

Fire & Domestic Water Design Report

For

Proposed C-Store, Gas Bar, and Car Wash
145 Speedvale Avenue West, Guelph, ON
N1K 1K5

PREPARED BY

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Introduction

The following report, the Water Supply for Fire-Fighting, provides a description of the services for the proposed Convenience Store, Car Wash, and Fuel Dispensing Facility with related Canopy and Underground Fuel Storage Tanks at 145 Speedvale Avenue West in Guelph. The Convenience Store will have an approximate gross floor area of 198 m², and the attached Car Wash will have an approximate gross floor area of 142 m² with an approximate total area of 340 m². The existing municipal water distribution system around the site consists of a 250mm diameter water-main west of the proposed new building on Edinburgh Road.

The existing water service will be abandoned. A new 100mm water service will be required to serve the new buildings and will connect to a proposed 250mm municipal water main on Edinburgh Road.

Water Supply for Fire-Fighting Calculations

The proposed Convenience Store would be classified as Group E and Car Wash would be classified as low-hazard Group F3.

An existing municipal hydrant is located south of the subject property on Speedvale Avenue within 45m of the main entrance of the proposed building. A Sprinkler system is not required for the entire building.

Fire Flow Demands

The fire flow demands for the proposed development were determined by using the methodology outlined in *Water Supply for Public Fire Protection* (Fire underwriters Survey (FUS), 1999). The FUS method was used to calculate the fire flow demand for the proposed convenience store building. A detailed calculation for the fire demand has been provided below:

An estimate of the fire flow is given by the following formula:

$$F = 220C\sqrt{A}$$

Where :

- F = required fire flow in liters per minute (L/min)
- 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 m²)

Adjustments to the calculated fire flow are made based on the building's occupancy, sprinkler protection, and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

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C = 1.0 for ordinary construction (brick or other masonry walls, combustible floor, and interior.
(Carwash & C-Store)

It has been assumed that the building will not be equipped with a sprinkler system and a fire department connection.

Increase for structures exposed:

There are exposed surrounding buildings within 45 m of the proposed building; we calculate the exposure charge for all exposed sides as follows:

East	>45m	0%
North	20.2m	10%
South	>45m	0%
West	>45m	0%
Total	-	10%

The fire demand and detailed calculations are summarized in the following Table.

			(1)		(2)		(3)		(4)		Final Adjusted		
Building	Area "A" (m ²)	C	Fire Flow "F"		Occupancy		Sprinkler		Exposure		Fire Flow		
			(l/min)	(l/s)	%	Adjusted Fire Flow (L/min)	%	Adjustment (L/min)	%	Adjustment (L/min)	(L/min)	Rounded (L/min)	(L/s)
C-Store & Carwash	340	1.0	4,056.6	67.61	-15	3,448.1	-0	-0	10	344.8	3,793	4,000	66.67

(2) Occupancy

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

(3) Sprinkler

30% credit for an adequately designed system per NFPA 13. Additional 10% if the water supply standard for both the system and fire department hose lines.

(4) Exposure

0 to 3m	25%
3.1 to 10m	20%
10.1 to 20m	15%
20.1 to 30m	10%
30.1 to 45m	5%

(Calculate for all sides. Maximum charge shall not exceed 75%)

As per the City of Guelph, the available fire flow at the Speedvale Avenue hydrant near the development area is 322 L/s and at Edinburgh Road is 277 L/s and the results indicated that the system has a sufficient flow to meet the proposed facility at a flow rate of 1,056 USGPM (66.67 L/s) @ 20 psi pressure requirements.

Domestic Water Demands

Using the Fixture Unit method: (Refer to Appendix A)

Calculated Fixture Units (C-Store) = 16

Calculated Maximum Domestic Demand (C-Store) = 29 USGPM = 1.83 L/s

Estimated Maximum Domestic Demand (Car Wash) = 60 USGPM = 3.79 L/s

Total Maximum Domestic Demand = 89 USGPM = 5.62 L/s

We used 5.62 L/s (89 USGPM) as domestic water demand.

Sizing Calculation

New Watermain - Outside the Building

Consider new water main connected to the existing municipal 250mm on Edinburgh Road. Calculate the total head loss using the Hazen-Williams equation:

Consider a 4" (100mm) water services

$$f = 0.2083 (100/C)^{1.852} q^{1.852} / d_h^{4.8655}$$

Where

- f = friction head loss in feet of water per 100 feet of pipe ($f_{h20}/100$ ft pipe)
- c = 110 For PVC Pipe (Hazen Williams roughness constant)
- q = 5.62 L/s (89 USGPM) - Volume Flow
- d_h = 4" (100mm) - (Pipe inside diameter)
- l = 82 ft (25m) - Pipe Length

Specific Head Loss

$$f = 0.906 \text{ m} / 100\text{m Pipe} = 8.9 \text{ kPa} / 100\text{m pipe}$$

Actual Head Loss:

$$H_1 = f \times l \text{ (pressure drop)}$$

$$H_1 = (0.906 \times 25)100$$

$$H_1 = \mathbf{0.227 \text{ m} = 2.2 \text{ kPa}}$$

$$\text{Velocity} = 0.7 \text{ m/s for 100mm pipe at 5.62 L/s}$$

The calculated velocity for a 100mm pipe is less than the max. the allowable velocity of 3.0 m/s and is acceptable.

Dynamic pressure loss:

$$H_2 = \Sigma K \cdot V^2 / (2g)$$

Where

$$\Sigma K = K_{\text{valve}} + K_{\text{Tee}} + K_{\text{Reducer}} + K_{\text{Elbow}(90)} = 1 \times 0.39 + 1 \times 0.84 + 1 \times 0.25 + 2 \times 0.22 = 1.92$$

$$H_2 = 1.92 \times 0.7^2 / (2 \times 9.8)$$

$$H_2 = \mathbf{0.048 \text{ m} = 0.47 \text{ kPa}}$$

(New water service will be including one Valve, one Tees, one Reducer, and two 90 Elbow)

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Total Head Loss:

$$H = H_1 + H_2$$

$$H = 0.227 + 0.048$$

$$H = 0.275 \text{ m} = 2.67 \text{ kPa} = 0.39 \text{ psi}$$

Residual pressure at building = 55 psi – 0.39 psi = 54.61 psi

Conclusion:

1. The proposed 4" (100mm) water service is adequately sized to serve the facility;
2. Domestic water demand is 5.62 liters per second;
3. Residual pressure @ building water meter is about 54.61 psi (376.5 kPa).

We trust these calculations and explanations will satisfy your requirements regarding these items.

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October 2022



Appendix A

Using Fixute Unit Methods

Project	C-Store, Gas Bar & Car Wash
Location	145 Speedvale Avenue, Guelph, Ontario
Customer	

Job no.:	1808	
Designed	JG	2022-10-25
Checked		

Fixture Type	Present Number of Fixtures	Future Number of Fixtures	Total Number of Fixtures	Number of Fixture Units	Total Fixture Units
Basin, private lav			0	1	0
Basin, public lav	1		1	2	2
Drinking fountain			0	1	0
WC -Valve	1		1	6	6
WC -Tank			0	4	0
Urinal -Valve			0	5	0
Urinal -Tank			0	3	0
Bathtub			0	3	0
Dish washer			0	9	0
Kitchen sink, private			0	2	0
Kitchen sink, public	2		2	2	4
Laundry tub			0	4	0
Pantry sink			0	5	0
Shower			0	2	0
Service sink	1		1	2	2
Clothes washer			0	9	0
Hose bibb	1		1	0	0
Lab sink			0	1.5	0
Sink w bubbler	0		0	2	0
Emerg Eye Wash	1		1	2	2
Totals	6	0			16

Check Modified Hunter Curve for:

Fixture units		Commercial Building		
Fixture Unit Equivalent Flow		16 FU		
Hose bibbs	1	5	24 usgpm	1.51 L/s
C-Store			5 usgpm	0.32 L/s
			29 usgpm	1.83 L/s
Car Wash			60 usgpm	3.79 L/s
Total			89 usgpm	5.62 L/s

