S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

September 27, 2017

File: 17086

City of Hamilton
71 Main St. West
Hamilton, Ontario
L8P 4Y5

RE: Fire Flow Estimate
154 Main Street East
City of Hamilton

The proposed development consists of constructing a 25-storey mixed-use condominium building with a 6-storey parking garage. Refer to the Site Plan prepared by WZMH Architects for details.

Fire flow demands for the development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA).

Existing hydrants are located at 60 Walnut Street South and 172 Main Street East both within the required 90m separation from building face adjacent to a street (as per Sentence 3.2.5.7 of the 2012 Ontario Building Code), no additional private fire hydrants are proposed for this development.

The proposed condominium building and parking garage structure will require a 2 hour firewall to separate the residential/commercial portion of the building from the parking garage, effectively separating the overall development into two separate building structures as shown on the attached plan (first floor example).

Residential/Commercial Portion:
This portion of the proposed building will be constructed of fire-resistive construction (C=0.6), with 1 hour fire rating protection on vertical openings and exterior communications. The building will also be constructed with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction). The exposure corrections for the residential/commercial portion of the proposed building are based on the following:

North face: 10% correction (20.1m to 30.0m)
South face: 10% correction (Firewall)
East face: 25% correction (0m to 3.0m)
West face: 15% correction (10.1m to 20.0m)
Total: 60%

Attached is an estimate of the required fire flow rate for the residential/commercial portion of the proposed building. The flow rate was determined in accordance with the Fire Underwriters Survey - 1999 Water Supply for Public Fire Protection, as specified by the City of Hamilton. It

has been determined that the required fire flow for the proposed development is **5000 l/min (83 l/s)**.

Parking Structure Portion:
This portion of the proposed building will be constructed of fire-resistive construction (C=0.6), with 1 hour fire rating protection on vertical openings and exterior communications with limited combustible occupancy (-15% correction) and a sprinkler system (-40% correction). The exposure corrections for the parking structure portion of the proposed building are based on the following:

North face: 10% correction (Firewall)
South face: 15% correction (10.1m to 20.0m)
East face: 25% correction (0m to 3.0m)
West face: 15% correction (10.1m to 20.0m)
Total: 65%

Attached is an estimate of the required fire flow rate for the parking garage portion of the proposed building. The flow rate was determined in accordance with the Fire Underwriters Survey - 1999 Water Supply for Public Fire Protection, as specified by the City of Hamilton. It has been determined that the required fire flow for the proposed development is **7000 l/min (117 l/s)**.

The following hydrant flow test data for the public fire hydrant in closest proximity to the proposed development has been analysed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 1 below summarizes the hydrant flow data made available by the City of Hamilton:

Table 1 – Hydrant Flow Data	
Hydrant ID	HA16H003
Location	172 MAIN STREET EAST
Test Date	25-08-2015 7:10:42 AM
Static Pressure	86 psi
Residual Pressure During Test Flow	66 psi
Test Flow Rate	770 IGPM (58 l/s)
Theoretical Flow @ 20 psi	**1467 IGPM (111 l/s)**
Hydrant ID	HA14H032
Location	60 WALNUT STREET SOUTH
Test Date	09-11-2015 3:15:30 PM
Static Pressure	68 psi
Residual Pressure During Test Flow	60 psi
Test Flow Rate	790 IGPM (60 l/s)
Theoretical Flow @ 20 psi	**2079 IGPM (158 l/s)**

Based on the above hydrant flow test data, the theoretical maximum available flow rate for the hydrant closes to the main entrance from Walnut Street and fire panel is **158 l/s**, while the maximum required fire flow for the proposed development is only **117 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the subject site.

Therefore, based on the above analysis, the proposed water distribution system will have the capacity and pressure required to adequately service the proposed development.

We trust that the information provided addresses the City of Hamilton requirements.

Prepared by:

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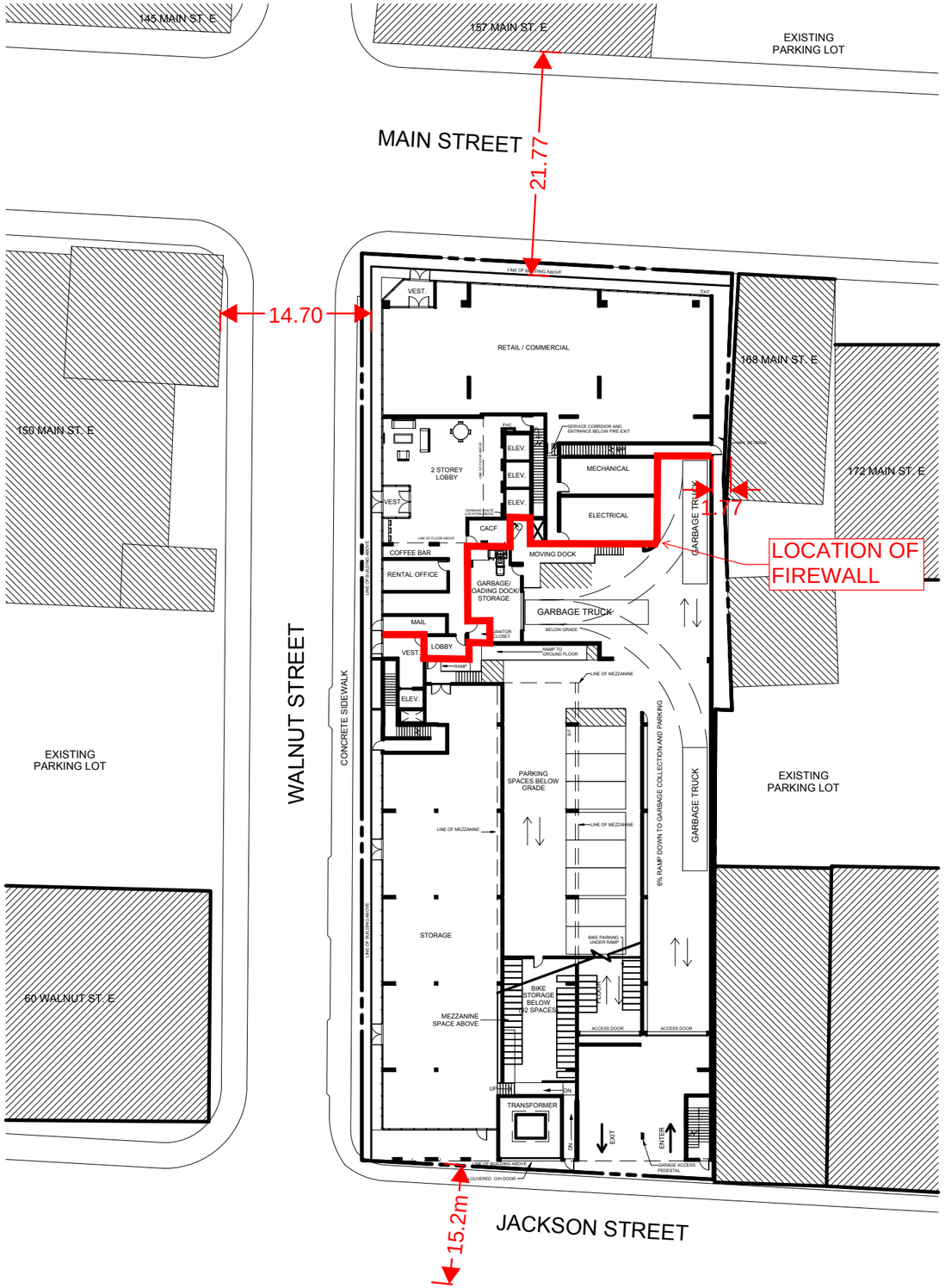

FIGURE 1.0

FIRE FLOW

SCALE: 1:500

PROJECT: 154 MAIN STREET EAST
PROJECT No.: 17086

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

Project Number: 17086
Project Name: 154 Main Street East
Date: 27-Sep-17

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:

$$F = 220\,C\sqrt{A} \qquad (1)$$

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

	Building Area				(1)		(2)			(3)		(4)		Final Adjusted Fire Flow	
Building / Location	Footprint Area (m^2)	# of Storeys	**Total GFA (m^2)**	Type of Construction	***Fire Flow "F"*** (l/min)	(l/s)	***Occupancy*** %	Adjustment (l/min)	**Adjusted Fire Flow (l/min)**	***Sprinkler*** %	Adjustment (l/min)	***Exposure*** %	Adjustment (l/min)	**(l/min)**	**(l/s)**
154 Main Street East (Residential/Commercial)	**1481.82**	**1**	**1481.82**	**0.6**	5000	83.3	**-15**	-750.0	**4250.0**	**-50**	-2125.0	60	2550.0	**5000**	**83**

Total Area Calculation:
Largest floor plus 25% of each of the two immediately adjoining floors.

Floor:	Area:	Total:
3	987.88	987.88
4-5	987.88	493.94

Total= 1481.82

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure

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

Side	Exposure (m)	Charge (%)
North =	**20.1 to 30m**	**10**
South =	**Firewall**	**10**
East =	**0 to 3.0m**	**25**
West =	**10.1 to 20m**	**15**
Total Expoure =		***60***

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

Project Number: 17086
Project Name: 154 Main Street East
Date: 27-Sep-17

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:

$$F = 220\,C\sqrt{A} \qquad (1)$$

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

	Building Area				(1)		(2)			(3)		(4)		Final Adjusted Fire Flow	
Building / Location	Footprint Area (m^2)	# of Storeys	**Total GFA (m^2)**	Type of Construction	***Fire Flow "F"*** (l/min)	(l/s)	***Occupancy*** %	Adjustment (l/min)	**Adjusted Fire Flow (l/min)**	***Sprinkler*** %	Adjustment (l/min)	***Exposure*** %	Adjustment (l/min)	**(l/min)**	**(l/s)**
154 Main Street East (Parking)	**2512.77**	**1**	**2512.77**	**0.6**	7000	116.7	**-15**	-1050.0	**5950.0**	**-40**	-2380.0	65	3867.5	**7000**	**117**

Total Area Calculation:	**Floor:**	**Area:**	**Total:**
Largest floor plus 25% of each of the two immediately adjoining floors.	3	1675.18	1675.18
	4-5	1675.18	837.59

Total= 2512.77

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

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

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

Side	Exposure (m)	Charge (%)
North =	**Firewall**	**10**
South =	**10.1 to 20m**	**15**
East =	**0 to 3.0m**	**25**
West =	**10.1 to 20m**	**15**
Total Expoure =		***65***