

Technical Memorandum

03 March 2023

To	Norbert Woerns	Project No.	010978-MEM-302
Copy to	JART, Kevin Mitchell (CRH), Brian Zeman (MHBC), Ellen Ferris (MHBC), Anthony Goodban (GEC)		
From	Kyle Fritz, Richard Murphy		
Project Name	Dufferin Aggregates Milton Quarry East Extension (MQEE)		
Subject	MQEE Water Budget Drought Scenarios		

1. Introduction

GHD has undertaken additional analysis of the proposed Milton Quarry East Extension (MQEE) rehabilitation conditions in further response to Joint Agency Review Team (JART) comments and subsequent discussion on February 3, 2023. Related JART comments on the GWRA include: 61, 62, 63, and 72. As requested, additional evaluation of reduced precipitation conditions is undertaken herein using historical data rather than predicted future climate conditions.

2. Drought Evaluation

The 30-year Canadian Climate Normals (CCN) data set spanning the period from 1981-2010, as referenced in the GWRA water budget evaluation, is employed for this evaluation. Two scenarios were considered including a Dry Decade scenario, and an Extreme Drought scenario.

The Dry Decade scenario was developed using the driest 10 individual years from the 30-year period (i.e. not contiguous years) and conservatively assumes that the conditions occur contiguously. For this scenario the average annual precipitation is reduced from 866 mm/yr to 715 mm/yr.

The second "extreme drought" scenario was evaluated using the single driest year from the 30-year period and average annual precipitation is reduced from 866 mm/yr to 571 mm/yr.

Both these drought conditions were evaluated using the long-term rehabilitation condition water budget as this scenario has the lowest water surplus and is therefore the most conservative. The results of this analysis are presented in the attached Table 1 comparing the three scenarios:

- Baseline climate conditions as presented in the GWRA (Table 10.2)
- Dry Decade scenario
- Extreme Drought scenario

Under all of these scenarios, all mitigation flow requirements and the required minimum 700,000 m³/year discharge to Hilton Falls Reservoir Tributary are fulfilled.

The annual water surplus for the Dry Decade condition is expected to be neutral or slightly negative (calculated to be -1,878 m³/year), indicating that over this period little or no change will occur in the total storage of water at the site. For this scenario a negative surplus or reduction of storage in the Reservoir may occur in individual years; however, the net storage over the 10-year period would be little or no change.

The estimated water surplus for the Extreme Drought condition is approximately -635,000 m³ for the year, and indicates water would need to be drawn from storage to fully sustain offsite discharge requirements and mitigation flows during an extreme drought condition.

The 70-hectare Reservoir provides significant on-Site storage and allows for buffering of exceptionally wet and dry conditions. The interim maximum water elevation in the Reservoir is 308 m AMSL with an estimated storage volume of approximately 5,500,000 m³. Under lower Reservoir conditions (e.g., an elevation of 305 m AMSL) total storage is approximately 3,200,000 m³. It is anticipated that the Reservoir could sustain the site under the Extreme Drought conditions for approximately 5 years from the low storage level or potentially longer if more water is retained in storage without any reduction in mitigation flows or discharge to Hilton Falls Reservoir Tributary.

3. Conclusion

Two additional water budget scenarios were evaluated to determine the effect of reduced precipitation on the quarry water surplus at rehabilitation. Under the Dry Decade scenario the water surplus is reduced to approximately neutral or slightly negative and under the Extreme Drought scenario a deficit of approximately 635,000 m³ is estimated for the year. While a deficit may occur in individual years, Reservoir storage provides a buffer against reduced water availability. It is anticipated that the Reservoir capacity would be sufficient to sustain the site for a 5-year period under the reduced precipitation conditions evaluated. Given these results, GHD concludes that short- or longer-term fluctuations in precipitation do not present a concern to water availability for mitigation or off-Site discharges. In fact, the water management system was designed in collaboration with Conservation Halton to help buffer the watershed from severe climatic conditions such as droughts.

Regards,



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Attachments: Table 1 – MQEE Water Budget Drought Scenarios

**MQEE Water Budget Drought Scenarios
Milton Quarry East Extension
Region of Halton, Ontario**

	Rehabilitation Condition		
	Approved Quarry Plus MQEE (m ³ /year)	Approved Quarry Plus MQEE Dry Decade Scenario ⁽¹⁾ (m ³ /year)	Approved Quarry Plus MQEE Extreme Drought Scenario ⁽²⁾ (m ³ /year)
Inflows			
Dry Quarry Recharge	1,055,638	774,010	505,438
Lake Quarry Recharge	490,749	108,774	-255,493
Groundwater Inflow	325,849	325,849	325,849
Upstream Runoff	94,396	0	0
Total Inflows	1,966,632	1,208,634	575,794
Outflows			
Recharge System	442,394	442,394	442,394
Quarry Operations	--	--	--
Required Outflow to HFRT	700,000	700,000	700,000
Escarpment Leakage	35,320	35,320	35,320
Vertical Leakage	32,797	32,797	32,797
Total Outflows	1,210,511	1,210,511	1,210,511
Calculated Available Annual Surplus	756,121	-1,878	-634,717

Notes:

1) Precipitation is reduced to represent a "dry decade" condition. The driest 10 years from the 30 year CCN period are assumed to occur contiguously and total annual precipitation is reduced from 866 mm/yr to 715 mm/yr.

2) Precipitation is reduced to represent an extreme dry condition using the driest year from the 30 year CCN period and total annual precipitation is reduced from 866 mm/yr to 571 mm/yr.