EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Blast Impact Analysis
Freymond Quarry
Part of Lots 51 & 51, Concession W.H.R.
Township of Faraday
County of Hastings

Submitted to:

EcoVue Consulting Services Inc.
25 Reid Street,
P.O. Box 129
Lakefield, ON
K0L 2H0

LICENSED PROFESSIONAL ENGINEER
R. J. CYR
PROVINCE OF ONTARIO

Prepared by

Explotech Engineering Ltd.
58 Antares Drive, Unit 5
Ottawa, Ontario
K2E 7W6

February 18, 2014

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EXECUTIVE SUMMARY

Explotech Engineering Ltd. was retained in February 2014 to provide a Blast Impact Analysis for the proposed Freymond Quarry located on Part Lots 51 & 52, Concession W.H.R., Township of Faraday, County of Hastings.

Vibration levels assessed in this report are based on the Ministry of Environment Model Municipal Noise Control By-law (NPC119) with regard to Guidelines for Blasting in Mines and Quarries. We have assessed the area surrounding the proposed Aggregate Resources Act license with regard to potential damage from blasting operations and compliance with the aforementioned by-law document.

We have inspected the property and reviewed the available site plans. Explotech is of the opinion that the planned aggregate extraction on the proposed property can be carried out safely and within MOE guidelines as set out in NPC 119 of the By-Law.

Recommendations are included in this report to ensure that blasting operations in all phases of this project are carried out in a safe and productive manner to ensure that no possibility of damage exists to any buildings, structures or facilities surrounding the property.

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INTRODUCTION

Freymond Lumber Ltd. (Freymond) intends to apply for a Class A, Category 2 Licence for the property legally described as Part Lots 51 & 52, Concession W.H.R., Township of Faraday, County of Hastings. This Blast Impact Analysis assesses the ability of the proposed licence to operate within the prescribed blast guideline limits as required by the Ontario Ministry of Environment (MOE).

The land surrounding the proposed Freymond Quarry is a mixture of Marginal Agriculture, Rural Industrial, Environmental Protection, Rural Residential, Limited Service Residential and Recreational / Resort Commercial land uses. The site is currently zoned Marginal Agriculture.The proposed Freymond Quarry operation is bounded by scrub brush and Bay Lake Road to the South, Gaebel Road and scrub brush to the West, properties fronting onto Jeffery Lake Road to the North and properties fronting onto Bay Lake Road and Highway 62 to the East. The property is accessed via a private haulage road off of Bay Lake Road.

This Blast Impact Analysis has been prepared based on the Ministry of the Environment (MOE) Model Municipal Noise Control By-law with regard to Guidelines for Blasting in Mines and Quarries (NPC 119). We have additionally assessed the area surrounding the proposed license with regard to potential damage from blasting operations.

Given that 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. It has been our experience that this data represents a conservative starting point for blasting operations. It is a recommendation of this report that a vibration monitoring program be initiated on-site upon the commencement of blasting operations and maintained for the duration of all blasting activities to permit timely adjustment to blast parameters as required. We note that blast monitoring is a prescribed condition to any licence issued for the proposed quarry under the Aggregate Resources Act.

Recommendations are included in this report to ensure that the blasting operations are carried out in a safe and productive manner and to ensure that no possibility of damage exists to any buildings, structures or residences surrounding the property.

EXISTING CONDITIONS

The licenced area for the proposed Freymond Quarry encompasses a total area of approximately 35HA. The extraction area is approximately 28HA when allowing for setbacks and sterilized areas. The site is broken into two (2) distinct extraction phases (Refer to Appendix A Operational Plan). The Phase 1 extraction areas lie in the central portion of the proposed licence area and involve bringing the existing landscape down to an average ground level of 363masl. The Phase 2 of the licence area involves excavation to the proposed 332-339masl final depth of the quarry.

The topography of the proposed licence area is generally lowest in the East portion of the site at an elevation in the order of 332masl rising towards the West and South with the highest elevations (392masl) lying in the Southwest portion of the site. A ridge rises in the middle portion of the site to an elevation of approximately 385m.

The lands surrounding the proposed licence area are largely characterized by undeveloped natural vegetation and forested areas with the closest sensitive receptors lying to the South of the limits of extraction along Bay Lake Road, to the North along Jeffrey Lake Road, to the East along Highway 62 and Bay Lake Road, and to the West along Gaebel Road.

The land immediately to the North is predominantly natural vegetation and forest currently owned by the proponent but excluded from the licence application. Sensitive receptors further North along Jeffrey Lake Road lie in excess of 400m North of the limits of extraction.

The land immediately to the East is also owned by the proponent, but excluded from the licence application, and currently houses light industrial properties. Bay Lake Road and Highway 62 lie approximately 190m and 250m respectively East of the site and house several sensitive receptors.

The land immediately to the South is owned by the proponent, but excluded from the licence application, and consists predominantly of natural vegetation and forest. The closest sensitive receptors to the South front onto Bay Lake Road in excess of 300m removed from the limits of extraction.

The land to the west is privately owned and is predominantly natural vegetation and forest. Two sensitive receptors fronting Gaebel Road lie as close as 100m Northwest of the extraction limits.

PROPOSED AGGREGATE EXTRACTION

The proposed initial quarry operations will involve extraction in the Phase 1 area with extraction initiated at the Northeast base of the existing escarpment and retreating towards the Southwest corner of the site. Phase 1 extraction will take place to approximate elevation 360masl – 364masl with the existing topography eliminating the need for a sinking cut. Initial blasting will be located approximately 500m from the closest sensitive receptor behind the blast, namely 342 Gaebel Road, and 550m from the closest sensitive receptor in front of the blast, 2344 Bay Lake Road. Based on existing Phase 1 elevations in the order of 375 – 395masl, this phase of extraction will take place in 1 – 3 benches.

Extraction in Phase 2 will begin with the blasting of a North – South slot approximately midway along the East-West extraction limit. Once this slot is removed, retreat will take place in both an East and West direction (Refer to Appendix A). A sinking cut will be necessary at the start of the slot excavation. The final design floor elevation for the quarry is 332masl – 338masl. Based on Phase 2 maximum elevations in the order of 360 – 364masl, this phase of extraction will take place in 1 - 3 benches.

As previously noted, benching shall be employed as required so as to limit the size of blasts conducted. Quarrying operations on varied phases and benches may be ongoing concurrently throughout the life of the quarry.

As quarry operations migrate across the property, the closest sensitive receptors to the required blasting operations will vary with the governing structures and closest separation distances being as follows:

- Northwest corner: 342 Gaebel Road - 100m
- Southwest corner: 431 Gaebel Road - 450m
- South corner: 2204 Bay Lake Road - 250m
- East corner: 27915 Highway 62 - 230m
- Northeast corner: 2344 Bay Lake Road - 180m

The above distances incorporate maintenance of a minimum 15m extraction setback within the Quarry property limits on all sides.

As noted above, the closest sensitive receptor to the initial blast is located approximately 500m and 550m (back and front respectively) removed from the blast. Our composite data suggests that a maximum explosive load of 190kg per period can be employed to remain compliant with MOE guidelines for ground vibrations and in excess of 308kg per period can be employed to remain compliant with guidelines for overpressure.

Quarries in Ontario normally employ 76 to 152 mm diameter blast holes which, for a 15m bench, would employ 70kg to 275kg of explosive load per hole. The choice of hole diameter and bench height will govern the maximum number of holes to be fired per period for the sinking cut. Once the quarry is opened up, subsequent blasts can be designed to minimize the number of holes fired per period.

BLAST VIBRATION AND OVERPRESSURE LIMITS

The Ontario MOE guidelines for blasting in quarries are among the most stringent in North America.

Studies by the U.S. Bureau of Mines have shown that normal temperature and humidity changes can cause more damage to residences than blast vibrations and overpressure in the range permitted by the MOE. The limits suggested by the MOE are as follows.

Vibration	12.5mm/sec	Peak Particle Velocity (PPV)
Overpressure	128 dB	Peak Sound Pressure Level (PSPL)

The above guidelines apply when blasts are being monitored. Cautionary levels are slightly lower and apply when blasts are not monitored on a routine basis. It is a recommendation of this report that all blasts at the operation be monitored to quantify and record ground vibration and overpressure levels employing a minimum of two (2) digital seismographs.

BLAST VIBRATION AND OVERPRESSURE DATA

Blast vibration and overpressure data used in this report was collected from an amalgamation of quarries and mines throughout Ontario.

All ground vibration data was plotted using square root scaling from blast vibrations (Refer to Appendix C for a sample plot of data). The composite data employed has been proven to be very conservative and has been used as a start-up guideline for many aggregate extraction operations.

Overpressure data was plotted employing cube root scaling (Refer to Appendix C for a plot of data). It should again be noted that given the high dependence on local environmental conditions, overpressure prediction is far less reliable as a means of blast control.

Our experience and analysis demonstrates that blast overpressure is greatest when blasting toward residences, and blast vibrations are greatest when retreating towards the residences. Based on our complete data set from other Ontario quarries, we present the following initial guidelines for blasting operations at the proposed Freymond Quarry:

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MAXIMUM EXPLOSIVE LOADING BASED ON MOE GUIDELINE LIMITS

Blast Vibration Limit – 12.5 mm/sec

Distance to Receptor (Meters)	Allowable Explosives per Period - kg	
	Front of Blast	Back of Blast
150	39	17
200	69	30
250	108	48
300	156	68
350	213	94
400	278	122
500	434	190
600	625	275
700	851	374
800	1,111	477
900	1,406	604
1000	1,831	746
1100	2,216	903
1200	2,500	1,075

Blast Overpressure Limits – 128 dB

Distance to Receptor (Meters)	Allowable Explosives per Period – kg	
	Front of Blast	Back of Blast
150	8	38
200	20	88
250	38	171
300	67	296
350	105	470
400	158	702
500	308	1,372
700	846	3,764
900	1,799	8,000
1200	4,264	18,962

INITIAL BLASTING PARAMETERS

Blast Pattern:	2100 x 2100 to 3300 x 3300 mm
Number of holes:	Varies
Hole depth:	5 – 15m
Hole Diameter:	76 to 152mm
Stemming:	Clearstone
Toe Load:	Cast Booster / Cartridge
Column Load:	ANFO / ANFO WR / Emulsion
Maximum Charge per hole:	Varies with cut depth
Total Explosives per blast:	Varies with blast size
Material being blasted:	Precambrian bedrock
Tonnage per blast:	Varies
Number of blasts per year	Varies with production required

The above parameters provide initial guidance to direct blasting operations. Upon the commencement of blasting on site, these parameters will require revision based on site-specific data obtained and attenuation equations developed required as a recommendation of this report.

While initial operations and in fact the majority of required blasting will be performed at extended distances from the closest sensitive receptors, blasting along the extraction limit perimeters will come within approximately 100m of the residences bordering the property. Given planned phasing for the quarry, an abundance of vibration data and experience with the rock will be available long before any blasting in closer proximity to structures will be required thereby permitting effective design modifications as required to ensure compliance.

BLAST MECHANICS AND DERIVATIVES

The detonation of explosives within a borehole results in the development of very high gas and shock pressures. This energy is transmitted to the surrounding rock mass, crushing the rock immediately surrounding the borehole (approximately 1 borehole radius) and permanently distorts the rock to several borehole diameters (5-25, depending on the rock type, prevalence of joint sets, etc).

The intensity of this stress wave decays quickly so that there is no further permanent deformation of the rock mass. The remaining energy from the detonation travels through the unbroken material in the form of a pressure wave or shock front which, although it causes no plastic deformation of the rock mass, is transmitted in the form of vibrations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. As such, for the purposes this report, ground vibration units have been listed in mm/s.

In addition to the ground vibrations, overpressure, or air vibrations are generated through the direct action of the explosive venting through cracks in the rock or through the indirect action of the rock movement. In either case, the result is a pressure wave which travels though the air, measured in decibels (or dB) for the purposes of this report.

VIBRATION AND OVERPRESSURE THEORY

Transmission and decay of vibrations and overpressure can be estimated by the development of attenuation relations. These relations utilize empirical data relating measured velocities at specific separation distances from the vibration source to predict particle velocities at variable distances from the source. While the resultant prediction equations are reliable, divergence of data occurs as a result of a wide variety of variables, most notably site-specific geological conditions and blast geometry and design for ground vibrations and local prevailing climatic conditions for overpressure.

In order to circumvent this scatter and improve confidence in forecast vibration levels, probabilistic and statistical modeling is employed to increase conservatism built into prediction models, usually by the application of 95% confidence lines to attenuation data.

The attenuation relations are not designed to conclusively predict vibrations levels at a specific location as a result of a specific blast design, application of this probabilistic model creates confidence that for any given scaled distance, 95% of the resultant velocities will fall below the calculated 95% regression line.

While the data still provides insight into probable vibration intensities, attenuation relations for overpressure tends to be less reliable and precise than results for ground vibrations. This is due primarily to wider variations in variables outside of the influence of the blast design which impact propagation of the vibrations. Atmospheric factors such as temperature gradients and prevailing winds (refer to Appendix B) as well as local topography can all serve to significantly alter overpressure attenuation characteristics.

Our experience and analysis demonstrates that blast overpressure is greatest when blasting toward receptors, and blast vibrations are greatest when retreating towards the receptor.

PREDICTED VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR

The most commonly used formula for predicting PPV is known as Bureau of Mines (BOM) prediction formula or Propagation Law. We have used this formula to predict the PPV's at the closest house for the initial operations.

$$PPV = k\left(\frac{d}{\sqrt{w}}\right)^{e}$$

Where, PPV = the calculated peak particle velocity (mm/s)

K, e = site factors

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

The value of K is highly variable and is influenced by many factors (i.e. rock type, geology, thickness of overburden, etc.). Based on monitoring performed in Ontario quarries with similar material characteristics, our initial estimates for "e" will be set at -1.76 and "K" will be set at 5175 (refer Appendix C). In the absence of data for the proposed aggregate extraction operation, these are used for initial prediction purposes.

An ***example*** of this calculation is as follows:

For a distance of 500m (the standoff distance to the closest existing sensitive receptor behind the blast for the initial blasting) and a maximum explosives load per delay of 150kg (101mm diameter hole, 10m deep, 1.5 meter surface collar and 2 holes per delay), we can calculate the maximum PPV at the closest building as follows:

$$ppv = 5175\left(\frac{500}{\sqrt{150}}\right)^{-1.76} = 7.6mm/s$$

As discussed in previous sections, the MOE guideline for blast-induced vibration is 12.5 mm/s (0.5 in/s). The calculated 95% predicted PPV (based on the proposed blasting data discussed above) would be 7.6mm/s, well below the MOE guideline limit.

OVERPRESSURE LEVELS AT THE NEAREST SENSITIVE RECEPTOR

It is unusual for overpressure to reach damaging levels, and when it does, the evidence is immediate and obvious in the form of broken windows in the area. However, overpressure remains of interest due to its ability to travel further distances as well as cause audible sounds and excitation in windows and walls.

Air overpressure decays in a known manner in a uniform atmosphere, however, a uniform atmosphere is not a normal condition. As such, air overpressure attenuation is far more variable due to its intimate relationship with environmental influences. Air vibrations decay slower than ground vibrations with an average decay rate of 6dBL for every doubling of distance.

Air overpressure levels are analyzed using cube root scaling based on the following equation:

$$PSPL = k\left(\frac{d}{\sqrt[3]{w}}\right)^{e}$$

Where, PSPL= the peak sound pressure level particle velocity (dBL)
K, e = site factors
d = distance from receptor (m)
w = maximum explosive charge per delay (kg)

Data collected at various Ontario quarry was used to develop the following 95% regression equation (refer to Appendix C). The values for "e" and “K” have been established at -0.0456 and 159 respectively based on the collected empirical data.

$$PSPL = 159\left(\frac{D}{\sqrt[3]{W}}\right)^{-0.0456}$$

As discussed in previous sections, the MOE guideline for blast-induced overpressure is 128dBL. For a distance of 550 m (i.e. the standoff distance to the closest existing sensitive receptor in front of the blast for the initial blasting) and a maximum explosive weight of 150kg (101mm diameter hole, 10m deep, 1.5 meter collar, two holes per delay), we can calculate the PSPL at the nearest receptor in front of the blast to be at or below 128.7dBL. Based on this calculation and the assumed blast parameters, blasting from the initial operations may marginally exceed the MOE NPC 119 guideline limit of 128dBL. Fortunately, minor design revisions may be readily implemented including increased collar depths and decreased load to effectively reduce this calculated overpressure level to compliant levels.

We reiterate that air overpressure attenuation is far more variable due to its intimate relationship with environmental influences and as such, the equation employed is less reliable than that developed for ground vibration. Overpressure monitoring performed on site shall be used to guide blast design as it pertains to the control of blast overpressures. As demonstrated in Appendix B, prevailing winds during quarry operational periods are predominantly out of the West, a condition which may necessitate coordinating blasting operations with favourable environmental conditions.

RECOMMENDATIONS

It is recommended that the following conditions be applied for all blasting operations at the proposed Freymond Quarry:

1. An attenuation study shall be undertaken by an independent blasting consultant during the first 12 months of operation in order to obtain sufficient quarry data for the development of site specific attenuation relations. This study will be used to confirm the applicability of the initial guideline parameters and assist in developing future blast designs.

2. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) digital seismographs – one installed in front of the blast and one installed behind the blast. Monitoring shall be performed by an independent third party engineering firm with specialization in blasting and monitoring.

3. The guideline limits for vibration and overpressure as stipulated in the Model Municipal Noise Control By-law publication NPC 119 shall be adhered to.

4. Orientation of the aggregate extraction operation will be designed and maintained so that the direction of the overpressure propagation and flyrock from the face will be away from structures as much as possible.

5. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with applicable guidelines and regulations. Decking, reduced hole diameters and sequential blasting techniques will be used to ensure minimal explosives per delay period initiated.

6. Clear crushed stone will be used for stemming.

7. Primary and secondary dust collectors will be employed on the rock drills to keep the level of rock dust to a minimum.

8. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

9. Detailed blast records shall be maintained. The MOE (1985) recommends that the body of blast reports should include the following information:

   - Location, date and time of the blast.
   - Dimensional sketch including photographs, if necessary, of the location of the blasting operation, and the nearest point of reception.
   - Physical and topographical description of the ground between the source and the receptor location.
   - Type of material being blasted.
   - Sub-soil conditions, if known.
   - Prevailing meteorological conditions including wind speed in m/s, wind direction, air temperature in ^{o}C, relative humidity, degree of cloud cover and ground moisture content.
   - Number of drill holes.
   - Pattern and pitch of drill holes.
   - Size of holes.
   - Depth of drilling.
   - Depth of collar (or stemming).
   - Depth of toe-load.
   - Weight of charge per delay.
   - Number and time of delays.
   - The result and calculated value of Peak Pressure Level in dB and Peak Particle Velocity in mm/s.
   - Applicable limits.
   - The excess, if any, over the prescribed limit.

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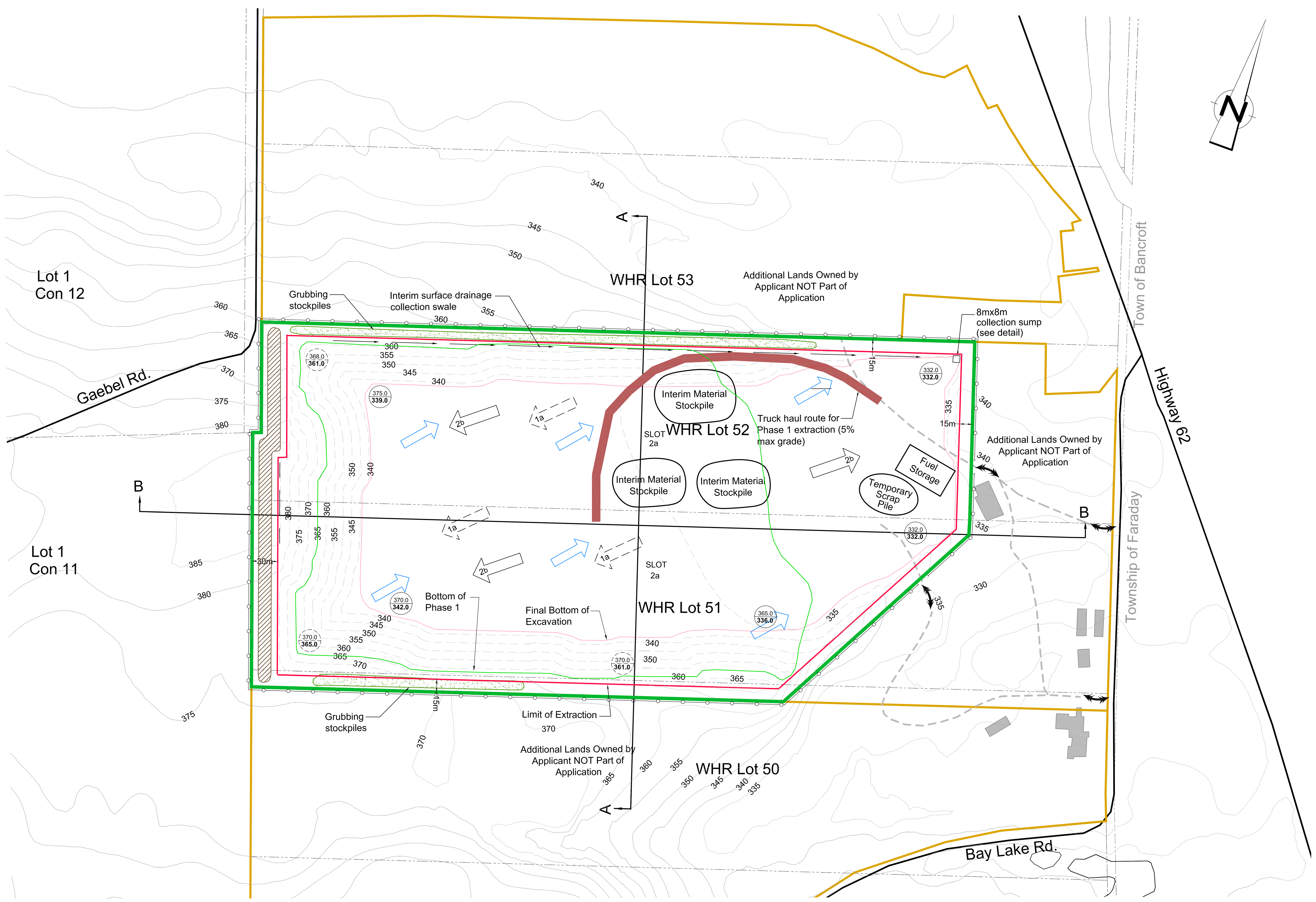
CONCLUSION

The blast parameters described within this report will provide a good basis for the initial blasting operations at this location. As site specific blast vibration and overpressure data becomes available, it will be possible to refine these parameters on an on-going basis.

Blasting operations required for operations at the proposed Freymond Quarry site can be carried out safely and within governing guidelines set by the Ministry of the Environment.

Modern blasting techniques will permit blasting to take place with explosives charges below allowable charge weights ensuring that blast vibrations and overpressure will remain minimal at the nearest receptors.

Appendix A



Spills Response Plan

All employees and contractors must obey the following instructions when handling potential contaminates. Failure to comply with the following will result in immediate dismissal.

All employees and contractors handling fuel and/or other potential contaminates will be instructed as to the proper, safe handling of such materials.

A skimming device, diesel operated pump and portable containers will be available at the site.

Storage of potential contaminates, ie fuel, will be stored and handled as required by Provincial Legislation.

All spills or release of contaminates must be cleaned up immediately and transported to an approved waste disposal site by a licensed hauler. Any spill must be immediately contained to prevent further spread, i.e. excavate and contain oil soaked material in a loader bucket until proper disposal can be arranged.

All spills or release of contaminates must be immediately reported to the MOEE Spills Action Centre (SAC) by telephone at 1-800-268-6060

This Spills Response Plan will be posted on site and all employees and contractors will be informed and required to comply with this plan

General Operational Notes:

Quarry operations will generally follow in sequence but may vary due to material quality or production demands. The height (max 25 metres) and number of lifts may vary.

In each phase a swale will be constructed on the north limit of the excavation to collect and direct the surface water and trapped groundwater to a collection sump. The collection sump will be constructed at the north east corner of the site to collect groundwater, runoff, and precipitation running off the extraction area. Fines and other potential contaminants introduced during blasting and quarrying will be allowed to settle or be removed at the sump.

There will be no water storage on the site other than what is collected in the sump and there is no proposed direct water discharge to surface water features.

Extraction of aggregates will extend approximately 43m below the groundwater level (determined by MTE 2013 to be 375.22 mAMSL) to 332.0 mAMSL. The final depth of extraction will not exceed that noted on these plans without prior approval of MNR.

Aggregate processing and stockpiling will generally be located on the quarry floor as shown when possible but not within 30 metres of the licensed boundary or 90 metres of a licensed boundary that abuts land in use for residential purposes. Stockpiles will not exceed 10metres in height.

Topsoil and subsoil will be stripped separately and stored in berms (minimum 3 metres high) progressively around the extraction area limits to outline this area and create a buffer for the surrounding environment. This will assist in rehabilitation of the site as required. The stockpiles and/or berms will be naturally vegetated (or seeded, if necessary).

The existing tree cover within the set back areas will provide screening of the operation. In areas to be stripped, all trees will be harvested and used for lumber or firewood.

Scrap will be stored on the quarry floor as shown and removed on an ongoing basis.

Storage of fuels and maintenance of equipment will be done in accordance with Provincial Legislation. Fuel tanks may be located throughout the site as needed. All fuel tanks will be doubled sided or placed in containment facilities large enough to hold the tanks maximum volume.

Importation of material for use in rehabilitation, i.e. topsoil and/or inert fill, may occur with prior approval of MNR.

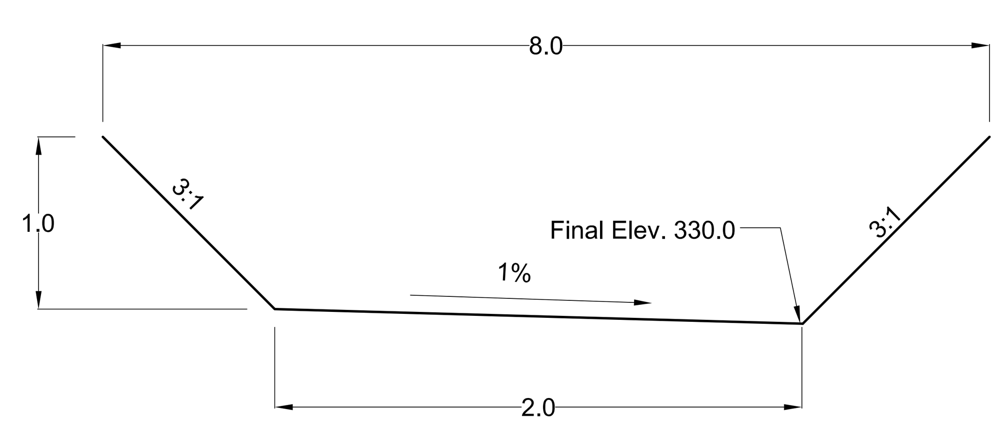
The types of equipment to be use will include but not be limited to trucks, loaders, low noise drill, scapers, excavators, portable crusher(s), and screening plants.

The area to be licensed is 35ha. The area to be extracted is 28ha.

A page wire fence with steel and wooded posts shall be constructed along the limit of the licensed area with gates provided at all ingress/egress points.

Hours of operation will generally be 07:00 - 19:00. Under normal circumstances there are no plans to operate the quarry at night.

DRAFT



Section C-C
Collection Sump Details
N.T.S.

Note:
Slopes and bottom of sump shall be finished with geotextile filter cloth overlain with 0.3 cu.m. blasted rock

Scale 1:3,000
0 100 200 300m

Legend

- Boundary of Lands Owned by Applicant
- Proposed Licensed Boundary
- Proposed Extraction Limit
- A—A Cross-Section
- Lot Line
- Existing Building
- 258 / 252 Surface Elevation / Elevation of Phase Floor
- 258 / 252 Surface Elevation / Elevation of Final Floor
- Phase 1 Direction
- Phase 2 Direction
- Proposed Entrance/Exit
- Proposed Berm - see detail pg 2 of 4
- 1.2m Page Wire Fence on steel and wood posts
- Final Surface Water Flow Direction

This site plan is prepared under the Aggregate Resources Act for a Class "A" Licence Category 2, Quarry Below Water

Freymond Aggregates

Operational Plan
Pages 2 of 4

Quarry Location:
Part of Lots 51 and 52, Concession W.H.R.
Township of Faraday
County of Hastings

Quarry Licensed To:
Freymond Lumber Ltd.
RR #1, 2287 Bay Lake Road
Bancroft, Ontario K0L 1C0

I acknowledge and shall carry on the operation of this site in accordance with the plan upon which my license is based.

Applicant Name Date

Site Plans Approved By:

Ministry of Natural Resources Date

Designed and Prepared By:

GEOLOGICAL INVESTIGATIONS
Box 122, 38 Alpine Drive
Moonstone, Ontario L0K 1N0
Bus/Fax (705) 835-5636
geologicalinvestigations@sympatico.ca
William D. Fitzgerald MSc., PGeo.

Date

Site Plan Override

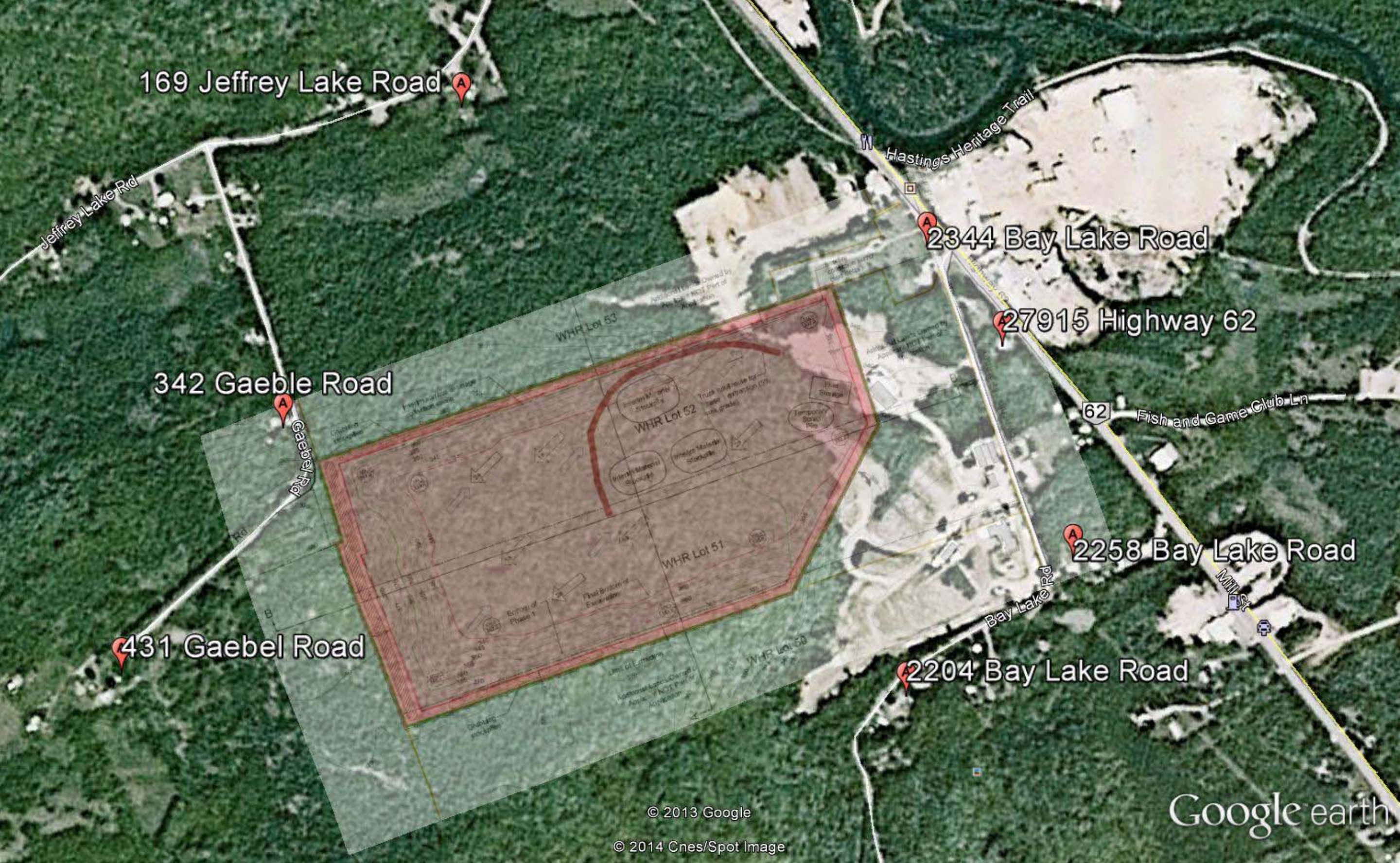
The following conditions illustrated on these plans vary from the requirements of ROS 1990 Chapter A.8; as provided for under Section 15, RRO 1990.

Item	Section

Site Plan Amendments

No.	Date	Submission/Amendment	Approved by

Plotted Oct 2 2013



169 Jeffrey Lake Road
Jeffrey Lake Rd
Hastings Heritage Trail
2344 Bay Lake Road
27915 Highway 62
WHR Lot 53
342 Gaeble Road
Gaebel Rd
WHR Lot 52
62
Fish and Game Club Ln
WHR Lot 51
2258 Bay Lake Road
Mill St
Bay Lake Rd
431 Gaebel Road
2204 Bay Lake Road
© 2013 Google
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Google earth

Appendix B

Freymond Quarry

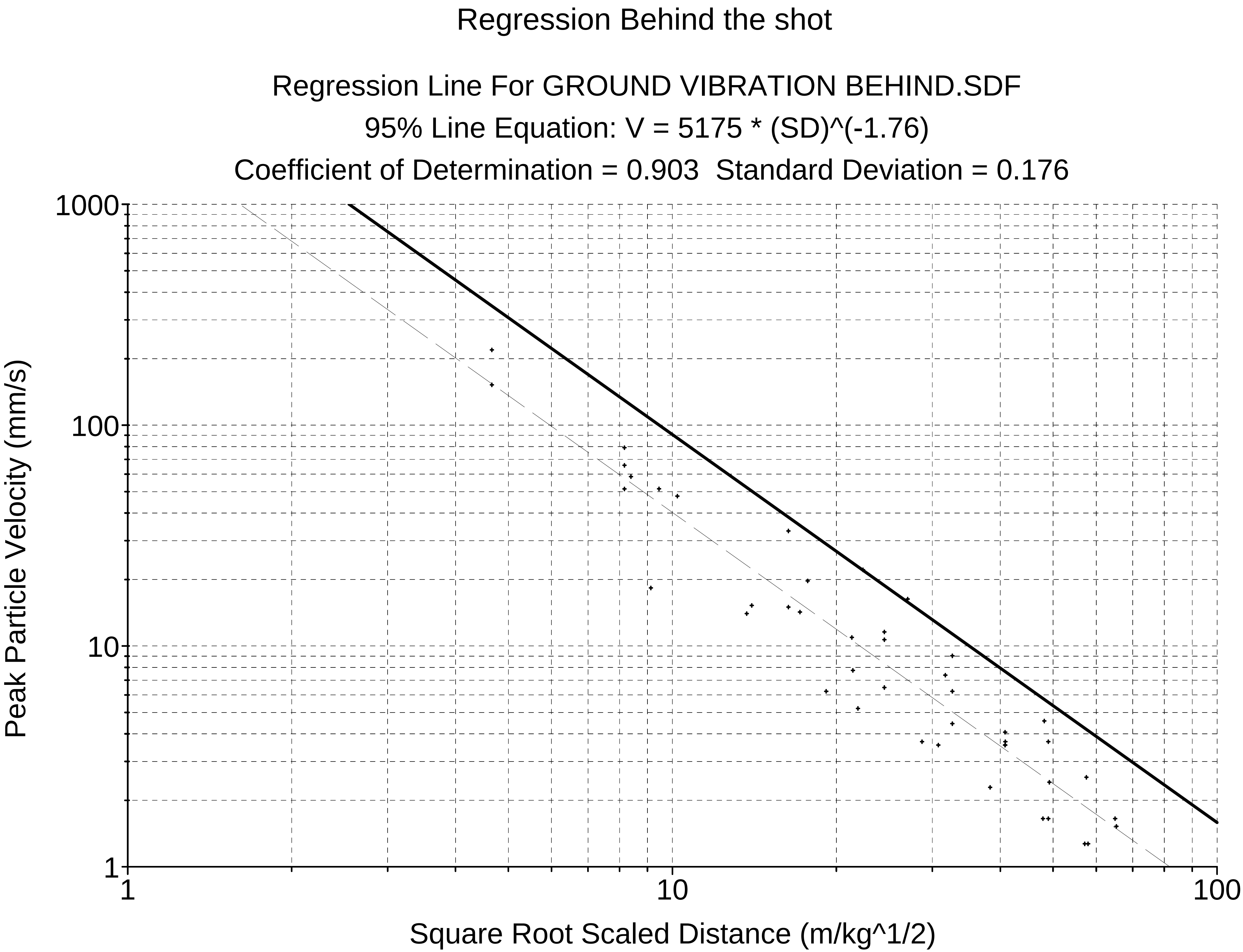
PREVAILING METEOROLOGICAL CONDITIONS

Medians provided by Environment Canada

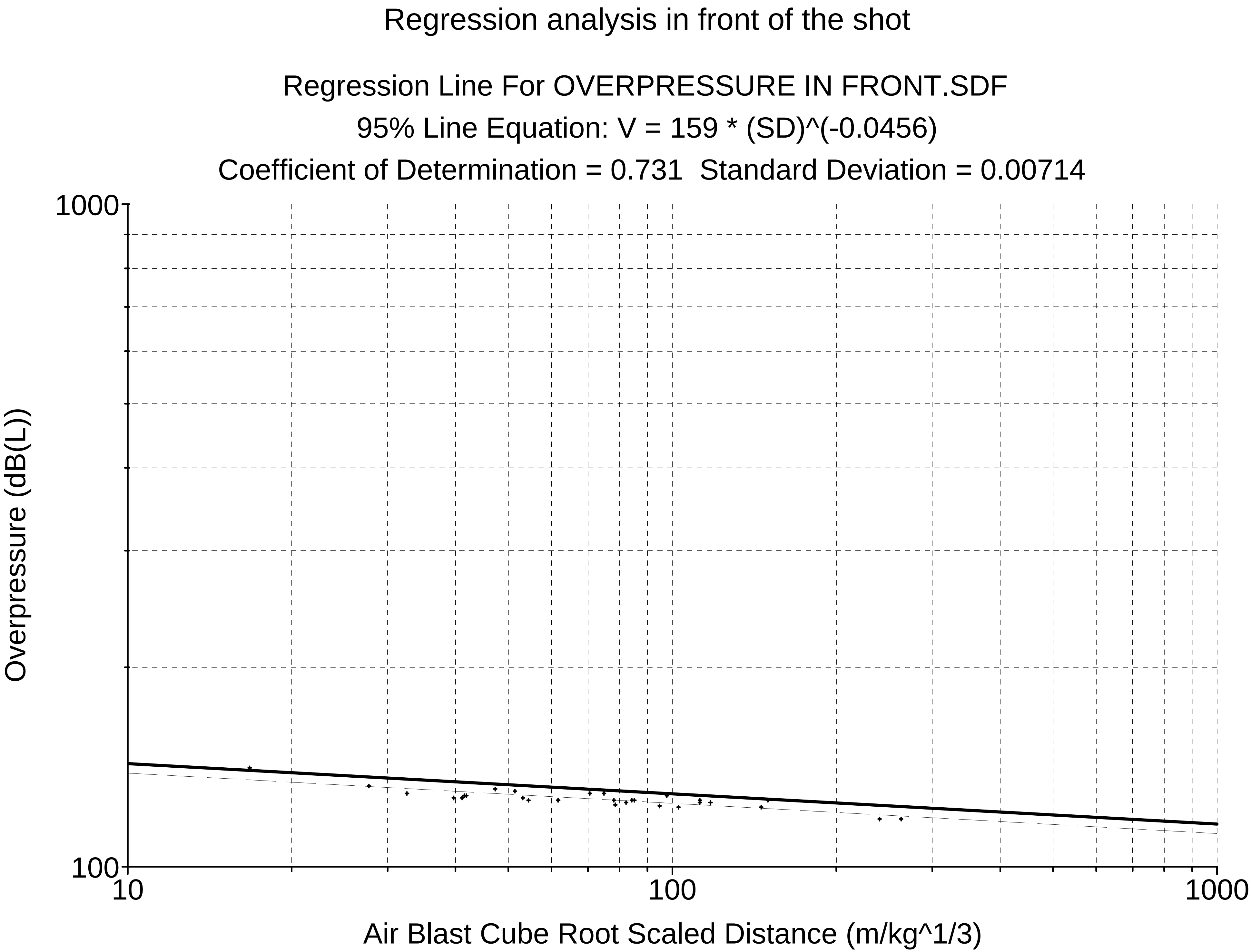
Date	Wind Direction	Wind Velocity Km/h	Temperature (Deg Celsius)
January	W	11.9	-10.0
February	W	12.5	-14.0
March	W	12.4	-7.9
April	W	12.6	0.9
May	W	12.2	11.6
June	W	11.2	14.5
July	W	10.1	18.2
August	W	10.0	16.4
September	W	10.1	12.6
October	W	11.7	4.6
November	W	12.6	-1.1
December	W	11.7	-8.8

** Data is not available specifically for the proposed quarry location.
Nearest weather station is Killaloe/Bonnechere Airport in Killaloe, Ontario
** Data is based on averaged climate normals gathered 1955 – 1980.

Appendix C



Regression Behind the shot
Regression Line For GROUND VIBRATION BEHIND.SDF
95% Line Equation: V = 5175 * (SD)^(-1.76)
Coefficient of Determination = 0.903 Standard Deviation = 0.176
1000
100
10
1
1
10
100
Peak Particle Velocity (mm/s)
Square Root Scaled Distance (m/kg^1/2)


Regression analysis in front of the shot
Regression Line For OVERPRESSURE IN FRONT.SDF
95% Line Equation: V = 159 * (SD)^(-0.0456)
Coefficient of Determination = 0.731 Standard Deviation = 0.00714
1000
100
Overpressure (dB(L))
10
100
1000
Air Blast Cube Root Scaled Distance (m/kg^1/3)

Appendix D

René A. (Moose) Morin, P. Eng.

Co-owner, Principal of Explotech Engineering Ltd.

EDUCATION

B. Sc. Mining Engineering, University of Alberta 1959
Summer Management Program University of Western Ontario
Extension English - Queen's University
Extension French - University of Montreal

PROFESSIONAL AFFILIATIONS

P. E. O. O.I.Q.
Canadian Institute of Mining and Metallurgy (CIMM)
International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

Since 1958, Mr. Morin has specialized in drilling and blasting phases of mining, quarrying and construction throughout Canada as well as offshore. This experience includes all aspects of drilling, blast design, blast control, operations and management. Mr. Morin has been accepted as an expert witness in the field of explosives and blasting in provincial and federal courts as well as at Municipal Board hearings in Ontario.

INSTANTEL INC., the world leader in digital blasting seismographs was created by Mr. Morin and Mr. Doyle some twenty years ago.

PROFESSIONAL RECORD

1979- Present	**- Owner/Principal, Explotech Engineering Ltd.**
1977 - 1979	**- Manager Operations, Armac Drilling and Blasting**
1961 - 1977	**- Various responsibilities, starting as Branch Manager in Western Quebec, through Construction Sales Manager, Bulk Products Manager and National Sales Manager DuPont of Canada Explosives Division.**

EXPLOTECH

Robert J. Cyr, P. Eng.

Associate, Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Civil Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
International Society of Explosives Engineers (ISEE)
Aggregate Producers Association of Ontario (APAO)
Canadian Institute of Mining and Metallurgy (CIMM)

SUMMARY OF EXPERIENCE

Over twenty years experience in many facets of the construction and mining industry has provided the expertise and experience required to efficiently and accurately address a comprehensive range of engineering and construction conditions. Sound technical training is reinforced by formidable practical experience providing the tools necessary for accurate, comprehensive analysis and application of feasible solutions. Recent focus on vibration analysis, blast monitoring, blast design, damage complaint investigation for explosives consumers and specialized consulting to various consulting engineering firms.

PROFESSIONAL RECORD

2001 – Present	-Project Engineer, Explotech Engineering Ltd.
1996 – 2001	-Leo Alarie & Sons Limited - Project Engineer/Manager
1993 – 1996	-Rideau Oxford Developments Inc. – Project Manager
1982 – 1993:	-Alphe Cyr Ltd. – Project Coordinator/Manager/Engineer

Appendix E

EXPLOTECH

Blasting Terminology

ANFO:	Ammonium Nitrate and Fuel Oil – explosive product
ANFO WR:	Water resistant ANFO
Blast Pattern:	Array of blast holes
Body hole:	Those blast holes behind the first row of holes (Face Holes)
Burden:	Distance between the blast hole and a free face
Column:	That portion of the blast hole above the required grade
Column Load:	The portion of the explosive loaded above grade
Collar:	That portion of the blast hole above the explosive column, filled with inert material, preferably clean crushed stone
Face Hole:	The blast holes nearest the free face
Overpressure:	A compressional wave in air caused by the direct action of the unconfined explosive or the direct action of confining material subjected to explosive loading.
Peak Particle Velocity:	The rate of change of amplitude, usually measured in mm/s or in/s. This is the velocity or excitation of the particles in the ground resulting from vibratory motion.
Scaled distance:	An equation relating separation distance between a blast and receptor to the energy (usually expressed as explosive weight) released at any given instant in time.
Spacing:	Distance between blast holes
Stemming:	Inert material, preferably clean crushed stone applied into the blast hole from the surface of the rock to the surface of the explosive in the blast hole.
Sub-grade:	That portion of the blast hole drilled band loaded below the required grade
Toe Load:	The portion of explosive loaded below grade