



January 19, 2024

The Regional Municipality of Niagara
Planning and Development Services
1815 Sir Isaac Brock Way, P.O. Box 1042
Thorold, ON L2V 4T7
Attention: Sean Norman, PMP, MCIP, RPP

Subject: Upper's Quarry Final Peer Review Plain Language Summary - Blast Impact Analysis - Revision 1

Summary of revised Blast Impact Assessment Report (AAR) for the Upper's Quarry (the Quarry) in Niagara Falls, Ontario prepared for Walker Aggregates Inc. (WAI), prepared by Explotech Engineering Ltd. (Explotech) dated August 2023
Englobe reference: 02105316.000

1 Introduction

Englobe Corp. (Englobe) was retained by the Regional Municipality of Niagara (Municipality) to provide a brief plain language memorandum summarizing the latest Blast Impact Assessment Report for the proposed Upper's Quarry (the Quarry) in Niagara Falls, Ontario. The Blast Impact Assessment (BIA) was prepared by Explotech Engineering Ltd. in accordance with guidelines outlined in the Aggregate Resources Policies and Procedures Reference Manual. The main objective of the report was to determine if the planned aggregate extraction on the proposed property can be carried out safely and within guidelines set out in the Ministry of Environment, Conservation and Parks (MECP) Model Municipal Noise Control By-law NPC 119 which governs blasting operations in mines and quarries in the province of Ontario. As part of the report Explotech also acknowledges the presence of third-party (not owned by WAI) sensitive (residential and commercial properties) and non-sensitive (pipelines and transmission towers) receptors within the vicinity of the proposed extraction area and provides mitigation measures to address potential impacts of the blasting operations on these receptors to maintain compliance with MECP, TC Energy pipeline and transmission tower companies specific vibration, overpressure and blasting specifications.

In addition to the requirements specified in the Aggregate Resources Act, Explotech's BIA report also addresses issues such as flyrock control, potential impact on residential water wells, and nearby waterbodies.

Please note that this memorandum was prepared with the purpose of summarizing and simplifying the Quarry's latest BIA Report. As such, some of the terminology and concepts were adapted and/or streamlined in an effort to ease a layperson's comprehension of the BIA Report. Please refer to the original reports for full context and technical terminologies, including descriptions, justifications, and assumptions.

2 Project Background

The proposed Quarry is located east of Thorold Townline Rd, west of Beechwood Rd, north of Upper's Lane (by approximately 400m), and south of Upper's Lane to the power transmission line right-of-way. A full, legal description of the Quarry limits is provided in the BIA Report.

Extraction of aggregate materials within the Quarry will be done in phases, with each phase focusing on a limited area of the overall Quarry limits. The initial phase is located in the southwestern area of the Quarry limits, where the distances to nearby residences is the greatest. Each subsequent phase results in Quarry equipment operating gradually closer to nearby residences.

The operating hours for the quarry operations is generally Monday to Saturday, from 07h00 to 19h00. However, the following specific activities are expected to operate 24 hours per day, 7 days a week:

- Hauling aggregate materials within the Quarry.
- Shipping and receiving activities.
- Asphalt plant operations.

3 Blast Vibration and Overpressure Limits

Peak Particle Velocity (PPV), measured in mm/s, is used to describe vibration levels due to its superior correlation with the appearance of cosmetic cracking. Many blasting consultants recommend, as a general guideline, that blasting vibrations monitored at the closest structure to the blast site be kept below 50 mm/s Peak Particle Velocity. The maximum “zero to peak” particle velocity of 50 mm/s at frequencies above 40 Hz is in our opinion, and that of most other blasting consultants, including experts such as the United States Bureau of Mines (USBM), the American Insurance Association (AIA), and the National Research Council of Canada (NRC), the threshold for the possibility of cosmetic cracking in weak construction materials such as drywall and plaster. The MECP guidelines for blasting in mines and quarries are amongst the most stringent in North America. The guideline limits at sensitive receptors suggested by the MECP in NPC 119 for routinely monitored blasts in mines and quarries in Ontario are:

Vibration: 12.5 mm/s Peak Particle Velocity

Overpressure: 128 dB(L) Peak Sound Pressure Level (PSPL)

A TC Energy High Pressure Natural Gas Pipeline and Hydro One transmission line corridor run adjacent to certain limits of the proposed quarry license. The MECP guideline for blast induced vibration does not apply to these receptors as they are not classified as sensitive receptors. As such, vibration levels are dictated by their respective owners. Both TC Energy and Hydro One employ a vibration limit of 50 mm/s on their respective infrastructure.

4 Sensitive Receptors

As part of the BIA report, all receptors within 500 m of the proposed extraction limits and the closest distances to the extraction limits have been identified. A total of 41 sensitive and 5 non-sensitive receptors ranging in distance from 484 m to 63 m are located within 500 m of the licence boundary. The guidelines and regulations noted above were used as the basis for assessing the impact of the blasting on these receptors.

5 Results and Comparison to Applicable Limits

In order to mitigate the potential impact of vibrations and overpressures generated by blasting activities on the existing receptors, the BIA uses a well-known predictive model known as the US Bureau of Mines (USBM) prediction formula or Propagation Law, to predict vibration and overpressure levels at various standoff distances. This prediction formula is the most commonly employed and widely accepted method of predicting vibration levels for surface mines and quarries. Since the quarry is new and historical vibration and overpressure data is not available for this site, Explotech has used vibration and overpressure data collected from many similar limestone quarries with similar geological and operational characteristics to establish the predictive attenuation curves (graphs) which are used to determine site factors used in the Propagation Law. Based on the proposed phases of extraction, the closest sensitive receptor to the initial blasting for phase 1a is approximately 710 m. Using a proposed bench height of 15 m, and typical loading parameters employed in similar quarries, Explotech calculates the maximum quantity of explosive per delay period to be 118 kg. Using the propagation law, distance and maximum quantity of explosive per delay, the maximum PPV at the closest sensitive receptor to the initial blasting will be 4.14 mm/s, well below the MECP guidelines. Similarly, overpressures for initial blasting are calculated to be 126.8 dB(L), also below the allowable limits in the MECP guidelines. These initial predictions are generally worst-case scenarios, and actual measured vibration levels are lower than those predicted. Additionally, vibration waves propagate outwards radially from the source (blast) and dissipate relatively rapidly with distance in a similar manner to what is seen when throwing a rock in a pond, meaning the vibrations will always be highest at the closest receptor and lower at receptors further away.

6 Recommendations and Mitigation Measures

In order to comply with the vibration and overpressure level limits given in Section 3, Explotech has recommended that all blasts at the quarry be monitored for vibration and overpressure at the closest sensitive receptors, or closer, at a minimum of two locations in front and behind the blast to ensure vibration levels are maintained below the MECP regulations. Additionally, it is recommended that an independent blasting consultant complete an attenuation study during the first 12 months of operation to obtain sufficient data to produce a site-specific attenuation curve to confirm initial guideline parameters and assist in refining future blast designs. As mentioned above, the site-specific attenuation curve is what is used to determine the factors used in the Propagation Law. The more site-specific data that is available, the more accurate the attenuation curves become, making the predictions of vibration levels and calculations of maximum quantities of explosives per delay that much more accurate for this site as well, resulting in more efficient blasting. As phases 3 and 4 of the quarry move closer to residential areas, this site-specific data will be valuable in determining blast parameters to ensure all vibration and overpressure limits are not exceeded, and evaluating if it is financially viable to extract the rock. As the size of the blast decreases, the cost per cubic meter of rock produced increases, and at some point may cost more to produce than it can be sold for.

As part of their calculations, Explotech has provided tables showing the maximum quantity of explosive per delay period required to maintain vibration and overpressure levels below allowable limits at various standoff distances. Based on their calculations, any blasting within in an approximate standoff distance of 319 m from a sensitive receptor may necessitate a reduction in the maximum quantity of explosives per delay. As the blasting nears sensitive receptors, given current blasting technology and techniques it will be technically possible to maintain overpressures and vibrations below MECP limits, however market economics will dictate the feasibility of extracting the rock at closer distances.

In addition to monitoring vibrations at the closest sensitive receptors, Explotech also recommends that when blasting operations are within 100 m of the TC Energy pipeline, or the Hydro One corridor, or predicted vibration levels on the pipeline and hydro infrastructure exceed 35 mm/s, the pipeline and/or hydro towers should also be monitored for ground vibration.

7 Englobe Peer Review Summary

Englobe has conducted a peer review of both the original and the updated BIA Reports, respectively dated October 2021 and August 2023. Requests for additional details were made and have been addressed by Explotech to Englobe's satisfaction. The BIA report has satisfied the requirements of the Aggregate Resources Act as it applies to the effects and impacts of blast induced vibration and overpressure levels on sensitive and non-sensitive receptors, provided the proponent implements the recommendations outlined in Explotech's updated BIA report of August 2023..

8 Concluding Remarks

We trust the foregoing will satisfy your present requirements. If you have any questions regarding this matter, please do not hesitate to contact us.

Yours very truly,

Englobe Corp.

A handwritten signature in blue ink that reads "James Hicks". The signature is written in a cursive, flowing style.

James Hicks, P. Eng.
Director of Operations, Engineering

Revisions and publications log

REVISION No.	DATE	DESCRIPTION
0A	November 20, 2023	Final Summary Report
0B	January 19, 2024	Revision 1

Distribution

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