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April 8, 2014

Via: Email and Mail (sdenhoed@hardenv.com)

Mr. Stan Denhoed, M.Sc., P.Eng.
Sr. Hydrogeologist
Harden Environmental Services Limited
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Dear Mr. Denhoed:

Re: Harden Environmental Services Limited January 14, 2014 Letter – Response to Burnside Review of Summary of Drilling and Testing of New Well M15 at Hidden Quarry Site
File No.: 300032475.0000

Thank you for your letter of January 14, 2014 which provides your responses to the November 12, 2013 Burnside review of the Summary of Drilling and Testing of New Well M15 at the Hidden Quarry Site.

The level of on-site data has been improved. Additional assessment and background data collection is required to reduce the number of variables. Burnside recommends that the monitor well construction/testing/sampling and domestic well survey be completed as soon as possible to improve our understanding of the bedrock aquifer.

The Burnside responses below are ordered in the same number as your comments in the January 24, 2014 letter.

2.2 Bedrock

Burnside concurs with Harden that the Eramosa confining layer is not present at the site and that the extraction will occur in the Niagara Falls Member and Gas Port Formation.

2.3 Description of Core Breaks

Agreed.

3.0 Pumping Test

Burnside is satisfied with the Harden response. It is anticipated that the pre extraction monitoring program that will be conducted at the Site will assist in identifying which

fractures are inter connected and as a result which of the bedrock fractures may be impacted during the extraction of rock from the Quarry.

3.1 Flow Test

Burnside is satisfied by the Harden response. The pre-extraction monitoring program will assist in confirming that the maximum allowable dewatering of the bedrock of 2.5 m as developed by Harden is an appropriate value. It is anticipated that Harden/James Dick will provide additional detail on how the daily maximum drawdown will be monitored. It is expected that monitoring of water levels during the initial stages of the site works will be intensive (less than hourly). Once conditions are understood then monitoring events can reduce to the frequency indicated. For example, setting automatic water level recorders to 5 minute sampling intervals for the first month of quarrying activities will provide an excellent indication of the water level response at no additional cost.

6.0 Water Quality Results

The Burnside comment expressed concerns that the quarrying activities could impact current concentrations of nitrate, iron and also introduce surface water pathogens into the nearby groundwater system. The Harden response is broken down by nitrate, iron and surface water pathogens. Our response is provided below:

Nitrate

Harden provides examples from the Guelph Limestone (formerly Dolime Quarry), the Holcim Quarry in Milton Ontario and from two much larger quarries located in Florida. The examples provided by Harden indicate that the amount of nitrogen added from the explosives is generally less than 2 mg/L. Burnside trusts that the information provided by Harden is accurate and that the amount of nitrogen added from the explosives used in the quarrying process will have a small impact the down gradient well's water quality. Water samples obtained from the standing water in the Dolime quarry would be useful in this assessment as the nitrogen concentration in the discharge from a dewatering pump appears to be reduced by Dilution as the nitrogen in the discharge (0.24 to 0.65 mg/L) was much less than that measured in a sample collected within 4 hours of explosives detonation (1.9 mg/L).

Iron

Harden indicates that although samples of local groundwater contain reduced iron, the presence of a quarry with elevated concentrations of dissolved oxygen will result in the reduction of iron concentration in surface water and the groundwater down gradient of the quarry. In addition, the reduced iron will assist in the denitrification of the surface water. Burnside concurs with Harden that concentrations of iron in the groundwater will not be increased significantly down gradient of the quarry. However, there is the potential that oxygenated water entering the downgradient bedrock aquifer may result in changes to the existing downgradient water quality.

Nitrogen Mass Balance

Harden indicates that there are two sources of nitrogen at the proposed quarry. The first source is nitrogen imported to the site within the explosives used to liberate the rock. The second is nitrogen flowing onto the site in groundwater. The origin of this nitrogen is up-gradient farms which apply fertilizers (both commercial and natural) or generate manure. Harden provides a number of calculations to show the mass of nitrogen provided from the explosives, from groundwater inflow and the mass of nitrogen from up-gradient groundwater.

Burnside points out that the following factors could significantly affect the predictions made by Harden:

- The nitrate concentrations entering the quarry from the up-gradient direction may increase or decrease significantly seasonally.
- The nitrate concentration in the deep well M15 was 2 mg/L on May 24, 2013. This well is open across the entire bedrock sequence and as a result this nitrate value likely represents a mixing of water from all zones.
- The water produced from the individual fractures is based on the distribution of flows from M15; a more accurate understanding of the individual fracture characteristics including water quality, static water level and hydraulic conductivity will be obtained once the monitor well is constructed.

Burnside recommends that once M15 has been reconstructed as a multi-level monitor that water quality, water levels and hydraulic parameters be assessed in order to provide a more defensible prediction. We also note that there may be additional dilution that occurs due to precipitation which falls on the site.

Surface Water Pathogens

In their response Harden provides a list of sources of pathogens and indicates that the quarry does not represent the most likely source of surface water pathogens. Harden indicates that "*considering the elevated nitrate observed in water samples from Tributary B indicating contamination from up-gradient farming, more likely source of surface pathogens is water infiltrating into the bedrock from Tributary B. Also, the elevated nitrate concentrations in groundwater indicate that the overburden does not provide effective protection from anthropogenic activity.*" Harden should provide some commentary as to the impact of water fowl on the surface water in the quarry and how this may impact down-gradient wells.

In addition, Harden indicates that the mining is phased such that quarrying will commence in the northern portion of the site. This is the most distant part of the site from down-gradient water wells. The monitoring program is designed to determine if groundwater quality is being impacted by the quarry. Harden should provide additional detail on how the existing monitoring well network will provide sufficient early warning so that treatment systems can be installed in down-gradient domestic wells before unacceptable impacts to drinking water have occurred. In addition, once the door to door well survey has been completed, Harden should provide details on which of the three listed remedial options is the most appropriate for each individual well in the event that water quality is impacted. It is likely that given the small diameter of the existing

wells in the area that the use of a liner will be impractical. As a result, Harden will need to qualify if any existing wells can be deepened or whether the installation of water treatment equipment will be the preferred option.

7.0 Recommended Multi-level Installation Details

Agreed.

8.0 Discussion

No additional comment required. However, local residents continue to raise concerns with regards to the potential for karst features to be present on the site. This issue is discussed in the response to the January 14, 2014 Harden letter responding to the Burnside comments regarding the Hydrogeological Summary Report.

Section 9.0 Response to Burnside Comments

Comment 72

Harden has indicated that James Dick Construction Limited has agreed to limit the maximum drawdown in the excavation to 2.54 m below the historic low water level.

Burnside provides the following comments:

- The location of the drawdown measurement needs to be clearly defined and should actually be a monitoring well that is representative of water levels within the quarry limits and is completed as an open hole to 320 masl. In addition to monitoring pre extraction water levels for several years within the quarry limits, James Dick will need to monitor levels in nearby domestic wells to see how levels correlate with “quarry” water levels.
- The “historic low water level” requires additional clarification. As indicated above, the location of the water level measuring point needs to be defined as does the period of monitoring used to define the historic low water level. Harden predicts that a drawdown of 2.54 m in the quarry will result in 1.60 m of drawdown in the closest domestic well. Assuming that the historic low water level in the quarry corresponds to the historic low water level in the monitored domestic well, confirmation that an additional 1.6 m of drawdown in the domestic well will not impact it’s use needs to be confirmed and the allowable drawdown in the quarry decreased as necessary.
- Harden should provide additional details on how the drawdown will be monitored and which wells will be used to decide what the water level is prior to extraction of the rock. Domestic wells to be monitored should also be identified. We understand from personal communication that the water level will be measured with a float connected to the excavation itself, but this approach needs to be documented.

Comment 60

Burnside agrees that the fracture distribution with depth can vary significantly in bedrock and two wells in close proximity can have different fracture patterns. However, we note that the reliability of the water found depths in MOE well records is subject to the

experience of the well contractor whereas the fracture depths in M15 were identified by both visual and flow measurements. Once M15 has been completed as a multi-level well it should be tested so that the results of the flow profiling can be verified and the nitrate values with depth confirmed. Similarly, well M16 should be completed as soon as possible. Hydraulic and water quality data from the multi-level wells should be assessed and the model revised if necessary.

Collection of both water level and water quality data should continue so that predictions regarding water quality and water level response can be confirmed/revised.

Comment 54

No Comment.

Comment 56

The Burnside letter suggested that there must be areas in the southern portion of the site where the silt unit is thin or absent which results in Tributary B entering the bedrock at some point upstream of SW3. Harden agreed with the Burnside comment. Burnside notes that concerned residents have suggested that the disappearance of Tributary B suggests that there are karst features beneath the site. It is not clear to Burnside whether Tributary B always disappears at the same point on a consistent basis or if the tributary dries up in the summer and as a result there is no flow in the tributary at the southern end of the site. It may be that the stream disappears because of the lack of a till layer over lying the bedrock combined with low flow allowing infiltration to become dominant over lateral flow. However, this should be confirmed in order to alleviate residents' concerns. Collection of water level data in the tributary at several locations with automatic recorders will provide an improved understanding of the tributary and will provide better baseline data for the assessment of impacts in the future.

Should you have any questions regarding the above, please contact the undersigned.

Yours truly,

R.J. Burnside & Associates Limited

Dave Hopkins
Sr. Hydrogeologist
DH:sd

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