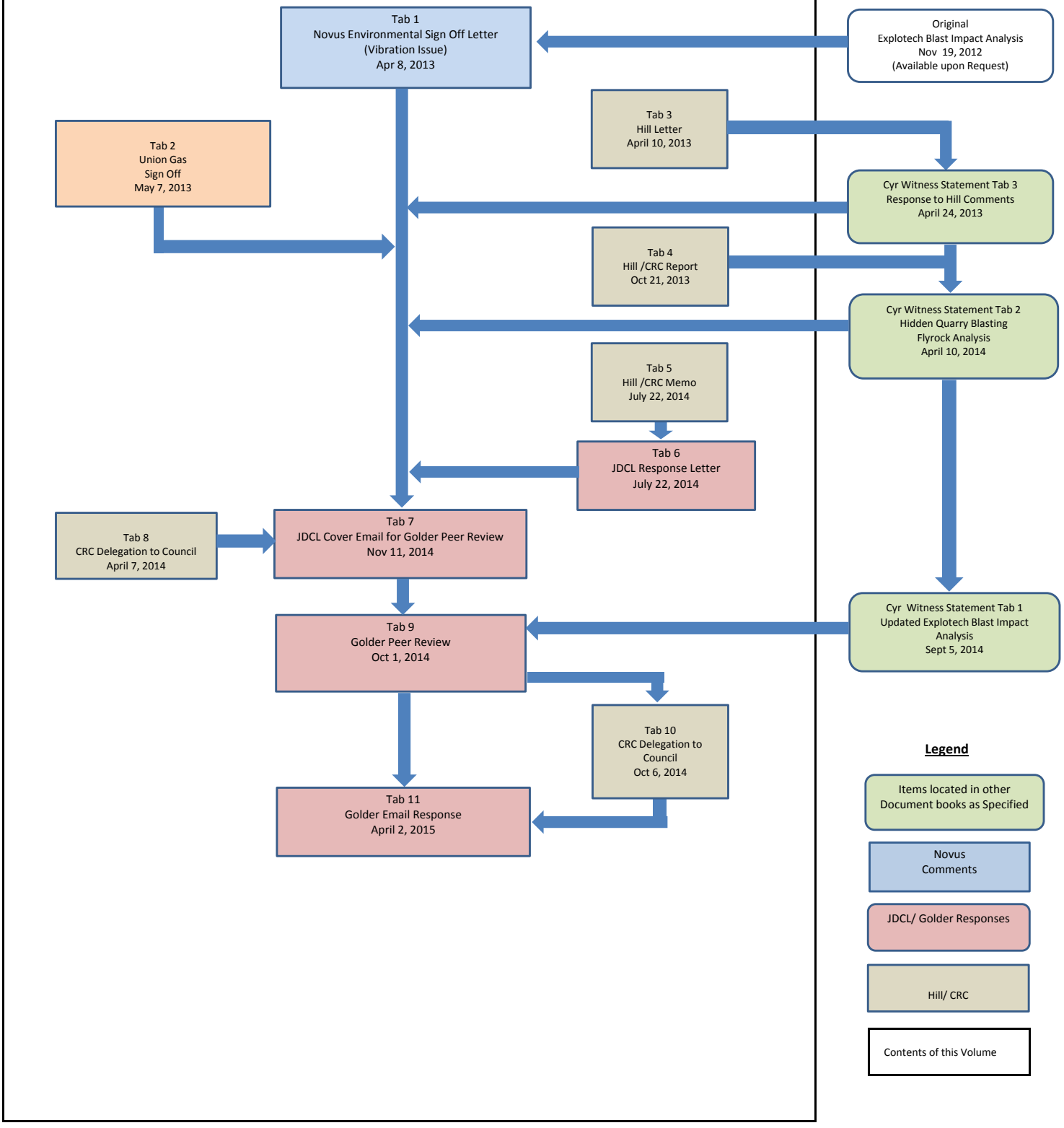
Evidence Book 14

11-Apr-16

Township of Guelph/Eramosa

Blasting Impact Review Document Book



Township of Guelph/Eramosa
Blasting Impact Review Document Book Index

April 8, 2013

Cuesta Planning Consultants Inc.
978 First Avenue West
Owen Sound, ON N4K 4K5

Attn: Mr. Michael Davis

Re: Peer Review, Acoustical Study
Hidden Quarry
Novus Project No. 12-0258

Novus Environmental was retained by Cuesta Planning Consultants Inc. on behalf of the Township of Guelph/Eramosa to conduct a peer review of the noise and vibration assessment work conducted for the proposed James Dick Construction Ltd. "Hidden Quarry", to be located in Rockwood, Ontario. This letter presents the results of our findings.

In conducting our assessment the following information have been reviewed:

- "Noise Impact Study, Project 11007, Hidden Quarry, Rockwood Ontario" prepared by Aercoustics Engineering Ltd. (AEL), dated November 19, 2012;
- "Blast Impact Analysis, James Dick Hidden Quarry", prepared by Explotech Engineering Ltd. (Explotech), dated November 19, 2012;
- Ministry of the Environment (MOE) Publication NPC-205 noise guidelines for semi-rural areas;
- MOE Publication NPC-232 noise guidelines for rural areas;
- Township of Guelph/Eramosa Noise Bylaw 5001-05;
- County of Wellington Official Plan, 1999 (Last Revision February 24, 2011);
- Correspondence with Mr. David Grant, Aercoustics Engineering Ltd.; and
- A site visit to the area of the proposed quarry.

Novus Environmental Inc. | Research Park Centre, 150 Research Lane, Suite 105, Guelph, Ontario, Canada N1G 4T2
e-mail info@novusenv.com | **tel** 226.706.8080 | **fax** 226.706.8081

1.0 Aercoustics Noise Impact Assessment

We have reviewed the noise impact assessment prepared by AEL, and in general, are satisfied with the approaches taken. However, we do have some comments and concerns with the analysis and conclusions.

1.1 Criteria

Novus is in agreement with the criteria selected. MOE Publication NPC-205 "Class 2" and NPC-232 "Class 3" limits apply to the residences in the area, as outlined in **Table 1** of the AEL report.

Receptor-specific limits for residences along Highway 7 were developed, based on road traffic noise modelling, for receptors R2, R10, R14, and R16. While the report states on Page 4 that sample calculations are provided in Appendix C, the copy of the report provided does not include this information. AEL provided this information via email, and Novus is in agreement with the guideline limits proposed.

1.2 Receptor Height

Page 6 of the AEL report notes that a receptor height of 1.5 m was used in the assessment. This is inconsistent with both MOE NPC-205 and NPC2-232 noise guidelines.

NPC-205 defines the point of reception as "any point on the premises of a person where sound or vibration originating from other than those premises is received." NPC-232 defines it as any "point on the premises of a person within 30 m of a dwelling or a camping area, where sound or vibration originating from other than those premises is received."

The guidelines do not distinguish between "daytime" receptors and "night-time" receptors". Under the definitions, points of reception include first storey windows, upper-storey bedroom windows, and ground level outdoor amenity areas within 30 m of the residence. It is important that upper storey bedroom windows be included in the analysis, as these locations receive less acoustical screening (mitigation) from berms and noise barriers, and thus can experience higher sound levels. These receptor locations are typically modelled at a 4.5 m receptor height for second-storey windows.

MOE Publication LU-131 – *Noise Criteria for Land Use Planning* is often used as a justification for using lower receptor heights. While LU-131 does identify daytime and night-time points of reception separately, it does not apply to the on-going permitting of operations at the proposed quarry, which must meet NPC-205 and NPC-232 requirements. The Ministry of the Environment has been consistently clear that "night-time" points of reception such as bedroom windows should also be investigated during daytime hours from a permitting perspective under NPC-205 and NPC-232. This was made explicit in the draft replacement NPC-300, which, while not in force, serves to illustrate the MOE's position. In the draft guideline, which is a replacement for both LU-131 and NPC-205, no differentiation is made between daytime and night-time receptors.

This is a major issue with the AEL analysis, as receptor height plays a crucial role in the effectiveness of noise berms and barriers. However, many of the residences in the area are one storey, and therefore the conclusions of AEL analysis (that the facility will be in compliance) may be correct. This needs to be confirmed to ensure compliance with the guidelines. Based on a drive-by survey, the following receptor heights and locations should be used in the analysis:

Receptor Heights and Locations for Noise Impact Assessment

Receptor No.	Location	NPC Area Classification	No. Of Storeys	Receptor Height and Location Per NPC-205 / NPC-232
R1	Highway 7	Class 2	2	4.5 m at house; 1.5 m on property
R2	Highway 7	Class 2	1	1.5 m at house; 1.5 m on property
R3	6th Line	Class 3	1	1.5 m at house; 1.5 m on property within 30 m of house
R4	6th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R5	6th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R6	7th Line	Class 3	1	1.5 m at house; 1.5 m on property within 30 m of house
R7	7th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R8	7th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R9	7th Line	Class 3	1	1.5 m at house; 1.5 m on property within 30 m of house
R10	Highway 7	Class 2	2	4.5 m at house; 1.5 m on property
R11	6th Line	Class 3	1	1.5 m at house; 1.5 m on property within 30 m of house
R12	Highway 7	Class 2	1	1.5 m at house; 1.5 m on property
R13	Highway 7	Class 2	1	1.5 m at house; 1.5 m on property
R14	Highway 7	Class 2	1	1.5 m at house; 1.5 m on property
R15	5th Line	Class 2	1	1.5 m at house; 1.5 m on property
R16	Highway 7	Class 2	1	1.5 m at house; 1.5 m on property
R17	5th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R18	5th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house
R19	6th Line	Class 3	2	4.5 m at house; 1.5 m on property within 30 m of house

Recommendation – the AEL analysis needs to be updated to reflect the appropriate receptor heights, to ensure that the applicable Ministry of the Environment noise guideline limits are met.

1.3 Construction Activity

Novus is in agreement that noise from the "construction" aspects of the quarry operation, including striping of overburden and rehabilitation, are exempt from NPC-205 and NPC-232 noise guideline limits.

Novus also agrees that the noise emissions from quarry equipment be restricted to meeting NPC-115 limits, as applicable. These restrictions should be listed in as part of the quarry's operating plan.

The prohibitions of the Township of Guelph/Eramosa Noise Bylaw 5001/05 would also apply to noise emissions, and is not addressed in the AEL report. The bylaw requires that equipment be fitting with effective exhaust and/or intake muffling and be maintained in good working order.

Recommendation – an Acoustic Audit by an independent third-party contractor be conducted during the first year of operation of the quarry, to ensure that the noise emissions from facility equipment meet NPC-115 limits.

1.4 Noise Source Emission Rates

Novus has reviewed the source emission rates used in the noise modelling. The values are consistent with those typically used in these studies. It is uncertain if a tonal penalty has been applied to rock drilling noise. Noise emissions from this equipment is typically tonal in nature, and under MOE Publication NPC-104, a +5 dB tonal penalty would be applied to the assessment of impacts.

Recommendation

- ***AEL to confirm if tonal penalties should apply to rock drilling, or if a specific non-tonal drill type will be used.***
- ***Tonality should be confirmed through an Acoustic Audit***

1.5 Modelling Results

The modelling result provided in **Table 6** of the AEL report show the proposed quarry to be in compliance with the applicable guideline limits. However, these results are subject to the issues identified above (receptor height, guideline limits, tonality) and need to be updated.

The quarry will be excavated in several phases. The report does not indicate which phase was being assessed (or if the results are worst-case for all phases). The report does not indicate where source equipment is being located within the quarry for noise modelling purposes. Without this data, the accuracy of the noise modelling cannot be confirmed.

In addition, the tabular format of the data does not allow for compliance with NPC-232 to be confirmed for receptors removed from Highway 7. For these locations, the applicable limit needs to be met both at all points on the house, but also at all points at ground level within 30 m of the dwelling. This can be addressed through providing noise contours (isopleths of equal noise levels) of the noise modelling results. This can be easily accommodated using the Cadna/A noise model.

Recommendations

- ***Update the results to address receptor height, guideline limits, etc., as discussed previously.***
- ***Update the analysis to show impacts for various phases of the excavation. Ideally, provide the electronic Cadna/A noise model for peer review. Alternatively, provide drawings showing the location of modelled noise sources for each phase of excavation.***
- ***Provide noise contours at a high of 1.5 m above grade to allow for confirmation of compliance with NPC-232.***
- ***An Acoustic Audit by an independent third-party contractor be conducted during the first year of operation of the quarry, to ensure that the noise emissions from facility operations meet NPC-205 and NPC-232 limits.***

2.0 Explotech Vibration Report

Novus has reviewed the blasting vibration report produced by Explotech. We are in agreement with the guidelines used; the assessment techniques used; and with the general conclusions of the study.

We agree with the recommendations on Page 9 and Page 19 of the report, that blast monitoring should be used and that all blasts at the quarry be monitored at two locations. Novus further recommends that the blast record information be made available to the Township for its review in the presence of vibration complaints.

3.0 Conclusions

From our review, we conclude that:

- The Vibration Impact Assessment conducted by Explotech is adequate, and Novus agrees with the recommendations and conclusions. Novus further recommends that the blast record information be made available to the Township for its review in the presence of vibration complaints.

- The Noise Impact Assessment conducted by AEL has been reviewed. Novus is generally in agreement with the approach taken; however, several issues have been identified which will need to be addressed to ensure that the facility is in compliance with the applicable noise guideline limits.

- Novus recommended the following additional analysis be undertaken / additional information be provided by AEL:

    - Update the modelling to use 4.5 m receptor heights for daytime and night-time, in accordance with NPC-205 and NPC-232 requirements
    - Provide source locations used in the modelling for the extraction phases considered

- Provide noise contours at a 1.5 m and 4.5 m height for the various phases of extraction considered in the analysis, to allow for compliance with nPC-205 and NPC-232 to be confirmed.
- Confirm if NPC-104 tonal penalties apply to the assessment of the rock drill
- Ideally, provide the Cadna/A electronic noise modelling files for review

- Novus also recommends that a third party acoustical audit be conducted during the first year of operation. The audit would ensure that:

  - Noise emissions from the actual facility equipment meets NPC-115 requirements and are equal to or less than that used in the noise impact assessment;
  - The equipment is in good operating order, meeting the Township Noise Bylaw requirements;
  - The mitigation measures, including berms and barriers, outlined in the noise report are installed and in operation; and
  - The resulting noise impacts from facility operations are in compliance with NPC-205 and NPC-232 requirements.

  Such acoustic audits are often agreed to as part of conditions of approval.

Should you have any questions or concerns, please feel free to contact us.

Sincerely,
Novus Environmental Inc.

R. L. Scott Penton, P.Eng
Principal

uniongas
A Spectra Energy Company

LANDS DEPARTMENT
Fax (519) 436-5353

May 7, 2013

SENT BY FACSIMILE 519-856-2240

The Corporation of the Township of Guelph/Eramosa
8348 Wellington Road 124
P. O. Box 700
Rockwood, Ontario N0B 2K0

Attention: Meaghen Reid, Clerk

Re: Zoning ByLaw 57/1999
W1/2 Lot 1, Concession 6 (Eramosa) Township of Guelph-Eramosa
Hidden Quarry ZBA 09/12
Hwy 6 & 7 Eramosa

Further to your Notice regarding the above mentioned property please be advised as follows:

- Union Gas requires that vibrations at the pipeline remain below 50mm/sec – As per the blasting company at the proposed Quarry at Hwy 6 & 7 Eramosa, vibration is going to be limited to 12.5mm/sec.
- Union Gas requires that blasting is not proposed within 30 meters of gas pipelines – As per the blasting company the blasting will be performed 200 meters away from our pipeline.

UNIONGAS LIMITED
Yours truly

Shirley Brundritt
Lands Support Analyst
Lands Department
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William Hill P. Eng.
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April 10, 2013

Greg Sweetnam
James Dick Construction
P.O. Box 470
Bolton, ON
L7E 5T4
gsweetnam@jamesdick.com (by email only)

and

Stephen May
Ministry of Natural Resources
1 Stone Road West
Guelph, ON
N1G 4Y2
stephen.may@ontario.ca (by email only)

Dear Mr. Sweetnam and Mr. May:

I am writing to you to lodge my objection to the development of the Hidden Quarry by James Dick Construction Ltd. (James Dick), located at the corner of Highway # 7 and the 6th Line of Eramosa Township. The principle reason for my objection to permitting this project relates to the unacceptable impact which blasting will have on the neighbouring properties and indeed the Town of Rockwood, which is less than 1.5 kilometres away from the proposed development site.

My objections are based upon what I believe to be flawed analyses with respect to the impact of blasting as well as inadequate attention given to its impact in the reports prepared by James Dick and the subsequent reviews by the consultants retained by the Guelph Eramosa Township.

My career spanned 60 years in the mining industry as an operator, consultant and director of numerous public companies and I believe this experience, eminently qualifies me to comment on this matter. As an operator I have managed open pit mines smaller than the expected size of the Hidden Quarry up to those with a daily production rate of 500,000 tonnes per day – all with drilling and blasting operations. The largest operation that I managed produced in a day, what James Dick proposes to produce in a year from the Hidden Quarry.

The Hidden Quarry will impact my family and me. I own a 100-acre crop-producing farm on the Sixth Line of Eramosa Township, roughly 700 metres north of the proposed quarry operation. I have lived here with my family for over 40 years.

James Dick proposes to drill and blast the stone contained in the Hidden Quarry deposit under water. There are hundreds of closed and operating open pits in Canada but few if any are mined under the water table level in an urban setting. As such, the operators will venture into uncharted territory and I can only assume their rationale is to avoid the hydrological impact and associated issues, (potentially water treatment), encountered with dewatering the mine.

In Chile, I was involved with the drilling and blasting of a harbour to accommodate the size and draft of iron ore carriers. The shock waves produced by blasting underwater, were approximately 30% greater than those above water for similar blast designs. A review of the report prepared by Explotech, (James Dick's blasting consultants) does not address the expected magnitude of the shock waves, which will result from underwater blasting in the quarry.

At the Guelph Eramosa Township public meeting on March 25th, Mr Sweetman of James Dick referenced quarry operations in Florida which were using similar underwater blasting techniques as proof that it was a safe and viable technique, particularly in close proximity to urban development. Unfortunately this was not the case as significant problems were encountered at the Miramar site north of Miami. A search of "Blasting Problems – Florida, highlights the extremely negative impact this operation's mining practice had on neighbouring communities.

The problems and complaints at Miramar spanned a 15-year time frame and eventually several of the pits in close proximity to residential development were closed. Complaints varied from unpleasant vibrations to structural damage from shock waves and in one year 109 complaints were lodged – roughly one every three days. Of note, is the fact that many of the complaints and damage, occurred up to 9,000 feet, or 2.7 kilometres, away from the quarry operation.

The distance, over which blasting impacts are experienced, is strongly influenced by geology and the rock formations/types in which the blasting occurs. The geological conditions at Miramar, are extremely similar to those that exist at the proposed Hidden Quarry Site; shallow overburden, on top of porous limestone with a shallow water table elevation. A 2.7 kilometre radius from the Hidden Quarry includes almost all of Rockwood south of the Eramosa River, which translates into a potential impact on approximately 3,000 individuals.

The Lac Quarry, located west of Milton produced blasting shock waves felt by residents 1.5 kilometres to the west on the Appleby Line. The blasting impacts were so severe that the owner's of the quarry were forced to close down. A similar 1.5 kilometre radius from the Hidden Quarry would impact approximately 315 dwellings, with the majority located in the south east part of Rockwood , the Rockwood Ridge Subdivision.

The potential for blast damage and impact is significant and the likelihood of its occurrence should not be underestimated. The blasting reports prepared by Explotech and presented by James Dick appear to trivialise the issue and in fact "borrow" a substantial amount of their findings from reports on operations with little or no similarities to the Hidden Quarry site and location. This type of analysis needs to be site specific.

For example, a June 2011 report on Dewdney Mountain Farms Ltd., located in Peterborough County presents an Executive Summary that is identical to the Hidden Quarry Executive Summary with the only exceptions being the Client's names and dates. There are substantial differences between the two projects, summarised as follows:

- Dewdney Mountain Farms is in a relatively sparsely populated area with the "Closest Sensitive Receptors" being 11 hunting camps an average distance of 1,090 metres away from the site and one residence 1,250 metres distant. There are 250 residents, within 1,250 metres of the Hidden Quarry site;

- The geology of both properties is very different and the Hidden Quarry is proposing to mine under water;

- The nearest travelled road to the Dewdney Mountain sites is approximately one kilometre away, while the Hidden Quarry site is 50 metres north of Highway # 7. There is a distinct probability that mining of the top benches, (that is those above the water table), will result in fly rock. Fly rock is material that is projected outside the declared danger zone of a quarry blast. Explotech has not addressed the probability of fly rock to damage structures and/or vehicles on Highway # 7. In North America there have been at least three fatalities from fly rock in the past decade. It is difficult to estimate what the impact could be on Highway # 7 with over 4,000 vehicles passing by the site during the proposed operating hours of the quarry. Fly rock and its potential consequences are not adequately addressed in the reports.

- In a July 2006 report prepared by Explotech with respect to the Miller Braeside quarry located in Renfrew, the underlying data on blast vibrations appears suspect. Golder Associates confirmed this, in a peer review. Explotech's calculated level of maximum ground vibration was understated by a factor 50% of the actual maximum recorded ground vibrations. In one case the difference was close to 600% lower than the actual. Based on that fact I have little faith in Explotech's ability to include the following statement in their Executive Summary:

  > *"Explotech is of the opinion that the planned aggregate extraction on the proposed property can be carried out safely within the MOE guidelines as set out in NPC 119 of the By-Law".*

- All three reports included the recommendation that once the property began operating, blasting procedures could be tailor-made for the application. Unlike the other two properties studied, the Hidden Quarry cannot "experiment" with blast design and protocols within such proximity to urban development. The results of experimenting could have terrible consequences.

The consultants retained by GET to review the material submitted by JDC appear to have either ignored the Explotech report or were incapable of grasping the problems associated with mining this open pit. Consequently it appears that our elected representatives have been misguided by their consultants in their judgment of what appears likely to be a very risky project.

In taking into account the foregoing, the Ministry of Natural Resources should not consider granting an aggregate licence to JDC. New comprehensive reports prepared by qualified independent consultants with expertise in pit operation, blasting, seismology and rock mechanics must be commissioned; furthermore, the reports must then be peer reviewed by equally qualified professionals.

Sincerely Yours

William Hill P. Eng.

P.S. Time has not permitted me to include references such my C.V. and a list of material drawn upon. Should anyone wish to have them I will be able to furnish them upon my return in May.

APPRAISAL OF THE MINING ASPECTS OF REPORTS

Prepared as Part of the
Hidden Quarry Rezoning Application
To the
Guelph/Eramosa Township Council

WILLIAM HILL MINING CONSULTANTS LIMITED
OCTOBER 21, 2013

Foreword

This written appraisal of five reports dealing with the Hidden Quarry (HQ) was prepared by William Hill Mining Consultants Limited. The appraisal was written by William Hill with the help and support of professionals in the Concerned Residents Coalition (CRC); as well as professionals who have extensive knowledge in mining and geology. On October 21, 2013 William Hill gave a Power Point Presentation to the Guelph/Eramosa Township (GET) Council titled Mining Explained. The presentation gave the Council an opportunity to become better informed on drilling and blasting in open pit mines.

William Hill is a resident of GET on the sixth line. He owns a cash crop farm 700 metres north and slightly west of the HQ. The property also abuts the eastern boundary of the town of Rockwood.

William Hill has been actively involved in the mining industry continuously since 1949 and from 1958 as a Mining Engineer. The title of Professional Engineer of Ontario was assigned to him over 40 years ago. His professional career has taken him to projects in close to fifty countries. He continues to serve the industry as a Mining Consultant, as a Mining Company Director and he has mining interests in Latin America.

William Hill has extensive knowledge of open pit mines - his field of specialty – in almost all types of rock and mineral. The mining work has involved the drilling and blasting and transport of rock totaling well over one billion tonnes. In one mine alone the daily tonnage moved was close to 500,000 tonnes per day. Other operations involved as little as three men, a compressor, a drill and several wheel barrows. This experience is particularly applicable for commenting on the proposed operations of the HQ. The reason for the foregoing statement is that the HQ is actually an open pit mine involving drilling and blasting just as it is done in thousands of such operations throughout the world.The term quarry usually connotes a more innocuous (sand and gravel) type of operation.

Over the years William Hill has developed a love and respect for the mining industry and has benefited from being involved in its growth: However, it has also given him the knowledge to recognize that mining should only be carried out in suitable locations. Paramount consideration, in determining whether the environment is suitable, must be given to location, particularly with respect to the surrounding residents - in this case those of the Rockwood area.

Also in determining the environment, consideration should be given to the physical setting particularly with respect to geology. The dolomitic rock in the area is not suitable for drilling and blasting because geological time will likely have produced irregularities in the rock, such as crevices and cavities, which could contribute to possible dangers with blasting such as personal and highway injuries, fatalities and damages to property.

Appraisal of the Mining-Related Aspects of Reports Prepared as Part of the Hidden Quarry Rezoning Application To the Guelph/Eramosa Township Council

Introduction

Early in 2013, citizens in and around the town of Rockwood became aware that James Dick Construction Limited (JDC) had applied for a rezoning permit from the Guelph/Eramosa Township Council (GET). This would allow for the extraction of aggregate, both sand and gravel near surface and dolomite in bedrock below the water table. The property planned to be exploited lies in the first 100 acre lot north of Highway7 and east of the 6th Line of Eramosa Township.

The proposal was accompanied by several reports of studies and plans prepared for the exploitation of the aggregate resources. This report presents a review of those reports but covers only the material which is related directly to the mining (quarrying) operations in the Hidden Quarry project.

Summary

The GET posts a complete set of reports submitted by JDC as well as reports commissioned by consultants as peer reviews on its web site.

William Hill Mining Consultants Limited (WHMC) reviewed five of these reports concentrating on the mining-related aspects contained in them drawing on knowledge of the problems associated. The opinion of WHMC with respect to the reports is summarized as follows.

All five of the reports fall short of providing adequate coverage of the subject. In doing so, the problems which may arise from the implementation of the HQ project, as proposed, have been inadequately presented to Council and could potentially lead to faulty decision-making.

Conclusions

The dangers posed by flyrock in proximity of people, homes, structures, Highway 7 and side roads are absent in all reports.

The problems typically associated with blasting shock waves have been dealt with inadequately.

The protection of the Northwest Wetland, the Allen Wetland and the Northeast wetland is probably inadequate in view of their proximity to blasting.

The proposed protection of the Brydson Creek may not be sufficient to assure its existence because the planning for its preservation is flawed.

Rec**ommendation**

GET should commission a review of the five reports as well as this one. The new study should be carried out by independent qualified engineers with extensive experience in mining, particularly with knowledge in rock mechanics and blasting in open pits.

Preamble

This appraisal can be divided into two parts with appendices.

The first part presents the results of a review by William Hill Mining Consultants Limited (WHMC) of reports dealing with the rezoning application for the Hidden Quarry (HQ) presented to the Guelph/Eramosa Township (GET) Council. These reports can be accessed through the GET website under Hidden Quarry. The first part of the appraisal -

1. Cuesta/Burnside – Cuesta Planning Consultants Inc (Cuesta) “Planning Report #1, Zoning By-law Amendment, January 29, 2013” and “ZBA Hidden Quarry, January 11, 2013” by Burnside and Associates Limited (Burnside
2. “Blasting Impact Analysis, November 12, 2012”- Explotech Engineering Limited (EEL).
3. “Planning Report, September, 2012 “- Stovel and Associates Inc (Stovel).
4. “Level l and ll Hydrogeological Investigation, September, 2012” – Harden Environmental Services Ltd. (Harden).

The second part of the appraisal covers what WHMC considers to be omissions and shortcomings of the EEL Report. These are dealt with in two sections:

5. Flyrock
6. Blasting Vibrations

Appendices in the last pages of this report include;
1. Actual examples of flyrock experiences at other sites.
2. Illustrations.

1. Cuesta /Burnside

In its application for rezoning of the Hidden Quarry (HQ) property, James Dick Construction Limited (JDC) submitted several documents prepared by experts to the Guelph/Eramosa Township Council (GET).

GET retained the services of Cuesta and Burnside to review the documentation on its behalf. Peer-review reports prepared by Cuesta and Burnside were presented to Council on January 29th, 2013. These reports were reviewed by WHMC. WHMC is qualified to comment on parts relating directly with the mining (quarrying) aspects of the reports.

Unfortunately, the Cuesta and Burnside reports provide very little in the way of mining material for comment. Given this gap in its analysis, it appears that the proposal for mining had been either tacitly accepted, as being adequate, or else simply ignored. It is clear the problems, and dangers posed by the mining proposal have not been fully understood by the GET consultants. As a consequence, Council may have received inadequate analysis and advice. The consultants should have recognized their lack of understanding about the subject and sought out the advice of experienced mining consultants.

WHMC asserts that three reports presented to council by JDC should have received far more detailed and critical attention by Cuesta/Burnside. They are:

1. ,The “Blast Impact Analysis” by EEL dated November 19, 2012,
2. The “Planning Report” by Stovel dated September 2012, and
3. The Hydrogeological Investigation by Harden dated September 2012.

WHMC has reviewed this collective material and presents opinions in sections 2, 3 and 4 which follow.

2. Blasting Impact Analysis

Introduction

This section of the report presents an appraisal of the report titled “Blast Impact Analysis” for JDC by EEL. This appraisal has been prepared to address deficiencies in the review process by the consultants Cuesta and Burnside retained by GET.

Commentary

The omission of any reference to the potential dangers posed by flyrock in the EEL report is the most significant observation identified by WHMC in this appraisal.
(The mechanics and dangers of flyrock are explained in section 4. of this report)

Conclusions and Recommendations

The primary conclusion is the EEL report does not present accurate and credible facts on which to base a re-zoning decision for the HQ property as it does not touch in any way on the potential dangers of flyrock.

GET Council should direct JDC to commission a new report by qualified consulting engineers on the impact of blasting. **This report must include a detailed study of the impact of flyrock.**

Report Analysis

This appraisal covers the facts as presented in the Explotech (EEL) presentation dated November 19, 2012 with reference to the page being analyzed.

Page 3, paragraph 4

“*Given that the mining operations have not been undertaken in the past on this property, site specific blast monitoring data is not available. We have therefore applied data generated at a variety of quarries across Ontario which present similar material characteristics*”

At a minimum, EEL should have provided the names and locations of the quarries referred to in this paragraph.

In WHMC's search of quarries in Ontario there does not appear to be another property which presents the unique characteristics of the proposed Hidden Quarry. That is, the HQ is planned to be mined:

- Under the water table,
- From the surface of bedrock,
- In a fragile rock structure (Karst topography),
- In an urban setting that includes 19 structures and houses within what could be typically deemed an Exclusion Zone by several countries.), and
- Abutting both Highway 7 and the Sixth Line over a length of 1.5 km.

Furthermore EEL goes on to recommend:

"*this data represents a conservative starting point for blasting operations - vibration monitoring program be initiated on site upon commencements of blasting operations - to permit timely adjustments to the blast parameters as required*"

EEL appears to be suggesting that with experiment and experience they may be able to arrive at safe blasting parameters. In other words, the pit may be a testing ground in order to determine if safe mining is achievable, at the expense of the neighbouring property owners.

Page 4, paragraph 4

"*The properties immediately surrounding the proposed license area are largely characterized by farmland and sparse residential development*".

This statement is, at best, misleading.

It would appear to indicate that EEL does not give importance to the relatively close proximity of 19 residences or structures within 440 metres of the license area. In many other jurisdictions that distance would constitute an "exclusion zone", Exclusion zones are established around blast sites for the safety of people and livestock. They are intended to minimize the risk of any injuries due to flyrock. Extending the radius out a further 500 metres could include an additional 30 homes and be close to 250 homes and structures which could be affected.

Pages 6 and 7

A table presents the distance from the pit boundaries to the 45 closest receptors. With some exceptions, the measurements appear to be reasonable. Of particular note is the distance from the pit to the nearby Mushroom Farm (Receptor 19).

The table makes a reference to a distance of 165 metres, when, in actual fact, the distance is 80 metres. There are 19 receptors listed as being closer than 440 metres. These receptors all fall within an area that could be subject to vibrations either close to or in excess of limits permitted by the Ministry of Environment (MOE).

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This section of the report titled "Predicted Vibration Levels at the Nearest Sensitive Receptor" EEL suggests the vibration levels even at the closest receptor will be lower than the 12.5mm/second as allowed by the Ministry of the Environment (MOE).

EEL has applied a formula developed by the US Bureau of Mines (BOM) to predict vibration levels at different distances from the blasts. The use of the formula results in the theoretical measurement of vibrations termed Peak Particle Velocity (PPV). The formula is based on the distance from the blast to receptors, the maximum charge per delay of explosives and two site-specific factors termed "k and e" which are "***based on monitoring performed in an Ontario quarry with similar material characteristics***". No mention is made of the name or location of the example quarry. It would be of interest to know what quarry is referenced and which are the similar characteristics.

The BOM formula is almost universally accepted in the mining industry and equally widely used in predicting the effect on buildings. Acceptable limits are usually a maximum PPV of 12.5 mm/second.

The example used by EEL states:

"*for a distance of 425 m (i.e. the closest standoff distance for initial operations at the proposed quarry) and a maximum explosive load per delay of 150 kg…The calculated 95% predicted PPV (based on the proposed blasting data discussed above) would be 10.1mm/second, below the MOE guidelines limit*".

This statement is misleading as the closest receptor, (see page 6 of the EEL report), is approximately 80 metres from the blast not 425 metres (also the starting point of extraction). If the same formula as used by EEL is applied with the distance corrected to 80 metres, the resulting PPV is over 250 mm/second, which is far in excess of any allowable limit for structures and could result in extensive damage and injuries.

Applying the formula with the factors used by EEL, the PPV of 12.5 mm/second could be exceeded at any receptor closer than 375 metres from a blast. This means that 18 receptors may potentially receive vibrations from blasting in excess of MOE guidelines.

Predictions of PPV

In many cases, the theoretical PPV as calculated using the BOM formula is not always replicated in the actual blasts carried out in the field. PPV can be measured at the actual blasting sites employing instrumentation similar to those used for measuring earthquakes. The results are often used to determine "site-specific factors" for a given location.

An example of the difference between actual and theoretical PPVs, (using the BOM formula) can be found in a peer review by Golder Associates on the report prepared by EEL for the County of Renfrew in April 2007 for the proposed extension to the Miller Braeside Quarry.

In its review, Golder presented a table comparing 11 PPV values at various distances as calculated by EEL, to actual measured blasting results over the same intervals in the field. The comparison of the results showed a marked difference with the actual values exceeding the EEL theoretical by a wide margin perhaps close to 90%.

The results of the comparison could lead to the conclusion that the "K and e" "site specific factors" assigned to measure the PPV values may have required some modification. In other words the formula for PPV estimation is not always 100% dependable due to the difficulty of deriving reliable "K and e" site-specific factors.

3. Planning Report

This section presents an appraisal of the report titled Planning Report prepared for JDC by Stovel and Associates. (Ref. F1)

This report is difficult to appraise in that it omits for the most part in depth reference to the subject of greatest importance – that is detail on the the extraction method. Reference is only made in statements such as ***"Extraction below the water table involves drilling and blasting of dolostone resources. Once the dolostone has been broken up, the raw aggregate will be removed by an excavator or dragline –"***

However, it is the opinion of WHMC the basic design of the proposed HQ operations is flawed in that it provides inadequate protection for the Brydson Creek, the wetland on the northwest corner, the Allen wetland and the wetland adjacent to the northeast corner of the property. Each of these inadequacies is discussed in the following sections.

Figure 1: HQ Site Plan

Brydson Creek

The Brydson Creek flows through the HQ property from north to south exiting under Highway 7 near the southeastern corner. The stream flows intermittently depending on precipitation. It was reported that the stream disappears into the ground within the HQ property during dry spells. It is clearly visible from Highway 7 flowing in the southeastern part of the HQ property except during spells of dry weather. The stream is an important contributor to the Blue Springs Water Basin at the top of the Grand River Watershed.

The plan for development includes provision for a 40-meter right of way (20-meter setbacks on either side of the creek). This would allow water to flow undisturbed in its channel through the pit - much like a big aqueduct. This involves mining the rock in two pits – one on each side leaving a pillar of dolomite 30m high plus overlying gravels and sand with a depth of up to 8m on top holding the stream bed.

The writer has had experience in this type of procedure. In one occasion, a pit in Cerro de Pasco (in central Peru) required a similar structure to remain in place to provide access for trucking. There it was demonstrated that the problem with this idea is that the pillar remains intact when blasting approaches from the first pit.

However, when the opposite wall of the pillar is similarly impacted by blasting shock waves, the structural integrity of the rock in the pillar is compromised. As well, the overlying gravel may not be able to sustain the vibrations from the blasts. The result is that the flow of the creek, both at surface and underground, may be dried up completely with water percolating into the pit.

The flow of water in the Brydson Creek appears to have already been compromised by the drainage of the wetland (close to the middle of the HQ property in the course of the stream) through a dug channel which appears to have been excavated for that purpose. The wetland is now termed as a "depression". The drainage of that wetland and its effect on the water table may have contributed to the lack of capability of the stream to flow constantly.

The Wetlands

The Northwest Wetland

The Wetland on the northwest corner bounded on the west by the 6th Line is a resource protected by law and cannot be compromised. It is the nesting area for several different types of ducks and Canada geese, as well as the breeding area for numerous turtles and numerous other forms of wildlife.

This wetland is defined technically as a "perched lake". A perched lake is a a body of water underlain by an "aquiclude". An aquiclude is defined as the impermeable layer of rock or stratum that acts as a barrier to the flow of water. This aquiclude permits the water in the wetland to exist at ground level several metres above the water table and close to ten metres above the water table near to Highway 7. It should be noted the final pit design may leave water levels in the pit considerably lower than the wetland which could require a totally impervious barrier.

JDC proposes to build a barrier around the wetland to leave it intact. (The description of the barrier is provided in section #4 - Hydrogeological Report)

Unfortunately, it may likely be impossible to protect the area considering that the pit will be mined right up to its barrier. Again, the blasting shock wave vibrations -- no matter how carefully controlled –will probably compromise the integrity of the barrier and aquiclude underlying the pond. The fragile rock under the aquiclude barrier will probably be weathered and contain cavities, faults, clay seams, porous gravels etc. which over the centuries since the last ice age have been filled with gravels and clays to form an impermeable barrier. Blasting shock waves could have the effect of destabilizing those features and create drainage channels allowing the waters to percolate out of the wetland and eventually dry it up.

Local readers may recall the mill pond in Eden Mills. The writer's children learned how to swim in it in the 1970s. The pond has now dried up, although the dam remains intact. After being in existence for over a century, likely the pond was drained as a result of the failure of the underlying aquiclude.. It is possible that the traffic of heavy trucks on the road close to the dam could have been a contributing factor in causing the vibrations which led to the destruction of that underlying barrier

The Allen Wetland and The Northeast Wetland

The Allen Wetland is located to the north of the of the HQ property and is the source of the Brydson Creek. The Northeast Wetland is located adjacent to the proposed eastern pit. Although both these wetlands may be affected by the blasting in both pits no mention is made with respect to their protection in the planning, as in the Northwest Wetland. The Northeast Wetland is a perched water feature and, once again, its aquiclude might be adversely affected by blasting.

4. Hydrogeological Investigation Report (Ref. F1)

This section presents an appraisal of the report titled Level 1 and 2 Hydrogeological Assessment prepared by Harden for JDC. The Harden report appears to be excellent in almost all aspects, except in its proposed provision for the protection of the three wetlands and the Brydson Creek (tributary B). Insufficient attention has been given to the effects of blasting and other mining activity. It's believed the proposed protection falls far short of what is required and may be impossible to accomplish with any assurance of success. Each water feature is discussed in the following paragraphs.

The Brydson Creek

The Brydson Creek (tributary B) flows through the HQ property entering at its northern boundary close to the eastern boundary and exits south under Highway 7 close to its eastern boundary. At the mid-point in the property there exists a "depression" . Aerial photographs indicate a sink hole occupying what was once likely a wetland. The depression appears to have been drained by a "man dug" channel. To the north of the depression the stream occupies the southern extension of the (Provincially Significant Wetland) Allen Wetland. It continues to the north on the Allen Farm and eventually the De Grandis pond. The draining of the depression has contributed to the draining of the wetland in the HQ property and is probably contributing factor for the reported loss of water into the ground during periods of low precipitation.

The proposal for the HQ is to protect the creek from further damage by providing a 20m buffer zone on both banks.

The first problem with this proposal is that even a very light explosive charge (Example: 150kg in a three inch hole at 20m) could result in a PPV of 2200mm/sec or 175 times the allowable limit set by the MOE guidelines. These estimates of PPV were derived using the BOM formula as in the EEL report. Even at double the distance, the PPV may still be close to 50 times the allowable 12.5mm/sec. The threatening PPV values have all been calculate using EEL site-specific constants which appear to be too conservative considering the blasting will be under water.

It may be argued the limits of PPV are specifically meant for structures. In the case of the Brydson Creek, there is an overlying 8 m of sand and gravel which may compound the problem and suffer much more than a building. The gravels may probably shake and lose stability. The stream bed may lose its capability for containing the water flow and could be completely lost into the ground even in periods of high precipitation. This may also have an adverse effect on the Allen Wetland to the north.

The second problem is associated with the blasting shockwaves when they are reflected back in tension from the opposite side of the 40m set backs. These could crack the rock pillar and eventually render it incapable of supporting the stream bed and its underlying gravels.

The Northwest Wetland

The proposed plan for protecting the wetland in the northwest corner of the HQ is similar to that for the Brydson Creek -- that is providing a 20m setback from the wetland. As a further protection "*A hydraulic barrier will be constructed in the location shown on Figure 4.2 to prevent the draw of overburden water into the excavation. – The barrier is constructed by digging a trench downgradient of the wetland and replacing the sand and gravel with silt. – The barrier will be keyed into the silt/till layer."*

The report goes on to cite examples of the successful use of the proposed method. The method could be effective provided the right setting is prevalent. The writer has had experience in the (mostly) successful containment of concentrator tailings ponds (very finely ground mine waste after treatment of ore). However, many such structures did not always withstand earthquake shock waves, sometimes even mild shocks.

The examples stated in the Harden report are "*the Reid's Heritage Homes pit in Puslinch Township*" and at "*Warnock Lake adjacent to the Caledon Sand and Gravel pit".* Both sites are gravel and sand operations. The differences in water level on both sides of the barrier are insignificant compared to those present in the HQ pit plan.

However, using these sites as a means of comparison is largely inappropriate. Neither site makes use of holes drilled 30 meters under water or explosives.

The proposal, as it stands, may likely be ineffective in protecting the wetland. The barrier could be destroyed by vibrations of blasts as close as 20m.

The underlying aquiclude may be compromised. The underlying rock could be shaken and natural water courses reopened. This may drain the overburden water table down to bedrock water level several metres below. The wetland will likely be drained.

The Allen Wetland and the Northeast Wetland

These two features are conspicuously absent in proposals for protection in the Harden report. However:

> If the Brydson Creek protection measures fail, then the Allen Wetland could be drained not long afterward.
>
> The northeast wetland, a perched water body, is close to the proposed east pit, and may also be drained under the strain of blasting vibrations.

5. Flyrock (Ref. F2 & F3)

Flyrock is generally defined as “the undesired propulsion of rock fragments through the air beyond the normal blast zone by the force of the detonations of explosives being employed to fragment the rock”.

In general flyrock is caused by two main factors – either too little or too much confinement. Confinement, also referred to as burden, is the amount of rock placed in the way of the intended direction in which the broken rock should be thrown.

In most pits, including the HQ, the intended direction of throw is horizontal. If too little confinement is provided in the horizontal direction the blast blows out causing flyrock to be thrown at a low angle. In the HQ the lateral blow out should not be a problem because the pit filled with water will dampen the blast.
In the HQ any flyrock will be propelled by the relative amount of confinement in the lateral direction as compared to the vertical. The result of too much lateral confinement is the tendency for blow outs in the vertical direction. This type of blow out is relatively low in frequency and generally arises from geological conditions. Karst type of weathering, which is present in the Rockwood area, could probably pose a serious problem with flyrock because of the difficulty in knowing where the problem may arise.

There are recorded instances where particles of flyrock as large as one cubic foot (described in one report as being roughly the size of a “microwave oven”). have been propelled as far as 1.2 kilometers from the blasting site with a potentially enormous destructive capacity.

More commonly, rocks about the size of a baseball are propelled at speeds measured at up to 600 km/hour at point of impact. These too may have devastating consequences including property damage, **injuries and fatalities**.

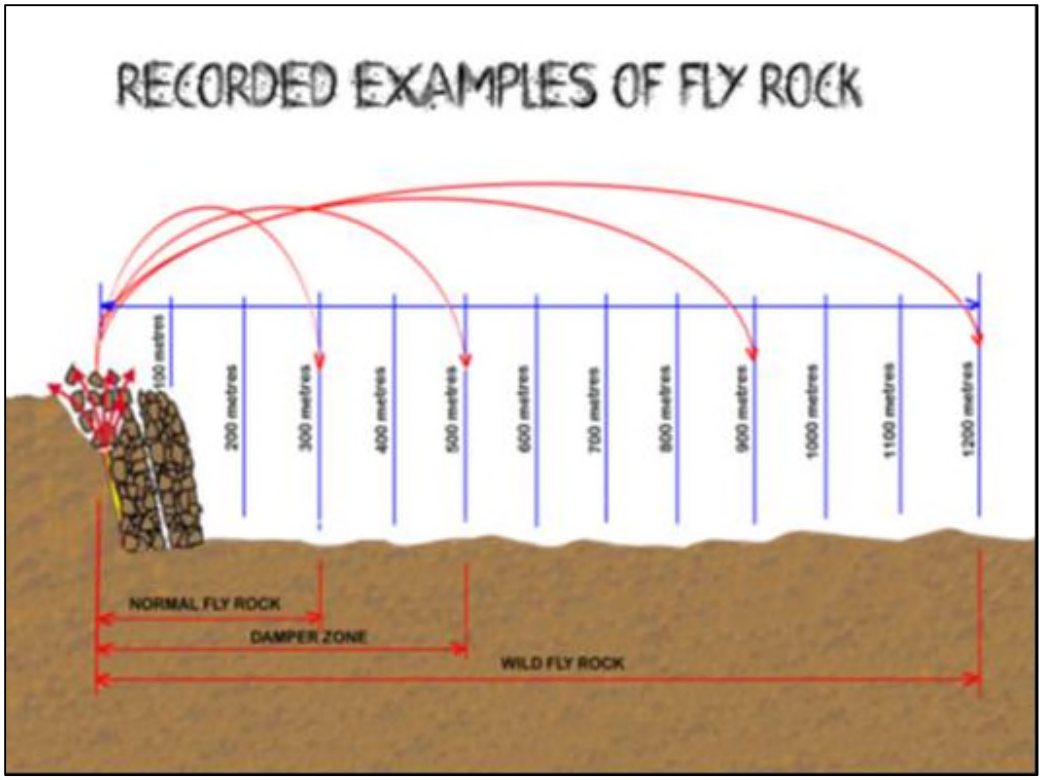


Figure 2: Range of Fly Rock

The distance of particle travel was analyzed in the United Kingdom, covering a five year period. The range is illustrated in the table that follows. The distribution indicated below shows that “normal flyrock” could be assumed to affect an area extending outwards 300m in all directions from the blast. To mitigate risk, an exclusion zone could probably be reasonably set at 500m.

Figure 3: Fly Rock Danger Zones at Hidden Quarry

Distance (m) from blast	Number of instances	percent of total	cumulative %
100	17	20	20
200	22	26	46
300	25	29	75
400	7	8	84
500	8	9	93
600	2	2	95
700	3	4	99
800	1	1	100
total	85	100	

There are, broadly speaking, two types of flyrock. The first simply called “flyrock”, is the undesired but statistically expected fragment of rock which is expected to fall within a prescribed area of exclusion – typically between 300-500m from the blast. When blasting, preparations are made to evacuate all personnel to a safe distance beyond the blasting area.

The second sometimes termed “wild flyrock” (with ranges up to 1200m) is statistically rare but can occur with disastrous and sometimes tragic results.

The severity of flyrock incidents is illustrated in Mine Safety and Health Administration (MSHA) statistics for a period covering 1978 to 1998. During that time, there were 281 injuries in the US caused by flyrock. Roughly half of the injuries were the result of “wild flyrock”. 16% of the injuries resulted in fatalities.

Numerous publications by blasting experts state that flyrock can be controlled for the most part, but should never be eliminated or ruled out entirety.. All too often, the human element comes in to play with common mistakes like the use of too much explosive or the placement of the explosive too close to the rock surface.

The most important factor, influencing the launching of flyrock, is the geology of the area where mining is carried out. With rigorous control and diligence human factors can be reduced, but geological conditions and rock structure variations often remain beyond technical control.

It is well known that limestone and dolomite which underlie the area of the proposed quarry are prone to dissolving and as a result produce irregularities such as sink holes, enlarged faults and fissures and even caves. A review of the aerial photographs around the HQ reveals traces of no fewer than ten sink holes including two on the HQ property itself. Areas with these characteristics are termed to have Karst Topography.

The process for Karst weathering is often referred to as “carbon dioxide cascade”. This is explained as follows;

1. As rain falls through the atmosphere it picks up Carbon Dioxide which dissolves in the droplets.
2. Once the rain hits the ground it percolates through the ground and picks up more Carbon Dioxide to form a weak solution of Carbonic Acid.
3. The infiltrating water naturally exploits any cracks or crevices in the underlying rocks.
4. Over long periods of time, the rock is dissolved by the acid waters leading to the propagation of solution cavities and widening cracks.

Visual evidence of this phenomenon is prevalent in the Rockwood Conservation Area.

The problem which most likely be encountered in drilling and blasting in this geological environment is that if a drill hole is inadvertently located too close to a cavity or enlarged fissure the blast will likely take the path of least resistance -- that is, into the cavity. This could result in cratering at surface and the ejection of rocks at velocities exceeding 500km/hour. (Ref F4 & F5)

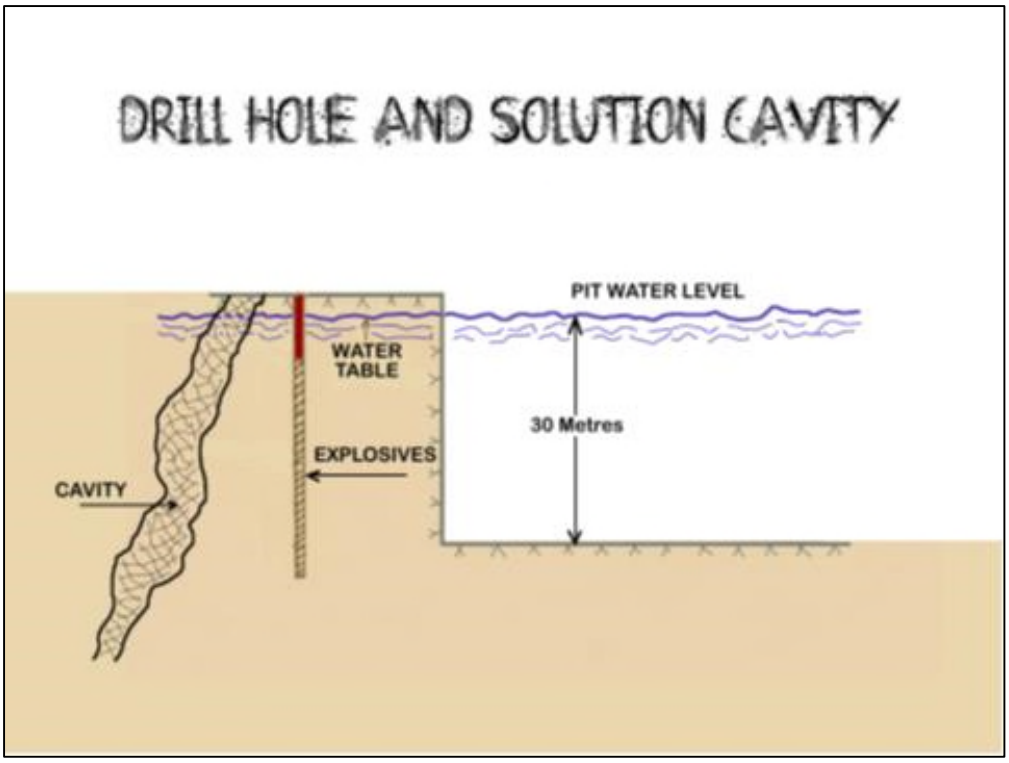


Figure 4: Drill Hole and Solution Cavity

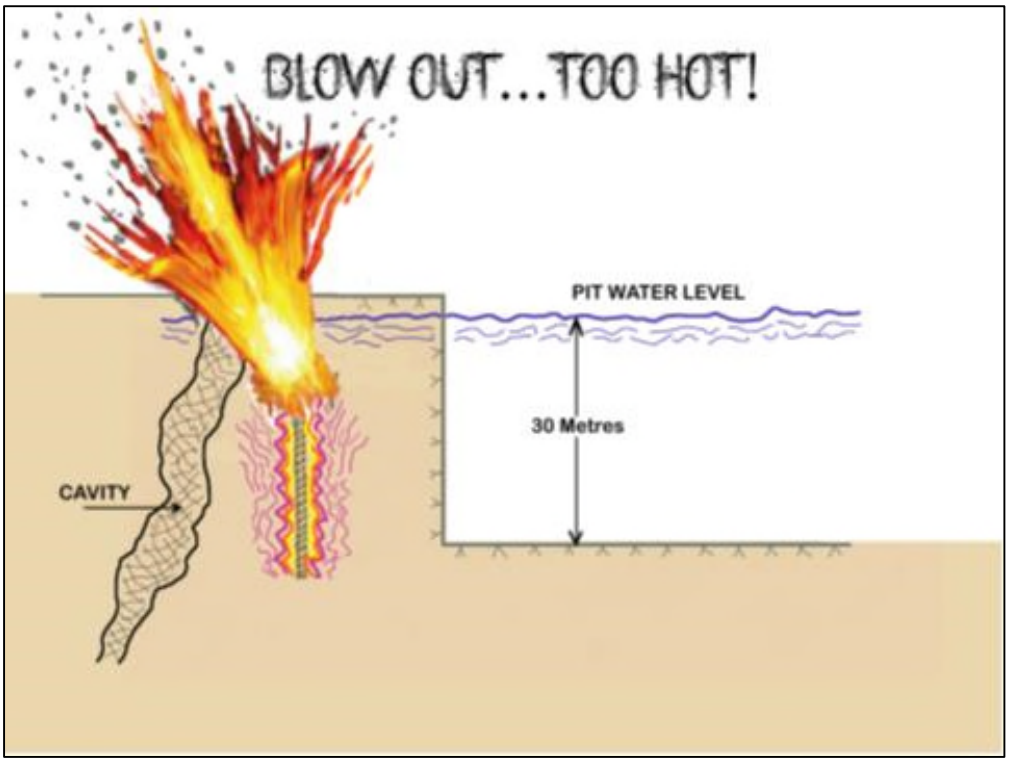


Figure 5: Drill Hole Blow Out

A tragic reminder of what can happen as a result of geological conditions – occurred in Campbell County, Tennessee on June 4, 1993.

> "A 16 year old passenger, in a car driven by his parent on Interstate I-75 was fatally injured by flyrock originating from an overburden blast in a nearby coal mine…(The official report stated)…***The blaster, apparently was unaware of the presence of an 8-ft thick layer of clay"***"

During the proposed 17-year life of the HQ project there could be 20,000 to 50,000 individual holes blasted which may provide ample opportunity to cause injuries and deaths as well as property damage including vehicles on Highway 7 and neighbouring side roads.

The only solution available to reduce the risk (even with rigorous control) of human injury or death and damage to property is to set blast clearance through the aforementioned exclusion zones. These exclusion zones establish minimum distances from inhabited buildings and roads to the blast sites.

In Scotland and Wales the minimum distance is set at 500m after a "tragic accident" in Burnfoot Moor in 1998. Western Australia has established a minimum limit of 400m. If these same regulations were applied in the HQ case, mining would likely not be permitted at the site.

In the US, the Federal Office of Surface Mining (OSM) regulations specify that "flyrock shall not be cast from the blasting site –

- More than half the distance to the nearest dwelling or other occupied structure,
- Beyond the area of control required under 30 816.66(6) CFR (exclusion zone), or
- Beyond the permit boundary".

If the OSM regulations were adopted, it is possible that none of the proposed HQ operating area would be permitted for blasting as the closest structure is only 80m from the boundary.

Exclusion zones also very deliberately apply to highways. If the HQ is allowed to proceed there will be approximately 1.5km of Highway 7 within what could be deemed the exclusion zone. There occurred a fatal flyrock occurrence in a car traveling on I-75 and also one on the M1 in the UK at greater distances than the HQ property is from Highway 7.

During its 17-year operating life the HQ will probably have blasted up to 40,000 separate explosive charges (drill holes) each with between roughly 150kg and 700kg. It is impossible to estimate the probability that some of them may propel

flyrock – but, considering the history of open pit mines there is a chance that some may.

6. Blasting Vibrations

Unlike flyrock, blasting vibrations transmitted through the ground are difficult to quantify. Flyrock is quite easy to identify -- if a rock crashed through a house roof at blast time it is hard to argue about its origin. With blasting vibrations on the other hand, the impact is usually measured by the use of instrumentation similar to seismographs used for earthquakes.

Vibrations can be quite noticeable and are similar to the feeling of an earthquake. The problems usually associated with blasting vibrations include cracked basement walls and floors, drywall cracks, broken windows, floor tile loosening and a host of others. Psychological problems are even more difficult to quantify but can be worse as people react in their own individual way to the unpleasant sudden jarring caused by blasting.

Figure 6: Milton Quarry Shockwave Impact Superimposed on Hidden Quarry Site

According to the Explotech Study (EEL), blasts will occur between 12 and 20 times per year. This implies that each blast may require roughly up to 30,000 kg of explosives. The quantities are very large considering the urban setting.

When starting new mines the only method known to WHMC of theoretically estimating blasting vibrations is by the use of the US Bureau of Mines (BOM) formula for estimating Peak Particle Velocity (PPV). This in effect measures the displacement of the ground by shock waves in terms of milimetres per second. Readings of less than 12.5mm/s are considered acceptable by many regulatory agencies including the MOE in Ontario. When readings exceed 12.5mm/s, damage to buildings and structures may occur.

The mathematical equation for estimating PPV is shown as follows;

$PPV = K(D/\sqrt{W})^{-x}$ Where PPV = velocity in milimetres per second
K = constant relating to the particular site
D = distance from the blast in metres
W = maximum charge per delay in kilograms
x = constant relating to the particular site

When considering W it is important to point out that although the blast could have a total amount of explosives of up to 30,000kg, each hole is blasted separately by the use of millisecond delays. These delayed detonations allow each hole, with up to 700kg of explosives, to be blasted independently at intervals of a few thousandths of a second between each. This results in a much lower individual shock wave (PPV) but a longer overall blasting impact time.

Note the underlined "relating to the particular site". The prediction of the theoretical PPV for a particular site is entirely dependent on the chosen K and x constants - at best, a good guess. The only way to truly and reliably determine those constants is through experience.

A three-stage process is often used:.

1. Charges are set with known weights of explosives
2. The shockwaves are measured at various distances by instrumentation, and
3. The K and x constants are derived from stages 1 and 2.

An example of the difference between the actual and the theoretical PPV (using the BOM formula) is illustrated in a peer review by Golder Associates on the report prepared by EEL for the County of Renfrew in April 2007 for the proposed extension to the Miller Braeside Quarry. In the review, Golder presented a table comparing 11 PPV values at various distances as calculated by EEL, to actual measured blasting results over the same intervals in the field. The comparison of the results showed a marked difference. The actual values exceeded the EEL theoretical numbers by an average of 91%.

Another case provides an example of the inadequacy of the BOM formula (unless the cite-specific constants are chosen correctly) can be found in the difference between actual PPV per blast measurements compared to formula estimates in Miramar City, Florida. 74 seismograph readings (taken by an independent government agency) at Miramar City were compared to the theoretical results derived by using the BOM formula and the EEL site-specific constants. The results of actual readings are far in excess of the theoretical, by an average difference of close to 100%. These results are shown in the following chart (which is shown in full, in the section covering the Miramar experience later in this report),

Distance metres	Seismograph readings	Actual Miramar PPV mm/s	Predicted EEL PPV mm/s	ratio Miramar/EEL
1150	10	4.8	3.3	1.5
1440	18	4.0	2.2	1.8
2240	33	2.7	1.0	2.7
3100	13	1.9	0.8	3.3

In the EEL report on the HQ the site specific constants were arbitrarily chosen ***"Based on monitoring performed in an Ontario quarry with similar material characteristics…In the absence of data for the proposed aggregate extraction operation, these data are used for initial prediction purposes"****.*

The use of an arbitrary selection of site specific constants could result in an inadequate assessment of PPV for the HQ. Moreover, the determination of PPV by EEL is only for "***initial prediction purposes***". The PPV calculations could turn out to be too low by half? Is the "***Ontario quarry with similar material characteristics"*** applicable to the HQ considering the following condition;

- Mined under the water table.
- In virgin weathered rock (Karst type weathering).
- Drill holes over 30m in depth.
- Urban setting.

The writer has reviewed publications on several quarries in Ontario but has not turned up one with all the unique features of the HQ.

The BOM formula used by EEL assumes that 150kg of explosives will be used in drill holes of 3in diameter and has based its estimate that at "***425m i.e. the closest stand off distance…the maximum PPV at the closest building***" will be 10.1mm/s. It bears repeating the closest receptor at the HQ is less than 100m from the proposed pit – not 425m.

Furthermore it is unlikely, based on the EEL report, that 3in drill holes will be used exclusively. Rather, a substantial amount of the drilling will be carried out using 6in drill holes using charges of up to 550kg. If 100m is applied as the closest standoff distance, the PPV may actually be 128mm/s possibly resulting in injuries and in damage to the structure. If 6in holes are used, the PPV could be 31.6mm/s at 425m. Using the BOM formula, the 16 residences surrounding the HQ may be subjected to blasting shock waves with PPV values of over the MOE guidelines. This is far in excess of the MOE recommended allowable PPV limits. The southern part of Rockwood 1km from the HQ may be subjected to values of PPV estimated at 7mm/s which, while not necessarily damaging are at best uncomfortable to humans and for some bordering on psychologically devastating

Understanding that shock waves likely may have undesirable effects, it's worth looking at the recent experiences of three other communities.

1. The Lac – Milton Quarry (Ref. F6)
2. Guelph - also involving James Dick Construction Ltd.
3. The City of Miramar, Florida

1. The Lac Quarry in Milton operated a drill and blast operation for many years on the escarpment to the west of Milton. The pit was closed down after repeated complaints by the neighbouring residents. The operators tried multiple means to alleviate problems, but had little success with any. It is important to mention the affected residences were located about 1km to the west of the pit blasts. That's about the same distance between the HQ and the southern part of Rockwood. The PPV values were, in fact, below the 12.5mm/s allowable limit but were so disturbing that eventually the pit was closed down.

2. The Dolime Quarry in Guelph operated by JDC has been in the news in recent years not only because of water problems but also because of neighbouring residents' complaints regarding blasting. The closest residences, on College Ave. to the south, appear to be located roughly 400 metres from the blasting sites. Other populated areas to the east and to the north are farther away.

It should be pointed out that almost all the residences were built well after the mine started production in the 1800s. However, it appears the blasting norms in Guelph may have changed, and if so there may exists a case for complaining.

3. Miramar City is located just north of Miami in Dade County, Florida. Quarries similar to the proposed HQ are being mined close to its city limits. The similarity was drawn to our attention in a Power Point presentation to council by JDC (March 25, 2013). In its presentation JDC indicated that a Florida quarry, (shown in one of their slides), was mined under the water table and had been carried out without incident for many years. JDC stressed the suitability of the mining method for use in the proposed HQ. WHMC followed up on the reference

to Florida and uncovered revealing data on blasting in pits filled with water, particularly with respect to blasting vibrations.

Ample information is available on “Google” relating to blasting in Florida, and more particularly in Dade County, close to Miami. The information is found under the title “Blasting Problems” followed by –In “Dade County” or “Doral” or “Palm Springs” or “Miramar City” (Miramar) etc. Most of the information involves complaints by residents “over 9000 feet away” (2.7km) regarding blasting damages from seismic shock waves, but also provides significant information and ample data on blasting vibrations in an under water setting.

The writer had experience in under water blasting in the early 1960s when employed by Compania Minera Santa Fe in an iron ore mining operation in Chanaral, Chile. The ore was shipped by freighters. To compete in an increasingly tight market, larger ships had to be used and, as a consequence, the port had to be deepened. The work involved drilling and blasting both on shore and under water. The residences and businesses in the town of Chanaral were as close as 75m requiring meticulous control of each blast. This necessitated procedures to measure the blasting vibrations. There was in fact a distinct difference in the shock wave recordings between the blasts on land and those under water. The under water blasts registered much higher values using identical explosive charges.

Problems with quarries in Dade County and particularly Miramar go back almost twenty years. Complaints by home owners regarding vibrations resulting in damages succeeded in having the quarries close to Miramar shut down. Operations east of the city limits, in Dade County were allowed to continue. These operations -- although farther away -- continued to cause problems in Miramar with numerous complaints resulting in compensation. The shock waves experienced were in excess of the allowable limits. Ultimately, regulatory PPV limits were increased to the equivalent of 12.5mm/s. Complaints continued, prompting local authorities to carry out a study using seismograph readings to determine the extent of the problems.

It has been reported ***“The city placed seismographs – after hearing complaints from residents that the blasts at nearby quarries were causing leaks in their pools, shattering glass and breaking floor tiles[in] the closest neighborhood to the quarries”*** This part of the city was 9000 feet or 2.7 km away, roughly the same distance between the proposed HQ and the rail crossing on Main Street in Rockwood. Seventy-four of the seismograph readings from Miramar were assembled on a spread sheet separated into 14 groups of similar distance ranging from 1000 to 3500 metres from the blasts along with the average actual PPV for each group. These values were then compared to the theoretical PPV derived using the EEL constants and the BOM equation. It is evident that the theoretical values understate the magnitude of the PPV with the magnitude of the discrepancy increasing with the distance from the blast.

distance Metres	Seismograph Readings	Miramar average PPV mm/s	Calculated EEL - BOM PPV mm/s	Actual ratio of PPV Miramar/EEL
1040	1	5.1	3.9	1.3
1131	3	4.0	3.3	1.2
1267	6	4.7	2.7	1.7
1349	6	4.3	2.4	1.7
1437	6	4.0	2.2	1.8
1539	6	3.7	1.9	1.9
1832	4	3.2	1.4	1.2
2112	5	3.1	1.1	2.8
2417	17	2.5	.9	2.9
2603	7	2.2	.8	2.9
2760	2	2.8	.7	4.1
2864	3	2.1	.5	3.3
3152	7	1.5	.2	2.8
3584	1	1.3	.4	3.0
total readings	74			
weighted	Average	3.1	1.5	2.1

The similarity between the quarries in Dade County and the HQ appear to provide a reason to believe the EEL choice of site-specific constants for the HQ may not be totally justified. The rational for using site specific factors which are applicable in Dade County rather than those based on ***"an Ontario Quarry with similar characteristics"*** are presented in the following paragraphs.

It appears that blasting under water has entirely different shock wave characteristics compared to those created by normal blasting into an open air face.

Another example of the impact of water was provided in WWII by the "Dam Busters". The air raids destroyed the German dams in the Ruhr Valley by dropping bombs close to and on the water side of the dams, with huge (and disastrous) success..

The same phenomenon appears to take place when explosives charges are backed by water in the quarries in Florida. The most important factor derived from the Dade County blast vibrations, in terms of PPV readings in their geological environment, is the magnitude of the shock waves which are noticeably greater than those of ***"an Ontario Quarry with similar characteristics"*** . It appears that the fact that blasting, is carried out under the water table and that the surrounding area is underlain by a shallow water table, provides a very efficient medium for transmitting shock waves.

The reason for the greater efficiency is that fault planes or cavities in the rock are filled with water-saturated and compacted debris. This allows waves to travel relatively unimpeded. If the same fault planes and cavities are dryer they act as shock absorbent impediments, thus dampening the vibrations. This effect is particularly accentuated in the initial distances from the blasts. In water-free pits, the surrounding area is drained for the most part to below the pit floor causing a very marked dampening of shock waves in the initial few hundred metres from the pit.

A comparison is made in the following chart of the actual PPV recorded in Miramar (column 3) with values estimated using the EEL site-specific factors (column 4). In addition the highest PPV in each range at Miramar are presented in the second column. The results of PPV values estimated in a study by independent specialists commissioned by Dade County are presented in column #5. It is interesting to note that there appear to be no residences closer than one kilometer to the mining operations.

AVERAGE RANGE METRES	MIRAMAR HIGHEST PPV mm/s	MIRAMAR AVERAGE PPV mm/s	EEL ESTIMATED PPV mm/s	DADE COUNT ESTIMATE PPV mm/s
1150	6.5	4.6	3.3	
1450	5.0	4.0	2.2	8.9
2250	4.4	2.7	1.0	4.1
3100	2.8	1.9	0.6	2.5
AVERAGE	4.7	3.3	1.8	

It is important to point out that the explosives charges, in all the Miramar and Dade County figures shown on the charts were less than the quantity compared to those used in the EEL Blasting Impact Study.

In summary it appears that the HQ blasting operations may have a greater adverse effect than indicated by the estimates of EEL. In estimating the impact of blasting WHMC believes that explosives charges will not all be 150kg per drill hole but rather, some will be closer to 550kg, (as proposed by EEL using 6in drill holes rather than 3in holes). The smaller sized hole based on the experience of WHMC may be impractical for drilling of 33m depths as well as more difficult to control.

An estimate of the impact of the blasting at the HQ is summarized in the following paragraphs.

Structures within a radius of 500m from the HQ may suffer vibrations with a PPV (based on the EEL site specific constants) in excess of the permissible 12.5mm/s. The effect could be cracked basements and pools, cracked plaster and broken windows, damage to glass and crockery from falling off shelves etc. Older stone houses may also be damaged or perhaps even destroyed as cement will have deteriorated with age.

Structures within a radius of 1000m -- using the Miramar experience -- may also be subjected to vibrations of perhaps greater than permissible in Ontario. Although the damages will not be as great as those closer to the blasting, there may still be extensive cracking and breakage.

Within a radius of 1500m the houses nearest the HQ could still be close to the permissible limits. Those homes could be rattled and sustain lesser damage. If the formula used by the Dade County independent consultants is employed in the calculations then the vibrations from shock waves will be greater still.

Respectfully submitted

William Hill Mining Consultants Limited

William Hill P. Eng.
Mining Engineer

Appendices

Flyrock

Examples of flyrock incidents are presented in most cases in brief as follows

1. The first example of flyrock is taken from the personal experience of the writer, William Hill P Eng.

In 1963 the William Hill was working in the McCune Open Pit of Cerro de Pasco Corporation (CDP) in Peru. Underground mining had been carried out at that time for close to 400 years and the city of Cerro De Pasco was built up close to the mine shafts. Upon starting the open cast operations the city was close to the eastern border of the pit because of the location of the ore body. The closest distance from the mining operations to habitations was less than 100m, consequently every blast was monitored with great care. The open pit operations had been relatively successful for an extended period of time, probably more than a year, with only minor complaints regarding some damage from flyrock, noise and vibration which was easily taken care of (remembering that this was a company town – only one employer) by help with the repairs. Guards were sent into the populated area during each blast and warning sirens were placed in all areas where there was the remotest chance of flyrock falling.

In 1963 a catastrophic event took place. One drill hole blew upward causing a huge explosive noise and a serious propagation of flyrock. The damage, by a stroke of good luck, caused only minor injuries (probably because the people, accustomed by lesser events, took shelter) but resulted extensive damage in more than 300 houses, some up to 300m from the blast. The outcome of that blast was that a large portion of the city was moved to a safer location with an expenditure in today's dollars close to $50 million.

Other examples of fly rock incidents are summarized in the following brief paragraphs (detail information on each reference is available for the most part on Google).

2. Burlington, Vermont. "In September 2008 – detonated a blast that threw flyrock several hundred yards and resulted in damages estimated to be a million dollars to aircraft, vehicles, buildings and the grounds at the Burlington International Airport"

3. On June 11, 2007 in West Lebanon, New Hampshire – a quarry blast resulted in flyrock being thrown 3000 feet into an industrial park – the same blast

also sent flyrock about 4000 feet landing on the airport property including the runway" "flyrock as big as a bucket"

4. In a study of a serious blasting problem researched by the Department of Mining Engineering of the University of Belgrade reference is made to the following.
"Some of the fly rock traveled a distance of 600 metres and had speeds estimated at 600 km per hour. Rocks up to 200 kg were projected over a distance of 300 metres".

Flyrock Fatalities

Most fatalities attributed to flyrock involve operators of mines principally because the mines or quarries are generally situated in remote areas with sparse population. There are cases which illustrate that flyrock is dangerous to people who are not associated with the operations. Examples of these are as follows;

5. (Repeated for emphasis) "A sixteen year old passenger in a car driven by his parents on interstate I – 75 was fatally injured by flyrock originating from an overburden blast in a nearby coal mine".

6. A resident in the vicinity of a coal mine unknowingly drove up a trail and parked his ATV about 35m from the blast area and was killed by flyrock.

7. "fly rock from a limestone quarry traveled about 300m and fatally injured a resident who was mowing grass in his yard".

8. September 2011, Shawinigan Lake Gravel Pit. A 50 year old woman observing the pit lost her arm to flyrock. "Debris flew 400m".

A few examples of fatalities by flyrock mostly near the working area are listed as follows

9. In a report by the US Department of Labour, regarding a coal mine in Kentucky, 2007. A fatal accident occurred killing a miner with 20 years experience. "The fly rock that struck the victim traveled approximately 1500 feet (483m) into an area where miners parked their personal vehicles – the rock passed over a 20m high embankment" Pieces of rock "16 x 20 inches (50kg) also hit close to where the man had been standing".

10. An equipment operator with seven years experience at the mine was in his pickup guarding the access to the pit 270m the blast. Fly rock entered by the windshield and killed the operator.

11. “A foreman was fatally injured when fly rock struck the roof his ¾ ton truck. The impact caused the roof to bend downward and strike the foreman’s head. The Upon firing the shot, a sandstone rock weighing 8.5 pounds traveled 50m and hit the roof of the cab”.

12. “a blaster was fatally injured by fly rock weighing 14 pounds traveling over a 200 foot highwall - about 600 feet from the blast holes”.

13. Preparing a logging road outside of the pit area. “The blast projected flyrock about 300m and fatally injured the victim. Several boulders were scattered near the accident site”. “The MSHA investigation determined that a blown out shot caused the fly rock”.

14. A visitor and drill/blast helper were 50m from the blast. The drill/blast helper was killed and the visitor was injured.

15. “A blaster was fatally injured by a 1ft 5in by 2ft, 11 in by 8.5 in fly rock (MSHA 1992). The blaster positioned himself under a Ford 9000, 2 ½ ton truck while detonating the shot. A fly rock traveled 250m.

16. “A crane operator was fatally injured when fly rock struck him on the back. During the blast the victim and the blaster were standing on a top bench 40m from the nearest blast hole. The blast holes were covered with blasting mats”. ‘Upon initiation of the blast one of the holes threw fly rock toward the victim”.

17. In a report by the Department of Mining Engineering, Indian School of Mines, Dhanbad, flyrock from secondary blasting is discussed.
“A study of blasting has revealed that more than 40% of fatal and 20% of serious accidents resulting due to fly rock (Mishra 2003)”
A boulder 3m by 1.5m by1.6m – two holes of 45 mm diameter, spaced 0.6 m apart and 1.5m deep were drilled and blasted. Fly rocks (2) were ejected 550m causing damage to a building but narrowly missing the occupants.

Foreword

There appear to be some misunderstanding regarding the similarities of the Dolime Quarry (DQ) west of Guelph and the proposed Hidden Quarry (HQ) close to Rockwood. The principal factor is, “if it works in Guelph why not in the HQ”. Without considering all the facts the question appears to be quite valid. Furthermore, the proponents of the HQ, JDCL, probably believe that the two projects are similar enough that their planning, which is based on the Guelph project, are applicable and will result in a viable operation in the HQ. It is also possible that agencies such as the MNR in Guelph and our own council members all of whom are familiar to some extent with the DQ may also have doubts respecting the CRC’s concerns respecting flyrock and shockwaves. This report, which will form part of a more detailed review of the mining aspects of the DQ, will attempt to explain the enormous difference which exists between the two projects.

Introduction

The clarification to the question of whether the two projects are similar enough to justify mining of the HQ based on the criteria derived from the proponents’ experience in the DQ can only be attained by understanding the geology of the two project areas.

The author does not claim to have sufficient knowledge of the area to be able to provide an adequate explanation of the geology of the DQ and the HQ. Instead, this report is based on all-encompassing information available on the geology of the area provided by the extensive research and writings of Mr. Frank R. Brunton of the Ontario Geological Survey (OGS), a world renowned authority on karst and in particular the recognised expert on geology of the region. Almost all of the discussion on geology in this writing is based on Mr. Brunton’s information. The explanation makes extensive use of of his own figures to clarify the writing.

Geology

In general the rocks that are mined for dolostone are the ones which the aggregate industry calls the Amabel Formation which are in effect a sequence of rocks laid down during the Phanerozoic Eon . The Phanerozoic Eon is the youngest layer of rocks laid down starting 550,000,000 years ago overlying the rocks of the Precambrian Supereon which dates back to 4.5 billion years ago.

The Phanerozoic Eon is in turn divided into three eras of which the oldest group the Paleozoic Era (dating back 250 to 550 million years) is prevalent in the area of Guelph. The Paleozoic in turn has six subdivisions termed epochs of which the Silurian Epoch (dating back 425 to 450 million years) of interest for this study, in the Guelph and Niagara escarpment area. The Silurian Epoch is in turn divided into seven rock formations within which the Gasport is the dolostone source rock.

The foregoing sequence of deposition of rock formation is summarised on Figure 1 which follows.

Figure 1

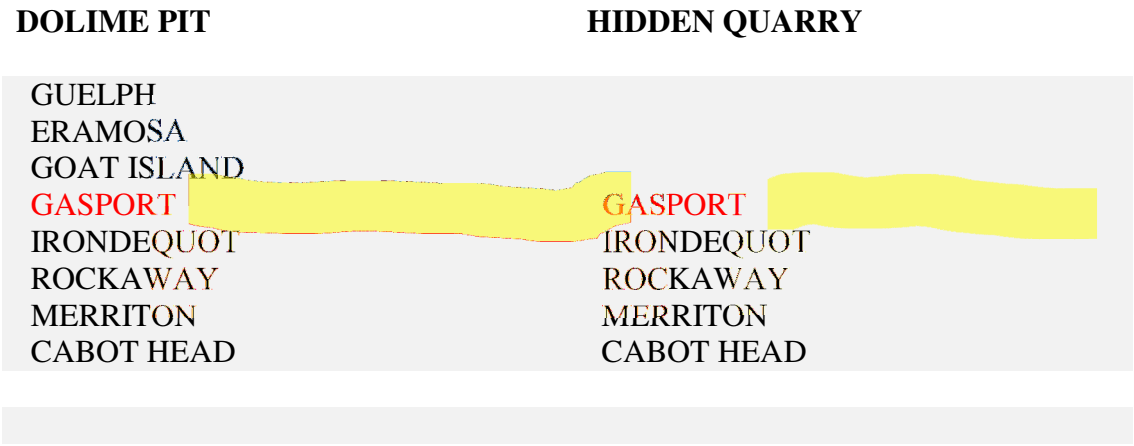
STRATIGRAPHY OF SOUTHERN ONTARIO

PHANEROZOIC	**0 YRS**	**250 M**	
550 M ILLION	CENOZOZOIC	PERMIAN	425 M
	65 M	300 M	GUELPH
		CARBONIFEROUS	ERAMOSA
	MESOZOIC	350 M	GOAT ISL.
	250 M	DEVONIAN	**GASPORT**
		425 M	IRONDEQUOT
	PALEOZOIC	**SILURIAN**	ROCKAWAY
	550 M	450 M	MERRITTON
		ORDOVICIAN	CABOT HEAD
PRECAMBRIAN		500 M	450 M
4.5 BILLION		CAMBRIAN	

The sequence of the rock formations underlying the Guelph and Rockwood area is summarised in table 2. It is quite evident that the principal difference in the sequence of rocks is the presence of the Guelph, Eramosa and Goat Island formations which covered the Dolime pit (now stripped off) but are absent in the HQ.

Figure 2

STRATIGRAPHY OF THE GUELPH AREA



The absence of the three rock layers (Guelph, Eramosa, and Goat Island) in the Rockwood area is due to erosional action, including glaciation, which exposed the more resistant Gasport dolostone layer.

As duration of exposure is the most important feature affecting karst weathering, it is quite obvious that the longer the Gasport has been exposed to the weathering the greater the chances of karst features being present.

It is important to note that, mining of the upper layers only started in the mid 1800's in the DQ. The Gasport was only recently exposed less than 100 years ago giving it, in geological terms, an infinitesimally short period of time for weathering after being buried for 425 million years. The likelihood of the presence of karstification in the Gasport formation in the DQ would appear to be insignificant compared to areas closer to the Niagara escarpment such as the Rockwood area.

In the Rockwood area on the other hand, the Gasport formation has been exposed for a much longer period of time. The period of time has certainly exposed the rocks in the Blue Springs Creek (100m south of the HQ property) for long enough to show ample evidence of karst weathering. Features in the HQ property such as four sink holes within or on the property boundaries of the HQ, the presence of springs, and a disappearing stream are all typical associated with Karst. These provide evidence that karst weathering has probably taken place in the HQ although not as intense as in the Blue springs Creek or the Conservation Area nearby.

Drilling with vertical holes in the HQ has proven that some karst weathering has taken place by observations such as vugs in the rock, open fractures up to 6 inches anad other features associated with this type of weathering. However, it is unlikely that cavernous openings will be found in the HQ which are often found in karst areas but certainly the presence of micro karst has been observed. The reason for the lesser amount of weathering is due to the overlying sand, gravel, clays and tills laid down since the last ice age 12,000 years ago. These overlying deposits have been eroded away in the Blue Springs Creek and Rockwood conservation areas giving access to weathering.

Conclusions

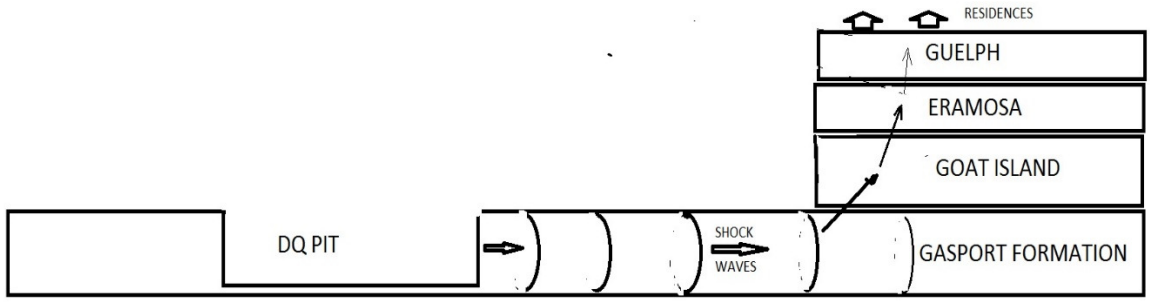
In conclusion, it is quite obvious that there is a vast difference between the two areas under consideration. This difference will manifest itself in exacerbating two main problem areas usually encountered in open pit drilling and blasting which are, blasting shock wave transmittal and potential for flyrock generation, which are discussed as follows.

Blasting Shock Waves

The closest receptors to the DQ, about 400 metres distant, are housing developments which predate the present operations by decades, that is, before the Gasport formation was mined. The housing developments however, are built on the original ground surface that existed before the pit started mining in the 1800s are at an elevation of more than 100 meters above the bottom of the Gasport formation presently being mined. This means that the major part of the shock waves generated pass under the residences (see Figure 3).

As shown on Figure 3 that follows, the shock waves generated by blasting will have to be deflected upward by close to 100 metres, through three major discontinuities in well drained rock formations, thus dampening their strength before reaching the closest residenses. The deflected shock waves however, are sufficiently powerful to cause discomfort, minor damages, and complaints by residents although reportedly with PPVs (a measure of seismic movement) lower than the mandatory provincial limits. Even so the neighbouring residents have been complaining for years about the effects of the shock waves.

Figure 3.



In the case of the HQ the shock waves will not be dampened by a 100 metre thickness of rock overlying the Gasport formation but rather a few metres of sand and silt. The shock waves will be far stronger at the same relative distance from the blasts as the homes near the DQ.

Flyrock

Almost every report covering flyrock (an extensive number of which can be found on Google) list the geology of the rock being blasted as the most important factor affecting flyrock.

It is well documented that when an explosion occurs the energy exerted will seek out the path of least resistance. In most mines which utilise vertical drill holes the path of least resistance is the vertical wall facing into the pit. The proper design of a blast makes use of this feature resulting generally in a safe fragmentation of rock with little in the way of ejecting flyrock, except for a minor amount which normally falls within the pit. An important criteria for such an orderly blast is the presence of homogenous rock with the absence of structural weakness or cavities.

Most open pit mines however, do not have “the god given gift” of perfectly homogenous rock. In such cases research has indicated that sometimes geology will play tricks which are not expected, resulting in the unexpected ejection of flyrock. Extensive data available indicate that most pits are expected to eject

flyrock occasionally within a radius termed “normal flyrock range” generally set at 200 to 300 metres. Much less frequent but still of significant importance are cases in which flyrock ranges are greater, these are termed wild flyrock with distances measured up to 500 metres but in some cases up to 1200 metres. Almost all of the wild flyrock instances are due to geological variations in the rock such as faults, cavities, fissures enlarged by weathering etc. which will almost certainly be present in the HQ.

In a casual conversation with an employee of DQ the writer was informed that “there is no problem with flyrock” in the Dolime operation (a prudent miner would preface the comment with “up to now” or add “yet”) . This would place it in an enviable position within the mining industry. If this highly unusual condition exists it is probably due to the existence of a very homogenous rock mass but perhaps also because any flyrock has been contained within the DQ property. The uniformity of the rock can be attributed by the lack of weathering due to the fact that it has been hermetically sealed for 400 million years.

The HQ on the other hand, based on the few exploratory holes drilled to date, the presence of karst weathering in the Blue Springs Creek and several features such as sink holes, springs and disappearing streams all indicate that karst weathering will probably be present. This leads to the conclusion that the rock mass will probably not be homogeneous and thus pose a problem with flyrock. The closest residences, structures and Highway 7 are a well within the “normal flyrock” range. As well the quantity of explosives per drill hole will be in the order 300 to 700 kilograms and there will be between 20,000 and 50,000 of them posing a potential danger for most of the 17 years of the operation.

JAMES DICK CONSTRUCTION LIMITED

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July 22, 2014

Township of Guelph Eramosa

Attention: **Ms. Liz Howson**
MSH Ltd.

RE: July 22 Mr. Hill Memo concerning Guelph Dolime and the Hidden Quarry

Hi Liz,

I have reviewed the memo you forwarded from Mr. Hill and have the following comments.

- Mr. Hill qualifies his memo in stating that, "The author does not claim to have sufficient knowledge of the area to be able to provide an adequate explanation of the geology of the DQ and the HQ." Hill July 22 Memo Page 1 Para 3.

- Mr. Hill has the geological strata in which the Dolime Quarry is operating incorrectly represented. The Dolime quarry generally operates in the Guelph Formation and the Eramosa member. Hill July 22 Memo Figure 3.

- Notwithstanding anything in his memo, Mr. Hill fails to understand that the vibration guideline applicable at any receptor is the same regardless of the blasting technique, rock formation or quarry geometry.

- Explotech concludes that "blasting operations required for operations at the proposed James Dick Construction Ltd Hidden Quarry site can be carried out safely and within governing guidelines set out by the Ministry of the Environment." Explotech Page 21 Para 2.

- The Town's Peer Reviewer is in agreement with the standards used, the assessment techniques used; and the conclusions of the Explotech Study. Novus Environmental Letter to Cuesta, April 8, 2013, Page 5 Section 2.0

- Mr. Hill also fails to understand that no fly rock is permitted to leave a quarry property in Ontario.

- As stated previously, James Dick has operated for 50 years in Ontario and has never had a piece of fly rock leave our property.

- Mr. Hill's definition of "normal flyrock range" is not accurate for controlled blasting in Ontario quarries.

- We appreciate Mr. Hill backing off his previous presentations to council when he states: "However, it is unlikely that cavernous openings will be found in the HQ …".

With the greatest respect to Mr. Hill, we do not believe that his “technical’ submissions should be weighed at all in the evaluation of the Hidden Quarry Application. The reasons for this are:

1. By his own admission he does not have sufficient knowledge.
2. He is not experienced in operating carbonate quarries in Ontario.
3. He is a member of the CRC, a group of residents that identifies themselves as being opposed to the Hidden Quarry. As such he has generally disqualified himself as acting in a professional expert capacity.
4. He has immediate family members who are also actively engaged in opposing the quarry.

If you have any further questions please feel free to contact me at any time,

Sincerely,
JAMES DICK CONSTRUCTION LIMITED

Greg Sweetnam, B.Sc.
Vice President, Resources
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.

Greg Sweetnam

From: Greg Sweetnam
Sent: November-11-14 4:35 PM
To: Liz Howson (howson@mshplan.ca)
Cc: Leigh Mugford
Subject: Golder Peer Review of Blast Impact Analysis
Attachments: 13-1193-0016 LTR 14Oct01 James Dick Response to Blast Impact Analysis.pdf

Hi Liz,
Please find attached the "belts and suspenders" review of the Explotech Blast Impact Analysis conducted by Golder Associates. You will find attached to it a slightly revised and updated Explotech Blast Impact Analysis taking into account the Golder submission.
You may recall that the CRC has been demanding a peer review of the Blast impact Study, by specifically Golder, for some time. This request was outlined in numerous verbal presentations to Council and more recently outlined in their submission April 7, 2014 item 6(e). Further at your meeting with CRC on May 22, 2014 the CRC submitted "We strongly recommended that a more extensive peer review by an expert company such as Golder Associates be undertaken." (from MSH Application Status Report August 12, 2014).
This Peer review is obviously submitted outside of the Township's Peer Review process. The Town's Peer Reviewer, Burnside and Novus, have concurred with the Explotech findings. As such, there should be no requirement to "peer review this peer review" as a matter of principle and economy. The Golder Peer Review is submitted for information only to provide an additional level of confidence in the Explotech Report.
You will note that Golder comes to the conclusion that "The report's recommendations are reasonable and acceptable."
Sincerely,
Greg

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Information on James Dick: www.jamesdick.com
Information on Aggregates: www.theholestory.ca

April 7, 2014

Concerned Residents Coalition

Delegation to GET Council Meeting

1. Our desire is to work with the Township in ensuring that there is a thorough evaluation of the Hidden Quarry application.

2. Part of ensuring that a thorough evaluation takes place is to evaluate the information that the applicant submits in support of the quarry application, but also to make sure the that the peer review consultants are doing their job—that every determination made by the peer review consultants is the result of thorough analysis and is completely substantiated by that analysis. We, the CRC and Council both, need to be testing every determination made by each and every one of the Township's peer review consultants

3. This will send a message to the peer review consultants—you had better have very, very good reasons for your opinions along the way and for your ultimate recommendations—that you had better not be just going through the motions—that Council is very concerned about this quarry application and really wants it to be carefully and thoroughly evaluated.

4. One of the aspects that the Concerned Residents Coalition has found frustrating about the evaluation process thus far is the difficulty we have had in obtaining copies of information which are apparently being exchanged between Township peer review consultants and the applicant. Without this information we are left in the dark as to whether the concerns of the peer review consultants are being resolved and we have no way of potentially challenging this subsequent information being provided by the applicant, nor challenging the determination of the peer review consultants that flow from this subsequent information. So we would like Council to ensure that all the information associated with this application, including any information and communication between the applicant and the Township's peer review consultants is also provided in a timely fashion to the Concerned Residents Coalition.

5. The other interrelated matter that the Concerned Residents Coalition has found frustrating is that we don't know what is happening to the issues that are being raised by the Concerned Residents Coalition. We have been expecting these issues and related information to be forwarded to the Township's peer review consultants and we have been expecting a response through Council from

the peer review consultants. And not at the end when the consultants present a recommendation to Council. By then it may to be too late and too large a task to ensure that the every determination made by the peer review consultants is a result of thorough analysis and is completely substantiated by that analysis.

6. Turning to the Summary of Delegations to GET Council which has been provided to Council, and to summarize a little further still:

a) We appreciate Council having obtained cultural heritage and visual impact studies from the applicant and would now request Council obtain peer reviews of the cultural heritage and visual impact studies;

b) We are requesting a meeting with Burnside regarding issues raised in peer reviews and applicant responses to those issues which are currently being assessed by Burnside;

c) We are requesting that Council undertake an economic impact assessment of the proposed Hidden Quarry, not only to determine the impact of the quarry on the value of properties around the quarry site, but also to evaluate other economic impacts. And these other economic impacts include determining how much additional tax burden will be shifted to each and every other property in Guelph-Eramosa Township as a result of declines in assessed values of properties near the quarry site;

d) We are requesting a response to the issue of impacts on agricultural resources including the mushroom farm adjacent to the quarry site;

e) We are requesting a response to the issues raised about impacts from blasting vibration and fly rock and we are more specifically requesting that Council hire a specialist peer review consultant with regards to this issue—a firm like Golders. The current peer comments with regards to blasting are inadequate; and

f) We are requesting a response to the interrelated issues regarding hydro-geological impacts, well monitoring and concerns with regards to mitigation in the event that well interference occurs, with regards to the inaccurate characterization of the quarry site has not having karst features and the implications for hydrogeological impact and hydrogeological modeling in light of karst features being present.

October 1, 2014

Project No. 13-1193-0016

Leigh Mugford
Quality Control and Project Manager
James Dick Construction Ltd.
P.O. Box 470
Bolton, Ontario L7E 5T4

FOLLOW-UP TO TECHNICAL PEER REVIEW – BLAST IMPACT ANALYSIS FOR HIDDEN QUARRY TOWNSHIP OF GUELPH-ERAMOSA, COUNTY OF WELLINGTON, ONTARIO

Dear Mr. Mugford:

In our Draft Technical Peer Review Letter dated November 1, 2013, Golder Associates Ltd. (Golder) provided a review of the November 19, 2012, Blast Impact Analysis (BIA) report, prepared by Explotech Engineering Ltd. (Explotech). The BIA report was in support of an aggregate licence application in the County of Wellington, Ontario. Comments were not provided on our draft letter and Explotech's BIA report revisions were made based on our recommendations provided in our November 2013 draft. The final Technical Peer Review Letter is attached following the text of this letter. On September 5, 2014, Explotech issued a revision of the BIA, which addressed the issues raised in our peer review. Our peer review and the revised BIA are attached to this letter.

The changes noted in the revised BIA include:

1) The map of the receptor locations, located in Appendix A, now includes an outline indicating the quarry property.

2) The attenuation models used to estimate the vibrations at the nearest sensitive receptors were different than those presented earlier in the BIA for "initial prediction purposes". Additional information has been included in the revised BIA which clarifies the model differences and suggests recommended usage.

3) The example equation for the ground vibration estimate, shown on page 15 of the BIA has been corrected in the revision.

4) In the section for estimating the peak overpressure (page 17 of the BIA), there was inconsistency in the units used, which could create confusion or uncertainty for readers of the BIA report. In order to improve clarity in the revised BIA, the estimated overpressure is presented in both Pa and dBL.

5) In the original BIA, no mention was made regarding the potential impact of the proposed blasting on fish habitat or spawning beds, which may exist in the area adjacent the site. This has been adequately addressed on page 19 and in the recommendations of page 20 of the revised BIA.

Golder Associates Ltd.
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Tel: +1 (905) 567 4444 Fax: +1 (905) 567 6561 www.golder.com
Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

6) In the original BIA, there was no discussion of what special precautions might be implemented as the blast operations approach within 250 m of any sensitive receptor and to what extent they would reduce the ground and air vibration levels. On page 12 of the revised BIA, a description of the special precautions is presented. This primarily entails modifications to the blast design parameters.

The report's recommendations are reasonable and acceptable.

If you require any additional details or information, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

Daniel Corkery, B.Sc.
Senior Mining Consultant

David Sprott, M.Sc., P.Eng.
Principal, Senior Mine Engineer

DC/DS/kp

Attachments: Golder Technical Peer Review Letter – Blast Impact Analysis For Hidden Quarry Township Of Guelph-Eramosa, County Of Wellington, Ontario, dated October 1, 2014

Explotech Blast Impact Analysis Revised Report, dated September 5, 2014

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October 1, 2014

Project No. 13-1193-0016

Leigh Mugford
Quality Control and Project Manager
James Dick Construction Ltd.
P.O. Box 470
Bolton, Ontario L7E 5T4

TECHNICAL PEER REVIEW – BLAST IMPACT ANALYSIS FOR HIDDEN QUARRY TOWNSHIP OF GUELPH-ERAMOSA, COUNTY OF WELLINGTON, ONTARIO

Dear Mr. Mugford,

Acting on your request of October 8, 2013, Golder Associates Limited (Golder) has reviewed the Blast Impact Analysis (BIA) report prepared by Explotech Engineering Ltd. (Explotech) in support of an aggregate licence application in the County of Wellington, Ontario. The following is our technical peer review of the BIA report.

BACKGROUND

James Dick Construction Ltd. (James Dick) proposes to operate a Class A Category 2 quarry in the County of Wellington, Ontario. The proposed Hidden Quarry is legally described as Part of Lot 1, Concession 6, Township of Guelph – Eramosa, County of Wellington, Ontario. James Dick retained Explotech to prepare a BIA for the proposed Hidden Quarry. The BIA is documented in the BIA report entitled:

> *Blast Impact Analysis James Dick Hidden Quarry, Part of Lot 1, Concession 6, Township of Guelph – Eramosa, Former Township of Eramosa, County of Wellington, Ontario.*

The BIA report was prepared in accordance with the Aggregate Resources Act (ARA) requirements in order to delineate the potential environmental impacts from the required blasting operations. Our comments are confined to reviewing the report as it relates to the impact of the ground and vibration effects from the blasting operations within the proposed quarry area.

We understand that the quarry will not be dewatered as part of the operation and the will be excavated using single benches with water level within 5 meters of the bench top. That is, only the top 5 meters of the rock to be blasted will be exposed.

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Blast Impact Analysis

The BIA report assesses the potential impact of blasting operations within the proposed Hidden quarry on the surrounding area with regard to compliance with the Ontario Ministry of the Environment (MOE) ground vibration and air concussion guideline limits contained in NPC 119. Assuming routine monitoring at the proposed Hidden quarry, the standard limits of 12.5 mm/s and 128 dBL would apply at the nearest sensitive receptors. Since the quarry is proposed to proceed in three distinct phases, the closest sensitive receptors to the required blasting operations would vary with the standoff distance to the receptors for a given blast. The BIA report indicates that the minimum standoff distance between the closest sensitive receptors and the extraction limits for the proposed quarry would be 70 m. The table located on pages 6 and 7 of the BIA report identifies a sensitive receptor (R16 - 5036 Highway 7) at 70 m from the proposed extraction limit. The topographic figure contained in Appendix A of the BIA report shows the receptor's location. The report states that it would not be economically feasible to conduct the quarry blasting at the nearest sensitive receptor (i.e. as close as 70 m) and that the limit of blasting operations will be governed by on-site vibration monitoring and market economics.

The BIA report includes:

- initial blast design details for the proposed Hidden quarry (page 12);
- recommended maximum explosive loads to maintain compliance with the NPC 119 guideline limits (page 11);
- methodology and examples for the prediction of ground and air vibration levels at the nearest sensitive receptors based on assumed loading conditions at the initial blasting operations (page 15 – 18); and
- a list of recommendations for blasting operations at the proposed quarry site, including developing site specific attenuation data to confirm the assumptions contained within the report and continued monitoring of all blasts to demonstrate compliance with the MOE guideline limits (page 19 – 20).

It is noted in the report that since the water level will be above all but the top 5 meters of the blast bench face, there will be a "dramatic" reduction in the blast-induced air overpressure.

Additionally, the Department of Fisheries and Oceans Canada (DFO) has established a set of guidelines for the use of explosives in or near Canadian fisheries waters. These guidelines set out that "No explosive may be used that produces or is likely to produce, a PPV greater than 13 mm/s in a spawning bed during egg incubation". The DFO guidelines also set out an underwater overpressure limit of 100 kPa at fish habitat. The underwater overpressure limit only tends to become a measurable indicator when blasting or explosives are used within the water body itself. The BIA report states that no fish or spawning activity were identified in biological surveys of an intermittent stream and pond located on site and therefore were not assessed.

The report concludes the following:

> *"Blasting operations required for operations at the proposed James Dick Construction Ltd. Hidden Quarry site can be carried out safely and well within governing guidelines set out by the Ministry of the Environment."*

DISCUSSION

The objective of a blast impact assessment report for either a new quarry or the extension of an existing quarry in Ontario is to demonstrate that blasting operations can be carried out in compliance with the MOE recommended ground and air vibration guideline limits at the closest sensitive receptors.

Location Maps

The figure that displays the sensitive receptors, located in Appendix A, does not show the outline of the property, extraction limits or environmental control berms. Although this information is shown on a second map within Appendix A, displaying these features on the sensitive receptor location figure would provide clarity for the reader of the BIA.

Impact Estimates

Ground and Air Vibrations

Table 1 and 2 of the BIA report (page 11) provide estimates of the maximum loading to comply with the MOE guideline limits for ground and air vibrations in front and behind the blasts. According to the report, these were generated through the analysis of empirical data collected at quarries and mines throughout Ontario and that the tables were intended to provide very conservative start-up guidelines for the blasting operations at the Hidden Quarry. In subsequent sections (page 15 to 18), the methodology and examples for estimating the vibrations at the nearest sensitive receptors were based on monitoring records from an Ontario quarry with similar material characteristics and were intended for "initial prediction purposes". It was noted that the attenuation models used to estimate the vibrations at the nearest sensitive receptors were different attenuation models than those to derive the values in Table 1 and 2. This may lead to confusion for a blast designer in the early phases of the operation. The methods for estimating the vibration levels are only presented for ground vibration levels behind the blast and air vibrations in front of the blast. Although these represent the locations for the anticipated largest vibration levels (i.e. behind the blast for ground vibrations and in front of the blast for air vibrations) it appears at odds with the approach used for Table 1 and 2. The table below provides a comparison of the maximum explosive loading between the Tables 1 and 2 and the attenuation models discussed for prediction vibration levels at the nearest sensitive receptors.

Maximum Explosive Loading for Compliance with the MOE Guidelines

Distance [1] (m)	For a Ground Vibration Limit of 12.5 mm/s Behind the Blast		For a Air Overpressure Limit of 128 dBL in Front of the Blast	
	Table 1 Values (kg)	Model Page 15 [2] (kg)	Table 2 Values (kg)	Model Page 17 [3] (kg)
150	17	24	8	2.4
200	30	42	20	5
250	48	66	38	10
300	68	96	67	17
350	94	130	105	26
400	122	170	158	39

Distance [1] (m)	For a Ground Vibration Limit of 12.5 mm/s Behind the Blast		For a Air Overpressure Limit of 128 dBL in Front of the Blast	
	Table 1 Values (kg)	Model Page 15 [2] (kg)	Table 2 Values (kg)	Model Page 17 [3] (kg)
500	190	266	308	76
700	374	520	846	209
900	604	860	1799	443
1200	1075	1529	4269	1050

1) *Distance between the blast and the nearest sensitive receptor.*
2) *Model to estimate the ground vibration level behind the blast presented on page 15.*
3) *Model to estimate the air vibration level behind the blast presented on page 17.*

Clarification regarding the model differences and the recommended usage is suggested.

In the example equation for the ground vibration estimate shown on page 15 the formula should have been shown as $PPV = 5175 \times \left(\frac{425}{\sqrt{150}}\right)^{-1.76}$ not $PPV = 5175 \times \left(\frac{425}{150}\right)^{-1.76}$. However, the answer presented is correct.

In the section for estimating the peak overpressure (page 17) the estimate is given in Pa. However, the result is related to the MOE limit which is given in dBL (i.e. 128 dBL). The limit (50.2 Pa) was not given in Pa and no method of conversion was presented. Not including the limit in both units may create confusion or uncertainty for readers of the BIA report.

Since the quarry will not be dewatered and all but the top 5 meters of the blast bench face will be below the water level, there is likely to be a significant reduction in the blast-induced air overpressure. The level of reduction will be determined by monitoring of the airblast overpressure.

Impact on Fisheries

The BIA report stated that no assessment was necessary to address the compliance with the DFO Guidelines since neither fish nor spawning beds were indicated in the results of biological surveys conducted on the pond and intermittent stream located on site. No mention was made regarding the potential impact of the blasting on fish habitat or spawning beds which may exist in the area adjacent the site. It is suggested that the area adjacent the site be considered in the potential impact of the blasting operations on the local fisheries waters.

Blast Designs

The report states that special precautions must be implemented as the operations approach within 250 m of any sensitive receptor (page 12). There is no discussion of what these precautions might be and to what extent they would reduce the ground and air vibration levels.

CONCLUSION

Following review of the BIA report prepared by Explotech, we are conditionally in agreement with the BIA conclusion that the "blasting operations required for operations at the proposed James Dick Construction Ltd Hidden Quarry site can be carried out safely and within governing guidelines set out by the Ministry of the Environment." While the empirical formulas applied are generic in nature and are to be confirmed on site through the institution of attenuation analysis and compliance monitoring programs, it is also important to apply realistic estimates so that designs, and associated costs, more closely reflect the reality to be expected. This statement should not be interpreted to mean that compliance with MOE overpressure limits would not be possible. However, compliance may require additional effort and associated additional cost. As suggested in the BIA, "the point of termination of blasting operations will be governed by the results of the on-site monitoring program and market economics".

The remainder of the report's recommendations are reasonable and acceptable.

Additional discussion related to points raised in this peer review may be beneficial to ensure any implications do not severely impact fiscal, operational and compliance feasibility studies prepared.

We trust that the foregoing meets the request your peer review. If you require any additional details or information, please do not hesitate to contact us.

Yours very truly,

GOLDER ASSOCIATES LTD.

Daniel Corkery, B.Sc.
Senior Mining Consultant

David Sprott, M.Sc., P.Eng.
Principal, Senior Mine Engineer

DC/DS/kp

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Golder Associates

Golder engagement – timeline?
Burnside meeting date?

October 6, 2014

Delegation to GET Council re: Hidden Quarry

The CRC would first like to acknowledge and thank Council for listening to our concerns (and the concerns of others) over the last year and a half and for moving in a new, more positive direction with regard to what we increasingly see is not only the CRC's goal, but now Council's goal, of ensuring that the Hidden Quarry proposal receives a comprehensive evaluation.

Secondly, we would like to specifically acknowledge and thank Council for requiring that a economic impact study, a haul route study, and an agricultural impact study be undertaken, but we would also request that the CRC be permitted an opportunity to review and comment on the Terms of Reference for these studies.

Thirdly, the CRC would like to ask when the meeting which we had requested with Burnside will be scheduled. We would like this meeting to be arranged as soon as possible so that we can seek an understanding of why certain matters have been dealt with by Burnside in the manner they have. For instance, the original peer review report by Burnside required that the applicant, James Dick Construction Limited, drill two deep monitoring wells in the area proposed for extraction where no such wells existed. The CRC was happy to see this requirement being recommended by Burnside, and felt that it was also the position of Council. We understand that JDCL responded by saying that they would drill one deep monitoring well, but that they would only drill a second well when and if they received approval for their quarry. Our concern is that Burnside seems to have agreed with this approach, which we don't feel is appropriate. For

the requirement for two wells to become a requirement for only one well, Burnside should have consulted with Council and this compromise should only have been agreed to if Council supported the compromise. And this is only one of the issues we would like to explore with Burnside in our meeting with them. There are many others.

Finally, we have to express concerns about JDCL undertaking what they have described as a peer review of the interrelated issues of noise, blasting, vibration and risks of mining. If the applicant feels that the work of its consultants to date with regards to these issues has been inadequate and they feel the need to supplement their work to-date, well, ok. They are entitled to do additional work. But to call that work a "peer review" is a contradiction in terms. It isn't a peer review if it is being undertaken by an applicant with a very substantial vested interest. So the CRC remains of the view that a proper peer review of the noise, blasting, vibration and risks of mining issues, conducted by a well qualified consultant will still need to happen once Golders does its work on behalf of the applicant. And we continue to have concerns that the Township's previous peer review consultants, Novus, do not have the expertise and experience to carry out this proper peer review.

Leigh Mugford

From: Corkery, Daniel <Daniel_Corkery@golder.com>
Sent: April-02-15 7:26 AM
To: Leigh Mugford
Subject: RE: Blasting and Fly Rock questions

Hi Leigh,

I have read the attachments regarding our Technical Peer Review – Blast Impact Analysis for Hidden Quarry. As requested by you, this is not intended to provide a formal detailed technical response to Mr. Hill's appraisal of the peer review. Rather, this provides a comment on the question as to whether Golder report constitutes a "peer review" because of the fact that Golder was employed by the proponent without the knowledge of either GET or CRC. The CRC's presentation questions whether Golder can provide a valid peer review since we have done business with James Dick Construction Ltd. in the past.

Golder Associates has a highly specialised team of engineers and other professionals providing technical services in all aspects of drilling and blasting. With over 30 years of national and international experience Golder can provide a multi-disciplinary team for all types of blast projects. Golder has conducted and peer reviewed numerous blast impact assessments across Ontario and provided expert witness testimony during Ontario Municipal Board hearings regarding licencing applications. Our reliability in providing technically sound and impartial reports is trusted within industry and by government agencies. As an independent reputable engineering company, we are able to provide impartial third party review of Explotech's impact assessment. This does not preclude GET or CRC from retaining an engineering firm to provide a peer review.

The letter from Explotech, dated April 10 2014, described the approach widely used by industry to estimate flyrock range from quarry bench blasts that has been described in the published paper by Richards and Moore (2004). We agree with the approach and flyrock range estimates contained with the letter report. The presence of water within the quarry will restrict the face burst flyrock from below the water level and not that from the bench top cratering.

The reference for Richards and Moore (2004) is as follows:

Richards, A.B., and Moore, A. J., 2004. "Flyrock Control – By Chance or Design" in the proceedings of The 30th Annual Conference on Explosives and Blasting Technique, (The International Society of Explosives Engineers: New Orleans, Louisiana, USA), p 335-347.

If you require additional information or a formal response for wider distribution, please contact me.

Regards,
Dan

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From: Leigh Mugford [mailto:lmugford@jamesdick.com]
Sent: April 1, 2015 1:41 PM
To: Corkery, Daniel
Subject: Re: Blasting and Fly Rock questions

Hi Dan I thought I would check in with you to see how you are doing with this stuff?

Thanks

Leigh