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November 19, 2007

Ref. No.: 04-233-4

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 Hydrogeological Work Plan, St. Marys Flamborough Quarry Site, City of Hamilton

Dear Mr. Flint,

Please accept this letter as INTERA Engineering Ltd. (INTERA) report on hydrogeologic review of the final draft of the hydrogeological work plan for the proposed St Marys Flamborough Quarry Site. The proposed Quarry is to be developed in the Amabel Formation dolostone to depths of about 36 m in Part of Lot 1, and Lots 2 and 3, Concession 11, geographic Township of East Flamborough, now the City of Hamilton.

The hydrogeological work plan, prepared by Gartner Lee Limited (GLL), describes the proposed sequence and recent results of activities to be undertaken to further characterize the Amabel Formation dolostone aquifer and to undertake the pilot scale testing of the groundwater recirculation system (GRS) to mitigate quarry-induced drawdowns in the bedrock aquifer and impacts to local surface water ecological features. The hydrogeological work plan was requested by the City of Hamilton.

The hydrogeological work plan is follow-up to the *Revised Work Plan for the Evaluation of Groundwater Recirculation System* prepared by GLL in September 2006, the draft three-volume *Hydrogeological Level 2 Report* prepared by GLL in June, 2005 and the *Preliminary Hydrogeological Assessment Repor*t, prepared by GLL in August, 2004. The last two of these earlier reports were prepared for Lowndes Holdings Corporation, former site owners. I previously provided hydrogeological review comments on these three earlier reports in correspondence with you dated 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 primary documentation describing the proposed hydrogeological work plan.

This letter is organized by the following four sections:

1. Primary Documents Reviewed
2. Hydrogeological Work Plan
3. Hydrogeologic Review and Concerns
4. Conclusions

1. PRIMARY DOCUMENTS REVIEWED

The following primary documents were the focus of this review:

- *Hydrogeological Work Plan, St Marys Flamborough Quarry Site,* Final Draft Report prepared by Gartner Lee Limited for St. Marys Cement CBM, August 2007.

- *Flamborough Quarry Project, Geophysical Logging and Testing Results for Monitoring and Test Wells,* Lotowater Technical Services Inc., Report prepared for CBM St Marys Cement, July 24, 2007.

- *Flamborough Quarry Project, 2006/2007 Packer Testing and Depth Specific Water Quality Sampling Results for Monitoring and Test Wells,* Lotowater Technical Services Inc., Report prepared for CBM St Marys Cement, July 31, 2007.

2. HYDROGEOLOGICAL WORK PLAN

The hydrogeological work plan was prepared at the request of the City of Hamilton for submission to the Combined Aggregate Review Team (CART). The hydrogeological work plan was intended to assist the proponent, CART and others in "reaching a common understanding of the expectations of the required submission, and to establish a basis for the technical review of the submissions, once they have been received".

In short, the proposed hydrogeological work plan is intended to provide an integrated and comprehensive outline the details of the hydrogeological work to be undertaken to assess the GRS pilot study and other hydrogeological site assessment work that is underway and proposed to support hydrogeological characterization of the site.

The hydrogeological work plan report is a combination of a review/status report and a work plan for hydrogeological work completed and proposed for the Quarry site, with an appended set of generic or boiler plate field procedures, which may or may not be directly applicable to the proposed work. The work plan provides additional details on planned GRS testing and analysis activities, locations and types of monitoring to be performed, monitoring and procedures to address private well interference problems, adaptive management plans and contingency plans. Earlier versions of this plan were reviewed by Jagger Hims Limited on behalf of the City of Hamilton and the current version has benefited from those earlier reviews.

3. HYDROGEOLOGIC REVIEW AND CONCERNS

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 proposed hydrogeological work plan.

1. There is new hydrogeological data in this report (notably the Lotowater borehole geophysical/dynamic flow logging and packer testing) that confirm for me the great difficulties that will be encountered in doing the GRS pilot test and in attempting to implement a full-scale GRS for the quarry. For example, the dynamic flow logging and the packer testing show that there are very permeable horizons (production zones) within the bedrock that are separated by intervening low permeability thicknesses of bedrock. Such production zones are shown to sporadically exist at depths of 5-15 m, 20-25 m and 30–35 m depth in different wells. The low permeability intervening zones mean the GRS will probably not function without the drilling of wells to connect the GRS trench to the full depth of permeable production zones that will create Quarry drawdowns.

2. The depth occurrence of the permeable horizons is clearly not predicable and will likely create operational problems with the pilot GRS. For example, the three proposed pumping wells intended to simulate full Quarry drawdown (i.e., TW-13, TW-14, TW-15) show much different depth distribution and magnitude of these permeable production zones. The bottom of TW-14 is permeable (transmissivity, T = 84 m^2/day), but only the top of TW13 is permeable (T=1350 m^2/day), while the bottom of TW-15 is permeable, but less that than for TW-14. The magnitude range and depth distribution of these permeabilities mean that it will be difficult to achieve the 30 m drawdown in these wells. That is, while pumping from TW-14 may achieve the targeted drawdown in the 30-35 m deep production zone, pumping from TW-13 will not create any significant drawdown in this deeper zone. Such are the inescapable vagaries of undertaking pumping tests and trying to implement a GRS in the fractured and highly heterogeneous permeability rocks of the Amabel Formation.

3. The occurrence of the very high transmissivity in the shallow zone of TW-13 with little to no transmissivity in the deeper zones of TW-13 is the scenario I outlined in point 10 of my November 26, 2006 letter to you, that can contribute to escape of injected water during the GRS. If these same TW-13 conditions exist in some of the trench injection wells while conditions similar to those of TW-14 occur in the pumping wells, re-injected water has the potential to escape.

4. On the use of fluorescent dye tracers, some discussion or description on safe drinking water levels for these tracers is necessary. They are after all, injecting these tracers into a drinking water aquifer where there is some potential for escape to domestic wells (which is why the tracers are proposed). I do not think it is adequate to simply state that they have approval for use as colouring agents in drugs. If they get into drinking water supplies, the intake may be greater than that associated with ingestion of drugs. Some additional justification of the safety and health risk of doing these tracer tests should be provided.

5. I was pleased to see in the documentation that serious consideration has now been given to ensuring that the most permeable sections of the borehole are selected for monitoring, as opposed to earlier GLL habit of just setting the interval at predetermined depths. I gather there is now review of all intervals to be selected for monitoring and that an effort has been made to rectify the earlier GLL monitoring wells that were of limited use because they did not monitor the permeable sections of the boreholes.

6. The issue of discharge of groundwater that exceeds PWQO remains a concern to me, notwithstanding the recalculation of surface water impact using deep groundwater and the cited Stantec arguments given on why exceedence of PWQO for zinc should not be a problem. The water quality testing conducted by Lotowater shows that some wells and intervals will produce water that exceeds PWQO for zinc. For example, the proposed main pumping well for the GRS pumping test (TW-14) will yield zinc concentrations that exceed PWQO. It should be noted that the reported zinc concentrations (0.034 and 0.038 mg/L) are only for dissolved zinc concentrations. Total zinc concentrations (i.e., dissolved + particulate) which are the bio-available concentrations that should be reported in assessing surface water quality impact, were not analysed in these samples. Total zinc concentrations are usually greater than dissolved concentrations. I am not an aquatic toxicologist, and I assume that MOE in reviewing the PTTW for this work will address these issues.

7. The description of the proposed GRS testing program given in Section 3.2.5 of the work plan does not define numerical trigger values for groundwater and surface water during the proposed GRS pilot testing, stating that these will be defined with City of Hamilton input. These numerical trigger values need to be defined with corresponding response actions clearly described prior to undertaking the GRS pilot test.

8. It is proposed in Section 3.3 of the work plan that the existing 3-D MODFLOW groundwater flow model be updated to incorporate geologic and hydrogeologic information acquired over the last year. The proposed update is to occur following completion of the GRS pilot study. It would be beneficial to update the groundwater flow model prior to undertaking the GRS pilot study and to the use the model to identify those private and communal water supply wells at risk of being dewatered during the GRS pumping tests. In this way, wells at risk can be identified for priority monitoring and sampling.

4. CONCLUSIONS

The hydrogeologic work plan and the new information contained therein confirm my earlier opinion on the great difficulty and potential hazards of undertaking the pilot scale GRS and of implementing such a system to a full Quarry scale. Consequently, it remains important that stakeholders other than the proponent be allowed to monitor the field implementation of the proposed GRS and that the data from this test be made available for review by third parties.

The proposed hydrogeological work plan would benefit from the following revisions.

1. Additional information on the expected concentrations of fluorescent dye tracers in groundwater and safe drinking water levels for these tracers should be given to provide confidence in the assessment of risk to drinking water supplies posed by these tracer tests.

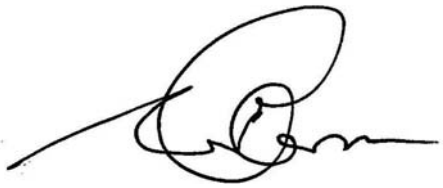
2. Numerical trigger values need to be defined with corresponding response actions clearly described for mitigating adverse impacts to groundwater and surface water during the proposed GRS pilot test.

3. The groundwater flow model should be updated prior to undertaking the GRS pilot study and then be used to identify those private and communal water supply wells at risk of being dewatered during the GRS pumping tests. In this way, wells at risk can be identified for priority monitoring and sampling.

All of the hydrogeologic concerns and issues that were expressed in my November 26, 2007 letter to you, remain for the proposed GRS pilot test and full scale implementation of GRS at the proposed St Marys Flamborough Quarry.

Respectfully submitted,

Intera Engineering Ltd.



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

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