1842 King Street
City of Hamilton

Storm Water Management Report

February 2022

Lamarre Consulting Group Inc.
25 Brookside Terrace, Smithville, ON L0R 2A0
(905) 818-5205 j.lamarre@cogeco.ca

1.0 INTRODUCTION

Lamarre Consulting Group Inc. has been retained by LanHack Consultants Inc. to assess the storm water management requirements relating to the proposed re-development of the former Brock University property located at 1842 King Street East in the City of Hamilton. The property is approximately 2.682 ha in size and is located between Kenilworth Avenue South and Rosedale Avenue abutting King Street East to the north and Lawrence Road to the south.

Figure 1 – Site Location Map

The site was previously the Hamilton Campus of Brock University. The site consisted of a large single building with associated parking. The coverage of the site under existing conditions is approximately 62.1%. It is proposed to develop the property with six multi-storey buildings. It is noted however that in order to receive LEED certification for this development it is proposed to use green roof technology on the buildings and to utilize permeable pavement on much of the parking and walkway areas. With the use of green roof technology the total impervious coverage of the site will be reduced to approximately 31.2% impervious coverage. This report will review the recommended storm water management strategy used to develop the proposed site in accordance with City of Hamilton storm water management criteria.

2.0 STORMWATER MANAGEMENT

The following section will describe the proposed stormwater management (SWM) plan for the existing and proposed development conditions.

2.1 Stormwater Management Criteria

There is a 450mm combined sewer and a 900mm storm relief sewer along Lawrence Road, and a 375/450mm combined sewer along King Street. Existing and proposed drainage boundaries are shown on the Drainage Area Plans provided in **Appendix E**. According to City GIS mapping, the existing site is mostly accommodated within the storm relief sewer along Lawrence Road. Based on the City of Hamilton standard conditions the following stormwater management (SWM) criteria will be applied to the site:

Stormwater Quantity Control

The 100yr post-development peak flow should be controlled to the lesser of the 2-year pre-development flow or the free flow capacity of the existing storm lateral.

Stormwater Quality Control

Water quality control requirement is to provide Level 1 (enhanced) treatment levels for the proposed site works as per the MOECC SWM Practices Planning and Design Manual (2003).

2.2 Existing/Proposed Conditions

The existing and proposed conditions were assessed using the SWMHYMO Hydrologic Modeling and the 2-year and 100-year IDF parameters for the City of Hamilton design storms.

King Street Outlet

Under existing conditions only a small grassed area and a portion of the west driveway drain out to the King Street East combined sewer. The total area draining to King Street is currently 0.483ha (7.5% impervious). There is an existing 150mm service connection to the King Street combined sewer (150mm @ 12.0% - 0.118m^3/s capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at **0.014m^3/s** and would be the governing criteria to meet. The 100yr pre-development flow from the site to this sewer is estimated at 0.101m^3/s.

Under proposed conditions the area draining to King Street will be reduced such that only the narrow setback strip between the proposed building face and roadway right of way will continue to drain to King Street. This will reduce the total area draining to King Street from 0.483ha to 0.0896ha (28.4% impervious) or approximately 20% of the current drainage area to this outlet. As

it is not feasible to construct quantity controls within this narrow 185m long strip, no further reduction of flows to this system is feasible. The 100yr peak flow from the site to King Street will be reduced from 0.101m^3/s to **0.016m^3/s**, just slightly in excess of the 2yr pre-development peak flow of 0.014m^3/s.

Lawrence Road Outlet

Under existing conditions the majority of the site drains to Lawrence Road. The area draining to Lawrence Road is estimated at 2.199ha with 61.2% impervious coverage. There is an existing 375mm service connection to the Lawrence Road sewer (375mm @ 2.0% - 0.259m^3/s capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at **0.220m^3/s** and would be the governing criteria to meet. The 100yr pre-development flow from the site to this sewer is estimated at 0.737m^3/s.

Under proposed conditions the area draining to Lawrence Road will be increased as recommended by City of Hamilton staff. The total area draining to Lawrence Road will increase from 2.199ha at 61.2% impervious to 2.5924ha at 38.4% impervious coverage. The reduced impervious coverage is due largely to the use of permeable pavers where feasible within the site. Site runoff, except for the narrow setback area between the buildings and the Lawrence Road right of way, will be collected into a storm water tank located on the second level of underground parking in order to allow for a gravity connection to the storm relief sewer on Lawrence Road. The tank footprint of **324m^2** and will hold a total volume of **598m^3**. This volume includes storage within the on-site storm sewer system (21m^3). It is proposed to control the outlet rate from the site using a **275mm orifice plate** installed in MH1 prior to outlet to the storm sewer on Lawrence Road**.** This restriction will back the storm runoff up into the storage tank**.** The depth of water in the SWM tank under a 100-year storm event will be approximately 1.35m (465m^3 at elevation 103.92). The total peak flow to the Lawrence Road storm sewer would be controlled to **0.220m^3/s**, equivalent to the 2yr pre-development peak flow rate. As this tank is below the ground elevation, the top of tank is set at 104.35 while the lowest CB on site 105.45, there is no possibility to have a direct to surface emergency overflow. As such it is proposed to install an overflow stand-by pump system. When the water level reaches elevation 103.92, the design 100yr water level, storm runoff will spill into the pump room adjacent to the storage tank. Assuming a 50% blockage of the outlet pipe, the emergency overflow pump would be sized to convey a minimum of 64l/s (storage tank full) and a maximum of 95l/s such that the total outlet rate to the storm sewer does not exceed the 2yr pre-development flow rate.

See SWMHYMO model analysis in **Appendix B** for more detail. Table 2.1 summarizes the stage-storage-discharge characteristics for the underground SWM tank.

Table 2.1: Stage-Storage-Discharge Relationship for Stormwater (SWM) Storage Tank

Stage Storage Discharge
King Street Hamilton

Input Data:		Orifice Diameter		275	mm			
		Orifice Elevation		102.20	Invert	102.3375	Center	
		Pipe Diameter		250	mm	Overflow Pipe		
		Pipe Elevation						
		C Co-efficient		0.65				
Design to Control to 2yr Pre-Development Flow Rate (0.220cms)								
Stage Storage Discharge								
	Incr.	Area		Total		Orifice	Orifice	Total
Elev.	Elev.	Tank	Depth	Volume		Outlet	Outlet	Outflow
(m)	(m)	(m2)	(m)	(m3)		(m3/s)	(m3/s)	(m3/s)
102.20	0	0	0	0		0		0
102.57	0.00	324	0	16		0.104		0.104
102.82	0.25	324	0.25	102		0.119		0.119
103.07	0.25	324	0.50	183		0.146		0.146
103.32	0.25	324	0.75	264		0.170		0.170
103.57	0.25	324	1.00	345		0.190		0.190
103.82	0.25	324	1.25	426		0.208		0.208
104.07	0.25	324	1.50	507		0.225		0.225
104.35	0.28	324	1.78	598		0.243		0.243

Table 2.2 Hydrologic modelling results.

	2yr (m^3/s)	**100yr (m^3/s)**
Pre-Development		
To King Street (m^3/s)	0.014	0.101
To Lawrence Road (m^3/s)	0.220	0.737
Post- Development		
To King Street (m^3/s)		0.016
Site to Tank (m^3/s)		0.591
Storage Volume (m^3)		465
Depth (m)		1.35
Outlet Rate (m^3/s)		0.216
Total to Lawrence Road (m^3/s)		0.220

From these results, it can be concluded that the 100yr post development peak flows from the site are controlled to the existing 2yr rate into the Lawrence Road storm sewer. The 100yr peak flow from this site into the King Street combined sewer will be reduced from 0.101m^3/s to 0.016m^3/s, slightly exceeding the 2yr peak flow rate.

Stormwater Quality Control

Level 1 enhanced quality control for the proposed site works is required. It is proposed to install a single OGS unit downstream of the storage tank. This unit will be a Hydro First Defense model FD-5HC to treat runoff prior to entering the municipal storm sewer system. Based on the DJDEP/ETV distribution, this unit is sized to provide 83.6% TSS removal, "enhanced" treatment, for the new paved surfaces, excluding the buildings. The installation of an OGS unit on this site will significantly improve storm runoff quality from the property as the existing institutional use currently has no water quality treatment measures in place. See Servicing Plan for the FD-6HC location and refer to the detailed Hydro First Defence sizing report prepared by Hydro International in **Appendix C** for further detail.

2.3 Sediment and Erosion Control

During development of the site, it is important that sediment disturbed by the construction operations are controlled and maintained throughout the construction period. Sediment and erosion control measures will be implemented on site during construction and will conform to the Erosion & Sediment Control Guideline for Urban Construction and City of Hamilton Standards.

Sediment and erosion control measures will include:

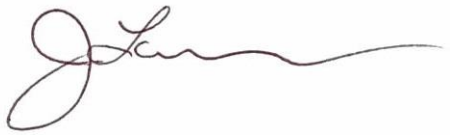
- Installation of silt control fencing at strategic locations around the perimeter of the site where feasible;
- Preventing silt or sediment laden water from entering inlets (existing catch basins/catch basin manholes) by wrapping their tops with filter fabric or installing silt sacks, where feasible;
- Maintaining sediment and erosion control structures in good repair (including periodic cleaning as required) until such time that the Engineer or City of Hamilton approves their removal. Erosion control measures to be inspected daily and after any rainfall event.
- Should excess mud-tracking occur during construction, mud-mats shall be installed to assist with mud-tracking control; where feasible.

2.4 Conclusions and Recommendations

Based on the information provided herein, we conclude that:

- The 100yr peak runoff rate from this site into the Lawrence Road storm sewer will effectively be controlled to the existing 2yr peak rate. This is achieved through the installation of 598m^3 on-site storage (577m^3 tank +21m^3 in pipe) with a 275mm orifice plate to restrict the outlet rate.
- The100yr peak runoff rate from this site into the King Street combined sewer will be effectively controlled to slightly greater than the existing 2yr peak rate. This is achieved through the significant reduction in contributing drainage area to this system.
- Quality of site storm water runoff from the paved areas will be to MOECC enhanced levels through the installation of a Hydro First Defense model FD-6HC unit downstream of the stormwater management tank outlet.
- Erosion and sediment controls be installed as described in section 2.3 of this report.

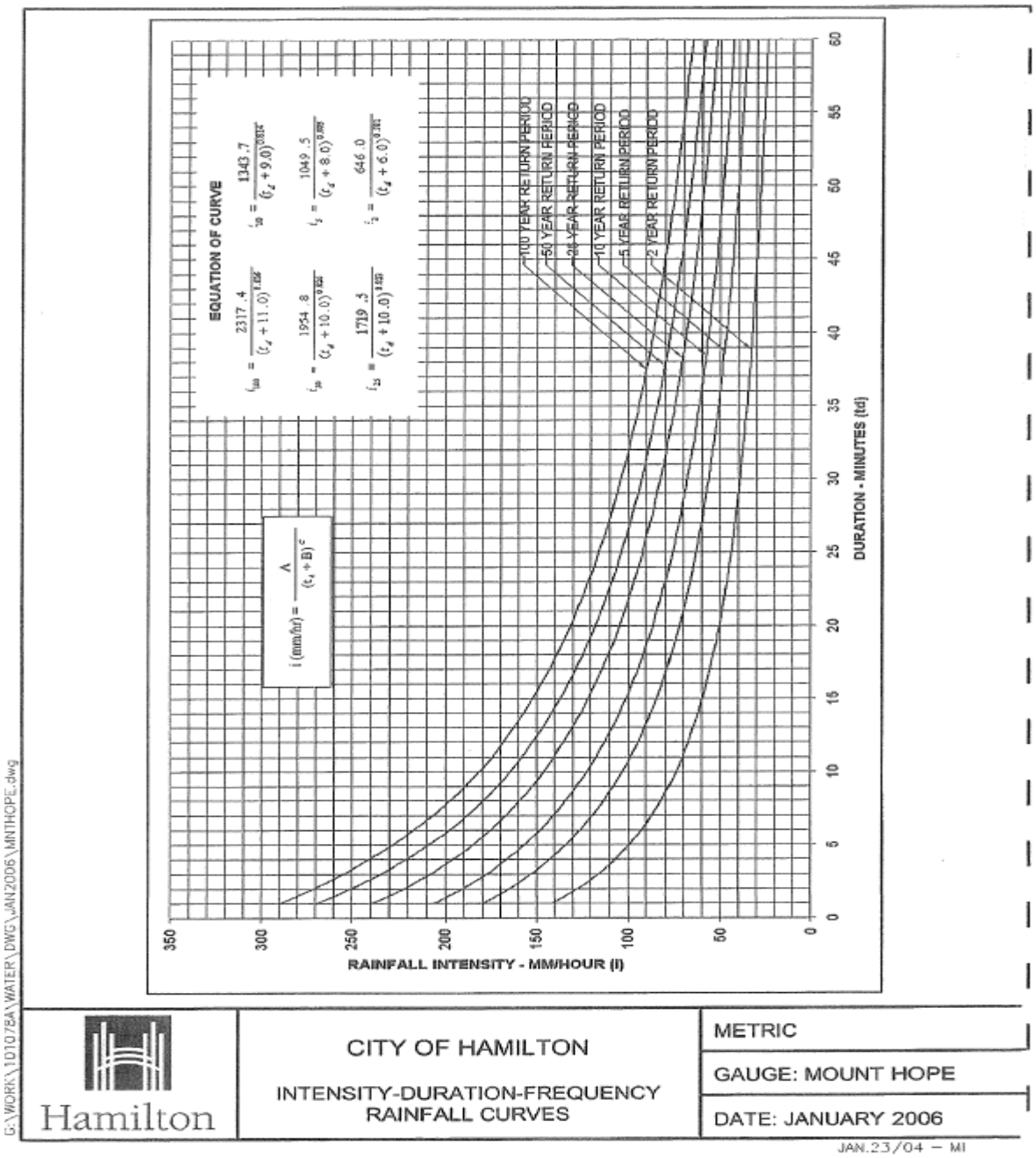
Respectfully submitted,



John Lamarre, P.Eng.
Lamarre Consulting Group Inc.

APPENDIX A: Stormwater Management Information

The rainfall intensities used in the SWMHYMO Modeling Program were taken from the IDF Curve from the City of Hamilton design guidelines.



G:\WORK\101078A\WATER\DWG\JAN2006\MNTHOPE.dwg

Hamilton

CITY OF HAMILTON

INTENSITY-DURATION-FREQUENCY RAINFALL CURVES

METRIC

GAUGE: MOUNT HOPE

DATE: JANUARY 2006

JAN.23/04 — MI

Design storm information used in the hydrologic modeling was based on Chicago Storm Distribution Intensity-Duration Frequency (IDF) equations for the City of Hamilton in the form:

$$i = \frac{A}{(t+B)^C}$$

- i = rainfall intensity (mm/hour)
- t = time of concentration in minutes (10 minutes)
- A, B and C = constant (see above)

APPENDIX B: SWMHYMO Input and Output

```
2
START            0.0
*#*********************************************************************
*#              1842 King Street - City of Hamilton
*#                   LAMARRE CONSULTING GROUP
*#                          February 2022
*#*********************************************************************
*#*********************************************************************
*#
*# 2yr EVENT
*#
*#*********************************************************************

CHICAGO STORM      IUNITS=2  TD=4hrs TPRAT=.40  CSDT=10 min
                        ICASEcs=1      A=646  B=6  C=.791

*#*********************************************************************
*#* PRE DEVELOPMENT
*#*********************************************************************

*#
*# TO KING STREET
*#
CALIB NASHYD            NHYD=1 NHYD=100  DT=10min, AREA=0.447ha DWF=0.0cms
                        CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD          ID=2 NHYD=100  DT=10min AREA=0.036ha
                        XIMP=0.99 TIMP=0.99 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=30 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=30 MNI=0.015  SCI (hr)=0 -1

ADD HYD                 ID=3  NHY=100  ID=1,2

*#
*# TO LAWRENCE ROAD
*#
CALIB STANDHYD          ID=4 NHYD=200  DT=10min AREA=2.199ha
                        XIMP=0.50 TIMP=0.612 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=120 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=120 MNI=0.015  SCI (hr)=0 -1



*#*********************************************************************
*#
*# 100yr EVENT
*#
*#*********************************************************************

CHICAGO STORM      IUNITS=2  TD=4hrs TPRAT=.40  CSDT=10 min
```

```
                        ICASEcs=1      A=2317.4  B=11  C=.836

*#*********************************************************************
*#* PRE-DEVELOPMENT
*#*********************************************************************

*#
*# TO KING STREET
*#
CALIB NASHYD            NHYD=1 NHYD=100  DT=10min, AREA=0.447ha DWF=0.0cms
                        CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD          ID=2 NHYD=100  DT=10min AREA=0.036ha
                        XIMP=0.99 TIMP=0.99 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=30 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=30 MNI=0.015  SCI (hr)=0 -1

ADD HYD                 ID=3  NHY=100  ID=1,2

*#
*# TO LAWRENCE ROAD
*#
CALIB STANDHYD          ID=4 NHYD=200  DT=10min AREA=2.199ha
                        XIMP=0.50 TIMP=0.612 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=120 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=120 MNI=0.015  SCI (hr)=0 -1

*#*********************************************************************
*#* POST DEVELOPMENT
*#*********************************************************************

*#
*# TO KING STREET
*#

CALIB STANDHYD          ID=1 NHYD=401  DT=10min AREA=.0896ha
                        XIMP=0.001 TIMP=0.284 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=120 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=120 MNI=0.015  SCI (hr)=0  -1

*#
*# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)
*#

CALIB STANDHYD          ID=3 NHYD=401  DT=10min AREA=2.5451ha
                        XIMP=0.384  TIMP=0.384 DWF (cms)=0  LOSS=2   CN=76
                        Ia =5.0mm      SLPP (%)=2.0  LGP (m)=120 MNP=0.25  SCP (hr)=0
                        DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=120 MNI=0.015  SCI (hr)=0 -1

*# STORAGE TANK
ROUTE RESERVOIR     ID=4 NHYD=401 IDIN=3 DT=5min
                        OUTFLOW (cms)  STORAGE (ham)
                              0              0
```

```
                    0.104      0.0016
                    0.119      0.0102
                    0.146      0.0183
                    0.170      0.0264
                    0.190      0.0345
                    0.208      0.0426
                    0.225      0.0507
                    0.243      0.0598    -1 -1

*# SOUTH BLVD UNCONTROLLED TO LAWRENCE ROAD


CALIB STANDHYD        ID=5 NHYD=401  DT=10min AREA=0.0473ha
                     XIMP=0.001  TIMP=0.420 DWF (cms)=0  LOSS=2   CN=76
                     Ia =5.0mm      SLPP (%)=2.0  LGP (m)=120 MNP=0.25  SCP (hr)=0
                     DPSI =1.0mm  SLPI (%)= 2.0  LGI  (m)=120 MNI=0.015  SCI (hr)=0 -1

*# TOTAL FLOW TO LAWRENCE ROAD

ADD HYD               ID=6  NHYD=401  ID=4,5


*# Emergency Overflow Sizing - Assume 50% Blockage
*# STORAGE TANK
ROUTE RESERVOIR    ID=4 NHYD=401 IDIN=3 DT=5min
                    OUTFLOW (cms)  STORAGE (ham)
                         0            0
                    0.052      0.0016
                    0.060      0.0102
                    0.073      0.0183
                    0.085      0.0264
                    0.095      0.0345
                    0.104      0.0426
                    0.108      0.0465
                    0.184      0.0466
                    0.185      0.0598    -1 -1



FINISH
```

```
RUN#:COMMAND#
R0001:C00001-----------------------------------------------------------------------------------------
   START
    [TZERO =    .00 hrs on        0]
    [METOUT=   2    (1=imperial, 2=metric output)]
    [NSTORM=   0 ]
    [NRUN  = 0001 ]
#*********************************************************************

#               1842 King Street - City of Hamilton

#                    LAMARRE CONSULTING GROUP

#                              February 2022

#*********************************************************************

#*********************************************************************

#

# 2yr EVENT

#

#*********************************************************************

R0001:C00002-----------------------------------------------------------------------------------------
   CHICAGO STORM
    [SDT=10.00:SDUR=   4.00:PTOT=  33.19]
    [A/B/C= 646.000/   6.000/    .791]
#*********************************************************************

#* PRE DEVELOPMENT

#*********************************************************************

#

# TO KING STREET

#

R0001:C00003------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB NASHYD         10.0 01:       100      .45     .007 No_date    1:50    5.20 .157     .000
    [CN= 76.0: N= 3.00: Tp=  .12]
R0001:C00004------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 02:       100      .04     .007 No_date    1:40   31.94 .962     .000
    [XIMP=.99:TIMP=.99]
    [LOSS= 2 :CN= 76.0]
    [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
    [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI=  30.:MNI=.015:SCI=   .0]
R0001:C00005------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
```

```
   ADD HYD            10.0 01:      100      .45     .007 No_date    1:50    5.20  n/a     .000
              +    10.0 02:      100      .04     .007 No_date    1:40   31.94  n/a     .000
            SUM=    10.0 03:      100      .48     .014 No_date    1:40    7.20  n/a     .000
#

# TO LAWRENCE ROAD

#

R0001:C00006------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 04:      200     2.20     .220 No_date    1:40   20.79 .626     .000
     [XIMP=.50:TIMP=.61]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI=   .0]
#*********************************************************************

#

# 100yr EVENT

#

#*********************************************************************

R0001:C00007-----------------------------------------------------------------------------------------
    CHICAGO STORM
     [SDT=10.00:SDUR=   4.00:PTOT=  91.39]
     [A/B/C=2317.400/  11.000/    .836]
#*********************************************************************

#* PRE-DEVELOPMENT

#*********************************************************************

#

# TO KING STREET

#

R0001:C00008------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB NASHYD         10.0 01:      100      .45     .082 No_date    1:40   41.00 .449     .000
     [CN= 76.0: N= 3.00: Tp=  .12]
R0001:C00009------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 02:      100      .04     .018 No_date    1:40   89.94 .984     .000
     [XIMP=.99:TIMP=.99]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI=  30.:MNI=.015:SCI=   .0]
R0001:C00010------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
   ADD HYD            10.0 01:      100      .45     .082 No_date    1:40   41.00  n/a     .000
              +    10.0 02:      100      .04     .018 No_date    1:40   89.94  n/a     .000
```

```
            SUM=    10.0 03:       100      .48     .101 No_date    1:40   44.64  n/a     .000
#

# TO LAWRENCE ROAD

#

R0001:C00011------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 04:       200     2.20     .737 No_date    1:40   70.77 .774     .000
     [XIMP=.50:TIMP=.61]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI=   .0]
#*********************************************************************

#* POST DEVELOPMENT

#*********************************************************************

#

# TO KING STREET

#

R0001:C00012------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 01:       401      .09     .016 No_date    1:40   53.09 .581     .000
     [XIMP=.00:TIMP=.28]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI=   .0]
#

# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)

#

R0001:C00013------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 03:       401     2.55     .591 No_date    1:40   62.31 .682     .000
     [XIMP=.38:TIMP=.38]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI=   .0]
# STORAGE TANK

R0001:C00014------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
   ROUTE RESERVOIR ->   10.0 03:       401     2.55     .591 No_date    1:40   62.31  n/a     .000
            out <=    5.0 04:       401     2.55     .216 No_date    2:10   62.31  n/a     .000
    {MxStoUsed=.4650E-01  m3}
# SOUTH BLVD UNCONTROLLED TO LAWRENCE ROAD

R0001:C00015------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
 *  CALIB STANDHYD       10.0 05:       401      .05     .010 No_date    1:40   58.00 .635     .000
```

```
     [XIMP=.00:TIMP=.42]
     [LOSS= 2 :CN= 76.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI=   .0]
# TOTAL FLOW TO LAWRENCE ROAD

R0001:C00016------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
   ADD HYD              5.0 04:       401     2.55     .216 No_date    2:10   62.31  n/a     .000
                  +    10.0 05:       401      .05     .010 No_date    1:40   58.00  n/a     .000
               SUM=     5.0 06:       401     2.59     .220 No_date    2:05   62.23  n/a     .000
# Emergency Overflow Sizing - Assume 50% Blockage

# STORAGE TANK

R0001:C00017------------DTmin-ID:NHYD---------AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
   ROUTE RESERVOIR ->   10.0 03:       401     2.55     .591 No_date    1:40   62.31  n/a     .000
             out <=    5.0 04:       401     2.55     .185 No_date    2:15   62.31  n/a     .000
    {MxStoUsed=.5979E-01  m3}
R0001:C00018-------------------------------------------------------------------------------------
   FINISH
```

APPENDIX C: Hydro First Defense HD-6HC Sizing

Hydro First Defense® - HC

Hydro International

Rev. 9.8

Project Name:	1842 King Street	Report Date:	2/8/2022
Street:		City:	Hamilton
Province:	Ontario	Country:	
Designer:		email:	

Paste

Treatment Parameters:

Structure ID:	
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	0.3588 ha
Percent Impervious:	100%
Rational C value:	0.90 Calc. Cn
Rainfall Station:	Hamilton, ONT MAP
Peak Storm Flow:	416 L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	68.2%	99.6%
FD-4HC	78.4%	100.0%
FD-5HC	79.7%	99.9%
FD-6HC	**83.6%**	**99.9%**
FD-8HC	89.2%	99.9%

Model Specification:

Model:	FD-6HC
Diameter:	1800 mm
Peak Flow Capacity:	906.00 L/s
Sediment Storage:	1.22 m^3
Oil Storage:	1878.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	mm	OK
Inlet Pipe 1 Size:	mm	OK
Inlet Pipe 2 Size:	mm	OK
Inlet Pipe 3 Size:	mm	OK
Rim Level:	m	Calc Invs.
Outlet Pipe Invert:	m	
Invert Pipe 1:	m	OK!
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Net Annual Removal Model: FD-6HC

Intensity[1] (mm/hr)	Fraction of Rainfall[1] (%)	FD-6HC Removal Efficiency[2] (%)	Weighted Net Annual Efficiency (%)
0.50	0.4%	100.0%	0.4%
1.00	18.8%	97.1%	18.3%
1.50	10.9%	92.7%	10.1%
2.00	13.9%	89.6%	12.4%
2.50	4.5%	87.2%	4.0%
3.00	2.7%	85.2%	2.3%
3.50	7.8%	83.6%	6.5%
4.00	4.2%	82.1%	3.4%
4.50	2.2%	80.8%	1.8%
5.00	4.7%	79.7%	3.7%
6.00	4.2%	77.7%	3.2%
7.00	4.2%	76.1%	3.2%
8.00	3.2%	74.6%	2.4%
9.00	1.9%	73.4%	1.4%
10.00	2.6%	72.2%	1.9%
20.00	9.2%	64.7%	6.0%
30.00	2.3%	60.4%	1.4%
40.00	1.1%	57.3%	0.6%
50.00	0.5%	54.8%	0.3%
100.00	0.6%	47.4%	0.3%
150.00	0.1%	43.0%	0.0%
200.00	0.0%	39.9%	0.0%
Total Net Annual Removal Efficiency:			**83.6%**
Total Annual Runoff Volume Treated:			**99.9%**

1. Rainfall Data: 1970:2007, HLY03, Hamilton, ON, 6153194.
2. Based in NJDEP / Canada ETV PSD.
3. Rainfall adjusted to 5 min peak intensity based on hourly average.

STATE OF MAINE
JOHN L. LARSON III
No. 10583
LICENSED PROFESSIONAL ENGINEER

2-8-22

Designer Notes:

Certification Note:
Certification is provided herein by a Professional Engineer that this material has been prepared and reviewed by a Professional Engineer registered in the jurisdiction where the work was performed. No assertions are made or implied in regards to certification to the Province of Ontario standards.