

MEMORANDUM



TO: Norm Sisson, FMA, Project Manager
Canadian Bank Note Company, Limited
975 Gladstone Ave
Ottawa, ON K1Y 4W5

FROM: Noah Chauvin on behalf of
Bryan Kipp, P.Eng
Morrison Hershfield

PROJECT No.: 200098300

RE: New Warehouse at 975 Gladstone Ave –
Adequacy of Water Servicing

DATE: 6/3/2020

P:\2020\200098300-CBN GLADSTONE - NEW BUILDING\08. WORKING\MUNICIPAL\MEMO\CBN FIRE FLOW ANALYSIS MEMO.DOCX

1.0 Introduction

Morrison Hershfield Limited is currently engaged by the Canadian Bank Note Company, Limited (CBN) to analyze the adequacy of existing water servicing for a new warehouse to be constructed at 975 Gladstone Ave.

2.0 Site Description

A manufacturing facility owned by the CBN is currently located at 975 Gladstone Ave. A new warehouse is to be constructed to provide approximately 948m³ of additional space.

2.1 Existing Watermain Infrastructure

The existing facility at 975 Gladstone Ave is currently serviced by three 150mm water services located on the east, south, and west sides of the building. The services are connected to the 152mm dia. watermain on Breezehill Ave (west), the 203mm dia. watermain on Loretta Ave (east) and the 406mm watermain on Gladstone Ave (south). The existing water infrastructure is shown in **Figure 1** below.

Figure 1 - Existing Water Infrastructure



3.0 Design Criteria

In accordance with the Ottawa Design Guideline – Water Distribution (OWDG), 2010 (including Technical Bulletin ISD-2010-2), the desired range of system pressures should be approximately 350 to 480 kPa (50 to 70 psi) and not less than 275 kPa (40 psi) during normal operating conditions. Normal operating conditions are defined as the range of system flows from average day to maximum hour demand. The following criteria, as outlined in the OWDG, were used in order to determine the existing services adequacy to provide the required flow:

- Under the condition of maximum daily flow, pressure ranges between 345 kPa (50 psi) and 552 kPa (80 psi).
- Under the condition of maximum hourly flow, pressures are not less than 276 kPa (40 psi)
- Under the condition of maximum daily and fire flow, the pressure at any point in the system shall not be less than 140 kPa (20 psi).
- Service areas with a basic day demand greater than 50 m³/day shall be connected with a minimum of two feeder mains (i.e. redundant water services) to avoid the creation of a vulnerable service area.

3.1 Water Demands

The required fire flow (RFF) for the proposed expansion was calculated in accordance with the Fire Underwriters Survey (FUS), Water Supply for Public Fire Protection, 1999, as modified and amended by the City of Ottawa Design Guidelines, Water Distribution, Appendix H "Protocol to Clarify the Application of the Fire Flow Calculation Method Published by Fire Underwriters Survey (FUS)" (Technical Bulletin ISTB-2018-02).

It was determined that the existing building would require 16,000 L/min, and the new warehouse would result in an increase of 3,000 L/min, resulting in a total required flow of 19,000 L/min. The required fire pump size is 1500 gpm (5,700 L/min) as determined by the Mechanical Engineer. With the addition of 1,900 L/min for inside/outside hose allowance, the total demand for the pump is 7,600 L/min.

The domestic water demands were determined using Section 4.2.8 of the Ottawa Design Guideline – Water Distribution, 2010 (including Technical Bulletin ISD-2010-2). The demand type of "Industrial - Light" was used to determine the average daily demand by multiplying the gross area of the site by the average demand of 35,000 L/gross ha/day.

The peaking factors provided are 1.5 x avg. daily and 1.8 x max. daily for maximum daily demand and maximum hourly demand, respectively. The total demand for the site was determined to be 63 m³/day (0.8 L/s), 95 m³/day (1.1 L/s), and 171 m³/day (2.0 L/s) for average daily, max daily and peak hourly, respectively. The OWDG requirement to have redundant water services where the daily volume exceeds 50 m³/day is satisfied as three water services are connected to the CBN Gladstone building. Complete domestic demand and fire flow calculations are provided in **Appendix B**.

3.2 Boundary Conditions

A boundary condition request was submitted to the City for the three existing water services based on the demands outlined in **Section 3.1**.

The City advised that the maximum fire flow that can be provided by the 150mm diameter Breezehill watermain, and the existing CBN connection point, is 80 L/s (4800 L/min) at the minimum allowable pressure of 20 psi. The demand for the proposed fire pump (7,600 L/min) was applied to the Gladstone water service. The remainder of fire flow was distributed between the two services on Loretta and Breezehill, with Breezehill capped at the maximum 80 L/s. The Breezehill water service is closest to the new warehouse, however was found to be incapable of providing the required fire flow while maintaining pressure above 20 psi.

The boundary conditions provided by the City for the Gladstone service are provided in **Table 1**.

Table 1 - Boundary Conditions

Boundary Location	Minimum HGL	Maximum HGL	Max Day + Fire Flow HGL
Boundary Location #2 (Gladstone Ave.)	107.0	114.7	109.0m

A copy of correspondence with the City is provided in **Appendix A**.

3.3 Hydraulic Analysis

A hydraulic analysis was completed for the existing 150mm diameter water service on Gladstone Ave. Based on hydraulic analysis results, it was determined that the minimum residual pressure in the 150mm service under max day + fire and max hourly conditions exceeds the minimum allowable pressures. The existing 150mm diameter Gladstone service has adequate capacity to provide the required fire flow for the new fire pump. A summary of the hydraulic analysis is presented in **Table 2**, and complete calculations are provided in **Appendix B**.

Table 2 - Summary of Hydraulic Analysis

	Scenario			Source of Data
	Max Day + Fire	Max Hourly	Max Day	
Flow Demand (L/s)	128	2.02	1.12	Calculated for CBN Gladstone
Boundary Condition: Available Pressure under proposed demand (psi)	62.1	59.3	59.3	Provided by City of Ottawa for 200mm Watermain
Residual Pressure at Service Tee including losses in 150mm diameter pipe (psi)	41.73	59.26	59.27	Calculated for CBN Gladstone
Minimum Allowable Pressure (psi)	20	40	50	City of Ottawa Water Design Guidelines

In addition, the number of available fire hydrants within proximity of the building was analyzed in accordance with Technical Bulletin ISTB-2018-02 (dated March 21, 2018, Appendix I of OWDG). The following tables demonstrate that the RFF can be provided by the existing hydrants within 150m of the building.

Table 3 - Excerpt from Technical Bulletin ISTB-2018-02, Appendix I, Table 1

Hydrant Class	Distance to asset/structure/building (m)	Contribution to required fire flow (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800

Table 4 - Availability of Fire Flow from Hydrants

Building	Fire Flow Demand (L/min)	Fire Hydrant(s) within 75m	Fire Hydrant(s) within 150m	Combined Fire Flow (L/min.)
975 Gladstone	19,000	5	4	43,700

Figure 2 - Fire Hydrants within proximity of the Building



The calculations and hydraulic analysis are provided in **Appendix B**.

4.0 Conclusion

For the new warehouse to be constructed at 975 Gladstone Ave, the adequacy of the existing water services to provide the required water servicing was analyzed. A hydraulic analysis concluded that the three existing services are able to provide the required flows while meeting the criteria required by the OWDG.

Closure

We trust that this memo is sufficient for your current requirements. Please contact the undersigned with any questions or clarifications.

Sincerely,

Morrison Hershfield Limited



Noah Chauvin
Municipal Designer



Bryan Kipp, P.Eng.
Municipal Engineer

Appendix A

CORRESPONDENCE

Noah Chauvin

From: Fraser, Mark <Mark.Fraser@ottawa.ca>
Sent: Tuesday, May 26, 2020 2:17 PM
To: Noah Chauvin
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Please see the highlighted correction below. It was 20 psi, forgot to convert to HGL.

The following are boundary conditions, HGL, for hydraulic analysis at **975 Gladstone Ave.** (zone 1W) assumed to be connected to the 152mm dia. watermain on Breezehill Ave. (connection 1), the 203mm dia. watermain on Loretta Ave. (connection 3) and the 406mm watermain on Gladstone Ave. (connection 2). See attached PDF for connection locations.

Minimum HGL = 107.0m, same at all connections

Maximum HGL = 114.7m, same at all connections

Boundary Location	Scenario #1 - Fire Flow (L/min)	Scenario #1 - HGL	Scenario #2 - Fire Flow (L/min)	Scenario #2 - HGL
Boundary Location #1 (Breezehill Ave.)	4,800	76.0m	4,800	76.0m
Boundary Location #2 (Gladstone Ave.)	6,600	109.0m	7,600	109.0m
Boundary Location #3 (Loretta Ave.)	7,600	91.0m	6,600	94.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermain deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Regards,

Mark Fraser, P. Eng.
Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department

110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
[Tel:613.580.2424](tel:613.580.2424) ext. 27791
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From: Noah Chauvin <NChauvin@morrisonhershfield.com>
Sent: May 26, 2020 1:49 PM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi Mark,

Thanks for providing the updated boundary conditions. Are you able to confirm the HGL for the Breezehill service, it seems to be incorrect based on the previous boundary condition? Based on the elevation in the area, an HGL of 20.0m would result in a negative pressure.

Thanks,
Noah.

From: Fraser, Mark [<mailto:Mark.Fraser@ottawa.ca>]
Sent: Monday, May 25, 2020 7:17 PM
To: Noah Chauvin <NChauvin@morrisonhershfield.com>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Please find below boundary conditions (based on your request), HGL, for hydraulic analysis at **975 Gladstone Ave.** (zone 1W) assumed to be connected to the 152mm dia. watermain on Breezehill Ave. (connection 1), the 203mm dia. watermain on Loretta Ave. (connection 3) and the 406mm watermain on Gladstone Ave. (connection 2). See attached PDF for connection locations.

Water Demands:

Industrial Average Daily Demand = 44.0 L/min
Industrial Maximum Daily Demand = 66.0 L/min
Industrial Peak Hour Demand = 118.8 L/min
Fire Flow = 19,000 L/min

Minimum HGL = 107.0m, same at all connections
Maximum HGL = 114.7m, same at all connections

Boundary Location	Scenario #1 - Fire Flow (L/min)	Scenario #1 - HGL	Scenario #2 - Fire Flow (L/min)	Scenario #2 - HGL
Boundary Location #1 (Breezehill Ave.)	4,800	76.0m	4,800	76.0m
Boundary Location #2 (Gladstone Ave.)	6,600	109.0m	7,600	109.0m
Boundary Location #3 (Loretta Ave.)	7,600	91.0m	6,600	94.0m

We believe this is a situation where a multi-hydrant analysis as per Tech Bulletin ISTB-2018-02 is more suitable to provide more realistic boundary conditions compared to splitting the fire flow demands as shown, unless the intention is to use each service for fire purposes. The above analysis assumes that all flow during a fire would be drawn from the connection points but Tech Bulletin ISTB-2018-02 allows for the distribution of the required fire flow to available hydrants.

These are for current conditions and are based on computer model simulation.

***Disclaimer:** The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.*

Regards,

Mark Fraser, P. Eng.

Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor, Ottawa ON, K1P 1J1
Tel: 613.580.2424 ext. 27791
Fax: 613-580-2576
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Email: Mark.Fraser@ottawa.ca

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From: Noah Chauvin <NChauvin@morrisonhershfield.com>

Sent: May 20, 2020 5:19 PM

To: Fraser, Mark <Mark.Fraser@ottawa.ca>

Cc: Bryan Kipp <bkipp@morrisonhershfield.com>; Matt Jardine <Mjardine@morrisonhershfield.com>

Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi Mark,

Thank you for providing that confirmation. With that being said, I would like to submit a revised boundary condition request based on two alternative scenarios:

1. Scenario #1: Fire demand for the pump applied to the Loretta service. Remainder of fire flow will be distributed between the two services on Gladstone and Breezehill with Breezehill capped at the maximum 80 L/s (4800 L/min)
2. Scenario #2: Fire demand for the pump applied to the Gladstone service. Remainder of fire flow will be distributed between the two services on Loretta and Breezehill with Breezehill capped at the maximum 80 L/s (4800 L/min)

Ideally the Loretta service (Scenario #1) can be used for the fire pump due to its proximity to the proposed warehouse development. If it is unable to provide the required flow of 7,600 L/min, please use Scenario #2. A summary of the flow distributions is provided in the table below.

Boundary Location	Scenario #1 - Fire Flow (L/min)	Scenario #2 - Fire Flow (L/min)
Boundary Location #1 (Breezehill Ave)	4,800	4,800
Boundary Location #2 (Gladstone Ave)	6,600	7,600
Boundary Location #3 (Loretta Ave)	7,600	6,600

The domestic water demands have remained unchanged and are as follows:

Industrial Average Daily Demand = 44.0 L/min

Industrial Maximum Daily Demand = 66.0 L/min

Industrial Peak Hour Demand = 118.8 L/min

Please let us know if you have any question or need any further information.

Thanks,

Noah Chauvin

Municipal Designer – Infrastructure Ottawa

nchauvin@morrisonhershfield.com



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morrisonhershfield.com

From: Fraser, Mark [<mailto:Mark.Fraser@ottawa.ca>]

Sent: Wednesday, May 20, 2020 2:57 PM

To: Noah Chauvin <NChauvin@morrisonhershfield.com>

Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

I have confirmed with the Water Resources Unit that the existing 152mm dia. UCI (1909) watermain on Breezehill Ave. N can only provide a maximum available fire flow of 80L/s at this connection point and thus is not able to provide the required fire flow of 127L/s, assuming there is no internal looping. There are no plans to replace this old watermain.

Regards,

Mark Fraser

Project Manager, Planning Services
Development Review Central Branch
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110 Laurier Avenue West, 4th Floor, Ottawa ON, K1P 1J1
[Tel:613.580.2424](tel:613.580.2424) ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

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From: Noah Chauvin <NChauvin@morrisonhershfield.com>
Sent: May 20, 2020 9:18 AM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi Mark,

My question is in regards to the Breezehill connection, the boundary condition provided states "Available flow @20psi = 80L/s" although we requested a fire flow of 127 L/s. We just wanted to confirm that this means that the maximum available flow for this service is only 80 L/s and thus is not able to provide our required fire flow of 127 L/s? This will have a ripple effect as the pump will most likely have to be rerouted internally to a different service so I just wanted to confirm before proceeding with the mechanical engineer.

If this is the case, we will most likely have to submit a revised boundary condition request based on the new distribution.

Thanks,
Noah.

From: Fraser, Mark [<mailto:Mark.Fraser@ottawa.ca>]
Sent: Tuesday, May 19, 2020 6:56 PM
To: Noah Chauvin <NChauvin@morrisonhershfield.com>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Please send me your questions and I will try and respond or I will follow up with our Water Resources Unit as they provided the boundary conditions.

Regards,

Mark Fraser

Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor, Ottawa ON, K1P 1J1
[Tel:613.580.2424](tel:613.580.2424) ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

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From: Noah Chauvin <NChauvin@morrisonhershfield.com>
Sent: May 19, 2020 5:57 PM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi Mark,

I called and left you a message today in regards to the boundary conditions for the Breezehill connection. I was just hoping to confirm a few things with you, if you are able to talk on the phone sometime tomorrow that would be greatly appreciated.

Thanks,

Noah Chauvin

Municipal Designer – Infrastructure Ottawa
nchauvin@morrisonhershfield.com



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From: Fraser, Mark [<mailto:Mark.Fraser@ottawa.ca>]
Sent: Friday, May 15, 2020 1:29 PM
To: Noah Chauvin <NChauvin@morrisonhershfield.com>
Cc: Matt Jardine <MJardine@morrisonhershfield.com>; Bryan Kipp <BKipp@morrisonhershfield.com>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Please find below boundary conditions, HGL, for hydraulic analysis at **975 Gladstone Ave.** (zone 1W) assumed to be connected to the 152mm dia. watermain on Breezehill Ave. (connection 1), the 203mm dia. watermain on Loretta Ave. (connection 3) and the 406mm watermain on Gladstone Ave. (connection 2). See attached PDF for connection locations.

Water Demands:

Industrial Average Daily Demand = 44.0 L/min
Industrial Maximum Daily Demand = 66.0 L/min
Industrial Peak Hour Demand = 118.8 L/min
Fire Flow = 19,000 L/min

Minimum HGL = 107.0m, same at all connections
Maximum HGL = 114.7m, same at all connections
Available flow @20psi = 80L/s, Breezehill Ave. connection 1
MaxDay + FireFlow (95 L/s) = 97.0m, Loretta Ave. connection 3
MaxDay + FireFlow (95 L/s) = 109.0m, Gladstone Ave. connection 2

*Please note we did not assume any internal looping. Please confirm otherwise.

These are for current conditions and are based on computer model simulation.

***Disclaimer:** The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.*

Regards,

Mark Fraser, P. Eng.
Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
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From: Noah Chauvin <NChauvin@morrisonhershfield.com>
Sent: May 12, 2020 12:25 PM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Cc: Matt Jardine <Mjardine@morrisonhershfield.com>; Bryan Kipp <bkipp@morrisonhershfield.com>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi
Mark,
Please

see below for domestic water demands as requested. The rationale for distributing the remainder of the fire flow as proposed is the site is bordered on all sides by streets which each have a fire hydrant.

Design Parameter	Value (L/min)	Design Criteria
Industrial Average Daily Demand	44.0	35,000 L/gross ha/day – Industrial Light
Industrial Maximum Daily Demand	66.0	1.5 x Average Daily
Industrial Maximum Hourly Demand	118.8	1.8 x Max Daily
<u>Fire Flow</u>	<u>19,000</u>	<u>Based on the FUS</u>

Please let me know if you need any further information.

Thanks,
Noah.

From: Fraser, Mark [<mailto:Mark.Fraser@ottawa.ca>]
Sent: Sunday, May 10, 2020 7:27 PM
To: Noah Chauvin <NChauvin@morrisonhershfield.com>
Cc: Matt Jardine <MJardine@morrisonhershfield.com>; Bryan Kipp <BKipp@morrisonhershfield.com>
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Can you please provide an update on the below email. We are unable to process the request for boundary conditions until the below requested information is provided.

Regards,

Mark Fraser

Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor, Ottawa ON, K1P 1J1
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From: Fraser, Mark
Sent: May 07, 2020 1:43 PM
To: NChauvin@morrisonhershfield.com
Cc: MJardine@morrisonhershfield.com; bkipp@morrisonhershfield.com
Subject: RE: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

Hi Noah,

Please provide the domestic water demands (require Max Day+Fire Flow demand) and can you provide rationale for distributing the remainder of the RFF (11,400 L/min) evenly between the two services on Gladstone and Loretta.

Regards,

Mark Fraser

Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor, Ottawa ON, K1P 1J1
[Tel: 613.580.2424](tel:613.580.2424) ext. 27791
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From: Noah Chauvin <NChauvin@morrisonhershfield.com>
Sent: May 04, 2020 11:04 AM
To: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Cc: Matt Jardine <Mjardine@morrisonhershfield.com>; Bryan Kipp <bkipp@morrisonhershfield.com>
Subject: Water Pressure / Flow Boundary Condition Request - 975 Gladstone Ave

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Hi Abdul,

Morrison Hershfield has been retained by the Canadian Bank Note Company to analyze the adequacy of fire protection and fire flow for the proposed expansion at 975 Gladstone Ave. (City of Ottawa #:D07-12-19-0209). We are looking to obtain the boundary conditions for the water distribution system in 3 locations near 975 Gladstone Ave.

The required fire flow (RFF) for the proposed expansion was calculated in accordance with the Fire Underwriter Survey (FUS) methodology. It was determined that the existing building would require 16,000 L/min and the proposed expansion would result in an increase of 3,000 L/min for a new required flow of **19,000 L/min**.

The required fire pump size is 1500 gpm (5,700 L/min) as determined by the mechanical engineer. With the addition of 1,900 L/min for inside/outside hose allowance, the total demand for the pump is 7,600 L/min.

Currently there are three 150mm diameter water services which service the existing building (Breezehill Ave, Gladstone Ave, and Loretta Ave), see attached plan. The flow demand from the proposed fire pump will be applied to the north-west service on Breezehill Ave due to the proximity of the service within the building. The remainder of the RFF (11,400 L/min) will be distributed evenly between the two services on Gladstone and Loretta. Could you please provide the boundary conditions based on the distribution outlined below for the three existing water service connections:

Boundary Location	Fire Flow (L/min)	Boundary Conditions (kPa)
-------------------	-------------------	---------------------------

Boundary Location #1 (Breezehill Ave)	7,600	
Boundary Location #2 (Gladstone Ave)	5,700	
Boundary Location #3 (Loretta Ave)	5,700	

In addition, the number of available fire hydrants within proximity of the building was analyzed in accordance with Technical Bulletin ISTB-2018-02 dated March 21, 2018, Appendix I. Based on a preliminary site investigation, it was determined that five (5) AA rated hydrants (blue) are within $\leq 76\text{m}$ of the building. Could you please confirm the rating of these hydrants so that we can ensure conformance with this requirement.

If you require other details or need more information about the site, or if I should direct this request to one of your colleagues, please let me know

Regards,

Noah Chauvin

Municipal Designer – Infrastructure Ottawa
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Appendix B

HYDRAULIC ANALYSIS



CBN Gladstone Fire Underwriters Survey Calculations

Project Name CBN Gladstone - New Warehouse
Project Number 20009830
Site Address 975 Gladstone Ave.
Completed By M Jardine
Date 14-May-20

Per Fire Underwriters Survey, Water Supply for Public Fire Protection, 1999, as modified and amended by the City of Ottawa Design Guidelines, Water Distribution, Appendix H "Protocol to Clarify the Application of the Fire Flow Calculation Method Published by Fire Underwriters Survey (FUS)"

Assumptions:

The existing portion of the CBN building located at 975 Gladstone Avenue in Ottawa is a single storey building comprised of non-combustible construction with a building area of 10, 107m² and a 1,320m² mezzanine. The building is classified as a Group F Division 3 Occupancy under the Ontario Building Code. The building is fully sprinklered and provided with a standpipe system supplied by a municipal water supply. The building is also equipped with a fire alarm system which is monitored by a remote monitoring company. All sprinkler control valves in the building are supervised by the fire alarm system.

Calculation:

1. Determine Estimated Fire Flow based on Building Floor Area

$F = 220 C \sqrt{A}$
 $F =$ Required flow in litres / minute
 $A =$ Total floor area in m²
 $C =$ Coefficient related to Construction
 = 1.5 for wood frame construction
 = 1.0 for ordinary construction
 = 0.8 for non-combustible construction
 = 0.6 for fire-resistive construction

$C =$ 0.8

Floor	Area
Existing Building	11,427
New Warehouse (x3)	948
Total	14,271

Note: Note F in the FUS recommends that a single storey building be considered as a 3 storey building where it is being used for "high piled stock, or for rack storage". Given that this is the only the warehouse portion of the building which will be utilized as such, the surcharge will only be applied to warehouse floor area.

Non-combustible: Use sum of all floor areas

$A =$ 14271 m²

F=	21025.2 L/min
Round to nearest 1000 L/m, F =	21000.0 L/min

2. Adjust flow based on Fire hazard and contents

A	Non-combustible	-25%
B	Limited Combustible	-15%
C	Combustible	0%
D	Free Burning	15%
E	Rapid Burning	25%

Type of Construction (A,B,C,D)	D
Adjustment Factor	15%

Flow From 1.	21000.0 L/min
Adjusted Flow	24150.0 L/min
Minimum Flow (2000 L/min)	24150.0 L/min
Flow	24150.0 L/min

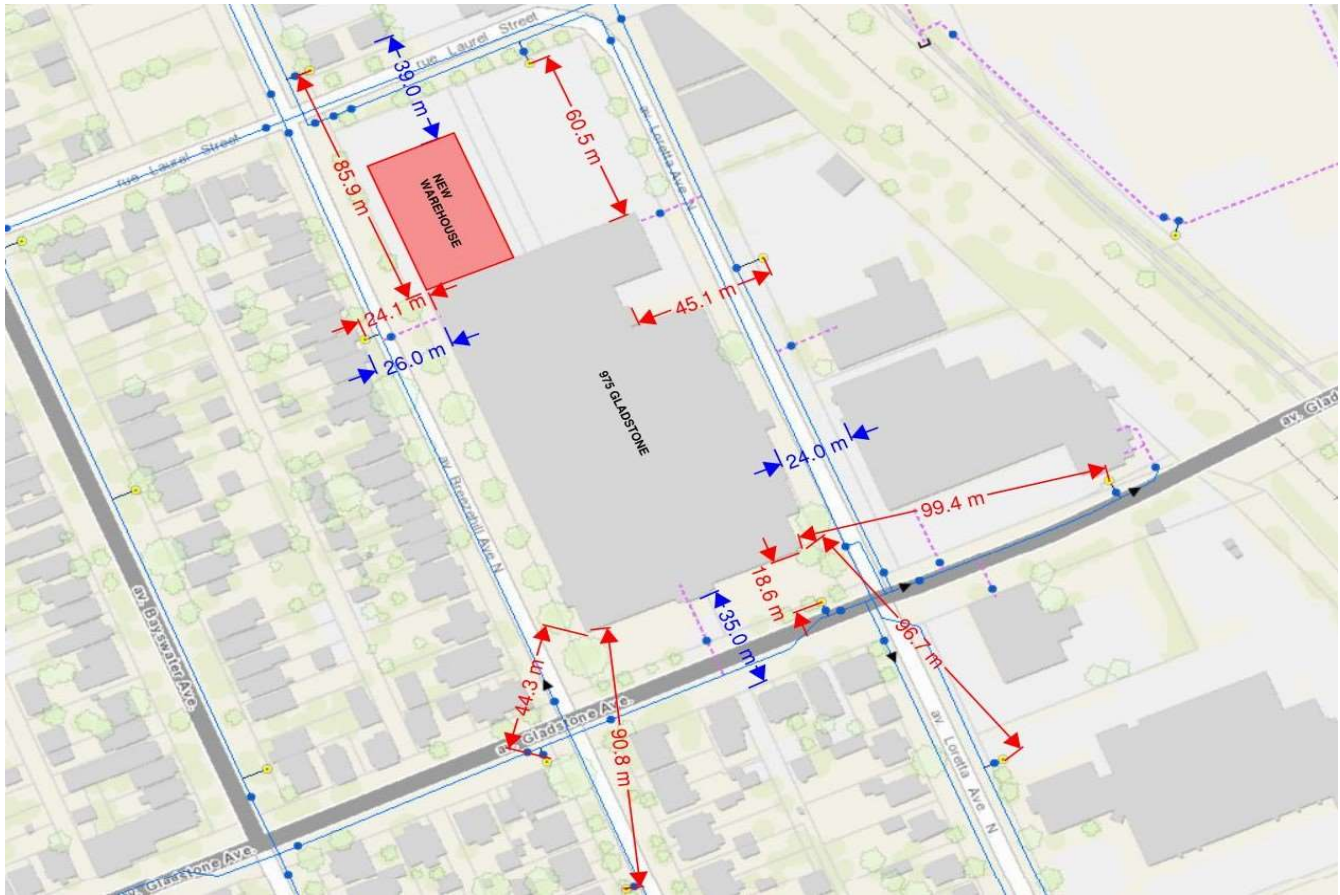
3. Reduce flow from No. 2. based on automatic sprinkler protection

Flow from 2.	24150.0 L/min
Automatic Sprinkler Protection (yes/no)	Yes
% of building covered by sprinklers	100%
<i>CBN Gladstone is fully sprinklered</i>	
Reduction	30% (Maximum 30%)
Water supply is standard (yes/no)	Yes
Additional Reduction	10% (Maximum 10%)
Sprinkler System is fully supervised (yes/no)	Yes
Additional Reduction	10% (Maximum 10%)
Total Reduction	50%
Flow after Sprinkler Reduction	12075.0 L/min

4. Adjacent Structures / Fire Separation with other buildings

Flow from 3.	12075.0 L/min
--------------	---------------

Figure 1: Adjacent Buildings & distances to hydrants



Exposure charge based on Table G5:

Note: The exterior face of the existing is comprised of masonry construction with unprotected opening. The west exterior face is approximately 176m long. It should be noted that although the new portion of the building is considered three storeys for the purposes of FUS, it has no bearing here as L:H Factors above 120 are penalized uniformly. (10% surcharge). The east exterior face is 170 m long, however only 70m of which is exposed to the adjacent commercial buildings. The north and south faces are approximately 71m long. For the north face however, on 20m of which is exposed within 39m to residential buildings across Laurel St.

Side	Construction Type	Storeys	Length (m)	LH Factor
North	Fire resistive with unprotected openings	1	20	20
East	Fire resistive with unprotected openings	1	70	70
South	Fire resistive with unprotected openings	1	71	71
West	Fire resistive with unprotected openings	1	176	176

Side	Separation Distance (m)	Exposure Charge	Exposure Charge to include in Cumulative Increase
North	39	5%	5%
East	24	8%	8%
South	35	5%	5%
West	26	10%	10%

Cumulative Increase (Max 75%)

28%

Flow Increased for Adjacent Structures	18837.0 L/min
Maximum Permitted Flow (45 000 L/min)	18837.0 L/min
Minimum Permitted Flow (2 000 L/min)	18837.0 L/min

Required Fire Flow (rounded to nearest 1000 L/m)	19000.0 L/min
	316.67 L/s

Confirmation that required fire flow is available from hydrants within 150m of building:

Building	Fire Hydrants within 75m of the building	Fire Hydrants within 150m of the building	Contribution to required fire flow (L/m)
975 Gladstone	5	4	43700
Available Flow			43700

Required Flow (FUS calc)

19000.0 L/min

Project Canadian Bank Note - New Warehouse
Project No. 20009830
Address 975 Gladstone St
Designed By N. Chauvin
Check By B. Kipp

Excerpt from City of Ottawa Water Design Guidelines (2010), Table 4.2

Demand Type	Amount	Units
AVERAGE DAILY DEMAND		
Residential	350	L/person/day
Industrial - Light	35000	L/gross ha/d
Industrial - Heavy	55000	L/gross ha/d
Commercial & Institutional		
Shopping Centre	2500	L/(100m ² /d)
Hospital	900	L/(bed/day)
School	70	L/(Student/day)
Trailer Park no Hook-up	340	L/(space/day)
Trailer Park with Hook Up	800	L/(space/day)
Campgrounds	225	L/(Campsite/day)
Mobile Home Parks	1000	L/(space/day)
Motels	150	L/(bed-space/day)
Hotels	225	L/(bed-space/day)
Tourist Commercial	28000	L/gross ha/d
Other Commercial	28000	L/gross ha/d

MAXIMUM DAILY DEMAND			
Residential	2.5	x avg. day	L/person/day
Industrial	1.5	x avg. day	L/gross ha/d
Commercial	1.5	x avg. day	L/gross ha/d
Institutional	1.5	x avg. day	L/gross ha/d

MAXIMUM HOURLY DEMAND			
Residential	2.2	x max day	L/person/day
Industrial	1.8	x max day	L/gross ha/d
Commercial	1.8	x max day	L/gross ha/d
Institutional	1.8	x max day	L/gross ha/d

Value			
Class of Building (A-N)	Industrial - Light	35000	L/gross ha/d
Quantity (persons/spaces/gross ha)		1.8	gross ha
Peaking Factor (Max Daily)	Industrial	1.5	x avg. day
Peaking Factor (Max Hourly)	Industrial	1.8	x max day

Average Daily Demand	63350.0	L/day
Maximum Daily Demand	95025.0	L/day
Maximum Hourly Demand	171045.0	L/day

Water Demand Calculations - FUS Fire Flow

Water demands for CBN Gladstone (Gladstone Service):

Average Day Demand

Average Day Demand 0.75 L/s

Maximum Day Demand

Factor (x Average Day) 1.5
Maximum Day Demand 1.12 L/s

Peak Hour Demand

Factor (x Maximum Day) 1.8
Peak Hour Demand 2.02 L/s

Fire Demand

Fire Flow Requirement From 126.7 L/s
FUS Calculation
Maximum Day + Fire Flow 128 L/s

Maximum Day + Fire Flow =	127.79 L/s
Maximum Day =	1.12 L/s
Maximum Hourly =	2.02 L/s

Building Service Sizing - Fire Flow: CBN Gladstone

Scenario: Max Daily + Fire Flow

Connection Point: Gladstone
 Size of City Main: 406 mm
 Building FFE 65.34 m

	HGL	Static Water Level	Pressure	Pressure
	m	m	kPa	PSI
Minimum HGL	107	41.66	408.64	59.27
Maximum HGL	114.7	49.36	484.17	70.22
Max Day + FireFlow	109	43.66	428.26	62.11

$P_{\text{Road}} = 62.1$ (psi) Max Day + FireFlow Water Pressure

Existing Service

Length

L= 30 (m)
 98 (ft)

Head Loss

$$P_d = \frac{4.52Q^{1.85}}{C^{1.85}d^{4.87}}$$

Pipe Diameter	C-Factor
150	100
200-250	110
300-600	120
600+	130

Size

d= 150 (mm)
 6 (in)

$$P = 0.434hSG$$

SG= specific gravity of water

= 1

C = 100

$P_d = 0.207110973$ (psi)

h= 0.477214 (ft/ft)

46.9698 (ft)

Flow

Q = 0.1278 (m³/s) (FUS)
 2026 (Usg/min)

Velocity

$$V = \frac{1.274Q}{d^2}$$

V= 7.24 (m/s)

Pressure Loss

$P_{\text{ROAD}} = 62.11$ (psi)

$P_L = 20.38$ (psi)

$P_{\text{AT METER}} = 41.73$ (psi)

Min Allowable Pressure (Under Fire Flow)

20 psi

OK

Building Service - Sizing - Max Hourly Demand

Scenario: Max Hourly Demand

Connection Point: Gladstone
 Size of City Main: 406 mm
 Building FFE 65.34 m

	HGL	Static Water Level	Pressure	Pressure
	m	m	kPa	PSI
Minimum HGL	107	41.66	408.64	59.3
Maximum HGL	114.7	49.36	484.17	70.2
Max Day + FireFlow	109	43.66	428.26	62.1

$P_{\text{Road}} = 59.27$ (psi) Minimum Water Pressure (HGL)

Existing Service

Length

L= 30 (m)
 98 (ft)

Head Loss

$$P_d = \frac{4.52Q^{1.85}}{C^{1.85}d^{4.87}}$$

Pipe Diameter	C-Factor
150	100
200-250	110
300-600	120
600+	130

Size

d= 150 (mm)
 6 (in)

$$P = 0.434hSG$$

SG= specific gravity of water

= 1

C = 100

$P_d = 9.65614E-05$ (psi)

h= 0.000222 (ft/ft)

0.0219 (ft)

Flow

Q = 0.0020 (m3/s)
 32 (Usg/min)

Velocity

$$V = \frac{1.274Q}{d^2}$$

V= 0.11 (m/s)

Pressure Loss

$P_{\text{ROAD}} = 59.27$ (psi)

$P_L = 0.0095$ (psi)

$P_{\text{AT METER}} = 59.26$ (psi)

Min Allowable Pressure (Max Hourly Demand))

40 psi

OK

Building Service - Sizing - Max Daily Demand

Scenario: Max Daily Demand

Connection Point: Gladstone
 Size of City Main: 406 mm
 Building FFE 65.34 m

	HGL	Static Water Level	Pressure	Pressure
	m	m	kPa	PSI
Minimum HGL	107	41.66	408.64	59.3
Maximum HGL	114.7	49.36	484.17	70.2
Max Day + FireFlow	109	43.66	428.26	62.1

$P_{\text{Road}} = 59.27$ (psi) Minimum Water Pressure (HGL)

Existing Service

Length

L= 30 (m)
 98 (ft)

Head Loss

$$P_d = \frac{4.52Q^{1.85}}{C^{1.85}d^{4.87}}$$

Pipe Diameter	C-Factor
150	100
200-250	110
300-600	120
600+	130

Size

d= 150 (mm)
 6 (in)

$$P = 0.434hSG$$

SG= specific gravity of water

= 1

C = 100

$P_d = 3.25499E-05$ (psi)

h= 0.000075 (ft/ft)

0.0074 (ft)

Flow

Q = 0.0011 (m3/s)
 18 (Usg/min)

Velocity

$$V = \frac{1.274Q}{d^2}$$

V= 0.06 (m/s)

Pressure Loss

$P_{\text{ROAD}} = 59.27$ (psi)

$P_L = 0.0032$ (psi)

$P_{\text{AT METER}} = 59.27$ (psi)

Min Allowable Pressure (Max Hourly Demand))

50 psi

OK