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Friends of the Rural Communities and Environment (FORCE)
c/o Lawson Park Ltd.,
P.O. Box 15, R.R. #1
Freelton, Ontario L0R 1K0

Attention: Graham Flint, Chair, FORCE

Re: Review of GRS Phase 1 Pumping Test Report, St. Marys Flamborough Quarry Site, City of Hamilton

Dear Mr. Flint,

Please accept this letter as INTERA Engineering Ltd. report on hydrogeologic review of the Phase 1 Pumping Test Report evaluating the proposed Groundwater Recirculation System (GRS) at the St. Marys Cement (Canada) Inc. property under MOE PTTW #8461-7CFLG5. The St. Marys Cement property is the site of a proposed Quarry is to be developed in the Amabel Formation dolostone to depths of about 36 to 40 m in Part of Lot 1, and Lots 2 and 3, Concession 11, geographic Township of East Flamborough, now the City of Hamilton.

The MOE PTTW was issued by MOE on July 8, 2008. The Phase 1 Pumping Test Report was released by Gartner Lee Limited (GLL) on August 27, 2008. The GRS is proposed to mitigate Quarry-induced drawdowns in the bedrock aquifer and impacts to local surface water ecological features.

This review letter is follow-up to series of hydrogeological review letters I have prepared for this site since March, 2005. I have previously reviewed the following six major hydrogeological documents and sets of documents:

- *MOE Draft PPTW and Supporting Documentation,* prepared by MOE and Nova Hydrogeology Inc., in May, 2008;
- *Final Hydrogeological Work Plan,* prepared by GLL in March, 2008;
- *Final Draft – Hydrogeological Work Plan,* prepared by GLL in August, 2007;
- *Revised Work Plan for the Evaluation of Groundwater Recirculation System* prepared by GLL in September 2006;
- *Draft Three-Volume Hydrogeological Level 2 Report* prepared by GLL in June, 2005; and
- *Preliminary Hydrogeological Assessment Repor*t, prepared by GLL in August, 2004.

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The last two of these earlier reports were prepared for Lowndes Holdings Corporation, former site owners. I previously provided hydrogeological review comments on these six earlier sets of reports in correspondence with you dated May 31 2008, April 30 2008, November 19 2007, November 26 2006, November 11 2005 and March 28 2005, respectively.

This report was prepared by Kenneth G. Raven, P.Eng., P.Geo., Principal and Senior Hydrogeologist of INTERA Engineering Ltd. This report reviews the Phase 1 Pumping Test Report and supporting documentation provided by MOE, Hamilton in early September and via e-mail on September 15, 2008.

This letter is organized by the following four sections:

1. Primary Documents Reviewed
2. Hydrogeologic Review and Concerns
3. Conclusions

1. PRIMARY DOCUMENTS REVIEWED

The following four primary documents were the focus of this review:

- *Permit to Take Water, Bedrock Well TW14, St Marys Cement Inc. (Canada), Number, 84616-7CFLG5,* Issued by Ontario Ministry of the Environment, July 8, 2008.

- *Phase 1 Pumping Test Report, PTTW # 8461-7CFLG5 – Condition 4.22,* Report prepared by Gartner Lee Limited for St. Marys Cement (Canada) Inc., August 27, 2008.

- *Proposed Flamborough Quarry PTTW Surface Water Monitoring,* Report prepared by Stantec Consulting Ltd. for St. Marys Cement, August 27, 2008.

- *Report on Oversight of Phase 1 Pumping Test, Proposed St. Marys Quarry Site, Flamborough, Ontario,* Report prepared for St. Marys Cement Inc. (Canada) by Golder Associates Ltd., September, 2008.

2. HYDROGEOLOGIC REVIEW COMMENTS

Based on my review of the primary documents outlined in Section 1 and in consideration of previous reports prepared for this site as listed in my earlier review letters, I offer the following comments and identify the following hydrogeologic issues and concerns for the Phase 1 Pumping Test Report and supporting documentation.

1. There is some apparent confusion in the GLL Phase 1 Pumping Test Report concerning the objectives of the pumping test that, in my opinion, need to be clarified before commenting on the success or failure of the pumping tests. GLL states on page 20 of the Phase 1 Pumping Test Report, that the primary goal of this initial phase of testing was to characterize the aquifer properties and that this goal was achieved. I do not believe that this is correct. The primary goal

of the Phase 1 pumping test, as outlined in the Revised Work Plan for the Evaluation of Groundwater Recirculation (page 9), is to assess the un-mitigated impact of the proposed Quarry dewatering against which the effectiveness of the various GRS mitigation measures can then be assessed in Phase 2 and 3 pumping tests. While I acknowledge that further hydrogeological characterization was one of the goals of the Phase 1 pumping test, it was not the primary goal. In fact as stated at the top of page 5 of Final Hydrogeological Work Plan, this objective of further hydrogeological characterization is principally in response to MOE request because:

> "*the November 2004 pumping test was influenced by a prolonged period of wet weather and as such, the water level response in the piezometers was influenced by recharge*. "

2. The Phase 1 pumping tests were undertaken during a period of extraordinary amounts of rainfall, runoff and increased groundwater recharge, not unlike those experienced during the November 2004 test. In my opinion these test conditions have severely biased and compromised the ability of the Phase 1 pumping tests to meet primary test objectives of defining the unmitigated drawdown that would be created by future Quarry dewatering.

   The large amounts of rainfall created increased runoff and recharge which occurred immediately prior to pumping, during pumping and during pumping recovery. Such conditions confound and obscure the results of both the surface water and groundwater monitoring programs. The surface water quality monitoring results are swamped by the increased runoff making determination of quality impacts to surface water from pumping discharge impossible to discern. The recharge-related water level increases of up to about 0.8m in both overburden and bedrock monitoring wells obscure any drawdown that may have occurred within mini-piezometers and shallow overburden and bedrock monitoring wells.

   These transient groundwater recharge conditions and water level fluctuations make quantitative interpretation of the pumping tests for determination of hydraulic properties using conventional analytical methods difficult if not impossible for many if not all of the monitoring intervals.

   Lastly and most importantly, the transient recharge and rising water levels observed in most of the monitoring wells beyond the immediate vicinity of TW-14 and the GRS test area throughout the pumping test compromises (underestimates) the baselining of the unmitigated pumping test response and the future comparison of water level responses during Phase 2 and Phase 3 mitigation tests. Since future Phase 2 and 3 pumping tests will not be completed under similar rainfall and recharge conditions, there will be no common basis for assessment of GRS mitigation tests.

3. The Phase 1 pumping test was run at an average pumping rate of 10 L/s (864 m^3/day) or 29% of the maximum permitted rate of 3000 m^3/day. While pumping at these relatively low rates certainly mitigated any off-site groundwater drawdown, they resulted in limited drawdown in TW-14 (~ 14m), in the GRS test area (i.e., 2 to 6m in MWB22 to MWB-25 wells) and beyond the GRS test area (i.e., no drawdown in sentinel wells). Thus although the Phase 1 pumping tests did most likely not result in any noticeable drawdown in off-site domestic wells, an appropriate question to ask is whether the pumping test provided useful and meaningful data as part of the GRS pilot test.

   Although there has been considerable movement by MOE and GLL about what is a meaningful amount of drawdown that would meet the objectives of the Phase 1 pumping test (i.e., from full Quarry drawdown to something much less), I don't believe that achieving a maximum drawdown of about 2 to 6m near the GRS pilot test site with zero discernable drawdown beyond within sentinel wells, can be considered meeting objectives of the Phase 1 program. I think by any objective standard, the amount of drawdown recorded in this Phase 1 pumping test is a very poor

representation of the types of drawdowns that a future Quarry operating at depths of 36 to 40 m would create.

4. The amounts of drawdown recorded in the Phase 1 pumping test are a poor surrogate for full Quarry drawdown and should not be used to extrapolate and predict future unmitigated Quarry drawdown for two important hydrogeological reasons.

   Firstly and most obviously, the recorded drawdowns have been strongly diminished by the significant groundwater recharge that occurred prior to and during the pumping test. Such groundwater recharge rates cannot be sustained over the long term and therefore obscure the actual drawdowns that would have been created under more representative recharge conditions.

   Secondly, the drawdowns recorded in the Phase 1 pumping test, even if they were measured under more representative steady state groundwater recharge conditions, cannot be linearly scaled to predict full Quarry drawdowns because the net drawdown is a transient and vertical leakage limited process (as demonstrated by Dr. Novakowski in his May 5 2008 review of the draft PTTW). Neglecting recharge variations, the amount of drawdown that will occur during a pumping test or Quarry dewatering is determined by the hydraulic properties of the aquifer or production zones and the amount of water that can be released from storage in overlying and underlying less permeable bedrock horizons.

   For the short Phase 1 pumping test of 7 days duration, drawdown will be limited primarily by vertical release of water from storage or vertical leakage. However, such vertical leakage is a transient process with a finite volume of water that can be released over time. At the start of the pumping test this vertical leakage is greatest, reducing throughout the test. At some point in time, the water available for vertical leakage would be exhausted and the drawdown cone will significantly increase in radial extent and amount to that representative of long-term Quarry drawdown conditions. Such depleted vertical leakage conditions were not observed in the Phase 1 pumping test.

   Given the confounding and drawdown limiting effects of significant groundwater recharge and transient vertical leakage, the Phase 1 pumping test should not be used as a surrogate for unmitigated Quarry drawdown that will experience conditions of depleted vertical leakage.

5. MOE (B. Ryter letters of January 19, July 27 and August 31, 2005) has previously expressed concern over the reliability of the drawdowns from both the April and November 2004 pumping tests due to the occurrence of significant rainfall events during the tests and the obvious response of the hydrogeologic system to these events. MOE has stated that these issues and associated interpretational inaccuracies from the pumping tests may not satisfy the requirements of MOE. In response to these MOE comments GLL identified the need to repeat the November 2004 pumping test as part of the additional site characterization objective of the Phase 1 pumping test.

   By my calculation the amount of rainfall experienced during the Phase 1 GRS pumping test (155 mm) is nearly 50% greater than that recorded during the November 2004 pumping test (93 mm). Consequently, it is reasonable to conclude that the Phase 1 pumping tests were not successful in achieving the additional site characterization objective of improving the November 2004 pumping test.

   I disagree with the GLL statement that "*the reliability of the interpretation is not compromised by the precipitation, which occurred during the testing program"* (top of page 21 - Phase 1 Pumping Test Report). The reliability of the interpretation of the Phase 1 pumping tests has clearly been compromised by precipitation.

If MOE was of the opinion that the November 2004 pumping test may not satisfy MOE requirements, consistency dictates that the Phase 1 GRS pumping test is similarly lacking with interpretational inaccuracies and may not satisfy MOE requirements.

6. The discharge water quality from TW-14 showed frequent exceedences of PWQO for zinc and occasional exceedences of PWQO for free cyanide. Although the PWQO zinc exceedences were expected based on earlier pump testing of wells, the impact of these discharges on normal surface water flows were entirely obscured by the extraordinary surface water flows in Mountsberg Creek experienced prior to and during the TW-14 pumping test.

7. It is important to note that the Golder Oversight Report is restricted to confirming that Gartner Lee Limited and Stantec Consulting Ltd. completed the work as outlined and described in their respective reports. The Golder Oversight Report does not comment on the results of the Phase 1 pumping test, the meaning of these results, or on the adequacy of the work to achieve GRS pumping test objectives.

3. CONCLUSIONS

The GLL Phase 1 Pumping Test Report and supporting documentation outline several hydrogeologic concerns that confirm my earlier opinion on the great difficulty of undertaking meaningful pilot scale GRS and of application of the results of pilot scale GRS to a full Quarry scale.

The key hydrogeological concerns identified in this review include:

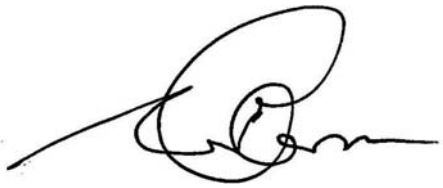
1. The Phase 1 pumping tests were performed during a period of significant rainfall, runoff and recharge that have biased and compromised the results of the surface water and groundwater monitoring programs.

2. The Phase 1 pumping tests have failed to achieve the intended primary objective of providing a baseline which represents the anticipated full Quarry drawdowns against which the effects of mitigation by GRS can be simply and easily judged in Phase 2 and Phase 3 pumping tests.

3. The Phase 1 pumping tests have failed to achieve the intended secondary objective of repeating the November, 2004 pumping test under conditions of normal rainfall and recharge.

Respectfully submitted,

Intera Engineering Ltd.



Kenneth Raven, P.Eng., P.Geo.
Principal

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