

**FUNCTIONAL SERVICING AND  
STORM WATER MANAGEMENT (SWM) REPORT**

for

**1842 King Street East**  
Hamilton, Ontario

Prepared for:

**New Horizon Development Group Inc. (NHDGI)**  
**1842 King St. E. Inc.**

Prepared by:

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Project No. 20064A

April 09, 2021





## Table of Contents

<b>1.0</b>	<b>INTRODUCTION</b> .....	<b>1</b>
1.1	Overview .....	1
1.2	Background Information .....	1
1.3	Geotechnical Investigation .....	2
<b>2.0</b>	<b>STORMWATER MANAGEMENT</b> .....	<b>3</b>
2.1	Stormwater Management Criteria .....	3
2.2	Existing/Proposed Conditions .....	3
2.3	Sediment and Erosion Control .....	6
2.4	Storm Water Conclusions and Recommendations .....	7
<b>3.0</b>	<b>Wastewater Assessment</b> .....	<b>8</b>
3.1	Existing Sanitary Drainage System .....	8
3.2	Sanitary Demands .....	8
<b>4.0</b>	<b>Proposed Water Assessment</b> .....	<b>10</b>
4.1	Existing Water Distribution System .....	10
4.2	Domestic/Fire Water Demands .....	10
4.3	Proposed Water Servicing Plan and Analysis .....	11
<b>5.0</b>	<b>Hydraulic Assessment</b> .....	<b>12</b>
<b>6.0</b>	<b>Conclusion (Domestic/Fire and Sanitary)</b> .....	<b>12</b>
<b>APPENDIX A: Storm Water Management Information</b>		
<b>APPENDIX B: SWMHYMO Input and Summary</b>		
<b>APPENDIX C: Hydro First Defence FD-5HC Sizing</b>		
<b>APPENDIX D: Fire Flow Requirements Calculations</b>		
<b>APPENDIX E: Site Plan and Engineering Drawings</b>		



## 1.0 INTRODUCTION

### 1.1 Overview

Lanhack Consultants Inc. has been retained by New Horizon Development Group Inc. (NHDGI) to prepare a Storm Water Management Report (SWM) and a Water/Wastewater Generation Report (WWGR) in support of a proposed residential condominium and stacked townhouse development consisting of 1381 units in the condominium buildings and 80 units in the stacked townhouse buildings, totaling 1461 units. The property is approximately 2.683 hectares, after road widening, located between King Street East and Lawrence Road, just west of Kenilworth Avenue South. Please refer to **Figure 1** for the Location Map and **Appendix E** for the Site Plan designed by Graziani and Corazza Architects Inc.

The site is currently developed with an existing school.

The site will be equipped with storm and sanitary service connections to Lawrence Road and water service connections to King Street East and Lawrence Road. The proposed building will be sprinklered.

This portion of the report will provide the conceptual framework for water distribution, fire flows, sanitary sewage, and storm water for the development of this site. This report will also provide design drawings, prepared by Graziani and Corazza Architects Inc. and Lanhack Consultants Inc., in support of the planning applications.

Please refer to the Graziani and Corazza Architects Inc. and Lanhack drawings attached in **Appendix E** for additional information.

The proposed condominium development is intended to be a LEED certified development. The developer, at the site plan stage, will be considering the feasibility of several sustainable measures such as:

- Over sizing the SWM tank for rainwater collection for irrigation purposes
- Infiltration trenches along the west and east property lines
- Permeable paver driveway
- Salt management
- Increasing topsoil thickness along the side lot lines due to the native clay soils
- Heat island mitigation measures
- Stockpiling of topsoil off site to be reused after the structure has been completed.

### 1.2 Background Information

The following documents were referenced in the preparation of this report:

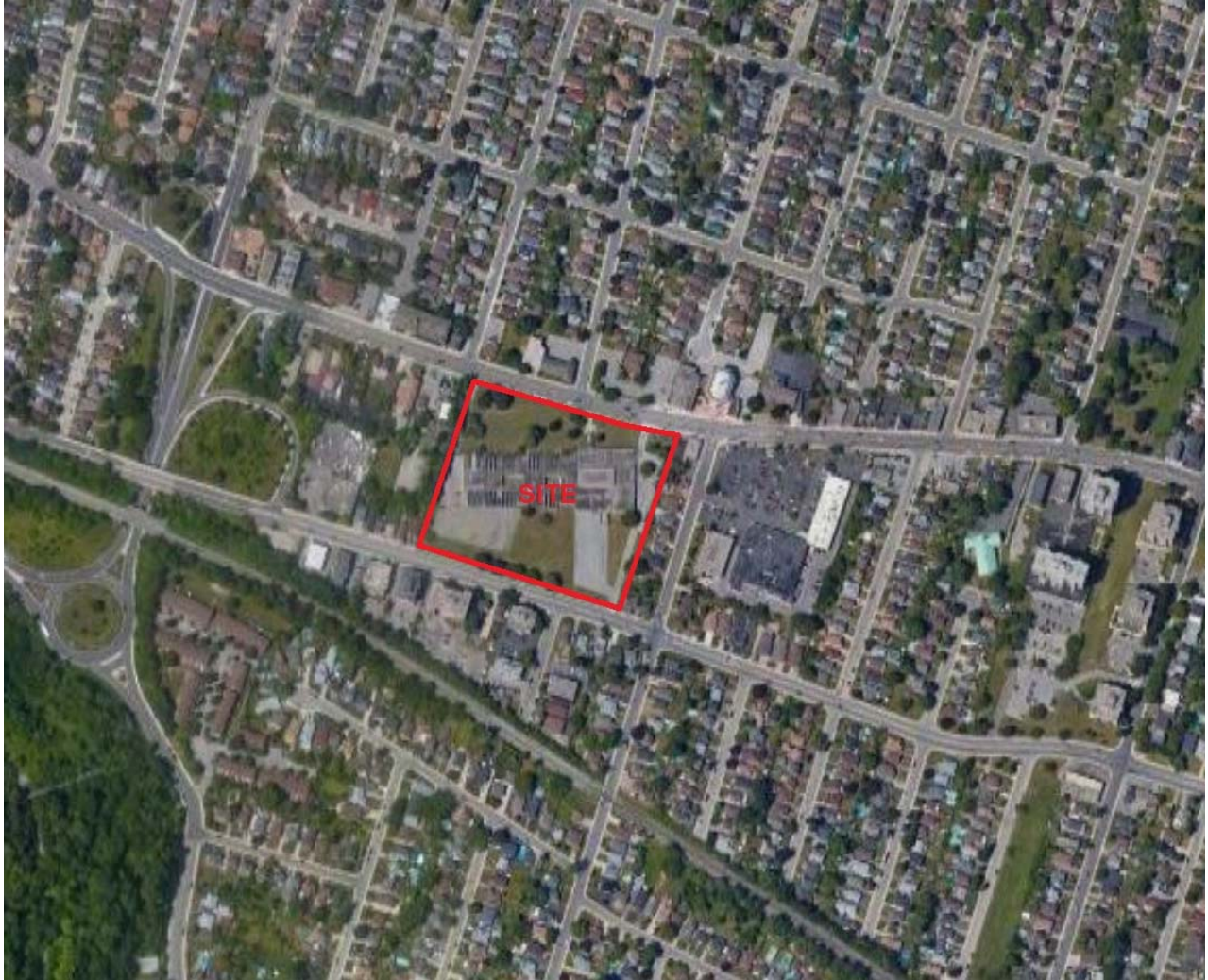
*Ref. 1: Comprehensive Development Guidelines and Financial Policies Manual (City of Hamilton, 2019)*

*Ref 2: Ontario Building Code (OBC - 2012)*

*Ref 3: Ministry of the Environment (MOE) – Design Guidelines for Drinking Water Systems (2008)*

### 1.3 Geotechnical Investigation

The Geotechnical Report will be submitted by others under a separate cover.



**Figure 1:** Location plan of 1842 King Street East (via Google Maps)



## 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 375/450 mm 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 flow should be controlled to the lesser of the 2-year pre-development flow or the free flow capacity of the existing storm lateral. In addition, City of Hamilton staff provided drainage area plans outlining the design assumptions for the existing sewer systems on King Street and Lawrence Road.

#### **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. In addition, the 5yr design allowance into the receiving system on King Street West and Lawrence Road were determined based on the Rational Method.

#### **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. There is an existing 150mm service connection to the King Street combined sewer (150mm @ 12.0% - 0.118m<sup>3</sup>/s capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at 0.014m<sup>3</sup>/s. The 100yr pre-development flow from the site to this sewer is estimated at 0.101m<sup>3</sup>/s. The City of Hamilton design allowance into this system is estimated at 0.128m<sup>3</sup>/s (Rational Method 5yr). Hence, the existing service connection to King Street has the capacity to convey the existing 100yr flow from the site without surcharge. In addition, the existing 100yr flows from the site are less than the design allowance in this system as per the City of Hamilton (5yr design storm).



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 0.096ha, 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<sup>3</sup>/s to 0.018m<sup>3</sup>/s, just slightly in excess of the 2yr pre-development peak flow of 0.014m<sup>3</sup>/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<sup>3</sup>/s capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at 0.220m<sup>3</sup>/s. The 100yr pre-development flow from the site to this sewer is estimated at 0.737m<sup>3</sup>/s. The City of Hamilton design allowance into this system is estimated at 0.383m<sup>3</sup>/s (Rational Method 5yr). Hence, the existing service connection to Lawrence Road Street has the capacity to convey the existing 2yr flow from the site without surcharge. The existing service connection does not have capacity to convey the existing 100yr peak flows from the site and the 5yr design allowance as per the City of Hamilton (5yr design storm).

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 2.586ha at 76.0% impervious coverage. The storm runoff from the developed site will be controlled by an underground stormwater storage tank with an orifice plate outlet. This storage tank would be located on the first level of underground parking in order to allow for a gravity connection to the storm relief sewer on Lawrence Road.

In order to control the peak flow from this site to the City of Hamilton recommended 2yr pre-development peak flow (0.220m<sup>3</sup>/s), without any change in impervious coverage on the site, a 805m<sup>3</sup> tank would have to be constructed. The footprint of this tank would be 405m<sup>2</sup>. In order to control the peak flow from this site to the City of Hamilton recommended 2yr pre-development peak flow (0.220m<sup>3</sup>/s), with an impervious coverage of 76% as per the current site plan, a 942m<sup>3</sup> tank would have to be constructed. The footprint of this tank would be 470m<sup>2</sup>. In order to control the peak flow from this site to the City of Hamilton design allowance for flows to Lawrence Road (0.383m<sup>3</sup>/s), with an impervious coverage of 76% as per the current site plan, a 636m<sup>3</sup> tank would have to be constructed. The footprint of this tank would be 330m<sup>2</sup>.

See Servicing Plan in **Appendix E**. **Appendix A** contains detailed hydrologic modeling parameters and **Appendix B** contains SWMHYMO input/output printouts for the proposed conditions.

It is recommended that storm water quantity control be achieved through the construction of underground stormwater management (SWM) tank with a total volume of **636m<sup>3</sup>**. It is proposed to control



the outlet rate from this tank using a **365mm orifice plate**. The depth of water in the SWM tank under a 100-year storm event will be approximately 1.93m. The total peak flow to the Lawrence Road storm sewer will be controlled to the 5yr design allowance in the Lawrence Road sewer system (0.383m<sup>3</sup>/s). This is significantly less than the pre-development 100yr flow from the site (0.737m<sup>3</sup>/s). See SWMHYMO model analysis in **Appendix B** and Servicing Plan in **Appendix E** for more detail. Table 2.1 summarizes the stage-storage-discharge characteristics for the underground SWM tanks.

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

<b>Stage Storage Discharge</b>								
<b>King Street Hamilton</b>								
<b>Input Data:</b>		Orifice Diameter	365 mm					
		Orifice Elevation	102.57	Invert	102.7525	Center		
		Pipe Diameter	200 mm		Overflow Pipe			
		Pipe Elevation	104.57	Invert	104.67	Center		
		C Co-efficient	0.62					
<b>Design to control to 5yr Design Allowance per City of Hamilton Plans (0.383cms)</b>								
<b>Stage Storage Discharge</b>								
Elev. (m)	Incr. Elev.	Area Pond	Depth Area	Total Volume		Orifice Outlet # 1	Orifice Outlet # 2	Total Outflow
102.57	0.00	330	0	0		0.000		0.000
102.82	0.25	330	0.25	83		0.075		0.075
103.07	0.25	330	0.50	165		0.162		0.162
103.32	0.25	330	0.75	248		0.216		0.216
103.57	0.25	330	1.00	330		0.260		0.260
103.82	0.25	330	1.25	413		0.297		0.297
104.07	0.25	330	1.50	495		0.330		0.330
104.32	0.25	330	1.75	578		0.360		0.360
104.57	0.25	330	2.00	660		0.387	0.000	0.387
104.82	0.25	330	2.25	743		0.413	0.000	0.413



Table 2.2 Hydrologic modelling results.

	2yr	5yr	100yr
<b>Pre-Development</b>			
To King Street (m <sup>3</sup> /s)	0.014	0.033	0.101
To Lawrence Road (m <sup>3</sup> /s)	0.220	0.335	0.737
<b>City Design Allowance</b>			
To King Street (m <sup>3</sup> /s)		0.128	
To Lawrence Road (m <sup>3</sup> /s)		0.383	
<b>Post- Development</b>			
To King Street (m <sup>3</sup> /s)			0.018
Site to Tank (m <sup>3</sup> /s)			0.949
Storage Volume (m <sup>3</sup> )			636
Depth (m)			1.93
Outlet Rate (m <sup>3</sup> /s)			0.378
Total to Lawrence Road (m <sup>3</sup> /s)			0.383

From these results, it can be concluded that the 100yr post development peak flows from the site are controlled to less than the 5yr City of Hamilton design allowance for flows into the King Street and Lawrence Road sewer systems.

### **Stormwater Quality Control**

Level 1 enhanced quality control for the proposed site works is required. It is proposed to install a single OGS units downstream of the storage tank. This unit will be a Hydro First Defence HC model FD-5HC to treat runoff prior to entering the municipal storm sewer system. Based on the standard “fine” distribution, this unit is sized to provide enhanced treatment for the entire site, including building roof tops. Based on the DJDEP/ETV distribution, this unit is sized to provide 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. See Servicing Plan for the FD-5HC 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 (Ref 6) 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 Town of Milton 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 Storm Water Conclusions and Recommendations

Based on the information provided herein, we conclude that:

- Site runoff will effectively be controlled to less than the City of Hamilton 5yr design allowances for the receiving sewers on King Street and Lawrence Road through the reduction in contributing drainage area to King Street and the installation of a single 636m<sup>3</sup> storage tank with a 365mm orifice plate to restrict the outlet rate.
- Quality of site storm water runoff will be to enhanced levels through the installation of a Hydro First Defence HC model FD-5HC unit downstream of the stormwater management tank outlet.
- Erosion and sediment controls be installed as described in section 2.4 of this report.

Respectfully submitted,

Lanhack Consultants Inc.

A handwritten signature in cursive script, appearing to read 'John Lamarre'.



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



### **3.0 Wastewater Assessment**

The proposed development will consist of four (4) residential condominium buildings containing 1175 one-bedroom units, 198 two-bedroom units, and 8 three-bedroom units, totaling 1381 units between the four condominium buildings. There will also be two (2) stacked townhouse buildings on the proposed development each containing 16 two-bedroom units and 24 three-bedroom units, totaling 32 two-bedroom units and 48 three-bedroom units. Based on the site plan and floor plans prepared by Graziani and Corazza Architects Inc., the design population and equivalent sanitary flow for the development were determined using the City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual 2019.

#### **3.1 Existing Sanitary Drainage System**

The existing sanitary drainage system consists of a 450mm $\emptyset$  combined sewer within the King Street East right-of-way, and a 600mm $\emptyset$  sanitary sewer within the Lawrence Road right-of-way. See Servicing Plan in **Appendix E** for more details.

#### **3.2 Sanitary Demands**

The anticipated sanitary discharge from the proposed development was estimated using the City of Hamilton Development Guidelines (2019). The sanitary discharge flow from the subject site is summarized in **Table 3.1**.



Table 3.1: Sanitary Discharge Flow Rate

Type of Unit	Number of Bedrooms per Unit <sup>(1)</sup>	Average Daily Flow per Capita (L/d) <sup>(2)</sup>	Total Number of Units <sup>(3)</sup>	Design Population <sup>(4)</sup>	Total Peak Flow <sup>(5)(6)</sup> (L/s)	Including Infiltration Allowance <sup>(7)</sup> (L/s)
1-Bedroom Unit	1.0	360	1175	2350	58.17	<b>59.78</b>
2-Bedroom Unit	2.0	360	230	920		
3-Bedroom Unit	3.0	360	56	336		
<i>(1) Number of bedrooms based on site plan and floor plans prepared by Graziani and Corazza Architects Inc.</i>						
<i>(2) Average Domestic Sewage Flow Rate from City of Hamilton Development Guideline Chapter E.1.4 Daily Flow = 360 L/day/capita</i>						
<i>(3) Refer to site plan prepared by Graziani and Corazza Architects Inc. – <b>Appendix E</b></i>						
<i>(4) Design population based on two (2) persons per sleeping room within a dwelling unit or suite. Refer to OBC Section 3.1.17.1.(1).(b)</i>						
<i>(5) Total Avg. Flow = [(Avg. Daily Flow per Capita) x (Total Design Population)] = [360 L/d/person x (2350 persons + 920 persons+ 336 persons)] / 24 / 60 / 60 = 15.03 L/s</i>						
<i>(6) Total peak flow determined from City of Hamilton Development Guideline Chapter E.1.5 (Babbitt Formula) <math>M = 5 / P^{0.2} = 5 / (3606/1000)^{0.2} = 3.87</math></i>						
<i>(7) Infiltration Allowance determined from the City of Hamilton development Guideline Chapter E.1.6. Infiltration Allowance of 0.6 L/s/ha was used for the site = 0.6 L/s x 2.68 ha = 1.61 L/s</i>						

**Total Sanitary Discharge Peak Flow Rate = 59.78 L/s**

### 3.3 Proposed Servicing Plan and Capacity Analysis (Review based on peak flows)

The proposed development will be serviced with two (2) 375mmØ sanitary services. The sanitary services will drain to the existing sanitary sewer along Lawrence Road. As calculated in **Table 3.1**, the total anticipated peak sanitary sewer discharge from the proposed development is **59.78 L/s**. It is expected that the receiving system has the capacity for the estimated sanitary discharge rate.



## 4.0 Proposed Water Assessment

The proposed development will consist of four (4) residential condominium buildings and be two (2) stacked townhouse buildings which will contain 1175 one-bedroom units, 230 two-bedroom units, and 56 three-bedroom units, totaling 1461 units between the six (6) buildings. Based on the site plan and floor plans prepared by Graziani and Corazza Architects Inc., the design population for the development will be determined using the Ontario Building Code (OBC 2012), City of Hamilton Design Standards and the equivalent domestic water flow will be determined using the Design Guidelines for Drinking-Water Systems (MOE, 2008).

### 4.1 Existing Water Distribution System

The existing municipal water distribution system around the site consists of a 200mm $\varnothing$  within King Street East and Lawrence Road. There are two existing fire hydrants along King Street East and two existing fire hydrants along Lawrence Road on the other side of the street. See Servicing Plan in **Appendix E** for more detail.

### 4.2 Domestic/Fire Water Demands

The expected domestic demand for the proposed development was estimated according to the City of Hamilton Design Standards and MOE design criteria. The estimated water consumption was calculated based on an occupancy rate of 2.0 persons per sleeping room within a dwelling unit or suite as per OBC Section 3.1.17.1(1).(b). The design population will be taken at 3,606 persons at the domestic water demand at a rate of 360 L/day/capita. Anticipated water demands are summarized in **Table 4.1**.

Water supply calculations for fire protection were determined using the Ontario Building Code (OBC 2012) and the City of Hamilton Watermain Fire Flow Requirement Design Guidelines. See **Appendix D** for a detailed analysis. The required fire flow is **150.00 L/s**.





## 5.0 Hydraulic Assessment

C3 Water Inc. has prepared a supportive hydraulic assessment report for the proposed development. The hydraulic assessment will be submitted as a separate document.

## 6.0 Conclusion (Domestic/Fire and Sanitary)

Based on the information provided herein, we conclude that the maximum water supply flow and the sanitary discharge at 1842 King Street East meet the design requirements of the City of Hamilton and the Ministry of Environment (MOE). The available flows within the municipal system are adequate and are not expected to be negatively impacted from the proposed development. Therefore, it is recommended that:

### *Sanitary Drainage System*

- The sanitary discharge for the subject site will drain to the existing 450mm and 600mm diameter sanitary sewer along Lawrence Road. The anticipated total peak discharge will be **59.78 L/s**.

### *Water Supply System*

- The water supply for the subject site will be from the existing 200mm diameter watermain along King Street East and Lawrence road, respectfully. The anticipated maximum daily water consumption rate for the development will be **178.56 L/s**.
- A minimum fire suppression flow of **9,000 L/min (150.00 L/s)** will be required as per the Ontario Building Code and City of Hamilton Watermain Fire Flow Requirement Design Guidelines.

We trust the information enclosed is satisfactory. Should you have any questions please do not hesitate to contact our office.

Respectfully submitted,

Glenn Worley  
Lanhack Consultants Inc.

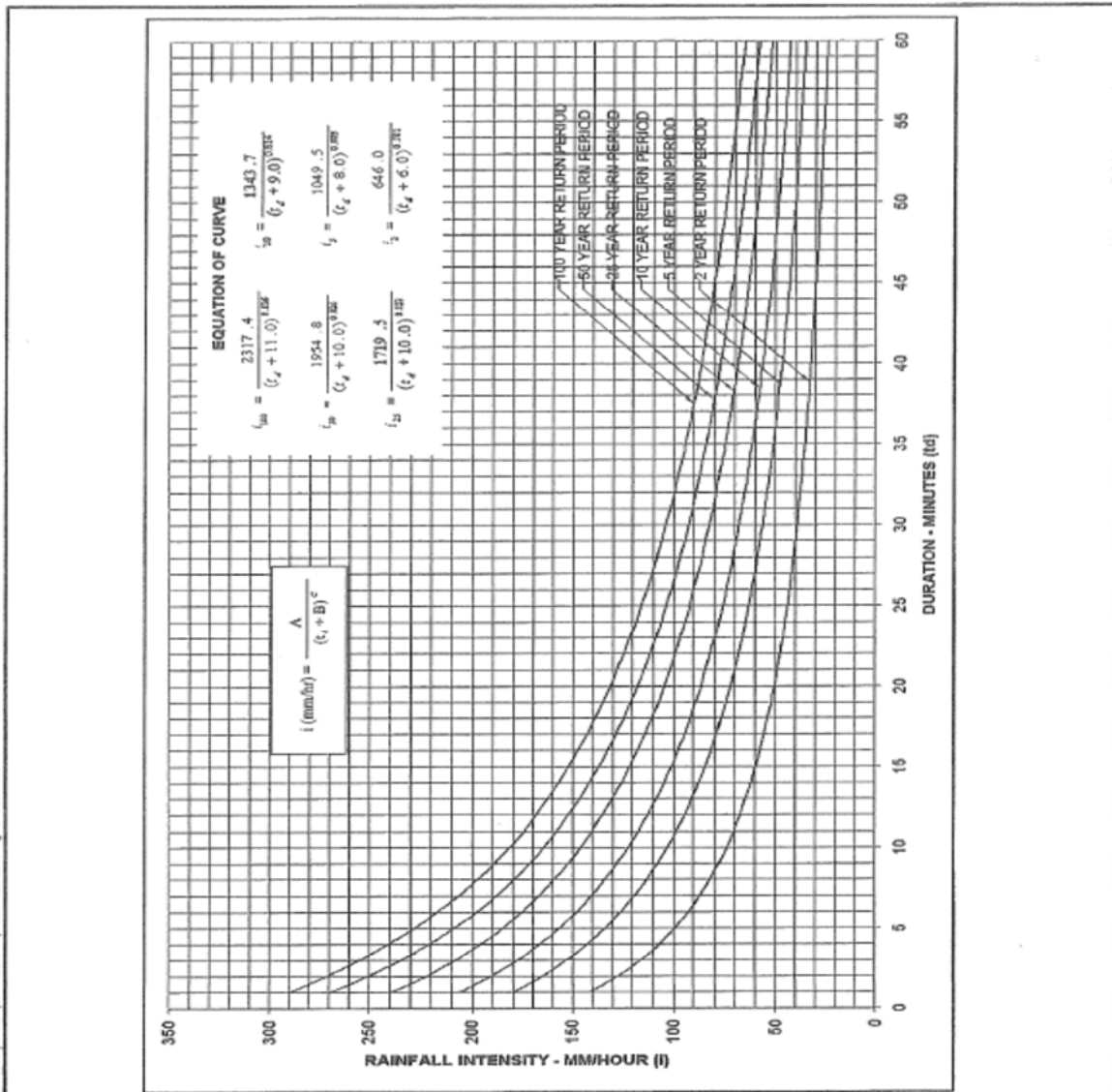


Dave Hacking, P.Eng  
Lanhack Consultants Inc.



### APPENDIX A: Storm Water 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\101076A\WATER\DWG\JAN2006\MINTHOPE.dwg



CITY OF HAMILTON  
 INTENSITY-DURATION-FREQUENCY  
 RAINFALL CURVES

METRIC
GAUGE: MOUNT HOPE
DATE: JANUARY 2006



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 Summary

```

2
START      0.0
*#*****
*#      1842 King Street - City of Hamilton
*#      LAMARRE CONSULTING GROUP
*#      March 2021
*#*****
*#*****
*#
*# 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

```

```

*#*****
*#
*# 5yr EVENT
*#
*#*****

```

```

CHICAGO STORM  IUNITS=2 TD=4hrs TPRAT=-.40 CSDT=10 min
                ICASEcs=1  A=1049.5 B=8 C=.803

```

```

*#*****
*#* 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 NASHYD NHYD=1 NHYD=300 DT=10min, AREA=0.096ha DWF=0.0cms  
CN=76 IA=10.0mm N=3 TP=0.12hrs -1

\*#

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

\*# SAME IMPERVIOUS COVERAGE AS EXISTING CONDITION

\*#

CALIB NASHYD NHYD=2 NHYD=400 DT=10min, AREA=0.041ha DWF=0.0cms  
CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD ID=3 NHYD=401 DT=10min AREA=2.545ha  
XIMP=0.50 TIMP=0.612 DWF (cms)=0 LOSS=2 CN=76



File No. 20064A  
 Functional Servicing and SWM Report – 1842 King Street East

la =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
0.053	0.0101
0.095	0.0203
0.123	0.0304
0.146	0.0405
0.166	0.0506
0.184	0.0608
0.200	0.0709
0.215	0.0810
0.229	0.0911 -1 -1

ADD HYD ID=5 NHYD=400 ID=2, 4

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

CALIB NASHYD NHYD=2 NHYD=400 DT=10min, AREA=0.041ha DWF=0.0cms  
 CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD ID=3 NHYD=401 DT=10min AREA=2.545ha  
 XIMP=0.50 TIMP=0.76 DWF (cms)=0 LOSS=2 CN=76  
 la =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
0.053	0.0118
0.095	0.0235
0.123	0.0353
0.146	0.0470
0.166	0.0588
0.184	0.0705
0.200	0.0823
0.215	0.0940
0.229	0.1058 -1 -1

ADD HYD ID=5 NHYD=400 ID=2, 4

\*#  
 \*# TO LAWRENCE ROAD (CONTROLLED TO DESIGN ALLOWANCE Q=0.383cms)  
 \*#

CALIB NASHYD NHYD=2 NHYD=400 DT=10min, AREA=0.041ha DWF=0.0cms  
 CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD ID=3 NHYD=401 DT=10min AREA=2.545ha  
 XIMP=0.50 TIMP=0.76 DWF (cms)=0 LOSS=2 CN=76  
 la =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
0.075	0.0083



File No. 20064A  
Functional Servicing and SWM Report – 1842 King Street East

0.162	0.0165
0.216	0.0248
0.260	0.0330
0.297	0.0413
0.330	0.0495
0.360	0.0578
0.387	0.0660
0.413	0.0743 -1 -1

ADD HYD

ID=5 NHYD=400 ID=2, 4

FINISH



SSSS W W M M H H Y Y M M O O O 222 000 11 77777 =====
S W W W M M M M H H Y Y M M M O O 2 0 0 11 7 7
SSSS W W W M M M H H H H Y M M M O O 2 0 0 11 7 Ver4.05.0
S W W M M H H Y M M O O 222 0 0 11 7 APR 2017
SSSS W W M M H H Y M M O O 2 0 0 11 7 =====
2 0 0 11 7 #2720641
StormWater Management HYdrologic Model 222 000 11 7 =====

\*\*\*\*\*
\*\*\*\*\* SWMHYMO Ver4.05.0 \*\*\*\*\*
\*\*\*\*\* A single event and continuous hydrologic simulation model \*\*\*\*\*
\*\*\*\*\* based on the principles of HYMO and its successors \*\*\*\*\*
\*\*\*\*\* OTTHYMO-83 and OTTHYMO-89. \*\*\*\*\*
\*\*\*\*\* Distributed by: J.F. Sabourin and Associates Inc. \*\*\*\*\*
\*\*\*\*\* Ottawa, Ontario: (613) 836-3884 \*\*\*\*\*
\*\*\*\*\* Gatineau, Quebec: (819) 243-6858 \*\*\*\*\*
\*\*\*\*\* E-Mail: swmhymo@jfsa.com \*\*\*\*\*
\*\*\*\*\*

+++++
+++++ Licensed user: John Lamarre, P.Eng. +++++
+++++ Grimsby SERIAL#:2720641 +++++
+++++

\*\*\*\*\*
\*\*\*\*\* +++++ PROGRAM ARRAY DIMENSIONS +++++ \*\*\*\*\*
\*\*\*\*\* Maximum value for ID numbers : 11 \*\*\*\*\*
\*\*\*\*\* Max. number of rainfall points: 105408 \*\*\*\*\*
\*\*\*\*\* Max. number of flow points : 105408 \*\*\*\*\*
\*\*\*\*\*

\*\*\*\*\* SUMMARY OUTPUT \*\*\*\*\*
\*\*\*\*\*
\* RUN DATE: 2021-03-21 TIME: 19:05:11 RUN COUNTER: 000001 \*
\*\*\*\*\*
\* Input file: D:\WORK FILES\2020 Projects\2014 - King Street Hamilton\KingSt.dat \*
\* Output file: D:\WORK FILES\2020 Projects\2014 - King Street Hamilton\KingSt.out \*
\* Summary file: D:\WORK FILES\2020 Projects\2014 - King Street Hamilton\KingSt.sum \*
\* User comments: \*
\* 1: \_\_\_\_\_ \*
\* 2: \_\_\_\_\_ \*
\* 3: \_\_\_\_\_ \*
\*\*\*\*\*

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
# March 2021
#\*\*\*\*\*
#\*\*\*\*\*



```

#
# 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]
#*****
#
# 5yr EVENT
#
#*****
R0001:C00007-----
  CHICAGO STORM
  [SDT=10.00:SDUR= 4.00:PTOT= 50.15]
  [A/B/C=1049.500/ 8.000/ .803]
#*****
#* 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 .023 No_date 1:40 13.39 .267 .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 .010 No_date 1:40 48.82 .974 .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 .023 No_date 1:40 13.39 n/a .000
    + 10.0 02: 100 .04 .010 No_date 1:40 48.82 n/a .000
  SUM= 10.0 03: 100 .48 .033 No_date 1:40 16.03 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 .335 No_date 1:40 34.44 .687 .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:C00012-----
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:C00013-----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:C00014-----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:C00015-----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:C00016-----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:C00017-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C---DWFcms
* CALIB NASHYD 10.0 01: 300 .10 .018 No_date 1:40 41.00 .449 .000
[CN= 76.0: N= 3.00: Tp= .12]
#
# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)
# SAME IMPERVIOUS COVERAGE AS EXISTING CONDITION
#
R0001:C00018-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C---DWFcms
* CALIB NASHYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 .449 .000
[CN= 76.0: N= 3.00: Tp= .12]
R0001:C00019-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C---DWFcms
* CALIB STANDHYD 10.0 03: 401 2.55 .853 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]
# STORAGE TANK
R0001:C00020-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ROUTE RESERVOIR -> 10.0 03: 401 2.55 .853 No_date 1:40 70.77 n/a .000
out <= 5.0 04: 401 2.55 .214 No_date 2:05 70.77 n/a .000
{MxStoUsed=.8054E-01 m3}
R0001:C00021-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ADD HYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 n/a .000
+ 5.0 04: 401 2.55 .214 No_date 2:05 70.77 n/a .000
SUM= 5.0 05: 400 2.59 .217 No_date 2:05 70.30 n/a .000
#
# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)
#
R0001:C00022-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
* CALIB NASHYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 .449 .000
[CN= 76.0: N= 3.00: Tp= .12]
R0001:C00023-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
* CALIB STANDHYD 10.0 03: 401 2.55 .949 No_date 1:40 76.26 .834 .000
[XIMP=.50:TIMP=.76]
[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:C00024-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ROUTE RESERVOIR -> 10.0 03: 401 2.55 .949 No_date 1:40 76.26 n/a .000
out <= 5.0 04: 401 2.55 .215 No_date 2:05 76.26 n/a .000
{MxStoUsed=.9425E-01 m3}
R0001:C00025-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ADD HYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 n/a .000
+ 5.0 04: 401 2.55 .215 No_date 2:05 76.26 n/a .000
SUM= 5.0 05: 400 2.59 .218 No_date 2:05 75.70 n/a .000
#
# TO LAWRENCE ROAD (CONTROLLED TO DESIGN ALLOWANCE Q=0.383cms)
#
R0001:C00026-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
* CALIB NASHYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 .449 .000
[CN= 76.0: N= 3.00: Tp= .12]
R0001:C00027-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
* CALIB STANDHYD 10.0 03: 401 2.55 .949 No_date 1:40 76.26 .834 .000
[XIMP=.50:TIMP=.76]
[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:C00028-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ROUTE RESERVOIR -> 10.0 03: 401 2.55 .949 No_date 1:40 76.26 n/a .000
out <= 5.0 04: 401 2.55 .378 No_date 1:55 76.26 n/a .000
{MxStoUsed=.6362E-01 m3}
R0001:C00029-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C----DWFcms
ADD HYD 10.0 02: 400 .04 .008 No_date 1:40 41.00 n/a .000
+ 5.0 04: 401 2.55 .378 No_date 1:55 76.26 n/a .000
SUM= 5.0 05: 400 2.59 .383 No_date 1:55 75.70 n/a .000
R0001:C00030-----
FINISH

```



### APPENDIX C: Hydro First Defence FD-5HC Sizing

Hydro First Defense® - HC Net Annual Water Quality Worksheet Rev. 9.8				Hydro International			
Project Name: 1842 King Street		Report Date: 2020-12-04		Net Annual Removal Model: FD-5HC			
Street:		City: Hamilton		Intensity <sup>(1)</sup>	Fraction of Rainfall <sup>(1)</sup>	FD-5HC Removal Efficiency <sup>(2)</sup>	Weighted Net Annual Efficiency
Province: Ontario		Country:		(mm/hr)	(%)	(%)	(%)
Designer:		email:		0.50	0.4%	99.2%	0.4%
<b>Treatment Parameters:</b>				<b>RESULTS SUMMARY</b>			
Structure ID:				<b>Model</b>	<b>TSS</b>	<b>Volume</b>	
TSS Goal: 80 % Removal				FD-3HC	75.4%	90.0%	1.00
TSS Particle Size: Fine				FD-4HC	79.5%	96.9%	1.50
Area: 2.586 ha				<b>FD-5HC</b>	<b>83.3%</b>	<b>99.2%</b>	2.00
Percent Impervious: 76%				FD-6HC	85.7%	99.7%	2.50
Rational C value: 0.76 Calc. Cr				FD-8HC	90.2%	100.0%	3.00
Rainfall Station: Hamilton, ON MAP							3.50
Peak Storm Flow: 416 L/s							4.00
							4.50
							5.00
							6.00
							7.00
							8.00
							9.00
							10.00
							20.00
							30.00
							40.00
							50.00
							100.00
							150.00
							200.00
				<b>Total Net Annual Removal Efficiency:</b>			<b>83.3%</b>
				<b>Total Annual Runoff Volume Treated:</b>			<b>99.2%</b>
<b>Model Specification:</b>				1. Rainfall Data: 1970:2007, HLY03, Hamilton, ON, 6 153 194.			
Model: FD-5HC				2. Based on third party verified data and approximating the removal of a PSD similar to the STC Fine distribution			
Diameter: 1500 mm				3. Rainfall adjusted to 5 min peak intensity based on hourly average.			
Peak Flow Capacity: 566.00 L/s							
Sediment Storage: 0.84 m <sup>3</sup>							
Oil Storage: 1136.00 L							
<b>Installation Configuration:</b>							
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							
<b>Designer Notes</b>							



# Hydro First Defense® - HC

## Net Annual Water Quality Worksheet



Rev. 9.8

Project Name: **1842 King Street** Report Date: **2020-12-04** Paste  
 Street: \_\_\_\_\_ City: **Hamilton**  
 Province: **Ontario** Country: \_\_\_\_\_  
 Designer: \_\_\_\_\_ email: \_\_\_\_\_

Net Annual Removal Model: FD-5HC			
Intensity <sup>(1)</sup>	Fraction of Rainfall <sup>(1)</sup>	FD-5HC Removal Efficiency <sup>(2)</sup>	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	100.0%	0.4%
1.00	18.8%	94.9%	17.9%
1.50	10.9%	90.6%	9.9%
2.00	13.9%	87.4%	12.1%
2.50	4.5%	85.0%	3.9%
3.00	2.7%	83.1%	2.3%
3.50	7.8%	81.4%	6.3%
4.00	4.2%	80.0%	3.3%
4.50	2.2%	78.7%	1.7%
5.00	4.7%	77.6%	3.6%
6.00	4.2%	75.6%	3.1%
7.00	4.2%	73.9%	3.1%
8.00	3.2%	72.5%	2.3%
9.00	1.9%	71.2%	1.4%
10.00	2.6%	70.1%	1.8%
20.00	9.2%	62.6%	5.8%
30.00	2.3%	58.2%	1.3%
40.00	1.1%	55.1%	0.6%
50.00	0.5%	52.7%	0.3%
100.00	0.6%	45.2%	0.3%
150.00	0.1%	40.8%	0.0%
200.00	0.0%	37.7%	0.0%
<b>Total Net Annual Removal Efficiency:</b>		<b>81.5%</b>	
<b>Total Annual Runoff Volume Treated:</b>		<b>99.9%</b>	

### Treatment Parameters:

Structure ID: \_\_\_\_\_  
 TSS Goal: **80% Removal**  
 TSS Particle Size: **NJDEP / ETV**  
 Area: **0.304 ha**  
 Percent Impervious: **100%**  
 Rational C value: **0.90** Calc. Cn  
 Rainfall Station: **Hamilton, ON** MAP  
 Peak Storm Flow: **416 L/s**

### RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	70.2%	99.7%
FD-4HC	80.4%	100.0%
<b>FD-5HC</b>	<b>81.5%</b>	<b>99.9%</b>
FD-6HC	85.4%	99.9%
FD-8HC	90.6%	99.9%

### Model Specification:

Model: **FD-5HC**  
 Diameter: **1500 mm**  
 Peak Flow Capacity: **566.00 L/s**  
 Sediment Storage: **0.84 m<sup>3</sup>**  
 Oil Storage: **1136.00 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

### Designer Notes

1. Rainfall Data: 1970-2007, HLY03, Hamilton, ON, 6 53 194.

2. Based in NJDEP / Canada ETV PSD.

3. Rainfall adjusted to 5 min peak intensity based on hourly average.



## APPENDIX D: Fire Flow Requirements Calculations

The following calculations are for the proposed development at 1842 King Street East Hamilton, Ontario. The required fire flow for the proposed development is based on the largest residential condominium (Building A) representing the worst-case scenario. The required fire flow will be based calculated using the Ontario Building Code (OBC) and the City of Hamilton Watermain Fire Flow Requirement Design Guidelines, the greater of both methods will be used in the design calculations.

### **Required Fire Flow calculated using the OBC:**

The Ontario Building Code 2012 requires that a minimum water supply source 'Q' be provided at a minimum pressure of 140 kPa (20 psi). The minimum flow 'Q' can be calculated as:

$$Q = K \cdot V \cdot Stot$$

#### **Determining 'K' – Water Supply Coefficient:**

As per KNYMH Inc. design, the building is classified under the OBC as 3.2.2.42 Group C, Any Height, Any Area, Sprinklered. Therefore, the building will be of non-combustible construction with fire separations and fire resistance ratings provided in accordance with Subsection 3.2.2.42.

Using the OBC Div. B – A-3.2.5.7. Table 1 we determine the value of 'K' as:

$$K = 10$$

#### **Determining 'V' – Volume of Building:**

Volume of the residential condominium building provided by Graziani and Corazza Architects Inc.

$$V = 171,678 \text{ m}^3$$

#### **Determining 'S<sub>tot</sub>' – Spatial Coefficient:**

The spatial coefficient is based on the exposure distance from the property line to all sides of the residential condominium. Refer to site plan designed by Graziani and Corazza Architects Inc., **Appendix E**. The spatial coefficient can be calculated as:

$$S_{tot} = 1.0 + (S_N + S_E + S_S + S_W)$$

The north side of the building will be used as S<sub>1</sub> and will then go in a clockwise manner ending with the west side of the building being S<sub>6</sub>. Values for all sides are as follows:



Side	Exposure Distance (m) <sup>(1)(2)(3)</sup>	Spatial Coefficient <sup>(4)</sup>
Side S <sub>1</sub>	16.82	0.0
Side S <sub>2</sub>	8.00	0.2
Side S <sub>3</sub>	9.00	0.1
Side S <sub>4</sub>	19.07	0.0
Side S <sub>5</sub>	4.50	0.5
Side S <sub>6</sub>	7.50	0.25

*(1) Refer to site plan designed by Graziani and Corazza Architects Inc. – Appendix E*

*(2) When facing a street, the property line shall be deemed to be the centre of the street as per the “Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code”*

*(3) When facing a building the exposure distance was calculated using the mid-point between the two buildings*

*(4) Spatial Coefficient from OBC Div. B – A-3.2.5.7. Figure 1*

$$S_{\text{tot}} = 1.0 + (0.0 + 0.2 + 0.1 + 0.0 + 0.5 + 0.25) = 2.05$$

$$S_{\text{tot}} = 2.0 \text{ as per OBC Div. B. - A-3.2.5.7.3.(a)}$$

**Determining ‘Q’ – Minimum Water Supply in Litres:**

$$Q = K \cdot V \cdot S_{\text{tot}}$$

$$Q = 10 \times 171,678 \times 2.0$$

$$Q = 3,433,560 \text{ L}$$

**Determining Minimum Water Supply Flow Rate:**

Using OBC Div. B – A-3.2.5.7. Table 2 we can determine the minimum water supply flow rate using the value Q = 3,433,560 L. Since the value of Q is greater than 270,000 L, we can determine the minimum water supply flow rate as:

$$\text{Flow Rate} = 9,000 \text{ L/min} = 150.00 \text{ L/s}$$

**Required Fire Flow calculated using City of Hamilton Watermain Fire Flow Requirement Design Guidelines:**

The building is classified as a Residential Multi (greater than 3 units) therefore we can determine the target available fire flow as:

$$\text{Flow Rate} = 150.00 \text{ L/s}$$



## **APPENDIX E: Site Plan and Engineering Drawings**

- *Site Plan designed by Graziani and Corazza Architects Inc.*
- *Preliminary Grading, Erosion and Sediment Control Plan prepared by Lanhack Consultants Inc.*
- *Preliminary Servicing Plan prepared by Lanhack Consultants Inc.*
- *Existing Catchment Area Plan prepared by Lanhack Consultants Inc.*
- *Proposed Catchment Area Plan prepared by Lanhack Consultants Inc.*







