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GMBP File No: 224052

Via Email - Adam.Wendland@caledon.ca

The Corporation of the Town of Caledon
6311 Old Church Road, Caledon,
ON, L7C 1J6, Canada

Attention: Adam Wendland

Re: Peer Review of Hydrogeological Reporting (Karst)
for Proposed Official Plan Amendment (POPA
2022-0006) and Zoning By-law Amendment (RZ
2022-0010) – CBM Caledon Quarry

Dear Adam,

At the request of The Corporation of the Town of Caledon, GM BluePlan Engineering Limited (GMBP) has been tasked with a Peer Review of Hydrogeological Reporting (Karst) for Proposed Official Plan Amendment (POPA 2022-0006) and Zoning By-law Amendment (RZ 2022-0010) – CBM Caledon Quarry.

INTRODUCTION

Glen Schnarr & Associates has submitted an application on behalf of CBM Aggregates/St. Mary's Cement Inc. to the Town of Caledon to amend the Official Plan and Zoning by-law to redesignate the land use. The applicant is requesting to change the zoning classification from General Agricultural, Rural, Lands, and Environmental Policy Area to Extractive Industrial Area B with the intention of creating a below the water table pit and quarry with a proposal for a Class A licence with a maximum tonnage of 2.5 million tonnes per annum.

The project site is located at Part of Lots 15-18, Concession 4 WSCR, and Part of Lot 16, Concession 3 WSCR (former Township of Caledon). The property is separated into three blocks of land and is approximately 261.2 hectares in size. The property is reported to contain up to approximately 80 million tonnes of bedrock resource and 5 million tonnes of sand and gravel resource. The site will include dewatering to allow operations to be completed in a dry state.

SCOPE OF TECHNICAL REVIEW

GMBP has been retained to complete a review of the Hydrogeological Information as it relates to Karst, or potential Karst. It should be noted that this review is separate from the full Hydrogeological Study Review that will be completed under separate cover. While our comments focus on matters related to Karst, some comments may also be related to the broader Hydrogeological Review. It is recommended that the Hydrogeological Reviewer be provided with a copy of these comments to facilitate review and comment.

GMBP's technical review included the following documents:

1. Full-Size, Scalable ARA Site Plan Drawings as prepared by MHBC Planning Limited (MHBC) dated Revised August 2023;
2. Final Rehabilitated Landform and Ecological Enhancement Areas prepared by MHBC Planning Limited (MHBC) dated Revised July 2023;

3. Natural Environment Report (including tree inventory, buffer planting details, landscape details and long-term monitoring) prepared by Golder Associates Ltd. dated December 2022 (Revised July 2023);
4. Water Report Level 1/2 (including long term monitoring) prepared by Golder Associates Ltd. dated December 2022 (Revised July 2023);
5. Maximum Predicted Water Table Report prepared by Golder Associates Ltd. dated December 2022 (Revised July 2023);
6. Water Report Level 1/2 Peer Review Letter prepared by GHD Engineering Ltd. dated August 30, 2023; and
7. Natural Environment Report Peer Review Letter prepared by GHD Engineering Ltd. dated August 30, 2023.

PREAMBLE

The Ontario Geologic Survey has labelled the site area as “Potential Karst”, referring to areas of carbonate rock units identified as most susceptible to karst processes. This is due to the Amabel/Gasport Formation, which is the primary target for bedrock extraction. Both the North and South sections of the site straddle the fringes of the Gasport/Amabel Formation which is typically where higher amounts of weathering occur, which in theory, can potentially lead to wider and more connected fissure systems especially when proximal to the escarpments (i.e., towards the Credit River). Based on the findings of the various reports and figures, the potential for the occurrence of minor karstic features is considered to be present on the property and surrounding areas.

The primary concern related to karstic features is their nature of inter-connected voids that provide for both rapid and preferential travel of water. Where karstic conditions are found, the aperture of the dissolution features in bedrock can allow the migration of water at orders of magnitude higher than typical subsurface environments and may also result in unpredictable connections between features that are relatively distant, or in an unexpected direction.

In the context of a quarry, karstic conditions have the potential to have a significant impact on several aspects including (but not limited to):

- Estimated dewatering rates – karstic conditions can cause significant increases in dewatering volumes due to higher hydraulic conductivity/transmissivity. Increased water taking would influence drawdown, discharge, and permitting.
- Estimated drawdown – as above, the amount of drawdown may be greater where karstic features are intercepted and have a larger radius of influence.
- Surface water feature impacts due to reduced/altered flow – where karstic conditions connect groundwater or surface water systems in the quarry area to off-site surface water features (such as seeps, wetlands, or streams), the dewatering of the quarry may reduce and/or alter the volume and or quality of groundwater discharge. Post development, standing water (ponds) would be subject to warming and/or change of quality.

Our review has been completed in the context above, both in consideration of the details provided in the information reviewed and in the overall context of the proposed works associated with the quarry.

Based on the volume of material, only the items that we have questions or comments on are provided below. Where no comments are provided, it can be inferred that we are in general concurrence with the information as it relates to the scope of our review.

REVIEW COMMENTS - SCOPE OF WORK

After reviewing the documents listed in the scope of study, it is our opinion that the documents reviewed are consistent with scope of work listed by the TOR. The level of work in both field characterization and associated studies appear to be consistent with that expected under the ARA process and for similar development proposals.

With respect to Karst, the field reconnaissance combined with on-site monitoring well drilling, geophysical testing and hydraulic testing (both packer and pumping tests with tracer) appears to provide sufficient information to inform the hydrogeological conceptual model sufficiently to assess the potential for impacts.

REVIEW COMMENTS – KARST

The Karst Assessment (Stephen Worthington, P.Geo., Appendix K of the Water Report Level 1/2) concluded the following:

The Karst investigation found that dolostone aquifer on the study area is a typical of such aquifers where there is fairly thin overburden, which allows substantial recharge to enter the bedrock. Such distributed recharge results in pervasive dissolution of fractures, with most enlarged fractures having apertures of 0.1 – 0.3 mm. This results in the aquifer having a predictable response to large-scale stresses such as quarry development.

The investigation did not identify any indicators that would suggest underground dissolution conduits, sink patterns, or caves (major karst features) in the study area. We generally concur with the information provided in Appendix K and as it relates to the Water Report Level 1/2).

Section 5.4.2 of the Water Report Level 1/2 Report states:

Results of the Packer tests performed in the Gasport Formation varied significantly, ranging from 2×10^{-8} m/s to 2×10^{-2} m/s. Results ranging by six orders of magnitude demonstrate the heterogeneity of the Gasport Formation in this area. The range of hydraulic conductivities observed in the Gasport Formation are within the range (Freeze and Cherry 1979) of expected values for carbonate rocks, ranging from fine grained unfractured dolostone to weathered, fractured or vuggy dolostone.

Variability of hydraulic conductivity in bedrock is typically controlled by secondary porosity features such as fractures. The degree, connectivity and aperture of fracturing primarily controls the hydraulic conductivity. It is our experience that the upper range of 10^{-2} m/s also correlates with highly weathered or carbonate rock with dissolution fractures (minor karstic fractures). Some evidence of minor dissolution features is also noted in the geophysical information.

Therefore, it appears that the bedrock has the potential for minor karstic conditions that may influence the impacts to groundwater conditions associated with the quarrying. It is our opinion implementation of the proposed monitoring program will be critical to ensuring the conceptual model developed as part of the investigations remains relevant and the potential for impacts are properly characterized in a proactive manner. The requirement for submission and review of the water monitoring program is considered a key element of this process.

The progression of the Quarry from the North (Main) area to the South is considered advantageous to determine the potential for impacts to the private domestic supply wells and surface water features to the south.

REVIEW COMMENTS – SEEPS AND SPRINGS

A primary potential concern related to Karst features is the direct connection of groundwater and surface water system in the quarry area to springs or seeps that may provide ecological function.

According to the information provided, there is a level of separation between most surface water features and Gasport/Amabel formation (targeted for extraction). We concur with these findings.

One seep was identified to the southeast of the South Section, just below the contact of the Gasport/Amabel Formation. It is understood that this occurs at (or near) the contact of the Gasport/Amabel and the Shaley Dolostone/Cabot Head Formation. Based on the nature of the seep, it doesn't appear to be associated with Karst and is a result of the intersection of the steep slope with the groundwater table. In our experience, such seeps and springs are common along the cut banks, where the water table intersects the ground surface.

During a brief site visit and walk along the southern trails bordering the Credit River (south of Cataract Rd.), there appeared to be two (2 additional) seepage features evident by creeks/streams. They appeared to be on private property south of the rail trail so were not accessed during the visit. A simple map showing their potential location is enclosed for reference.

It is recommended that these potential seeps be mapped, investigated, and included in the Water Level 1/2 Study. If they are found to be seeps that provide ecological function, it is recommended that they be added to the monitoring network.

REVIEW COMMENTS – DOMESTIC WELLS

Another primary concern with dewatering operations is lowering the water levels in neighboring areas and impacting domestic water wells (i.e., well interference). It is noted that the reports identify potential risks to neighboring supply wells. If the numerical modelling is assumed to be accurate, it is reasonable to expect that the neighboring wells will experience the drawdown as predicted, or potentially more, if localized increases to hydraulic conductivity are found. Therefore, we recommend that the monitoring program proposed ensures that it is pro-active in addressing potential impacts, and that there is a trigger level considered whereby remedial measures are taken prior to the loss of water supply.

From the Water Report Level 1/2 Report, we recommend that the ability to drill deeper wells and continue to provide adequate water supply (quality and quantity) should be verified for those that may experience potential impacts. In some cases, the water quality and quantity in deeper units may not be suitable for supply.

REVIEW COMMENTS – GENERAL (MINOR)

The following comments and/or questions in this section are considered minor in nature and are intended to strengthen or clarify the submission. These are not considered mandatory actions to meet the ARA/Planning process.

1. Full-Size, Scalable ARA Site Plan Drawings as prepared by MHBC Planning Limited (MHBC) dated Revised August 2023
 - a. A003:
 - i. Why is the rehabilitation lake level lower than the current average water table in the area? Although there is a slurry wall and grouting planned to reduce the hydraulic conductivity, it is expected that a level of hydraulic connection to the area will remain.
 - ii. Section B-B1, Lake levels between the south and main areas are different elevations and are divided by Charleston Sideroad. Based on the pumping test information a Hydraulic K estimates, isn't it reasonable to expect a level of hydraulic connection between these features? Please explain the rationale for post extraction pond water levels on the drawings.
 - b. A001-A004:
 - i. Tributary #1 disappears once reaching the water feature west of Phase 4, also not shown in Drawing A003 cross section A-A'. It should be clear how the tributary is connected to the rest of the watershed/surface water systems. From Section 6.8.2 of the Water Report Level 1/2 it is understood that the stream/water course may be seasonal and flow south along the roadside swale for Mississauga Road and terminate in a closed depression. It is recommended that the seasonal route be demarked on applicable Figures or drawings for clarity.
2. Water Report Level 1/2 (including long term monitoring) prepared by Golder Associates Ltd. dated December 2022 (Revised July 2023)
 - i. Figures 4-5 & 4-6 regarding the geological models / cross sections: It would be easier to interpret the cross section if the boundaries of the quarry were shown in the cross sections, similarly to the site plans A001-A004. The window in the top right showing the locations of the cross sections should show or reference the wells so the reader can better correlate the groundwater levels to the various conductivities and other metrics presented in the report.

CONCLUSION AND RECOMMENDATIONS

Overall, we concur with the findings of the Water Report Level 1/2 and Maximum Predicted Water Table Report as it relates to Karst. The level of site characterization and interpretation appears to adequately support the Hydrogeological Conceptual Model.

Notwithstanding, the potential for variability in fractured rock with dissolution features always exists and cannot be fully known until the quarry activities are completed. To this end we believe that the proposed monitoring program will be critical to the continued evaluation of the potential for impacts. We generally concur with the program and support the requirement for annual submission and review of the annual hydrogeological monitoring reports. We recommend that the broader Hydrogeological Review considers the adequacy of the proposed monitoring program as it relates to their own findings.

To support the application review process, we provide the following recommendations:

1. That the potential seeps south of Cataract be mapped, investigated and included in the Water Level 1/2 Study Report. If they are found to be seeps that provide ecological function, it is recommended that they be added to the monitoring network.
2. That the ability to drill deeper wells such that they are able to provide a continuation of adequate water supply (quality and quantity) be verified for those that may experience potential impacts, based on the Water Report Level 1/2 Report.

The following recommendation will likely be realized through the PTTW and or monitoring process, as opposed to the ARA/planning process since it may not be appropriately captured in Site Plan Notes. The recommendation is:

3. That the annual monitoring program ensures that it is proactive, requiring implementation of remedial measures prior to cessation of water use from area domestic wells.

This type of approach is typically required and/or implemented by the MECP through the PTTW Application, Approval, and the Annual Reporting process. Recommendation #3 is raised here so that the parties involved are aware of the importance of ensuring the process is proactive as opposed to reactive. It is recognized that the involvement of the property owners is required in such a program and thus may have limitations where access is not granted or is limited.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED
GEI CONSULTANTS INC

per:



Matthew Nelson, P.Eng. P.Geo.



Gerhard Kiessling, P.Geo.

cc: The Town of Caledon – Alex Mior: Alex.Mior@caledon.ca