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# Residential / Hotel Development 141 George Street / 325 Dalhousie Street / 110 York Street Ottawa, Ontario

## Servicing Design Brief

**RESIDENTIAL / HOTEL DEVELOPMENT  
141 GEORGE STREET / 325 DALHOUSIE STREET / 110 YORK STREET  
OTTAWA, ONTARIO**

**SERVICING DESIGN BRIEF**

**Prepared by:**

**NOVATECH**

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December 07, 2012 (R-2012-171)

February 28, 2013 (R-2013-019)

February 14, 2014

**Revised April 12, 2018**

**File No.: 112142**

**Report Reference No.: R-2014-020**

April 12, 2018

City of Ottawa  
Planning and Growth Management Department  
Development Review (Urban) Services Branch  
Infrastructure Approvals Division  
110 Laurier Avenue West, 4<sup>th</sup> Floor  
Ottawa ON, K1P 1J1

**Attention: Mr. Richard Buchanan**

Dear Sir:

**Reference: Residential / Hotel Development  
141 George Street / 325 Dalhousie Street  
Servicing Design Brief  
Our File No.: 112142**

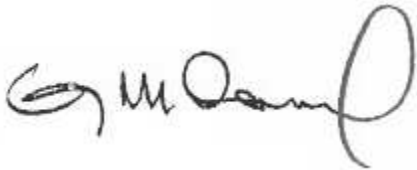
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Enclosed herein is the revised Servicing Design Brief for the proposed Residential / Hotel development at 141 George Street / 325 Dalhousie Street / 110 York Street, located east of Dalhousie Street between York Street and George Street. This brief is submitted in support of the zoning amendment for the site and outlines how the site will be serviced with sanitary, storm and watermain.

Trusting this report is adequate for your purposes. Should you have any questions, or require additional information, please contact us.

Yours truly,

**NOVATECH**



Greg MacDonal, P.Eng.  
Director | Land Development and Public-Sector Infrastructure

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## 1.0 INTRODUCTION

This Servicing Design Brief has been prepared in support of a Zoning By-Law Amendment Application of the property located at 110 York Street. A previous Servicing Design Brief was completed on February 14, 2014 in support of a Zoning By-Law Amendment Application for 141 George Street and 325 Dalhousie Street. The proposed development at that time included a 15-storey hotel with 200 rooms and a 22-storey residential condominium with 282 units with approximately 1097 m<sup>2</sup> of commercial floorspace on the ground floor. This report addresses the proposed hotel expansion on 110 York Street, which will add another 128 hotel rooms.

The subject site is located in the Byward Market, east of Dalhousie Street between York Street and George Street in the City of Ottawa. The existing properties are currently occupied by commercial spaces at 110 York Street (The Whiskey Bar), a 15-story hotel building at 325 Dalhousie Street (constructed in 2015), and a privately-owned surface parking lot. Aerial view of the subject is provided in **Figure 1**.

The proposed development of the site will consist of an 18-storey hotel addition at 110 York Street with 128 units and a 22-storey tower at 141 George Street with 282 condominium units. The condominium building will include approximately 1097 m<sup>2</sup> of commercial floor space located on the ground floor. A total of approximately 288 underground parking spaces will be provided on 4 levels of underground parking. Refer to **Figure 2** for details.

As identified in the City of Ottawa's Zoning By-Law, the site is currently designated as Mixed-Use Downtown (MD2). The minor zoning by-law amendment will revise the site's current designation for the proposed development to deal with building height, parking requirements and any applicable zoning provisions that cannot be met. The specific details regarding the changes proposed to the zoning of the subject site are provided in a Planning Rationale submitted as part of the Zoning By-Law Amendment application.

The subject site is approximately 0.42 ha in area. This servicing design brief will outline how the site will be serviced with sanitary, storm and watermain, and will demonstrate that adequate municipal capacity is available within the existing infrastructure to service the development.

## 2.0 SANITARY SEWER

The existing Dalhousie Street hotel is serviced by a 200 mm dia. sanitary service that connects to the existing 1200 mm dia. sanitary sewer on York Street. The proposed York Street hotel addition will have a separate 200 mm dia. sanitary service that will connect to the existing 1200 mm dia. sanitary sewer on York Street. The existing 200 mm dia. sanitary service for the 110 York Street property will be abandoned. The proposed condominium development will be serviced by a 200 mm dia. sanitary service that will connect to the existing 1980x1500 mm dia. sanitary sewer on George Street. Refer to **Figure 3** for details.

The proposed development flows are based on the City of Ottawa Sewer Design Guidelines. The calculated sanitary flow estimates for existing and proposed buildings on site will be compared to design flows based on current zoning.



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CITY OF OTTAWA  
 141 GEORGE STREET / 325 DALHOUSIE  
 STREET / 110 YORK STREET

AERIAL PHOTO

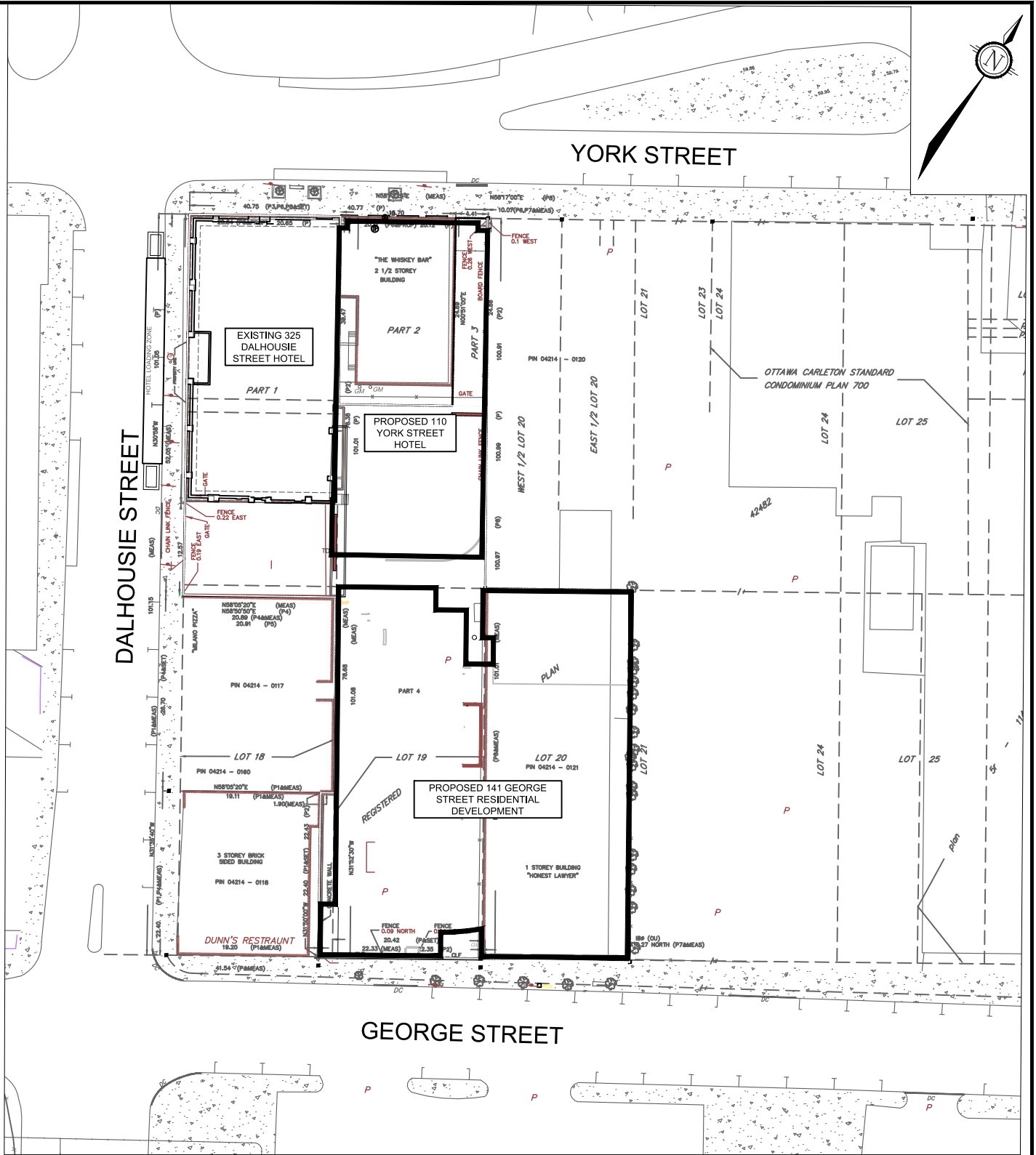
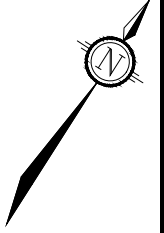
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FIGURE FIGURE 1

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CITY OF OTTAWA  
141 GEORGE STREET / 325 DALHOUSIE  
STREET / 110 YORK STREET

### CONCEPTUAL SITE PLAN

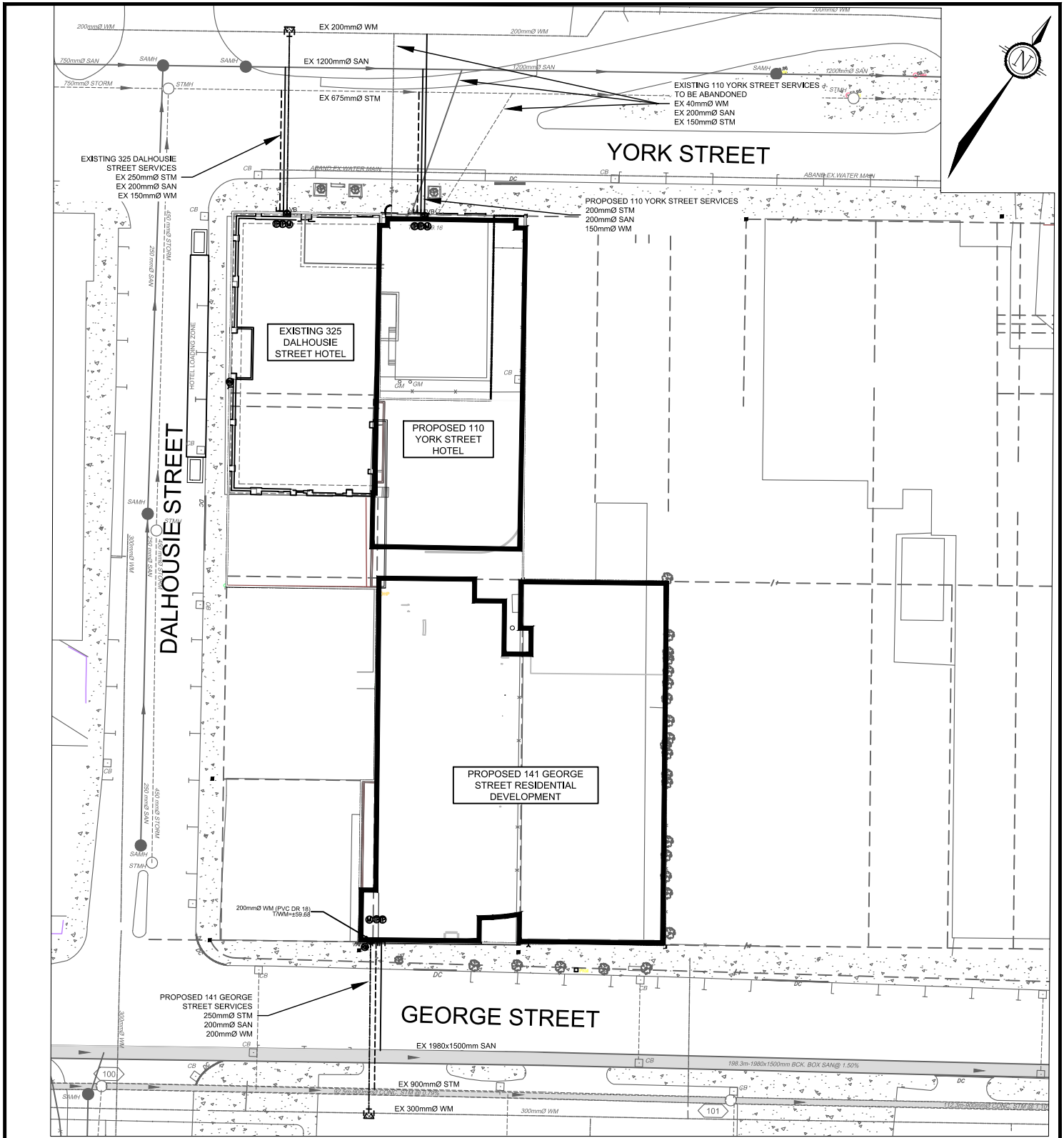
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FIGURE FIGURE 2

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CITY OF OTTAWA  
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 STREET / 110 YORK STREET

**CONCEPTUAL  
 SITE SERVICING PLAN**

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FIGURE FIGURE 3



**Sanitary Flows Under Proposed Development****Existing Hotel (Dalhousie Street)****Average Sanitary Flow:**Residential:  $Q_{SAN} = 200 \text{ units} \times 1.1 \text{ persons/unit} \times 225 \text{ L/cap/day} = 49,500 \text{ L/day} = 0.57 \text{ L/s}$ Restaurant/Bar:  $Q_{SAN} = 100 \text{ seats} \times 125 \text{ L/seat/day} = 12,500 \text{ L/day} = 0.14 \text{ L/s}$ Rooftop Bar:  $Q_{SAN} = 50 \text{ seats} \times 70 \text{ L/seat/day} = 3,500 \text{ L/day} = 0.04 \text{ L/s}$ Staff:  $Q_{SAN} = 20 \text{ staff} \times 40 \text{ L/staff/day} = 800 \text{ L/day} = 0.01 \text{ L/s}$ 

Total Average Residential Flow = 0.57 L/s

Total Average Commercial Flow = 0.14 L/s + 0.04 L/s + 0.01 L/s = 0.19 L/s

Total Average Sanitary Flow = 0.57 L/s + 0.19 L/s = 0.76 L/s

**Peak Sanitary Flow:**

Residential Peaking Factor (Harmon Equation) = 3.51

Total Peak Residential Flow = 0.57 L/s x 3.51 = 2.00 L/s

Commercial Peaking Factor = 1.0

Total Peak Commercial Flow = 0.19 L/s x 1.0 = 0.19 L/s

Total Peak Sanitary Flow = 2.00 L/s + 0.19 L/s = 2.19 L/s

*\* Based on predominantly one person per room (business travel).***Proposed Hotel (York Street)****Average Sanitary Flow:**Residential:  $Q_{SAN} = 128 \text{ units} \times 1.1 \text{ persons/unit} \times 225 \text{ L/cap/day} = 31,680 \text{ L/day} = 0.37 \text{ L/s}$ Ballroom/Bar:  $Q_{SAN} = 50 \text{ seats} \times 70 \text{ L/seat/day} = 3,500 \text{ L/day} = 0.04 \text{ L/s}$ Staff:  $Q_{SAN} = 20 \text{ staff} \times 40 \text{ L/staff/day} = 800 \text{ L/day} = 0.01 \text{ L/s}$ 

Total Average Residential Flow = 0.37 L/s

Total Average Commercial Flow = 0.04 L/s + 0.01 L/s = 0.05 L/s

Total Average Sanitary Flow = 0.37 L/s + 0.05 L/s = 0.42 L/s

**Peak Sanitary Flow:**

Residential Peaking Factor (Harmon Equation) = 3.56

Total Peak Residential Flow = 0.37 L/s x 3.56 = 1.32 L/s

Commercial Peaking Factor = 1.0

Total Peak Commercial Flow = 0.05 L/s x 1.0 = 0.05 L/s

Total Peak Sanitary Flow = 1.32 L/s + 0.05 L/s = 1.37 L/s

*\* Based on predominantly one person per room (business travel).***Proposed Condominium (George Street)****Average Sanitary Flow:**Residential:  $Q_{SAN} = 282 \text{ units} \times 1.8 \text{ persons/unit} \times 280 \text{ L/cap/day} = 142,128 \text{ L/day} = 1.65 \text{ L/s}$ Commercial:  $Q_{SAN} = 0.1097 \text{ ha} (1097 \text{ m}^2) \times 28,000 \text{ L/ha/d} = 3072 \text{ L/day} = 0.04 \text{ L/s}$

$$\text{Total Average Sanitary Flow} = 1.65 \text{ L/s} + 0.04 \text{ L/s} = 1.69 \text{ L/s}$$

**Peak Sanitary Flow:**

$$\text{Residential Peaking Factor (Harmon Equation)} = 3.38$$

$$\text{Total Peak Residential Flow} = 1.65 \text{ L/s} \times 3.38 = 5.58 \text{ L/s}$$

$$\text{Commercial Peaking Factor} = 1.0$$

$$\text{Total Peak Commercial Flow} = 0.04 \text{ L/s} \times 1.0 = 0.04 \text{ L/s}$$

$$\text{Total Peak Sanitary Flow} = 5.58 \text{ L/s} + 0.04 \text{ L/s} = 5.62 \text{ L/s}$$

**Infiltration – Site**

$$\text{Total Site Area} = 0.42 \text{ ha}$$

$$\text{Infiltration Flow} = 0.33 \text{ L/s/ha} \times 0.42 \text{ ha} = 0.14 \text{ L/s}$$

**Site Total**

$$\text{Total Average Sanitary Flow} = \mathbf{2.87 \text{ L/s}}$$

$$\text{Total Peak Sanitary Flow (including infiltration)} = \mathbf{9.32 \text{ L/s}}$$

**Sanitary Flows Under Current Zoning**

Currently, the site is zoned as MD2 – Mixed-Use Downtown. The current zoning by-law permits hotel and a restaurant component as well as residential mid to high use development and a commercial component ancillary to residential. Based on this, sanitary flows are calculated below.

**Existing Hotel (Dalhousie Street)**

$$\text{Average Sanitary Flow} = 0.76 \text{ L/s}^*$$

$$\text{Peak Sanitary Flow} = 2.19 \text{ L/s}^*$$

*\*See calculations in previous section.*

**Existing 110 York Street (The Whiskey Bar)****Average Sanitary Flow:**

$$\text{Bar: } Q_{\text{SAN}} = 170 \text{ seats} \times 70 \text{ L/seat/day} = 11,900 \text{ L/day} = 0.14 \text{ L/s}$$

$$\text{Staff: } Q_{\text{SAN}} = 6 \text{ staff} \times 40 \text{ L/staff/day} = 240 \text{ L/day} = 0.003 \text{ L/s}$$

$$\text{Total Average Sanitary Flow} = 0.14 \text{ L/s} + 0.003 \text{ L/s} = 0.14 \text{ L/s}$$

**Total Peak Sanitary Flow:**

$$\text{Commercial Peaking Factor} = 1.5$$

$$\text{Total Peak Sanitary Flow} = 0.14 \text{ L/s} \times 1.5 = 0.21 \text{ L/s}$$

**Future Residential Development (George Street)****Average Sanitary Flow:**

$$\text{Total Site Area} = 0.42 \text{ ha}$$

$$\text{Area Designated for Future Residential Development} = 0.21 \text{ ha}$$

Population = 0.21 ha x 1800 persons/ha = 378 persons

Total Average Sanitary Flow = 378 persons x 280 L/cap/day = 105,840 L/day = 1.23 L/s

Peak Sanitary Flow:

Residential Peaking Factor (Harmon Equation) = 3.43

Total Peak Residential Flow = 1.23 L/s x 3.43 = 4.22 L/s

#### Infiltration – Site

Total Site Area = 0.42 ha

Infiltration Flow = 0.33 L/s/ha x 0.42 ha = 0.14 L/s

#### Site Total

Total Average Sanitary Flow = **2.13 L/s**

Total Peak Sanitary Flow (including infiltration) = **6.76 L/s**

The sanitary flows from the proposed development are in close proximity to the flows calculated under the existing zoning. The existing receiving sewers are a 1200 mm dia. sanitary sewer at  $\pm 2.0\%$  slope on York Street with a capacity of approximately 5,750 L/s and a 1500 mm dia. sanitary sewer at  $\pm 1.5\%$  slope on George Street with a capacity of approximately 11,650 L/s. Therefore, the proposed development will have negligible impact on the existing municipal sanitary sewer system.

### **3.0 STORMWATER**

Stormwater flows from the site are currently conveyed to the existing storm sewer system via on-site catchbasins and overland flows to York Street, Dalhousie Street, and George Street. The stormwater from the Dalhousie Street hotel as well as the existing building at 110 & 112 York Street is captured by roof drains and outlet through their respective existing service connections. As part of this development, all stormwater will be controlled on site prior to being discharged to the storm system.

The proposed York Street hotel development will be serviced by a new 250 mm dia. storm service that will connect to the existing 675 mm dia. storm sewer on York Street; therefore, the existing 150 mm dia. storm service that is currently connected to the existing 675 mm dia. storm sewer on York Street will need to be abandoned. The new storm service connection to the building will be equipped with a backwater valve.

Furthermore, the proposed condominium development will be serviced by a 250 mm dia. storm service that will connect to the existing 900 mm dia. storm sewer on George Street. The proposed storm service connection to the building will be equipped with a backwater valve. Refer to **Figure 3** for details.

The City will require that on-site stormwater management be implemented to control post-development stormwater discharge for both the 5 & 100 year storm events based on an allowable runoff coefficient (C) of 0.50, a time of concentration ( $t_c$ ) of 20 minutes, and a 5-year storm control. Stormwater management will be achieved through the use of rooftop controls and surface ponding (as required). Should surplus storage be required, stormwater management

alternatives such as storage tanks or super-pipes will be implemented. Temporary storage will be provided at the surface as required to supply the necessary release rate during all phases until full build out is achieved with underground systems.

The site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to York Street, Dalhousie Street and George Street. Erosion and sediment control measures will be implemented during all phases of construction and inspected regularly.

## 4.0 WATERMAIN

### 4.1 Domestic Water Demand

The existing Dalhousie Street hotel is serviced by a 150mm dia. water service that is connected to the existing 200mm dia. watermain in York Street. The proposed York Street hotel development will be serviced by a separate 150 mm dia. water service that will connect to the existing 200 mm dia. watermain on York Street. The existing water service for the 110 York Street property will need to be blanked at the City watermain and abandoned. The proposed condominium development will be serviced by a 200mm dia. water service that will connect to the existing 300 mm dia. watermain on George Street. Refer to **Figure 3** for details.

Estimated domestic daily water demands for the development are roughly the same as the proposed development sanitary flows listed above in Section 2.0:

#### Existing Hotel (Dalhousie Street)

Residential Average Day Demand = 0.57 L/s

Residential Maximum Day Demand (2.5 x avg. day) = 1.43 L/s

Residential Peak Hour Demand (2.2 x max. day) = 3.15 L/s

Commercial Average Day Demand (Restaurant + Bar + Staff) = 0.19 L/s

Commercial Maximum Day Demand (1.5 x avg. day) = 0.29 L/s

Commercial Peak Hour Demand (1.8 x max. day) = 0.52 L/s

Total Average Day Demand = 0.76 L/s

Total Maximum Day Demand = 1.72 L/s

Total Peak Hour Demand = 3.67 L/s

#### Proposed Hotel (York Street)

Residential Average Day Demand = 0.37 L/s

Residential Maximum Day Demand (2.5 x avg. day) = 0.93 L/s

Residential Peak Hour Demand (2.2 x max. day) = 2.05 L/s

Commercial Average Day Demand (Ballroom/Bar + Staff) = 0.05 L/s

Commercial Maximum Day Demand (1.5 x avg. day) = 0.08 L/s

Commercial Peak Hour Demand (1.8 x max. day) = 0.14 L/s

Total Average Day Demand = 0.42 L/s

Total Maximum Day Demand = 1.01 L/s

Total Peak Hour Demand = 2.19 L/s

### Condominium (George Street)

Residential Average Day Demand = 1.65 L/s

Residential Maximum Day Demand (2.5 x avg. day) = 4.13 L/s

Residential Peak Hour Demand (2.2 x max. day) = 9.09 L/s

Commercial Average Day Demand = 0.04 L/s

Commercial Maximum Day Demand (1.5 x avg. day) = 0.06 L/s

Commercial Peak Hour Demand (1.8 x max. day) = 0.11 L/s

Total Average Day Demand = 1.69 L/s

Total Maximum Day Demand = 4.19 L/s

Total Peak Hour Demand = 9.20 L/s

Based on the data provided by the City, the existing watermains in the area are adequate to service this development. According to hydrant test results, the watermain in the street can deliver in the range of approximately 1000 igpm ( $\pm 75.8$  L/s) at a dynamic pressure greater than 56 psi. A copy of the watermain data is attached in **Appendix A**.

## **4.2 Fire Demand**

Section 4.2.11 of the City of Ottawa Water Design Guidelines reads:

“When calculating the fire flow requirements and affected pipe sizing, designers shall use the method developed by the Fire Underwriters Survey.”, and

“The requirements for levels of fire protection on private property are covered in Section 7.2.11 of the Ontario Building Code.”

The Fire Underwriters Survey is used to assess the performance of the water distribution system on a “City Block” basis rather than an individual building basis. The Ontario Building Code governs the assessment of fire demand for individual buildings.

Section 7.2.11.1 of the Ontario Building Codes states that the design, construction, installation and testing of fire service mains and water service pipe combined with fire service mains shall be in conformance with NFPA 24.

NFPA 24 is the standard for the “Installation of Private Fire Service Mains and their Appurtenances”. Chapter 13 of NFPA 24 discusses sizing the private service fire mains for fire protection systems which shall be approved by the authority having jurisdiction, considering the following factors:

- Construction and Occupancy of the building
- Fire Flow and Pressure of the Water Required
- Adequacy of the Water Supply

Specific to this project the buildings will be sprinklered per Section 3.2.2.45 of the Ontario Building Code (OBC). Section 3.2.5.7 of the OBC requires that an adequate water supply for fire fighting be provided to each building, and references Appendix A of the OBC. Sentence 3 of Section A 3.2.5.7 of the OBC (Appendix A) states that NFPA 13 be used for determining both sprinkler and hose stream demands for a sprinklered building.

The design of the sprinkler system is completed by a Fire Protection Engineer, or typically computed by the sprinkler contractor and approved by the Fire Protection Engineer. The process involves detailed hydraulic calculations based on building layout, pipe runs, head losses, fire pump requirements, etc. At this stage in the development process, these details are not available. However, using Chapter 7 of NFPA 13, it is possible to provide a fairly accurate estimate of the fire demand for the building. This estimate is provided below.

### **NFPA Chapter 7 Calculation**

22 Storey Residential Building – Light Hazard

15 Storey Hotel Building – Light Hazard [incl. restaurant - Ordinary Hazard (Group 1)]

18-Storey Hotel Building – Light Hazard

4 Level Underground Parking (under residential building - serve both) - Ordinary Hazard (Group 1)

Section 7.2.3 of NFPA 13, “Water Demand Requirements – Hydraulic Calculation Methods” is used to estimate the hose stream demand and the sprinkler demand. The water demand for sprinklers is estimated using the most remote area in the building. Figure 7.2.3.1.2 – Area/Density Curves is used for the worst case scenario, which in this case is the Ordinary Hazard Classification in the underground parking garage. For this classification, Figure 7.2.3.1.2 provides a density of 0.15 gpm/ft<sup>2</sup> using a coverage of 1500 ft<sup>2</sup>, or 225 gpm (US).

Table 7.2.3.1.1 is used to determine the hose stream demand. For Ordinary Hazard a total combined inside and outside hose stream demand of 250 gpm is required. Typically, 150 gpm would be drawn off the hydrant and 100 gpm off the hose cabinets.

Therefore, total estimated demand would be 225 gpm + 250 gpm = 475 gpm. Adding an allowance for head losses through out the sprinkler system, an estimated fire demand of between 550 – 600 gpm, or say 600 USgpm (2,270 L/min) would be required. According to the fire hydrant data provided by the City, the 200 mm and 300 mm watermains on York Street and George Street respectively can deliver in the range of 1,000 l gpm (1,200 USgpm) under normal conditions and 2,100 l gpm (2,500 USgpm) at 20 psi residual. The building will also be equipped with a fire pump, if necessary, to provide the minimum residual pressure at the sprinkler heads.

Reference material from NFPA 13 is contained in **Appendix A**.

## 5.0 CONCLUSIONS

Based on the foregoing, adequate sanitary, storm and water services are available to support this development.

### NOVATECH ENGINEERING CONSULTANTS LTD.

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**APPENDIX A**  
**Hydrant Flow Data/Fire Fighting Information**







**6-4.5.9\*** For individual fasteners, the loads determined in 6-4.5.6 shall not exceed the allowable loads provided in Figure 6-4.5.9.

The type of fasteners used to secure the bracing assembly to the structure shall be limited to those shown in Figure 6-4.5.9. For connections to wood, through bolts with washers on each end shall be used. Holes for through bolts shall be  $1/16$  in. (1.6 mm) greater than the diameter of the bolt.

*Exception No. 1: Where it is not practical to install through bolts due to the thickness of the member or inaccessibility, lag screws shall be permitted. Holes shall be pre-drilled  $1/8$  in. (3.2 mm) smaller than the maximum root diameter of the lag screw.*

*Exception No. 2: Other fastening methods are acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 6-4.5.9. Calculations shall be permitted where required by the authority having jurisdiction.*

**6-4.5.10** Sway bracing assemblies shall be listed for a maximum load rating. The loads shall be reduced as shown in Table 6-4.5.10 for loads that are less than 90 degrees from vertical.

*Exception: Where sway bracing utilizing pipe, angles, flats, or rods as shown in Table 6-4.5.8 is used, the components do not require listing. Bracing fittings and connections used with those specific materials shall be listed.*

**Table 6-4.5.10 Allowable Horizontal Load on Brace Assemblies Based on the Weakest Component of the Brace Assembly**

Brace Angle	Allowable Horizontal Load
30-40 degrees from vertical	Listed load rating divided by 2.000
45-59 degrees from vertical	Listed load rating divided by 1.414
60-89 degrees from vertical	Listed load rating divided by 1.155
90 degrees from vertical	Listed load rating

**6-4.5.11** Bracing shall be attached directly to feed and cross mains. Each run of pipe between changes in direction shall be provided with both lateral and longitudinal bracing.

*Exception: Pipe runs less than 12 ft (3.6 m) in length shall be permitted to be supported by the braces on adjacent runs of pipe.*

**6-4.5.12** A length of pipe shall not be braced to sections of the building that will move differentially.

#### 6-4.6 Restraint of Branch Lines.

**6-4.6.1\*** Restraint is considered a lesser degree of resisting loads than bracing and shall be provided by use of one of the following:

- (1) A listed sway brace assembly
- (2) A wraparound U-hook satisfying the requirements of 6-4.5.3, Exception No. 3
- (3) No. 12, 440-lb (200-kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe
- (4) Other approved means

Wire used for restraint shall be located within 2 ft (610 mm) of a hanger. The hanger closest to a wire restraint shall be of a type that resists upward movement of a branch line.

**6-4.6.2** The end sprinkler on a line shall be restrained against excessive vertical and lateral movement.

**6-4.6.3\*** Where upward or lateral movement would result in an impact against the building structure, equipment, or finish materials, branch lines shall be restrained at intervals not exceeding 30 ft (9 m).

**6-4.6.4\*** Sprig-ups 4 ft (1.2 m) or longer shall be restrained against lateral movement.

#### 6-4.7 Hangers and Fasteners Subject to Earthquakes.

**6-4.7.1** C-type clamps (including beam and large flange clamps) used to attach hangers to the building structure in areas subject to earthquakes shall be equipped with a restraining strap. The restraining strap shall be listed for use with a C-type clamp or shall be a steel strap of not less than 16 gauge thickness and not less than 1 in. (25.4 mm) wide for pipe diameters 8 in. (203 mm) or less and 14 gauge thickness and not less than  $1\frac{1}{4}$  in. (31.7 mm) wide for pipe diameters greater than 8 in. (203 mm). The restraining strap shall wrap around the beam flange not less than 1 in. (25.4 mm). A lock nut on a C-type clamp shall not be used as a method of restraint. A lip on a "C" or "Z" purlin shall not be used as a method of restraint.

Where purlins or beams do not provide an adequate lip to be secured by a restraining strap, the strap shall be through-bolted or secured by a self-tapping screw.

**6-4.7.2** C-type clamps (including beam and large flange clamps), with or without restraining straps, shall not be used to attach braces to the building structure.

**6-4.7.3** Powder-driven fasteners shall not be used to attach braces to the building structure.

*Exception: Powder-driven fasteners shall be permitted where they are specifically listed for service in resisting lateral loads in areas subject to earthquakes.*

**6-4.7.4** Powder-driven fasteners shall not be used to attach hangers to the building structure where the systems are required to be protected against earthquakes using a horizontal force factor exceeding  $0.50 W_p$ , where  $W_p$  is the weight of the water-filled pipe.

*Exception: Powder-driven fasteners shall be permitted where they are specifically listed for horizontal force factors in excess of  $0.50 W_p$ .*

## Chapter 7 Design Approaches

### 7-1 General.

**7-1.1** Water demand requirements shall be determined from the occupancy hazard fire control approach of Section 7-2.

*Exception: Special design approaches as permitted in Section 7-9.*

**7-1.2** For buildings with two or more adjacent occupancies that are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding occupancy shall extend 15 ft (4.6 m) beyond its perimeter.

## 7-2 Occupancy Hazard Fire Control Approach.

### 7-2.1 Occupancy Classifications.

7-2.1.1 Occupancy classifications for this standard relate to sprinkler installations and their water supplies only. They shall not be used as a general classification of occupancy hazards.

7-2.1.2 Occupancies or portions of occupancies shall be classified according to the quantity and combustibility of contents, the expected rates of heat release, the total potential for energy release, the heights of stockpiles, and the presence of flammable and combustible liquids, using the definitions contained in Section 1-4. Classifications are as follows:

Light hazard

Ordinary hazard (Groups 1 and 2)

Extra hazard (Groups 1 and 2)

Special occupancy hazard (*see Section 7-10*)

### 7-2.2 Water Demand Requirements — Pipe Schedule Method.

7-2.2.1 Table 7-2.2.1 shall be used in determining the minimum water supply requirements for light and ordinary hazard occupancies protected by systems with pipe sized according to the pipe schedules of Section 8-5. Pressure and flow requirements for extra hazard occupancies shall be based on the hydraulic calculation methods of 7-2.3. The pipe schedule method shall be permitted only for new installations of 5000 ft<sup>2</sup> (465 m<sup>2</sup>) or less or for additions or modifications to existing pipe schedule systems sized according to the pipe schedules of Section 8-5. Table 7-2.2.1 shall be used in determining the minimum water supply requirements.

*Exception No. 1: The pipe schedule method shall be permitted for use in systems exceeding 5000 ft<sup>2</sup> (465 m<sup>2</sup>) where the flows required in Table 7-2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler.*

*Exception No. 2: The pipe schedule method shall be permitted for additions or modifications to existing extra hazard pipe schedule systems.*

7-2.2.2 The lower duration value of Table 7-2.2.1 shall be acceptable only where remote station or central station water-flow alarm service is provided.

7-2.2.3\* The residual pressure requirement of Table 7-2.2.1 shall be met at the elevation of the highest sprinkler. (*See the Exceptions to 7-2.2.1*).

7-2.2.4 The lower flow figure of Table 7-2.2.1 shall be permitted only where the building is of noncombustible construction or the potential areas of fire are limited by building size or compartmentation such that no open areas exceed 3000 ft<sup>2</sup> (279 m<sup>2</sup>) for light hazard or 4000 ft<sup>2</sup> (372 m<sup>2</sup>) for ordinary hazard.

**Table 7-2.2.1 Water Supply Requirements for Pipe Schedule Sprinkler Systems**

Occupancy Classification	Minimum Residual Pressure Required (psi)	Acceptable Flow at Base of Riser (Including Hose Stream Allowance) (gpm)	Duration (minutes)
Light hazard	15	500–750	30–60
Ordinary hazard	20	850–1500	60–90

For SI units, 1 gpm = 3.785 L/min; 1 psi = 0.0689 bar.

### 7-2.3 Water Demand Requirements — Hydraulic Calculation Methods.

#### 7-2.3.1 General.

7-2.3.1.1\* The minimum water supply requirements for a hydraulically designed occupancy hazard fire control sprinkler system shall be determined by adding the hose stream demand from Table 7-2.3.1.1 to the water supply for sprinklers determined in 7-2.3.1.2. This supply shall be available for the minimum duration specified in Table 7-2.3.1.1.

*Exception No. 1: An allowance for inside and outside hose shall not be required where tanks supply sprinklers only.*

*Exception No. 2: Where pumps taking suction from a private fire service main supply sprinklers only, the pump need not be sized to accommodate inside and outside hose. Such hose allowance shall be considered in evaluating the available water supplies.*

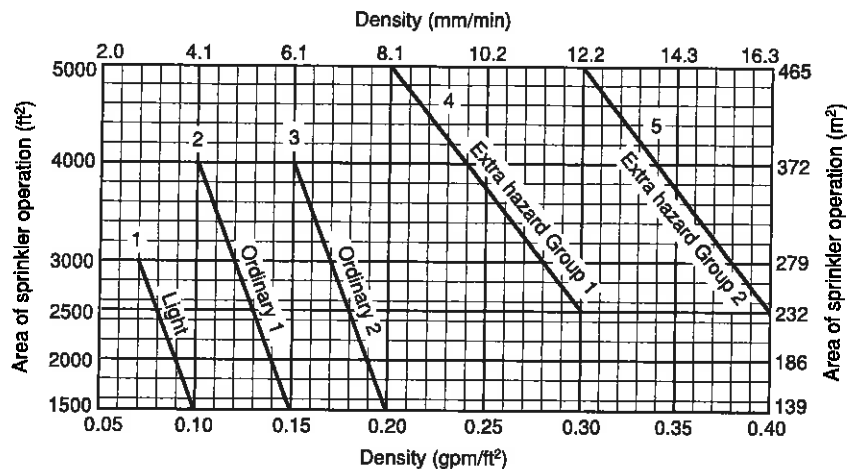
7-2.3.1.2 The water supply for sprinklers only shall be determined either from the area/density curves of Figure 7-2.3.1.2 in accordance with the method of 7-2.3.2 or be based upon the room design method in accordance with 7-2.3.3, at the discretion of the designer. For special areas under consideration, as described in 7-2.3.4, separate hydraulic calculations shall be required in addition to those required by 7-2.3.2 or 7-2.3.3.

**Table 7-2.3.1.1† Hose Stream Demand and Water Supply Duration Requirements for Hydraulically Calculated Systems**

Occupancy or Commodity Classification	Inside Hose (gpm)	Total Combined Inside and Outside Hose (gpm)	Duration (minutes)
Light hazard	0, 50, or 100	100	30
Ordinary hazard	0, 50, or 100	250	60-90
Extra hazard	0, 50, or 100	500	90-120
Rack storage, Class I, II, and III commodities up to 12 ft (3.7 m) in height	0, 50, or 100	250	90
Rack storage, Class IV commodities up to 10 ft (3.1 m) in height	0, 50, or 100	250	90
Rack storage, Class IV commodities up to 12 ft (3.7 m) in height	0, 50, or 100	500	90
Rack storage, Class I, II, and III commodities over 12 ft (3.7 m) in height	0, 50, or 100	500	90
Rack storage, Class IV commodities over 12 ft (3.7 m) in height and plastic commodities	0, 50, or 100	500	120
General storage, Class I, II, and III commodities over 12 ft (3.7 m) up to 20 ft (6.1 m)	0, 50, or 100	500	90
General storage, Class IV commodities over 12 ft (3.7 m) up to 20 ft (6.1 m)	0, 50, or 100	500	120
General storage, Class I, II, and III commodities over 20 ft (6.1 m) up to 30 ft (9.1 m)	0, 50, or 100	500	120
General storage, Class IV commodities over 20 ft (6.1 m) up to 30 ft (9.1 m)	0, 50, or 100	500	150
General storage, Group A plastics ≤ 5 ft (1.5 m)	0, 50, or 100	250	90
General storage, Group A plastics over 5 ft (1.5 m) up to 20 ft (6.1 m)	0, 50, or 100	500	120
General storage, Group A plastics over 20 ft (6.1 m) up to 25 ft (7.6 m)	0, 50, or 100	500	150

For SI units, 1 gpm = 3.785 L/min.

Figure 7-2.3.1.2 Area/density curves.



**7-2.3.1.3** Regardless of which of the two methods is used, the following restrictions shall apply:

(a) For areas of sprinkler operation less than 1500 ft<sup>2</sup> (139 m<sup>2</sup>) used for light and ordinary hazard occupancies, the density for 1500 ft<sup>2</sup> (139 m<sup>2</sup>) shall be used. For areas of sprinkler operation less than 2500 ft<sup>2</sup> (232 m<sup>2</sup>) for extra hazard occupancies, the density for 2500 ft<sup>2</sup> (232 m<sup>2</sup>) shall be used.

(b) \*For buildings having unsprinklered combustible concealed spaces (as described in 5-13.1.1 and 5-13.7), the minimum area of sprinkler operation shall be 3000 ft<sup>2</sup> (279 m<sup>2</sup>).

*Exception No. 1: Combustible concealed spaces filled entirely with noncombustible insulation.*

*Exception No. 2: \*Light or ordinary hazard occupancies where noncombustible or limited combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft<sup>3</sup> (4.8 m<sup>3</sup>) or less in volume.*

*Exception No. 3: \*Concealed spaces where the exposed surfaces have a flame spread rating of 25 or less and the materials have been demonstrated to not propagate fire in the form in which they are installed in the space.*

(c) Water demand of sprinklers installed in racks or water curtains shall be added to the ceiling sprinkler water demand at the point of connection. Demands shall be balanced to the higher pressure. (See Chapter 8.)

(d) Water demand of sprinklers installed in concealed spaces or under obstructions such as ducts and cutting tables need not be added to ceiling demand.

(e) Where inside hose stations are planned or are required, a total water allowance of 50 gpm (189 L/min) for a single hose station installation or 100 gpm (378 L/min) for a multiple hose station installation shall be added to the sprinkler requirements. The water allowance shall be added in 50-gpm (189-L/min) increments beginning at the most remote hose station, with each increment added at the pressure required by the sprinkler system design at that point.

(f) When hose valves for fire department use are attached to wet pipe sprinkler system risers in accordance with 5-15.5.2, the water supply shall not be required to be added to standpipe demand as determined from NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

*Exception No. 1: Where the combined sprinkler system demand and hose stream allowance of Table 7-2.3.1.1 exceeds the requirements of NFPA 14, Standard for the Installation of Standpipe and Hose Systems, this higher demand shall be used.*

*Exception No. 2: For partially sprinklered buildings, the sprinkler demand, not including hose stream allowance, as indicated in Table 7-2.3.1.1 shall be added to the requirements given in NFPA 14, Standard for the Installation of Standpipe and Hose Systems.*

(g) Water allowance for outside hose shall be added to the sprinkler and inside hose requirement at the connection to the city water main or a yard hydrant, whichever is closer to the system riser.

(h) The lower duration values in Table 7-2.3.1.1 shall be permitted where remote station or central station waterflow alarm service is provided.

(i) Where pumps, gravity tanks, or pressure tanks supply sprinklers only, requirements for inside and outside hose need not be considered in determining the size of such pumps or tanks.

**7-2.3.1.4** Total system water supply requirements shall be determined in accordance with the hydraulic calculation procedures of Section 8-4.

### 7-2.3.2 Area/Density Method.

**7-2.3.2.1** The water supply requirement for sprinklers only shall be calculated from the area/density curves in Figure 7-2.3.1.2 or from Section 7-10 where area/density criteria is specified for special occupancy hazards. When using Figure 7-2.3.1.2, the calculations shall satisfy any single point on the appropriate area/density curve as follows:

- (1) Light hazard area/density curve 1
- (2) Ordinary hazard (Group 1) area/density curve 2
- (3) Ordinary hazard (Group 2) area/density curve 3
- (4) Extra hazard (Group 1) area/density curve 4
- (5) Extra hazard (Group 2) area/density curve 5

It shall not be necessary to meet all points on the selected curve.

*Exception: Sprinkler demand for storage occupancies as determined in Sections 7-3 through 7-8.*

**7-2.3.2.2** For protection of miscellaneous storage, miscellaneous tire storage, and storage up to 12 ft (3.7 m) in height, the discharge criteria in Table 7-2.3.2.2 shall apply.

**Table A-1-4.11 Typical Cotton Bale Types and Approximate Sizes**

Bale Type	Dimensions		Average Weight		Volume		Density	
	in.	mm	lb	kg	ft <sup>3</sup>	m <sup>3</sup>	lb/ft <sup>3</sup>	kg/m <sup>3</sup>
Gin, flat	55 × 45 × 28	1397 × 1143 × 711	500	226.8	40.1	1.13	12.5	201
Modified gin, flat	55 × 45 × 24	1397 × 1143 × 610	500	226.8	34.4	0.97	14.5	234
Compressed, standard	57 × 29 × 23	1448 × 736 × 584	500	226.8	22.0	0.62	22.7	366
Gin, standard	55 × 31 × 21	1397 × 787 × 533	500	226.9	20.7	0.58	24.2	391
Compressed, universal	58 × 25 × 21	1475 × 635 × 533	500	226.8	17.6	0.50	28.4	454
Gin, universal	55 × 26 × 21	1397 × 660 × 533	500	226.8	17.4	0.49	28.7	463
Compressed, high density	58 × 22 × 21	1473 × 559 × 533	500	226.8	15.5	0.44	32.2	515

**A-1-4.11 Baled Cotton.** See Table A-1-4.11.

**A-1-4.12 Array, Standard (Paper).** The occasional presence of partially used rolls on top of columns of otherwise uniform diameter rolls does not appreciably affect the burning characteristics.

**A-1-4.12 Roll Paper Storage, Wrapped.** Rolls that are completely protected with a heavyweight kraft wrapper on both sides and ends are subject to a reduced degree of fire hazard. Standard methods for wrapping and capping rolls are outlined in Figure A-1-4.12.

In some cases, rolls are protected with laminated wrappers, using two sheets of heavy kraft with a high-temperature wax laminate between the sheets. Where using this method, the overall weight of wax-laminated wrappers should be based on the basis weight per 1000 ft<sup>2</sup> (92.9 m<sup>2</sup>) of the outer sheet only, rather than on the combined basis weight of the outer and inner laminated wrapper sheets. A properly applied wrapper can have the effect of changing the class of a given paper to essentially that of the wrapper material. The effect of applying a wrapper to tissue has not been determined by test.

**A-1-4.12 Roll Paper Storage Height.** The size of rolls and limitations of mechanical handling equipment should be considered in determining maximum storage height.

**A-2-1 Occupancy examples in the listings as shown in the various hazard classifications are intended to represent the norm for those occupancy types. Unusual or abnormal fuel loadings or combustible characteristics and susceptibility for changes in these characteristics, for a particular occupancy, are considerations that should be weighed in the selection and classification.**

The light hazard classification is intended to encompass residential occupancies; however, this is not intended to preclude the use of listed residential sprinklers in residential occupancies or residential portions of other occupancies.

**A-2-1.1 Light hazard occupancies include occupancies having uses and conditions similar to the following:**

Churches

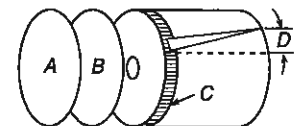
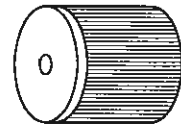
Clubs

Eaves and overhangs, if of combustible construction with no combustibles beneath

**Figure A-1-4.12 Wrapping and capping terms and methods.**

**Wrapper**  
 Exterior wrapper      General term for protective wrapping of sides and ends on roll.  
 Body wrapper

**Body wrap**  
 Sleeve wrap      Wrapper placed around circumference of roll.  
 Wrap — do not cap      No heads or caps needed.



**Heads**  
 Headers      Protection applied to the ends of the rolls (A and B). Heads do not lap over the end of the roll.

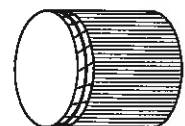
**Inside heads**      Protection applied to the ends of the rolls next to the roll itself (B). The wrapper of the rolls is crimped down over these heads.

**Outside heads**      Protection applied to the ends of the rolls on the outside (A). This head is applied after the wrapper is crimped.

**Edge protectors**  
 Edge bands      Refers to extra padding to prevent damage to roll edges (C).

**Overwrap**      The distance the body wrap or wrapper overlaps itself (D).

**Roll cap**      A protective cover placed over the end of a roll. Edges of cap lap over the end of the roll and are secured to the sides of the roll.



Educational  
Hospitals  
Institutional  
Libraries, except large stack rooms  
Museums  
Nursing or convalescent homes  
Offices, including data processing  
Residential  
Restaurant seating areas  
Theaters and auditoriums, excluding stages and prosceniums  
Unused attics

**A-2-1.2.1** Ordinary hazard occupancies (Group 1) include occupancies having uses and conditions similar to the following:

Automobile parking and showrooms  
Bakeries  
Beverage manufacturing  
Canneries  
Dairy products manufacturing and processing  
Electronic plants  
Glass and glass products manufacturing  
Laundries  
Restaurant service areas

**A-2-1.2.2** Ordinary hazard occupancies (Group 2) include occupancies having uses and conditions similar to the following:

Cereal mills  
Chemical plants — ordinary  
Confectionery products  
Distilleries  
Dry cleaners  
Feed mills  
Horse stables  
Leather goods manufacturing  
Libraries — large stack room areas  
Machine shops  
Metal working  
Mercantile  
Paper and pulp mills  
Paper process plants  
Piers and wharves  
Post offices  
Printing and publishing  
Repair garages  
Resin application area  
Stages  
Textile manufacturing  
Tire manufacturing  
Tobacco products manufacturing  
Wood machining  
Wood product assembly

**A-2-1.3.1** Extra hazard occupancies (Group 1) include occupancies having uses and conditions similar to the following:

Aircraft hangars (except as governed by NFPA 409, *Standard on Aircraft Hangars*)  
Combustible hydraulic fluid use areas  
Die casting

Metal extruding  
Plywood and particle board manufacturing  
Printing [using inks having flash points below 100°F (38°C)]  
Rubber reclaiming, compounding, drying, milling, vulcanizing  
Saw mills  
Textile picking, opening, blending, garnetting, or carding, combining of cotton, synthetics, wool shoddy, or burlap  
Upholstering with plastic foams

**A-2-1.3.2** Extra hazard occupancies (Group 2) include occupancies having uses and conditions similar to the following:

Asphalt saturating  
Flammable liquids spraying  
Flow coating  
Manufactured home or modular building assemblies (where finished enclosure is present and has combustible interiors)  
Open oil quenching  
Plastics processing  
Solvent cleaning  
Varnish and paint dipping

**A-2-1.4** Other NFPA standards contain design criteria for fire control or fire suppression (*see 2-1.4 and Chapter 13*). While these can form the basis of design criteria, this standard describes the methods of design, installation, fabrication, calculation, and evaluation of water supplies that should be used for the specific design of the system.

Other NFPA standards contain sprinkler system design criteria for fire control or suppression of specific hazards. This information has been either referenced or copied into Chapters 5 and 7 using NFPA's extract policy.

**A-2-2** Specification of the type, amount, and arrangement of combustibles for any commodity classification is essentially an attempt to define the potential fire severity, based on its burning characteristics, so the fire can be successfully controlled by the prescribed sprinkler protection for the commodity class. In actual storage situations, however, many storage arrays do not fit precisely into one of the fundamental classifications; therefore, the user needs to make judgments after comparing each classification to the existing storage conditions. Storage arrays consist of thousands of products, which make it impossible to specify all the acceptable variations for any class. As an alternative, a variety of common products are classified in this appendix based on judgment, loss experience, and fire test results.

Table A-2-2 provides examples of commodities not addressed by the classifications in Section 2-2.

Table A-2-2.3 is an alphabetized list of commodities with corresponding classifications.

Tables A-2-2.3.1 through A-2-2.3.4 and A-2-2.4.1 provide examples of commodities within a specific class.

**Table A-2-2 Examples of Commodities Not Addressed by the Classifications in Section 2-2**

Boxes, Crates
- Empty, wood slatted
Lighters (butane)
- Loose in large containers (Level 3 aerosol)

\*Should be treated as idle pallets.



**APPENDIX B**  
**Servicing Study Guidelines Checklist**

**Development Servicing Study Checklist**

4.1 General Content	Addressed (Y/N/NA)	Comments
Executive Summary (for larger reports only).	NA	
Date and revision number of the report.	Y	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	Figure 1
Plan showing the site and location of all existing services.	Y	Figure 3
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Y	Refer to Site Plan
Summary of Pre-consultation Meetings with City and other approval agencies.	N	
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defensible design criteria.	NA	
Statement of objectives and servicing criteria.	Y	
Identification of existing and proposed infrastructure available in the immediate area.	Y	
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	NA	
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	N/A	
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	NA	
Proposed phasing of the development, if applicable.	NA	
Reference to geotechnical studies and recommendations concerning servicing.	NA	
All preliminary and formal site plan submissions should have the following information:		
Metric scale	Y	
North arrow (including construction North)	Y	
Key plan	Y	Figure 1
Name and contact information of applicant and property owner	N	
Property limits including bearings and dimensions	Y	Figures 2 & 3
Existing and proposed structures and parking areas	Y	Figures 2 & 3
Easements, road widening and rights-of-way	Y	
Adjacent street names	Y	

**Development Servicing Study Checklist**

4.2 Water	Addressed (Y/N/NA)	Comments
Confirm consistency with Master Servicing Study, if available.	N/A	
Availability of public infrastructure to service proposed development.	Y	Figure 3
Identification of system constraints.	NA	
Identify boundary conditions.	Y	
Confirmation of adequate domestic supply and pressure.	Y	
Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Y	
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	NA	
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	NA	
Address reliability requirements such as appropriate location of shut-off valves.	NA	
Check on the necessity of a pressure zone boundary modification.	NA	
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Y	
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	
Description of off-site required feeder mains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	NA	
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	NA	

**Development Servicing Study Checklist**

4.3 Wastewater	Addressed (Y/N/NA)	Comments
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Y	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	NA	
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	NA	
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	NA	
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	NA	
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	NA	
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	NA	
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	NA	
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	NA	
Special considerations such as contamination, corrosive environment etc.	NA	

**Development Servicing Study Checklist**

4.4 Stormwater	Addressed (Y/N/NA)	Comments
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	
Analysis of the available capacity in existing public infrastructure.	NA	
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	NA	
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	N/A	
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	
Set-back from private sewage disposal systems.	NA	
Watercourse and hazard lands setbacks.	NA	
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	NA	
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	NA	
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	N	Will be addressed during detailed design for Site Plan application.
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	NA	
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	N	Will be addressed during detailed design for Site Plan application.
Any proposed diversion of drainage catchment areas from one outlet to another.	NA	
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM facilities.	Y	
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	NA	
Identification of municipal drains and related approval requirements.	NA	
Description of how the conveyance and storage capacity will be achieved for the development.	Y	
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N	Will be addressed during detailed design for Site Plan application.
Inclusion of hydraulic analysis including HGL elevations.	NA	
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	N	Will be addressed during detailed design for Site Plan application.
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	NA	
Identification of fill constrains related to floodplain and geotechnical investigation.	NA	

**Development Servicing Study Checklist**

4.5 Approval and Permit Requirements	Addressed (Y/N/NA)	Comments
Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	NA	
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N	
Changes to Municipal Drains.	N	
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	NA	

4.6 Conclusion	Addressed (Y/N/NA)	Comments
Clearly stated conclusions and recommendations.	Y	
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N	
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y	