



April 24, 2015

Via: Email

Mr. Stan Denhoed, P.Eng., M.Sc.
Harden Environmental
4622 Nassagaweya-Puslinch Townline Road
RR 1
Moffat ON L0P 1J0

Dear Mr. Denhoed:

**Re: Hidden Quarry Specific Well Contingency Plans
Project No.: 300032475.0000**

1.0 Introduction

Thank you for your memorandum of January 8, 2015 which uses existing information from well surveys and water well records to assist in the preparation of well specific contingency plans for domestic wells in the vicinity of the proposed Hidden Quarry.

The extraction of bedrock in the quarry is predicted to result in a permanent decline in bedrock water levels to the north and a rise in water levels to the south. The quarry will also result in mixing of water quality from a variety of previously unconnected zones in the bedrock which could impact wells downgradient of the site. In addition, although the site is not considered to be favourable for water fowl use, there is the potential for bacteria to be introduced into the quarry ponds and migrate laterally downgradient in bedrock fractures. Although the work completed to date by Harden suggests that the quarry will not result in water quality/quantity impacts, Burnside requested that the available information for each well be used to come up with a well-specific contingency plan to deal with potential impacts. Information for 39 wells is included in Table 1 which is attached to the Memorandum.

2.0 Water Quantity Issues

The maximum predicted drawdown in the bedrock aquifer at the nearest off-site well is about 1.4 m immediately northwest of the proposed quarry property. There are two options that can be used to mitigate water level declines:

1. Lower the pump in the well; and
2. Deepen the well.

The groundwater model used by Harden predicted that water level declines in the bedrock will be seen in the northern half of the site with increases seen to the south. Figure 4.3 from the

original report presents the predicted drawdown and is attached for reference. The December 9, 2014 Harden letter indicates that the groundwater model was revised to consider the potential of a zone of higher hydraulic conductivity beneath the quarry. The results indicated that the original predictions were conservative. As a result, it is considered reasonable to utilize the Figure 4.3 to assist in assessing the impacts to nearby domestic wells. As can be seen, drawdown is expected to occur north of Highway 7 along the 6th Line, west of the proposed quarry and along the 7th Line, east of the quarry.

Table 1 contains a significant amount of information including the well depth, well depth elevation, static water level (both measured and from MOECC water well record), recommended pump setting and available drawdown to recommended pump setting.

Calculating the available drawdown to the bottom of the well and to the recommended pump setting is a reasonable approach to assess if there is an opportunity to lower the pump in the event that water levels are approaching the pump intake. However, the recommended pump setting may not be the actual pump setting and is difficult to verify. A more conservative approach would be to use the pumping data from the water well record and look at the available drawdown from the pumping level to the recommended pump setting and the bottom of the well.

The wells that are predicted to experience the greatest drawdown due to quarry activities are W2, W4, W5, W6, W7 and W8 which are all completed in the bedrock. W31 is a shallow dug well with limited available drawdown. The spring feeding W31 is indicated by Harden to originate in the overburden. This needs to be confirmed as predicted drawdown in the bedrock is between 0.4 and 0.6 m. The well has limited available drawdown and could be significantly impacted if the spring was fed from the bedrock.

Burnside recommends the following:

1. The status of W7 be clarified; there is no information for this well provided in Table 1.
2. Additional information be provided for W2 and W3 which are located in the mushroom farm site.
3. Short term pumping tests should be completed on wells W2, W3, W4, W5, W,6, W7 and W8 to confirm the pumping water levels and the contingency options in Table 1 finalized.
4. The source of water for W31 should be confirmed.
5. Additional information be provided for wells W20, W35, W38, W42 and W43. Although they may be in areas where impacts are not expected, the information in Table 1 should be filled out for these wells as a condition of development. Burnside recommends that these wells be investigated in more detail, recognizing that provincial privacy rules and issues with owners not allowing access to their wells can make it difficult to correlate well records to specific properties

Bedrock drawdown in the order of 0.4 m is predicted northeast of the proposed quarry along 7th Line which could impact wells W25 to W34. With the exception of W26, all these wells are completed above the base of the quarry so the wells could be deepened if necessary.

3.0 Water Quality

Water quality impacts will be limited to wells located south of the proposed quarry where water levels are predicted to rise. In the majority of cases there is an option to drill the well deeper and extend the casing below the depth of the quarry to access deeper bedrock fractures. UV light protection is also recommended as a treatment option. Burnside recommends the following:

1. The well heads at W17, W18 and W21 be upgraded to comply with O. Reg. 903 to facilitate monitoring and reduce the potential for impacts from surface water infiltration which could be misconstrued as originating from the quarry. This should be completed as a condition of development.
2. Water treatment systems are not the preferred options as they will require long term maintenance by the property owner.

Yours truly,

R.J. Burnside & Associates Limited



David Hopkins, P.Geo.
Senior Hydrogeologist
DH:sd

cc: Ms. Kim Wingrove, Township of Guelph/Eramosa (enc.) (Via: email)
Ms. Liz Howson, Macaulay Shiomi Howson Ltd. (Via: email)