



December 2, 2021

The Corporation of the Town of Gananoque
30 King St E
Gananoque, ON
K7G 1E9

RE: Stormwater Management Brief - 875 Stone St N, Gananoque, ON

To Whom it may concern,

Home Hardware, located at 875 Stone St N, Gananoque, Ontario, is proposing to expand the gravel storage yard along the east side of the existing building. The site is located south of the Kings Highway 401 and has an existing storm pond with approximately 576 m³ of storage capacity with a poorly functioning weir as an inlet control device. **Groundwork Engineering Limited (GEL)** has been retained to review the existing stormwater management system and establish a plan to upgrade the existing stormwater management system to support the expanded gravel storage yard.

The proposed additional gravel storage area will add an additional 8,195 m² of impervious surface to the site and result in filling in part of the existing storm pond. As a result, it will be necessary to reconstruct the existing pond and expand it to the east of the current location. A new swale will be installed between the existing pavement and the gravel storage area to convey open sheet flows to the north and along the north side of the gravel storage area. This will allow for the existing runoff to drain to the storm pond without changing the existing parking lot grading.

The proposed gravel area will utilize split drainage and open sheet flow runoff to convey part of the flow to the northeast and directly into the pond. The larger portion will convey to the west and into the new rip-rap-lined swale between the storage area and existing parking lot. The rip-rap-lined swale will convey the flows to the north and under the storage yard entrances using 300mm diameter culvert. The culvert will discharge the collected flows to an enhanced grassed swale, which will reduce total suspended solids before entering into the reconstructed pond.

The reconstructed pond will be expanded to provide a minimum storage volume of 743.75 m³. The expanded storage volume was determined using the Rational Method, which is an effective method of calculating peak flows in small drainage areas of less than 100 ha (hectares) in size. A pre-development (native) base flow of 236.48L/s was established and is the governing flow for the inlet control device. It was calculated that there would be an additional 106.47 L/s increase in the runoff between the existing development and the proposed. The pond was sized to

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provide the 100-Year event runoff storage for the combined flow of the existing development and the additional gravel area and includes an additional 0.3m freeboard.

A time of concentration (T_c) of 15 minutes has been used to calculate the peak runoff flows for pre- and post-development flow rates.

Based on the proposed site conditions, the following runoff coefficients were used to develop a weighted coefficient for each drainage area and to determine runoff flow rates:

Gravel	0.90
Asphalt	0.90
Concrete	0.90
Grassed Areas	0.25
Building Roof Areas	0.90

Rainfall Intensities were derived from Intensity-Duration-Frequency (IDF) curves from MTO Rainfall data. IDF data was obtained from MTO Lookup and has been attached for review.

The existing inlet control device will be changed to a ditch inlet catch basin with sump and a 200mm diameter PVC discharge pipe at 0.3% slope. The discharge pipe flow was calculated to be 233.00L/s, using Manning's Equation to restrict the flow, which is less than the pre-development runoff flow of 236.5 L/s. Calculations are attached.

We trust this is satisfactory for your purposes.

Sincerely,

A handwritten signature in black ink that reads "MBurger".

Martin Burger
MEng., P.Eng.



Attachments:

- The Ministry of Transportation rainfall data for the Gananoque area.
- Calculation showing pre-development runoff flow, existing development runoff and proposed development runoff flow and storage requirements.
- Closed Conduits Partly Flowing Outlet Calculations.

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Active coordinate

44° 20' 15" N, 76° 10' 15" W (44.337500,-76.170833)

Retrieved: Thu, 02 Dec 2021 20:13:05 GMT



Location summary

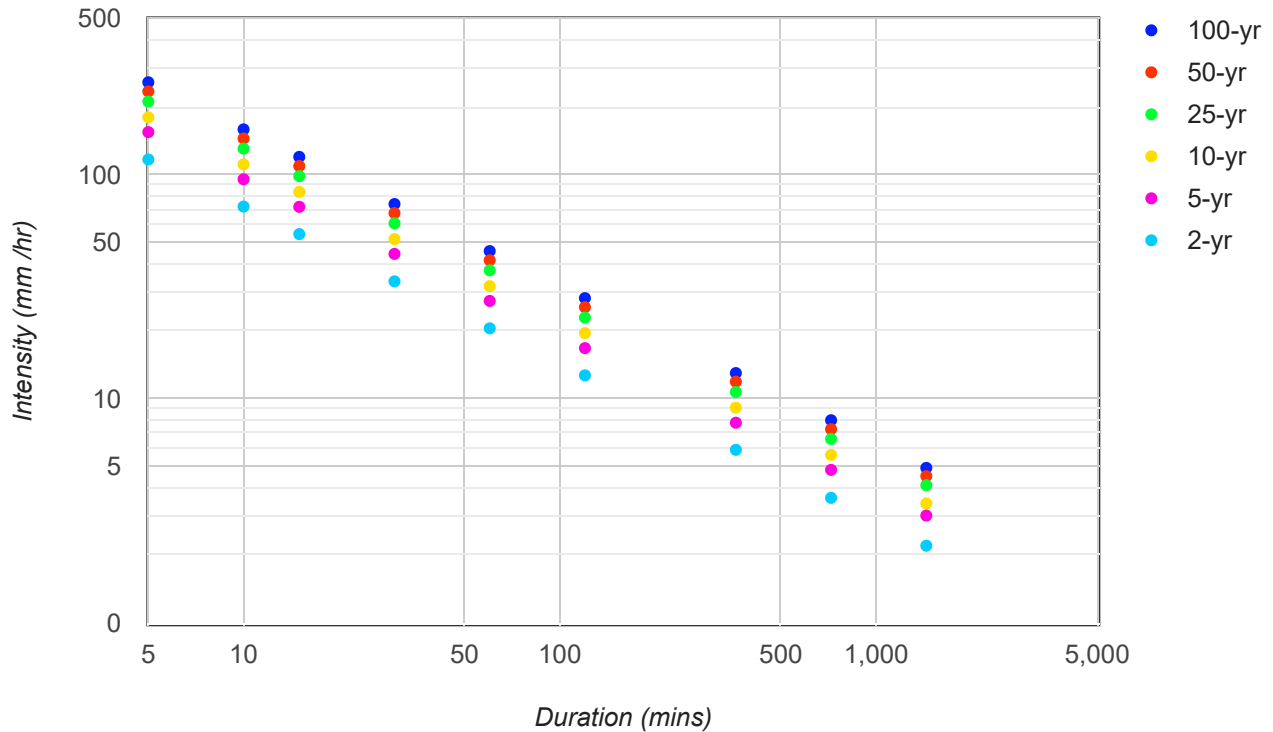
These are the locations in the selection.

IDF Curve: 44° 20' 15" N, 76° 10' 15" W (44.337500,-76.170833)

Results

An IDF curve was found.

Coordinate: 44.337500, -76.170833
IDF curve year: 2010



Coefficient summary

IDF Curve: 44° 20' 15" N, 76° 10' 15" W (44.337500,-76.170833)

Retrieved: Thu, 02 Dec 2021 20:13:05 GMT

Data year: 2010

IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	20.6	27.3	31.8	37.4	41.5	45.6
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	117.0	72.1	54.3	33.4	20.6	12.7	5.9	3.6	2.2
5-yr	155.1	95.5	71.9	44.3	27.3	16.8	7.8	4.8	3.0
10-yr	180.6	111.3	83.8	51.6	31.8	19.6	9.1	5.6	3.4
25-yr	212.4	130.9	98.6	60.7	37.4	23.0	10.7	6.6	4.1
50-yr	235.7	145.2	109.4	67.4	41.5	25.6	11.9	7.3	4.5
100-yr	259.0	159.5	120.2	74.0	45.6	28.1	13.0	8.0	4.9

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	9.8	12.0	13.6	16.7	20.6	25.4	35.3	43.5	53.6
5-yr	12.9	15.9	18.0	22.2	27.3	33.6	46.8	57.7	71.1
10-yr	15.1	18.5	21.0	25.8	31.8	39.2	54.5	67.2	82.8
25-yr	17.7	21.8	24.6	30.4	37.4	46.1	64.1	79.0	97.3
50-yr	19.6	24.2	27.3	33.7	41.5	51.1	71.2	87.7	108.0
100-yr	21.6	26.6	30.0	37.0	45.6	56.2	78.2	96.3	118.7

Terms of Use

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Last Modified: September 2016



Stormwater Management - Home Hardware Gananoque

Pre-Development
DESIGN November 22, 2021

Project Number: 21062
Prepared by: Tim Farrance

Prepared for: Site Plan Control
Checked by: Martin Burger

None Developed Site														
Drainage Area ID	Total Area (m ²)	Land Use & Topography								Grassed Area, Parkland		Product ha (AxR)	Average C	Q (L/s)
		Roof (m ²)	C	Asphalt (m ²)	C	Gravel(m ²)	C	Concrete (m ²)	C	Area (m ²)	C*			
Undeveloped	47324.00	0.00	0.90	0.00	0.90	0.00	0.40	0	0.90	47324.00	0.25	11.83	0.25	236.48
TOTAL	47324.00	0.00	0.90	0.00	0.90	0.00	0.40	0.00	0.90	47324.00	0.25	11.83	0.25	236.48

Tc 15min I= 0.00 Q = 2.78CIA

Pre-Development														
Drainage Area ID	Total Area (m ²)	Land Use & Topography								Grassed Area, Parkland		Product ha (AxR)	Average C	Q (L/s)
		Roof (m ²)	C	Asphalt (m ²)	C	Gravel(m ²)	C	Concrete (m ²)	C	Area (m ²)	C*			
Existing	47324.00	8171.00	0.90	13360.00	0.90	0.00	0.40	658	0.90	25135.00	0.25	26.25	0.55	524.77
TOTAL	47324.00	8171.00	0.90	13360.00	0.90	0.00	0.40	658.00	0.90	25135.00	0.25	26.25	0.55	524.77

Tc 15min I= 71.90 Q = 2.78CIA

Post-Development														
Drainage Area ID	Total Area (m ²)	Land Use & Topography								Grassed Area, Parkland		Product ha (AxR)	Average C	Q (L/s)
		Roof (m ²)	C	Asphalt (m ²)	C	Gravel	C	Concrete (m ²)	C	Area (m ²)	C*			
Proposed	47324.00	8171.00	0.90	13360.00	0.90	8195.00	0.90	658.00	0.90	16940.00	0.25	31.58	0.67	631.24
TOTAL	47324.00	8171.00	0.90	13360.00	0.90	8195.00	0.90	658.00	0.90	16940.00	0.25	31.58	0.67	631.24

Tc 15min I= 71.90 Q = 2.78CIA

Existing 5-yr Return Period (IDF)- Entire Property					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s)	Storage Rate (L/s)	Storage Volume (m ³)
10.00	95.50	697.01	236.48	460.53	276.32
15.00	71.90	524.77	236.48	288.29	259.46
30.00	44.30	323.33	236.48	86.85	156.32
60.00	27.30	199.25	236.48	-37.23	-134.03
120.00	16.80	122.62	236.48	-113.86	-819.82
Approx. Storage					276.32

Proposed 5-yr Return Period (IDF)- Entire Property					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s)	Storage Rate (L/s)	Storage Volume (m ³)
10.00	95.50	838.43	236.48	601.95	361.17
15.00	71.90	631.24	236.48	394.76	355.28
30.00	44.30	388.93	236.48	152.45	274.41
60.00	27.30	239.68	236.48	3.20	11.51
120.00	16.80	147.49	236.48	-88.99	-640.70
Approx. Storage					361.17

Existing 100-yr Return Period (IDF) - Entire Property					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s)	Storage Rate (L/s)	Storage Volume (m ³)
10.00	159.50	1164.12	236.48	927.64	556.58
15.00	120.20	877.29	236.48	640.81	576.73
30.00	74.00	540.09	236.48	303.61	546.50
60.00	45.60	332.81	236.48	96.33	346.80
120.00	28.10	205.09	236.48	-31.39	-226.01
Approx. Storage					576.73

Proposed 100-yr Return Period (IDF) - Entire Property					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s)	Storage Rate (L/s)	Storage Volume (m ³)
10.00	159.50	1400.32	236.48	1163.83	698.30
15.00	120.20	1055.28	236.48	818.80	736.92
30.00	74.00	649.68	236.48	413.20	743.75
60.00	45.60	400.34	236.48	163.86	589.90
120.00	28.10	246.70	236.48	10.22	73.59
Approx. Storage					743.75

Closed Conduits Partly Flowing Outlet Calculations – Home Hardware - Gananoque

Using Manning's Equation for open channel flow SI version (Applied Fluid Mechanics, Sixth Edition (pg. 463) (eq 14-21), Robert L. Mott, Pearson Prentice Hill):

$$Q = \left(\frac{1.00}{\eta} \right) * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

Where,

Q = Flow Rate in m^3/s
 η = Values for Manning's n
 A = Area of channel m^2
 R = hydraulic radius m
 S = Slope as a decimal

Using an iterative approach with various values of A and R it has been established that:

Q = 0.0233 m^3/s
 η = Values for Closed Conduits Flowing PVC 0.010
 A = 0.0314 m^2
 R = 0.05 m
 S = 0.003 (0.3%)

Solving Manning's

$$Q = \left(\frac{1.00}{\eta} \right) * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

$$Q = \left(\frac{1.00}{0.010} \right) * 0.0314 * 0.05^{\frac{2}{3}} * 0.003^{\frac{1}{2}}$$

$$Q = 100.00 * 0.0314 * 0.1357 * 0.0547$$

$$Q = 0.0233 \text{ } m^3/s$$

$$Q = 233.00 \text{ } L/s$$