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Reference: 129 Main St., Wellington, Ontario

Subject: Response to Concerns of Town 21 March 2022

The Town Development Services and Fire and Rescue identified concerns related to "Functional Servicing Report". We respond as follows:

27. The revised 'SERVICE REPORT for Potable Water and Sanitary Sewer' contains detail design criteria for sanitary and potable water for pre-development and proposed. Municipal capabilities were evaluated using "Design Guidelines for Potable Water" and "Design Guidelines For Sewage Works". The project service sizes were determined using the OBC20, Part 7. All calculations are included in the Report appendix.

28. The required fire fighting water flow is prescribed in OBC12 A3.2.5.7. This section determines if there is sufficient water flow from municipal sources. If not, water storage is required. The minimum required water was determined for the pre-development building [B0] and the proposed development building [B1].

The flow is calculated using the equation provided in the relevant section of the Building Code, section A-3.2.5.7. paragraph 3.(a)

$$Q=K*V*S_{tot}$$

Q= minimum supply of water in litres
K= water supply coefficient from Table 1
V=total building volume in cubic metres
S_{tot}=total spacial coefficient values from property line exposure

K for B0 is 23. K for B1 is 18, as this building is fire rated, with fire rated assemblies and fire rated stairwells.

B0 had no building within 10 metres of a nearest corner; therefore S_{tot} was 1.
B1 had one building within 10 metres, at 7.0 m; therefore the S_{tot} was 1.3
V[B0]=101834 litres [includes first floor], 56032 litres [excluding fist floor as sprinkler extinguish fire before fire fighting water is required]
V[B1]=52349 litres

Both of these conditions require 2700 litres per minute [713 gpm] fire fighting water supply. The attached pressure/flow chart that was developed from the hydrant flow test [conducted in April 2022] indicates 1021 gpm @ 30 psi. This is significantly higher than the minimum required flow as per OBC12 A-3.2.5.7.

The Town has asked for another analysis of fire fighting water flow based on the Fire Underwriters Survey [FUS]. Fire flow calculations were carried out to determine requirement for the pre and post developments. This method adopts several criteria that reduce the required fire fighting water flow from the high levels of flow to protect a building of combustible materials with no fire rated assemblies.

Even though the proposed development includes a significant increase in floor area in the principle building [B1] and additional peripheral buildings, the required fire fighting water flow is less after the development. The pre-development required fire fighting flow as per FUS is 12847 litres per minute [3394 usgal/min]. The post development required FUS fire fighting flow is 7146 litres per minute [1888 usgal/min]. The proposed buildings of the development may be constructed of combustible or non-combustible materials. Because the influence of 'neighbouring' buildings is limited to 75% of the basic requirement of the subject building, the construction of the neighbouring buildings does not impact the fire fighting flow required to protect the subject building any more than the designated 75%. That is, the basic required water supply for the subject building is factored up by 1.75 in each case for each building. The proposed development requires 56% of the fire fighting water flow for B0.

The 1888 usgal/min is moderately higher than the current available water at the site, based on a recent hydrant test; 1481 usgal/min at 20 psi and 1703 usgal/min at 10 psi.

An elevated water tower is under construction in the Town of Wellington with an expected completion in the summer of 2023. Once the tower is introduced into service, modeling predicts that 3312 usgal/min at 75 psi will be available to fight fires at the municipal supply to 192 Main St., Wellington. This far exceeds the required fire fighting flow for the proposed development - 1888 usgal/min.

In summary, the proposed development reduces the demand for fire fighting water to the site, though the supply is not adequate to satisfy the water supply criteria of FUS. The completion of the water tower in the summer of 2023 will provide adequate fire fighting water supply as per FUS.

The required water flow to adequately supply potable water to the sprinkler system must be determined as per '3.2.5.13. Automatic Sprinkler Systems, (1) Except as provided by Sentences (2) to (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Installation of Sprinkler Systems"'.

The area/density method was used, as per NFPA 13, section "11.2.3. Water Demand Requirements", Figure 11.2.3.1.1 . "Density/Area Curves". The water demand was based on the area that requires the most flow. Note this particular design area is designated as "Remote #1". This area is classified as an 'Ordinary Hazard' because it contains a portion of the kitchen. The other areas were classified as 'Low Hazard', as per NFPA 13 section A5.2, paragraph A5.2 (14) and A5.3.1 Group 2 (9), respectively.

The water service calculations are attached. The required water demand for the sprinkler and attached exterior hose connection [as per NFPA 14] are 200.23 gpm and 250 gpm, respectively.

This gives a total required water supply of 450.23 gpm at 30.9 psi for the sprinklers and the exterior water supply. This represents a portion of the total water service for the building. The domestic water requirement was determined to be 342.52 gpm. Therefore the required water service to the building would be a minimum of 793 gpm. The current water supply can provide 1021 gpm at 30 psi, as demonstrated during the hydrant test of last April. See attached. Therefore there is adequate water supply for the sprinkler system.

The required water supply for the pre-development building B0, as determined by OBC20 Table 7.4.9.3., Table 7.4.10.5 and ASPE vol. 2, Table 5-1, was 27 gpm.

Complying with "Design Guidelines for Drinking-Water Systems", the impact on the municipal drinking-water distribution system was considered. The design demand is the greater of:

- Maximum day demand plus fire fighting flow; or,
- peak hour demand

The domestic water demand was based on the "Design Guidelines for Drinking-Water Systems", section "3.4.2 Domestic Water Demands" and "3.4.3 Commercial and Institutional Water Demands". This demand determines the impact of water demand on the municipal system. The Guidelines have given an acceptable range of unit water demand from 270 to 450 L/cap/day. The Town has asked that 350 L/cap/day be used. The 350 L/cap/day has been used to determine domestic water demand. This value was used in determining the demand from the restaurant. The Guidelines suggest 225 L/bed/day for the hotel portion of the project. The 225 L/bed/day was used to determine the water demand from the hotel units/room.

These are average daily flows. "3.4.2 Domestic Water Demands" provides factors to estimate 'maximum' day flow and hour 'peak' flows. They are 2.75 and 4.13 respectively. This analysis estimates the average daily demand, maximum hourly demand and peak hourly demand as 81975 litres/day, 9393 litres/hour and 14107 litres/hr. These are the flows that impact the water system in Wellington.

The maximum daily flow is 9393 litres/hour, while the fire fighting demand is 162000 lites/hr, giving a minimum demand of 171393 litres/hr. This is greater than the peak flow. Therefore the daily maximum flow plus the fire fighting flow is the governing required drinking-water demand. This flow is equivalent to 755 gpm that is less than the available flow at the service of 1021 gpm at 30 psi.

The maximum domestic sanitary sewage flow was calculated as per "Design Guidelines for Sewage Works". Section 5.5.2.1 Domestic Sewage Flows recommends using a unit flow demand of 225 to 450 L/cap/day. The Town has asked that 350 L/cap/day be used. Using this average daily domestic flow, the peak domestic flow was determined using the following equations:

$$Q(d) = PqM/86.4 + IA$$

where

$$M=1 + (14/(4+P^{0.5})$$

or

$$M=5/(P^{0.2}).$$

The post development flow was determined to be 7.36 litres per second, 4.04 litres per second [l/s] for the kitchen for a total of 11.4 l/s - 181 usgal/min.

Infiltration to the system was reviewed. By taking the maximum allowable infiltration, the flow was negligible.

The peak flow [fire fighting + maximum daily flow] will be 2069 usgal/min. This is less than the available water flow after the construction and operation of the new water tower.

31. Drawing SP2.1 - 3 revised to indicate that the water cut off is on the property line.

32. Drawing D.1.1 -2c) was revised to specify 'T' and water 'shut off' procedures.

33. Drawing D1.1 -2e) was revised to specify a 1.8 m frost protection.

34. Drawing D1.1 - 2f) was revised to include the Watermain Disinfection Procedure for Ontario. A copy of both procedures was included in the revised service report.

35. Drawing SP3-1 has been revised to indicate a single 150 mm service from the 200 mm main. There is also a single 150 mm lateral from the service that enters the building to service both the sprinkler, fire hose pipe and the domestic. The 100 mm to supply the sprinkler system has a backflow preventer just inside the building.

36. The site plan has been revised to indicate a proposed OPSD manhole at the property line for easy municipal access. The lateral service line to this manhole will be 125 mm as requested.

37. The "Total Hydraulic Load" for the building is peak flow determined from the total fixture units. A fixture unit is the unit to measure hydraulic load in Part 7 of OBC12. So the total of all fixture units gives the peak flow to size the water supply pipe and the sanitary sewage pipe. The revised flow is now 342.52 usgal/min or 21.6 l/sec. As per OBC12 7.4.10.5., the size of water supply is determined. The same "Total Hydraulic Load" is used to determine the size of the sanitary waste, based on 7.4.10.8.

The total daily flow is determined from OBC12 Part 8, section 8.2.1.3.A and 8.2.1.3.B. This method determines the pre-development design daily flow to be 7.0 cubic metres per day, while the post design daily sewage flow would be 33.1 cubic metres per day. This would suggest a daily increase in design sewage flow of 26.1 cubic meters per day, not the 1653.7 cubic metres as suggested in the Town letter of 21 March 2022.

A second method of calculating the peak daily sewage flow is proposed by the Ministry of the Environment in "Design Guidelines for Sewage Works". This method is typically used in the large developments, not normally for small developments as this. This method generated a design flow of 7.3 litres per second. This method requires the designer to consider water infiltration. This is a proposed and new system that will not be leaking, so a value of infiltration equal to the maximum allowable was used - 0.075 l/mm diameter/100 metres of pipe. This value was added, but was also negligible.

The greater of the optional flows was used to determine pipe sizes.

Should the increased sewage of 26.1 cubic metres be considered excessive, it is proposed to add a sewage holding tank of a capacity of 26.1 cubic metres to the sanitary outlet. The stored sewage would be pumped into the municipal lines during the night, in the off-peak time. The Town can suggest the time slot to pump the sewage into the system. A half horse power pump would pump this volume of sewage in two hours. In actuality, the tank would seldom be near filled.

39. The drawing containing the Code Matrix has been reviewed and stamped by the engineer.

40. See paragraph 28.

The calculations used to determine these values are attached in Appendix 1.

Regards,

Edward Trought, P. Eng.
For HAMBLY GROUP

attachment - Appendix 1

Daily Sewage Flows for Proposed Development				
Using OBC20 Part 8	number	unit flow		
Using OBC12 Part 8, Table 8.2.1.3.B.		L/day/(seat/person)		
sewage from 'C' occupancy	16	250	4000	
sewage from 'A' occupancy	222	125	27750	
sewage from 'D' occupancy	18	75	1350	
			33100	**l/day**
			0.3831019	l/sec
			33.1	m^3/day

Daily Sewage Flows for Pre-Development				
Using OBC12 Part 8, Table 8.2.1.3.A.				
sanitary due to number of bedrooms				
	due to	5	2500	L/day
	due to	2	1000	L/day
	total	7	3500	L/day
additional sanitary due to floor area				
	main floor	305.6		
	second floor	183.7		
	third floor	109.5		
	total floor area	598.8		
dditional floor due to area over 200 sq m - 400 m^2			2000	L/day
		198.8	2000	L/day
			4000	L/day
total Pre-development sanitary sewage flow			**7500**	**L/day**
Additional Sanitary Sewage Design Flow Due to Proposed Development				
			25600	**L/day**

Alternative Review of Peak Hour sanitary sewage flow				
Note Table 8.2.1.3.B. Suggests a unit load for reastaurants at 200 L/day/seat				
and 275 L/day per person in an apartment, I.e. 550 per bedroom				
and 250 L/day per room in a hotel				
while Design Guidelines for Sewage Works, 5.3				
suggests 225 L/day per bed space				
using the same ratio of hotel use for reastaurant				
seats	180	L/day/seat		
	P'	q	P*q	
P[restaurant]=	222	180	39.96	
P[hotel]=	26	225	5.85	
P=P'/1000			45.81	
average daily flow, pre-development	12	350	4200	L/day
average daily flow, proposed-development	222	180	39960	L/day
	26	225	5850	L/day
			45810	L/day
M' from above	**11.74**			
peal flow "Q" (d) = PqM/86.4 + IA	**6.22**	**L/sec**		
pre-development peak flow from above	0.67	L/sec		
increase in peak hour flow after development	**5.55**	**L/sec**		