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J.L. Richards & Associates Limited
1000 – 343 Preston Street
Ottawa, ON K1S 1N4

Attention: Mr. Mark Buchanan, Associate / Senior Environmental Engineer

RE: Hydrogeological Support for Almonte Municipal Water Supply Assessment – Source Water Protection

Dear Mr. Buchanan,

This letter summarizes our discussions and Geofirma Engineering Ltd's recommendations related to Source Water Protection (SWP) considerations pertaining to the Almonte municipal water supply wells and their current Well Head Protection Area (WHPA) mapping and resulting vulnerability and threats assessment. This work is in support of a larger assignment being completed by J.L. Richards & Associated Limited (JLR) as part of an update to the Municipality of Mississippi Mills' Water and Wastewater Infrastructure Master Plan (WWMP). Specifically, Geofirma's review and recommendations will feed into JLR's work plan to update the WWMP focusing primarily on the Municipality's Official Plan Amendment No. 22 that addresses the urban settlement boundary expanding and hence increasing the municipal water demand.

1 BACKGROUND

Intera Engineering Ltd. (2003) completed a Well Head Protection Area (WHPA) study, focusing on the municipal water supply wells for Almonte, in accordance with the MOECC 2001/2002 Groundwater Studies Technical Terms of Reference (MOECC, 2001). This work was incorporated into the Province of Ontario Source Water Protection initiative that started in 2005 and provided a basis for the current Source Protection Plan. Population projections and projected future water use was included through 2020 as part of this analysis.

Intera Engineering Ltd. changed its name in 2011 to Geofirma Engineering Ltd. which corresponded to 100% employee ownership. On behalf of the Municipality of Mississippi Mills, Geofirma completed a review of current and historical information and provided an assessment of the original WHPA study in 2021. At that time, Geofirma noted that, the current population growth was similar to projections from the 2003 study however no future population projections were provided, water demand was slightly lower, and water distribution was somewhat different although still from the same municipal wells (Well 3, 5, 6, 7&8). As such, Geofirma recommended that the WHPA sensitivity analysis completed by Intera (2003) should be updated based on new information regarding water demand, distribution, and recent understanding of Nepean sandstone aquifers. Further, the model was recommended for use in planning future water taking distributions.

Recent information provided by JLR as part of the WWMP update indicate that the current population projections and therefore water demand is expected to increase significantly over the next 25 years due to expanding the urban boundary to include identified build-out areas not previously services by municipal water and sewer. This letter addresses this new information and the resulting impact on the mapped WHPAs and SWP considerations.

2 SUMMARY OF CURRENT WATER SUPPLY SYSETM CAPACITY AND WATER DEMAND ASSUMPTIONS

2.1 Summary Current Water Supply System Capacity

JLR provided Geofirma with updated operating limit for the Mississippi Mills water supply wells, confirmed by the Ontario Clean Water Agency (OCWA) who operates the system. During normal operation, all wells turn on/off at the same time to refill the elevated storage tank. A total combined operating limit for the current Almonte municipal water supply is 70.1 L/s with a breakdown by well as summarized in the following table (taken from the revised Mississippi Mills Water and Wastewater Infrastructure Master Plan - Draft, by JLR dated October 17, 2023).

Well	Year Constructed	Depth (m)	Size (mm)	Flow Parameter (L/s)				
				PTTW	DWWP	MDWL	Demonstrated Yield	Operating Limit (1)
3	1948	47.5	250	9.7	9.9	9.7	9.7	7.1
5	1970	38.1	203	9.5	9.5	9.5	9.5	6.4
6	1973	48.8	254	22.7	22.7	22.7	11.9(2)	11.9
7&8	1990/1991	79.2	254	44.7 (3)	44.8	44.7	75.7	44.7
TOTAL				***131.2*** (3)	***86.8***	***86.5***	***106.8***	***70.1***

Notes:
(1) Operational limitation provided by OCWA (November 2006) and confirmed in 2023.
(2) High turbidity/sediment levels limit the demonstrated yield to 11.9 L/s (operational limit).
(3) The PTTW authorizes both Well 7 and 8 to take 44.7 L/s, meaning the total authorization is a sum of five wells, 131.2 L/s. However, the system operation does not allow Well 7 and 8 to operate separately, and the MDWL set a limit of 44.7 L/s for Well 7 and 8 combined.

2.2 Summary of Water Demand Assumptions

JLR provided Geofirma with updated estimations of current water demand and future projections based on population growth assumptions (taken from the revised Mississippi Mills Water and Wastewater Infrastructure Master Plan - Draft, by JLR dated October 17, 2023).

While the total existing water supply operating limit of 70.1 L/s meets the current existing maximum daily

demand of 53.5 L/s, it is reaching its limit. Based on the Municipality's development plans, the short-term maximum daily demand is estimated at 96 L/s which exceeds the current systems operating limit and requires an increase to the PTTW for Wells 7 & 8 to the expected maximum yield from the initial well development and testing. However, this suggested increase will only be able to supply the population and water demand projections in the short-term (2023-2028) timeframe after which the projected demand exceeds the upgraded operational capacity of the current well system and a new municipal well, constructed similar to Wells 7 & 8, is planned.

3 RECOMMENDATIONS

The following table provides a comparison of the assumed pumping rates to meet the municipal water supply demand under 2002 conditions (the original WHPA study assuming average daily demand), current (2022) conditions assuming average daily demand and projected short-term conditions (2023-2028) assuming maximum daily demand. As shown in the comparison of 2002 average daily pumping rates for each municipal well used during the original WHPA study (Intera [now Geofirma], 2003) with the current required operating limit and the revised operational limits for short-term conditions, a significant increase in pumping rates is anticipated. Specifically for Wells 7 & 8 operating in tandem, the revised short-term pumping rate projections are approximately 371% higher compared to the average daily demand rates assumed during the original WHPA study in 2002. These revised projected pumping rates for Wells 7 & 8 account for approximately 75% of the municipal water supply needs.

Well	2002 WHPA Study			Current Average Daily Demand (2022)		JLR Design Operating Limit Short-Term (2023-2028)		
	Q (m^3/d)	Q (L/s)	% Distribution	Q (L/s)	% change to 2002 WHPA (same % distribution)	Q (L/s)	% change to 2002 WHPA	New % distribution
3	280	3.24	12%	3.52	1.0%	7.1	119%	7%
5	295	3.41	13%	3.81	1.1%	6.4	87%	6%
6	365	4.22	16%	4.69	1.4%	11.9	182%	12%
7&8	1390	16.09	60%	17.58	5.2%	75.7	371%	75%
Total	***2330***	***26.97***	***100%***	***29.3***	***8.6%***	***101.1***	***275%***	***100%***

Future potential increased pumping rates and changes to the distribution of water taking from the municipal wells create scenarios not captured as part of the original WHPA modelling study. Since it has been approximately 20 years since the original WHPA study and given the projected changes to water demand in Almonte, Geofirma recommends completing an update to the WHPA study (including vulnerability and threats assessments) following the guidance from the updated MECP (2021) Technical Rules under the Clean Water Act. The current conditions are similar to the 2002 rates used in the original

WHPA study and therefore the WHPA model update is not necessary based on the current conditions. However, future changes to increased pumping will require an update to the WHPA study.

This updated model can be used to help plan for increased water supply from Wells 7 & 8, future new municipal well(s), and proactively anticipate any changes to the WHPA vulnerability and threats assessments and the impacts this may have on planning strategies. Any information obtained as part of future drilling and testing for a new municipal well should also be incorporated into the WHPA model. Recent information about the Nepean aquifer in other locations indicates that it is dominated by highly fractured zones with lower permeable matrix in between, hence any future drilling should investigate if these conditions are consistent at the Almonte location and if applicable they should be incorporated into the WHPA model.

As part of this update, the sensitivity analysis completed by Intera (2003) should be updated based on new information regarding water demand, distribution, and recent understanding of Nepean sandstone aquifers. In addition, the updated study should include a discussion and assessment of climate change scenarios. This WHPA study update is recommended to be initiated in support of the Well 7 & 8 upgrade to increase future water supply planned during the short term.

4 CLOSURE

Should you have any questions or require additional information, please contact the undersigned.

Respectfully submitted,
Geofirma Engineering Ltd.

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