TOWN OF CALEDON

(CBM Caledon Quarry)

CAART COMMENT SUMMARY TABLE RESPONSE #1 – [BLASTING]

Please accept the following as feedback from the Caledon Aggregate Review Team (CAART). Fully addressing each comment will expedite the potential for resolution of the consolidated CAART comments and individual agency objections. **Additional comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

Colour Code	Description
	Resolved
	Resolved subject to additional information being provided to CAART Reviewers (e.g, Implementation Guide, Report Addendums)
(no colour)	Response provided, but no further action taken or required by Project Team

	Initial CAART Comments (Date)	Page / Section	Applicant Response (Date)	CAART Response (Date)	Applicant Response (Date)	CAART Response (Date)	Applicant Response
Report: Blasting Impact Assessment		**Author: Golder**					
1. .	Consider adding the following information and references to the site plan: - Discuss creating and implementing a planned approach for completing pre- and post-blast inspections of residential structures as the site develops. - Include consideration of pre-blast processes (i.e. reviewing drill logs, checking hole deviation, and inspecting any open faces) to help ensure blasting is safe and effective. - The site plans mention an independent third-party will perform blast vibration monitoring services for the site. RESPEC recommends discussing the roles and responsibilities of the site reporting any potential exceedances.	Site Plans					
2.	The paragraph references a tunnel under Regional Road 136 to access the north area from the main quarry after approximately 10 years of operation and another tunnel under Charleston Sideroad to access the south area after approximately 30 years of operation. The document does not note the required blasting for this tunnel. In both cases, the tunnel must go below the buried Enbridge natural gas pipeline. The tunnel excavations may result in some very restrictive blasting practices. RESPEC recommends noting this item in the report.	Blast Impact Assessment: Page 4, Paragraph 3					

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3.	The paragraphs are a duplicate of one another. One paragraph should be eliminated.	Blast Impact Assessment: Page 6, Paragraphs 1 and 2					
4.	The section notes, “the pit walls above the water table will slope at 3:1 and the pit walls below the water table will slope at 2:1.” This comment requires clarification on whether blasting the final walls down to these slopes will be required after completion of operations in the area (i.e., completion of mining in a particular area) or if the final production blasts in these areas are to be angled to produce the required results.	Blast Impact Assessment: Page 7, Section 2.0, Paragraph 2					
5.	The drawing shows the best estimate of the area where the depth of rock excavation would exceed 25 meters. This should be clarified in the report text. RESPEC recommends splitting the bench into two benches of approximately equal height as the pit wall approaches 25 meters in height to allow recovery of all resources. Having a bench of 25 meters and a secondary bench of 3 meters where the final wall height is 28 meters would not be economical or practical. This proposed split would also reduce the explosive loading per delay for each blast, lowering potential vibration levels (see bullet on page 5 [Page 24, Table 2]).	Blast Impact Assessment: Page 9, Figure 5					
6.	The blast pattern, hole size, stemming, subdrill depth, explosive weight per delay, and powder factor all appear to be very reasonable and equivalent to many operations in southern Ontario blasting in similar limestone rock formations. The explosive type is shown as a chemically sensitized, gassed bulk emulsion. RESPEC recommends showing this as an ammonium nitrate/fuel oil (ANFO) or gassed emulsion blend, which is most common in these types of operations. RESPEC recommends adding a 3-dimensional drawing or illustration of an example blast pattern.	Blast Impact Assessment: Page 10, Section 3.0					
7.	The first bullet point describing the initiation of explosives in a borehole notes that “the bedrock behind the borehole is fractured.” As noted in Section 4.0, the rock immediately around the borehole is pulverized by the explosive, but outside the immediate area and behind the borehole (i.e., away from the open face), some cracking and micro fracturing extends for a very short distance into the final wall. The description of fracturing behind the borehole is very limited. RESPEC recommends expanding this explanation.	Blast Impact Assessment: Page 11, Bullet Point 1					
8.	The term “Air vibrations or airblast” is used. RESPEC recommends defining and using the term “air overpressure” consistently throughout the report. Different terminology is used throughout the industry, causing a degree of confusion about the meaning of the terms.	Blast Impact Assessment: Page 11, Paragraph 2					
9.	The cause of air overpressure is described as “the indirect action of a confining material subjected to explosive loading.” This description is unclear. One cause of air overpressure is the face movement of the rock when an insufficient burden is in front of the face or openings in the rock, insufficiently confining and allowing the	Blast Impact Assessment: Page 11, Paragraph 2					

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	escape of high-pressure gases. This gas release pulse is responsible for some of the air overpressure and should be explained in more detail.						
10.	The description of flyrock uses the term “wild flyrock.” Although this does appear in some of the literature, RESPEC recommends not using this terminology as “wild flyrock” implies some sort of extreme event. In RESPEC’s opinion, flyrock should be defined as rock that is outside the controlled blast area or blast zone.	Blast Impact Assessment: Page 13, Section 4.2, Paragraph 1					
11.	The potential impacts on fisheries, pets, and livestock are well summarized and accurate. RESPEC agrees with the conclusions in these sections.	Blast Impact Assessment: Page 16, Section 4.3 and 4.4		No Action			
12.	The summary is very comprehensive. RESPEC has reviewed all the blast reports and vibration monitoring information from CBM’s Osprey Quarry near Collingwood (in a similar rock formation) for 3 years and produced a site attenuation forecast for ground vibrations. RESPEC’s results are very similar to Golder’s results. RESPEC believes the 95 percent confidence interval represents an excellent starting point to predict ground vibrations. As noted in the report, on-site monitoring at the proposed Caledon Quarry will be required to produce an attenuation relationship for the specific site. RESPEC is confident that the resulting site-specific equation will be similar to the prediction in Golder’s report. RESPEC’s data review and model are available upon request.	Blast Impact Assessment: Page 17, Section 5.2					
13.	The data supplied from the Osprey Quarry consisted of air overpressure readings at different ranges insufficient to generate an air overpressure attenuation model. Air overpressure regression curves are difficult to generate with high accuracy as weather conditions make a significant difference in readings. However, Figure 9 presents industry standard equations to use as a starting point for quarry development. RESPEC verified these equations by reviewing supporting documentation and performing validation checks. A more accurate site-specific model will be developed as ongoing monitoring occurs throughout the quarry development.	Blast Impact Assessment: Page 18, Section 5.3					
14.	The paragraph notes that cloud ceilings and temperature inversions can contribute to the air overpressure propagating further than expected. RESPEC’s experience is that this is a common occurrence with air overpressure when a temperature inversion or low cloud cover causes the shock wave to be reflected back to ground and creates a higher level of air overpressure in an area that normally experiences little or no air overpressure. This only occurs in a very local area and is not likely repeated in subsequent blasts. The result of these incidents are that people who typically have limited or no knowledge of the blasting occurring may be startled and complain; however, the levels will be well below that which could cause any potential damage. RESPEC recommends expanding the explanation of the air overpressure in this section.	Blast Impact Assessment: Page 18, Section 5.3, Paragraph 2					

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15.	RESPEC recommends emphasizing that proper control of face burdens and inspection of the face before shot loading should be done to minimize the potential for face bursting and higher air overpressure levels.	Blast Impact Assessment: Page 19					
16.	RESPEC recommends explaining that air over pressure may be noticeable, but far below damage thresholds and that the effect of significant air overpressure on nearby residences will result in potential vibrations in the mid-wall sections of the house, potentially causing dishes to rattle or wall hangings to shift. Such air overpressure levels are far below what would cause any damage. Air overpressure would have to be as high as 148 to 150 dBL to have the potential to crack windows (which is the first damage noted from air overpressure).	Blast Impact Assessment: General Comment					
17.	The paragraph notes that “the blasting operation will progress toward the extraction perimeter with the nearest sensitive receptors located behind the face.” This is generally true, but as the quarry is developed, there will be many situations where quarry faces will not be oriented this way (e.g., open corners). RESPEC recommends adding text to address these alternate situations.	Blast Impact Assessment: Page 20, Paragraph 2					
18.	The section on flyrock is very thorough and covers this subject clearly; however, RESPEC recommends two changes related to flyrock.	Blast Impact Assessment: Page 20, Section 6.0					
19.	- The equation for rifling shows sin2θDH with no reference to what DH represents, though it may be the launch angle noted in the list of terms. This should be updated or corrected in the report.						
20.	- (Starting with McKenzie [2009]) RESPEC suggests Golder add a paragraph recommending specifically what should be done with respect to flyrock control and blast area size.						
21.	- RESPEC has reviewed the flyrock prediction equations and supporting documents and completed validation checks, and supports the conclusions in the report.						
22.	Three distances are noted for different bench heights indicating the estimated standoff distances to adjacent receptor residences based on estimated air overpressure levels. These calculations are correct. RESPEC recommends adding a note stating that these readings will depend on weather conditions.	Blast Impact Assessment: Page 27					
23.	Three points provide suggestions for techniques to reduce vibration levels. RESPEC recommends adding a fourth point that suggests considering the use of electronic detonators to improve timing accuracy. Numerous studies have shown that improved timing accuracies can reduce ground vibration levels in sensitive areas.	Blast Impact Assessment: Page 29, Section 7.2					
24.	Enbridge’s specification notes that they may require a daily leak test when blasting occurs near a pipeline. Providing the notifications and approvals are completed correctly, it is up to Enbridge to determine the need for testing while CBM would be financially responsible for the testing.	Blast Impact Assessment: Page 30, Section 7.3					

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25.	The sections on heritage attributes, water wells, and repeated low level vibration effects on structures are well written and correct. RESPEC agrees with these sections.	Blast Impact Assessment: Page 30 and 31, Sections 7.4, 7.5, 7.6		No Action			
26.	RESPEC verified the minimum separation required based on the estimated maximum flyrock range calculations and provided data. However, Row 1, Column 6 appears to be incorrect and should show 230 meters instead of 330 meters.	Blast Impact Assessment: Page 33, Table 7					
27.	RESPEC recommends adding the following information and references to the blast impact assessment.	Blast Impact Assessment: General Comment					
28.	The report mentions an independent third-party will perform blast vibration monitoring services for the site. RESPEC recommends expanding on this role earlier in Section 7.0. It is also recommended this section discusses the roles and responsibilities of reporting and maintaining accountability for any potential exceedances.	Blast Impact Assessment: Page 34, Section 8.0					
29.	RESPEC recommends adding that the contractor should attempt to blast at approximately the same time frame each day blasting is scheduled. Neighbors will better expect and understand what is happening when a blast goes if there is more regularity and consistency around the blast events.	Blast Impact Assessment: Page 34, Seciton 8.0					
30.	The last point suggests monitoring the first five production blasts with multiple seismographs. RESPEC agrees with this suggestion; however, several sinking shots will be required to open up the ramps and start development before production blasting. Sinking shots tend to be heavily loaded (because they are more confined than a regular face shot) and produce higher vibrations. RESPEC recommends stating that the location of the sinking shots and ramp development should be done with this in mind and be monitored at five locations.	Blast Impact Assessment: Page 35, Section 8.0					
31.	RESPEC recommends updating the glossary as follows: - Add the definition of “air overpressure.” - Use the term “flyrock” instead of “rock missile” in the definition of blast area. - Update the definition for “blast area” to reflect how it is used in the report and define it as an area where controlled blast effects, such as controlled and intended rock movement, take place. - Clarify the definition of “deck.” A deck can be referenced as inert (stemming deck) material or explosive material (explosive deck). - Update the definition of “flyrock.” RESPEC assumes flyrock is being defined as uncontrolled and unintended rock movement using the current definition.	Blast Impact Assessment: Appendix B					

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	- RESPEC recommends adding an illustration to help define the blast zone and to differentiate between controlled and intended rock movement and flyrock.						
32.	RESPEC agrees with Golder's view that blasting can be done within the current quarry blasting guidelines (NPC-119) at all surrounding sensitive land uses. RESPEC recommends the clarifications and additions previously outlined be added to the report, but overall Golder has done a thorough job of assessing the impacts of blasting.	Blast Impact Assessment: Page 35 and 36, Section 9.0					