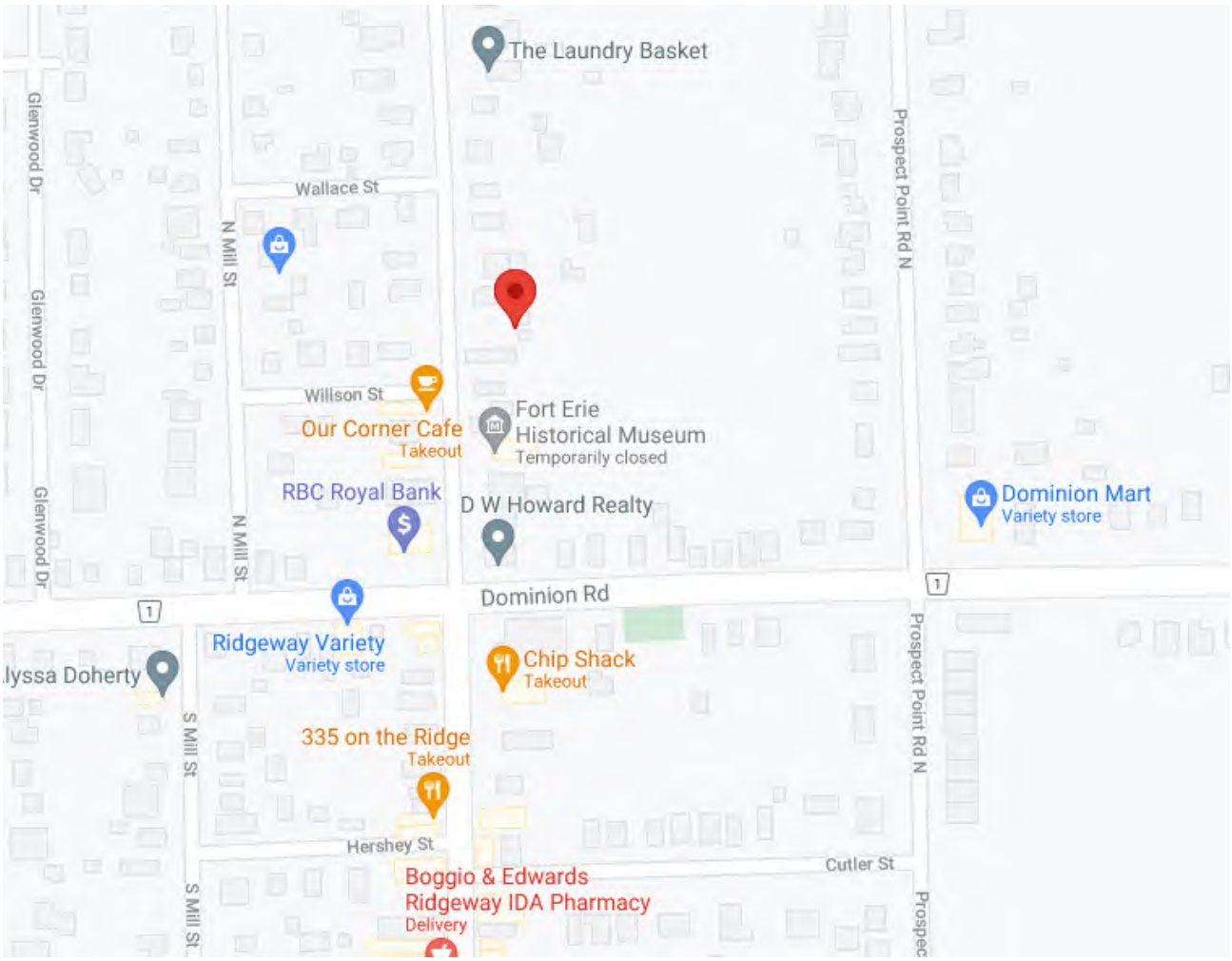

Site Location Map

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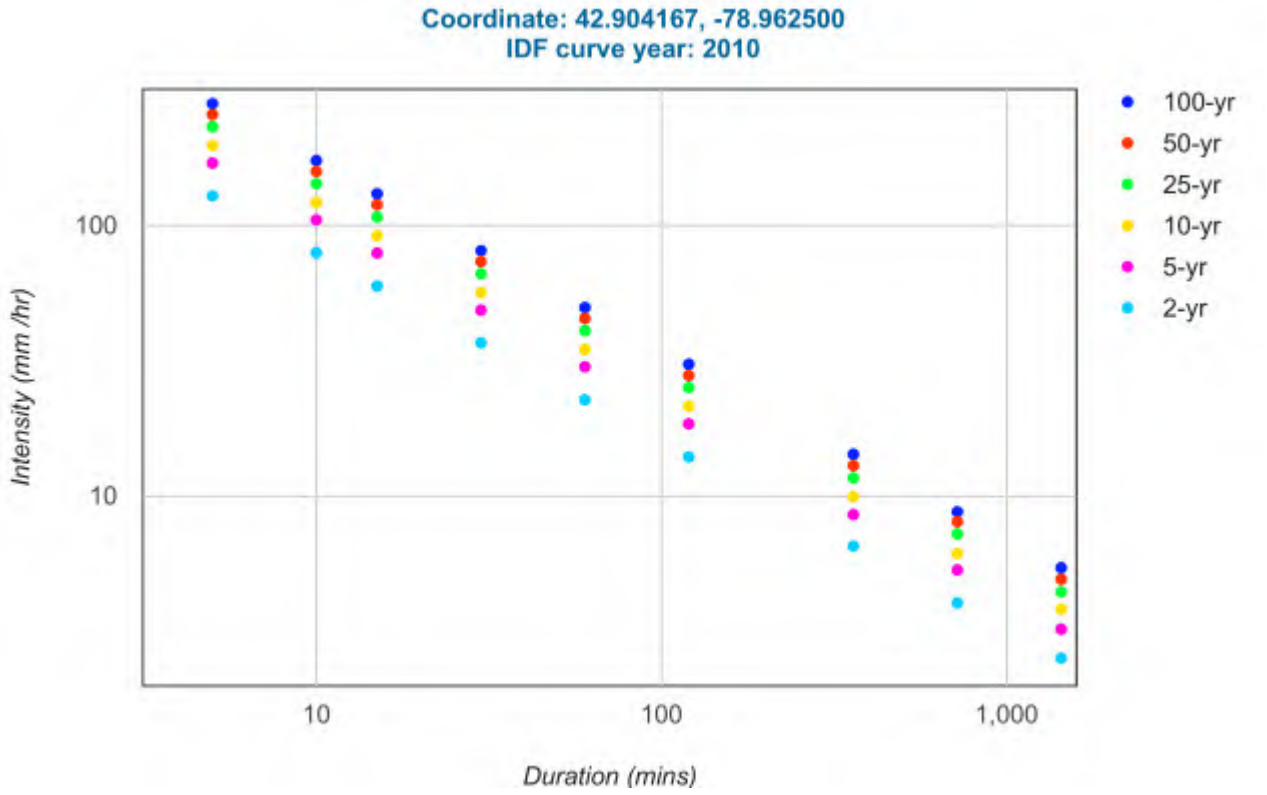

IDF Data/Curves

429 Exmouth Street, Suite 208
Sarnia, ON N7T5P8
Phone: 519-337-7211
Fax: 519-337-7213
Email: geoff@redaleltd.ca
Website: www.redaleltd.ca

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	22.6	29.9	34.7	40.7	45.2	49.6
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	128.4	79.1	59.6	36.7	22.6	13.9	6.5	4.0	2.5
5-yr	169.8	104.6	78.8	48.5	29.9	18.4	8.5	5.3	3.2
10-yr	197.1	121.4	91.4	56.3	34.7	21.4	9.9	6.1	3.8
25-yr	231.2	142.4	107.3	66.1	40.7	25.1	11.6	7.2	4.4
50-yr	256.7	158.1	119.1	73.4	45.2	27.8	12.9	8.0	4.9
100-yr	281.7	173.5	130.7	80.5	49.6	30.6	14.2	8.7	5.4

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.7	13.2	14.9	18.3	22.6	27.8	38.8	47.7	58.8
5-yr	14.2	17.4	19.7	24.3	29.9	36.8	51.3	63.2	77.8
10-yr	16.4	20.2	22.9	28.2	34.7	42.8	59.5	73.3	90.3
25-yr	19.3	23.7	26.8	33.0	40.7	50.1	69.8	86.0	105.9
50-yr	21.4	26.4	29.8	36.7	45.2	55.7	77.5	95.5	117.6
100-yr	23.5	28.9	32.7	40.3	49.6	61.1	85.1	104.8	129.1

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ROBERT E. DALE
LIMITED
CONSULTING ENGINEERS

DESIGN IT RIGHT- REAP THE REWARDS

Professional Engineers Ontario

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Email: geoff@redaleltd.ca
Website: www.redaleltd.ca

PRE-DEVELOPMENT PLAN

SCALE: 1:350

NORTH

LEGEND

- EXISTING WATERMAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- GAS GAS EXISTING GASMAIN
- B.BOX EXISTING BELL PEDISTAL
- EXISTING SANITARY/STORM
- MH MAINTENANCE HOLE
- CB EXISTING CATCHBASIN
- EXISTING WATER VALVE
- HYD. EXISTING FIRE HYDRANT

THIS DRAWING AS AN INSTRUMENT OF SERVICE IS PROVIDED BY AND IS THE PROPERTY OF ROBERT E. DALE LIMITED.

THE CONTRACTOR MUST VERIFY AND ACCEPT RESPONSIBILITY FOR ALL DIMENSIONS AND CONDITIONS ON SITE AND MUST NOTIFY ARCHITECT / ENGINEER OF ANY VARIATIONS FROM THE SUPPLIED INFORMATION.

THE ENGINEER IS NOT RESPONSIBLE FOR THE ACCURACY OF SURVEY, ARCHITECTURAL, MECHANICAL, ELECTRICAL, ETC., INFORMATION SHOWN ON THIS DRAWING. REFER TO THE APPROPRIATE CONSULTANT'S DRAWINGS BEFORE PROCEEDING WITH THE WORK.

CONSTRUCTION MUST CONFORM TO ALL APPLICABLE CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

THE CONTRACTOR WORKING FROM DRAWINGS NOT SPECIFICALLY MARKED 'FOR CONSTRUCTION' MUST ASSUME FULL RESPONSIBILITY AND BEAR COSTS FOR ANY CORRECTIONS OR DAMAGES RESULTING FROM HIS WORK.

THIS DRAWING IS NOT TO BE SCALED.

NOTE:

ALL DIMENSIONS AND ELEVATIONS MUST BE SITE MEASURED AND CONFIRMED PRIOR TO FABRICATION AND/OR ERECTION.

SHOP DRAWINGS

ALL SHOP DRAWINGS SUBMITTED TO THE ENGINEER SHALL BE REVIEWED FOR GENERAL COMPLIANCE WITH THE INTENT OF THE STRUCTURAL DESIGN CONTAINED WITHIN THESE PROJECT DOCUMENTS ONLY.

DO NOT SUBMIT SHOP DRAWINGS AND/OR COVERING TRANSMITTALS MARKED 'FOR APPROVAL'. AFOREMENTIONED DOCUMENTS SO MARKED WILL NOT BE REVIEWED.

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DISCLAIMER:
THESE DESIGN DOCUMENTS HAVE BEEN PREPARED BY ROBERT E DALE LIMITED FOR THE ACCOUNT OF: _____. ANY USE WHICH A THIRD PARTY MAKES OF THESE DESIGN DOCUMENTS, OR ANY RELIANCE ON OR DECISIONS TO BE MADE BASED ON THEM, ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES. ROBERT E. DALE LIMITED ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANY THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS TAKEN BASED ON THESE DESIGN DOCUMENTS.

NO.	REVISION	DATE
A	PRELIMINARY--ISSUED WITH CIVIL BRIEF	01/10/2022
B	GENERAL SERVICING REVISION	04/24/2023
C	ISSUED FOR PERMITS AND PRICING	05/10/2023

STAGE OF DESIGN AND DRAFTING:

Issued for Site Plan Approvals	
Preliminary Design	
Issued for Comments and Coordination	
Issued for Building Permit	05/10/2023
Issued for Pricing	05/10/2023
Issued for Construction	
As Built Record Set	

ALL DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND MAY NOT BE USED OR REPRODUCED WITHOUT THE ENGINEER'S APPROVAL.

THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING.

DRAWINGS MUST NOT BE SCALED.

ROBERT E. DALE LIMITED
CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

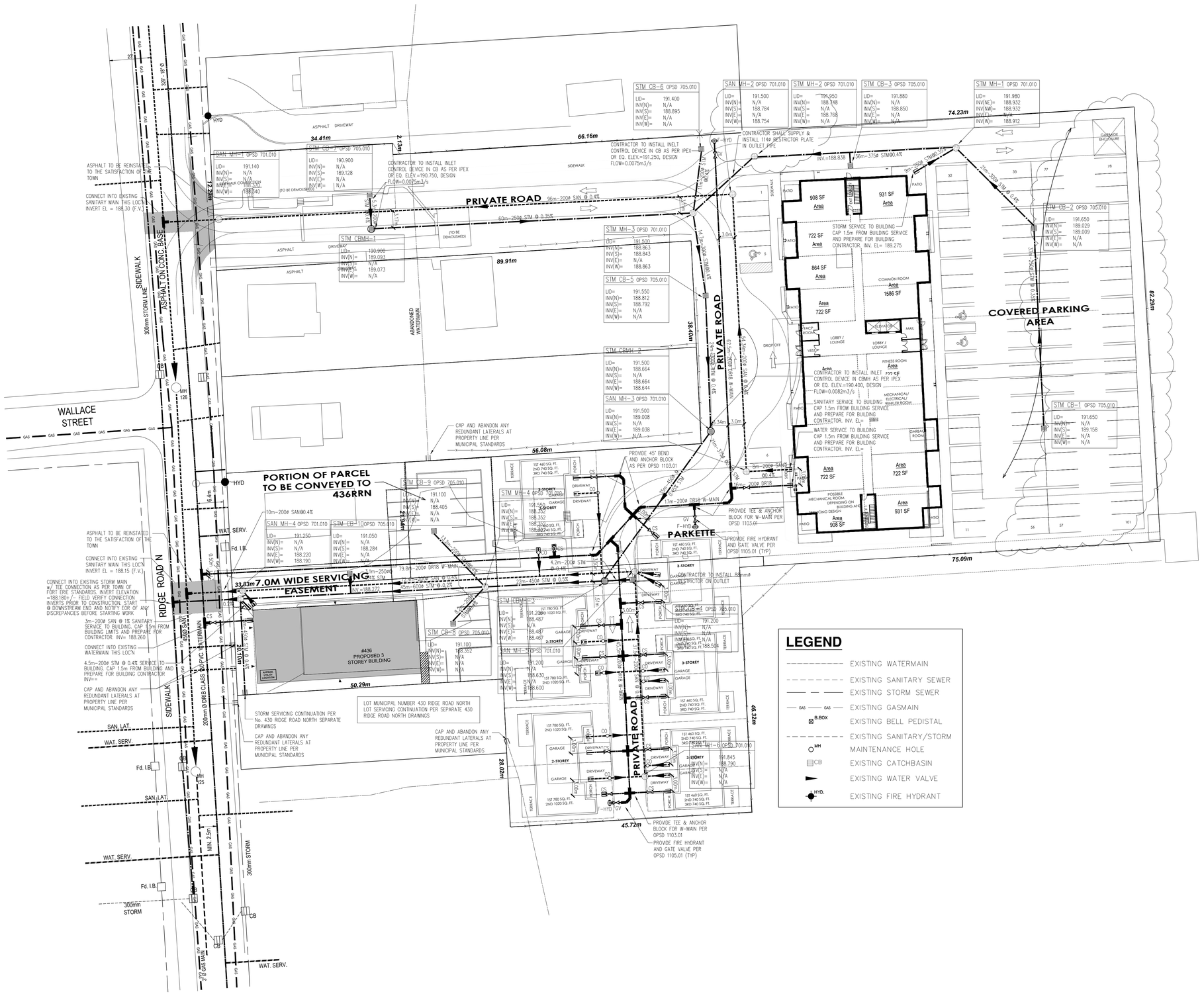
not valid unless signed

PROJECT
SITE PLAN/CIVIL DESIGN FOR 440 RIDGE RD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT: JPD

DWG. TITLE
PREDEVELOPMENT PLAN

DATE	APRIL 2023	SCALE	1:350 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-0
DRAWN BY	UNNATI C.		
PROJ. No.	230372		



SITE SERVICING PLAN - 440 AND 436 RIDGE ROAD

SCALE: 1:350

NORTH

WATERMAINS:

1. PVC WATERMAINS SHALL BE A MINIMUM DR 18 CLASS 235 (AWWA) C900-07.
2. EMBEDMENT MATERIAL FOR FLEXIBLE PIPE SHALL BE ACCORDING TO OPSD 802.010 AND USING GRANULAR A ACCORDING TO TS 1010 AND COMPACTED TO MINIMUM 98% F MAXIMUM DRY DENSITY.
3. MINIMUM COVER ON WATERMAINS SHALL BE 1.8m.
4. ALL HYDRANTS SHALL BE CONSTRUCTED ACCORDING TO T-1105.01.
5. HYDRANT LEADS SHALL BE MINIMUM DR 18 CLASS 235 (AWWA) C900-07.
6. ALL SERVICE CONNECTIONS SHALL REQUIRE A SERVICE CONNECTION PERMIT FROM THE INFASTRUCTURE SERVICES DEPARTMENT. THE FINAL DETAILS OF THE CONNECTION WILL BE DETERMINED THROUGH THE SERVICE CONNECTION PERMIT PROCESS.
7. SINGER WATER SERVICE CONNECTIONS SHALL BE MINIMUM OF 19mm DIA. TYPE 'K' SOFT COPPER ACCORDING TO CITY STANDARDS. WHEN SERVICE LENGTH EXCEEDS 30m, THE DIAMETER SHALL BE 25mm DIA.
8. ALL CURB AND VALVE BOXES SHALL BE LOCATED AT STREET LINE.
9. MECHANICAL THRUST RESTRAINTS SHALL BE INSTALLED AT ALL FITTINGS, BENDS, TEES, CROSSES, REDUCERS AND VALVES FOR ALL WATERMAIN SIZES. MECHANICAL RESTRAINTS AT JOINTS SHALL BE INSTALLED AT EVEY PIPE JOINT 6.1mOF EITHER SIDE OF THE VALVE FOR WATERMAIN 100mm DIAMETER OR LARGER.
10. ALL TEES, PLUGS, HORIZONTAL, VERTICAL BENDS, REDUCERS AND HYDRANTS TO HAVE CONCRETE THRUST BLOCKS ACCORDING TO T-11103.01 AND T-1003.020.
11. WATERMAINS MUST FOLLOW THE ONTARIO MINISTRY OF ENVIRONMENT PROCEDURE F-6-1 THAT GOVERN THE SEPARATION OF SEWERS AND WATERMAINS. A MINIMUM VERTICAL CLEARANCE OF 0.30m WHEN CROSSING OVER AND 0.5m WHEN CROSSING UNDER SEWERS AND ALL OTHER UTILITIES IS REQUIRED. MUST ALSO MAINTAIN 2.5m HORIZONTAL SEPARATION WITH SEWERS.
12. ALL VALVES LESS THAN 400mm WILL BE IN A VALVE AND BOX ACCORDING TO T-1101.02-2. ALL VALVES 400mm AND LARGER SHALL BE IN A CHAMBER.
13. SACRIFICIAL ANODES SHALL BE INSTALLED ON ALL METALLIC PIPES AND APPURTENANCES, WATER SERVICES AND FITTINGS ACCORDING TO T-1106.04, T-106.05, T01106.06, AND TS 7.22.
14. TRACER WIRE INSTALLATION SHALL BE BE ACCORDING TO TS 7.40.
15. HYDROSTATIC PRESSURE TEST AND LEAKAGE TESTING OG THE WATERMAIN SHALL BE ACCORDING TO CITY REQUIREMENTS.
16. THE NEW WATERMAIN SHALL BE ISOLATED ACCORDING TO CITY REQUIREMENTS UNTIL BACTERIOLOGICAL TESTS ARE SATISFACTORILY COMPLETED.
17. PROVISIONS FOR FLUSHING THE WATERMAIN PRIOR TO TESTING AND SO FORTH MUST BE PROVIDED WITH AT LEAST A 500mm OUTLET ON 100mm AND LARGER LINES ACCORDING TO CITY REQUIREMENTS. COPPER WATER SERVICES SHALL BE HAVE FLUSHING POINTS AT THE END, THE SAME AS THE LINE. ON FIRE LINES, FLUSHING OUTLET TO BE 50mm DIAMETER MINIMUM OR A HYDRANT.

ROAD RECONSTRUCTION:

1. CONSTRUCTION AND RECONSTRUCTION OF ALL ACCESS DRIVEWAYS SHALL BE ACCORDING TO CITY STANDARDS AT NO COST TO THE MUNICIPALITY.
2. LIMITS OF THE SIDEWALK/CURB RECONSTRUCTION ARE APPROXIMATE. ACTUAL LIMITS ARE TO BE CONFIRMED IN THE FIELD BY THE CONTRACT ADMINISTRATOR.
4. ADJUST ALL STRUCTURES (MAINTENANCE HOLES, CATCH BASINS, ETC) TO SUIT THE NEW DESIGN ELEVATIONS INCLUDING BREAKING DOWN AND REMOVAL OF PORTIONS OF THE TOP OF STRUCTURES TO ALLOW DOE MINIMUM 150mm ADJUSTMENTS.
5. ALL CURB SHALL BE CONSTRUCTED WITH A LEDGE AT THE BACK OF THE CURB TO FACILITATE FUTURE SIDEWALK CONSTRUCTION.
6. FULL DEPTH SAW-CUTS ARE REQUIRED AT CONSTRUCTION LIMITS OF EXISTING CURB,SIDEWALK AND PAVEMENT UNLESS OTHERWISE SHOWN.
7. SAW CUT EXISTING PAVEMENT, SIDEWALK, CURB, GUTTER, DRIVEWAYS, WALKWAYS ETC. AT CONSTRUCTION LIMITS TO PROVIDE A CLEAN JOINT FOR THE PROPOSED WORK.
8. CONSTRUCT PEDESTRIAN SIDEWALK RAMPS WITH TACTILE WALKING SURFACE INDICATORS ACCORDING TO CITY STANDARDS.
9. EXISTING ENTRANCE RAMPS TO BE RE-INSTALLED. VEHICULAR SIDEWALK RAMP SHALL BE ACCORDING TO CITY STANDARDS.
10. ADJUSTMENT OR APPROACHES, WALKWAYS, AND STEPS MAY BE REQUIRED. LIMITS ARE TO BE DETERMINES IN THE FIELD BY THE CONTRACT ADMINISTRATOR.
11. EXISTING ASPHALT THICKNESS MAY VARY, TAPER TO MATCH EXISTING AT CONSTRUCTION LIMITS (MINIMUM 2.0).

GRADING NOTES:

1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC SHALL BE PLACED A MIN. OF 0.45m OFF THE PROPERTY LINE. ALL WALLS 1.0m OR HIGHER SHALL BE DESIGNED BY A P.ENG.
3. SHOULD A RETAINING WALL BE REQUIRED, THE TOP OF WALL ELEVATION SHALL BE SET 150mm ABOVE THE PROPOSED SIDE YARD SWALES.
4. RETAINING WALLS 0.6m IN HEIGHT OR GREATER REQUIRE CONSTRUCTION OF A FENCE OR GUARD FAIL AT THE TOP OF THE REAR OF THE WALL. GUARDS FOR RETAINING WALLS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF EXTERIOR GUARDS AS CONTAINED IN THE ONTARIO BUILDING CODE.
5. TOP OF FOUNDATION WALLS FOR BUILDINGS SHALL BE 150mm (MIN) ABOVE FINISHED GRADE.
6. DRIVEWAY SLOPES SHALL NOT BE LESS THAN 2% AND NOT MORE THAN 8.0%. REVERSED SLOPED DRIVEWAYS IN NEW DEVELOPMENTS ARE NOT PERMITTED.
7. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MIST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER TO ALLOW THE DEVELOPER TO GRADE ON THE ADJACENT LANDS, OTHERWISE RETAINING WALLS MUST BE USED.
8. THE WRITTEN PERMISSION REQUIRED FROM THE ADJACENT LANDOWNER SHALL BE OBTAINED PRIOR TO ENTERING THE LANDS. SHOULD PERMISSION NOT BE OBTAINED OR IS WITHDRAWN PRIOR TO THE COMMENCING OF WORK, THEN THE DEVELOPER SHALL LIMIT HIS ACTIVITIES TO THE LIMITS OF THE DEVELOPMENT SITE.
9. DRIVEWAY AND DRIVEWAY APPROACHES SHALL BE LOCATED SUCH THAT HYDRO VAULTS AND OTHER STREET FURNITURE ARE A MIN OF 1.2m FROM THE PROJECTION OF THE OUTSIDE GARAGE WALLS.
10. ANY CHANGES IN GRADES AND CATCH BASINS REQUIRE THE APPROVAL OF THE CITY'S MANAGER OF DEVELOPMENT ENGINEERING.
11. ALL DRIVEWAYS FROM PROPERTY LINES FOR THE FIRST 7.5m SHALL BE WITHIN 5% MAXIMUM GRADE, THEREAFTER, ALL DRIVEWAYS SHALL BE WITHIN 10% MAXIMUM GRADES.

LEGISLATION, REGULATION AND CODES:

1. ALL WORK WITHIN THE CITY RIGHT-OF-WAY SHALL BE CONSTRUCTED ACCORDING TO THE LATEST CITY OF FORT ERIE STANDARD DRAWINGS AND SPECIFICATIONS. ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATION MAY, SUBJECT TO THE APPROVAL OF THE CITY OF FORT ERIE, BE USED WHERE NO CITY STANDARD OR SPECIFICATION IS AVAILABLE.
2. AL WORK SHALL BE COMPLETED ACCORDING TO THE CURRENT OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS THE GENERAL CONTRACTOR SHALL BE DEEMED THE CONSTRUCTOR AS DEFINED IN THE ACT.
3. ALL TEMPORARY TRAFFIC CONTROL AND SIGNAGE DURING CONSTRUCTION SHALL BE ACCORDING TO THE CURRENT ONTARIO TRAFFIC MANUAL BOOK 7: CONDITIONS FIELD EDITION.

CONSTRUCTION NOTES:

1. ALL MATERIAL FOR SEWER FORCEMAIN, WATERMAIN, HYDRANTS, AND APPURTENANCES SHALL BE ACCORDING TO CITY SPECIFICATIONS AS REQUIRED.
2. UTILITY SEPARATION SHALL BE ACCORDING CITY DESIGN CRITERIA FOR SEWERS AND WATERMAINS MANUAL.
3. SERVICE CONNECTIONS AND UTILITY CUTS MADE IN ROAD PAVEMENTS SHALL BE BACKFILLED WITH UNSHRINKABLE FILL ACCORDING TO CITY STANDARDS.
4. ALL AREAS DISTURBED DURING CONSTRUCTION WITHIN THE CITYS RIGHT-OF-WAY SHALL BE RESTORED TO ORIGINAL OR BETTER CONDITIONED TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR. GRASS AREAS SHALL BE TREATED WITH 100mm OF TOPSOIL AND SHALL BE SODDED ACCORDING TO CITY STANDARDS.
5. ALL EXISTING UTILITIES SHOWN ON DRAWINGS (PLAN AND PROFILE) ARE FOR REFERENCE PURPOSES ONLY. THE CONTRACTOR SHALL SATISFY THEMSELVES AS TO THE ACTUAL LOCATION AND DEPTH OF ANY UTILITY AND SHALL BE LIABLE FOR ALL OR ANY DAMAGE.
6. ANY DISCREPANCIES BETWEEN SITE CONDITIONS AND CONSTRUCTION DRAWINGS MUST BE REPORTED TO THE CITY PRIOR TO COMMENCEMENT OF CONSTRUCTION AND APPROPRIATE ACTION TAKEN TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
7. ALL SURVEY STAKE LAYOUT POINTS SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION. ANY DISCREPANCIES BETWEEN THE DRAWINGS AND THE LAYOUT SHALL BE REPORTED IMMEDIATELY TO THE CITY.
8. ATTENTION IS DIRECTED TO THE POSSIBILITY OF EXISTING PRIVATE SPRINKLERS AND LIGHTING SYSTEMS WITHIN THE RIGHT-OF-WAY, WHICH ARE NOT SHOWN ON THE PLAN. LOCATING, WORKING AROUND AND PROTECTING THESE SYSTEMS SHALL BE COMPLETED AT NO EXTRA COST TO THE CITY.
9. AT ALL LOCATIONS WHERE THE PROPOSED WATERMAIN CROSSES UNDER OR ABOVE THE EXISTING TOP OF THE UPPER PIPE GRANULAR A TO BE COMPACTED TO MINIMUM 98% OF MAXIMUM FRT DENSITY.
10. CONTRACTOR TO PROVIDE ADEQUATE SUPPORT DURING CONSTRUCTION BETWEEN THE NEW WATERMAIN AND EXISTING GAS MAIN LINES THAN 300mm IN DIAMETER. MAINTAIN 600mm MINIMUM VERTICAL CLEARANCE BETWEEN THE NEW WATERMAIN AND EXISTING GAS MAINS EQUAL TO OR GREATER THAN 300mm IN DIAMETER.
11. ALL EXISTING WATERMAINS AND SEWER PIPES LARGER THAN 300mm DIAMETER SHALL BE SUPPORTED ACCORDING TO CITY STANDARDS.
12. ALL DIMENSIONS ARE EXPRESSED IN METERS (m) AND PIPE SIZES ARE EXPRESSING IN MILLIMETERS (mm) UNLESS OTHERWISE NOTED.
13. THE APPLICANT IS REQUIRED TO COMPLY WITH THE SEWER USE BY-LAW AND OBTAIN ALL APPROVALS/PERMITS FROM CITY STAFF.
14. THE APPLICANT IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE PROVINCIAL REQUIREMENTS AND OBTAINING THE NECESSARY APPROVALS AND/OR PERMITS FROM THE MINISTRY OF ENVIRONMENT & CLIMATE CHANGE WITH REGARD TO ANY PROPOSED DEWATERING.

NOTE:

ALL DIMENSIONS AND ELEVATIONS MUST BE SITE MEASURED AND CONFIRMED PRIOR TO FABRICATION AND/OR ERECTION.

SHOP DRAWINGS

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THESE DRAWINGS ARE THE PROPERTY OF ROBERT E. DALE LIMITED, CONSULTING ENGINEERS AND SHALL NOT BE USED AND OR REPLICATED IN THE GENERATION OF SHOP DRAWING PURPOSES.

NO.	REVISION	DATE
4	ISSUED FOR PERMITS AND PRICING	05/10/2023
3	GENERAL SERVICING REVISION	04/24/2023
2	PRELIMINARY-ISSUED WITH CIVIL BRIEF	01/10/2022
1		
0		

STAGE OF DESIGN AND DRAFTING:

	Issued for Site Plan Approvals	
	Preliminary Design	
	Issued for Comments and Coordination	
	Issued for Building Permit	05/10/2023
	Issued for Tender	05/10/2023
	Issued for Construction	
	As Built Record Set	

ROBERT E. DALE LIMITED CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

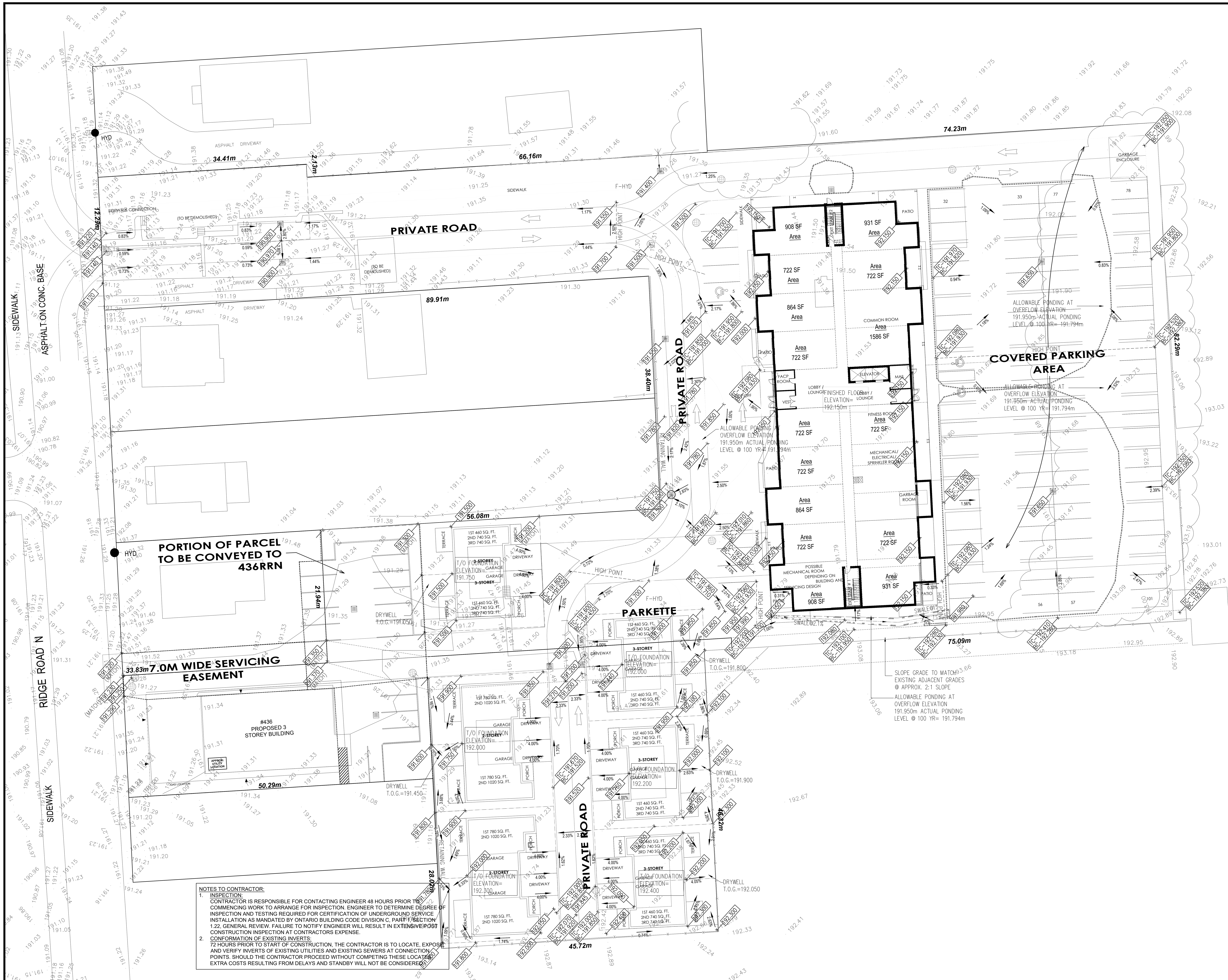
310 CHRISTINA STREET
SARNIA, ONTARIO

not valid unless signed

PROJECT

SITE PLAN/CIVIL DESIGN FOR 440 RIDGE RD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT:	JPD
DWG. TITLE	SERVICING PLAN - 440 & 436 RIDGE
DATE	APRIL 2023
SCALE	1:350 METRIC
DESIGNED BY	G.DALE
DRAWN BY	UNNATI C.
PROJ. No.	230372
DRAWING No.:	CVL-1



NOTES TO CONTRACTOR:

1. INSPECTION:
CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HOURS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.22, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.
2. CONFORMATION OF EXISTING INVERTS:
72 HOURS PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE, AND VERIFY INVERTS OF EXISTING UTILITIES AND EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY WILL NOT BE CONSIDERED.

SITE GRADING PLAN

SCALE: 1:350

NORTH

LEGEND

400 WM	EXISTING WATERMAIN	CB	EXISTING CATCHBASIN
300 SAN	EXISTING SANITARY SEWER	DCB	EXISTING DOUBLE CATCHBASIN
1500 ST	EXISTING STORM SEWER	WV	EXISTING WATER VALVE
GAS	EXISTING GASMAIN	FH	EXISTING FIRE HYDRANT
B.BOX	EXISTING BELL PEDISTAL	SA21	PROPOSED SANITARY MAINTENANCE HOLE
SA21 ST11	EXISTING SANITARY/STORM MAINTENANCE HOLE		
CO	PROPOSED SANITARY CLEANOUT	200 WM	PROPOSED WATERMAIN
250 ST	PROPOSED STORM SEWER	V&B	PROPOSED WATER VALVE AND BOX
CB	PROPOSED CATCHBASIN		PROPOSED CAP
HP	EXISTING HYDRO POLE	200 SAN	PROPOSED SANITARY SEWER
	EXISTING FENCE		
ST21	PROPOSED STORM MAINTENANCE HOLE		
190.65	PROPOSED FINAL GRADE		
	ENTRANCE SYMBOL		

GENERAL NOTES:

1. THIS/THESE PLAN(S) IS/ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SEALED BY THE ENGINEER AND INDICATED ISSUED FOR CONSTRUCTION ON THE DRAWING.
2. THIS/THESE PLAN(S) IS/ARE NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER.
3. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS ARE FURNISHED AS THE BEST AVAILABLE INFOMRATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS HE SEES FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR THE ACCURACY AND/OR SUFFICIENCY. THE CONTRACTOR HALL ASSUME LIABILITY FOR ANY DAMAGE TO EXISTING WORKS.
4. EXISTING TOPOGRAPHIC AND LEGAL INFORMATION TAKEN FROM PLANS PREPARED BY CHAMBERS AND ASSOCIATES SURVEYING LTD.
5. SITE PLAN INFORMATION TAKEN FROM PLANS PREPARED BY JPD.
6. THIS/THESE PLAN(S) TO BE READ IN CONJUNCTION WITH THE STORM WATER MANAGEMENT (SWM) REPORT PREPARED BY ROBERT E. DALE LIMITED.
7. THIS/THESE PLAN(S) ARE TO BE USED FOR SERVICING AND GRADING ONLY, FOR BUILDING LOCATION REFER TO THE SITE PLAN.
8. MUNICIPAL APPROVAL OF THESE DRAWINGS IS FOR MATERIAL AND COMPLIANCE WITH THE CITY OF FORT ERIE AND PROVINCIAL SPECIFICATIONS AND STANDARDS ONLY. APPROVAL AND INSPECTION OF THE WORKS BY THE CITY OF TORONTO STAFF DOES NOT CERTIFY THE LINE AND GRADE OF THE WORKS NO RELIEVE THE CONTRACTOR OF CERTIFICATION OF ALL WORK BY THE OWNERS ENGINEER.
9. ALTERNATE MATERIAL MAY BE ACCEPTABLE PROVIDED WRITTEN APPROVAL HAS FIRST BEEN OBTAINED BY THE THE CITY AND BY THE ENGINEER.
10. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S BONDED CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING:
   - ROAD CUT PERMITS
   -SEWER PERMITS
   -APPROACH APPROVAL PERMITS
   -RELOCATION OF SERVICES
   -COMMITTEE OF ADJUSTMENT
   -ENCROACHMENT AGREEMENTS
11. PRIOR TO CONSTRUCTION THE CONTRACTOR MUST:
   I) CHECK AND VERIFY ALL DIMENSIONS AND EXISTING ELEVATIONS WHICH INCLUDE BUT ARE NOT LIMITED TO THE BENCHMARK ELEVATIONS, EXISTING SERVICE CONNECTIONS, EXISTING INVERTS AND REPORT THE FINDINGS IN WRITING TO THE ENGINEER.
   II) OBTAIN ALL UTILITY LOCATED AND REQUIRED PERMITS AND LICENSES.
   III) VERIFY ALL FINISHED FLOOR ELEVATIONS AND BASEMENT FLOOR ELEVATIONS WHICH MAY APPEAR ON THESE PLANS COMPLY WITH THE FINAL ARCHITECTURAL DRAWINGS.
   IV) CONFIRM ALL DRAWINGS USED FOR CONSTRUCTION ARE OF THE MOST RECENT REVISION.
   V) NOTIFY THE ENGINEER OF THE PROPOSED CONSTRUCTION SCHEDULE FOR COORDINATION OF NECESSARY INSPECTIONS.
12. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE ENGINEER 48 HOURS PRIOR TO THE COMMENCING THE SITE WORKS TO ARRANGE FOR INSPECTION. THE ENGINEER SHALL DETERMINE THE EXTENT OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF THE UNDERGROUND SERVICE INSTALLATION AS MANDATED BY THE ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO MAKE SUITABLE ARRANGEMENT FOR INSPECTION WILL LEAD TO POST CONSTRUCTION TESTING AND INSPECTION AS DETERMINED BY THE ENGINEER. THE COSTS OF WHICH INCLUDING ANY DELAYS IN CONSTRUCTION SHALL BE BORNE BY THE CONTRACTOR. FULL PAYMENT FOR ANY UN-INSPECTED WORKS MAY BE WITHHELD UNTIL THE COMPLETION OF THE POST CONSTRUCTION INSPECTION AND TESTING TO THE SATISFACTION OF THE ENGINEER.
13. INSPECTION BY THE OWNER'S ENGINEER IS FOR CERTIFICATION AND GENERAL CONFORMANCE PURPOSES AND DOES NOT CERTIFY LINE AND GRADE OR IMPLY AND ASSURANCE OF QUALITY CONTROL. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THE INSTALLATION OF THE WORKS TO PROPER LINE GRADE AND QUALITY TO CURRENT INDUSTRY STANDARDS.
14. ANY UTILITY RELOCATIONS AND RESTORATIONS DUE TO THE DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/DEVELOPER AND SHALL BE COORDINATED BY THE CONTRACTOR.
15. ALL RESTORATIONS AND RECONSTRUCTION SHALL BE COMPLETED TO MATCH EXISTING CONDITIONS OR BETTER AND ARE TO BE PERFORMED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF FORT ERIE.
16. SERVICING CONTRACTOR TO MAINTAIN A "CONFINED TRENCH CONDITION" IN ALL SEWER AND WATERMAN INSTALLATION TRENCHES.
17. THE SITE SERVICING CONTRACTOR SHALL TERMINATE ALL SERVICES 1.0m FROM THE BUILDING FACE.
18. NO BLASTING WILL BE PERMITTED.

SANITARY AND STORM SEWERS:

1. CONSTRUCTION OF SANITARY AND STORM SEWERS AND PRIVATE DRAINS SHALL BE IN ACCORDANCE WITH CITY STANDARDS AND SPECIFICATIONS (LATEST EDITION) AND MINISTRY OF ENVIRONMENT (MOE) GUIDELINES (LATEST EDITION).
2. SANITARY SERVICE CONNECTION SHALL BE SINGLE , 150m MINIMUM PVC DR 28 INSTALLED AT 2 PERCENT AND THE COLOR SHALL BE GREEN FOR SINGLE RESIDENTIAL DWELLINGS.
3. EMBEDMENT MATERIAL FOR FLEXIBLE PIPE SHALL BE ACCORDING TO THE OPSD 802.010 AND USING GRANULAR A ACCORDING TO TS 1010 AND COMPACTED TO MINIMUM 98% OF MAXIMUM DRY DENSITY.
4. BEDDING FOR RIGID PIPE SHALL BE CLASS B BEDDING MATERIAL ACCORDING OT OPD 802.031 AND USING GRANULAR A BEDDING MATERIAL ACCORDING TO TS 1010 AND COMPACTED TO MINIMUM 98% OF MAXIMUM DRY DENSITY.
5. ALL SEWERS TO BE VIDEO INSPECTED AS PER OPSS 409.
6. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
7. MANHOLE FRAMES AND COVERS SHALL BE AS PER OPSD 400.010 (STORM-OPEN, SANITARY CLOSED)
8. CATCHBASIN FRAMES AND GRATES SHALL BE AS PER OPSD 400.100 IN PACED AREAS AND 400.120 IN LANDSCAPED AREAS.
9. ALL REAR LOT CATCHBASINS SHALL BE SUMPLESS AND HAVE NO GOSS TRAPS.
10. SANITARY SEWERS 200mm TO 375mm IN DIAMETER SHALL BE PVC PIPE, CSA B182.2, SDR-35.
11. STORM SEWERS 250mm TO 450mm IN DIAMETER SHALL BE PVC PIPE, CSA B18.2, SDR-35.
12. STORM SEWERS GREATER THAN 450mm IN DIAMETER SHALL BE CONCRETE PIPE, CSA A257.2 (AS SPECIFIED).
13. ALL PVC STORM SEWERS ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION AS PER OPSS 4.10. SANITARY SEWERS SHALL BE TESTED FOR DEFLECTION (MANDREL PASSAGE AND LEAKAGE (LOW AIR PRESSURE METHOD) AS PER OPSS 4.10. PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED

SEWER/WATER ABANDONMENT:

1. PLUG ENDS OF ALL ABANDONED METALLIC MAIN WITH CONCRETE.
2. PLUG ALL TEES AND CROSSES WHERE THE ABANDONED MAIN CONNECTS TO A MAIN REMAINING IN SERVICE.
3. PROVIDE MECHANICAL JOINT VALVES IN CHAMBERS AND SALVAGE.
4. ABANDON AND BURY LEAD JOINT TYPE VALVES.
5. REMOVE HYDRANTS FOR DISPOSAL OR SALVAGE FOR REUSE-IF MODEL COMPLIES WITH THE CURRENT STANDARD.
6. REMOVE TOP ONE METER OF CHAMBER, SALVAGE FRAME AND COVER FOR FUTURE REUSE. IF REMAINING CHAMBER IS IN THE ROADWAY, BACKFILL WITH UNSHRINKABLE FILL AS PER CITY STANDARDSOR IF IN THE BOULEVARD AREA, BACKFILL WITH GRANULAR FILL.
7. WATER SERVICES WHICH ARE BEING ABANDONED SHOULD BE DETACHED AT THE MAIN. IN THE CARE OF A DRIVEN NIPPLE, IT SHOULD BE PLUGGED OR A SLEEVE REPAIR USED AROUND THE MAIN TO COVER THE NIPPLE HOLE. IF IT IS A TEE IT IS TO BE REMOVED AND A FILLER PIECE INSTALLED. IF IT IS A TAPPING VALVE AND VALVE IS IN GOOD CONDITION, THE VALVE CAN BE SHUT OFF AND THE MAIN CAPPED.
8. UNUSED MAINTENANCE HOLES AND CATCHBASINS MUST BE COMPLETELY REMOVED.
9. OPENINGS IN MAINTENANCE HOLES AND CATCHBASINS WHERE SERVICES WERE REMOVED OR ABANDONED BUST BE BRICKED AND PARGED.

EROSION AND SEDIMENT CONTROL:

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING CONSTRUCTION PHASES TO PREVENT ENTRY OF SEDIMENT INTO THE WATER. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE REPAIRED OR REPLACED WITHIN 48 HOURS OF INSPECTION OR BOTH.
2. ALL DISTURBED AREAS WILL BE MINIMIZED TO EXTENT POSSIBLE AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES.
3. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINES ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE IPGRADED/AMENDED AS SIRE CONDITIONS CHANCE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREA. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, THEN ALTERNATIVE MEASURES MUST BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS AND A TORONTO REGION CONSERVATION AUTHORITY ENFORCEMENT OFFICER SHOULD BE IMMEDIATELY CONTACTED. ADDITIONAL ESC MEASURES TO BE KEPT ON SIRE AND USED AS NECESSARY.
4. ALL ACTIVITIES INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE, OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE OF REFUELING WILL BE CONDUCTED A MINIMUM OF 30M FORM WATER.
5. ALL GRADES WITHIN THE REGULATORY FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.
6. FILTER FABRIC TO BE PLACED UNDER GATES ON ALL CATCHBASIN TO TRAP SEDIMENT. SILT TRAPS ARE TO BE CLEANED REGULARLY AND ARE NOT TO BE REMOVED UNTIL SUCH TIME AS THE CURBS ARE CONSTRUCTED AND THE BOULEVARDS ARE SODDED OR BACKYARDS ARE GRADED AND SODDED. FILTER FABRIC FOR DOLT CONTROL TO BE TERRA FIX 27 OR APPROVED EQUIVALENT.

NOTE:

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SHOP DRAWINGS

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NO.	REVISION	DATE
C	ISSUED FOR PERMITS AND PRICING	05/10/2023
B	GENERAL SERVICING REVISION	04/24/2023
A	PRELIMINARY—ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

☐	Issued for Site Plan Approvals	
☐	Preliminary Design	
☐	Issued for Comments and Coordination	
■	Issued for Building Permit	05/10/2023
■	Issued for Tender	05/10/2023
☐	Issued for Construction	
☐	As Built Record Set	

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DRAWINGS MUST NOT BE SCALED.

ROBERT E. DALE LIMITED
CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

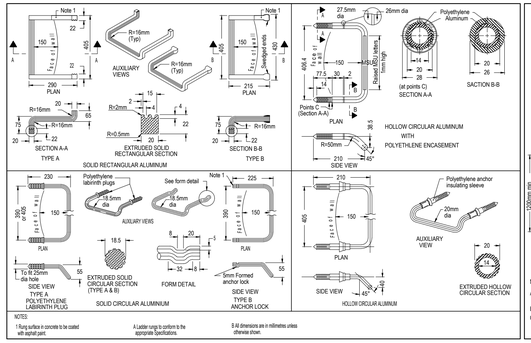
not valid unless signed

PROJECT
SITE PLAN/CIVIL DESIGN FOR 440 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT: ACK

DWG. TITLE
SITE GRADING PLAN

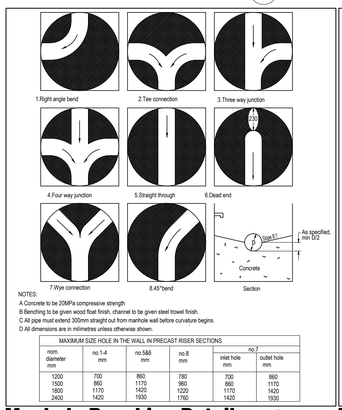
DATE	APRIL 2023	SCALE	1:300 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-2
DRAWN BY	W.J.REED		
PROJ. No.	230372		



Manhole Steps

SCALE: nts

1 CVL-3

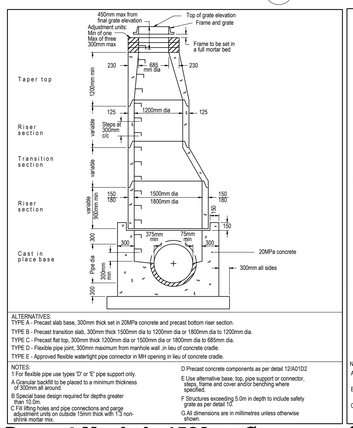


MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
nom. diameter mm	no.1-4 mm	no.5&6 mm	no.8 mm	no.7 inlet hole mm	no.7 outlet hole mm
1200	700	860	780	700	860
1500	860	1170	960	860	1170
1800	1170	1420	1220	1170	1420
2400	1420	1930	1760	1420	1930

Manhole Benching Details-

SCALE: nts

7 CVL-3



ALTERNATIVES:
TYPE A - Precast slab base, 300mm thick set in 20MPa concrete and precast bottom riser section.
TYPE B - Precast transition slab, 300mm thick 1500mm dia to 1200mm dia or 1800mm dia to 1200mm dia.
TYPE C - Precast flat top, 300mm thick 1200mm dia or 1500mm dia or 1800mm dia to 685mm dia.
TYPE D - Flexible pipe joint, 300mm maximum from manhole wall ,in lieu of concrete cradle.
TYPE E - Approved flexible watertight pipe connector in MH opening in lieu of concrete cradle.

NOTES:
1 For flexible pipe use types 'D' or 'E' pipe support only.
A Granular backfill to be placed to a minimum thickness of 300mm all around.
B Special base design required for depths greater than 10.0m
C Fill lifting holes and pipe connections and parge adjustment units on outside 10mm thick with 1:3 non-shrink mortar mix.
D Precast concrete components as per detail 12/A01D2
E Use alternative base, top, pipe support or connector, steps, frame and cover and/or benching where specified.
F Structures exceeding 5.0m in depth to include safety grate as per detail 10.
G All dimensions are in millimetres unless otherwise shown.

Precast Manhole 1500mmØ and 1800mmØ

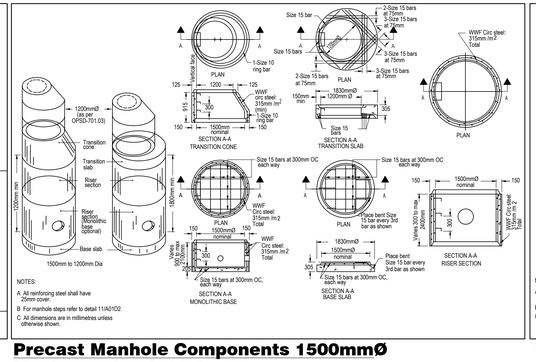
SCALE: nts

13 CVL-3

Precast Concrete Manhole Components 1500mmØ Maximum depth 10.0m

SCALE: nts

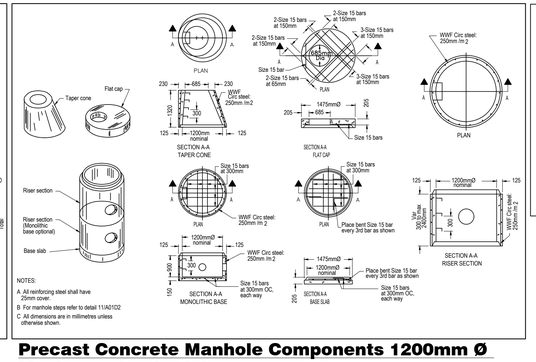
2 CVL-3

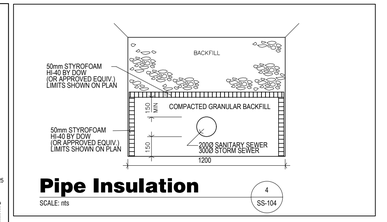


Precast Concrete Manhole Components 1200mm Ø Maximum depth 10.0m

SCALE: nts

3 CVL-3

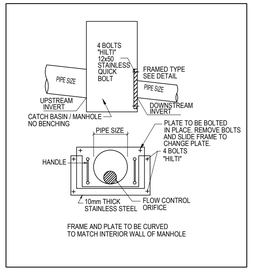




Pipe Insulation

SCALE: nts

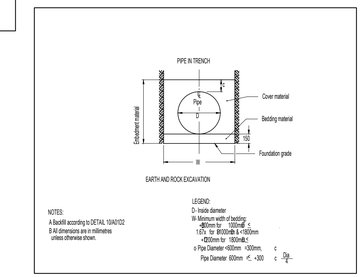
4 SS-104



Flow Control Orfice

SCALE: nts

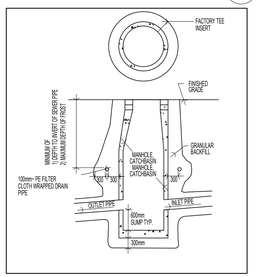
5 CVL-3



Pipe Bedding for Storm and Sanitary Sewers (Flexible Pipe)

SCALE: nts

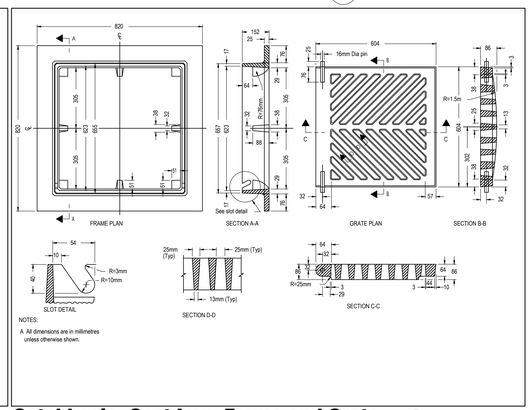
11 SP-4



Subdrain Pipe

SCALE: nts

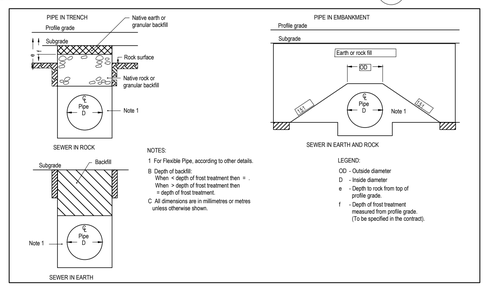
12 SP-4



Catchbasin, Cast Iron, Frame and Grate

SCALE: nts

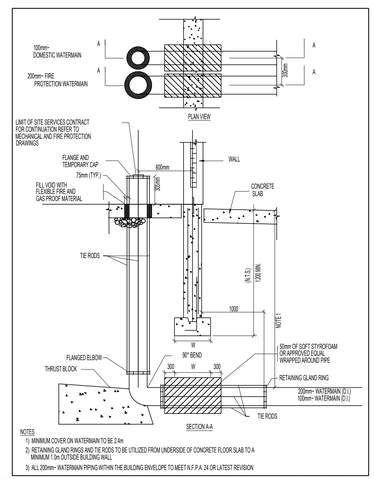
10 CVL-3



Backfill for Sewers and Pressurized Conduits

SCALE: nts

16 DIL3



Water Main Connection to Building

SCALE: nts

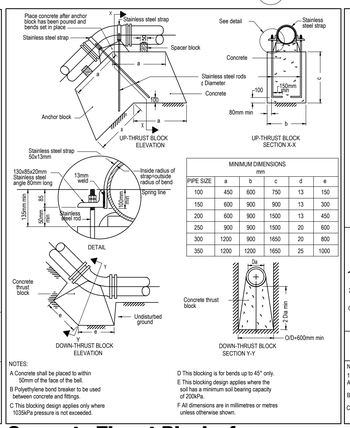
17 DIL3

Precast Conc. Catch Basin

SCALE: nts

600mmØ600mm

8 DIL3

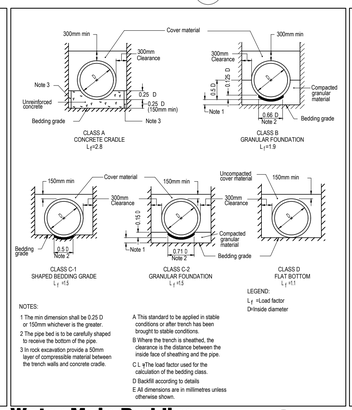


Water Main Bedding

SCALE: nts

(Maximum Pipe Size 900MMØ)

9 DIL3



Concrete Thrust Blocks for Vertical Bends

SCALE: nts

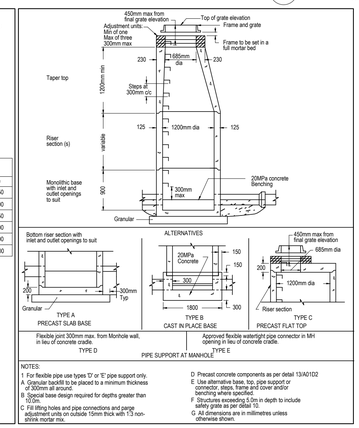
14 DIL3

MINIMUM DIMENSIONS mm					
PIPE SIZE	a	b	c	d	e
100	450	600	750	13	150
150	600	900	900	13	300
200	600	900	1500	13	450
250	900	900	1500	20	600
300	1200	900	1650	20	800
350	1200	1200	1650	25	1000

PreCast Manhole 1200mmØ

SCALE: nts

15 DIL3



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NO.	REVISION	DATE
C	ISSUED FOR PERMITS AND PRICING	05/10/2023
B	GENERAL SERVICING REVISION	04/24/2023
A	PRELIMINARY-ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

	Issued for Site Plan Approvals	
	Preliminary Design	
	Issued for Comments and Coordination	
	Issued for Building Permit	05/10/2023
	Issued for Tender	05/10/2023
	Issued for Construction	
	As Built Record Set	

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ROBERT E. DALE LIMITED
CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

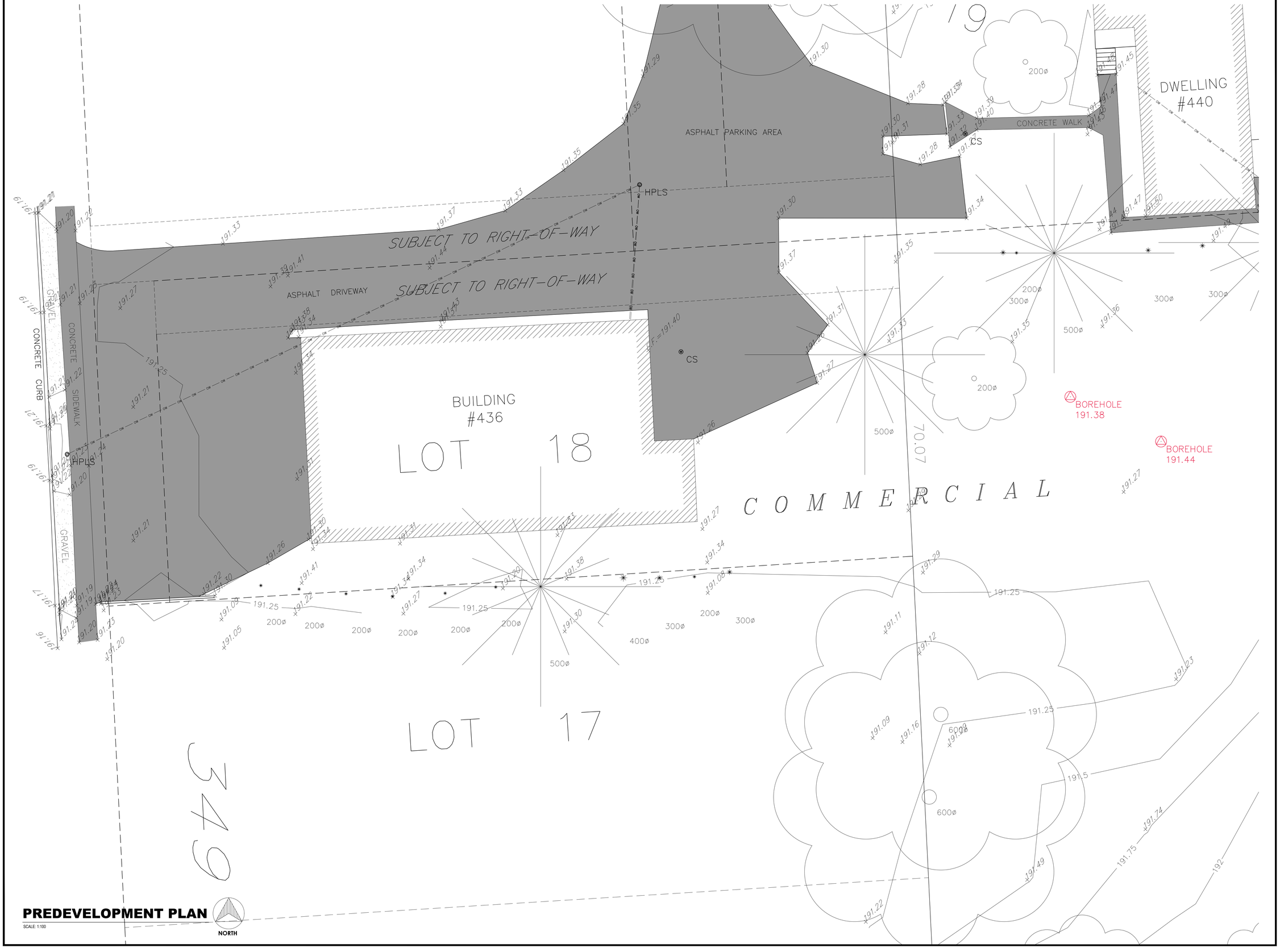
not valid unless signed

PROJECT
SITE PLAN/CIVIL DESIGN FOR 440 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT: ACK

DWG. TITLE
SITE SERVICING DETAILS

DATE	APRIL 2023	SCALE	1:300 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-3
DRAWN BY	W.J.REED		
PROJ. No.	230372		



PREDEVELOPMENT PLAN

SCALE: 1:100

NORTH

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NO.	REVISION	DATE
A	PRELIMINARY--ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

■	Issued for Site Plan Approvals	1/10/2022
	Preliminary Design	
	Issued for Comments and Coordination	
	Issued for Building Permit	
	Issued for Tender	
	Issued for Construction	
	As Built Record Set	

ROBERT E. DALE
LIMITED
CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

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PROJECT

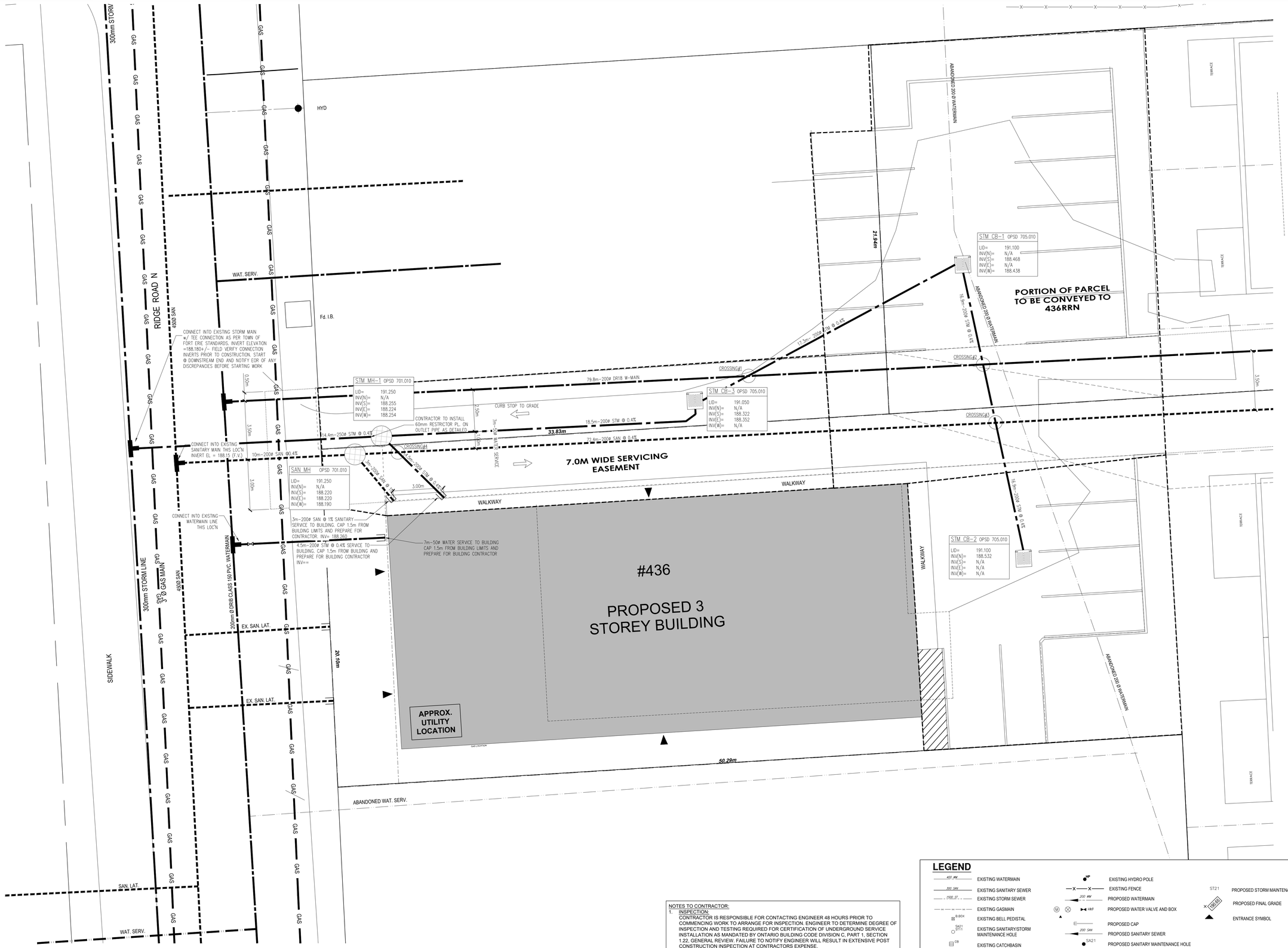
SITE PLAN/CIVIL DESIGN FOR 436 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT:

DWG. TITLE

PREDEVELOPMENT PLAN

DATE	APRIL 2023	SCALE	1:100 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-1
DRAWN BY	W.J.REED		
PROJ. No.	2304124		



SITE SERVICING PLAN

SCALE: 1:100

NORTH

NOTES TO CONTRACTOR:

1. INSPECTION:
   CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HOURS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.22, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.
2. CONFORMATION OF EXISTING INVERTS:
   72 HOURS PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE, AND VERIFY INVERTS OF EXISTING UTILITIES AND EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY WILL NOT BE CONSIDERED.

LEGEND

- 400 #W — EXISTING WATERMAIN
- 300 SAN — EXISTING SANITARY SEWER
- 1500 ST — EXISTING STORM SEWER
- EXISTING GASMAIN
- B.BOX — EXISTING BELL PEDISTAL
- SA21 / ST11 — EXISTING SANITARY/STORM MAINTENANCE HOLE
- CB — EXISTING CATCHBASIN
- DCB — EXISTING DOUBLE CATCHBASIN
- WV — EXISTING WATER VALVE
- FH — EXISTING FIRE HYDRANT
- HP — EXISTING HYDRO POLE
- EXISTING FENCE
- 200 #W — PROPOSED WATERMAIN
- WV / 18Ø — PROPOSED WATER VALVE AND BOX
- PROPOSED CAP
- 250 SAN — PROPOSED SANITARY SEWER
- SA21 — PROPOSED SANITARY MAINTENANCE HOLE
- CO — PROPOSED SANITARY CLEANOUT
- 250 ST — PROPOSED STORM SEWER
- CB — PROPOSED CATCHBASIN
- ST21 — PROPOSED STORM MAINTENANCE HOLE
- 190.00 — PROPOSED FINAL GRADE
- ENTRANCE SYMBOL

NOTE:

ALL DIMENSIONS AND ELEVATIONS MUST BE SITE MEASURED AND CONFIRMED PRIOR TO FABRICATION AND/OR ERECTION.

SHOP DRAWINGS

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NO.	REVISION	DATE
A	PRELIMINARY--ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

■	Issued for Site Plan Approvals	1/10/2022
	Preliminary Design	
	Issued for Comments and Coordination	
	Issued for Building Permit	
	Issued for Tender	
	Issued for Construction	
	As Built Record Set	

ROBERT E. DALE LIMITED
CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

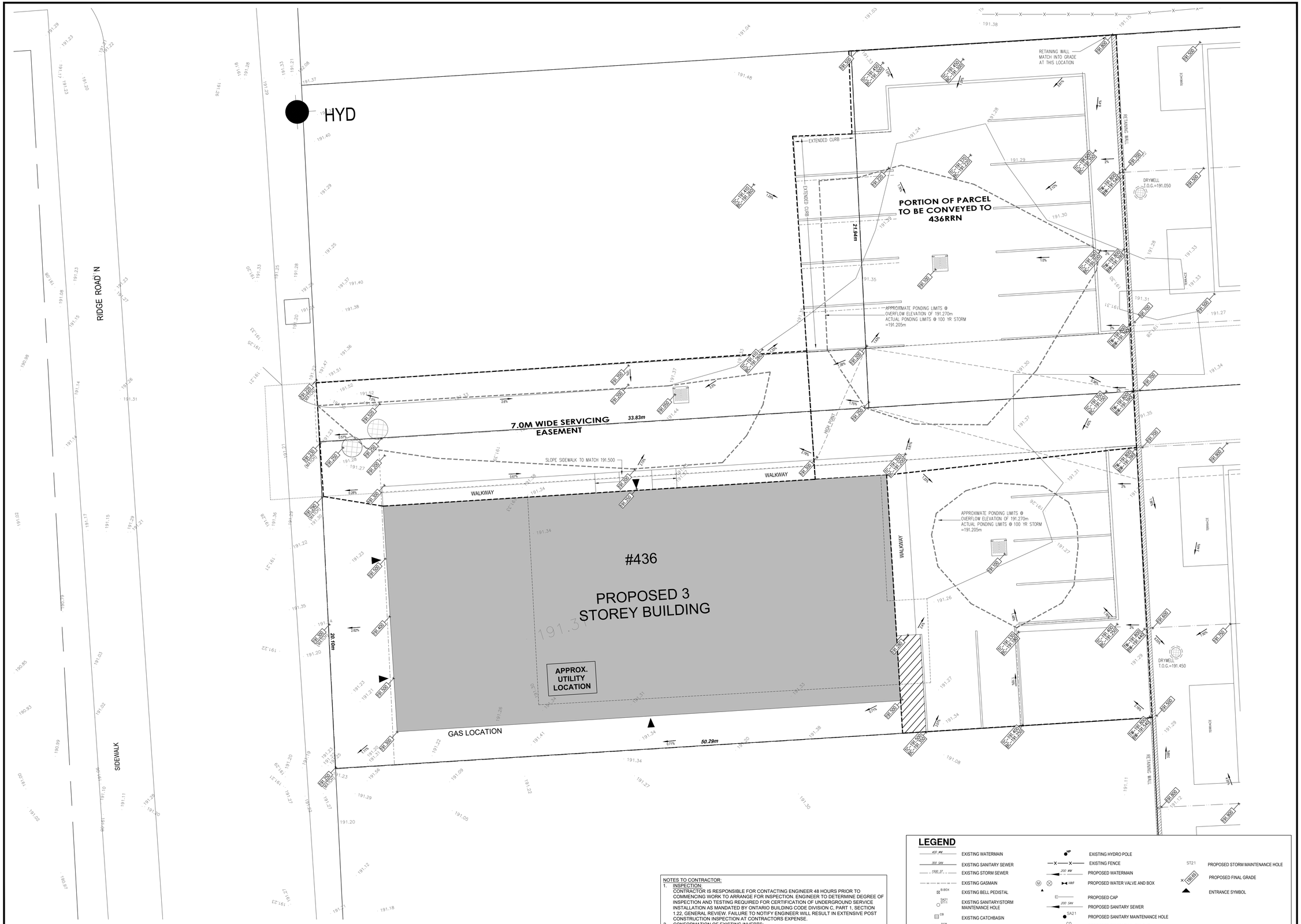
not valid unless signed

PROJECT
SITE PLAN/CIVIL DESIGN FOR 436 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT:

DWG. TITLE
SITE SERVICING PLAN

DATE	APRIL 2023	SCALE	1:100 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-2
DRAWN BY	W.J.REED		
PROJ. No.	2304124		



SITE GRADING PLAN

SCALE: 1:100

NORTH

NOTES TO CONTRACTOR:

1. INSPECTION:
   CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HOURS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.22, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.
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LEGEND

- 450 #W — EXISTING WATERMAIN
- 300 SAN — EXISTING SANITARY SEWER
- 1500 ST — EXISTING STORM SEWER
- EXISTING GASMAIN
- B.BOX — EXISTING BELL PEDISTAL
- SA21 ST11 — EXISTING SANITARY/STORM MAINTENANCE HOLE
- CB — EXISTING CATCHBASIN
- DCB — EXISTING DOUBLE CATCHBASIN
- WV — EXISTING WATER VALVE
- FH — EXISTING FIRE HYDRANT
- HP — EXISTING HYDRO POLE
- EXISTING FENCE
- 200 #W — PROPOSED WATERMAIN
- M — HW — PROPOSED WATER VALVE AND BOX
- PROPOSED CAP
- 200 SAN — PROPOSED SANITARY SEWER
- SA21 — PROPOSED SANITARY MAINTENANCE HOLE
- CO — PROPOSED SANITARY CLEANOUT
- 250 ST — PROPOSED STORM SEWER
- CB — PROPOSED CATCHBASIN
- ST21 — PROPOSED STORM MAINTENANCE HOLE
- 190.50 — PROPOSED FINAL GRADE
- ENTRANCE SYMBOL

NOTE:

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NO.	REVISION	DATE
1	PRELIMINARY--ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

■	Issued for Site Plan Approvals	1/10/2022
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PROJECT

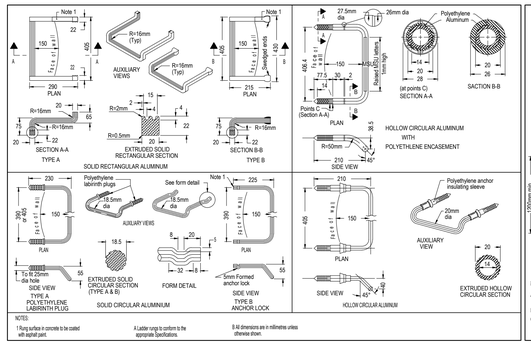
SITE PLAN/CIVIL DESIGN FOR 436 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT:

DWG. TITLE

SITE GRADING PLAN

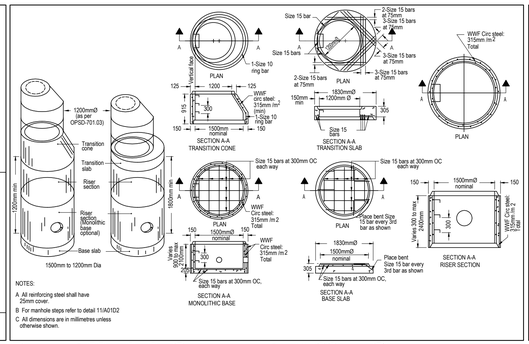
DATE	APRIL 2023	SCALE	1:100 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-3
DRAWN BY	W.J.REED		
PROJ. No.	2304124		



Manhole Steps

SCALE: nts

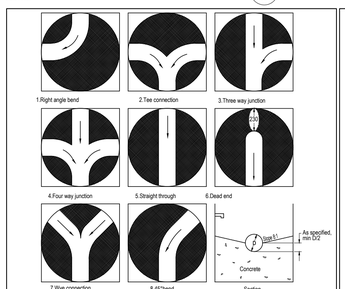
1 CVL-3



Manhole Benching Details-

SCALE: nts

3 OI-3



MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
nom. diameter mm	no.1-4 mm	no.5&6 mm	no.8 mm	no.7 inlet hole mm	no.7 outlet hole mm
1200	700	860	780	700	860
1500	860	1170	960	860	1170
1800	1170	1420	1220	1170	1420
2400	1420	1930	1760	1420	1930

Precast Manhole Components 1500mmØ Maximum depth 10.0m

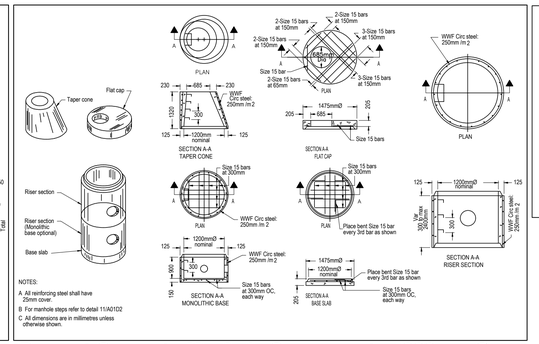
SCALE: nts

2 CVL-3

Precast Concrete Manhole Components 1200mm Ø Maximum depth 10.0m

SCALE: nts

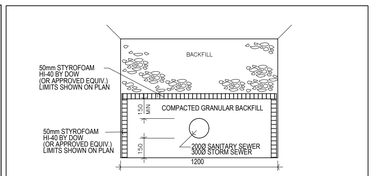
3 OI-3



Pipe Insulation

SCALE: nts

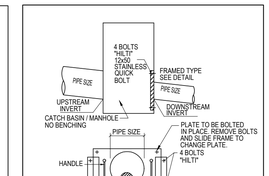
4 SS-104



Flow Control Orfice

SCALE: nts

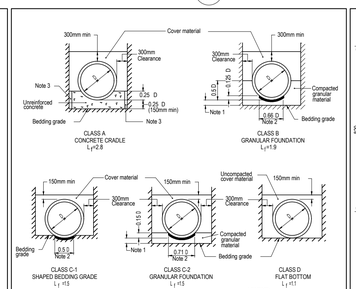
5 CVL-3



Precast Conc. Catch Basin

SCALE: nts 600mmx600mm

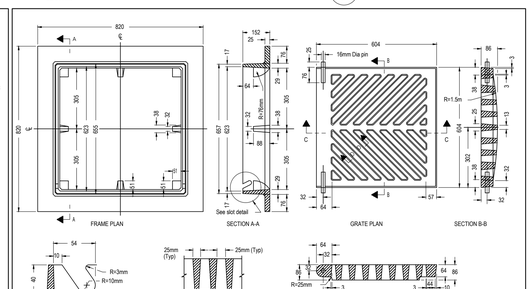
OI-3



Water Main Bedding

SCALE: nts (Maximum Pipe Size 900MMØ)

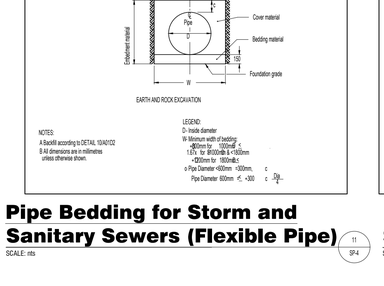
9 OI-3



Catchbasin, Cast Iron, Frame and Grate

SCALE: nts

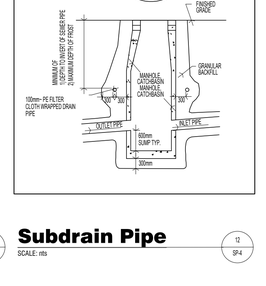
10 CVL-3



Pipe Bedding for Storm and Sanitary Sewers (Flexible Pipe)

SCALE: nts

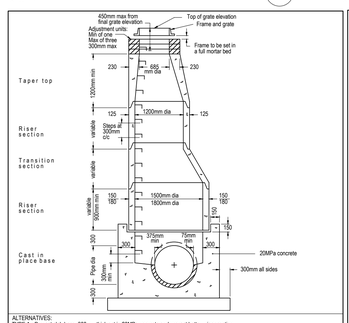
11 SP-4



Subdrain Pipe

SCALE: nts

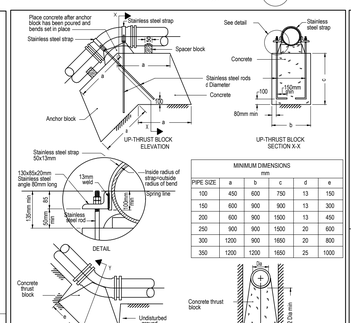
12 SP-4



Precast Manhole 1500mmØ and 1800mmØ

SCALE: nts

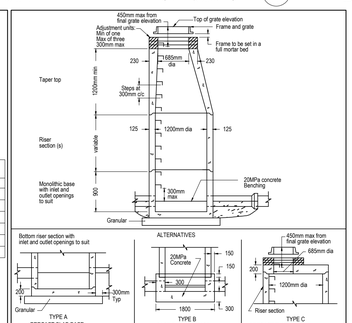
13 OI-3



Concrete Thrust Blocks for Vertical Bends

SCALE: nts

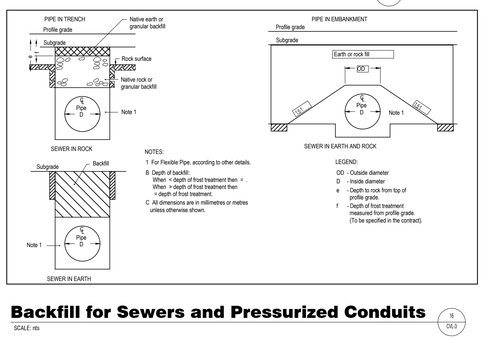
14 OI-3



PreCast Manhole 1200mmØ

SCALE: nts

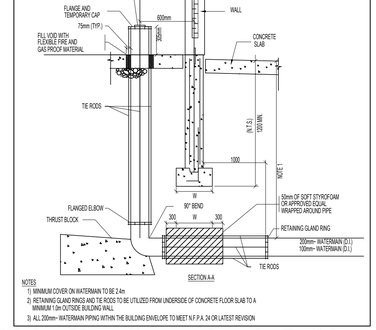
15 OI-3



Backfill for Sewers and Pressurized Conduits

SCALE: nts

16 OI-3



Water Main Connection to Building

SCALE: nts

17 OI-3

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THE CONTRACTOR MUST VERIFY AND ACCEPT RESPONSIBILITY FOR ALL DIMENSIONS AND CONDITIONS ON SITE AND MUST NOTIFY ARCHITECT / ENGINEER OF ANY VARIATIONS FROM THE SUPPLIED INFORMATION.

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CONSTRUCTION MUST CONFORM TO ALL APPLICABLE CODES AND REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

THE CONTRACTOR WORKING FROM DRAWINGS NOT SPECIFICALLY MARKED "FOR CONSTRUCTION" MUST ASSUME FULL RESPONSIBILITY AND BEAR COSTS FOR ANY CORRECTIONS OR DAMAGES RESULTING FROM HIS WORK.

THIS DRAWING IS NOT TO BE SCALED.

NOTE:

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NO.	REVISION	DATE
A	PRELIMINARY--ISSUED WITH CIVIL BRIEF	01/10/2022

STAGE OF DESIGN AND DRAFTING:

■	Issued for Site Plan Approvals	1/10/2022
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	Issued for Comments and Coordination	
	Issued for Building Permit	
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	Issued for Construction	
	As Built Record Set	

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THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING.

DRAWINGS MUST NOT BE SCALED.

ROBERT E. DALE LIMITED CONSULTING ENGINEERS

ENGINEERING DONE UPRIGHT.

310 CHRISTINA STREET
SARNIA, ONTARIO

not valid unless signed

PROJECT
SITE PLAN/CIVIL DESIGN FOR 436 RIDGE ROAD DEVELOPMENT FORT ERIE, ONTARIO

ARCHITECT:

DWG. TITLE
SITE SERVICING DETAILS

DATE	APRIL 2023	SCALE	1:100 METRIC
DESIGNED BY	G.DALE	DRAWING No.:	CVL-4
DRAWN BY	W.J.REED		
PROJ. No.	2304124		

SANITARY SEWER DESIGN SHEET

Project / Subdivision : 440 Ridge

Consulting Engineer : Robert E. Dale Limited

Project No.: 230372

Prepared by: G.Dale

Checked by:

Last Revised: Apr-23

Design Parameters

Residential Density (Single+Semis) =	3.5 cap/unit	Residential =	370 L/cap/day
Residential Density (Town Houses) =	2.9 cap/unit	Industrial (Light) =	35 m^3/ha/day
Residential Density (Apartments) =	4.0 cap/unit	Industrial (Heavy)=	55 m^3/ha/day
Manning 'n' =	0.013	Institutional =	65 m^3/ha/day
Extran. Flow=	0.21 L/s/ha	Commercial =	65 m^3/ha/day

Design Equations

$$M(r) = \frac{1+\frac{14}{4+(P)^{1/2}}}{}$$

$$M(ind) = 6.6604 \times A^{-0.1992}$$

$$Q(i) = i \times cr \times A$$

$$Q(r) = \frac{P \cdot q \cdot M}{86400}$$

NOTE: The pipe capacity is limited to maximum values according to Table E-1 of the Design Manual.

Notes/Comments:

Location					Individual Values									Cumulative Values								Flow Data							Sewer Data						
Street	From		To		Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential Area	Residential Units (Single+Semis)	Residential Units (Town Houses)	Residential Units (Apartments)	Residential Population	Light Industrial P.F.	Heavy Industrial P.F.	Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential P.F.	Residential Area	Residential Population	Light Industrial Peak Flow (L/s)	Heavy Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual Velocity
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	#	#	cap.	M(ind-L)	M(ind-H)	A(ind-L)	A(ind-H)	A(c)	A(ins)	M(r)	A(r)	P	Q(I-ind)	Q(h-ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)
Main Building	Outlet	S	Bldg	N								91	364							4.00		364.0					6.24		6.24	96.0	200	PVC	0.40	21.64	0.67	0.57
Single Family	Outlet	S	Bldg	N						12			42							4.00		42.0					0.72		0.72	96.0	200	PVC	0.40	21.64	0.67	0.30

Location					Individual Values									Cumulative Values									Flow Data							Sewer Data						
Street	From		To		Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential Area	Residential Units (Single+Semis)	Residential Units (Town Houses)	Residential Units (Apartments)	Residential Population	Light Industrial P.F.	Heavy Industrial P.F.	Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential P.F.	Residential Area	Residential Population	Light Industrial Peak Flow (L/s)	Heavy Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual Velocity
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	#	#	cap.	M(ind-L)	M(ind-H)	A(ind-L)	A(ind-H)	A(c)	A(ins)	M(r)	A(r)	P	Q(l-ind)	Q(h-ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)

SANITARY SEWER DESIGN SHEET

Project / Subdivision : 436 Ridge

Consulting Engineer : Robert E. Dale Limited

Project No.: 2304124

Prepared by: G.Dale

Checked by:

Last Revised: Apr-23

Design Parameters

Residential Density (Single+Semis) =	3.5 cap/unit	Residential =	370 L/cap/day
Residential Density (Town Houses) =	2.9 cap/unit	Industrial (Light) =	35 m^3/ha/day
Residential Density (Apartments) =	4.0 cap/unit	Industrial (Heavy)=	55 m^3/ha/day
Manning 'n' =	0.013	Institutional =	65 m^3/ha/day
Extran. Flow=	0.21 L/s/ha	Commercial =	65 m^3/ha/day

Design Equations

$$M(r) = \frac{1+\frac{14}{4+(P)^{1/2}}}{}$$

$$M(ind) = 6.6604 \times A^{-0.1992}$$

$$Q(i) = i \times cr \times A$$

$$Q(r) = \frac{P \cdot q \cdot M}{86400}$$

NOTE: The pipe capacity is limited to maximum values according to Table E-1 of the Design Manual.

Notes/Comments:

Location					Individual Values									Cumulative Values									Flow Data							Sewer Data						
Street	From		To		Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential Area	Residential Units (Single+Semis)	Residential Units (Town Houses)	Residential Units (Apartments)	Residential Population	Light Industrial P.F.	Heavy Industrial P.F.	Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential P.F.	Residential Area	Residential Population	Light Industrial Peak Flow (L/s)	Heavy Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual Velocity
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	#	#	cap.	M(ind-L)	M(ind-H)	A(ind-L)	A(ind-H)	A(c)	A(ins)	M(r)	A(r)	P	Q(I-ind)	Q(h-ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)
Main Building	Outlet	S	Bldg	N			0.05					8	32					0.05		4.00		32.0			0.04		0.55		0.59	3.0	200	PVC	0.40	21.64	0.67	0.29

Location					Individual Values									Cumulative Values									Flow Data							Sewer Data						
Street	From		To		Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential Area	Residential Units (Single+Semis)	Residential Units (Town Houses)	Residential Units (Apartments)	Residential Population	Light Industrial P.F.	Heavy Industrial P.F.	Industrial Light Area	Industrial Heavy Area	Commercial Area	Institutional Area	Residential P.F.	Residential Area	Residential Population	Light Industrial Peak Flow (L/s)	Heavy Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual Velocity
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	#	#	cap.	M(ind-L)	M(ind-H)	A(ind-L)	A(ind-H)	A(c)	A(ins)	M(r)	A(r)	P	Q(I-ind)	Q(h-ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)

5 Year

A = 747.93
B = 6.8
C = 0.768
Runoff Coefficient Adjustment = 1

ROBERT E. DALE LIMITED
STORM SEWER DESIGN SHEET (v1.0)
440 Ridge Road
May 10, 2023

Acceptable
Review
Incorrect

File No: 230372
Design Sheet: 1-Storm
Calculated By: G.Dale
Checked By: R.E.Dale

Catchment Area	Street Name	Maintenance Hole Number		Runoff Calculations										Hydraulic Calculations						
				Runoff Coefficent C	Runoff Coefficient w/ Adjustment C'	Area A	Incremental C'*A	Total C'*A	Time of Concentration		Intensity	Total Q		Diameter	Mannings N	Length	Slope	Q_{pipe}	Velocity	Capacity Check Q / Q_{pipe}
		From	To			Ha			Total minutes	Flow Time In Pipe minutes	mm/hr	m^3/s		mm		m	%	m^3/s	m/s	%
CA1	440 Ridge	CB1	CB2	0.700	0.700	0.174	0.122	0.122	10.000	0.884	85.669	0.029		250	0.013	38.000	0.350	0.035	0.717	82.4%
CA2	440 Ridge	CB2	STMMH1	0.700	0.700	0.172	0.121	0.242	10.884	0.462	82.362	0.055		300	0.013	24.000	0.400	0.061	0.865	90.7%
CA4	440 Ridge	STMMH1	STMMH2	0.700	0.700	0.035	0.024	0.267	11.346	0.166	80.745	0.087		375	0.013	10.000	0.400	0.111	1.004	78.0%
CA6	440 Ridge	CBMH	CB5	0.700	0.700	0.095	0.067	0.333	11.512	0.611	80.183	0.546		450	0.013	36.000	0.300	0.156	0.982	349.3%
CA8	440 Ridge	STMMH3	STMMH4	0.700	0.700	0.177	0.124	0.124	10.000	1.395	85.669	0.029		250	0.013	60.000	0.350	0.035	0.717	83.8%
CA7	440 Ridge	CB6	STMMH3	0.700	0.700	0.087	0.061	0.185	11.395	0.270	80.577	0.041		300	0.013	14.000	0.400	0.061	0.865	67.6%
	440 Ridge	CBMH	CBMH									0.587		450	0.013	35.000	0.400	0.180	1.134	325.5%
CA3	Building	CB1	CB2	0.700	0.700	0.160	0.112	0.112	10.000	0.233	85.669	0.027		250	0.013	10.000	0.350	0.035	0.717	75.9%
CA5	440 Ridge	CB4	CBMH	0.500	0.500	0.166	0.083	0.083	10.000	0.434	85.669	0.197		450	0.013	33.000	0.500	0.202	1.268	97.6%
	436 Ridge											0.229		600	0.013	33.000	0.200	0.275	0.971	83.3%
	430 Ridge		Outlet									0.248		600	0.013	33.000	0.200	0.275	0.971	90.2%

5 Year

A = 747.93
B = 6.8
C = 0.768
Runoff Coefficient Adjustment = 1

ROBERT E. DALE LIMITED
STORM SEWER DESIGN SHEET (v1.0)
436 Ridge Road
May 18, 2023

Acceptable
Review
Incorrect

File No: 2304124
Design Sheet: 1-Storm
Calculated By: G.Dale
Checked By: R.E.Dale

Catchment Area	Street Name	Maintenance Hole Number		Runoff Calculations										Hydraulic Calculations						
				Runoff Coefficent C	Runoff Coefficient w/ Adjustment C'	Area A	Incremental C'*A	Total C'*A	Time of Concentration		Intensity	Total Q	Diameter	Mannings N	Length	Slope	Q_{pipe}	Velocity	Capacity Check Q / Q_{pipe}
		From	To			Ha			Total minutes	Flow Time In Pipe minutes	mm/hr	m^3/s	mm		m	%	m^3/s	m/s	%
CA1	436 Ridge	CB1	CB2	0.700	0.700	0.025	0.018	0.018	10.000	0.404	85.669	0.004	200	0.013	16.000	0.400	0.021	0.660	20.1%
CA2	436 Ridge	CB2	CB3	0.700	0.700	0.053	0.037	0.055	10.404	0.543	84.120	0.013	200	0.013	21.500	0.400	0.021	0.660	61.5%
CA3	436 Ridge	CB3	STMMH1	0.700	0.700	0.022	0.015	0.070	10.947	0.429	82.137	0.016	200	0.013	17.000	0.400	0.021	0.660	76.7%
	436 Ridge	STMMH1	OUTET	0.700	0.700	0.000	0.000	0.070	11.376	0.261	80.644	0.024	250	0.013	12.000	0.400	0.038	0.766	63.4%
CA3	Building	BLDG	STMMH1	0.700	0.700	0.050	0.035	0.035	10.000	0.177	85.669	0.008	200	0.013	7.000	0.400	0.021	0.660	39.8%

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 1999)

Project	440 Ridge
Project #	230372
Designer	G.Dale
Address	Fort Erie, Ontario
Description	Fire Flows - Per Unit

= 220 × ×

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	**C =**	0.8
Description	**Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel**		

Floor Area	1604.16	m²	
# Storeys	5		
Fire Resistant Building?	YES		5614.56

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? NO

Area	**5614.56**	m²	167.5494
Description	Area of two largest floors + 50% of each of the floors above it (max 8)		29488.69
Required Fire Flow	**29488**	L/min	

Occupancy Charge	Non Combustible Contents			
Fire Flow Reduction	**0**	**OR**	**0.00**	L/min
Required Fire Flow	**29488.00**	L/min		

Automated Sprinker Protection			YES	
Designed to NFPA 13 Standard			YES	**30%**
Standard Water Supply to Sprinklers and Standpipes			YES	**10%**
Fully Supervised System			YES	**0%**
Fire Flow Adjustment			**11795.2**	L/min

Exposure 1 (North)	**Distance**	3	m	**Charge**	**25%**	
Description						
Exposure 2 (East)	**Distance**	16.2	m	**Charge**	**15%**	
Description						
Exposure 3 (West)	**Distance**	40	m	**Charge**	**5%**	
Description						
Exposure 4 (South)	**Distance**	11.5	m	**Charge**	**15%**	
Description						

Total Exposure Charge	**60%**	
Fire Flow Adjustment	**10615.680**	L/min
Total Required Fire Flow	**28308.480**	L/min
Total Required Fire Flow	**7473.44**	U.S. GPM
Total Required Fire Flow	**471.81**	L/s
Total Required Fire Flow	**5095526**	L/3 hour
Total Required Fire Flow	**5096**	m3/3 hour

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\,\sqrt{A}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

(2) Occupancy	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

30% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(4) Exposure		
0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 1999)

Project	436 Ridge
Project #	2304124
Designer	G.Dale
Address	Fort Erie, Ontario
Description	Fire Flows - Per Unit

= 220 × ×

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Fire-Resistive Construction	**C =**	0.8
Description	**Fully Protected Frame, Roof, Floors. Minimum 3 Hour Rated Structural Members and Floors with Reinforced Concrete or Protected Steel**		

Floor Area	495	m²	1237.5
# Storeys	3		
Fire Resistant Building?	YES		

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? NO

Area	**1237.5**	m²	60.93029
Description	Area of two largest floors + 50% of each of the floors above it (max 8)		10723.73
Required Fire Flow	**10723**	L/min	

Occupancy Charge	Non Combustible Contents			
Fire Flow Reduction	0	**OR**	0.00	L/min
Required Fire Flow	10723.00	L/min		

Automated Sprinker Protection	NO		
Designed to NFPA 13 Standard	NON	0%	
Standard Water Supply to Sprinklers and Standpipes	NO	0%	
Fully Supervised System	NO	0	
Fire Flow Adjustment		0	L/min

Exposure 1 (North)	**Distance**	3	m	**Charge**	20%	
Description						
Exposure 2 (East)	**Distance**	16.2	m	**Charge**	20%	
Description						
Exposure 3 (West)	**Distance**	40	m	**Charge**	25%	
Description						
Exposure 4 (South)	**Distance**	11.5	m	**Charge**	25%	
Description						

Total Exposure Charge	90%	
Fire Flow Adjustment	9650.700	L/min
Total Required Fire Flow	20373.700	L/min
Total Required Fire Flow	5378.66	U.S. GPM
Total Required Fire Flow	339.56	L/s
Total Required Fire Flow	3667266	L/3 hour
Total Required Fire Flow	3667	m3/3 hour

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220 C \sqrt{A}$$

where:

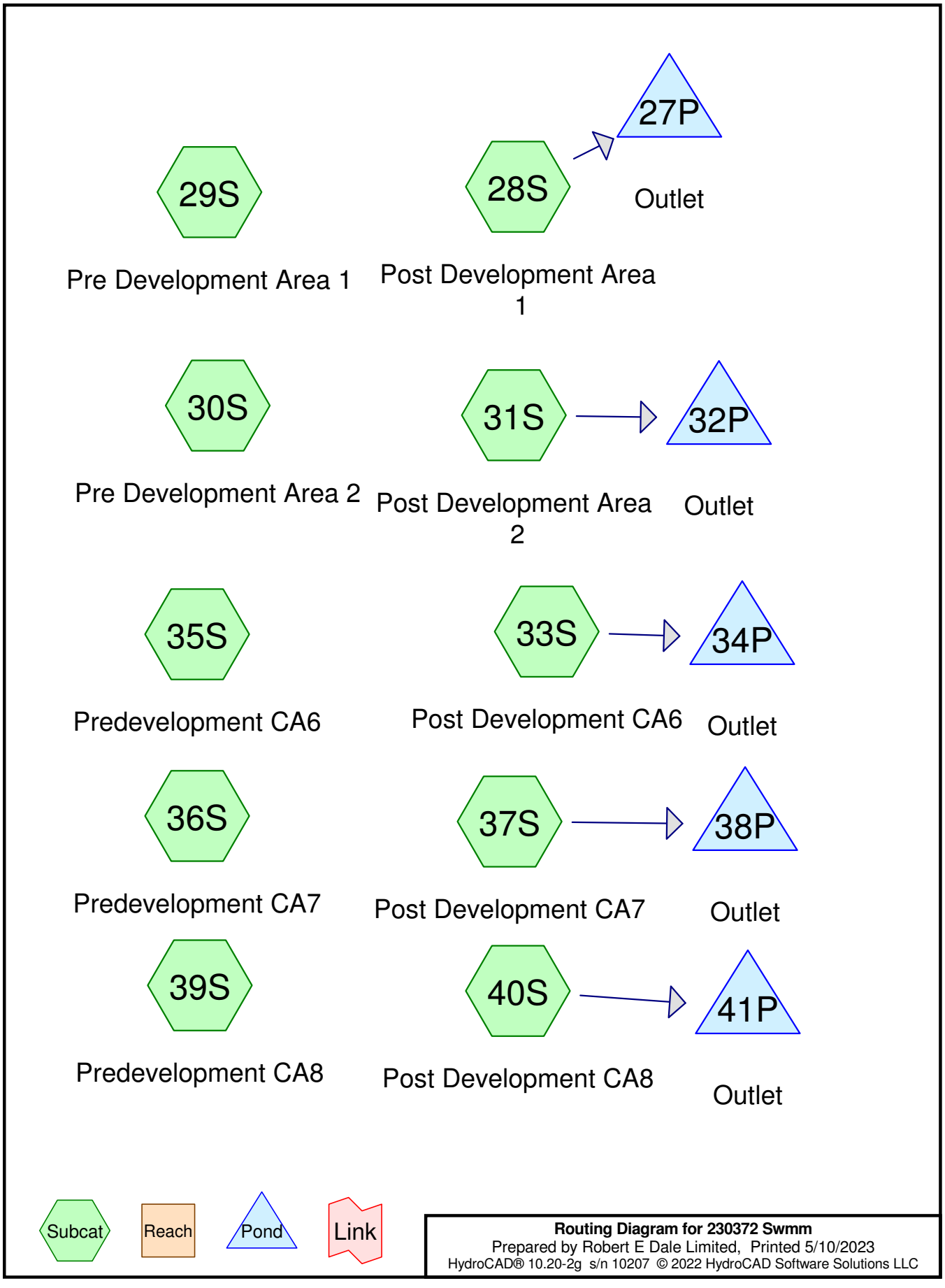
F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

(2) Occupancy	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler
30% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(4) Exposure		
0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%



Routing Diagram for 230372 Swmm
Prepared by Robert E Dale Limited, Printed 5/10/2023

Project Notes

Copied 2 events from Sample D 24-hr storm
Copied 2 events from Whitby Chicago Storm storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 6 events from Canada-St.Catharines 24-hr storm
Copied 6 events from Canada-Sarnia 24-hr storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 6 events from Canada-St.Catharines 24-hr storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 3 events from Canada-Fort Erie storm

Area Listing (all nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,740.0	0.70	CA1 (28S)
1,722.4	0.70	CA2 (28S)
1,604.2	0.70	CA3 (28S)
347.1	0.70	CA4 (28S)
1,652.4	0.70	CA5 (31S)
954.2	0.70	CA6 (33S)
874.5	0.70	CA7 (37S)
1,771.6	0.70	CA8 (40S)
11,940.4	0.40	Existing Single Family (29S, 30S, 35S, 36S, 39S)
22,606.8	**0.54**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
22,606.8	Other	28S, 29S, 30S, 31S, 33S, 35S, 36S, 37S, 39S, 40S
22,606.8		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Subcatchm Numbers
0.0	0.0	0.0	0.0	1,740.0	1,740.0	CA1	
0.0	0.0	0.0	0.0	1,722.4	1,722.4	CA2	
0.0	0.0	0.0	0.0	1,604.2	1,604.2	CA3	
0.0	0.0	0.0	0.0	347.1	347.1	CA4	
0.0	0.0	0.0	0.0	1,652.4	1,652.4	CA5	
0.0	0.0	0.0	0.0	954.2	954.2	CA6	
0.0	0.0	0.0	0.0	874.5	874.5	CA7	
0.0	0.0	0.0	0.0	1,771.6	1,771.6	CA8	
0.0	0.0	0.0	0.0	11,940.4	11,940.4	Existing Single Family	
0.0	**0.0**	**0.0**	**0.0**	**22,606.8**	**22,606.8**	**TOTAL AREA**	

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Area Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0692 m³/s 42.3 m³

Subcatchment 29S: Pre Development Area 1 Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0396 m³/s 24.2 m³

Subcatchment 30S: Pre Development Area 2 Runoff Area=2,926.0 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0214 m³/s 13.1 m³

Subcatchment 31S: Post Development Area Runoff Area=1,652.4 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0211 m³/s 12.9 m³

Subcatchment 33S: Post Development CA6 Runoff Area=954.2 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0122 m³/s 7.4 m³

Subcatchment 35S: Predevelopment CA6 Runoff Area=954.6 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0070 m³/s 4.3 m³

Subcatchment 36S: Predevelopment CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0064 m³/s 3.9 m³

Subcatchment 37S: Post Development CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0112 m³/s 6.8 m³

Subcatchment 39S: Predevelopment CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0129 m³/s 7.9 m³

Subcatchment 40S: Post Development CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0227 m³/s 13.8 m³

Pond 27P: Outlet Peak Elev=191.695 m Storage=6.1 m³ Inflow=0.0692 m³/s 42.3 m³
Outflow=0.0438 m³/s 42.9 m³

Pond 32P: Outlet Peak Elev=191.200 m Storage=0.0 m³ Inflow=0.0211 m³/s 12.9 m³
Outflow=0.0211 m³/s 12.9 m³

Pond 34P: Outlet Peak Elev=191.537 m Storage=0.9 m³ Inflow=0.0122 m³/s 7.4 m³
Outflow=0.0082 m³/s 7.5 m³

Pond 38P: Outlet Peak Elev=191.444 m Storage=0.8 m³ Inflow=0.0112 m³/s 6.8 m³
Outflow=0.0075 m³/s 6.8 m³

Pond 41P: Outlet Peak Elev=190.954 m Storage=1.7 m³ Inflow=0.0227 m³/s 13.8 m³
Outflow=0.0150 m³/s 13.9 m³

Total Runoff Area = 22,606.8 m² Runoff Volume = 136.5 m³ Average Runoff Depth = 6 mm
100.00% Pervious = 22,606.8 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

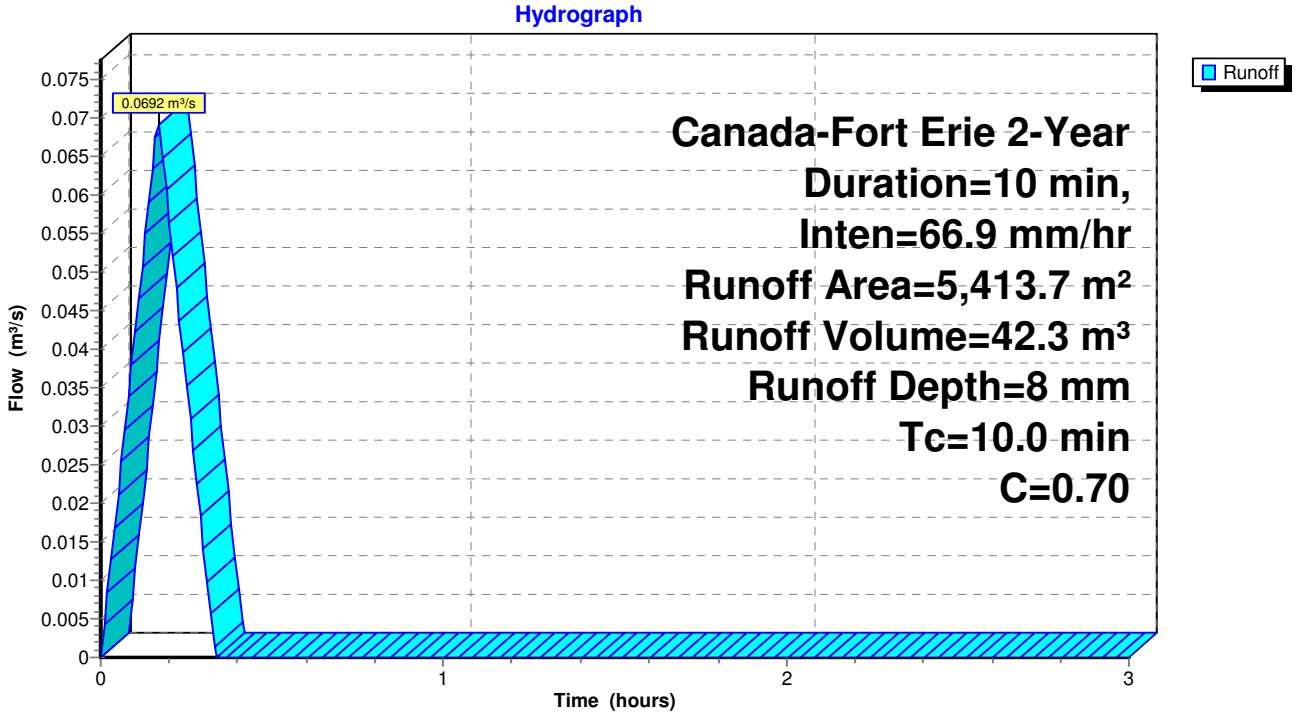
Runoff = 0.0692 m³/s @ 0.17 hrs, Volume= 42.3 m³, Depth= 8 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
1,740.0	0.70	CA1
1,722.4	0.70	CA2
1,604.2	0.70	CA3
347.1	0.70	CA4
5,413.7	0.70	Weighted Average
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development Area 1

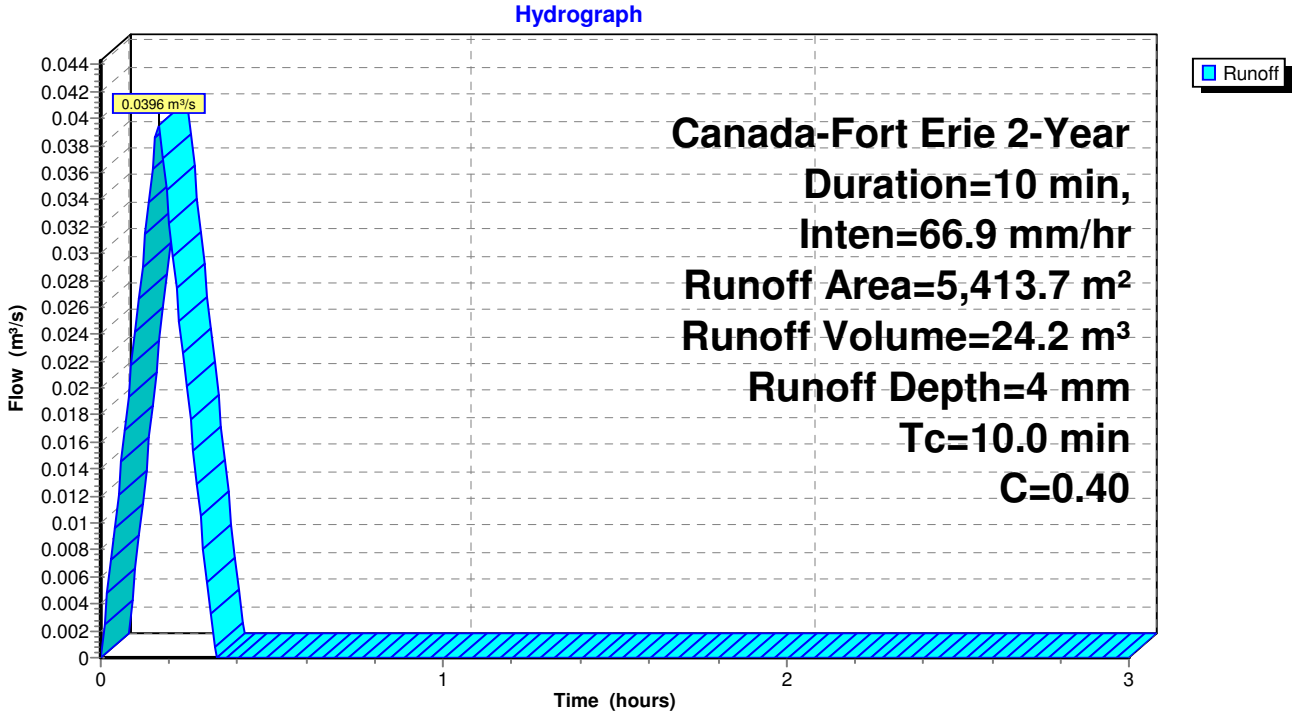
Runoff = 0.0396 m³/s @ 0.17 hrs, Volume= 24.2 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
5,413.7	0.40	Existing Single Family
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development Area 1



Summary for Subcatchment 30S: Pre Development Area 2

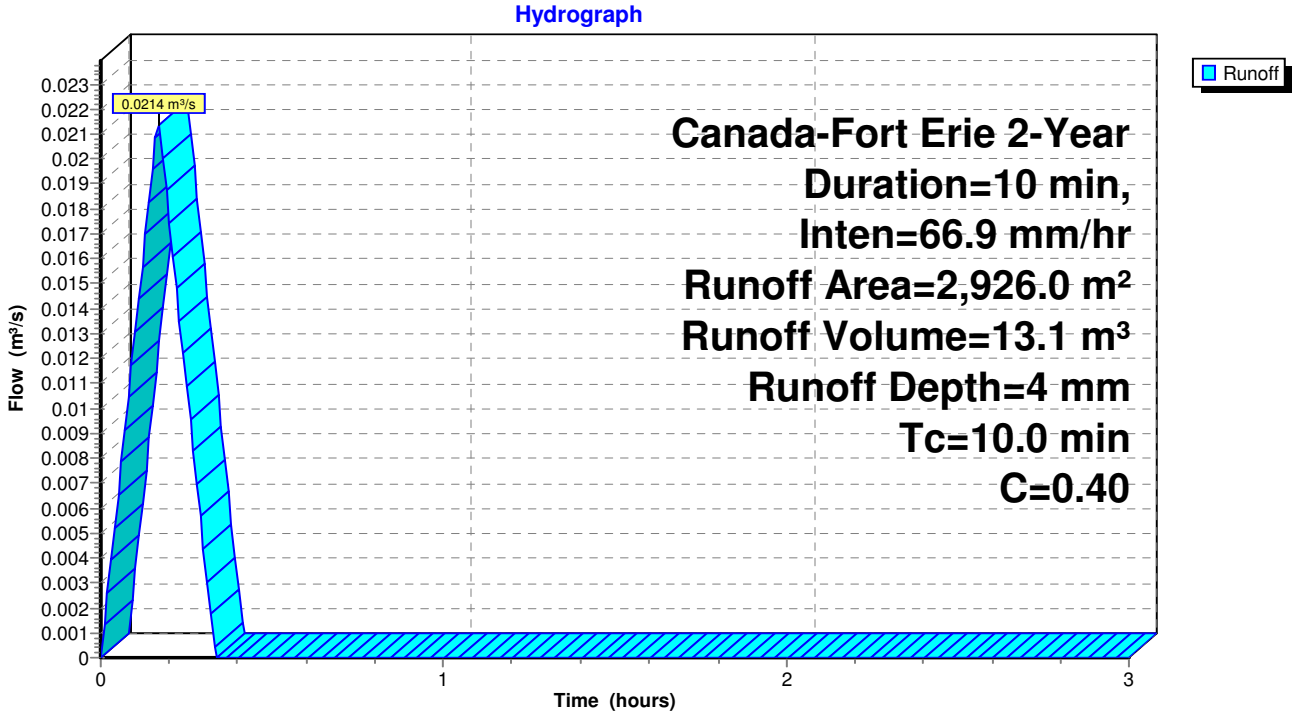
Runoff = 0.0214 m³/s @ 0.17 hrs, Volume= 13.1 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
2,926.0	0.40	Existing Single Family
2,926.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 30S: Pre Development Area 2



Summary for Subcatchment 31S: Post Development Area 2

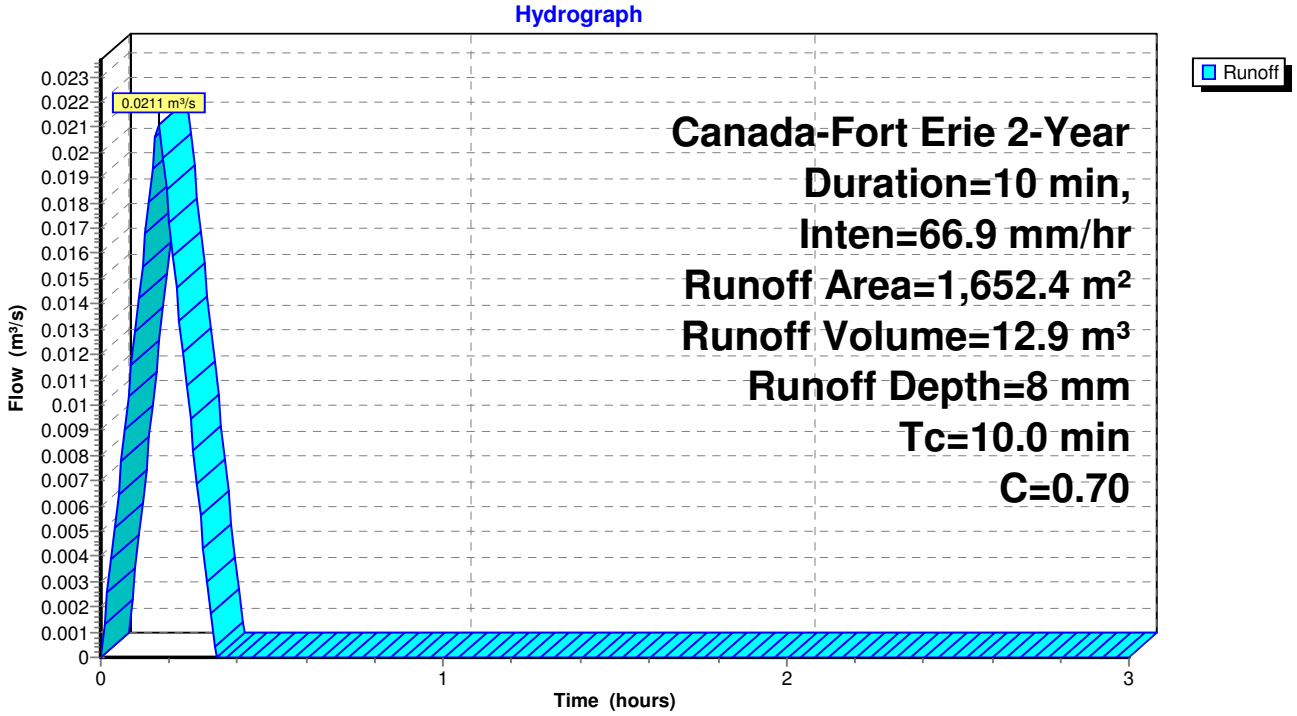
Runoff = 0.0211 m³/s @ 0.17 hrs, Volume= 12.9 m³, Depth= 8 mm
Routed to Pond 32P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
1,652.4	0.70	CA5
1,652.4		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 31S: Post Development Area 2



Summary for Subcatchment 33S: Post Development CA6

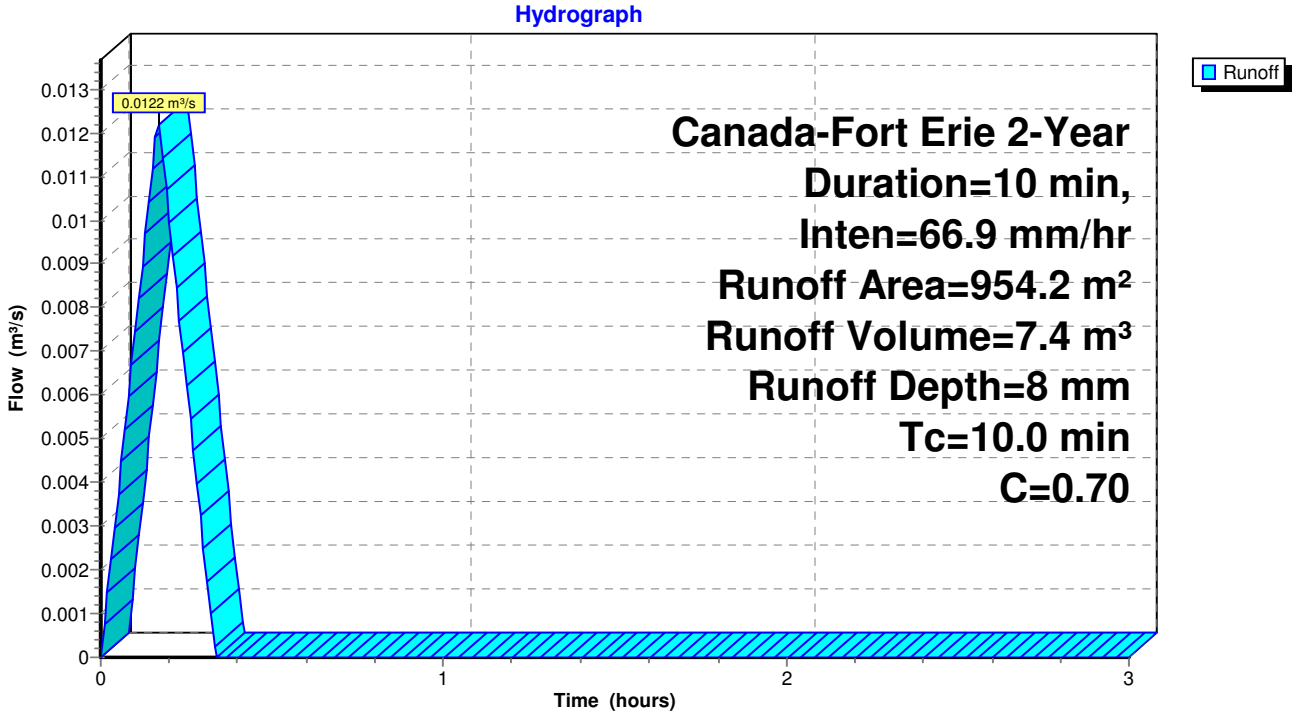
Runoff = 0.0122 m³/s @ 0.17 hrs, Volume= 7.4 m³, Depth= 8 mm
Routed to Pond 34P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
954.2	0.70	CA6
954.2		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 33S: Post Development CA6



Summary for Subcatchment 35S: Predevelopment CA6

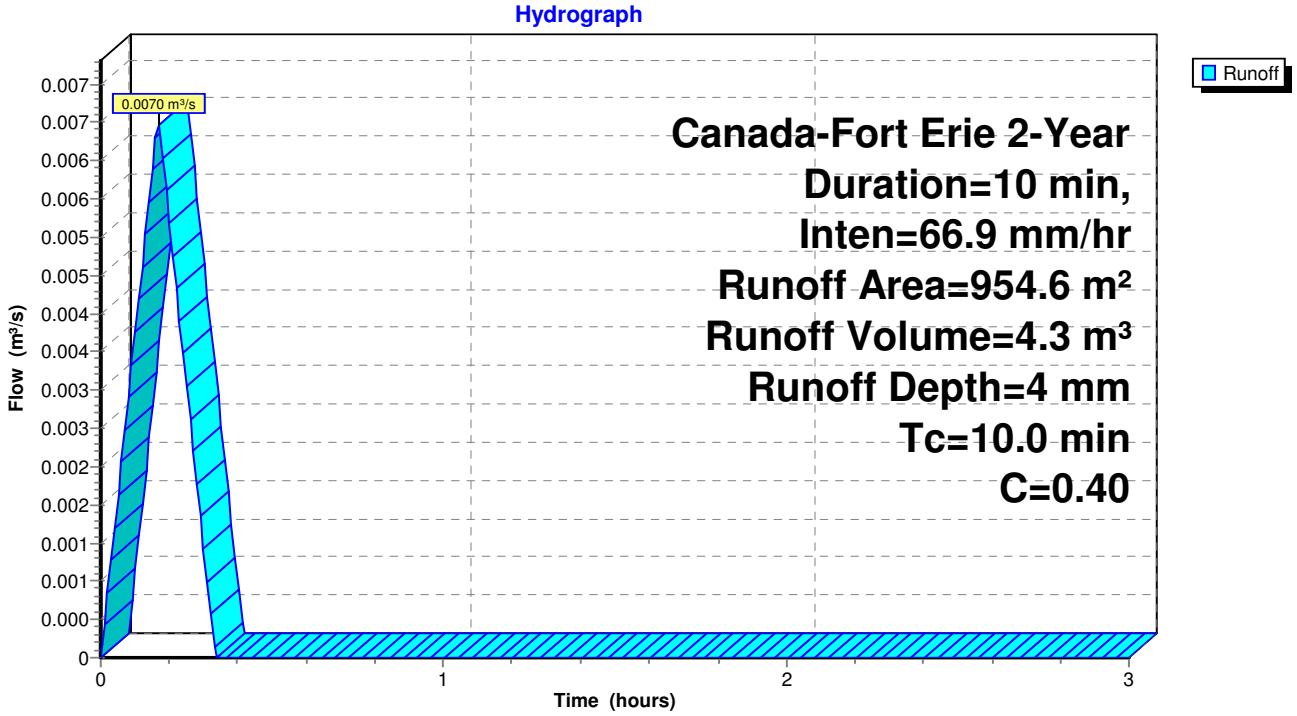
Runoff = 0.0070 m³/s @ 0.17 hrs, Volume= 4.3 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
954.6	0.40	Existing Single Family
954.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 35S: Predevelopment CA6



Summary for Subcatchment 36S: Predevelopment CA7

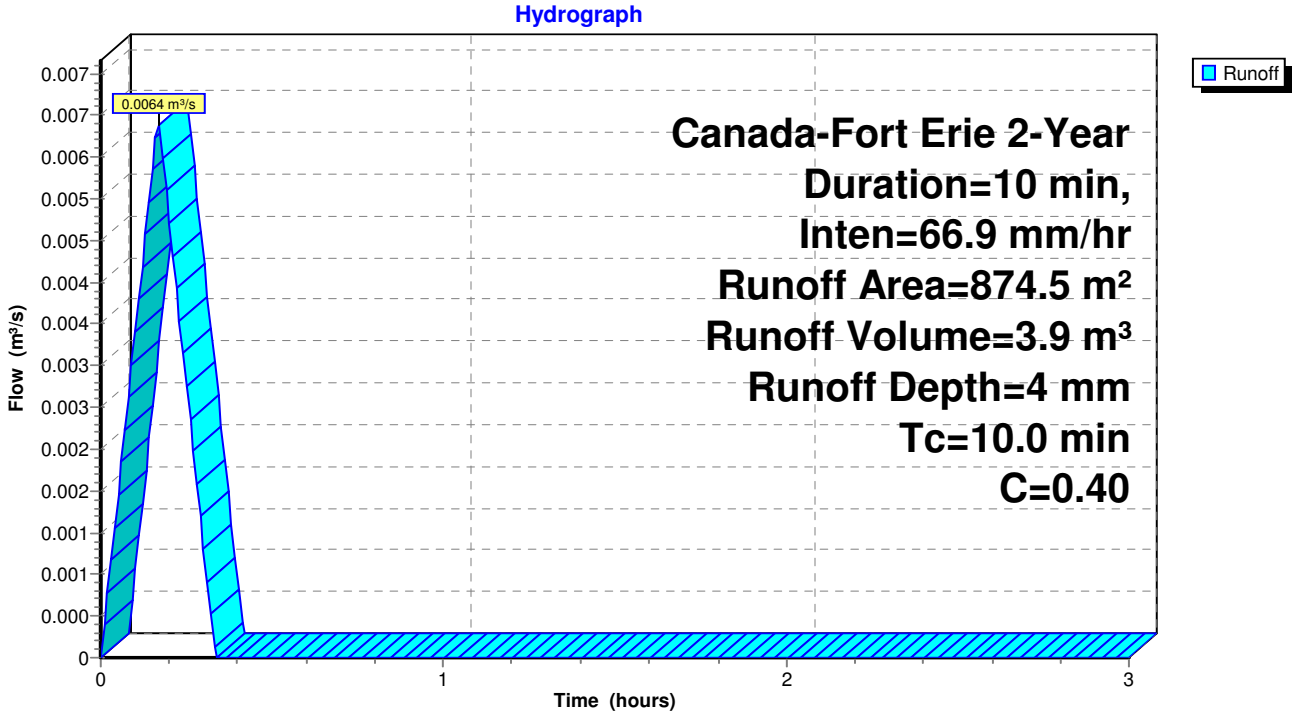
Runoff = 0.0064 m³/s @ 0.17 hrs, Volume= 3.9 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
874.5	0.40	Existing Single Family
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 36S: Predevelopment CA7



Summary for Subcatchment 37S: Post Development CA7

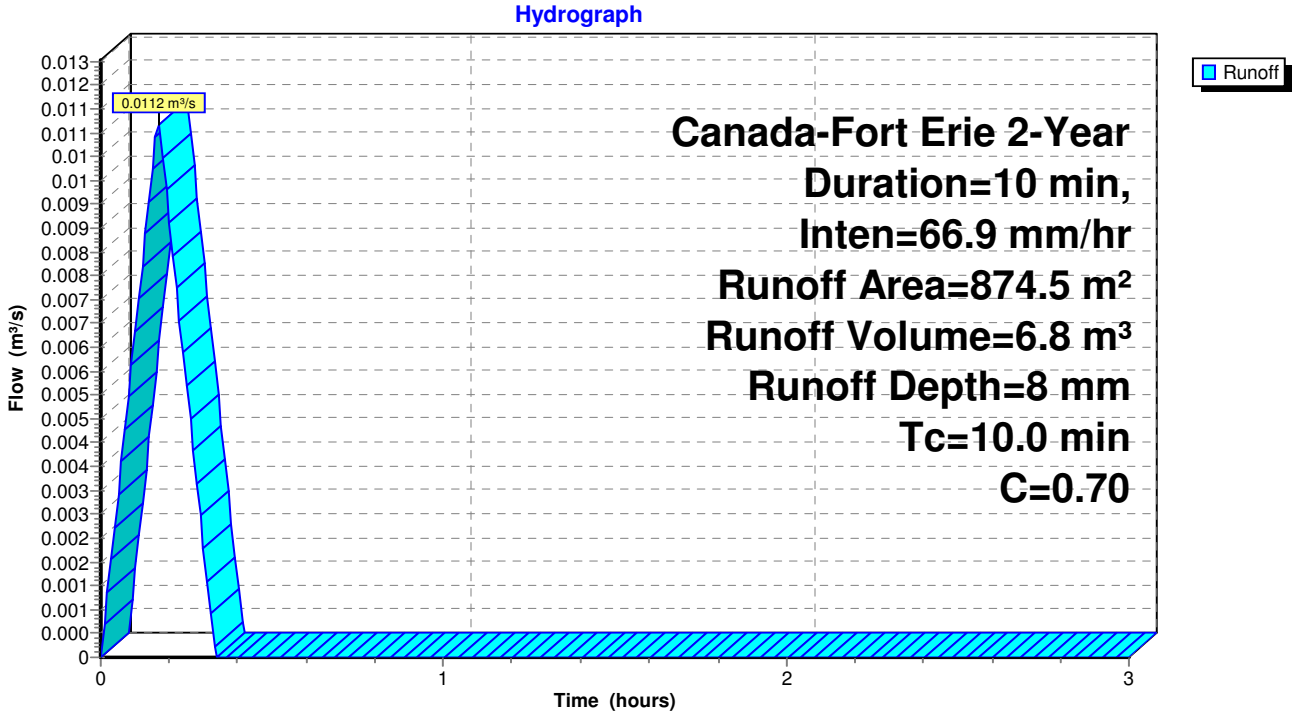
Runoff = 0.0112 m³/s @ 0.17 hrs, Volume= 6.8 m³, Depth= 8 mm
Routed to Pond 38P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
874.5	0.70	CA7
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 37S: Post Development CA7



Summary for Subcatchment 39S: Predevelopment CA8

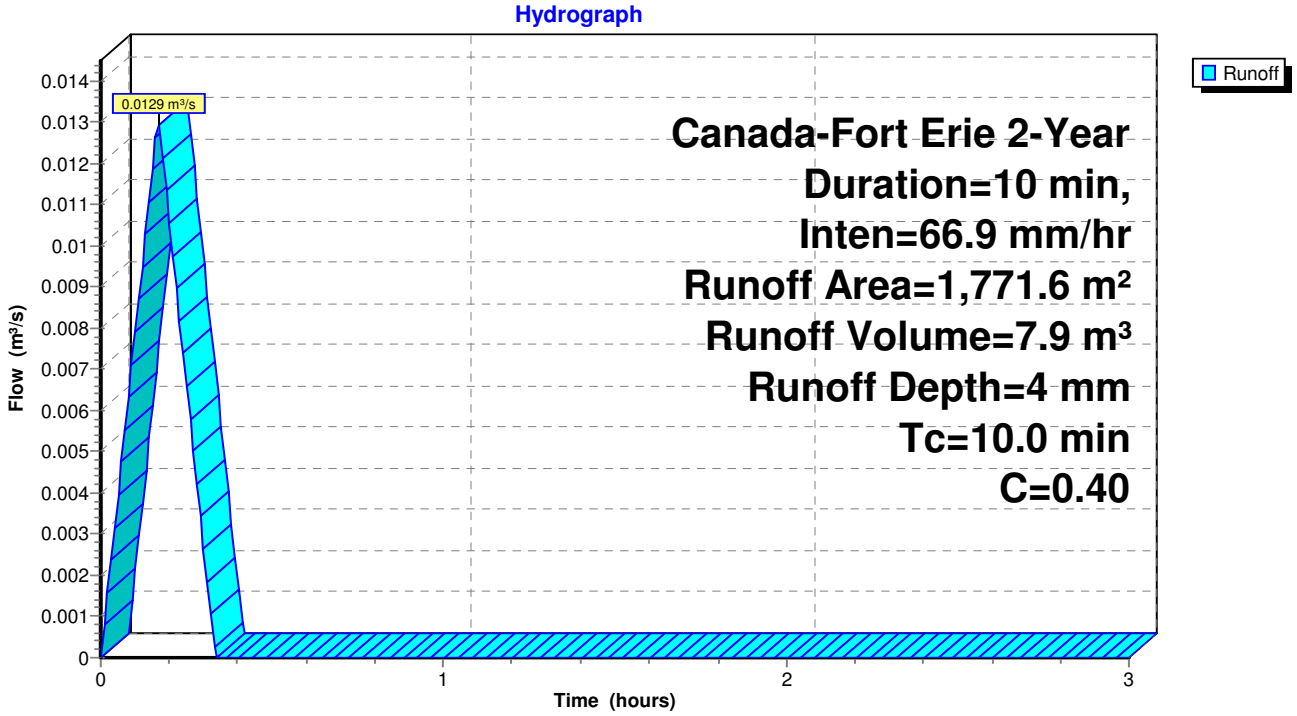
Runoff = 0.0129 m³/s @ 0.17 hrs, Volume= 7.9 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
1,771.6	0.40	Existing Single Family
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 39S: Predevelopment CA8



Summary for Subcatchment 40S: Post Development CA8

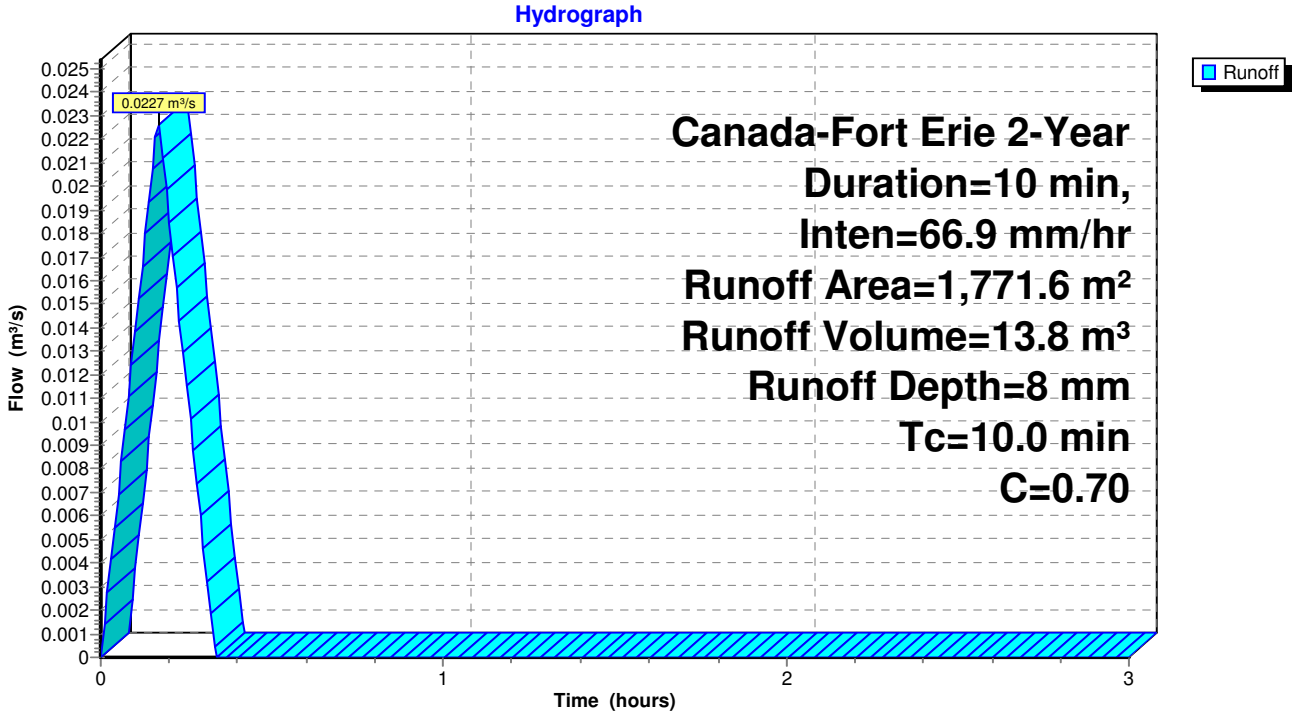
Runoff = 0.0227 m³/s @ 0.17 hrs, Volume= 13.8 m³, Depth= 8 mm
Routed to Pond 41P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
1,771.6	0.70	CA8
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 40S: Post Development CA8



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 5,413.7 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0692 m³/s @ 0.17 hrs, Volume= 42.3 m³
Outflow = 0.0438 m³/s @ 0.23 hrs, Volume= 42.9 m³, Atten= 37%, Lag= 3.7 min
Primary = 0.0438 m³/s @ 0.23 hrs, Volume= 42.9 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.695 m @ 0.23 hrs Surf.Area= 271.8 m² Storage= 6.1 m³
Flood Elev= 191.950 m Surf.Area= 1,873.2 m² Storage= 274.6 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.2 min (11.2 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.650 m	161.4 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.650 m	111.3 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.880 m	2.0 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		274.6 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	1,075.8	161.4	161.4

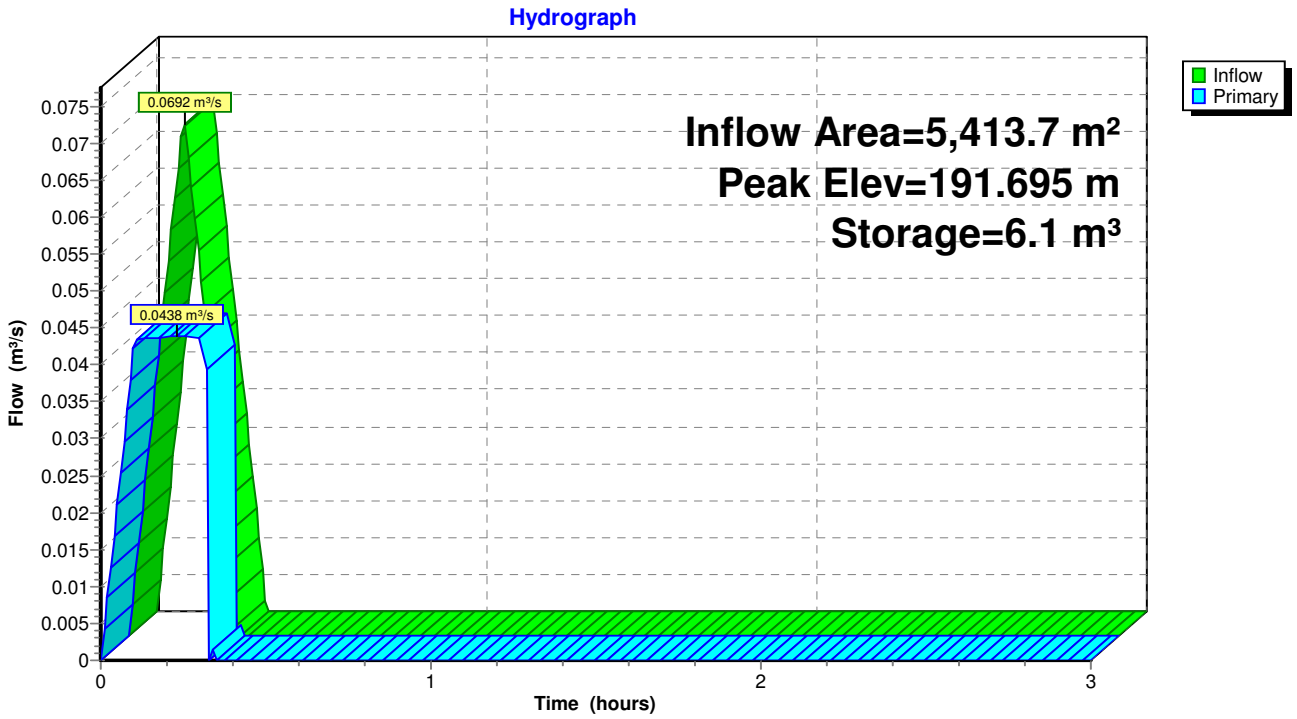
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	741.4	111.3	111.3

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.880	0.3	0.0	0.0
191.950	56.0	2.0	2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	189.030 m	**114 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0438 m³/s @ 0.23 hrs HW=191.695 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0438 m³/s @ 4.29 m/s)

Pond 27P: Outlet



Summary for Pond 32P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 1,652.4 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0211 m³/s @ 0.17 hrs, Volume= 12.9 m³
Outflow = 0.0211 m³/s @ 0.17 hrs, Volume= 12.9 m³, Atten= 0%, Lag= 0.0 min
Primary = 0.0211 m³/s @ 0.17 hrs, Volume= 12.9 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.200 m @ 0.17 hrs Surf.Area= 0.4 m² Storage= 0.0 m³
Flood Elev= 191.500 m Surf.Area= 265.0 m² Storage= 39.8 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (10.0 - 10.0)

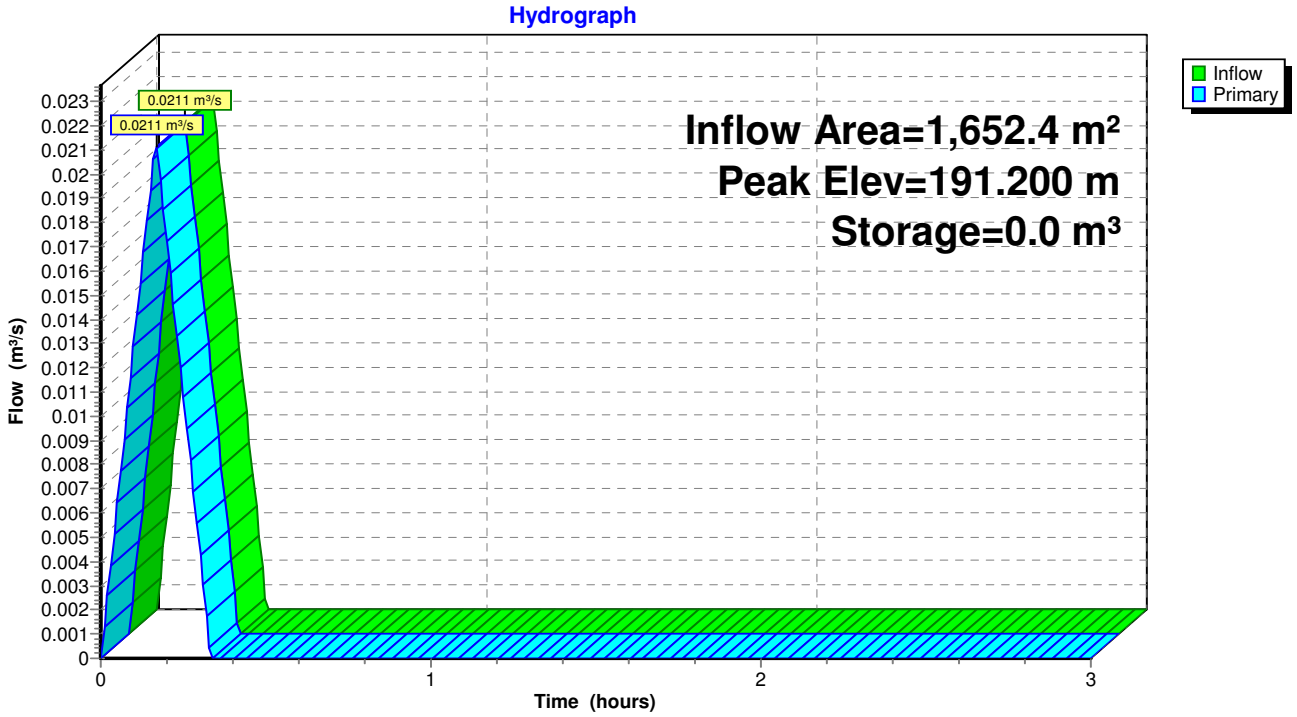
Volume	Invert	Avail.Storage	Storage Description
#1	191.200 m	39.8 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.200	0.3	0.0	0.0
191.500	265.0	39.8	39.8

Device	Routing	Invert	Outlet Devices
#1	Primary	189.050 m	**88 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0235 m³/s @ 0.17 hrs HW=191.200 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0235 m³/s @ 3.86 m/s)

Pond 32P: Outlet



Summary for Pond 34P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 954.2 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0122 m³/s @ 0.17 hrs, Volume= 7.4 m³
Outflow = 0.0082 m³/s @ 0.12 hrs, Volume= 7.5 m³, Atten= 33%, Lag= 0.0 min
Primary = 0.0082 m³/s @ 0.12 hrs, Volume= 7.5 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.537 m @ 0.22 hrs Surf.Area= 45.9 m² Storage= 0.9 m³
Flood Elev= 191.950 m Surf.Area= 343.6 m² Storage= 48.1 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.8 min (10.8 - 10.0)

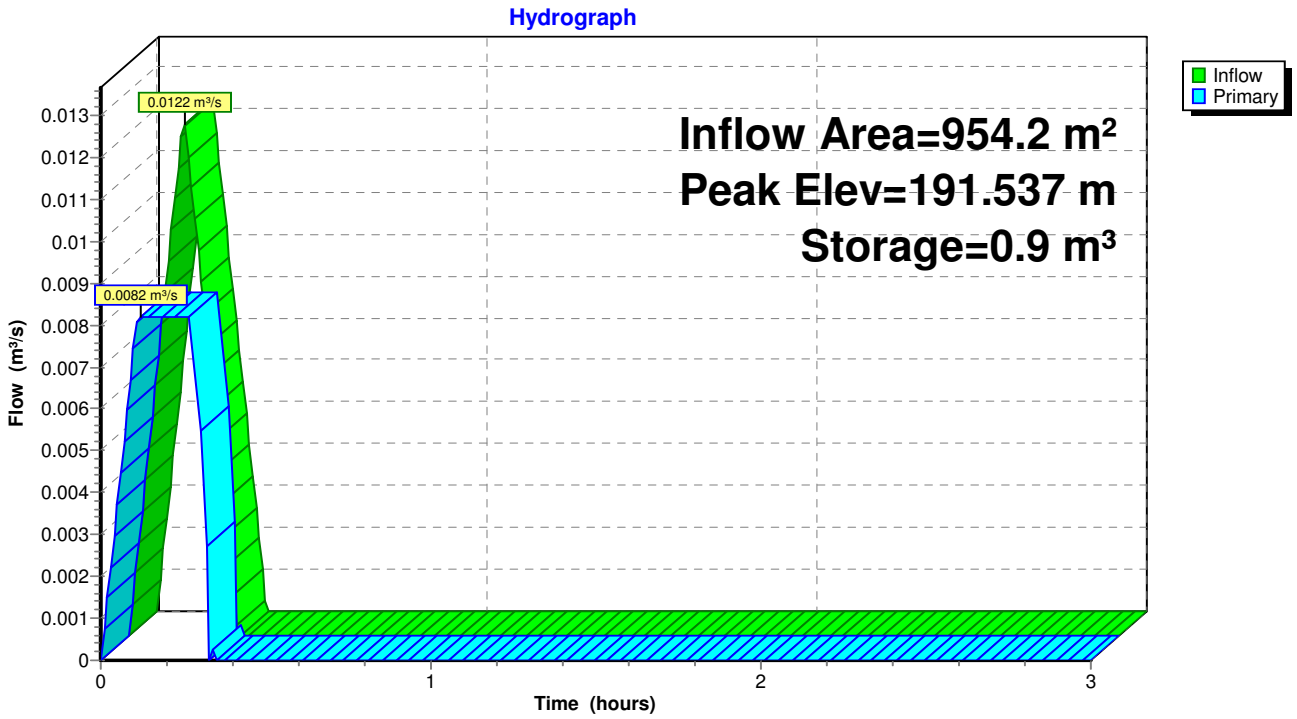
Volume	Invert	Avail.Storage	Storage Description
#1	191.500 m	48.1 m³	**CB Ponding @ CBMH (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.500	0.3	0.0	0.0
191.780	343.6	48.1	48.1

Device	Routing	Invert	Outlet Devices
#1	Primary	191.400 m	**0.00820 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0082 m³/s @ 0.12 hrs HW=191.505 m (Free Discharge)
↑**1=EZ Flo Hopper** (Constant Controls 0.0082 m³/s)

Pond 34P: Outlet



Summary for Pond 38P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 874.5 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0112 m³/s @ 0.17 hrs, Volume= 6.8 m³
Outflow = 0.0075 m³/s @ 0.12 hrs, Volume= 6.8 m³, Atten= 33%, Lag= 0.0 min
Primary = 0.0075 m³/s @ 0.12 hrs, Volume= 6.8 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.444 m @ 0.22 hrs Surf.Area= 35.6 m² Storage= 0.8 m³
Flood Elev= 191.550 m Surf.Area= 120.1 m² Storage= 9.0 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.8 min (10.8 - 10.0)

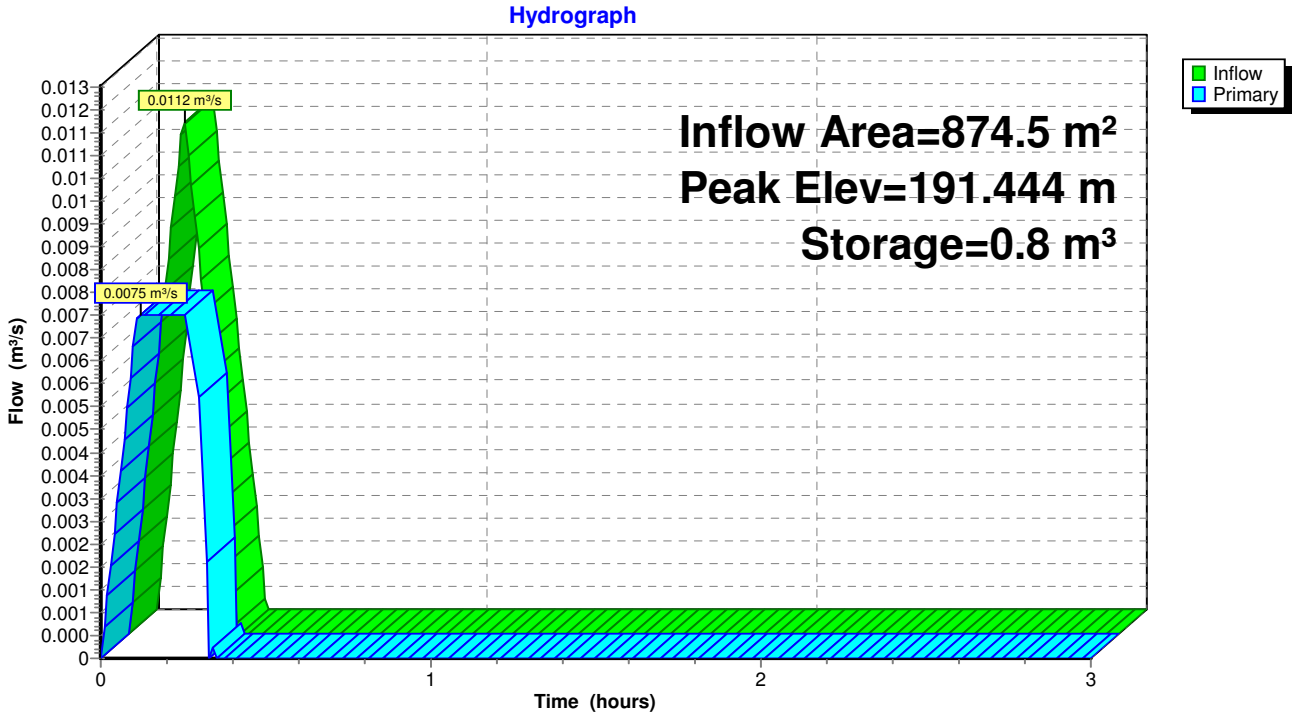
Volume	Invert	Avail.Storage	Storage Description
#1	191.400 m	16.0 m³	**CB Ponding @ CB (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.400	0.3	0.0	0.0
191.600	160.0	16.0	16.0

Device	Routing	Invert	Outlet Devices
#1	Primary	191.250 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0075 m³/s @ 0.12 hrs HW=191.406 m (Free Discharge)
↑**1=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)

Pond 38P: Outlet



Summary for Pond 41P: Outlet

[44] Hint: Outlet device #1 is below defined storage
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,771.6 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0227 m³/s @ 0.17 hrs, Volume= 13.8 m³
Outflow = 0.0150 m³/s @ 0.12 hrs, Volume= 13.9 m³, Atten= 34%, Lag= 0.0 min
Primary = 0.0150 m³/s @ 0.12 hrs, Volume= 13.9 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 190.954 m @ 0.22 hrs Surf.Area= 62.7 m² Storage= 1.7 m³
Flood Elev= 191.550 m Surf.Area= 350.0 m² Storage= 52.5 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.9 min (10.9 - 10.0)

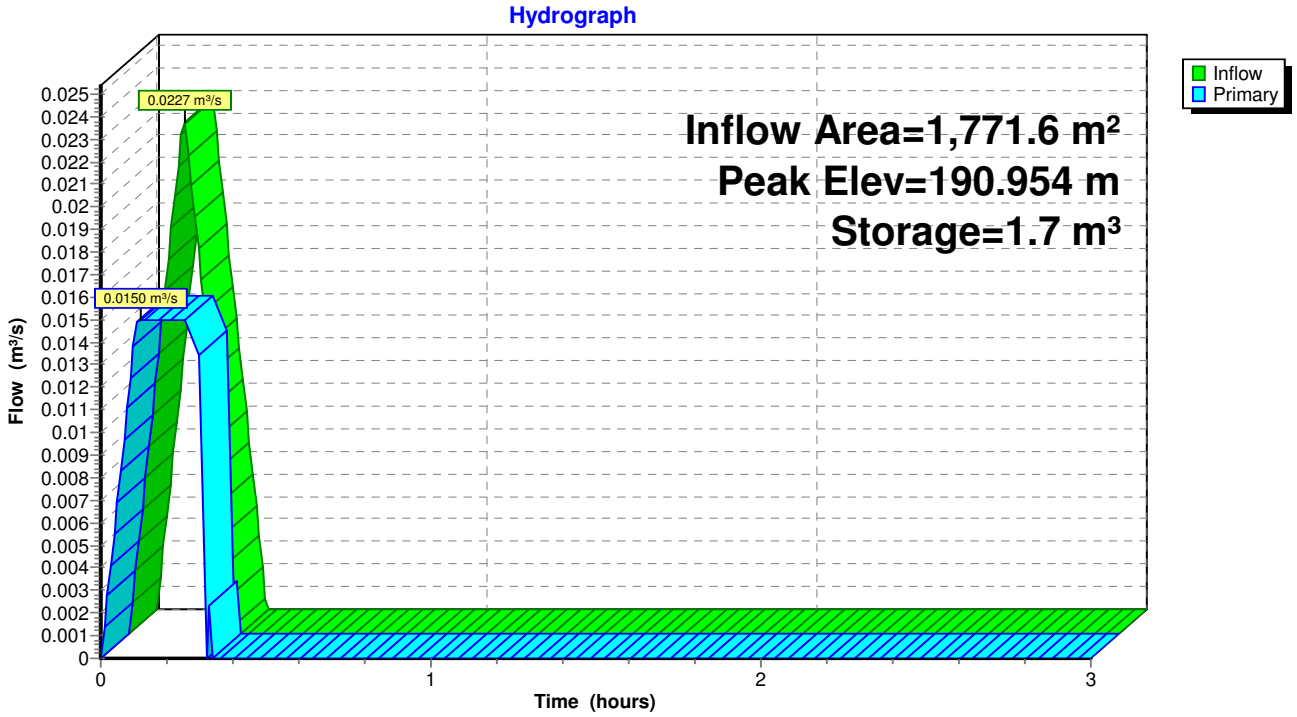
Volume	Invert	Avail.Storage	Storage Description
#1	190.900 m	52.5 m³	**Roadway Ponding (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
190.900	0.3	0.0	0.0
191.200	350.0	52.5	52.5

Device	Routing	Invert	Outlet Devices
#1	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**
#2	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0150 m³/s @ 0.12 hrs HW=190.908 m (Free Discharge)
└**1=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)
└**2=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)

Pond 41P: Outlet



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0898 m³/s 54.8 m³

Subcatchment 29S: Pre Development Area 1 Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0513 m³/s 31.3 m³

Subcatchment 30S: Pre Development Area 2 Runoff Area=2,926.0 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0277 m³/s 16.9 m³

Subcatchment 31S: Post Development Runoff Area=1,652.4 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0274 m³/s 16.7 m³

Subcatchment 33S: Post Development CA6 Runoff Area=954.2 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0158 m³/s 9.7 m³

Subcatchment 35S: Predevelopment CA6 Runoff Area=954.6 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0090 m³/s 5.5 m³

Subcatchment 36S: Predevelopment CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0083 m³/s 5.1 m³

Subcatchment 37S: Post Development CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0145 m³/s 8.9 m³

Subcatchment 39S: Predevelopment CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0168 m³/s 10.2 m³

Subcatchment 40S: Post Development CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0294 m³/s 17.9 m³

Pond 27P: Outlet Peak Elev=191.720 m Storage=14.8 m³ Inflow=0.0898 m³/s 54.8 m³
Outflow=0.0440 m³/s 55.2 m³

Pond 32P: Outlet Peak Elev=191.230 m Storage=0.4 m³ Inflow=0.0274 m³/s 16.7 m³
Outflow=0.0236 m³/s 16.8 m³

Pond 34P: Outlet Peak Elev=191.561 m Storage=2.3 m³ Inflow=0.0158 m³/s 9.7 m³
Outflow=0.0082 m³/s 9.8 m³

Pond 38P: Outlet Peak Elev=191.473 m Storage=2.1 m³ Inflow=0.0145 m³/s 8.9 m³
Outflow=0.0075 m³/s 9.0 m³

Pond 41P: Outlet Peak Elev=190.987 m Storage=4.5 m³ Inflow=0.0294 m³/s 17.9 m³
Outflow=0.0150 m³/s 18.0 m³

Total Runoff Area = 22,606.8 m² Runoff Volume = 177.1 m³ Average Runoff Depth = 8 mm
100.00% Pervious = 22,606.8 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

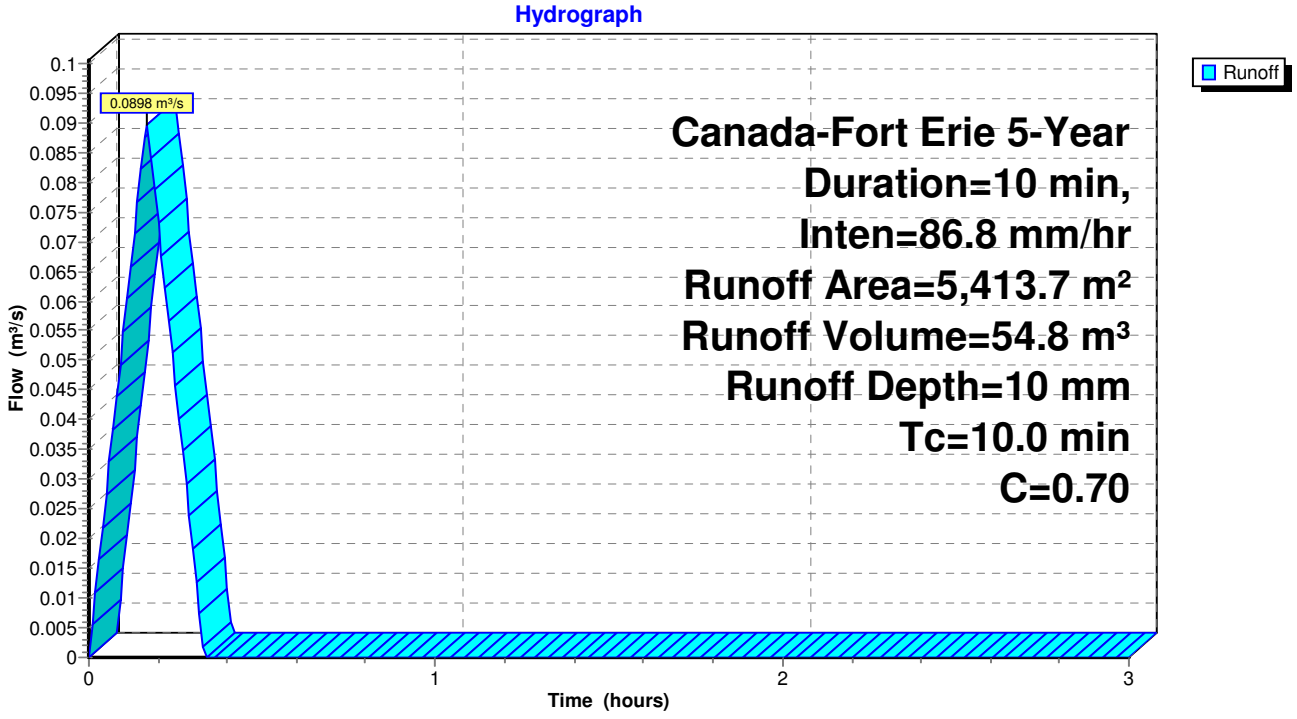
Runoff = 0.0898 m³/s @ 0.17 hrs, Volume= 54.8 m³, Depth= 10 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
1,740.0	0.70	CA1
1,722.4	0.70	CA2
1,604.2	0.70	CA3
347.1	0.70	CA4
5,413.7	0.70	Weighted Average
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development Area 1

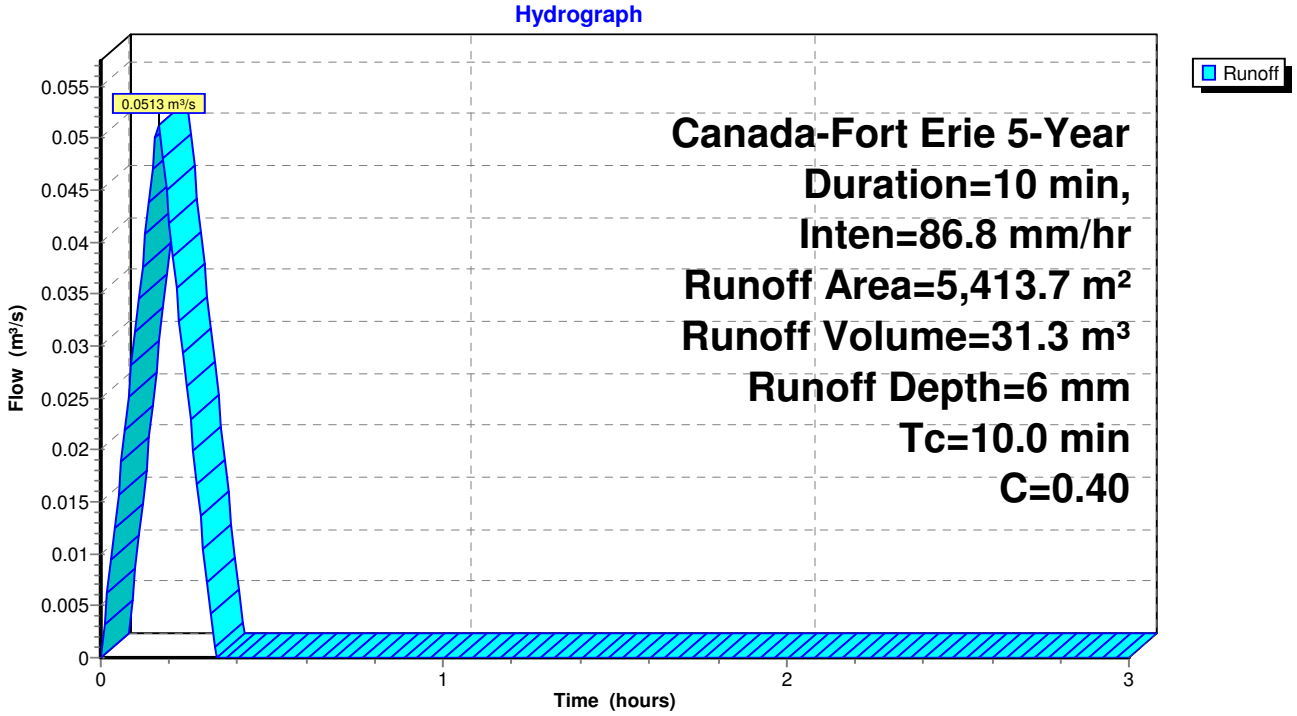
Runoff = 0.0513 m³/s @ 0.17 hrs, Volume= 31.3 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
5,413.7	0.40	Existing Single Family
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development Area 1



Summary for Subcatchment 30S: Pre Development Area 2

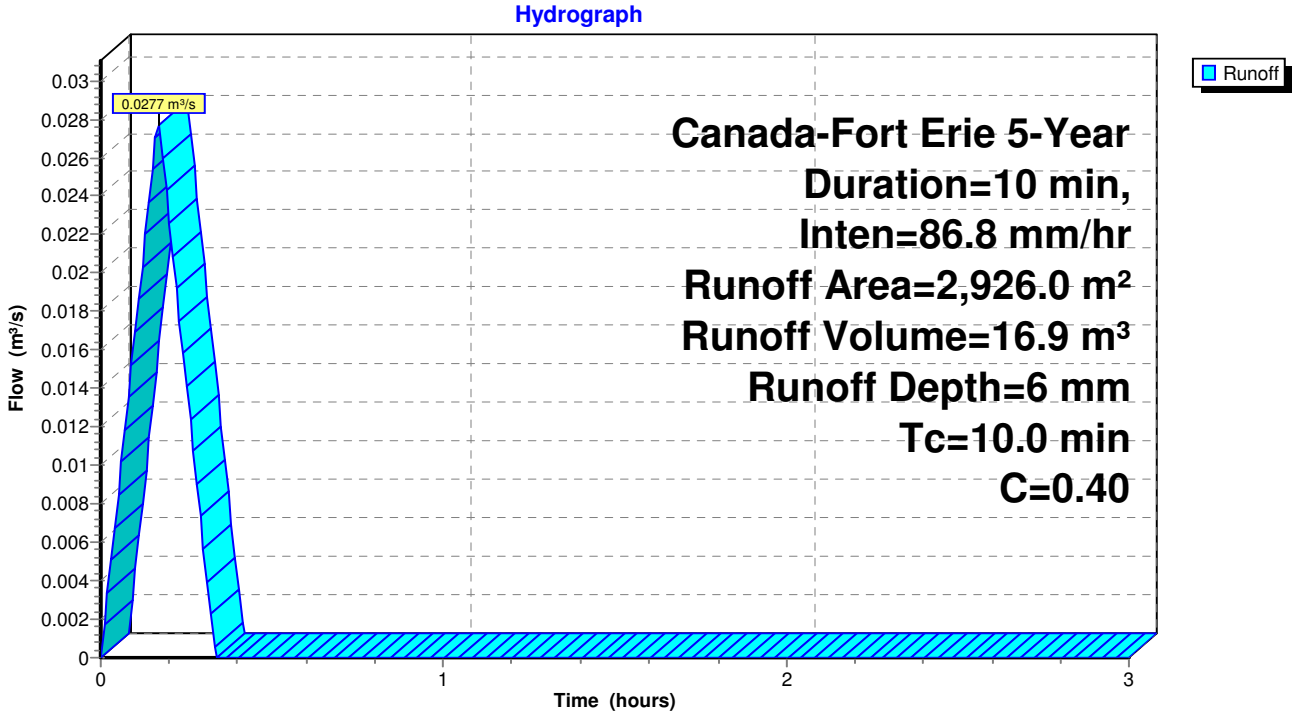
Runoff = 0.0277 m³/s @ 0.17 hrs, Volume= 16.9 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
2,926.0	0.40	Existing Single Family
2,926.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 30S: Pre Development Area 2



Summary for Subcatchment 31S: Post Development Area 2

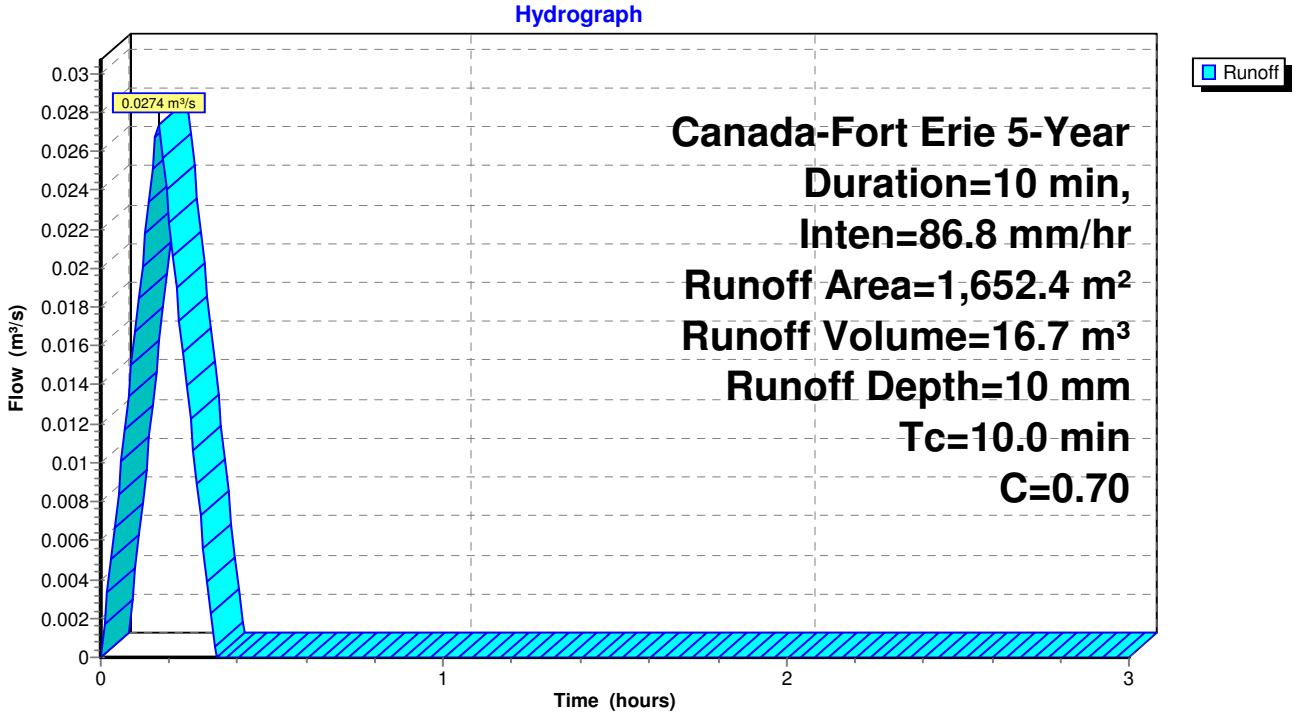
Runoff = 0.0274 m³/s @ 0.17 hrs, Volume= 16.7 m³, Depth= 10 mm
Routed to Pond 32P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
1,652.4	0.70	CA5
1,652.4		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 31S: Post Development Area 2



Summary for Subcatchment 33S: Post Development CA6

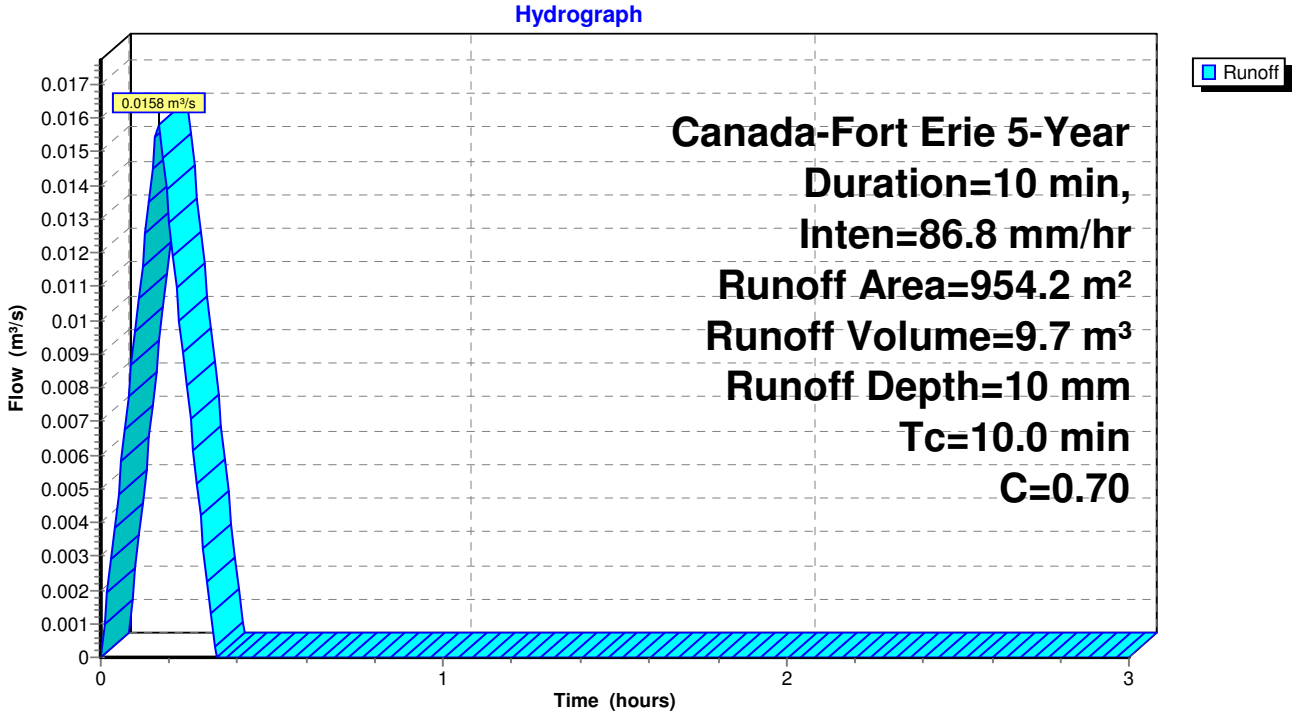
Runoff = 0.0158 m³/s @ 0.17 hrs, Volume= 9.7 m³, Depth= 10 mm
Routed to Pond 34P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
954.2	0.70	CA6
954.2		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 33S: Post Development CA6



Summary for Subcatchment 35S: Predevelopment CA6

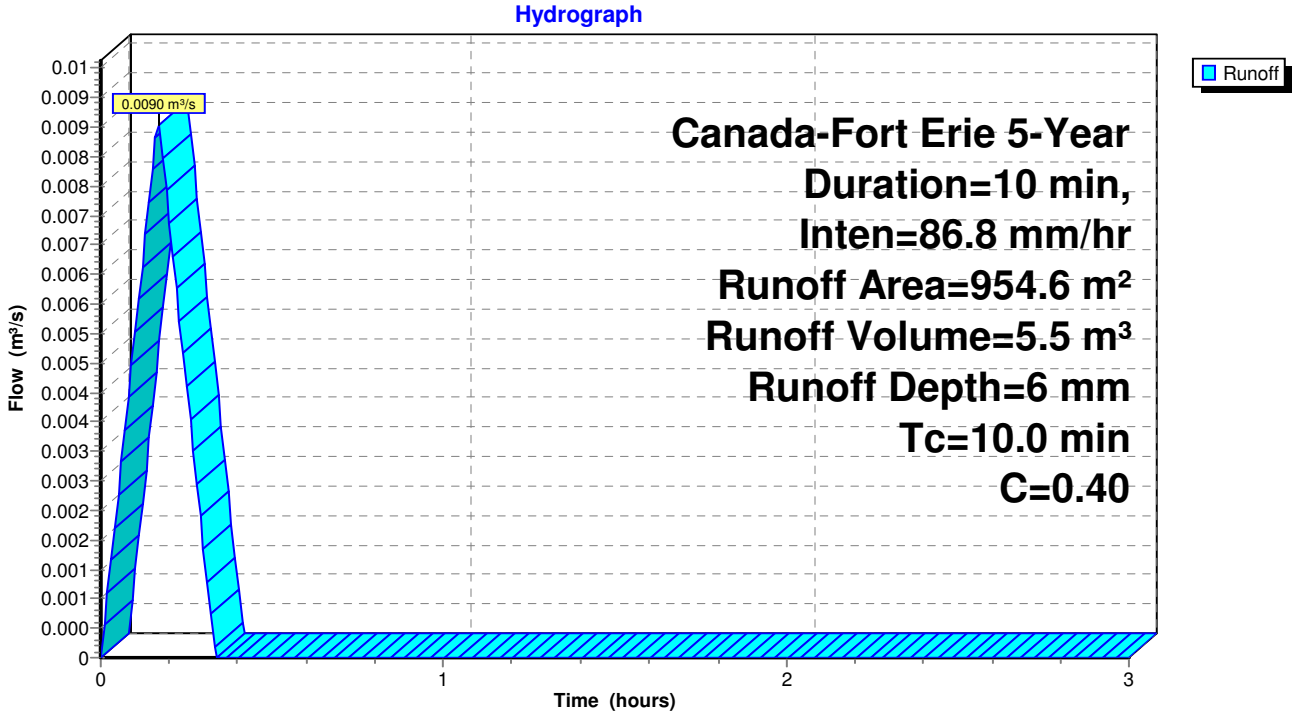
Runoff = 0.0090 m³/s @ 0.17 hrs, Volume= 5.5 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
954.6	0.40	Existing Single Family
954.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 35S: Predevelopment CA6



Summary for Subcatchment 36S: Predevelopment CA7

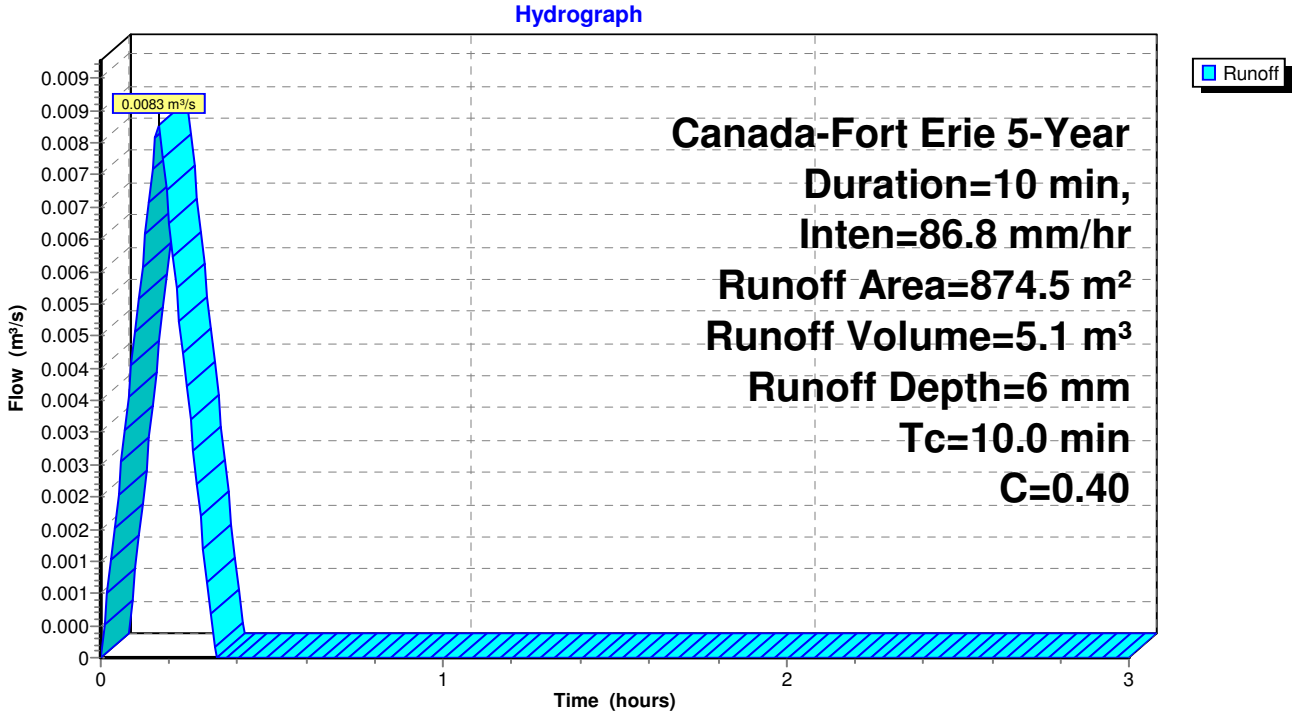
Runoff = 0.0083 m³/s @ 0.17 hrs, Volume= 5.1 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
874.5	0.40	Existing Single Family
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 36S: Predevelopment CA7



Summary for Subcatchment 37S: Post Development CA7

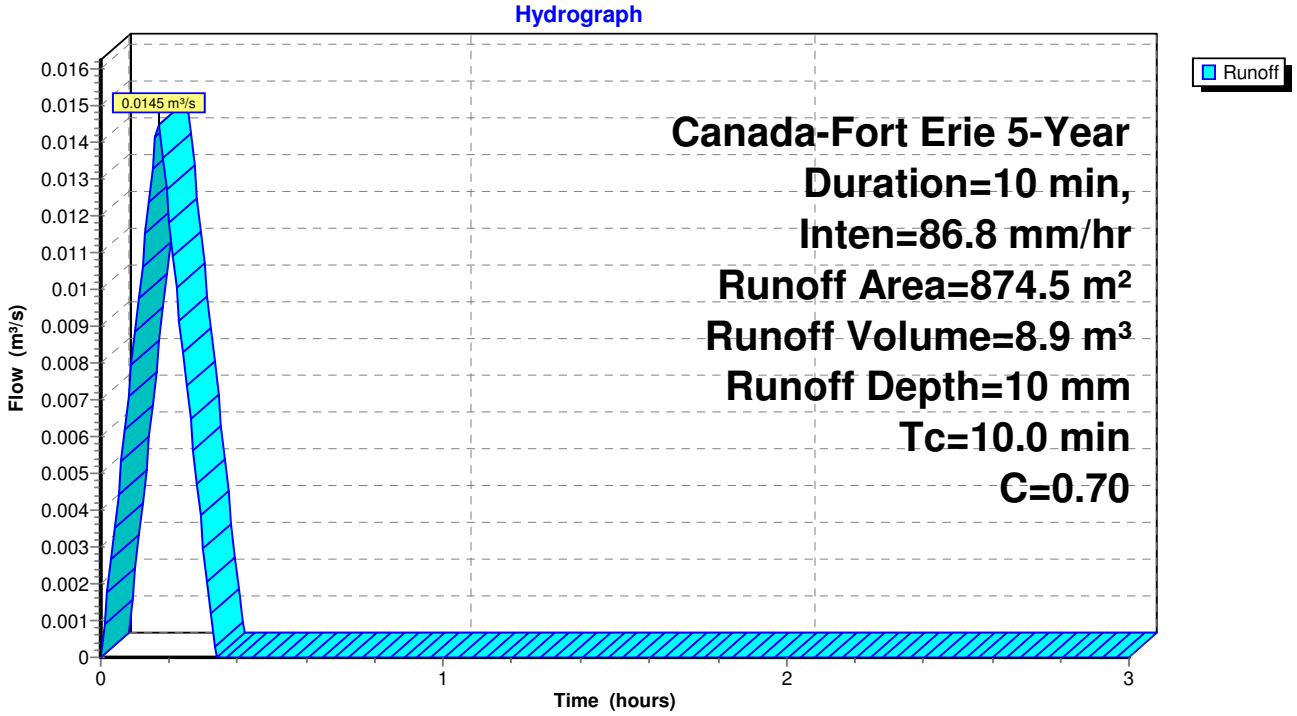
Runoff = 0.0145 m³/s @ 0.17 hrs, Volume= 8.9 m³, Depth= 10 mm
Routed to Pond 38P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
874.5	0.70	CA7
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 37S: Post Development CA7



Summary for Subcatchment 39S: Predevelopment CA8

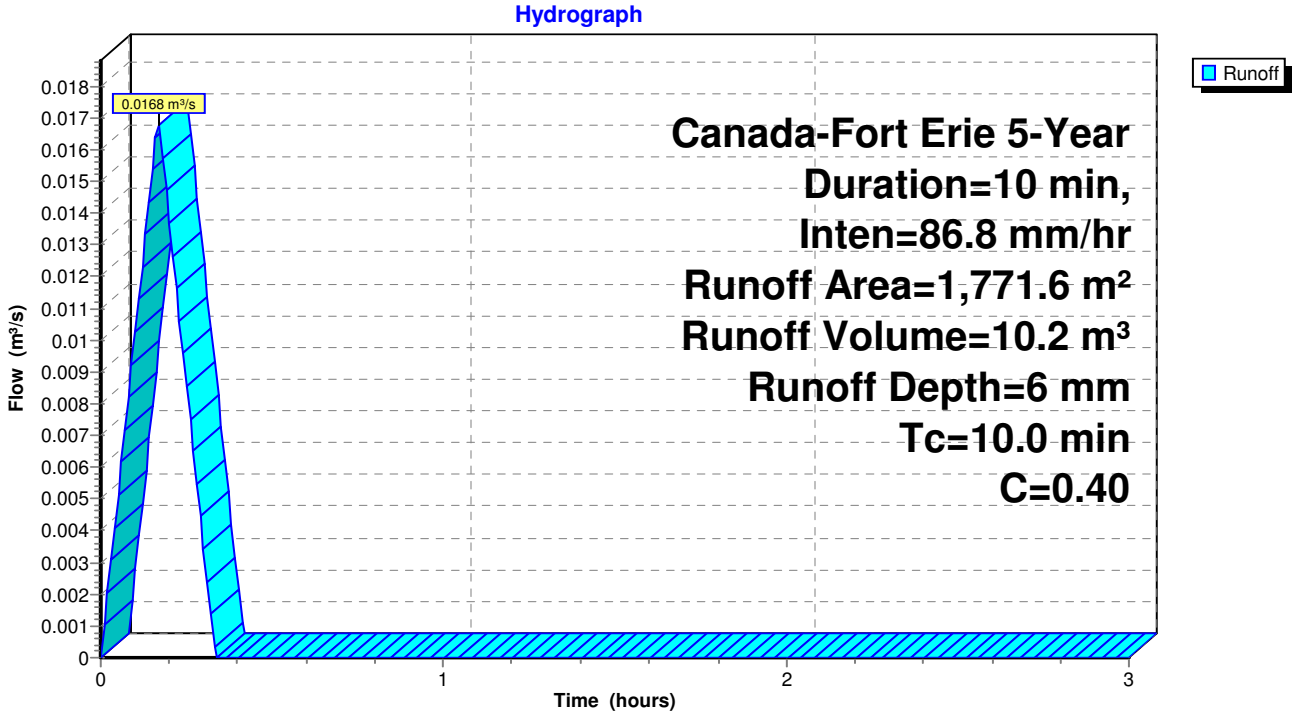
Runoff = 0.0168 m³/s @ 0.17 hrs, Volume= 10.2 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
1,771.6	0.40	Existing Single Family
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 39S: Predevelopment CA8



Summary for Subcatchment 40S: Post Development CA8

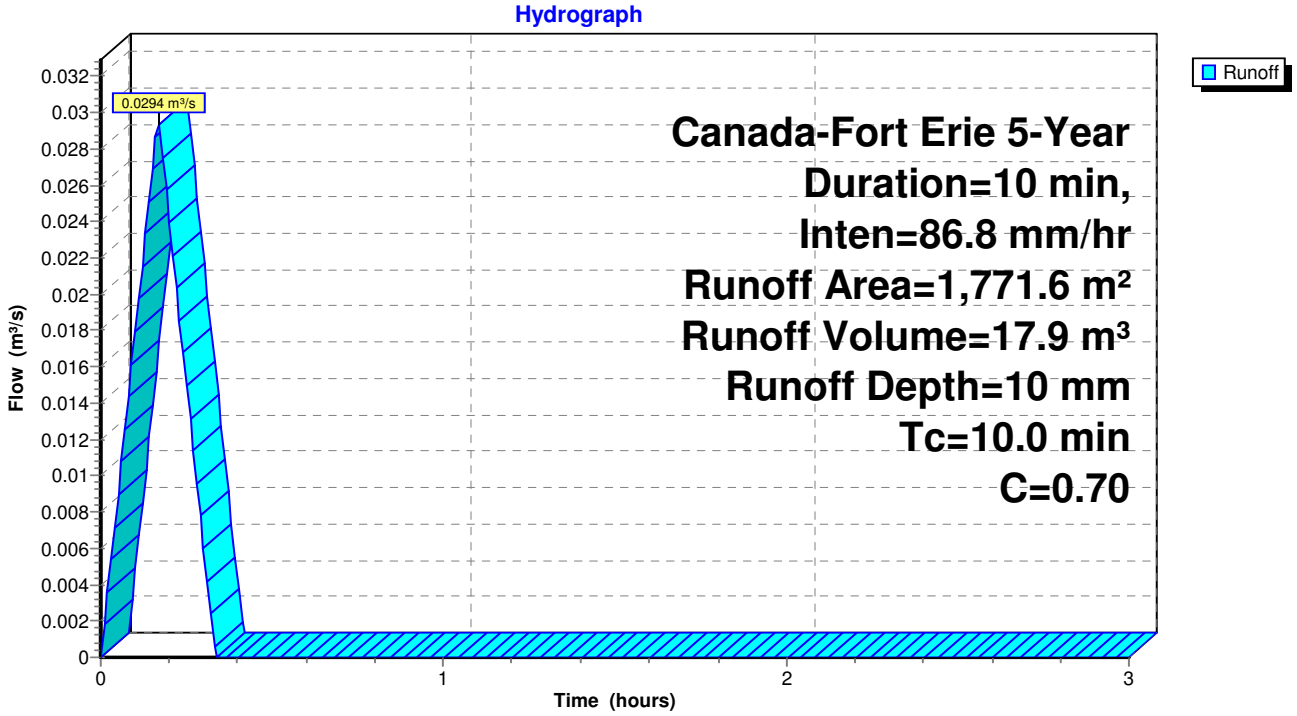
Runoff = 0.0294 m³/s @ 0.17 hrs, Volume= 17.9 m³, Depth= 10 mm
Routed to Pond 41P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
1,771.6	0.70	CA8
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 40S: Post Development CA8



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 5,413.7 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0898 m³/s @ 0.17 hrs, Volume= 54.8 m³
Outflow = 0.0440 m³/s @ 0.25 hrs, Volume= 55.2 m³, Atten= 51%, Lag= 5.1 min
Primary = 0.0440 m³/s @ 0.25 hrs, Volume= 55.2 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.720 m @ 0.25 hrs Surf.Area= 423.9 m² Storage= 14.8 m³
Flood Elev= 191.950 m Surf.Area= 1,873.2 m² Storage= 274.6 m³

Plug-Flow detention time= 2.8 min calculated for 54.6 m³ (100% of inflow)
Center-of-Mass det. time= 2.9 min (12.9 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.650 m	161.4 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.650 m	111.3 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.880 m	2.0 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		274.6 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	1,075.8	161.4	161.4

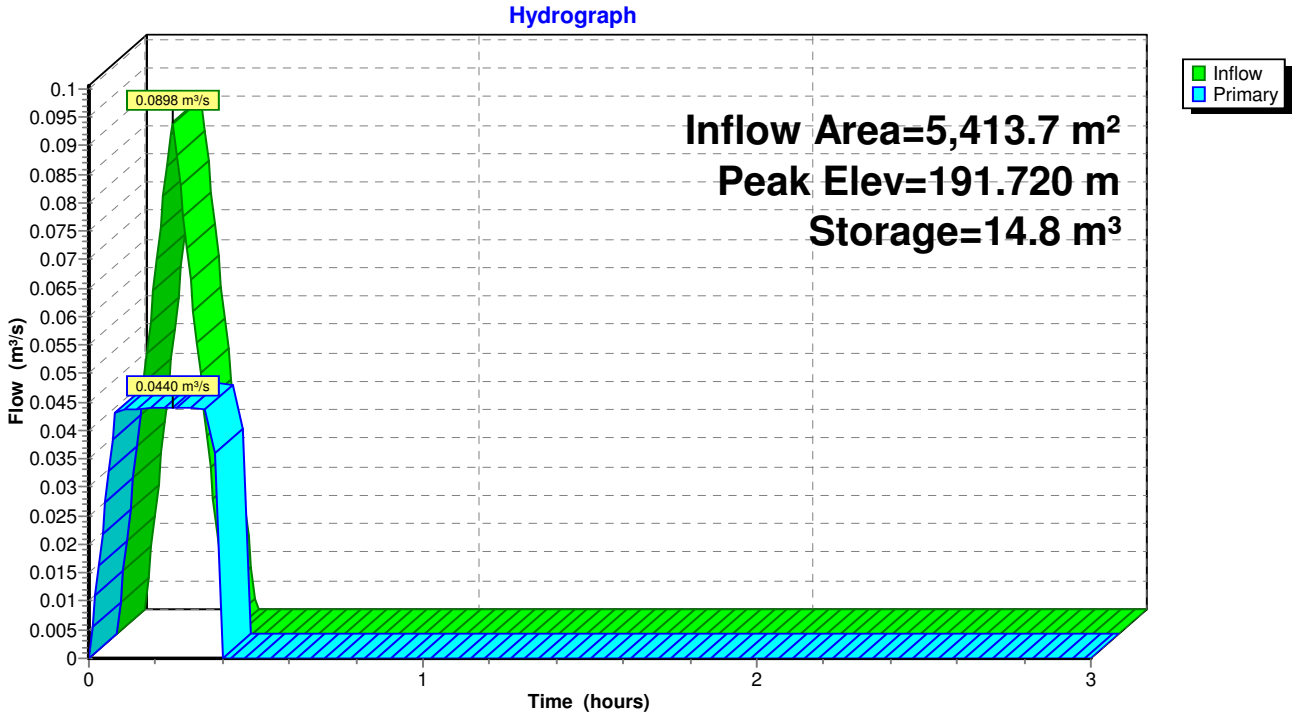
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	741.4	111.3	111.3

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.880	0.3	0.0	0.0
191.950	56.0	2.0	2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	189.030 m	**114 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0440 m³/s @ 0.25 hrs HW=191.720 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0440 m³/s @ 4.31 m/s)

Pond 27P: Outlet



Summary for Pond 32P: Outlet

[44] Hint: Outlet device #1 is below defined storage
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=3)

Inflow Area = 1,652.4 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0274 m³/s @ 0.17 hrs, Volume= 16.7 m³
Outflow = 0.0236 m³/s @ 0.19 hrs, Volume= 16.8 m³, Atten= 14%, Lag= 1.5 min
Primary = 0.0236 m³/s @ 0.19 hrs, Volume= 16.8 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.230 m @ 0.19 hrs Surf.Area= 26.4 m² Storage= 0.4 m³
Flood Elev= 191.500 m Surf.Area= 265.0 m² Storage= 39.8 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (10.1 - 10.0)

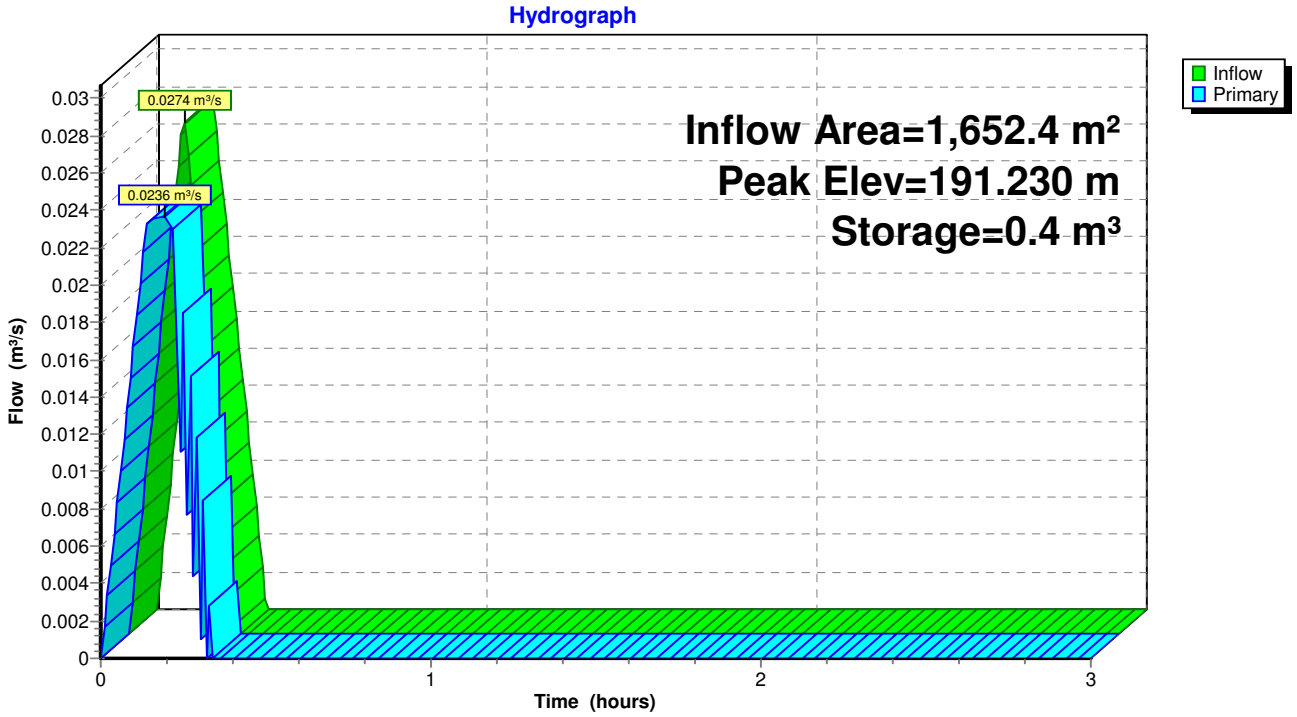
Volume	Invert	Avail.Storage	Storage Description
#1	191.200 m	39.8 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.200	0.3	0.0	0.0
191.500	265.0	39.8	39.8

Device	Routing	Invert	Outlet Devices
#1	Primary	189.050 m	**88 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0236 m³/s @ 0.19 hrs HW=191.229 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0236 m³/s @ 3.88 m/s)

Pond 32P: Outlet



Summary for Pond 34P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 954.2 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0158 m³/s @ 0.17 hrs, Volume= 9.7 m³
Outflow = 0.0082 m³/s @ 0.10 hrs, Volume= 9.8 m³, Atten= 48%, Lag= 0.0 min
Primary = 0.0082 m³/s @ 0.10 hrs, Volume= 9.8 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.561 m @ 0.25 hrs Surf.Area= 75.5 m² Storage= 2.3 m³
Flood Elev= 191.950 m Surf.Area= 343.6 m² Storage= 48.1 m³

Plug-Flow detention time= 2.3 min calculated for 9.6 m³ (100% of inflow)
Center-of-Mass det. time= 2.5 min (12.5 - 10.0)

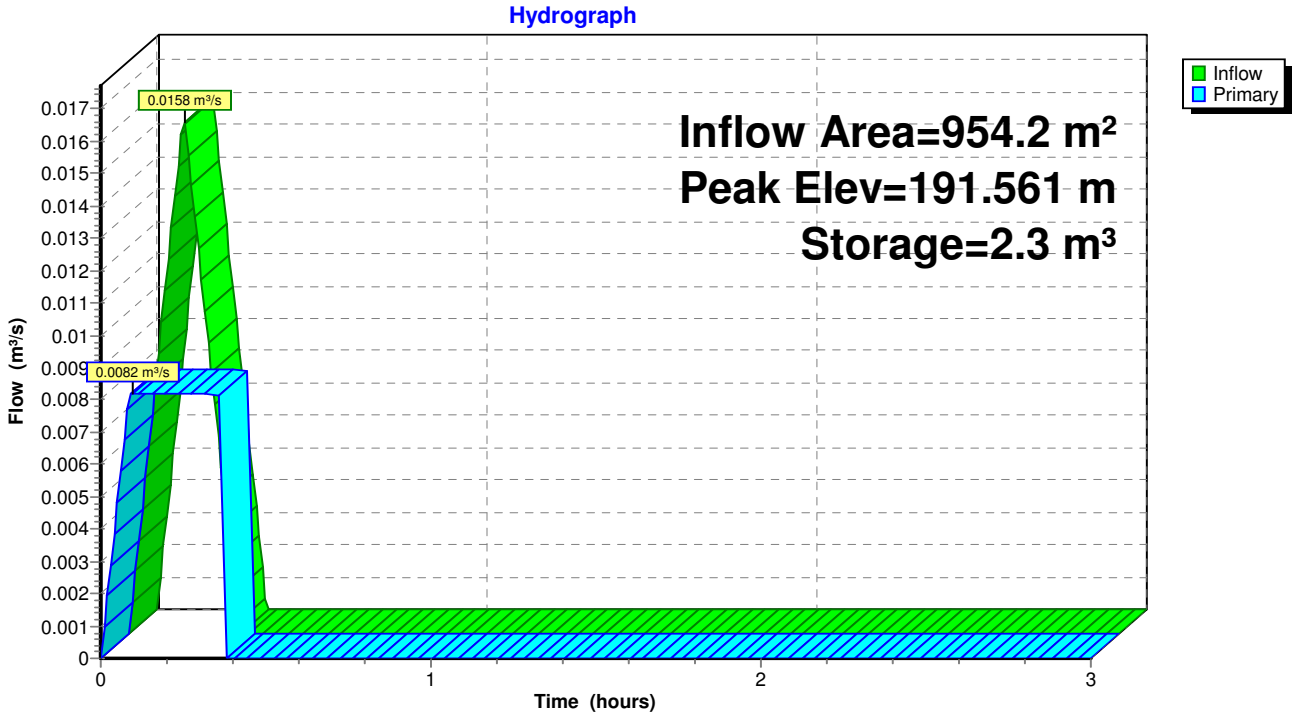
Volume	Invert	Avail.Storage	Storage Description
#1	191.500 m	48.1 m³	**CB Ponding @ CBMH (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.500	0.3	0.0	0.0
191.780	343.6	48.1	48.1

Device	Routing	Invert	Outlet Devices
#1	Primary	191.400 m	**0.00820 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0082 m³/s @ 0.10 hrs HW=191.508 m (Free Discharge)
↑**1=EZ Flo Hopper** (Constant Controls 0.0082 m³/s)

Pond 34P: Outlet



Summary for Pond 38P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 874.5 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0145 m³/s @ 0.17 hrs, Volume= 8.9 m³
Outflow = 0.0075 m³/s @ 0.09 hrs, Volume= 9.0 m³, Atten= 48%, Lag= 0.0 min
Primary = 0.0075 m³/s @ 0.09 hrs, Volume= 9.0 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.473 m @ 0.25 hrs Surf.Area= 58.5 m² Storage= 2.1 m³
Flood Elev= 191.550 m Surf.Area= 120.1 m² Storage= 9.0 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.5 min (12.5 - 10.0)

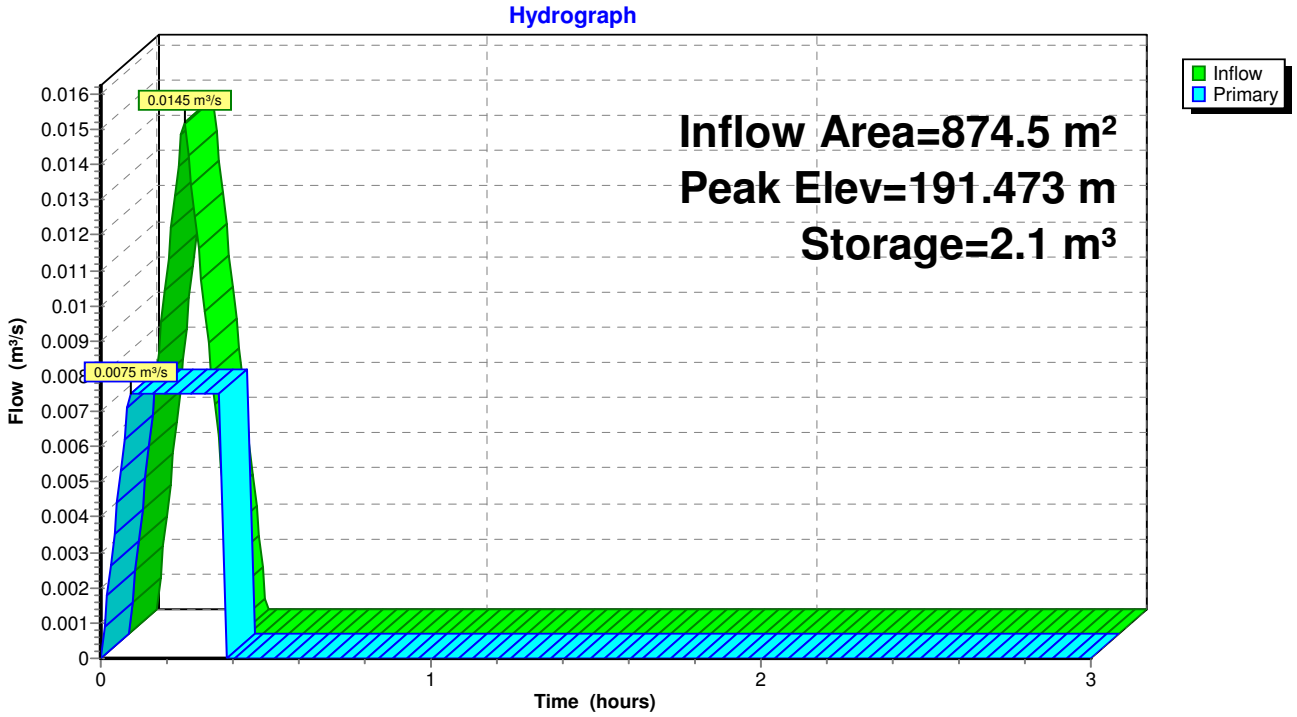
Volume	Invert	Avail.Storage	Storage Description
#1	191.400 m	16.0 m³	**CB Ponding @ CB (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.400	0.3	0.0	0.0
191.600	160.0	16.0	16.0

Device	Routing	Invert	Outlet Devices
#1	Primary	191.250 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0075 m³/s @ 0.09 hrs HW=191.404 m (Free Discharge)
↑**1=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)

Pond 38P: Outlet



Summary for Pond 41P: Outlet

[44] Hint: Outlet device #1 is below defined storage
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,771.6 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0294 m³/s @ 0.17 hrs, Volume= 17.9 m³
Outflow = 0.0150 m³/s @ 0.10 hrs, Volume= 18.0 m³, Atten= 49%, Lag= 0.0 min
Primary = 0.0150 m³/s @ 0.10 hrs, Volume= 18.0 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 190.987 m @ 0.25 hrs Surf.Area= 101.9 m² Storage= 4.5 m³
Flood Elev= 191.550 m Surf.Area= 350.0 m² Storage= 52.5 m³

Plug-Flow detention time= 2.4 min calculated for 17.9 m³ (100% of inflow)
Center-of-Mass det. time= 2.5 min (12.5 - 10.0)

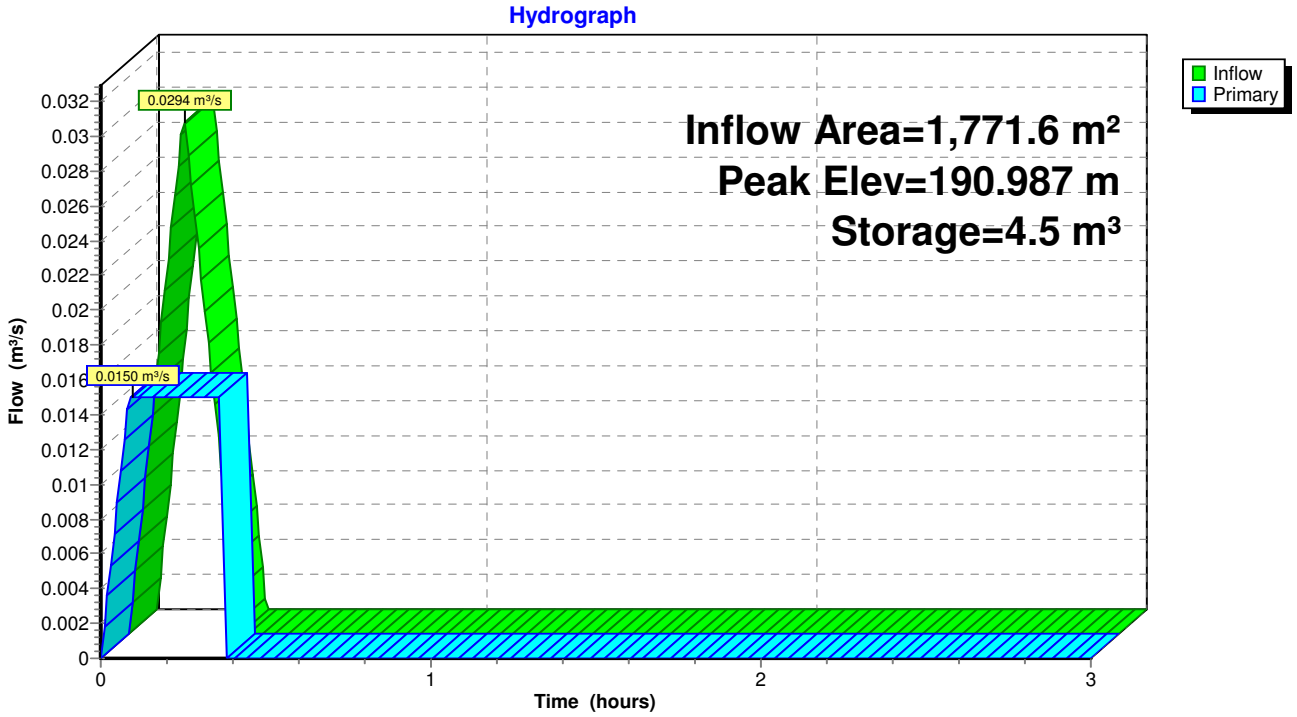
Volume	Invert	Avail.Storage	Storage Description
#1	190.900 m	52.5 m³	**Roadway Ponding (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
190.900	0.3	0.0	0.0
191.200	350.0	52.5	52.5

Device	Routing	Invert	Outlet Devices
#1	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**
#2	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0150 m³/s @ 0.10 hrs HW=190.913 m (Free Discharge)
└**1=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)
└**2=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)

Pond 41P: Outlet



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.1420 m³/s 86.7 m³

Subcatchment 29S: Pre Development Area 1 Runoff Area=5,413.7 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0812 m³/s 49.5 m³

Subcatchment 30S: Pre Development Area 2 Runoff Area=2,926.0 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0439 m³/s 26.8 m³

Subcatchment 31S: Post Development Runoff Area=1,652.4 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.0433 m³/s 26.5 m³

Subcatchment 33S: Post Development CA6 Runoff Area=954.2 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.0250 m³/s 15.3 m³

Subcatchment 35S: Predevelopment CA6 Runoff Area=954.6 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0143 m³/s 8.7 m³

Subcatchment 36S: Predevelopment CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0131 m³/s 8.0 m³

Subcatchment 37S: Post Development CA7 Runoff Area=874.5 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.0229 m³/s 14.0 m³

Subcatchment 39S: Predevelopment CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0266 m³/s 16.2 m³

Subcatchment 40S: Post Development CA8 Runoff Area=1,771.6 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.0465 m³/s 28.4 m³

Pond 27P: Outlet Peak Elev=191.767 m Storage=41.9 m³ Inflow=0.1420 m³/s 86.7 m³
Outflow=0.0444 m³/s 87.2 m³

Pond 32P: Outlet Peak Elev=191.312 m Storage=5.6 m³ Inflow=0.0433 m³/s 26.5 m³
Outflow=0.0241 m³/s 26.6 m³

Pond 34P: Outlet Peak Elev=191.607 m Storage=7.0 m³ Inflow=0.0250 m³/s 15.3 m³
Outflow=0.0082 m³/s 15.3 m³

Pond 38P: Outlet Peak Elev=191.527 m Storage=6.4 m³ Inflow=0.0229 m³/s 14.0 m³
Outflow=0.0075 m³/s 14.0 m³

Pond 41P: Outlet Peak Elev=191.050 m Storage=13.2 m³ Inflow=0.0465 m³/s 28.4 m³
Outflow=0.0150 m³/s 28.5 m³

Total Runoff Area = 22,606.8 m² Runoff Volume = 280.1 m³ Average Runoff Depth = 12 mm
100.00% Pervious = 22,606.8 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

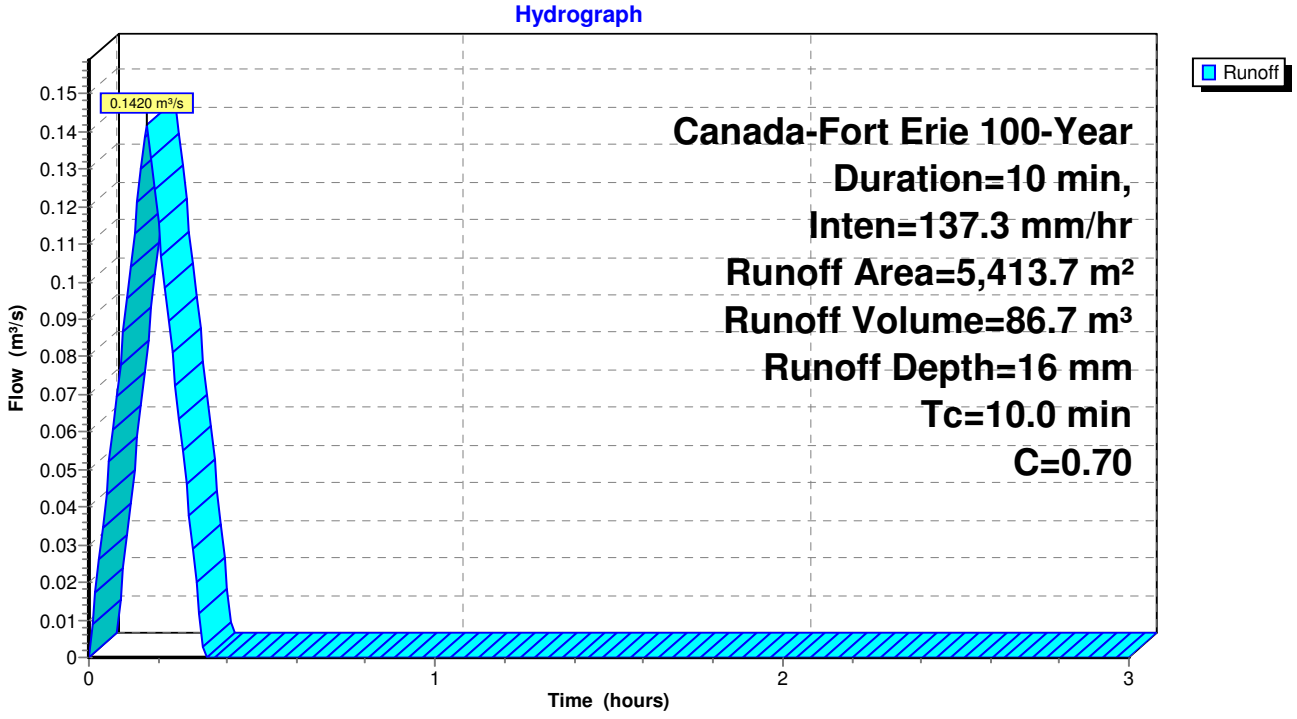
Runoff = 0.1420 m³/s @ 0.17 hrs, Volume= 86.7 m³, Depth= 16 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
1,740.0	0.70	CA1
1,722.4	0.70	CA2
1,604.2	0.70	CA3
347.1	0.70	CA4
5,413.7	0.70	Weighted Average
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development Area 1

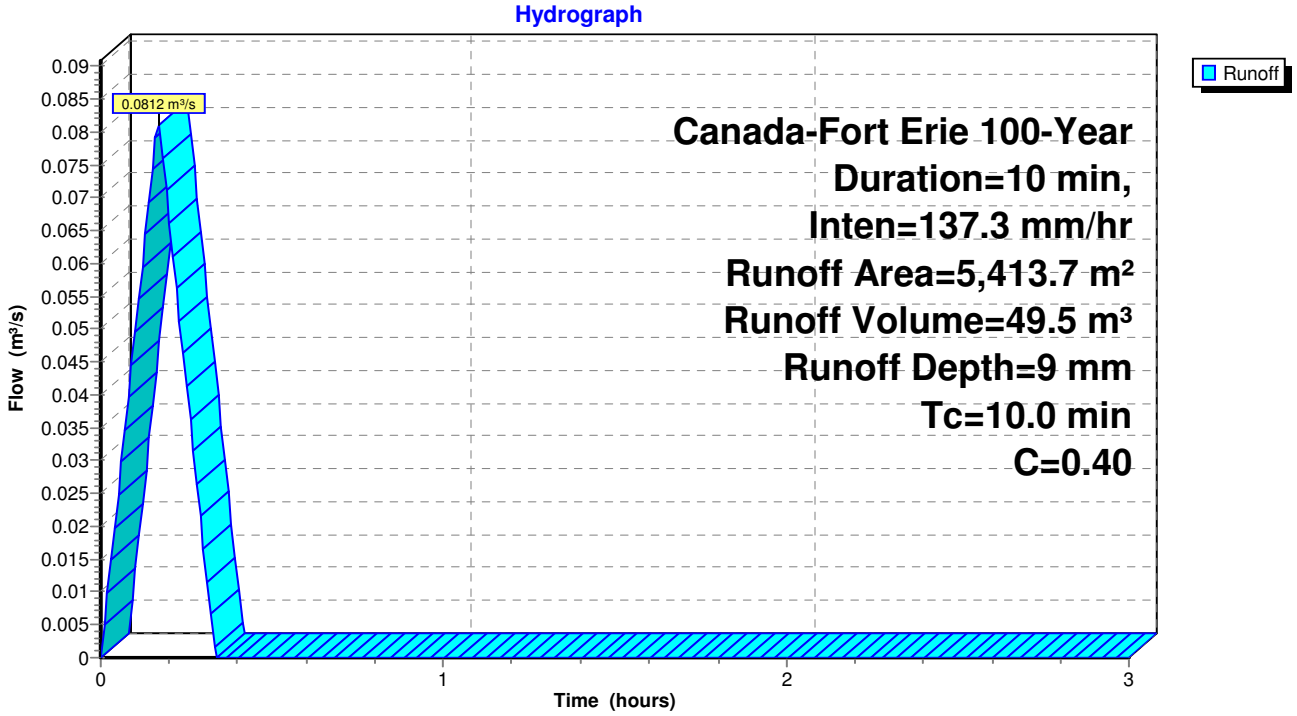
Runoff = 0.0812 m³/s @ 0.17 hrs, Volume= 49.5 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
5,413.7	0.40	Existing Single Family
5,413.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development Area 1



Summary for Subcatchment 30S: Pre Development Area 2

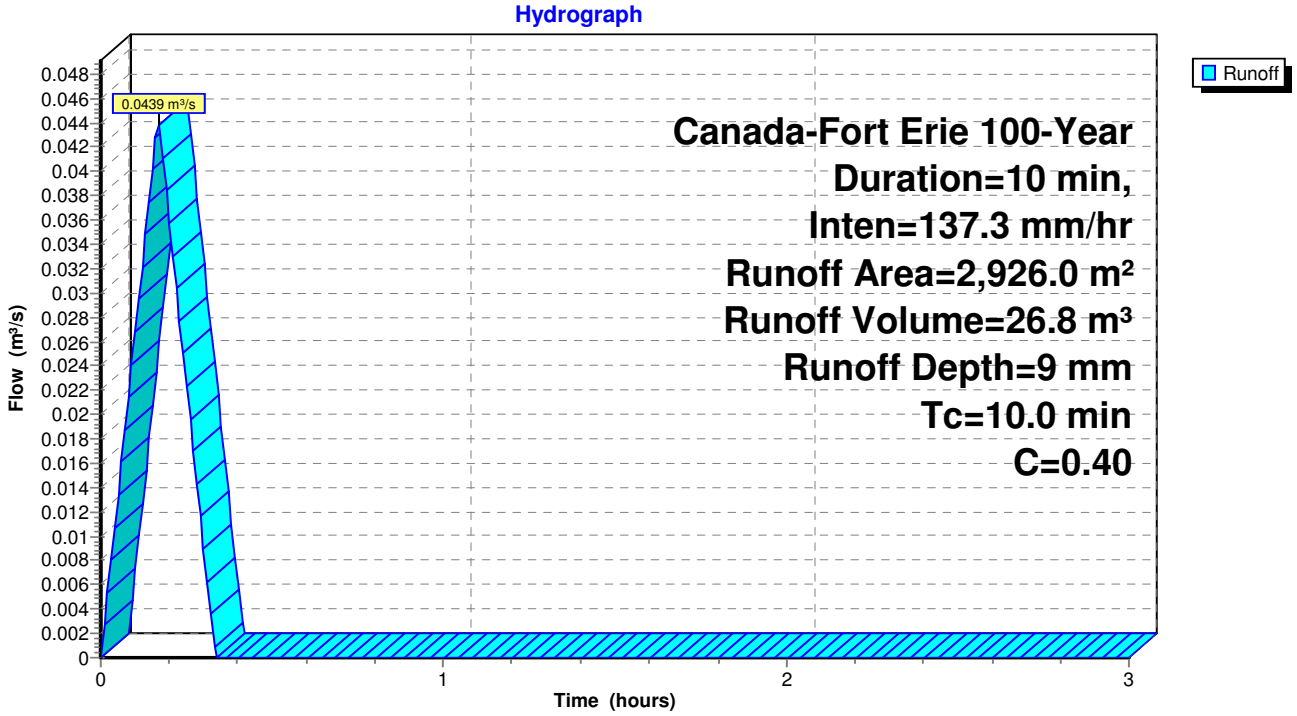
Runoff = 0.0439 m³/s @ 0.17 hrs, Volume= 26.8 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
2,926.0	0.40	Existing Single Family
2,926.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 30S: Pre Development Area 2



Summary for Subcatchment 31S: Post Development Area 2

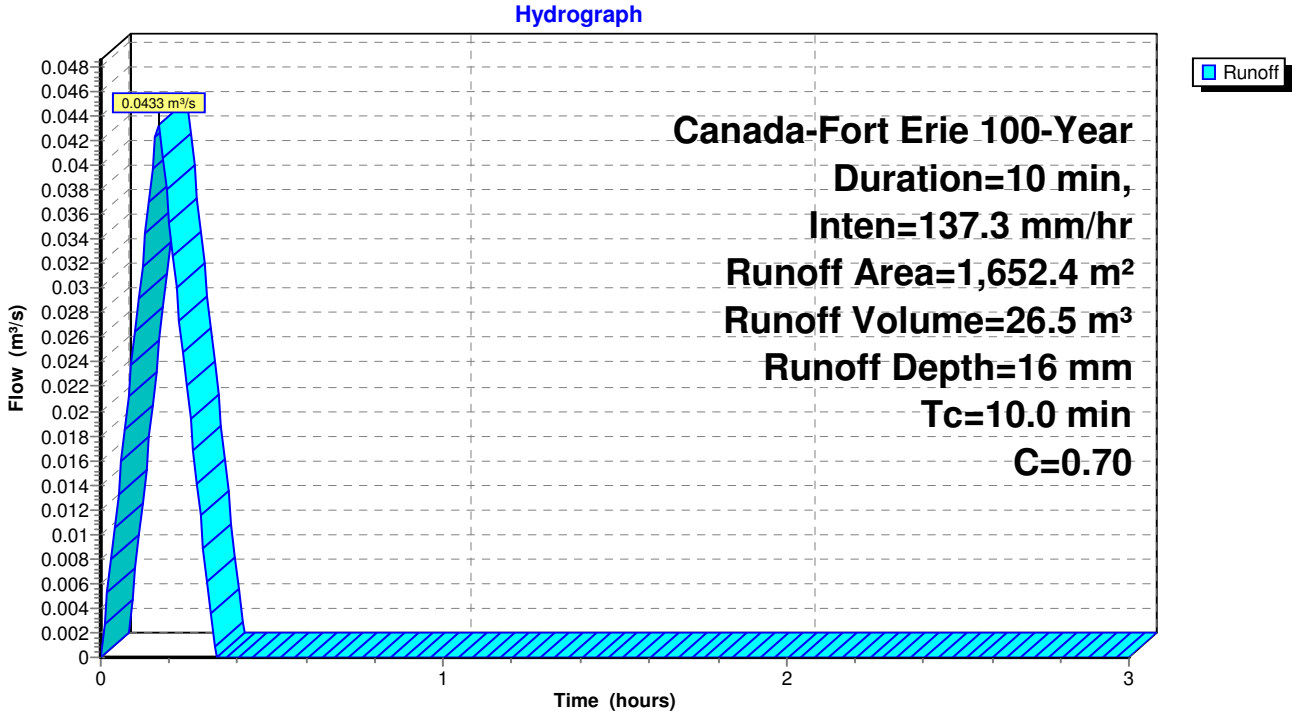
Runoff = 0.0433 m³/s @ 0.17 hrs, Volume= 26.5 m³, Depth= 16 mm
Routed to Pond 32P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
1,652.4	0.70	CA5
1,652.4		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 31S: Post Development Area 2



Summary for Subcatchment 33S: Post Development CA6

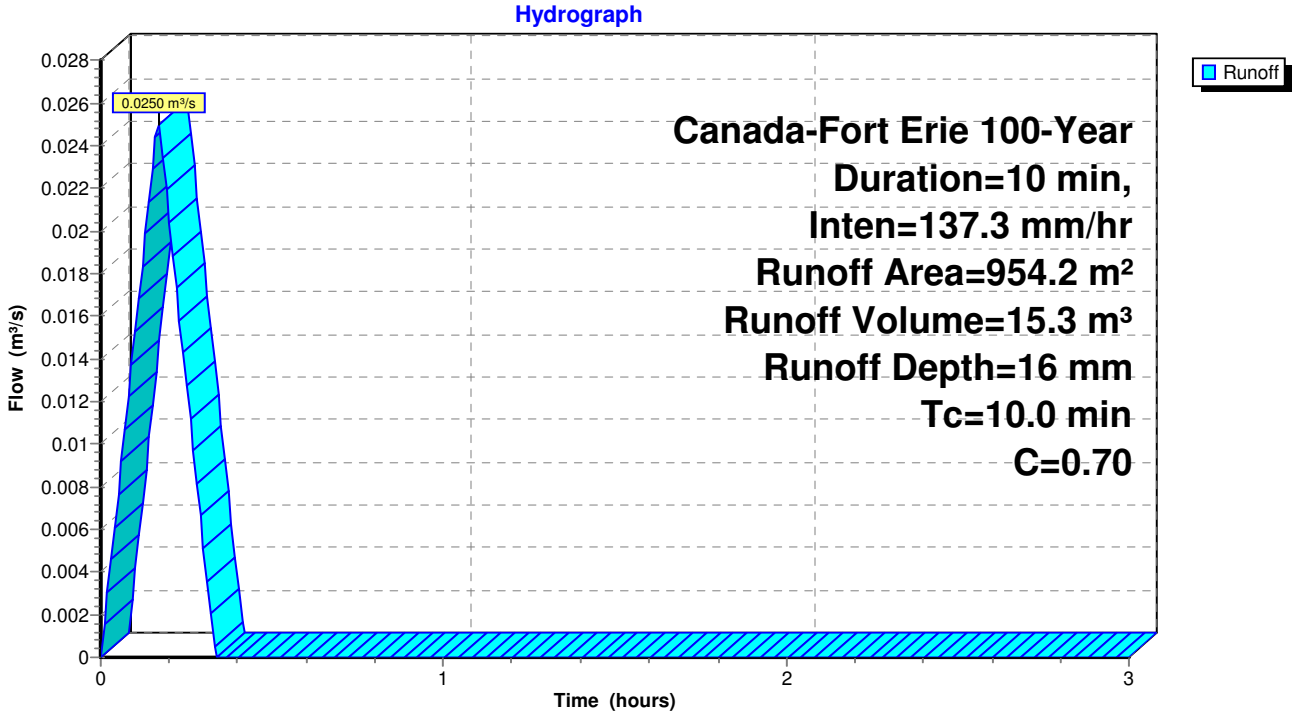
Runoff = 0.0250 m³/s @ 0.17 hrs, Volume= 15.3 m³, Depth= 16 mm
Routed to Pond 34P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
954.2	0.70	CA6
954.2		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 33S: Post Development CA6



Summary for Subcatchment 35S: Predevelopment CA6

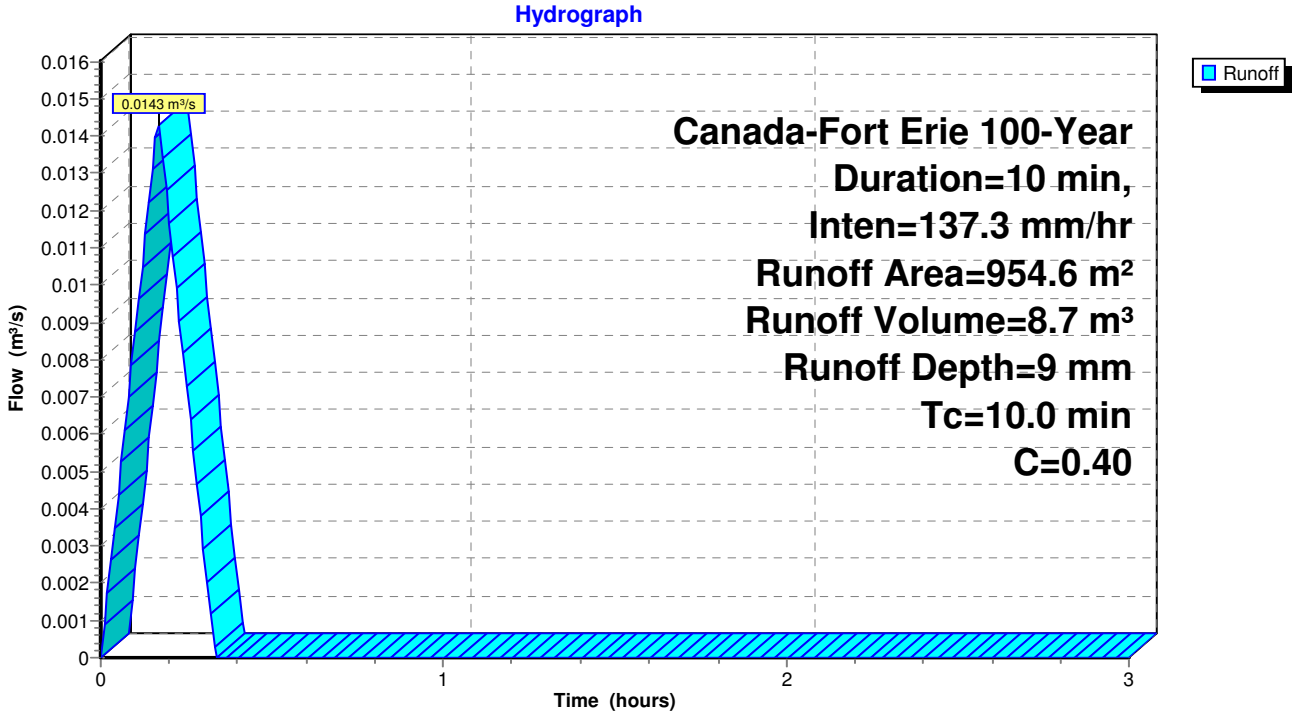
Runoff = 0.0143 m³/s @ 0.17 hrs, Volume= 8.7 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
954.6	0.40	Existing Single Family
954.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 35S: Predevelopment CA6



Summary for Subcatchment 36S: Predevelopment CA7

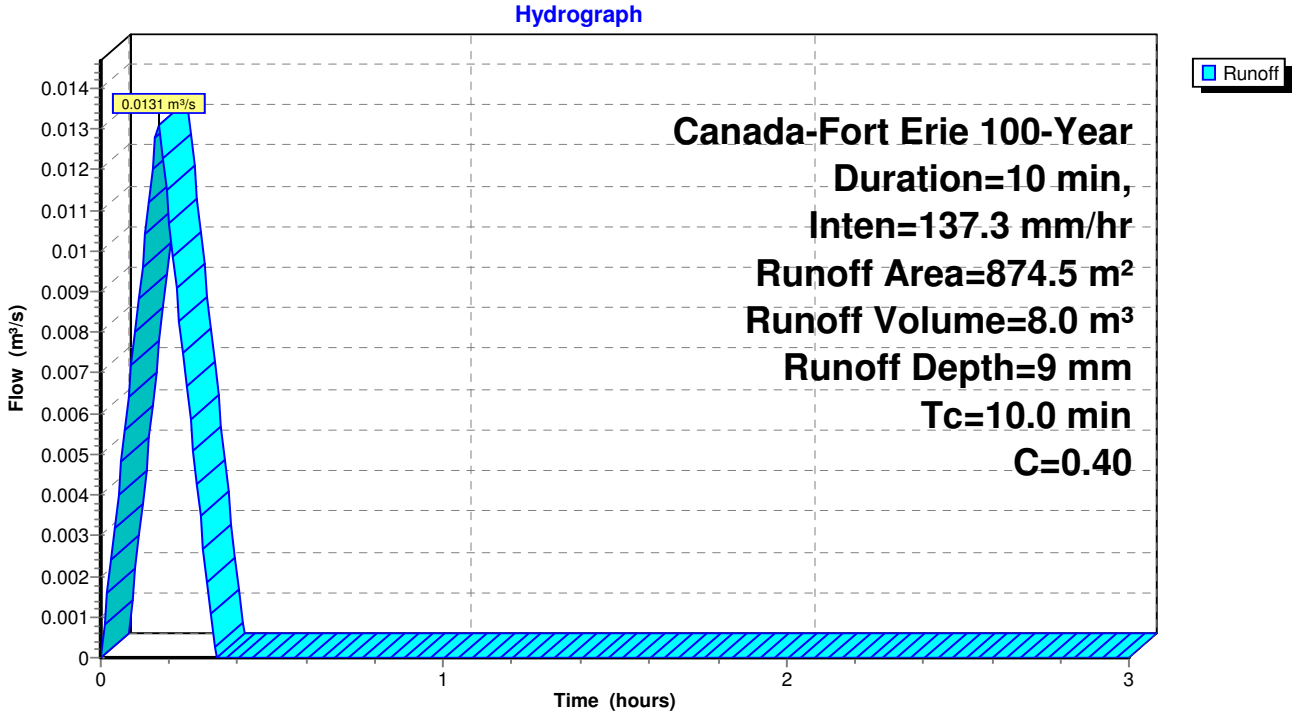
Runoff = 0.0131 m³/s @ 0.17 hrs, Volume= 8.0 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
874.5	0.40	Existing Single Family
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 36S: Predevelopment CA7



Summary for Subcatchment 37S: Post Development CA7

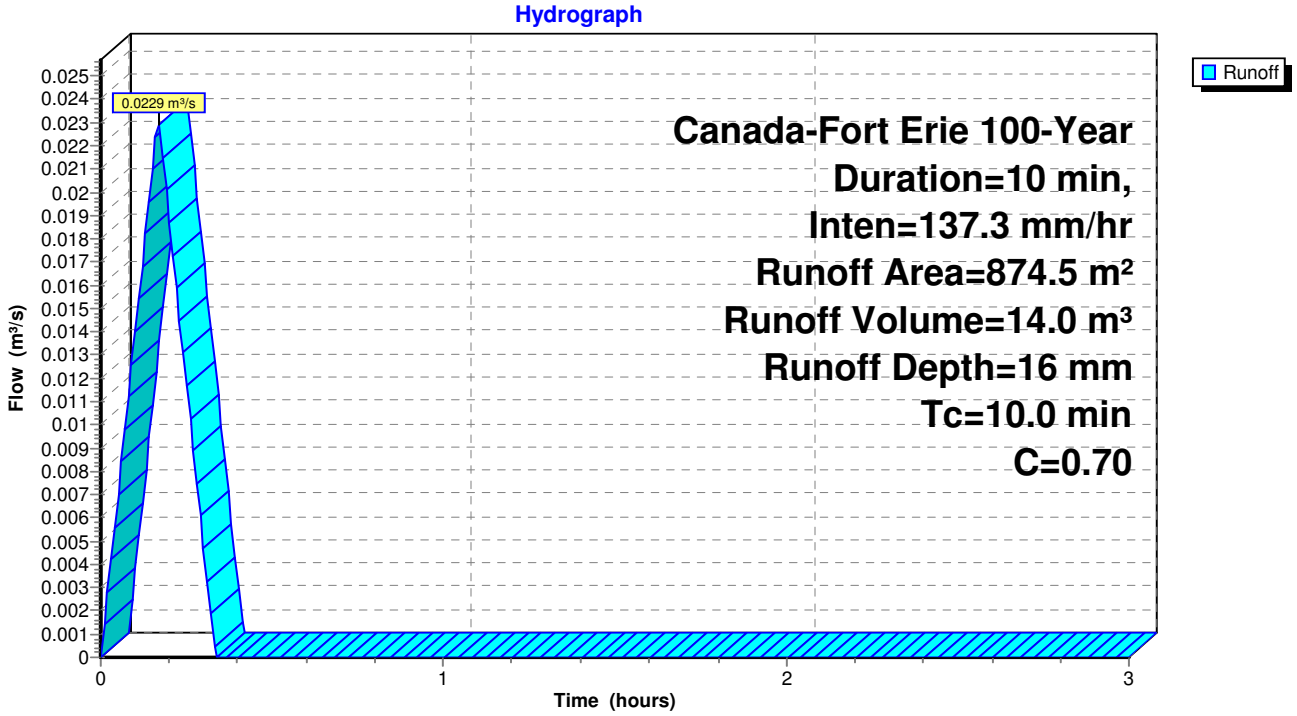
Runoff = 0.0229 m³/s @ 0.17 hrs, Volume= 14.0 m³, Depth= 16 mm
Routed to Pond 38P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
874.5	0.70	CA7
874.5		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 37S: Post Development CA7



Summary for Subcatchment 39S: Predevelopment CA8

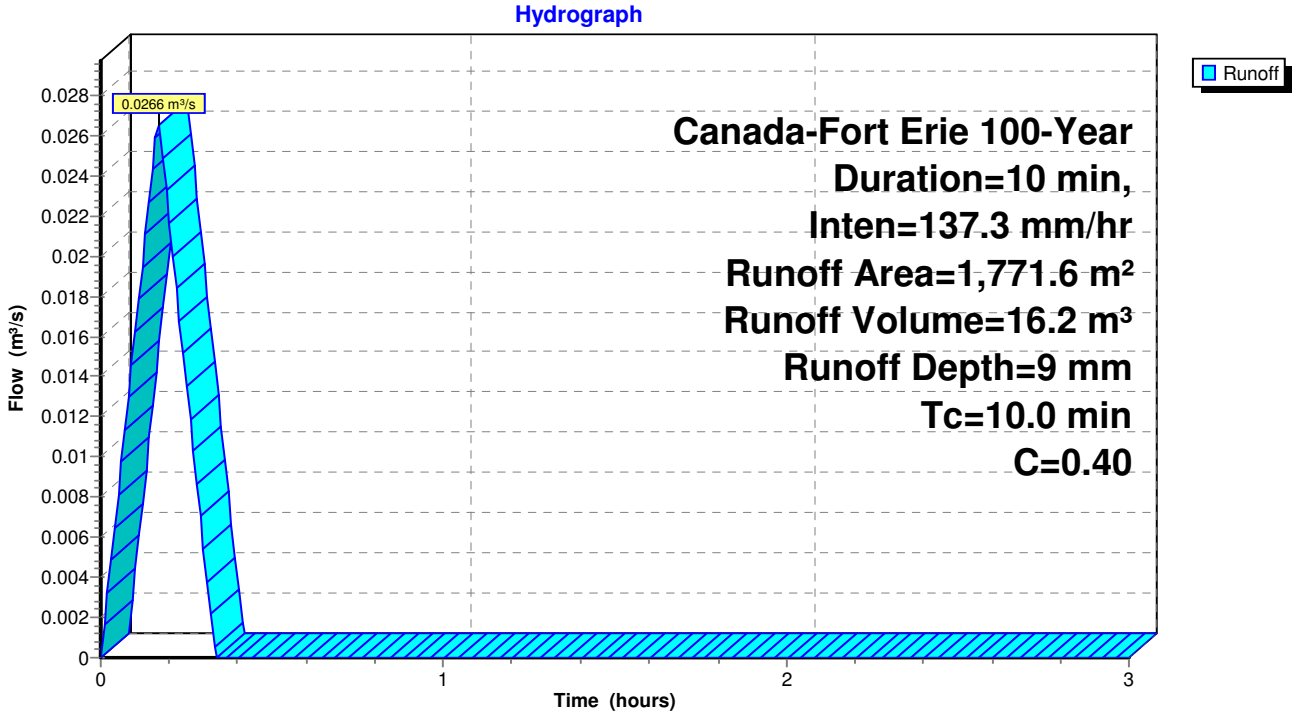
Runoff = 0.0266 m³/s @ 0.17 hrs, Volume= 16.2 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
1,771.6	0.40	Existing Single Family
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 39S: Predevelopment CA8



Summary for Subcatchment 40S: Post Development CA8

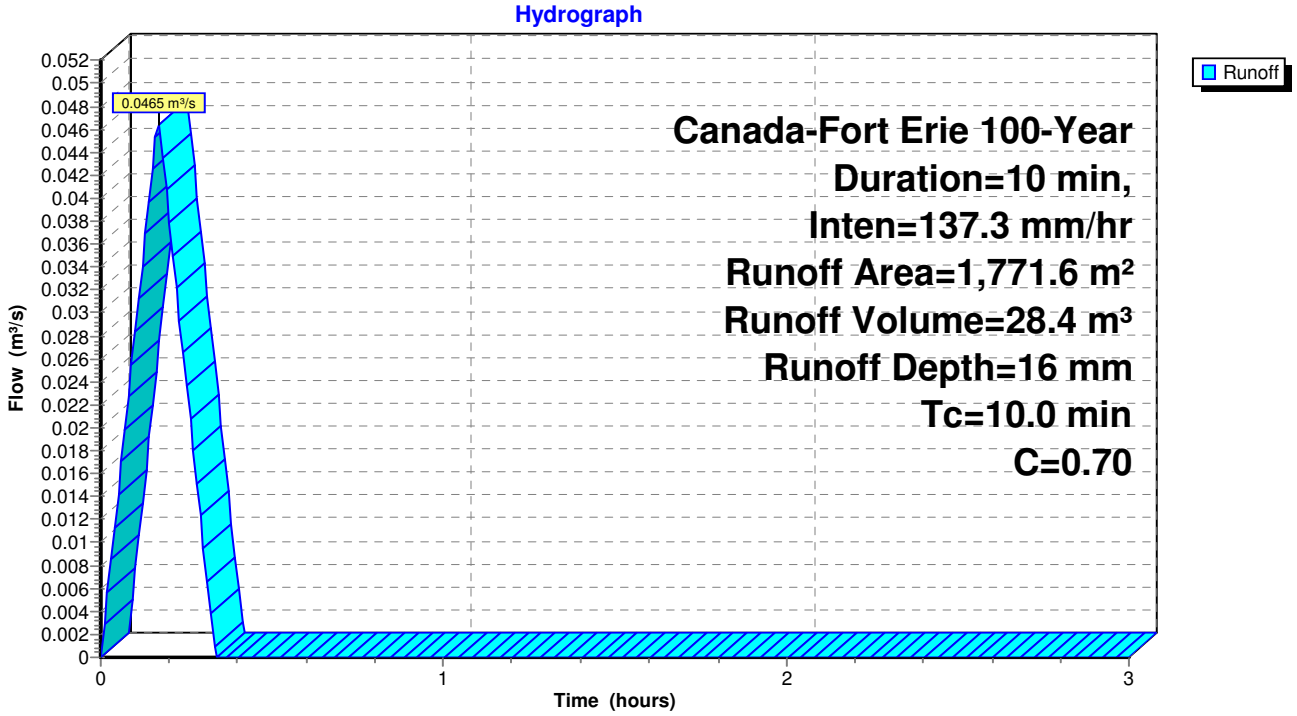
Runoff = 0.0465 m³/s @ 0.17 hrs, Volume= 28.4 m³, Depth= 16 mm
Routed to Pond 41P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
1,771.6	0.70	CA8
1,771.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 40S: Post Development CA8



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 5,413.7 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.1420 m³/s @ 0.17 hrs, Volume= 86.7 m³
Outflow = 0.0444 m³/s @ 0.28 hrs, Volume= 87.2 m³, Atten= 69%, Lag= 6.9 min
Primary = 0.0444 m³/s @ 0.28 hrs, Volume= 87.2 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.767 m @ 0.28 hrs Surf.Area= 712.1 m² Storage= 41.9 m³
Flood Elev= 191.950 m Surf.Area= 1,873.2 m² Storage= 274.6 m³

Plug-Flow detention time= 7.9 min calculated for 86.6 m³ (100% of inflow)
Center-of-Mass det. time= 8.0 min (18.0 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.650 m	161.4 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.650 m	111.3 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.880 m	2.0 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		274.6 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	1,075.8	161.4	161.4

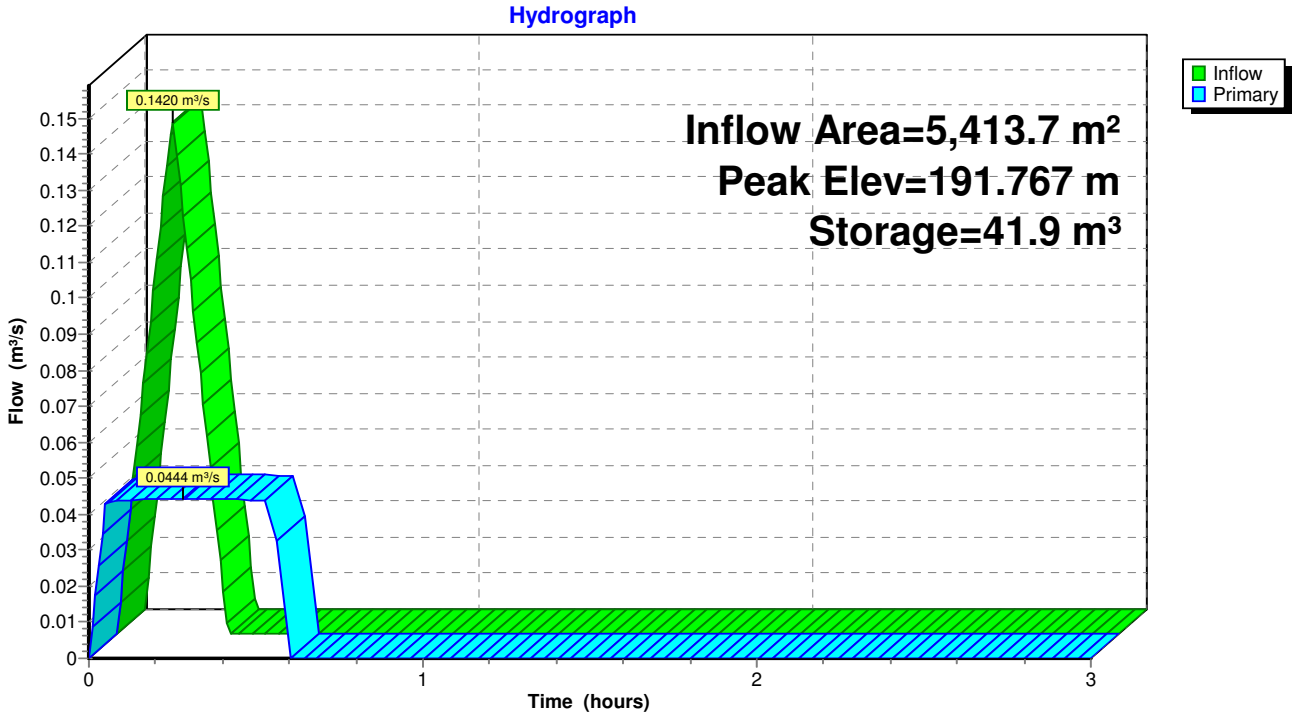
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.650	0.3	0.0	0.0
191.950	741.4	111.3	111.3

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.880	0.3	0.0	0.0
191.950	56.0	2.0	2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	189.030 m	**114 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0444 m³/s @ 0.28 hrs HW=191.767 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0444 m³/s @ 4.35 m/s)

Pond 27P: Outlet



Summary for Pond 32P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 1,652.4 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.0433 m³/s @ 0.17 hrs, Volume= 26.5 m³
Outflow = 0.0241 m³/s @ 0.24 hrs, Volume= 26.6 m³, Atten= 44%, Lag= 4.5 min
Primary = 0.0241 m³/s @ 0.24 hrs, Volume= 26.6 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.312 m @ 0.24 hrs Surf.Area= 99.2 m² Storage= 5.6 m³
Flood Elev= 191.500 m Surf.Area= 265.0 m² Storage= 39.8 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.9 min (12.0 - 10.0)

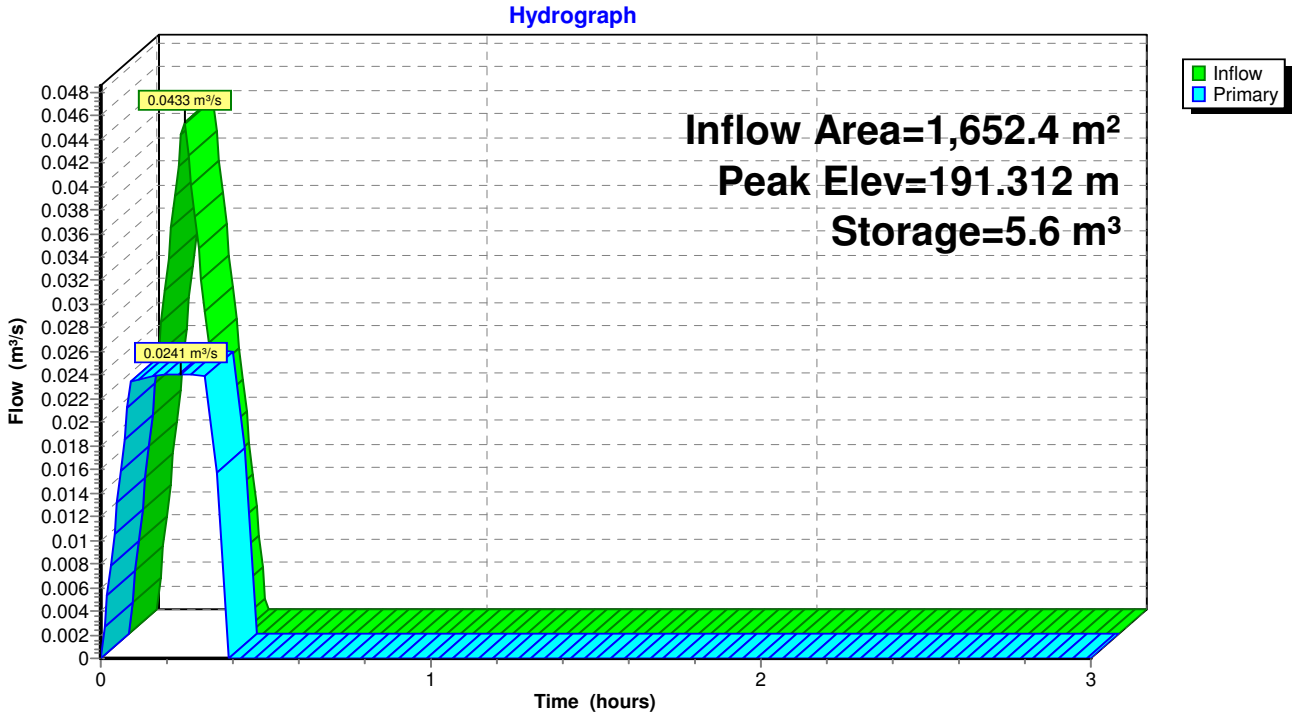
Volume	Invert	Avail.Storage	Storage Description
#1	191.200 m	39.8 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.200	0.3	0.0	0.0
191.500	265.0	39.8	39.8

Device	Routing	Invert	Outlet Devices
#1	Primary	189.050 m	**88 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0241 m³/s @ 0.24 hrs HW=191.312 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0241 m³/s @ 3.96 m/s)

Pond 32P: Outlet



Summary for Pond 34P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 954.2 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.0250 m³/s @ 0.17 hrs, Volume= 15.3 m³
Outflow = 0.0082 m³/s @ 0.06 hrs, Volume= 15.3 m³, Atten= 67%, Lag= 0.0 min
Primary = 0.0082 m³/s @ 0.06 hrs, Volume= 15.3 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.607 m @ 0.28 hrs Surf.Area= 131.2 m² Storage= 7.0 m³
Flood Elev= 191.950 m Surf.Area= 343.6 m² Storage= 48.1 m³

Plug-Flow detention time= 7.1 min calculated for 15.2 m³ (100% of inflow)
Center-of-Mass det. time= 7.1 min (17.1 - 10.0)

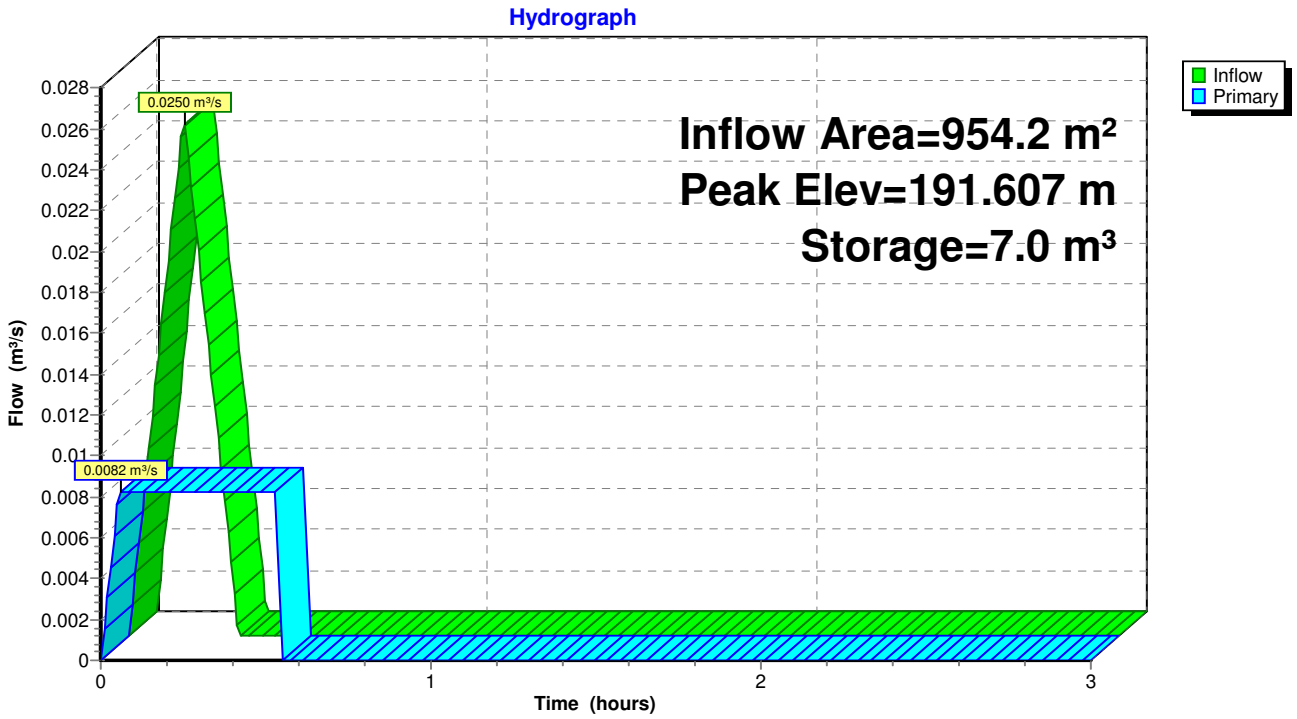
Volume	Invert	Avail.Storage	Storage Description
#1	191.500 m	48.1 m³	**CB Ponding @ CBMH (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.500	0.3	0.0	0.0
191.780	343.6	48.1	48.1

Device	Routing	Invert	Outlet Devices
#1	Primary	191.400 m	**0.00820 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0082 m³/s @ 0.06 hrs HW=191.505 m (Free Discharge)
↑**1=EZ Flo Hopper** (Constant Controls 0.0082 m³/s)

Pond 34P: Outlet



Summary for Pond 38P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 874.5 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.0229 m³/s @ 0.17 hrs, Volume= 14.0 m³
Outflow = 0.0075 m³/s @ 0.06 hrs, Volume= 14.0 m³, Atten= 67%, Lag= 0.0 min
Primary = 0.0075 m³/s @ 0.06 hrs, Volume= 14.0 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.527 m @ 0.28 hrs Surf.Area= 101.5 m² Storage= 6.4 m³
Flood Elev= 191.550 m Surf.Area= 120.1 m² Storage= 9.0 m³

Plug-Flow detention time= 7.1 min calculated for 14.0 m³ (100% of inflow)
Center-of-Mass det. time= 7.2 min (17.2 - 10.0)

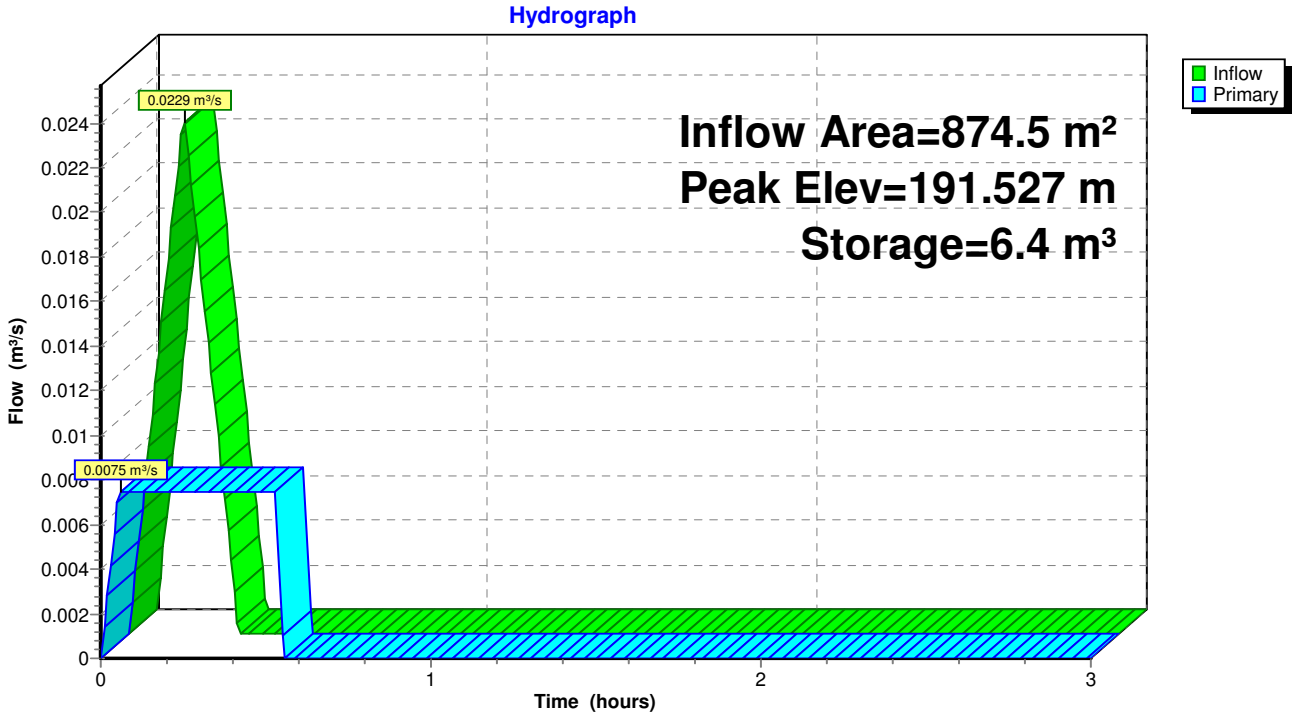
Volume	Invert	Avail.Storage	Storage Description
#1	191.400 m	16.0 m³	**CB Ponding @ CB (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.400	0.3	0.0	0.0
191.600	160.0	16.0	16.0

Device	Routing	Invert	Outlet Devices
#1	Primary	191.250 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0075 m³/s @ 0.06 hrs HW=191.406 m (Free Discharge)
↑1=EZ Flo Hopper (Constant Controls 0.0075 m³/s)

Pond 38P: Outlet



Summary for Pond 41P: Outlet

[44] Hint: Outlet device #1 is below defined storage
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,771.6 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.0465 m³/s @ 0.17 hrs, Volume= 28.4 m³
Outflow = 0.0150 m³/s @ 0.06 hrs, Volume= 28.5 m³, Atten= 68%, Lag= 0.0 min
Primary = 0.0150 m³/s @ 0.06 hrs, Volume= 28.5 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.050 m @ 0.28 hrs Surf.Area= 175.6 m² Storage= 13.2 m³
Flood Elev= 191.550 m Surf.Area= 350.0 m² Storage= 52.5 m³

Plug-Flow detention time= 7.3 min calculated for 28.3 m³ (100% of inflow)
Center-of-Mass det. time= 7.4 min (17.4 - 10.0)

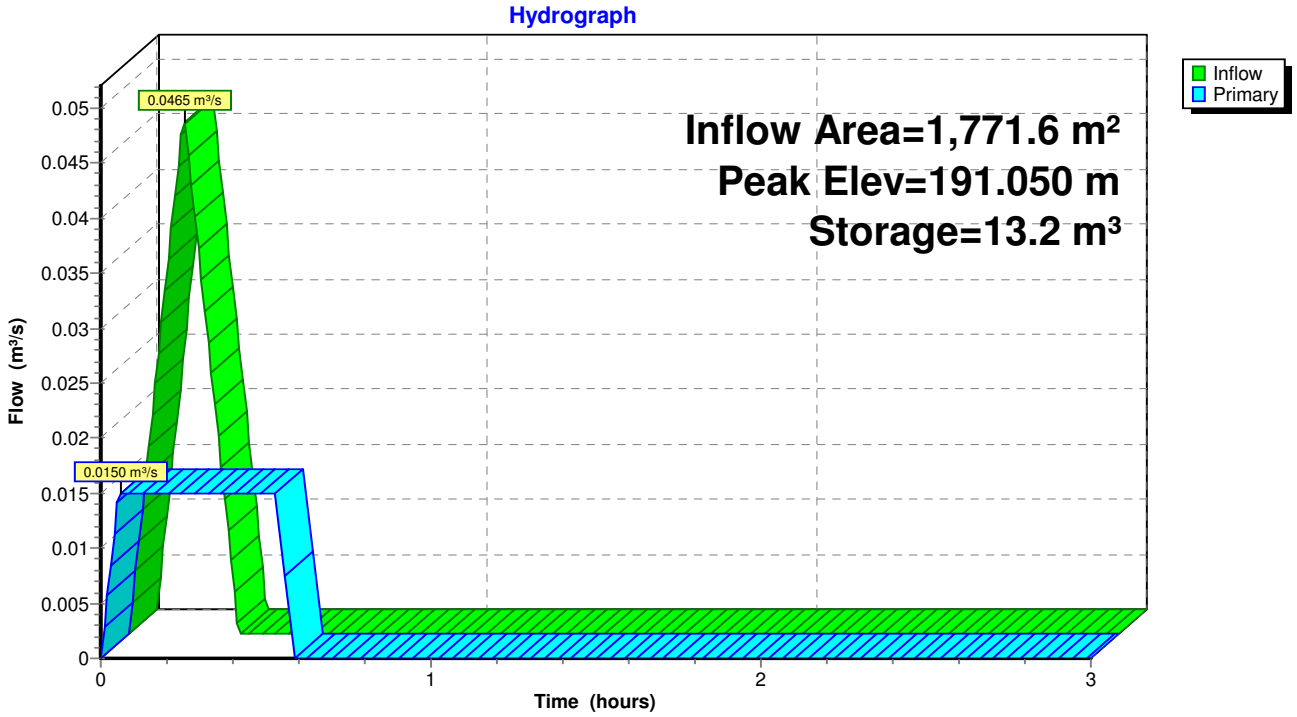
Volume	Invert	Avail.Storage	Storage Description
#1	190.900 m	52.5 m³	**Roadway Ponding (Prismatic)** Listed below (Recalc)

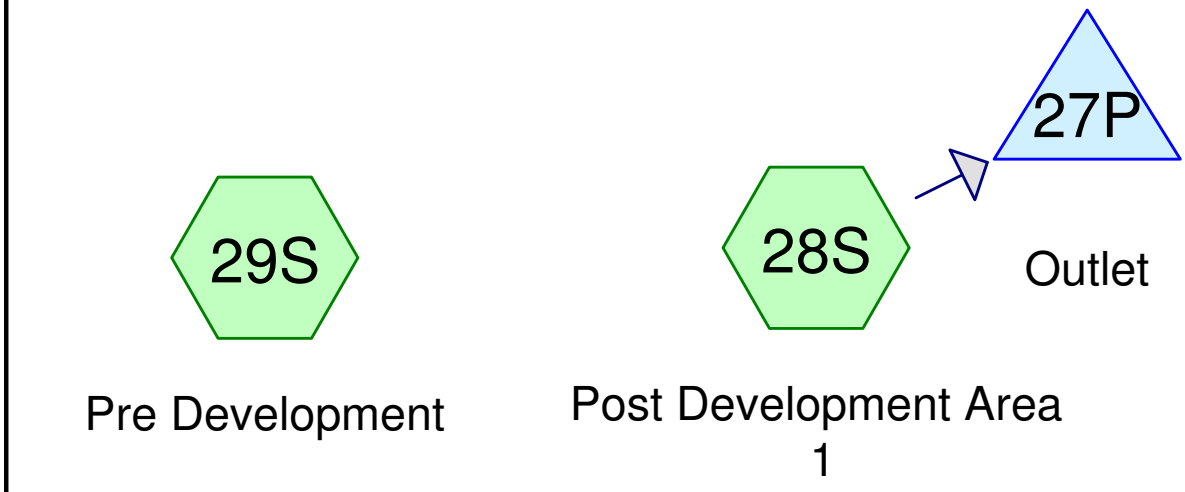
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
190.900	0.3	0.0	0.0
191.200	350.0	52.5	52.5

Device	Routing	Invert	Outlet Devices
#1	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**
#2	Primary	190.750 m	**0.00750 m³/s EZ Flo Hopper**

Primary OutFlow Max=0.0150 m³/s @ 0.06 hrs HW=190.908 m (Free Discharge)
└**1=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)
└**2=EZ Flo Hopper** (Constant Controls 0.0075 m³/s)

Pond 41P: Outlet





Subcat Reach Pond Link

Routing Diagram for 2304124 SWMM
Prepared by Robert E Dale Limited, Printed 5/18/2023

Project Notes

Copied 2 events from Sample D 24-hr storm
Copied 2 events from Whitby Chicago Storm storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 6 events from Canada-St.Catharines 24-hr storm
Copied 6 events from Canada-Sarnia 24-hr storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 6 events from Canada-St.Catharines 24-hr storm
Copied 5 events from Canada-ON Niagra Falls storm
Copied 3 events from Canada-Fort Erie storm

Area Listing (all nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
250.5	0.70	CA1 (28S)
534.8	0.70	CA2 (28S)
216.4	0.70	CA3 (28S)
1,496.7	0.40	Existing Single Family (29S)
495.0	0.70	bldg (28S)
2,993.4	**0.55**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,993.4	Other	28S, 29S
2,993.4		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Subcatchm Numbers
0.0	0.0	0.0	0.0	250.5	250.5	CA1	
0.0	0.0	0.0	0.0	534.8	534.8	CA2	
0.0	0.0	0.0	0.0	216.4	216.4	CA3	
0.0	0.0	0.0	0.0	1,496.7	1,496.7	Existing Single Family	
0.0	0.0	0.0	0.0	495.0	495.0	bldg	
0.0	**0.0**	**0.0**	**0.0**	**2,993.4**	**2,993.4**	**TOTAL AREA**	

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Area Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=8 mm
Tc=10.0 min C=0.70 Runoff=0.0191 m³/s 11.7 m³

Subcatchment 29S: Pre Development Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.40 Runoff=0.0109 m³/s 6.7 m³

Pond 27P: Outlet Peak Elev=191.130 m Storage=1.4 m³ Inflow=0.0191 m³/s 11.7 m³
Outflow=0.0128 m³/s 11.7 m³

Total Runoff Area = 2,993.4 m² Runoff Volume = 18.4 m³ Average Runoff Depth = 6 mm
100.00% Pervious = 2,993.4 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

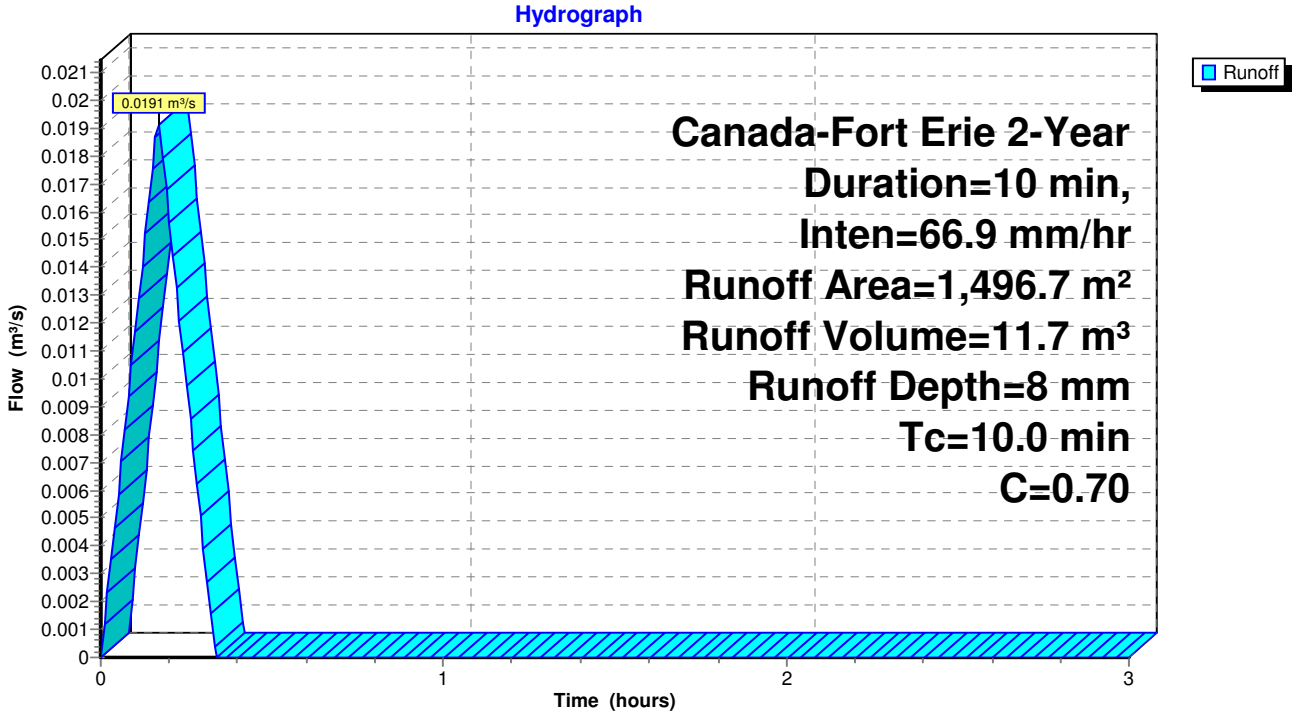
Runoff = 0.0191 m³/s @ 0.17 hrs, Volume= 11.7 m³, Depth= 8 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
250.5	0.70	CA1
534.8	0.70	CA2
216.4	0.70	CA3
495.0	0.70	bldg
1,496.7	0.70	Weighted Average
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development

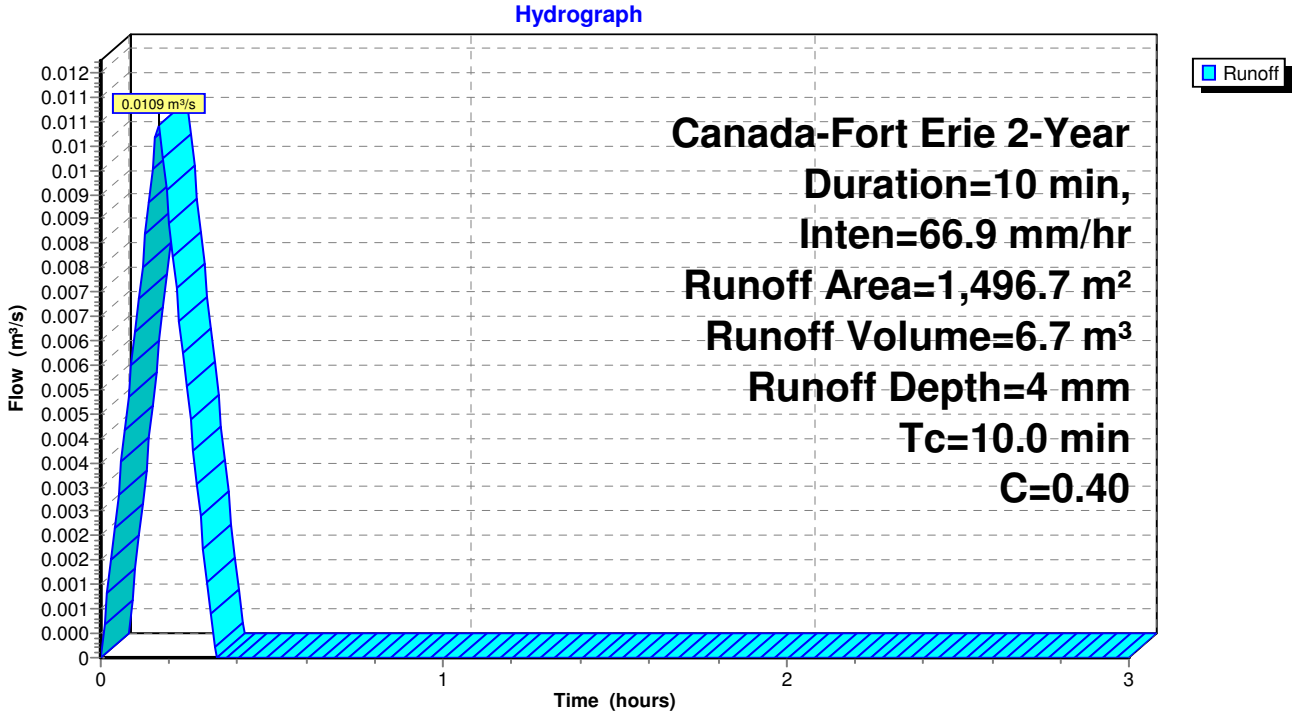
Runoff = 0.0109 m³/s @ 0.17 hrs, Volume= 6.7 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 2-Year Duration=10 min, Inten=66.9 mm/hr

Area (m²)	C	Description
1,496.7	0.40	Existing Single Family
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 1,496.7 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.0191 m³/s @ 0.17 hrs, Volume= 11.7 m³
Outflow = 0.0128 m³/s @ 0.22 hrs, Volume= 11.7 m³, Atten= 33%, Lag= 3.4 min
Primary = 0.0128 m³/s @ 0.22 hrs, Volume= 11.7 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.130 m @ 0.22 hrs Surf.Area= 92.6 m² Storage= 1.4 m³
Flood Elev= 191.220 m Surf.Area= 368.6 m² Storage= 22.2 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.8 min (10.8 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.100 m	3.6 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.100 m	12.0 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.100 m	6.5 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		22.2 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	60.4	3.6	3.6

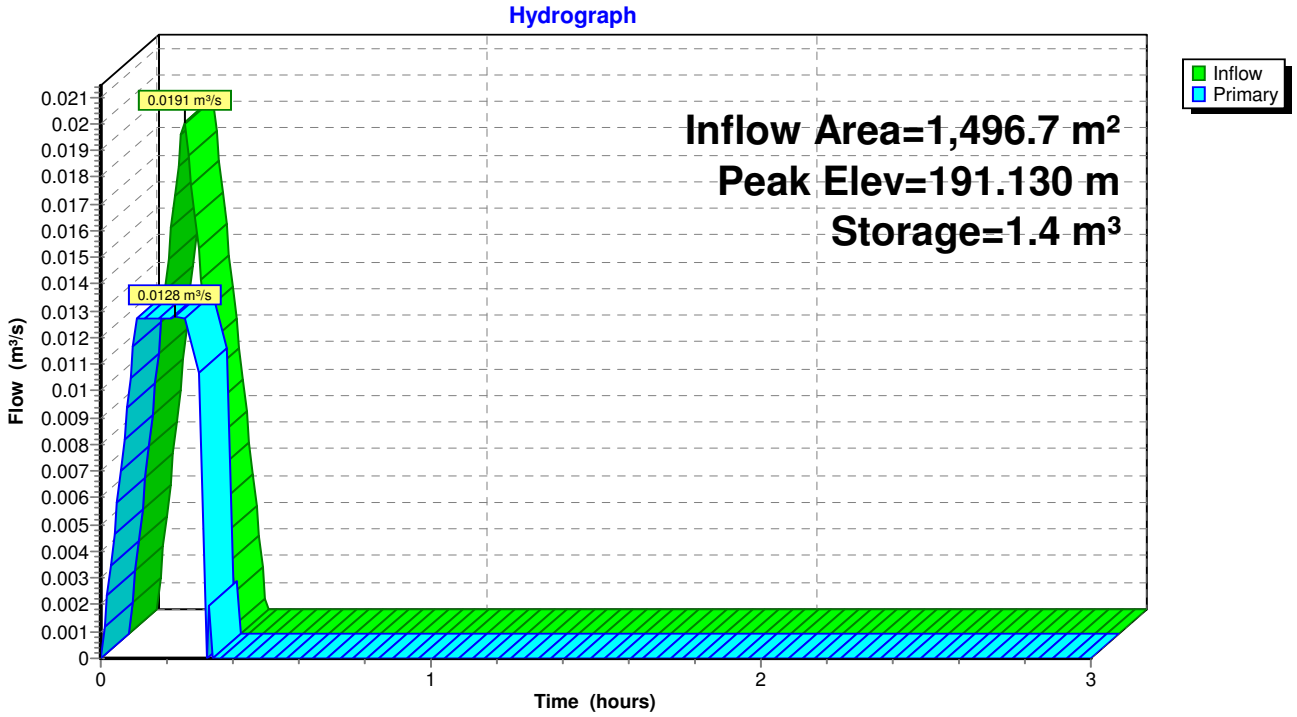
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	200.5	12.0	12.0

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	107.7	6.5	6.5

Device	Routing	Invert	Outlet Devices
#1	Primary	188.220 m	**60 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0128 m³/s @ 0.22 hrs HW=191.130 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0128 m³/s @ 4.51 m/s)

Pond 27P: Outlet



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.70 Runoff=0.0248 m³/s 15.2 m³

Subcatchment 29S: Pre Development Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.40 Runoff=0.0142 m³/s 8.7 m³

Pond 27P: Outlet Peak Elev=191.149 m Storage=3.7 m³ Inflow=0.0248 m³/s 15.2 m³
Outflow=0.0128 m³/s 15.3 m³

Total Runoff Area = 2,993.4 m² Runoff Volume = 23.8 m³ Average Runoff Depth = 8 mm
100.00% Pervious = 2,993.4 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

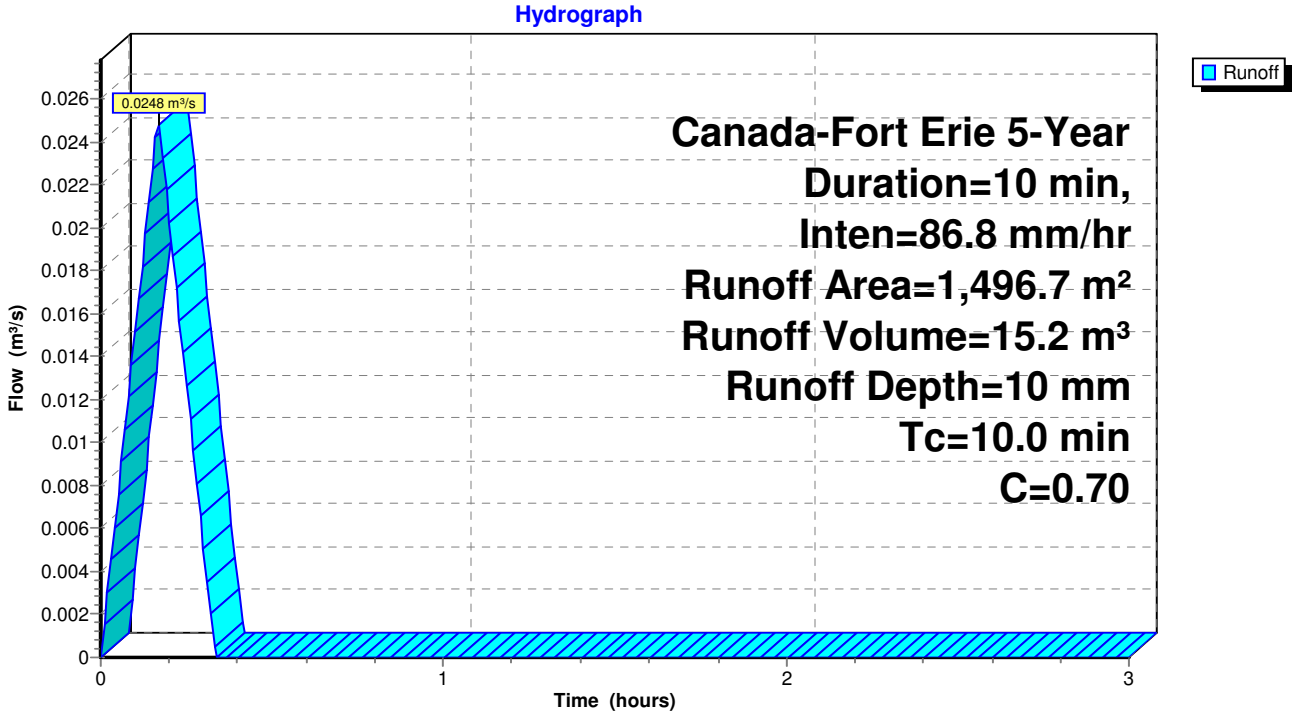
Runoff = 0.0248 m³/s @ 0.17 hrs, Volume= 15.2 m³, Depth= 10 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
250.5	0.70	CA1
534.8	0.70	CA2
216.4	0.70	CA3
495.0	0.70	bldg
1,496.7	0.70	Weighted Average
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development

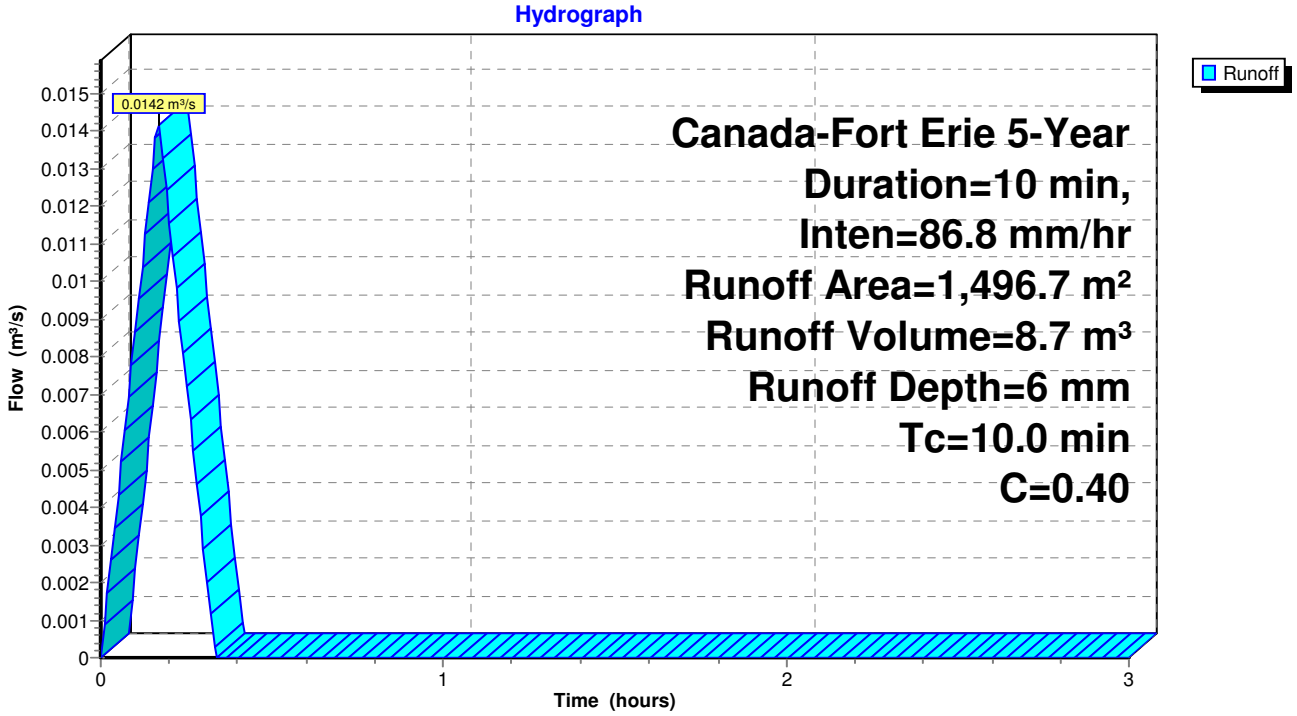
Runoff = 0.0142 m³/s @ 0.17 hrs, Volume= 8.7 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 5-Year Duration=10 min, Inten=86.8 mm/hr

Area (m²)	C	Description
1,496.7	0.40	Existing Single Family
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 1,496.7 m², 0.00% Impervious, Inflow Depth = 10 mm for 5-Year event
Inflow = 0.0248 m³/s @ 0.17 hrs, Volume= 15.2 m³
Outflow = 0.0128 m³/s @ 0.25 hrs, Volume= 15.3 m³, Atten= 48%, Lag= 4.9 min
Primary = 0.0128 m³/s @ 0.25 hrs, Volume= 15.3 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.149 m @ 0.25 hrs Surf.Area= 150.8 m² Storage= 3.7 m³
Flood Elev= 191.220 m Surf.Area= 368.6 m² Storage= 22.2 m³

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.5 min (12.5 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.100 m	3.6 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.100 m	12.0 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.100 m	6.5 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		22.2 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	60.4	3.6	3.6

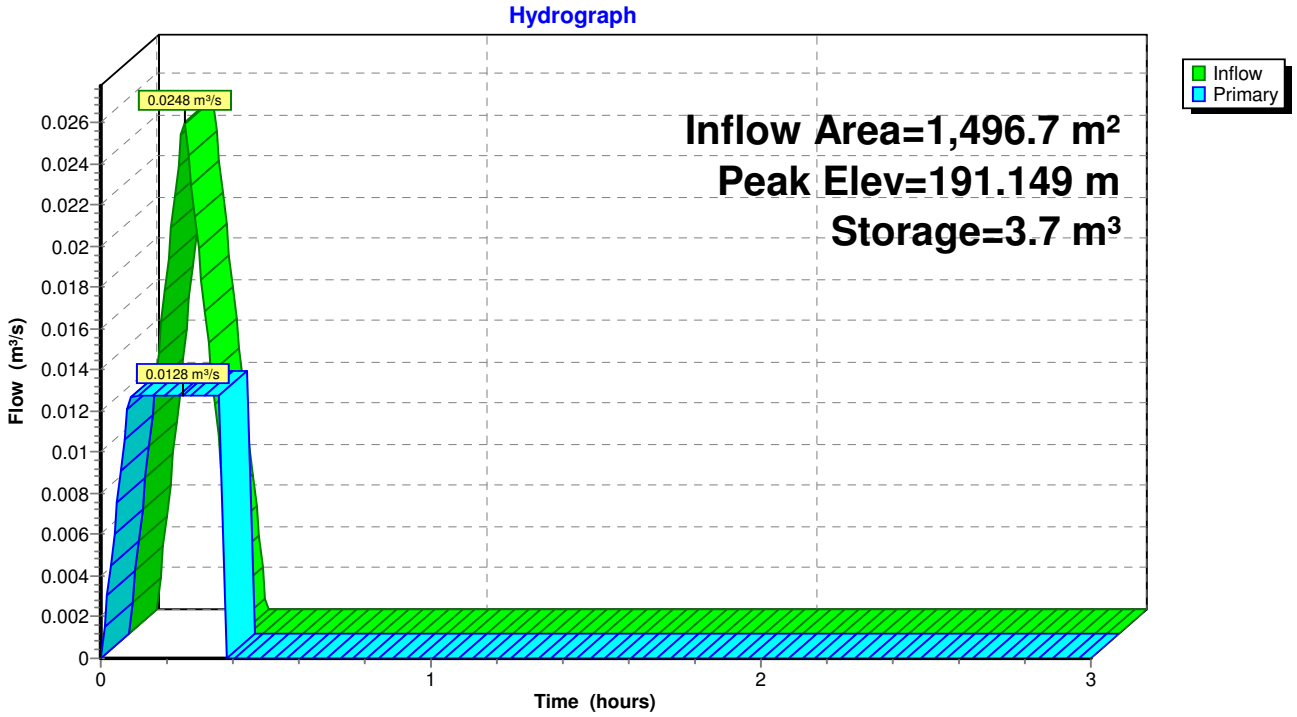
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	200.5	12.0	12.0

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	107.7	6.5	6.5

Device	Routing	Invert	Outlet Devices
#1	Primary	188.220 m	**60 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0128 m³/s @ 0.25 hrs HW=191.149 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0128 m³/s @ 4.52 m/s)

Pond 27P: Outlet



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 28S: Post Development Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.70 Runoff=0.0393 m³/s 24.0 m³

Subcatchment 29S: Pre Development Runoff Area=1,496.7 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.40 Runoff=0.0224 m³/s 13.7 m³

Pond 27P: Outlet Peak Elev=191.185 m Storage=11.1 m³ Inflow=0.0393 m³/s 24.0 m³
Outflow=0.0129 m³/s 24.0 m³

Total Runoff Area = 2,993.4 m² Runoff Volume = 37.7 m³ Average Runoff Depth = 13 mm
100.00% Pervious = 2,993.4 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 28S: Post Development Area 1

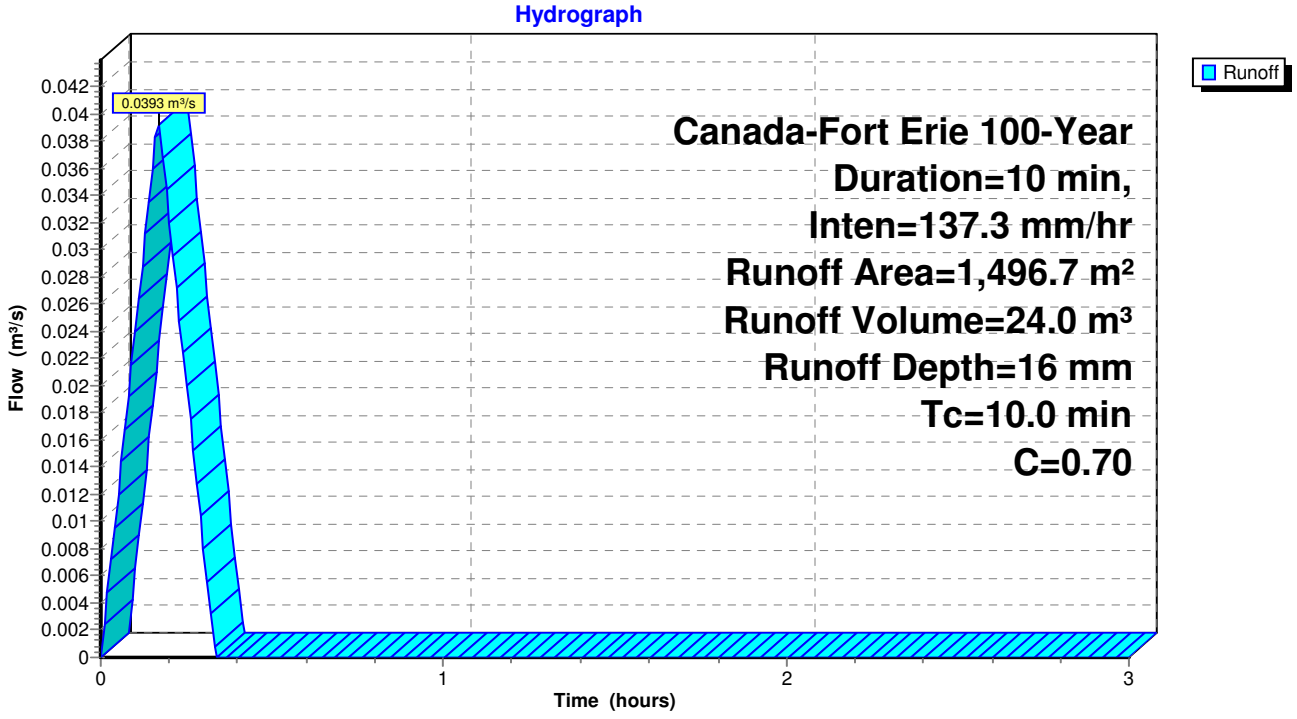
Runoff = 0.0393 m³/s @ 0.17 hrs, Volume= 24.0 m³, Depth= 16 mm
Routed to Pond 27P : Outlet

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
250.5	0.70	CA1
534.8	0.70	CA2
216.4	0.70	CA3
495.0	0.70	bldg
1,496.7	0.70	Weighted Average
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 28S: Post Development Area 1



Summary for Subcatchment 29S: Pre Development

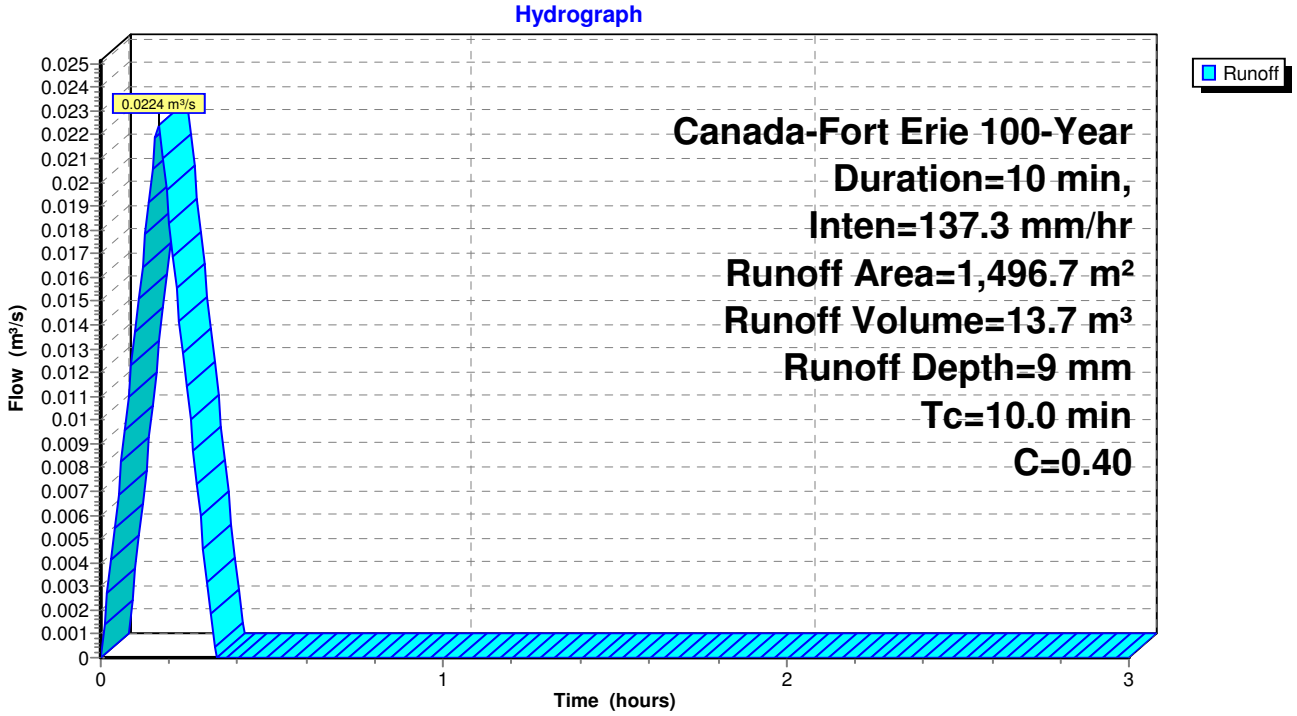
Runoff = 0.0224 m³/s @ 0.17 hrs, Volume= 13.7 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Canada-Fort Erie 100-Year Duration=10 min, Inten=137.3 mm/hr

Area (m²)	C	Description
1,496.7	0.40	Existing Single Family
1,496.7		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry, Direct Entry**

Subcatchment 29S: Pre Development



Summary for Pond 27P: Outlet

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 1,496.7 m², 0.00% Impervious, Inflow Depth = 16 mm for 100-Year event
Inflow = 0.0393 m³/s @ 0.17 hrs, Volume= 24.0 m³
Outflow = 0.0129 m³/s @ 0.28 hrs, Volume= 24.0 m³, Atten= 67%, Lag= 6.7 min
Primary = 0.0129 m³/s @ 0.28 hrs, Volume= 24.0 m³

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 191.185 m @ 0.28 hrs Surf.Area= 260.4 m² Storage= 11.1 m³
Flood Elev= 191.220 m Surf.Area= 368.6 m² Storage= 22.2 m³

Plug-Flow detention time= 7.2 min calculated for 24.0 m³ (100% of inflow)
Center-of-Mass det. time= 7.2 min (17.2 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	191.100 m	3.6 m³	**Cb1 Ponding (Prismatic)** Listed below (Recalc)
#2	191.100 m	12.0 m³	**Cb2 Ponding (Prismatic)** Listed below (Recalc)
#3	191.100 m	6.5 m³	**Cb3 Ponding (Prismatic)** Listed below (Recalc)
		22.2 m³	Total Available Storage

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	60.4	3.6	3.6

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	200.5	12.0	12.0

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
191.100	0.3	0.0	0.0
191.220	107.7	6.5	6.5

Device	Routing	Invert	Outlet Devices
#1	Primary	188.220 m	**60 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.0129 m³/s @ 0.28 hrs HW=191.185 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0129 m³/s @ 4.55 m/s)

Pond 27P: Outlet