



REPORT ON

BLAST IMPACT ANALYSIS PROPOSED ELGINBURG QUARRY EXPANSION CITY OF KINGSTON PROVINCE OF ONTARIO

Prepared for:

Cruickshank Construction Limited
751 Dalton Avenue
Kingston, Ontario
K7M 8N6

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FINAL REPORT

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1 copy – Cruickshank Ltd. - Kingston
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DST CONSULTING ENGINEERS INC.
885 Regent Street, Suite 3-1B, Sudbury, ON, P3E 5M4
Tel: (705) 523-6680 Fax: (705) 523-6690 Web: www.dstgroup.com

EXECUTIVE SUMMARY

DST Consulting Engineers Inc. was retained by Cruickshank Construction Limited (Cruickshank) of Kingston, Ontario, to conduct a blast impact analysis for the proposed expansion of their existing and active Elginburg Quarry (The Quarry). The Quarry will be operated by Cruickshank. The Quarry is Part of Lots of 12, 13, 14, and 15, Concession 5, in the Kingston Township, Province of Ontario.

The Blast Impact Analysis report is limited to the impact of blast induced overpressure/noise and vibrations on surrounding third party sensitive and non-sensitive receptors and includes recommended site specific “Blast Design” for the proposed quarry which is based on the following:

- Observations made during our site visit carried out on February 14, 2014,
- Review of site plan drawings prepared by THE BASE MAPPING Co. LTD. Of Ottawa, Ontario, September 2016,
- Review of Natural Environment Level I (NEL-I) Report prepared by Ecological Services of Elginburg, Ontario, October 2012,
- The Ontario Ministry of the Environment and Climate Change (MOECC) Guidelines for Blasting in Mines and Quarries, 1978,
- Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters, Department of Fisheries and Oceans Canada (DFO), 1998, and
- The worst-case scenario for potential blast damage to surrounding structures from blasting operations.

The quarry will be developed from the adjacent existing Elginburg Quarry in an east to west direction, in two separate areas, north and south of the cross-site pipeline. The land north of the pipeline is referred to as “Phase North of Pipeline”, and the land south of the pipeline is referred to as “Phase South of Pipeline”. The order of the phasing will be dictated by rock quality and market demand. The quarry will operate in up to 3 lifts, depending on existing elevations, with benches at approximate elevation of 125+/- m ASL and 115+/- m ASL. The existing licensed quarry is being excavated to elevation

ranging from 121+/- m ASL and 125+/- m ASL. The existing elevation of the proposed licensed area varies from 138+/- m ASL at the north end to 133+/- m ASL in mid section and 125+/- m ASL at the southeast area boundary. Depending on rock quality and market demand, the upper and middle lift may be combined into a single lift, but the combined lift will not exceed 13+/- m. The bottom of the third lift will be at approximately 103+/- m ASL. The existing average elevation of water table is estimated to be at 125+/- m ASL. All drilling and blasting operations will be carefully controlled during the proposed production phases to ensure that no damage occurs to nearby third-party buildings or structures and the natural environment.

Vibration prediction calculations for various standoff distances are carried out based on the worst-case blast parameters scenario and the Ontario Ministry of Environment and Climate Change (MOECC) vibration and overpressure guidelines for blasting in mines and quarries in the province of Ontario. The resulting calculations indicate that the Initial blasting operations carried out at the north section of the expansion area can be carried out safely. Blast vibration and overpressure levels obtained during the initial blasting can be used to adjust blasting parameters for the remaining blasting operations to ensure all phases of the operations meet the requirements of MOECC, provided recommendations in this report are implemented.

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1.0 INTRODUCTION

The proposed expansion of the existing Elginburg Quarry is geographically located on the south side of Unity Road, east of highway 38, namely Part of Lots 12, 13, 14, 15, Concession 5, Kingston Township, in the Province of Ontario. The proposed expansion area is bordered by Unity Road on the north, by existing quarry on the east, by farmland on the west and by K&P Rail Trail corridor and farmland on the south. The licenced area consists of approximately 73.8 Hectares with 63.4 Hectares of operational area. The applicant intends to extract aggregate under Class A, Category 2 Licence, with annual extraction of up to 1,000,000 tonnes. The extraction commences from established benches in the existing quarry. The proposed operation will primarily extract dolomitic limestone rock formed in horizontal strata layers with an average density of 2.8-2.9 g/cc. The site plan drawings showing proposed licenced area, information pertaining to mineral extraction, and the closest third-party properties within 120 m of the proposed licenced area. Site plan drawings are attached in Appendix "A".

There are a number of residential sensitive receptors located within the proximity of the proposed licenced boundary. Of these receptors, two are located within 120 m of the proposed expansion. There are additional 30 receptors located within 500 m. Some of the additional receptors may not be occupied, and thus are not considered sensitive.

The Blast Impact Analysis and blast design, recommended later in this report, is based on the Ontario Ministry of Environment and Climate Change (MOECC) Model Municipal Bylaw (NPC 119) with regard to Guidelines for Blasting in Mines and Quarries (1978) as well as Department of Fisheries and Oceans Canada (DFO) Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (1998). In the absence of adequate existing site-specific blast induced vibration and noise data, predictive formulas recommended by the International Society of Explosive Engineers are used. The reason for lack of reliable site-specific data, for the purpose of establishing regression curve is explained later in this report.

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 third-party receptor in the area.

2.0 BLASTING PRACTICES AT EXISTING ELGINBURG QUARRY

Cruickshank Limited currently operates a multi-bench quarry at the existing Elginburg Quarry. Based on existing operations, bench heights vary from 5.2+/- m to 10.7+/- m. Boreholes are drilled on a pattern ranging from 2.74 m (9') burden by 3.1 m (10') spacing to 3.1 m (10') burden by 3.1 m spacing pattern with a 102 mm (4") diameter drill bit. Boreholes are loaded with Ammonium Nitrate Fuel Oil (ANFO) dry blasting agent (pored) and primed with a 50 mm (2") diameter cartridge of cap-sensitive emulsion or Nitro-glycerine based explosive. A minimum collar of 1.5 m (5') is maintained for explosive confinement. The collar is increased to 1.8 m (6') or more in front holes when it is deemed necessary. Quantity of explosives per delay period (based on a single hole/delay) ranges from 20+/- kg to 65+/- kg. Blasts are monitored for vibration and overpressure levels at the closest sensitive receptors (two locations) and only for vibration levels at the closest point of pipeline corridor. Borehole diameter and drilling pattern are reduced when 40 m setback distance to the pipeline corridor and 15 m setback distance to power transmission line towers is approached.

3.0 RECEPTORS AND WATER BODIES

As stated previously, there are several third-party receptors located in the vicinity of the proposed quarry expansion area. There is also a pipeline corridor containing pipelines owned by Enbridge and TransCanada Pipelines Limited (TCPL) which runs through the existing and proposed expansion licenced area. In addition, there is a Power Transmission line with towers running east-west through the north phase on the expansion area. Historical vibration data recorded on the Enbridge and Trans Canada pipelines have been well within the required 50 mm/s PPV limit imposed by Enbridge and TCPL. Vibration Exceedance at the pipeline is not anticipated since MOECC's guidelines are more stringent. However, when blasting approaches the 40 m setback distance from the pipelines, and 15 m setback distance from the power transmission

towers, adjustments to blasting parameters (reduction in hole diameter, and/or multiple decking of explosive charges) will be required in order to meet the vibration level requirements. The addresses of all receptors located within 500 m of the proposed expansion area are listed below.

1. 2490 Unity Road,
2. 2467 Unity Road,
3. 2559 Unity Road,
4. 2528 Unity Road
5. 2611 Unity Road,
6. 2610 Unity Road,
7. 2604 Unity Road,
8. 2250 Cordukes Road,
9. 2243 Cordukes Road,
10. 2242 Cordukes Road,
11. 2217 Cordukes Road,
12. 2166 Cordukes Road,
13. 2150 Cordukes Road,
14. 2147 Cordukes Road,
15. 2130 Cordukes Road,
16. 2085 Cordukes Road,
17. 2017 Cordukes Road,
18. 2075 Cordukes Road,
19. 2039 Cordukes Road,
20. 2034 Cordukes Road,
21. 2005 Cordukes Road,
22. 1998 Cordukes Road,
23. 1995 Cordukes Road,
24. 1989 Cordukes Road,
25. 1986 Cordukes Road,
26. 1985 Cordukes Road,
27. 2659 Bur Brook Road,
28. 2643 Bur Brook Road,

29. 2630 Bur Brook Road,
30. 2514 Bur Brook Road,
31. 2506 Bur Brook Road, and
32. 2440 Bur Brook Road.

The closest third party inhabited building (sensitive receptor) is located at 2467 Unity Road. It must be noted that the blasting and subsequent rock extraction will be limited to areas where the rock is suitable for consumption. Thus, blasting does not necessarily occur along the licenced boundary. According to NEL-1 report, there are no existing water bodies within 120 m of the licenced boundary. The closest water-body to the proposed licenced area is a small stream located at an approximate stand-off distance of 140 m on the southeast of the licenced area. The extraction phases will be sequenced so that the blasting (direction of throw) will be to the east, northeast, and the south away from the receptors when blasting geometry allows. The existing quarry walls will also help in attenuation of overpressure/noise produced during the quarry blasting operations. Blasts will be designed so that the seismic activity induced by the blasting operations will remain well within the MOECC's vibration and overpressure guidelines and regulations for blasting in mines and quarries in the province of Ontario, and in compliance with the DFO guidelines. Aerial view of the approximate location of the proposed licenced area and surrounding third-party receptors are also shown within the highlighted area in Appendix "A".

The Blast Impact Analysis and blast design, recommended later in this report, is based on the MOECC Model Municipal Bylaw (NPC 119) with regard to Guidelines for Blasting in Mines and Quarries (1978) as well as DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (1998). In the absence of adequate and reliable existing site-specific blast induced vibration and noise data, stringent predictive formulas recommended by the International Society of Explosive Engineers are used.

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 the receptors in the area, and MOECC vibration and overpressure guidelines and regulations are met.

4.0 BLAST VIBRATION AND OVERPRESSURE LIMITS

4.1 Definitions

Blast Induced Peak Particle Velocity (Vibration)

The rate of change of the amplitude, usually measured in mm/sec or in/sec. This is the excitation of the particles in the ground resulting from vibratory motion induced by the blasting operations.

Blast Induced Overpressure or Peak Sound Pressure Level (PSPL)

A compression wave in air caused by,

- a) The direct action of the unconfined explosive, or
- b) The direct action of the confining material subjected to explosive loading.

4.2 MOECC Vibration and Overpressure Limits (NPC119)

The MOECC guidelines for blasting in quarries are amongst the most stringent in North America. Recent studies by the U.S. Bureau of Mines have shown that normal temperature and humidity changes as well as other environmental factors can cause more damage to buildings and structures than blast vibrations and overpressure in the range permitted by the MOECC. The guideline limits suggested by the MOECC for routinely monitored blasts in Ontario mines and quarries are as follows:

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

A copy of NPC 119 is included in Appendix "B".

It is recommended that each and every blast be monitored for vibration and overpressure at minimum of two receptors closest to the blast.

4.3 Enbridge and TCPL Limits

Enbridge and TCPL impose a vibration limit of 50 mm/s PPV, monitored at the surface level above their pipelines. Enbridge imposes a frequency component of greater than 40 Hz. Cruickshank shall adjust the blasting parameters to comply with these vibration requirements. Location of pipeline corridor within the expansion area is shown on site-plan drawings.

4.4 Power Transmission Tower Structures

The integrity of the tower structures, we recommend maintaining the vibration levels below 50 mm/s for frequencies above 40 Hz in accordance with published research conducted by US Bureau of mines, publication RI8507. Vibrations shall be monitored at the base of the tower when vibration levels are expected to reach 40 mm/s based on prediction calculations. Location of power transmission line is shown in site-plan drawings.

4.5 Solar Farm

The effect of blast induced vibrations on solar panels are not well studied since solar energy generation is a fairly new technology. As such, there is little published articles with respect to vibration limits on solar panels, regardless of the source of vibration.

As a firm using solar panels as power supply source for our remote seismic monitoring instrumentation installed at various receptors near blasting sites, we have not observed any vibration induced damage to the solar panels powering our seismographs. However, as a precaution, we recommend that vibrations monitored at the closest solar panel to the blasting be kept below 50 mm/s. Vibration and overpressure levels should be monitored at the solar farm when vibration calculations suggest vibration levels in excess of 40 mm/s at the closest panel.

5.0 BLAST VIBRATION AND OVERPRESSURE PREDICTION CALCULATIONS

Vibration prediction calculations made in this report are based on:

- The International Society of Explosives Engineers (ISEE) recommended attenuation (regression) prediction formulas.

5.1 Vibrations

We have obtained historical vibration data from the blasting operations carried out in the existing Elginburg Quarry. This data is limited to blasting conducted in the years 2012 to 2017 and consists of vibration and overpressure records from observation points, at residential and non-residential points such as Enbridge/TCPL pipeline corridor. Due to limited number of data points (from statistical point of view), the attenuation curve and the regression formula based on historical data is not reliable for the following reasons:

- Based on records provided by Cruickshank, the historical data is limited to 29 blasts in the year 2012, 2 blasts in the year 2013, 1 blast in 2014, 8 blasts in 2015, 1 blast in 2016, and 1 blast in 2017, for a total of 42 data points.
- Historically, vibration and overpressure were monitored at same locations and at the same relative distance to the blasts. This results in a cluster of data in the same region of attenuation graph which results in erroneous site-specific constants (i.e. k and e as defined in Section 6 of this report) in the regression formula.
- Statistically, number of data at different distances and quantity of explosives per delay period is limited for a reliable site-specific attenuation curve.
- Historical vibration and overpressure data has been collected for compliance purposes, and not for the attenuation development purposes.
- For a reliable development of a site-specific attenuation curve, a series of blasts must be monitored at various distances from each blast over a period of time in the existing Elginburg Quarry. This data can be used to develop a site-specific

attenuation curve. The site-specific attenuation curve can then be refined with adding more data points as the blasting and monitoring progresses through the life of the quarry.

- Based on William Gosset “rule-of-thumb”, a 30-sample data point may be sufficient for initial statistical analysis provided each data point is replicable (can be duplicated). For those who carry out blasting on a routine basis, it is clear that each blast is unique, and will not produce exact result including vibration and overpressure levels even when the blasting parameters are kept the same. However, site-specific attenuation curve with minimum data points is a good starting point, and can be used as one of the tools to predict vibration levels at a given distance from a blast. Thus, for the purpose of development of attenuation curve, it is prudent to collect a large number of data points for a single blast at various standoff distances.

Review of historical data (2012-2017) provided by Cruickshank indicates no vibration and overpressure exceedances with respect to MOECC regulations and imposed third party (Enbridge/TCPL) vibration limits. Copies of reviewed historical vibration and overpressure data is attached in Appendix “C”.

5.2 Overpressure

It is our experience that blast overpressure creates the greatest concern for nearby residents. However, blast induced overpressure is highly variable and influenced by many factors including:

- Orientation of the blast face with respect to the monitoring observation point,
- Wind speed and direction,
- Cloud Cover,
- Possible temperature and/or pressure inversions, and
- Length of collar within the borehole and the material used for stemming.

Due to high dependence of noise and overpressure induced by the blasting on the variables indicated above, it is very difficult to predict peak sound pressure levels induced by the blasting. However, we have outlined the best possible remedial measures as well as a mathematical method of predicting overpressure levels for designing blasts in a manner to keep the noise and overpressure within MOECC's recommended level. It must be noted that mathematical method of predicting blast induced overpressure should be considered as a tool and not a rule.

6.0 PREDICTION OF VIBRATION LEVELS

The most commonly used formula for predicting PPV is known as the Bureau of Mines (BOM) prediction formula or Propagation Law. This formula is used as a standard engineering tool to predict vibration levels induced by the blasting at a given distance from a source of explosion (blast) and is also adopted by the MOECC. Since the attenuation formula for upper bound typical data recommended by the ISEE is more conservative than the attenuation established by MOECC, we have used the site constants recommended by ISEE to predict the PPV at the closest third-party structure for a given explosives load per delay period.

$$PPV_{\max} = K [d \times w^{-1/2}]^e$$

Where, PPV = the predicted maximum 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 the ISEE recommended value the

initial estimates for “e” will be set at -1.6 and “K” will be set at 1725 (see Appendix “D”). In the absence of adequate site-specific vibration data from the existing quarry, these site factors are used for initial prediction purposes. Based on our experience, in almost all cases, the site-specific vibrations monitored at the time of blasting are lower than those predicted.

According to the site-plan drawings, initial blasting for the proposed expansion will commence along the existing high-wall at the southeast corner of “Phase North of Pipeline” at an approximate distance of 430 m from the closest sensitive receptor (2467 Unity Road) and continue westward. The closest point of high-wall for the initial first series of blasting along the east high-wall at the north boundary of the expansion area from the same receptor will reach to a standoff distance of approximately 206 m. Bench height for the first lift varies from 8.9 m (for initial blasting) to 12.5 m at the north boundary of excavation. An example of this calculation for initial blasting in the proposed expansion area is as follows:

For example, for a standoff distance of 430 m a maximum explosives weight of 51.1 kg per delay period (for a max. 102 mm diameter hole, max. 8.9 m deep and a min. 1.5 m collar), and a one hole per delay period detonation, loaded with poured ANFO explosives of average density 0.85 g/cc, we can predict the maximum PPV at the closest sensitive receptor.

$$\text{PPV}_{\text{max}} = 1725 [430 \times 51.1^{-1/2}]^{-1.6} = 2.46 \text{ mm/s} = 0.10 \text{ in/s}$$

Similarly, on a worst-case scenario, for a standoff distance of 206 m (where initial blasting will reach the north boundary) a maximum explosives weight of 76 kg per delay period (for a max. 102 mm diameter hole, max. 12.5 m deep and a min. 1.5 m collar), and a one hole per delay period detonation, loaded with poured ANFO explosives of average density 0.85 g/cc, we can predict the maximum PPV at the closest receptor.

$$\text{PPV}_{\text{max}} = 1725 [206 \times 76^{-1/2}]^{-1.6} = 10.9 \text{ mm/s} = 0.43 \text{ in/s}$$

Maximum allowable quantity of explosives per delay period for various distances to conform to regulatory requirements are presented in Table 1.

Table 1: Maximum allowable explosive load per delay period to conform to MOECC guideline limit for blasting in mines and quarries and TCPL/Enbridge guideline Limit Using ISEE recommended regression equation

Distance to Receptor (m)	Max. Explosive/Delay (kg)	Max. Explosive/Delay (kg)
	PPV = 12.5 mm/s MOECC Limit	PPV = 50 mm/s TCPL/Enbridge/Tower
50	5	27
75	12	60
100	21	107
125	33	166
150	48	237
175	65	322
200	85	419
225	107	529
250	132	651
275	160	786
300	190	933
325	223	1093
350	259	1266
375	297	1450
400	338	1647

It must be noted that since the ISEE regression formula is mainly based on data collected at range of distances closer to the blast, scatter can be clearly noticed in the upper range of distances. It is therefore prudent to rely on the predicted PPV levels in the ranges from 50 to 500 m.

At some point of proposed extraction within the “Phase North of Pipeline”, the high-wall at the northwest section will reach standoff distance of approximately 100 m from

sensitive receptors located at 2467 and 2528 Unity Road. To mitigate vibration and overpressure levels produced by the blasting, Cruickshank must reduce borehole diameter, bench height or apply multiple decking of charges in the boreholes in order to reduce the quantity of explosives per delay period to keep vibration and overpressure levels monitored at these receptors within MOECC's requirement levels (refer to Table 1 for allowable quantity of explosives per delay period for standoff distances. i.e. 21.1 kg at a standoff distance of 100 m).

7.0 PREDICTION OF OVERPRESSURE LEVELS

As discussed in previous sections, the MOECC guideline for blast-induced overpressure monitored at the closest sensitive receptor is 128 dB(L). Since factors such as climatic conditions affecting the overpressure levels induced by the blasting are highly variable and are not the same on a given day, predicting noise and overpressure based on explosives load is extremely difficult. There are, however, factors that can be controlled and observed, such as length of blast-hole collar, avoidance of blasting on an overcast day and during temperature inversion that can minimize the impact of noise and overpressure induced by blasting operations. In our experience, attention to these details will result in compliance with the MOECC guidelines for noise and overpressure.

As an added benefit, use of Cube-Root Scaling Law for calculating predicted overpressure levels recommended by ISEE for average climatic conditions, explosives confinement for overpressure suppression (minimum 1.5 m collar stemmed with ¾" crushed stone), and a maximum explosives weight per delay period can be used for prediction purposes. An example of this calculation using the same parameters for vibration prediction calculation is presented below.

$$PSPL_{max} = 1.0 [d X w^{-1/3}]^{-1.1}$$

Where, PSPL = peak sound pressure level (kPa)

$$K, e = \text{site factors, } K= 1.0, e= -1.1$$

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

For initial blasting:

$$\text{PSPL}_{\max} = 1.0 [430 \times 51.1^{-1/3}]^{-1.1} = 0.0053 \text{ kPa} = 5.3 \text{ Pa} = 108.46 \text{ dB(L)}$$

For setback distance of 206 m when initial blasting reaches the closest northern boundary:

$$\text{PSPL}_{\max} = 1.0 [206 \times 76^{-1/3}]^{-1.1} = 0.01394 \text{ kPa} = 13.94 \text{ Pa} = 116.86 \text{ dB(L)}$$

Where PSPL in dB(L) = 20 X Log (5XPa) +80

8.0 CALCULATION OF SETBACK DISTANCE FROM FISH HABITAT TO CONFORM TO DFO'S GUIDELINE CRITERIA OF 100 KPA

Based on DFO's formula for calculating a setback distance from fish habitat, knowing the type of substrate and the quantity of explosives per delay period, we can determine the required set back from an existing fish habitat in order to conform to the guideline of maximum overpressure of 100 kPa in the fish habitat, and PPV of 13.0 mm/s at the shore or along the side of a stream or water body induced by on-shore quarry blasting. In this case the closest fish habitat to the licenced boundary is a stream located directly on the east of the proposed licensed boundary at an approximate standoff distance of 140 m, and an approximate distance of over a kilometer from the initial blasting site.

$$V_R = 100 .0 (R/W^{0.5})^{-1.6}$$

Or after substitutions and solving for R,

$$R = (W^{0.5}) \cdot (K_{\text{rock}})$$

Where,

V_R = peak particle velocity (cm/s) = 1.3 cm/s = 13 mm/s

R = distance to detonation point (m)

$$W = \text{max. charge weight per delay period (kg)} = 76 \text{ kg}$$
$$K_{\text{rock}} = \text{substrate constant} = 5.03, \text{ for rock}$$

Therefore,

$$R = (76^{0.5}) \cdot (5.03) = 43.8 \text{ m}$$

Note: It is assumed that the rock formation being quarried extends under the stream, and thus, the K factor for rock is used in the calculation.

According to the calculation above, a minimum set back distance of 43.8 meters is required for carrying out the blasting while protecting the fish habitat (the stream). We know the closest distance from the stream to the proposed licenced boundary is approximately 140 m.

9.0 DETAILS OF RECOMMENDED BLASTING PROCEDURES

We recommend the following procedure for the blasting operations in the proposed quarry location:

- Sequential blasting techniques will be used to ensure minimum explosives per delay period is initiated. These include:
 - Non-electric blast initiation systems such as the EZ-Det / Handi-Det / Snap-Det systems or,
 - Electronic initiation system with remote detonation.
- Maximum drill-hole diameter for initial quarry blasting will be 102 mm (4"). Vibration and overpressure data acquired during initial blasting may allow for an increase in drill-hole diameter.
- Minimum collar will be 1.5 m (5 ft.).
- Bench height shall not exceed 13 m.
- Clear crushed stone will be used for stemming.
- Primary and secondary dust collectors will be employed on the rock drills to keep the level of rock dust to a minimum.

- Blasting should be avoided during overcast and temperature inversions.
- Blast-hole detonation shall be limited to a single hole per delay period, and when boreholes are decked, a single explosive deck per period.
- The quantity of explosives per delay period for initial quarry blasting shall not exceed 76 kg.

A typical blast lay out (design) is also shown in Appendix “D”.

10.0 IMPACT OF BLASTING ON WATER-WELLS

The effects of blast-induced vibrations on water wells have been studied by a number of mine operators and blasting consultants. In a study by Froedge (1983), blast vibration levels of up to 32.3 mm/s were recorded at the bottom of a shallow well located at a distance of 60 meters (200 feet) from an open pit blast. There was no report of visible damage to the well, nor was there any change in the water pumping flow rate. This study concluded that the commonly accepted limit of 50 mm/s PPV level is adequate to protect wells from any appreciable damage.

Rose et al. (1991), studied the effect of blasting in close proximity to water wells near an open pit mine in Nevada, USA. Blasts of up to 70 kilograms of explosives per delay period were detonated at a distance of up to 75 meters (245 feet) from a deep water well. There was no reported visible damage to the well. Fluctuations in water level and flow rate were evident immediately after the blast. However, the well water level and flow rate stabilized after a few days.

Matheson et al. (1997) brought together available information on the most common complaints, the possible causes of the complaints and the relation between blasting and the complaint causes. This publication stated:

“Probably the most frequent blast related complaint is that a well has ‘gone dry’. Related complaints about reductions in ground water quantity are also common. Blasting does not cause wells to go dry or reduce the water quantity available to a well. Research has shown that blasting near open borehole

wells in bedrock may actually increase the water production capacity due to opening rock fractures.

The major complaints for changes in well water production capacity include: loss of quantity production, air in water and/or water lines, damage to pump, and damage to well screen or borehole.

The review of research and common causes of these problems indicates that most of these complaints are not related to blasting and can be shown to be related to either environmental factors, poor well construction, or wells whose elements required repair or replacement prior to blasting.”

Based on observations and research, it is our professional opinion that vibrations produced by the blasting operations at the quarry proposed by Cruickshank will not affect the water wells in the area.

11.0 RECOMMENDATIONS

As it is implied by the regression equations discussed in previous sections, the most critical factors in controlling the vibrations, and to a lesser degree, overpressure levels from blasting is the distance and the maximum quantity of explosives per delay period since the predicted PPV and PSPL are directly proportional to the weight of explosives and inversely proportional to the distance. Since the distance cannot be changed from a given blast to a receptor, one can reduce the quantity of explosives per delay period to maintain the vibration levels below the acceptable levels. Reducing the quantity of explosives per delay period can be achieved by implementing combination or any one of the following measures:

- Reducing the blast-hole depth by a reduction in the bench height,
- Using multiple deck charges within the same blast-hole, and
- Reducing the blast-hole diameter with appropriate drill pattern.

For example, a reduction in a blast-hole diameter from 102 mm to 89 mm loaded with poured ANFO, would reduce the explosives weight from approximately 59 kg to 45 kg for

a 10 m deep blast-hole with a 1.5 m collar. Similarly, by introducing an extra deck (2 decks per hole), the quantity of explosives per delay period can be reduced to less than half, provided the delay per deck in the same blast-hole are different.

As indicated by the regression formula and the Table 1 in Section 6, provincial guidelines may be complied with when blasting occurs beyond 189 m from the closest inhabited building if blasting procedures remain the same as those being employed at the present Elginburg Quarry. When blasting approaches to within the 189 of receptors, change to the procedure may be required in order to conform to the provincial guidelines and regulations.

We recommend implementing a vibration monitoring program for development of a site-specific attenuation relation under controlled conditions. This can be achieved during blasting operations carried out at the existing Elginburg licensed quarry. A qualified blasting consultant can assist in establishing the procedure for collecting reliable data for this purpose.

All production blasts should be monitored for both vibration and overpressure (noise) at two closest receptors with digital seismographs. Compilation of the initial vibration and overpressure data can be used to plan subsequent blasting operations. This will also allow subsequent blasts to be designed specifically for this location and well within MOECC guidelines.

Seismographs should be self-triggering units capable of recording a complete waveform for blast overpressure and blast vibrations in three orthogonal directions (InstanTel Digital Seismograph or equivalent).

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

- a) Location, date and time of the blast.
- b) Dimensional sketch including photographs, if necessary, of the location of the blasting operation, and the nearest point of reception.

- c) Physical and topographical description of the ground between the source and the receptor location.
- d) Type of material being blasted.
- e) Sub-soil conditions, if known.
- f) Prevailing meteorological conditions including wind speed in m/s, wind direction, air temperature in °C, relative humidity, degree of cloud cover and ground moisture content.
- g) Number of drill holes.
- h) Pattern and pitch of drill holes.
- i) Size of holes.
- j) Depth of drilling.
- k) Depth of collar.
- l) Depth of toe-load if any.
- m) Weight of charge per delay period.
- n) Number and time of delays.
- o) The result and calculated value of Peak Sound Pressure Level (PSPL) in dB(L) and Peak Particle Velocity (PPV) in mm/s.
- p) Applicable limits.
- q) The excess, if any, over the prescribed limits.

The blast parameters described within this report will provide a good basis for the initial blasting operations at this quarry. However, it may be possible to refine these parameters once site-specific vibration and overpressure data from the blasting operation becomes available.

Blasting procedures such as drilling and loading should be audited on an occasional basis by an independent blasting consultant to ensure full compliance with governing guidelines and regulations.

12.0 CLOSURE

The Elginburg Quarry Expansion can be developed safely and productively in the proposed licenced area, while staying within the MOECC guidelines and regulations for

blasting in mines and quarries as well as regulations of the Department of Fisheries and Oceans provided the quarry operator follows all recommendations in this report. The proposed design will allow for changes in the drilling and blasting parameters to allow for implementation of blasting practices which will be consistent with the ongoing improvements in explosives, initiation technology and blasting practices.

13.0 REFERENCES

Froedge, D. T., "Blasting Effects on Water Wells", Proceedings of the Ninth Conference on Explosives and Blasting Technique", Dallas, Texas, 1983.

Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters, Canadian Technical Report of Fisheries and Aquatic Sciences 2107, Department of Fisheries and Oceans (DFO), Canada, 1998.

International Society of Explosives Engineers (ISEE), 17th Edition of the Blaster's Handbook" Chapter 38, 1998.

Matheson, G. M., Miller, D. K., "Blasting Vibration Damage to Water Supply, Well Water Quality and Quantity", Proceedings of the Twenty-Third Conference on Explosives and Blasting Technique", Las Vegas, Nevada, 1997.

Ontario Ministry of the Environment, "Publication NPC-119, Blasting", Noise Pollution Control Section, 1982.

Rose, R., Bowles, B., Bender, W. L., "Results of Blasting in Close Proximity to Water Wells at the Sleeper Mine", Proceedings of the Seventeenth Conference on Explosives and Blasting Technique", Las Vegas, Nevada, 1991.

A copy of writer's resume is attached in Appendix "E" for your records.

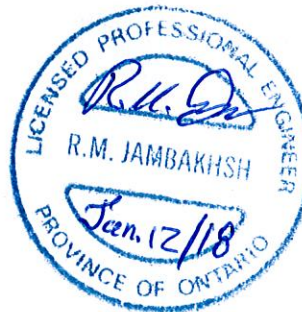
Sincerely,

For **DST CONSULTING ENGINEERS INC.**,

Prepared by:



Ray Jambakhsh, M.Sc., P. Eng.
Chief Technical Advisor, Sr. Principal



Append.

Appendix “A”

EXISTING FEATURES NOTES
 This site plan has been prepared to comply with the Provincial Standards for Bill 52 under the Aggregate Resources Act for a Category 2 Class "A" License. This license is for a quarry operation that intends to extract aggregate material from below the established water table.

Control for the site plan comes from an aerial photo taken November 2, 2009, and ground control established by GPS, Cruickshank.
 The quarry property is surrounded by mixed bush to the west, a solar farm on Lot 6 Conc. 6, a residential receptor at 2528 Unity Road, and a residential receptor at 2467 Unity Road (4 ha) to the north, mixed bush, and property owned by Cruickshank to the east, and property owned by Cruickshank to the south.

- NOTE NUMBERS BELOW REFER TO ARA CATEGORY 2 PROVINCIAL STANDARDS VERSION 1.0 -

- 1.1.10 REPORTS CONTRIBUTING TO THE OPERATION PLAN
 Hydrogeological Impact Assessment for the Expansion of the Cruickshank Elginburg Quarry, Morrison Hershfield, September 22, 2014
 Natural Environment Technical Report: Level I and II Elginburg Quarry, Ecological Services, October 2014
 Stage 1 Archaeological Assessment, Parts of Lots 12 & 13, Concession 5, Kingston Township, Frontenac County, City of Kingston, Ground Truth Archaeology & Abacus Archaeological Services, October 14, 2010
 Stage 2 Archaeological Assessment of the Elginburg Quarry Expansion, Frontenac County, Ontario, Ground Truth Archaeology, February 7, 2014
 Stage 3 Archaeological Assessment of the Albertson Lime Kiln (BbGd-59), Ground Truth Archaeology, November 17, 2014
 Stage 3 Archaeological Assessment of the Albertson Foundation (BbGd-60), Ground Truth Archaeology, November 17, 2014
 Stage 3 Archaeological Assessment of the Donovan Lime Kiln (BbGd-62), Ground Truth Archaeology, November 17, 2014
 Acoustic Assessment Report, Elginburg Quarry Expansion, Hugh Williamson Associates Inc., September 17, 2014
 Blast Impact Analysis, Proposed Elginburg Quarry, City of Kingston, Province of Ontario, DST Consulting Engineers, June 2014
 Elginburg Quarry (Unity Road) Traffic Review, IBI Group, November 2013
 Aggregate Resource Assessment, Elginburg Quarry, Kingston, Ontario, Morrison Hershfield, August 15, 2014
- Site Plans for the adjacent licenced Existing Elginburg Quarry licence number 2901 were prepared by Gorrell Resource Investigations, dated August 2002, and all supporting documentation

1.1.16 LOCATION AND USE OF BUILDINGS/STRUCTURES
 A scale house, aggregated testing lab, Ready-mix plant, asphalt plant, garage and several sheds exist on the existing quarry site. Residences within 120 m of the quarry are 2467 Unity Road, which is the 4 ha parcel adjacent and on the west side of the existing quarry, and 2528 Unity Road which is on the north side of Unity Road, west of the expansion area. There are no buildings or structures within the proposed expansion area of the site.

1.1.17 SITE ACCESS
 Access to this site is through the existing license 2901. There is also a secondary farm entrance existing west of the residential lot 2467 Unity Road on the north portion of the license boundary. (see map)

1.1.18 MAIN INTERNAL HAUL ROADS
 Main internal haul roads will be as shown, although subject to relocation as quarry progresses.

1.1.19 GROUNDWATER TABLE
 The ground water table was determined from the wells and diamond drill holes drilled on the site to vary from 134 M.A.S.L. at the north edge of the site to 106 M.A.S.L. at the south edge of the site. See cross-section this page.

1.1.20 EXISTING SURFACE WATER DRAINAGE WITHIN 120 M OF SITE
 There is a surface ditch running from north to south outside the south-east portion of the adjacent licence quarry boundary. See map this page. The ditch receives water pumped from the north part of the existing quarry through a culvert which traverses beneath the pipeline. This ditch receives water pumped from the south part of the existing quarry. The drainage ditch traverses the K&P Trail at a culvert and joins Collins Creek on the north side of Bur Brook Road. Drainage from the southern part of the expansion area currently flows overland to this same drainage feature.
 Drainage from the north part of the expansion area flows overland in the south-westerly direction to a tributary of Collins Creek.

1.1.21 FENCING
 There is existing page wire fencing running along the entire north and west boundaries of the site.

1.1.22 TREE COVER WITHIN 120 M OF SITE
 Much of the site and surrounding area is covered by mixed bush consisting of red cedar, sugar maple, and white ash. See map this page.

1.1.23 EXISTING STOCKPILES OF TOPSOIL AND OVERBURDEN
 No topsoil or overburden on-site. Site is undisturbed.

1.1.24 EXISTING AGGREGATE STOCKPILES
 None.

1.1.25 EXISTING SCRAP LOCATIONS
 There are no existing scrap locations.

1.1.26 EXISTING FUEL STORAGE
 There is no existing fuel storage on the site.

1.1.27 SIGNIFICANT NATURAL FEATURES ON AND WITHIN 120 M OF SITE
 There is a Significant Woodland outside the south boundary of the site. The site boundary does not cross a 30 metre imposed buffer.

1.1.28 SIGNIFICANT MAN-MADE FEATURES ON AND WITHIN 120 M OF SITE
 The site is transected from east to west by three gas pipelines. Two Trans-Canada Pipelines to the north and Enbridge to the south. An extraction setback of 40 m will be maintained north and south of the right-of-ways of the corridor.
 The site is transected from northwest to southeast by an electrical transmission line. There are 2 towers on the site, as shown on the map (this page).

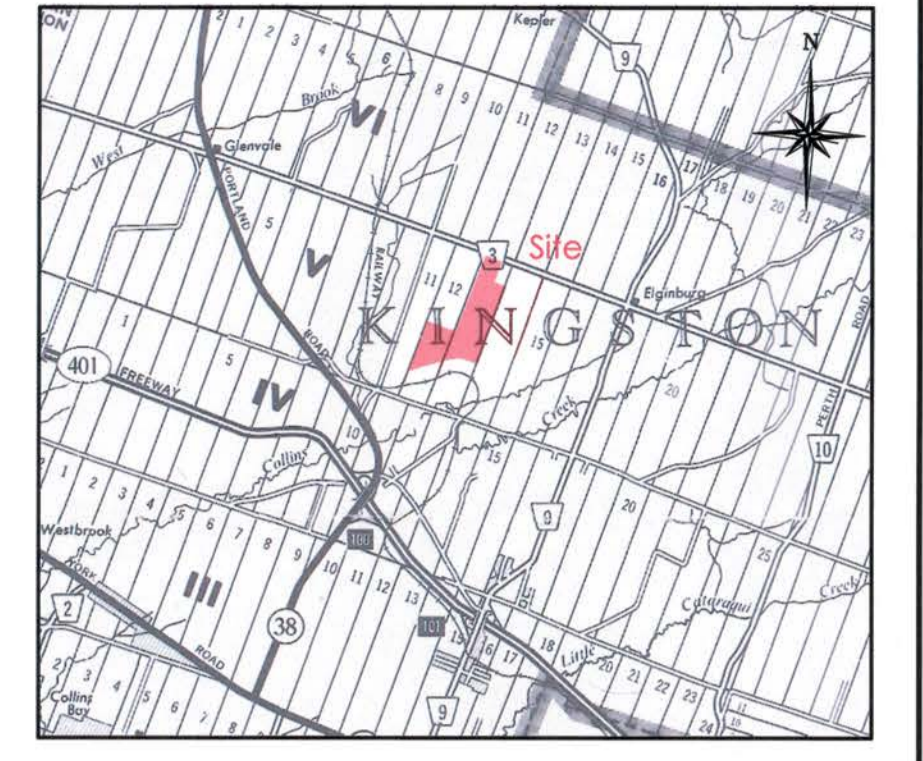
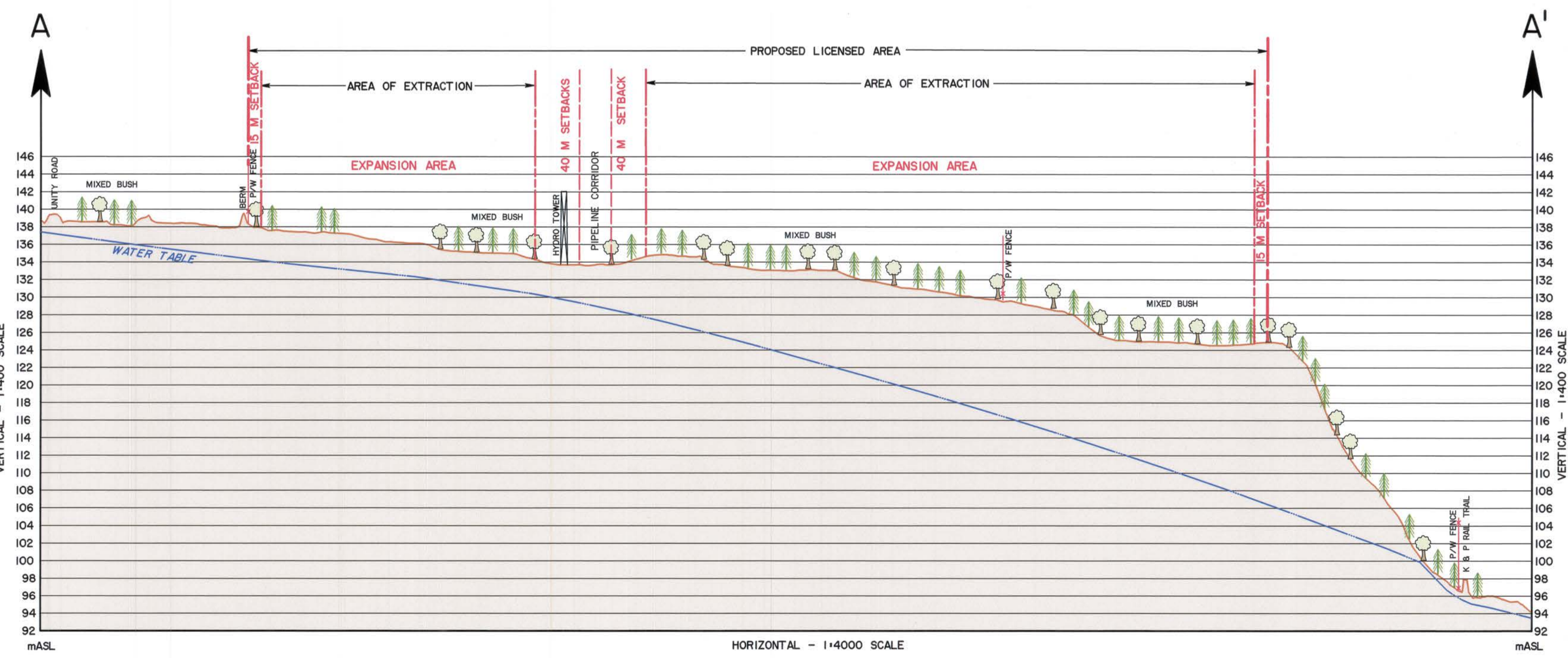
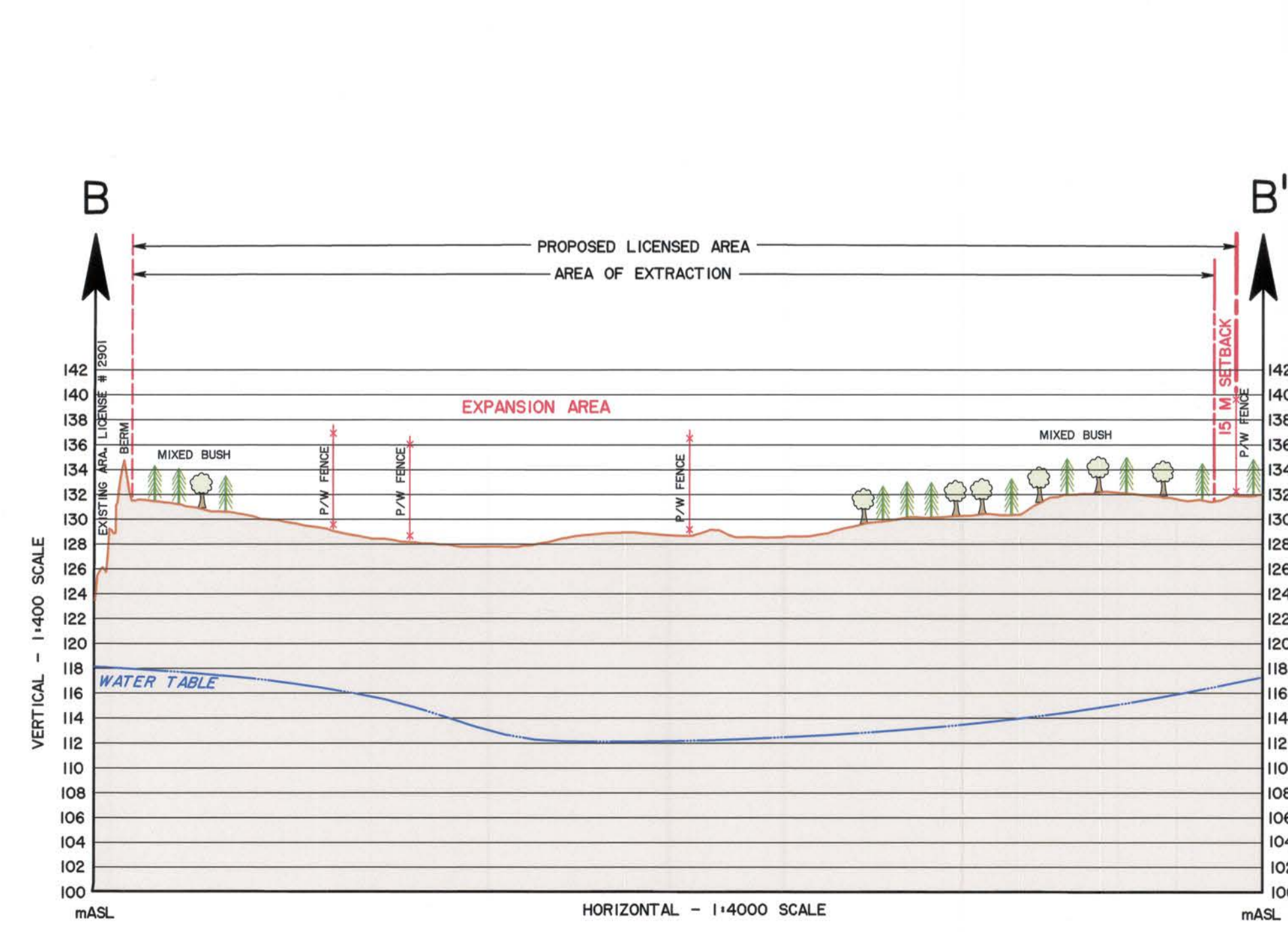
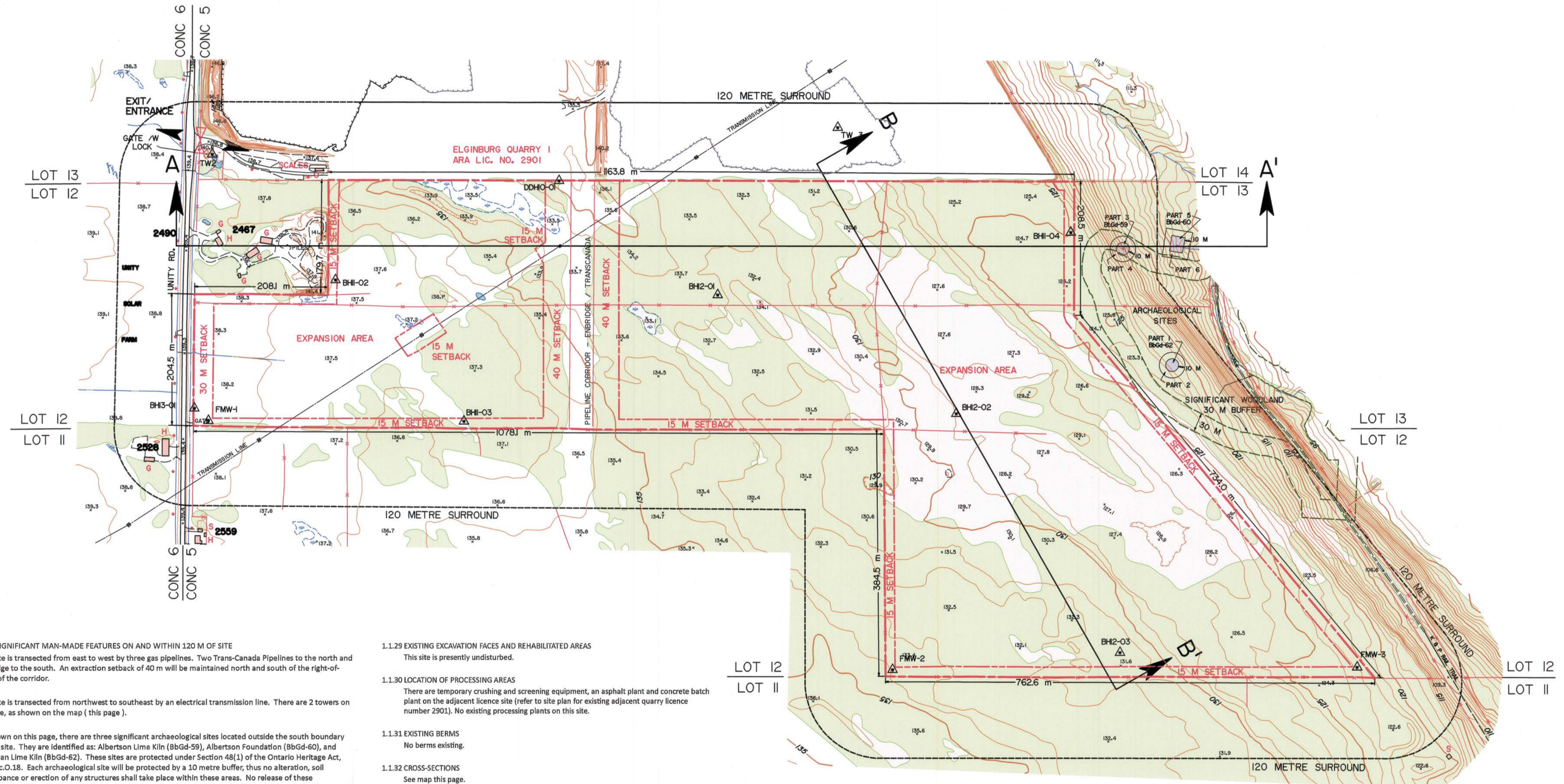
1.1.29 EXISTING EXCAVATION FACES AND REHABILITATED AREAS
 This site is presently undisturbed.

1.1.30 LOCATION OF PROCESSING AREAS
 There are temporary crushing and screening equipment, an asphalt plant and concrete batch plant on the adjacent licence site (refer to site plan for existing adjacent quarry licence number 2901). No existing processing plants on this site.

1.1.31 EXISTING BERMS
 No berms existing.

1.1.32 CROSS-SECTIONS
 See map this page.

As shown on this page, there are three significant archaeological sites located outside the south boundary of the site. They are identified as: Albertson Lime Kiln (BbGd-59), Albertson Foundation (BbGd-60), and Donovan Lime Kiln (BbGd-62). These sites are protected under Section 48(1) of the Ontario Heritage Act, R.S.O. c. 9.18. Each archaeological site will be protected by a 10 metre buffer, thus no alteration, soil disturbance or erection of any structures shall take place within these areas. No release of these restrictions will be given until such time as a licenced consultant archaeologist has recommended in a report that the archaeological site has no further cultural heritage value or interest and the Ministry of Tourism, Culture and Sport has stated its satisfaction with that report and entered it into the Ontario Public Register of Archaeological Reports according to Section 48(3) of the Ontario Heritage Act.



EXISTING FEATURES / SITE

- NOTES**
- LICENCED AREA 73.8 HECTARES.
 - AREA OF OPERATION 63.4 HECTARES.
 - EXISTING DISTURBED AREA 0.5 HECTARES.
 - THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS "A" LICENSE CATEGORY 2.
 - THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
 - LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
 - THIS IS NOT A LEGAL SURVEY DRAWING IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987. THIS DRAWING WAS PRODUCED USING STANDARD PHOTOGRAMMETRIC PRACTICES.

ELGINBURG QUARRY II
 PT LOTS 12,13,14,15, CONC 5
 GEOGRAPHIC TOWNSHIP OF KINGSTON

CRUICKSHANK CONSTRUCTION LIMITED
 751 DALTON AVENUE
 KINGSTON, ONTARIO
 K7M 8N6

- LEGEND**
- BOUNDARY OF AREA TO BE LICENSED
 - SETBACK LIMIT/LIMIT OF EXTRACTION
 - 120 M. SURROUND
 - ENTRANCE AND/OR EXIT
 - PIT/QUARRY FACE
 - PILE
 - BUILDINGS: H-HOUSE, G-GARAGE, B-BARN, S-SHED, O-OFFICE
 - P/W FENCE / GATE
 - ROAD: PAVED
 - ROAD: UNPAVED
 - TRAIL / PATHWAY
 - UTILITY POLE
 - BOREHOLE / MONITORING WELL
 - WATERCOURSE - DITCH / STREAM
 - ROCK OUTCROP
 - WETLAND
 - WATER BODY AND WATER LEVEL
 - BRIDGE/CULVERT
 - CONTOURS/INDEX CONTOURS
 - SPOT ELEVATION
 - WOODED AREA
 - CROSS SECTION

PHOTO SCALE 1:8000	ROLL NO. CAS09028	PHOTO DATE NOV. 2, 2009	SURVEY DATA NAD 83 UTM, ZN 18
MAP SCALE 1:4000	CONTOUR INTERVAL 1 METRE	DATE OF SITE PLAN SEPT. 2016	

AMENDMENTS	DATE

SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES AND FORESTRY.

SIGNATURE: _____ DATE: _____

PAGE 2 OF 4 CONTRACT 2562-13

SIGNATURE OF APPLICANT/LICENSEE: *Michael J. Moulton* DATE: *Oct. 5, 2017*

SIGNATURE: *Michael J. Moulton* DATE: *Oct. 3, 2017*

OPERATIONAL PLAN NOTES
NOTE NUMBERS BELOW REFER TO ARA CATEGORY 2 PROVINCIAL STANDARDS VERSION 1.0

1.2.1 SEQUENCE AND DIRECTION OF OPERATION
The expansion area will be developed from the adjacent Elginburg Quarry I in an east to west direction. In two separate areas, north and south of the cross-pipeline. The land north of the pipeline is called "Phase North of Pipeline", and the land south of the pipeline is called "Phase South of Pipeline". The order of the phasing will be dictated by rock quality and market demand.

1.2.2 STRIPPING AND STOCKPILING
Topsoil and overburden will be stripped seasonally, as required, to expose an area required for the season's production. Stripped material will be stockpiled into berms, used for progressive rehabilitation or stored in piles on site for future use.

1.2.3 LIFTS
The quarry will operate in up to 3 lifts, bermed at approximate elevation 125 m ASL and 115 m ASL. Depending on rock quality, market demand, and to facilitate rehabilitation, the lower bench may be mined to a steeper face provided the elevation does not exceed 25 metres in height and the upper bench can support a 2:1 slope to final water level.

1.2.4 INTERNAL HAUL ROADS
Internal haul routes will vary with the areas being developed. Only upon approval of the National Energy Board, one pipeline crossing is to be maintained between the north and south pipeline in the expansion area. The locations of the pipeline crossings may move as quarry operations advance.

1.2.5 PROPOSED ENTRANCE AND EXIT
Main entrance and exit from quarry will be through existing entrance on license 2901. There will be an entrance from existing license (2901) on both the north and south side of the pipeline.

1.2.6 GROUNDWATER TABLE AND DEPTH OF EXTRACTION
The groundwater table is sloped across the site in a mainly north to south direction. The water table elevation has been established at approximately 134 m ASL in the north to 106 m ASL at the south end of the site. The maximum depth of extraction will be 100 m A.S.L.

1.2.7 SURFACE WATER DIVERSION AND DISCHARGE
Water from the north expansion area will be pumped or will flow via gravity to the north sump on the east side of the existing quarry. From here it will flow via gravity or will be pumped through the culvert beneath the pipeline into the south quarry. This water and all other drainage from the south quarry (existing and expansion areas) will discharge via pumping from a sump or by gravity into the water course at the south side of the existing quarry. The enhanced permeability of the rock and the low water table at the south side of the quarry may allow for elimination of surface water discharge from the quarry. Discharge will be regulated under an Environmental Compliance Approval for an Industrial Sewage Works for the quarry.

1.2.8 FENCING
The property is currently fenced with the exception of the south perimeter. Current gate wire fencing will be maintained along the north and west boundaries. The south boundary will be clearly demarcated (refer to variation chart for details on other boundaries). Fencing along the south boundary will be installed within 6 months of license being issued.

1.2.9 BUILDINGS AND STRUCTURES
No new buildings are currently planned for the site. Buildings including ready-mix concrete plant, and asphalt plant on existing quarry, may be added, relocated or removed and new buildings may be added with prior approval of the MNR. A crushing plant may be located on the site and may be relocated from time to time.

1.2.10 STOCKPILES
Topsoil and overburden will be stockpiled in perimeter berms.

1.2.11 AGGREGATE STOCKPILES AND RECYCLED MATERIALS
Stockpiles may be constructed on the floor of the extraction. Typically, stockpiles will rise no higher than 20 m above the original ground elevation. Imported recycle materials will include asphalt grindings, concrete with re-enforcement bar removed, glass and porcelain and sand materials to blend and feed asphalt and concrete plant and crushing and screening plants.

1.2.12 SCRAP AREAS
Scrap will be kept in a designated area on site and may be relocated from time to time.

1.2.13 FUEL STORAGE
Fueling is restricted to mobile fuel browsers and portable above ground fuel tanks in accordance with the Technical Standards and the Safety Act and regulations. Underground tanks are prohibited. If portable fuel tanks are required, they would consist of double walled tanks and containment areas and would be located away from ponds and open water areas on original ground grade.

1.2.14 AREA TO BE EXTRACTED
The total area of extraction is 74 hectares, broken down as follows:
- expansion area north of the pipeline: 15.4 hectares
- expansion area south of the pipeline: 48.0 hectares

1.2.15 LOCATION OF ALL EXCAVATION SETBACKS
See plan for location of setbacks. Setback from pipeline corridor may be reduced to 20 m from 40 m to match existing quarry, only upon approval from the National Energy Board.

1.2.16 FINAL ELEVATION
See plan for final elevation.

1.2.17 PROCESSING AREAS
All processing equipment on site will be portable and be relocated as the quarry progresses.

1.2.18 BERMS
Berms will be constructed of overburden and topsoil. The topsoil and overburden will be constructed into berms to provide visual buffers along the north, west, and south property boundaries. The berms around residential lot and plant areas are noise attenuation berms to lessen impacts on residential receptor as per Acoustical report. Typically, these berms will be 3m high with a minimum side slope of 2:1. Continuous berms on the north and west side of the north expansion area shall be established prior to rock drilling.

1.2.19 BERM VEGETATION AND MAINTENANCE
Berms will be seeded with a suitable field grass mix upon development. Vegetation will be maintained as necessary to prevent erosion.

1.2.20 EQUIPMENT AND EQUIPMENT STORAGE
Various handling, excavation and haulage equipment will be used on site.
A crushing plant will be brought to the site as needed.

1.2.21 PROPOSED TREE SCREENS
Existing trees will be maintained where possible. Tree screens will be used to help control dust and noise.

1.2.22 HOURS OF OPERATION
Regular hours are 7 a.m. to 7 p.m. Monday to Saturday, except statutory holidays. Round-the-clock operations may be implemented if the market demands. All operations will be carried out in accordance with the recommendations of the technical studies, including the acoustic assessment report.

1.2.23 TREE AND STUMP REMOVAL
Timber will be harvested and used where possible. Debris from the trees and stumps will either be control-burned with approval, or ground into chips.

1.2.24 LOCATION OF CROSS-SECTIONS
See plan.

1.2.25 VARIATIONS FROM OPERATIONAL STANDARDS
A fence is maintained along the licensed boundary of the site, except for the east and south boundaries.

The south boundary is bordered by forest and the land is owned by the licensee. South boundary will be visually marked with stakes every 50 metres. A new fence will be installed along the southern boundary within 6 months of license being issued.

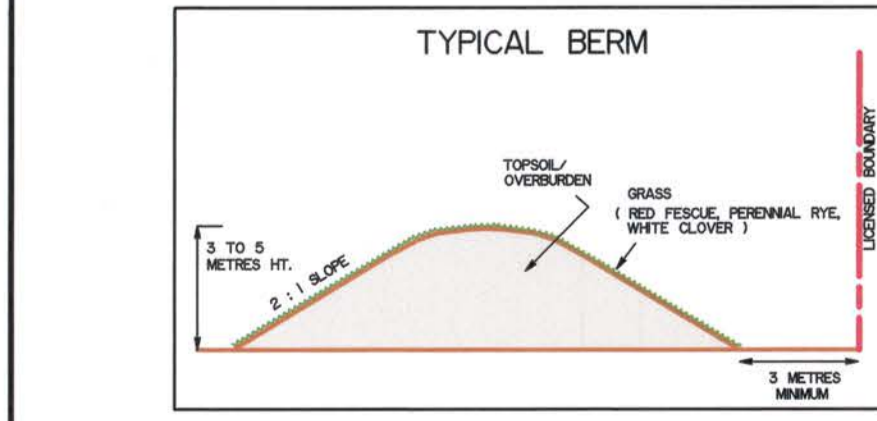
Fencing is provided for the east common boundary with quarry license number 2901.

The 15 metre setback along common boundary with license number 2901 will be relieved to 0 to the same common floor elevation as that quarry.

Regular hours of operation may be enhanced to accommodate public authority contracts and emergencies with prior notice to MNR&F (refer to operational notes 1.2.22).

1.2.26 FREQUENCY AND TIMING OF BLASTS
Blasting will not occur on a holiday or between 6 pm on any day and 8 am on the following day. All blasts will be monitored for vibration and over pressure levels.

1.2.27 MAXIMUM ANNUAL TONNAGE
No more than 1million tonnes of material shall be removed from this site in any calendar year.



1.2.28 MONITORING REQUIREMENTS
The recommendations and/or monitoring programs referenced in section 1.1.10 will be adhered to throughout the site development. Graphical components of these key recommendations are shown on these plans.

Hydrogeological Impact Assessment

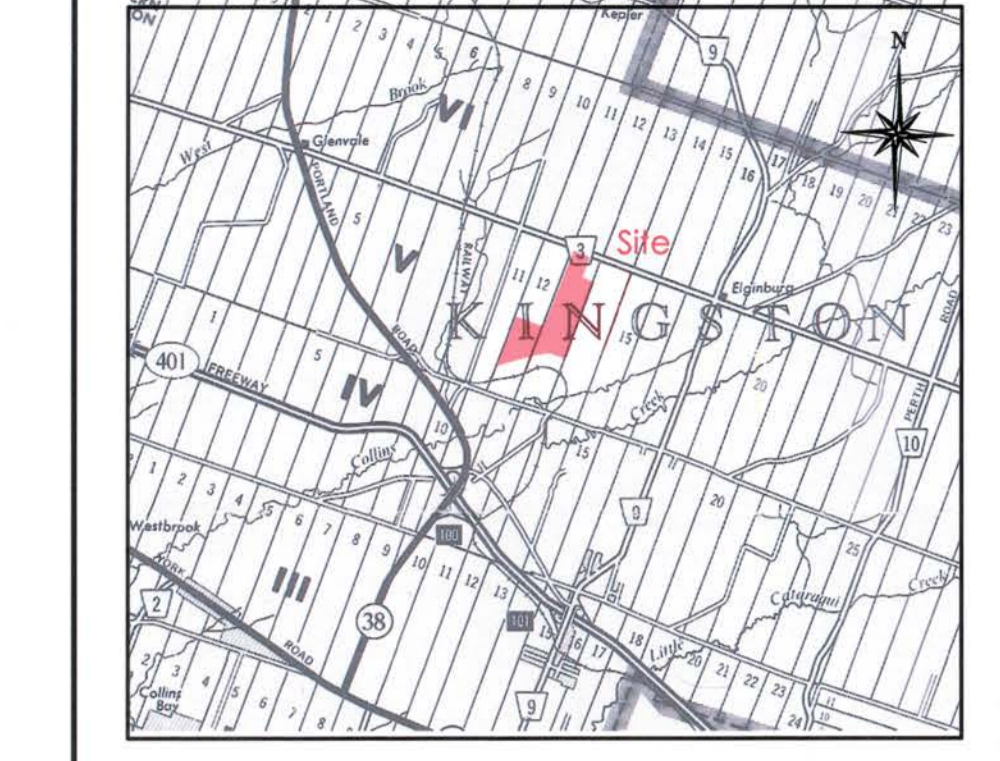
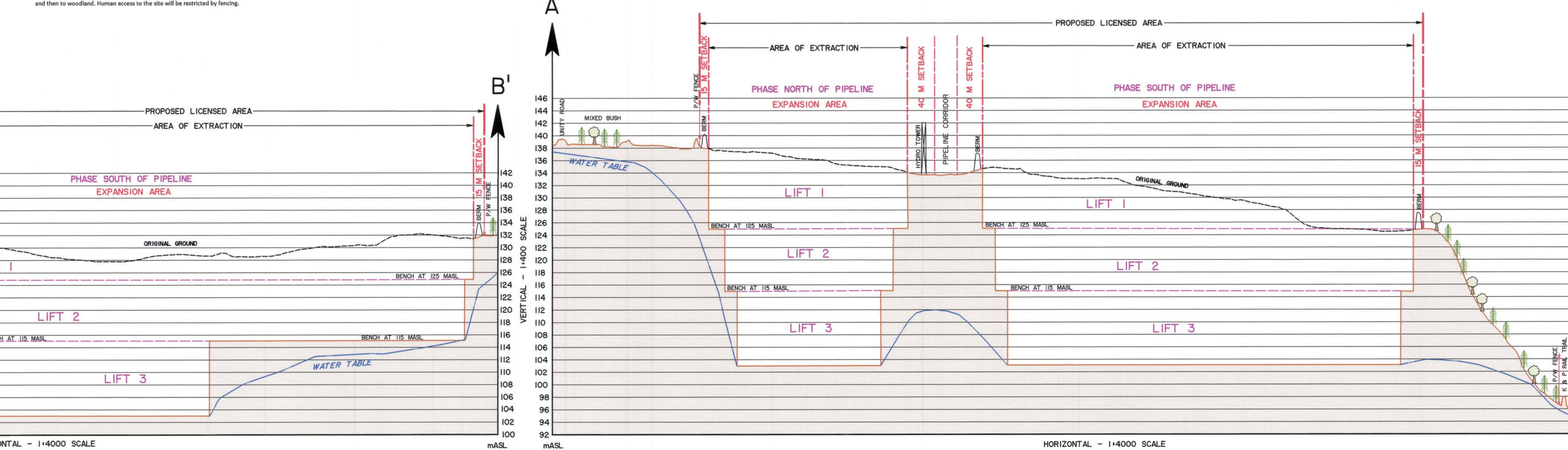
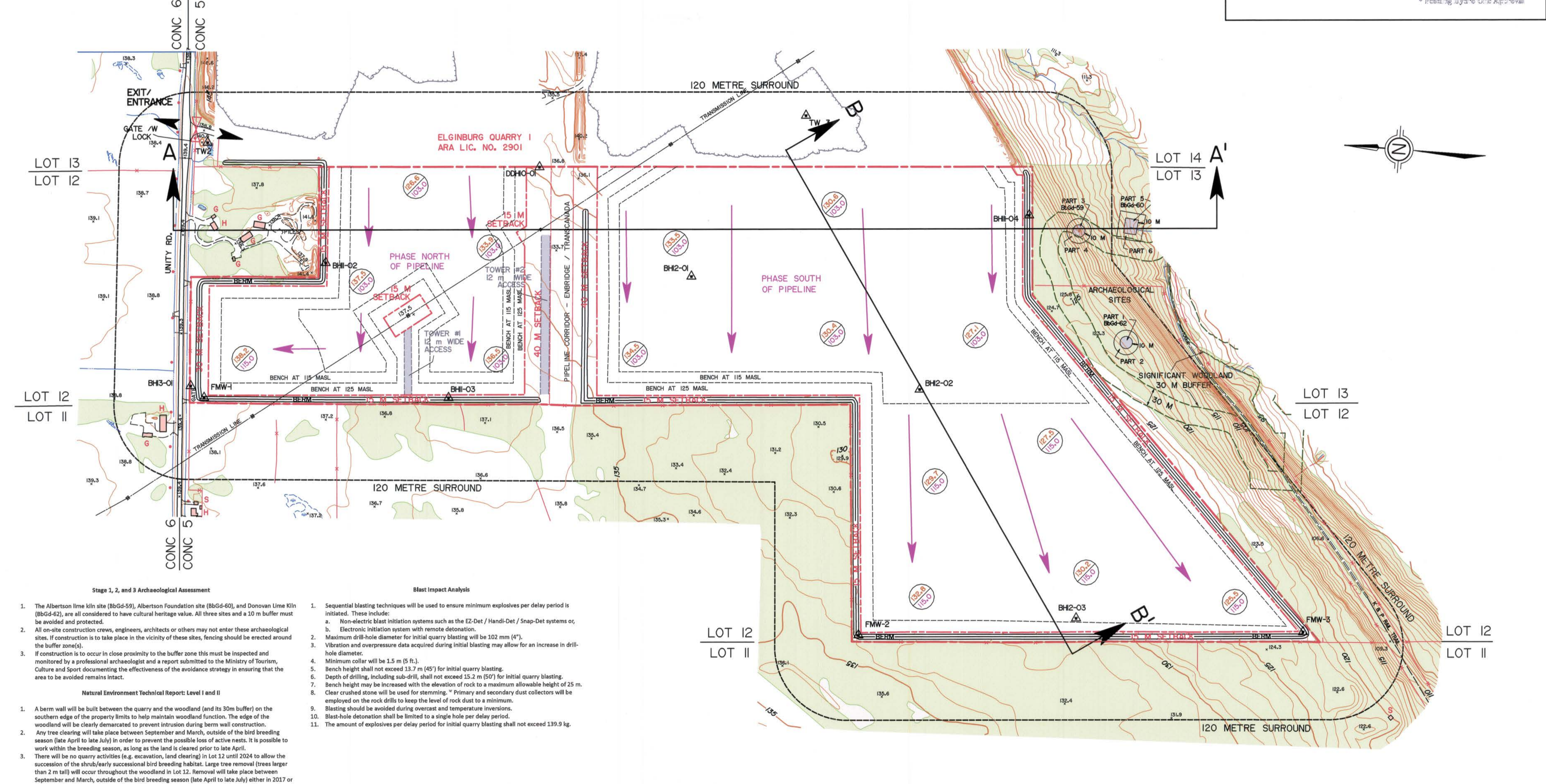
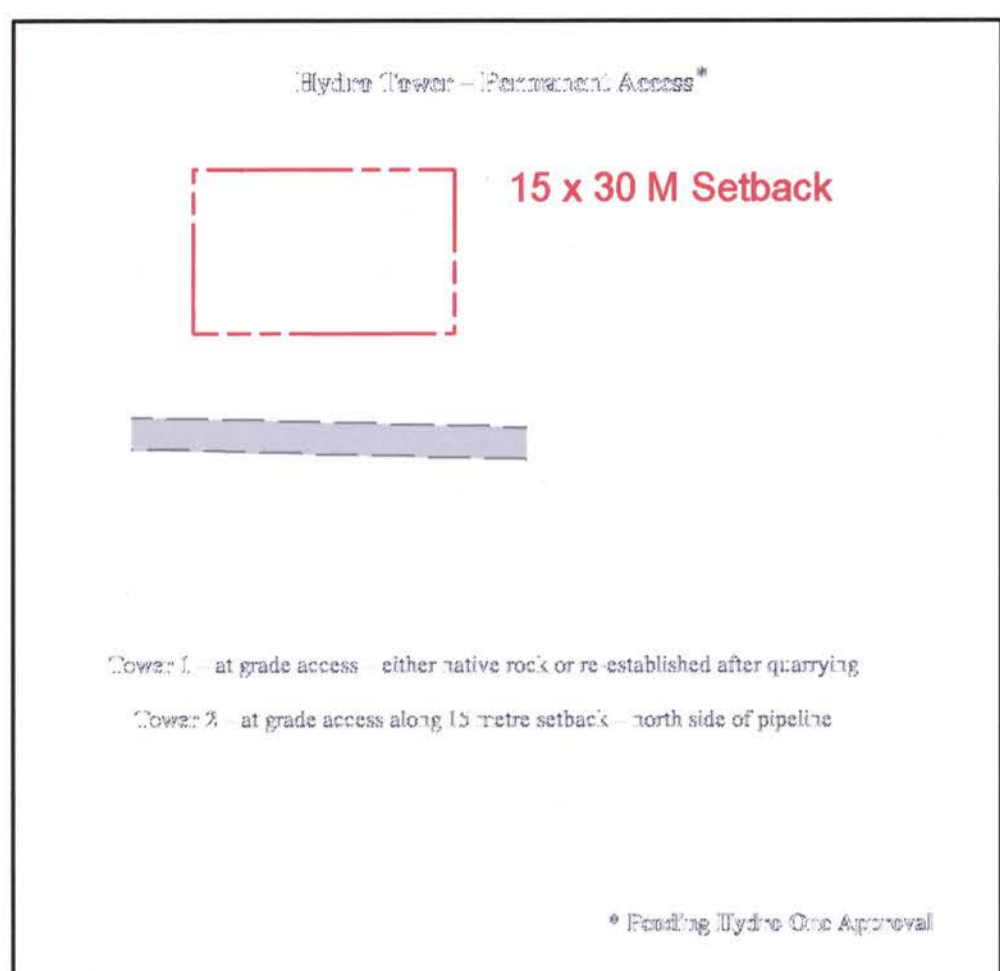
- The following is a summary of recommendations made:
 - Monthly groundwater level monitoring is recommended at DDH 10-GL, BH 11-02, BH 11-03, BH 11-04, BH 12-01, BH 12-02, BH 12-03, BH 13-01, the domestic well at 2528 Unity Road, and in the following three additional monitoring wells:
 - Future Monitoring Well 1 (FMW-1) on the Lot 12/Lot 13 boundary, approximately 60 m south of BH 13-01, to be drilled prior to extraction within the western half of Lot 13.
 - FMW-2 on the Lot 11/Lot 12 boundary at the northwest corner of the part of the expansion lands in Lot 12, to be drilled prior to extraction within Lot 12.
 - FMW-3 on the Lot 11/Lot 12 boundary at the southwest corner of the part of the expansion lands in Lot 12, to be drilled prior to extraction within Lot 12.
 - Annual winter photographic seepage face monitoring is recommended on all available extraction faces within 250 m of Unity Road in the western half of Lot 13 and also in Lot 12. This would consist of taking one or more photographs of the rock face from static viewpoints, where possible based on quarry operations. The information will provide a record of seepage into the quarry in the winter when ice will form at key seepage locations.
 - No extraction of the third lift (i.e., below 115 m ASL) should occur within 250 m of the property at 2528 Unity Road, and west of the Lot 12/Lot 13 lot line.
 - A geologic prior study may be considered during extraction of Lift 3 in Lot 13, if suitable conditions exist. The terms of reference for the study are included in Appendix 1.
 - In consultation with the property owner, drainage from 2467 Unity Road must be allowed to discharge at the southern end of this property by way of a culvert(s) or break(s) in the berm.
 - The existing FTW will be sufficient for dewatering of the existing quarry and the expansion area until its expiry in 2022. Upon renewal, it is recommended to combine the monitoring programs proposed in this report for the quarry expansion with the monitoring program for the existing quarry.

Acoustic Assessment Report

- The operation of the Portable Crushing and Screening Plant (Crusher), may take place only during the daytime period (07:00 – 19:00), and comply with the following:
 - When operating in Phase North of Pipeline:
 - The Portable Crushing and Screening Plant is to be located south of Line A.B at a maximum elevation of 125 m ASL, with Lift Road, located at a maximum of 25 m to the north and west of the Crusher, shielding receptors POB 1, 10 and 11.
 - A 7 m high noise barrier (Barrier 9) located at a maximum of 25 m from Crusher shielding POB 1 is to be provided. Barrier 9 can be reduced to 5 m high when operating the Crusher below 115 m ASL, refer to Figure AA.3, Appendix 4.
 - When operating in Phase South of Pipeline:
 - The Portable Crushing and Screening Plant is to be located at a maximum elevation of 125 m ASL, north of Line C.D and 115 m ASL, when south of Line C.D, with Lift Road located at a maximum of 25 m to the west of the Crusher, shielding receptors POB 8 and POB 9.
- The operation of a Standard Hydraulic Rock Drill (DRILL), may take place only during the daytime period (07:00 – 19:00), and shall comply with the following:
 - When operating in Phase North of Pipeline, the Standard Hydraulic Rock Drill is not to operate above grade north of Line A.B.
 - The operation of a Low Noise Rock Drill, such as the Atlas Copco SmartRig RDC D9C or similar, may take place only during the daytime period (07:00 – 19:00) anywhere in the extraction area, above or below grade.
- The operation of the Wash Plant, may take place only during the daytime period (07:00 – 19:00), and is to be located below grade as shown in Figure AA.1.3.
- The operation of the Asphalt Plant and associated equipment, may take place on 24 hour basis (24 hour), and comply with the following:
 - The Asphalt Plant is to be located as shown in Figure AA.1.3.
 - When operating the Asphalt Plant during the Evening and Night time period (19:00 to 07:00):
 - A 4 m high noise barrier (Barrier 6), located as shown in Figure AA.1, is to be provided shielding POB 5.
 - A 4 m high noise barrier (Barrier 7), located as shown in Figure AA.1, is to be provided shielding POB 3.
 - A 4 m high noise barrier (Barrier 8), located as shown in Figure AA.2, is to be provided shielding POB 3.

Notes

- The loading and shipping of Asphalt and Aggregate product using Highway Trucks, may take place on a 24 hour basis (24 hour). A maximum of two (2) loaders may be in operation concurrently during the evening and night time period (19:00 to 07:00).
- When operating on-site, Highway Trucks shall not exceed 20 kph and shall not use compression braking (Jake Brakes).
- Noise Barriers or berms are to be provided as shown in Figures AA.1, AA.2 and AA.3 and as specified in Appendix 4 - Noise Abatement Schedule.
- Noise barriers shielding portable equipment may be progressively established to provide shielding from location of operation to the identified noise sensitive point of reception (POB).
- Noise barriers or berms are to be solid, having no gaps, and are to have a surface density of no less than 20 kg/m². Examples of suitable barriers or berms are as follows:
 - Lift face or existing terrain;
 - Earth, gravel or aggregate berms or stockpiles;
 - Concrete or brick walls;
 - Commercial noise barriers;
 - Shipping containers;
 - A portable barrier such as a truck trailer equipped with movable flaps to block the space between the ground and the bottom of the trailer.
- Portable construction equipment used for site preparation (e.g. land clearing and construction of berms) and rehabilitation shall comply with MoE Publication NPC 115, Construction Equipment, August 1978. (This publication gives noise standards to be met by construction equipment in Ontario.) Site preparation and rehabilitation activities shall take place only during daytime hours (07:00 – 19:00).
- If a new process is introduced to the site, then this process shall be assessed by a qualified acoustical consultant as soon as possible after commissioning. Noise mitigation measures shall be reviewed, and altered if necessary, to ensure that MoF sound level limits are met at all points of reception.



OPERATION NOTES

- LICENSED AREA 73.8 HECTARES.
- AREA OF OPERATION 63.4 HECTARES.
- EXISTING DISTURBED AREA 0.5 HECTARES.
- THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS "A" LICENSE CATEGORY 2.
- THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
- LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
- THIS IS NOT A LEGAL SURVEY DRAWING IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987. THIS DRAWING WAS PRODUCED USING STANDARD PHOTOGRAMMETRIC PRACTICES.

ELGINBURG QUARRY II
PT LOTS 12,13,14,15, CONC 5
GEOGRAPHIC TOWNSHIP OF KINGSTON
CRUICKSHANK CONSTRUCTION LIMITED
751 DALTON AVENUE
KINGSTON, ONTARIO
K7M 8N6

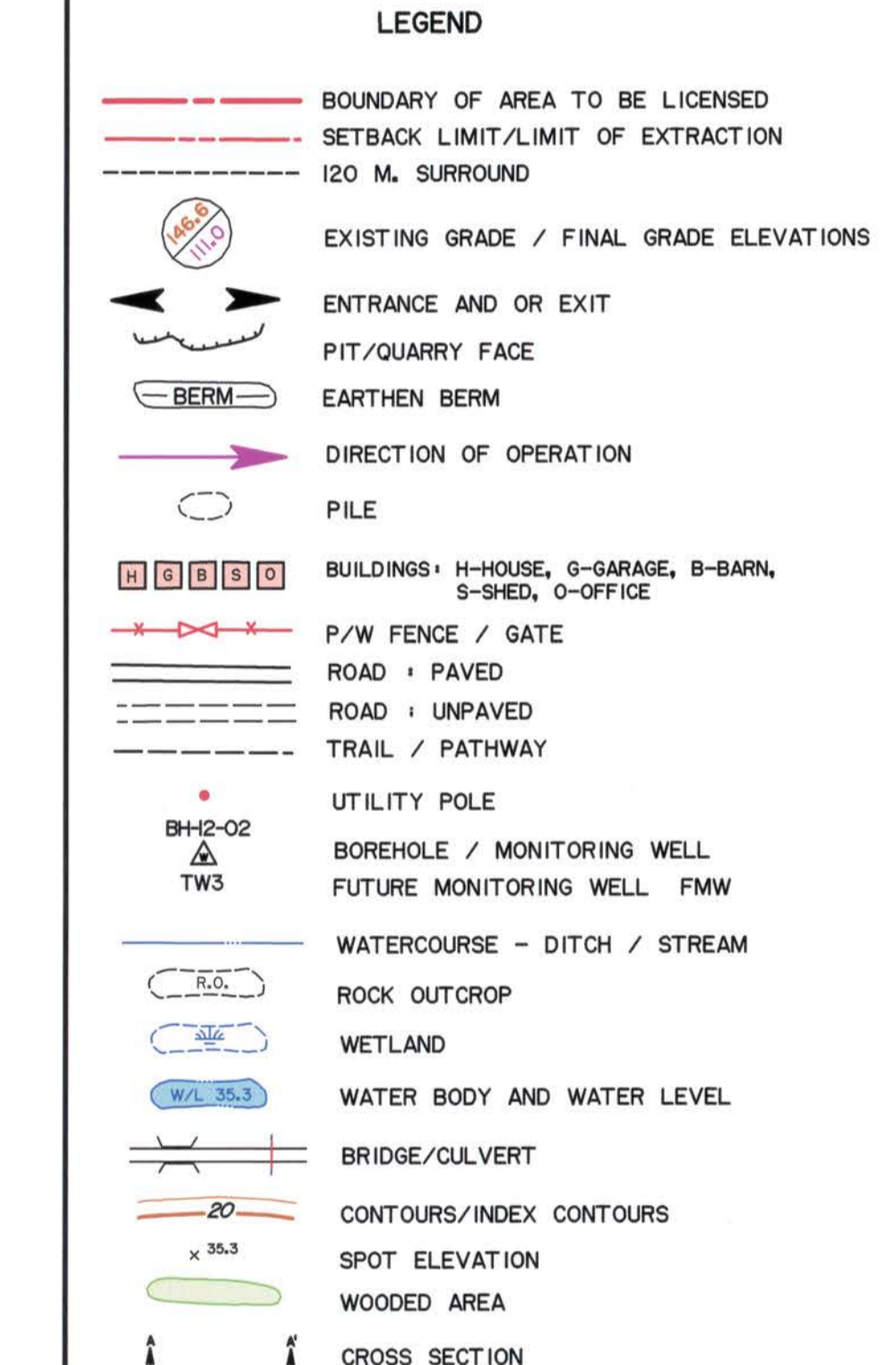
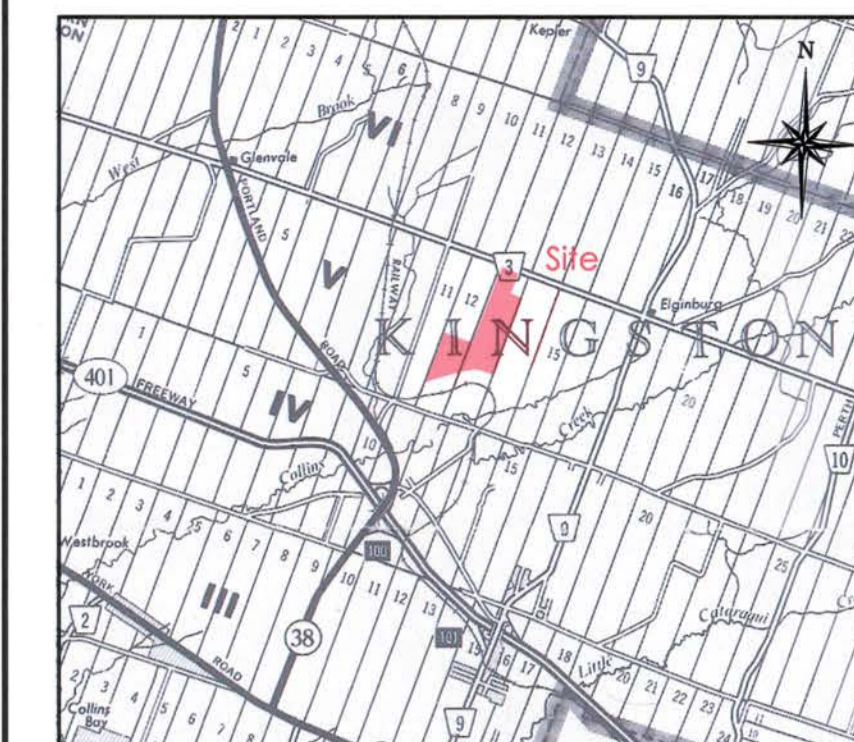
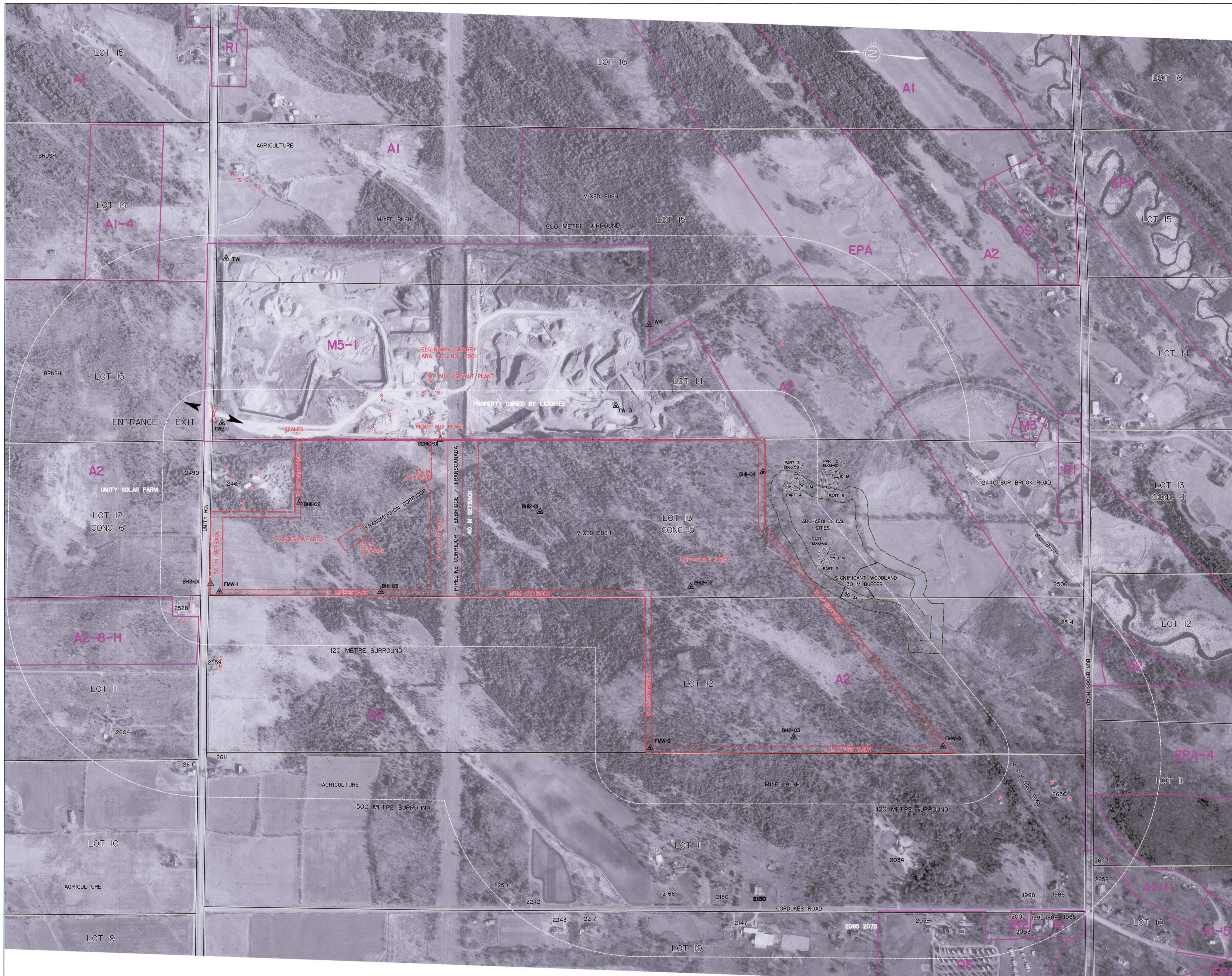


PHOTO SCALE	ROLL NO.	PHOTO DATE	SURVEY DATA
1:8000	CAS09028	NOV. 2, 2009	NAD 83 UTM, ZN 18
MAP SCALE	CONTOUR INTERVAL		DATE OF SITE PLAN
1:4000	1 METRE		SEPT 2016
0 40 80 120 160 200 240 METRES			
AMENDMENTS		DATE	
SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES AND FORESTRY.			
SIGNATURE	DATE		

PAGE 3 OF 4 CONTRACT 2562-13
SIGNATURE OF APPLICANT/LICENCEE DATE Oct 5, 2017
MIDDLETON DATE Oct 3, 2017
THE BASE MAPPING CO. LTD.
102-15 CAPELLA COURT, OTTAWA, ON K2E 7X1
T 613.723.9100 F 613.226.3269 W WWW.BASEMAP.CA



KEY MAP

EXISTING FEATURES / GENERAL

- NOTES
- LICENSED AREA 73.8 HECTARES.
 - AREA OF OPERATION 63.4 HECTARES.
 - EXISTING DISTURBED AREA 0.5 HECTARES.
 - THIS SITE PLAN IS PREPARED UNDER THE AGGREGATE RESOURCES ACT FOR A CLASS "A" LICENSE CATEGORY 2.
 - THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
 - LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
 - THIS IS NOT A LEGAL SURVEY DRAWING IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1997. THIS DRAWING WAS PRODUCED USING STANDARD PHOTOGRAMMETRIC PRACTICES.

ELGINBURG QUARRY II
 PT LOTS 12,13,14,15, CONC 5
 GEOGRAPHIC TOWNSHIP OF KINGSTON

CRUICKSHANK CONSTRUCTION LIMITED
 751 DALTON AVENUE
 KINGSTON, ONTARIO
 K7M 8N6

- LEGEND**
- BOUNDARY OF AREA TO BE LICENSED
 - SETBACK LIMIT/LIMIT OF EXTRACTION
 - ← ENTRANCE AND OR EXIT
 - RU LAND ZONING
 - [SQUARES] BUILDINGS: H-HOUSE, G-GARAGE, B-BARN, S-SHED, O-OFFICE
 - △ B42-02 BOREHOLE / MONITORING WELL
 - △ TW3 MUNICIPAL ADDRESS

TOWNSHIP OF KINGSTON ZONING BY-LAW NO. 76-26	
AI	RESTRICTED AGRICULTURAL ZONE
AI-4	- SPECIAL ZONE 4
AI-5	- SPECIAL ZONE 5
AI-11	- SPECIAL ZONE 11
A2	GENERAL AGRICULTURAL ZONE
A2-8-H	- SPECIAL ZONE 8 - HOLDING
EPA	ENVIRONMENTAL PROTECTION AREA
EPA-4	- SPECIAL ZONE 4
M3	SERVICE INDUSTRIAL ZONE
M5	EXTRACTIVE INDUSTRIAL ZONE
OS	OPEN SPACE
RI	RESIDENTIAL TYPE 1
R2	RESIDENTIAL TYPE 2

PHOTO SCALE 1:8000	ROLL NO. CAS09028	PHOTO DATE NOV. 2, 2009	SURVEY DATA NAD 83 UTM, ZN 18
MAP SCALE 1:4000	CONTOUR INTERVAL 1 METRE	DATE OF SITE PLAN SEPT., 2016	

AMENDMENTS	DATE

SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES AND FORESTRY.

SIGNATURE: _____ DATE: _____
 PAGE 1 OF 4 CONTRACT 2562-13
 SIGNATURE OF APPLICANT/LICENSEE: *Michael S. Moulton* DATE: *Oct 5, 2017*
 SIGNATURE: *Michael S. Moulton* DATE: *Oct 31, 17*

PROGRESSIVE REHABILITATION

The proposed final rehabilitation of the site would be two separate lakes. Upon completion of the quarrying operations, the bottom of the quarry will be allowed to fill with water to an expected elevation of 125 m ASL in the lake north of the pipeline corridor and to 110 m ASL in the lake south of the corridor.

-NOTE NUMBERS BELOW REFER TO ARA CATEGORY 2 PROVINCIAL STANDARDS VERSION 1.0-

1.3.1 SEQUENCE AND DIRECTION OF PROGRESSIVE REHABILITATION
 Progressive rehabilitation will begin at the east side of the site and progress to the west as conditions permit. The amount of area to be disturbed will be kept to a minimum. As extraction commences on the second lift, progressive backfilling, sloping and topsoil cover will commence from the setback limit to the bench at the bottom of the first lift. The slopes will be adequately vegetated.

Benches below the anticipated water surface may be removed to a final height of no more than 25 metres and left as a shear face below water. Any ramps to the quarry floor will be left in place to enhance fish and wildlife habitat (spawning and watering areas).

1.3.2 USE OF OVERBURDEN AND TOPSOIL IN REHABILITATION
 Overburden will be used for sloping the side of the quarry at approximately 2:1. Clean fill materials may include a combination of concrete, stone, rock, clay fill and loamy silty clay from off site. If waste rock is used as a base, available overburden and topsoil will be used on the slopes to provide a surface that will grow vegetation. All available on-site topsoil will be used to top-dress the rehabilitated surface.

1.3.3 VEGETATION DURING PROGRESSIVE REHABILITATION
 The surface will be seeded with non-maintenance grasses to prevent erosion.

1.3.4 SLOPING OF EXCAVATION AND FLOOR
 The sides will be rehabilitated by sloping the faces to a maximum 2:1 slope down to 3 m below the expected water level with stored overburden, waste rock or other approved inert material.

1.3.5 PROGRESSIVE REHABILITATION AND SITE OPERATIONS
 Progressive rehabilitation will be carried out as soon as quarrying operations permit it.

1.3.6 PROPOSED IMPORTATION OF MATERIAL TO FACILITATE REHABILITATION
 If there is not enough overburden to rehabilitate the property, material meeting the definition of "inert fill" may be brought onto the site to assist in the rehabilitation.

FINAL REHABILITATION
 Upon final rehabilitation, the excavation will be permitted to fill with surface water.

1.4.1 USE OF OVERBURDEN AND TOPSOIL IN REHABILITATION
 Clean fill materials may include a combination of concrete, stone, rock, clay fill and loamy silty clay from off site. If waste rock is used as a base, available on-site overburden and topsoil will be used on the slopes to provide a surface that will grow vegetation. All available on-site topsoil will be used to top-dress the rehabilitated surface.

1.4.2 FINAL SLOPING AND GRADING
 The sides will be rehabilitated by sloping the faces to a maximum 2:1 slope down to 3 m below the expected water level with the material stored in berms and other overburden.

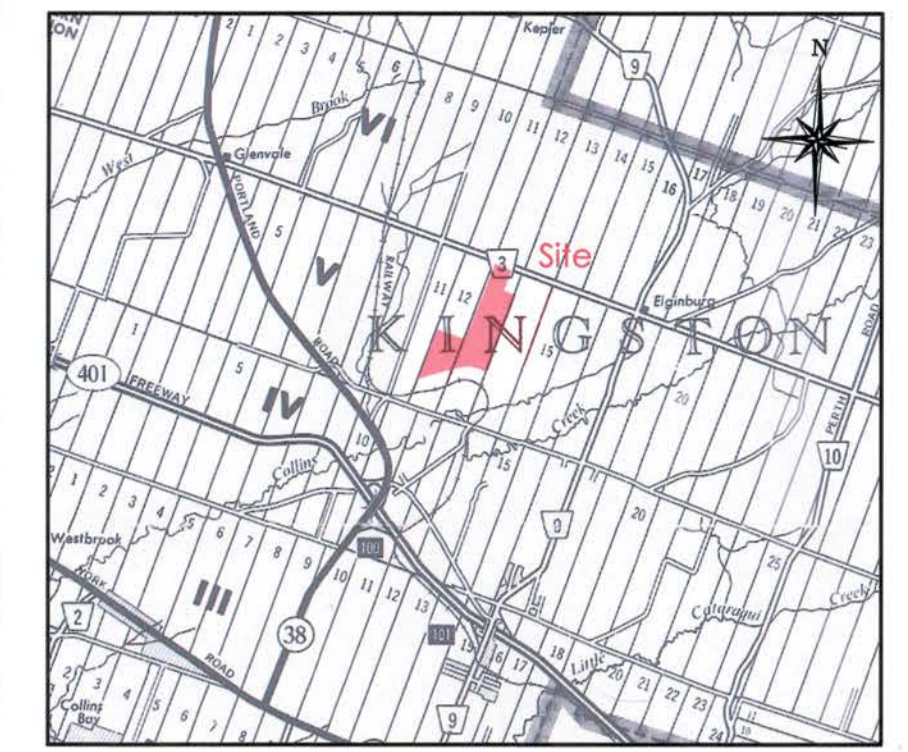
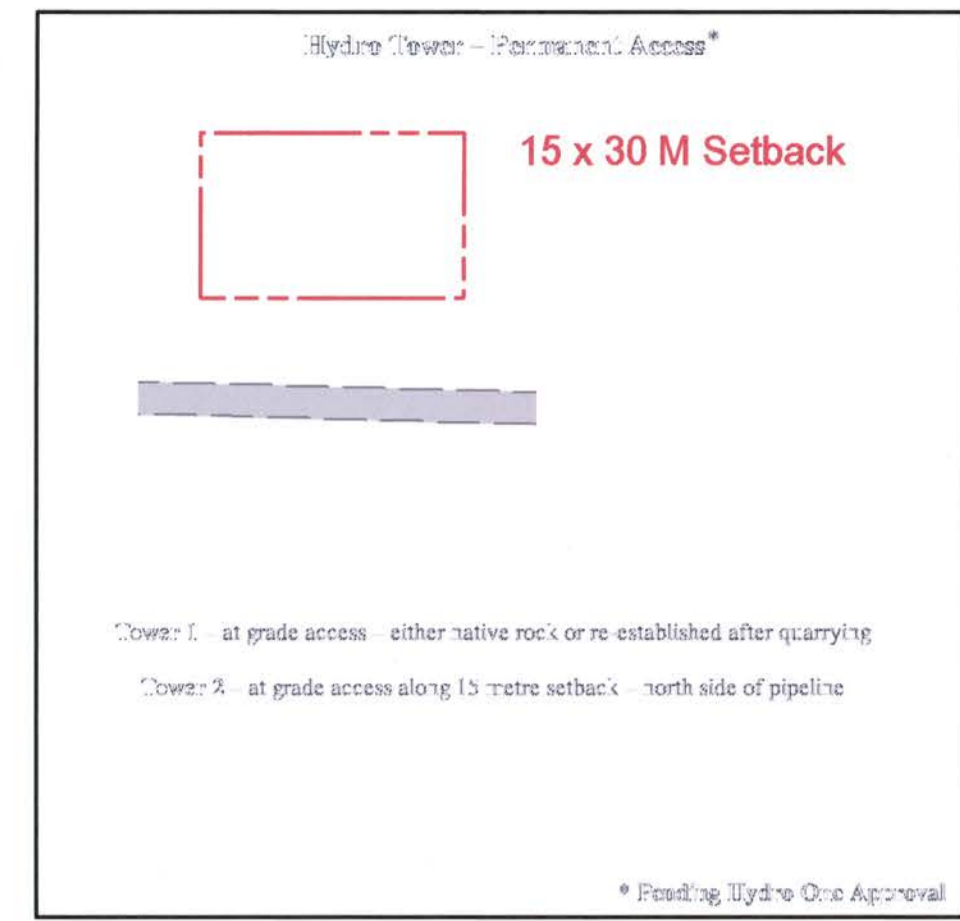
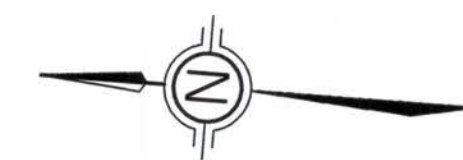
1.4.3 FINAL VEGETATION
 The surface will be seeded with non-maintenance grasses to prevent erosion. A mixture of native shrubs and tree plantings may be planted in scattered areas over the rehabilitated site.

1.4.4 BUILDINGS AND STRUCTURES
 Aside from the electrical transmission towers, there will be no buildings or structures on site following final rehabilitation.

1.4.5 ANTICIPATED ELEVATION OF WATER TABLE
 The lake north of the cross-site pipeline corridor is expected to fill to 125 m ASL. The lake south of the corridor is expected to fill to 110 m ASL.

1.4.6 INTERNAL ROADS
 Internal roads may be maintained to permit site maintenance.

1.4.7 FINAL SURFACE WATER DRAINAGE
 Water from the northern lake will likely flow into the southern lake, near the east side of the site. Surface flow from the southern lake is not anticipated.



KEY MAP

REHABILITATION

- NOTES**
- LICENCED AREA 73.8 HECTARES.
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ELGINBURG QUARRY II

PT LOTS 12,13,14,15, CONC 5
 GEOGRAPHIC TOWNSHIP OF KINGSTON

CRUICKSHANK CONSTRUCTION LIMITED
 751 DALTON AVENUE
 KINGSTON, ONTARIO
 K7M 8N6

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- SETBACK LIMIT/LIMIT OF EXTRACTION
- 120 M. SURROUND
- EXISTING GRADE / FINAL GRADE ELEVATIONS
- ENTRANCE AND OR EXIT
- PIT/QUARRY FACE
- EARTHEN BERM
- DIRECTION OF OPERATION
- PILE
- BUILDINGS: H-HOUSE, G-GARAGE, B-BARN, S-SHED, O-OFFICE
- P/W FENCE / GATE
- ROAD - PAVED
- ROAD - UNPAVED
- TRAIL / PATHWAY
- UTILITY POLE
- BOREHOLE / MONITORING WELL
- WATERCOURSE - DITCH / STREAM
- ROCK OUTCROP
- WETLAND
- WATER BODY AND WATER LEVEL
- BRIDGE/CULVERT
- CONTOURS/INDEX CONTOURS
- SPOT ELEVATION
- WOODED AREA
- CROSS SECTION

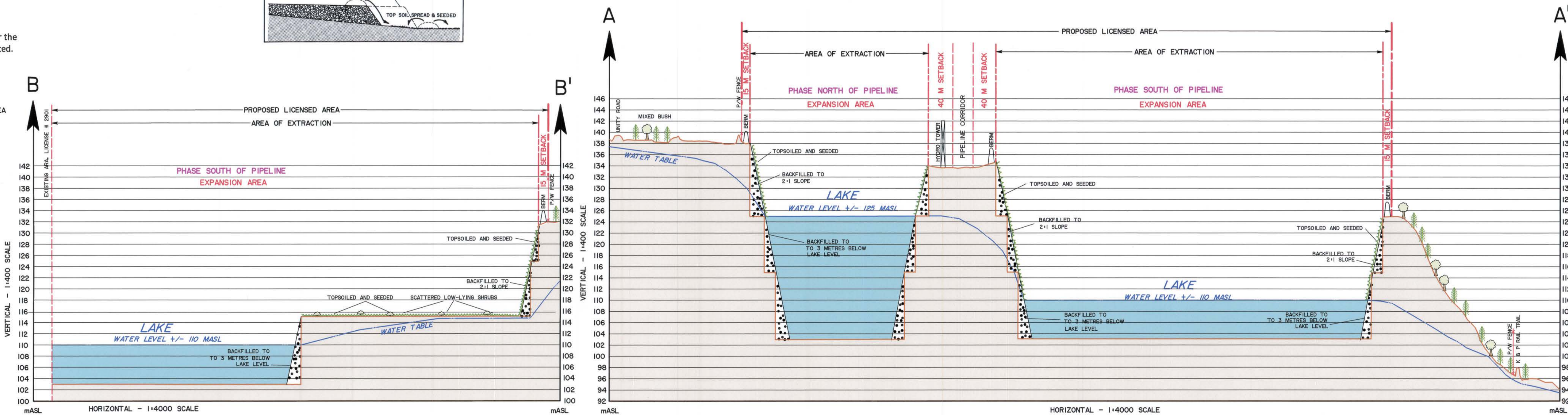
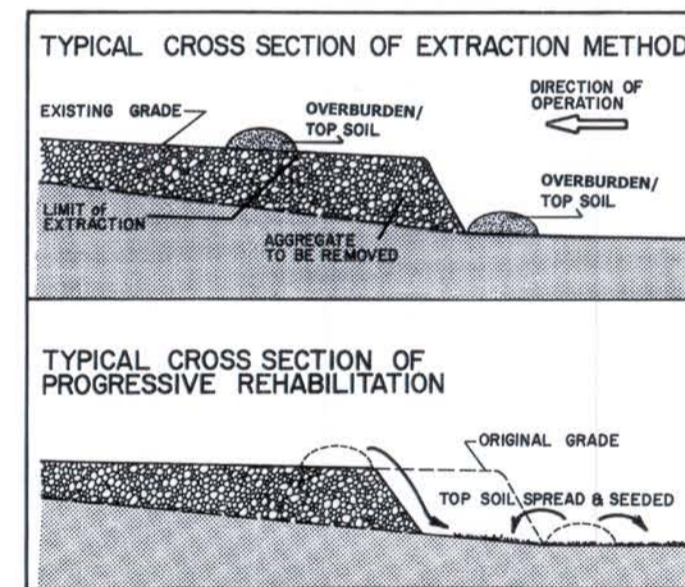
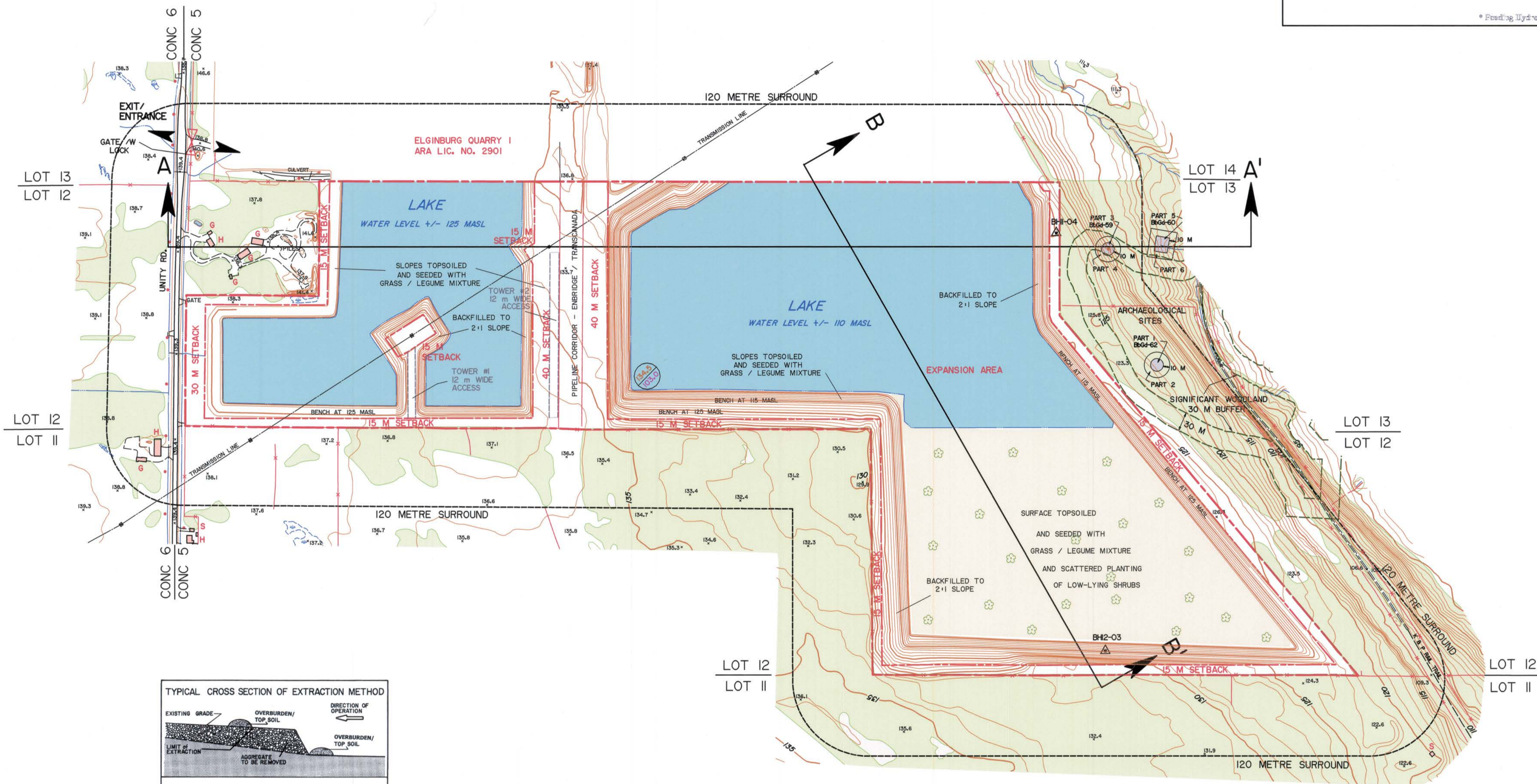
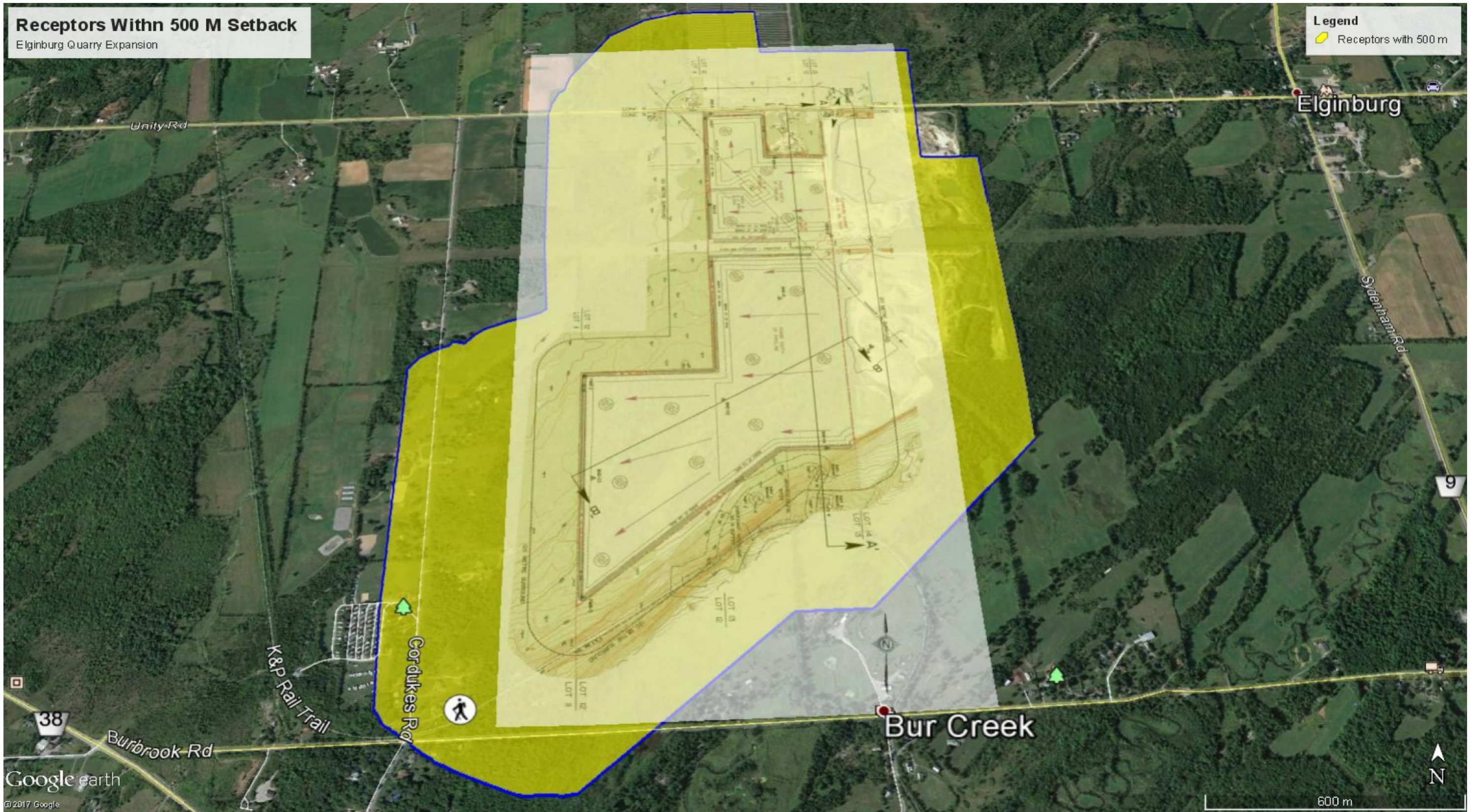


PHOTO SCALE 1:8000	ROLL NO. CAS09028	PHOTO DATE NOV. 2, 2009	SURVEY DATA NAD 83 UTM, 2N, 18
MAP SCALE 1:4000	CONTOUR INTERVAL 1 METRE	DATE OF SITE PLAN SEPT. 2016	

AMENDMENTS	DATE

SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES AND FORESTRY.

SIGNATURE: [Signature] DATE: Oct. 5, 2017
 SIGNATURE: [Signature] DATE: Oct. 13, 17



Aerial view showing the proposed expansion and receptors within 500 m of the proposed expansion

Appendix “B”

MODEL
MUNICIPAL
NOISE CONTROL
BY-LAW

Final Report

August, 1978



Ministry of
Environment
and Energy

RPC-119

Publication MPC-115

Blasting

1. Scope
This Publication refers to limits on sound (concussion) and vibration due to blasting operations.
2. Technical Definitions
The technical terms used in this Publication are defined in Publication RPC-101 - Technical Definitions.
3. Measurement Procedures
All measurements of peak pressure level and vibration velocity shall be made in accordance with the "Procedure for Measurement of Sound and Vibration due to Blasting Operations" set out in Publication MPC-103 - Procedures, section 5.
4. Concussion - Cautionary Limit
Subject to section 5 the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 120 dB.
5. Concussion - Peak Pressure Level Limit
If the person in charge of a blasting operation carries out routine monitoring of the peak pressure level, the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 128 dB.
6. Vibration - Cautionary Limit
Subject to section 7, the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.00 cm/s.
7. Vibration - Peak Particle Velocity Limit
If the person in charge of a blasting operation carries out routine monitoring of the vibration the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.25 cm/s.

Appendix “C”

Date/Time Vert at 12:40:52 April 2, 2012
Trigger Source Geo: 0.127 mm/s
Range Geo :254 mm/s
Record Time 4.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.4 Volts
Calibration November 28, 2011 by Instantel
File Name C528E82B.840
Scaled Distance 74.6 (350.0 m, 22.0 kg)

Notes

Location: AT RES UNITY RD CIVIC #2467 340m NW
 Client: ELGINBURG QUARRY # 4333
 User Name: REMI TREMBLAY
 Converted: April 16, 2012 14:12:00 (V8.01)

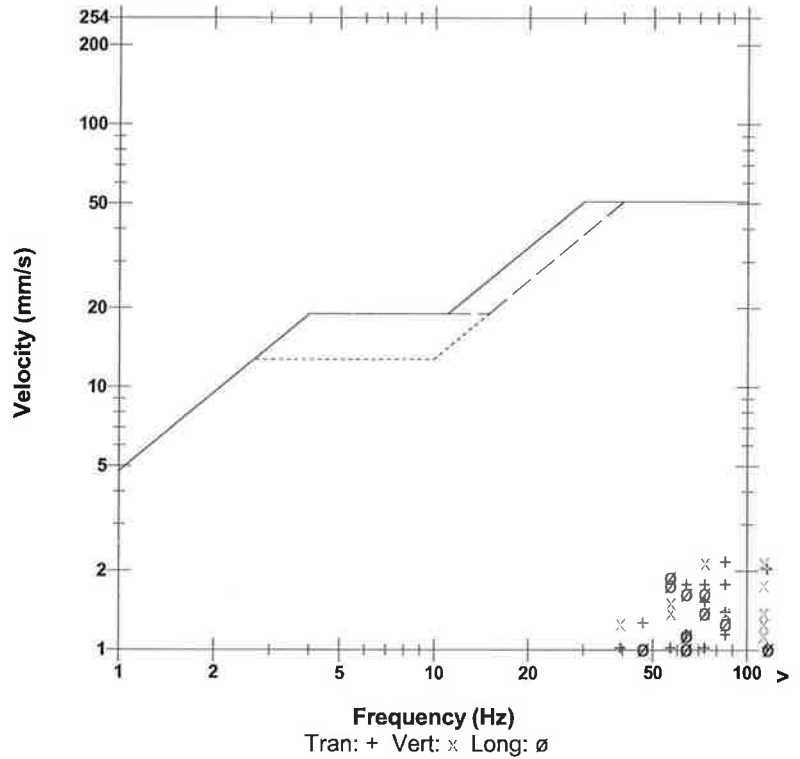
Extended Notes

135 HIS 18 ft 8x8 MAX. 22 kg PD SUNNY E WIND

Post Event Notes

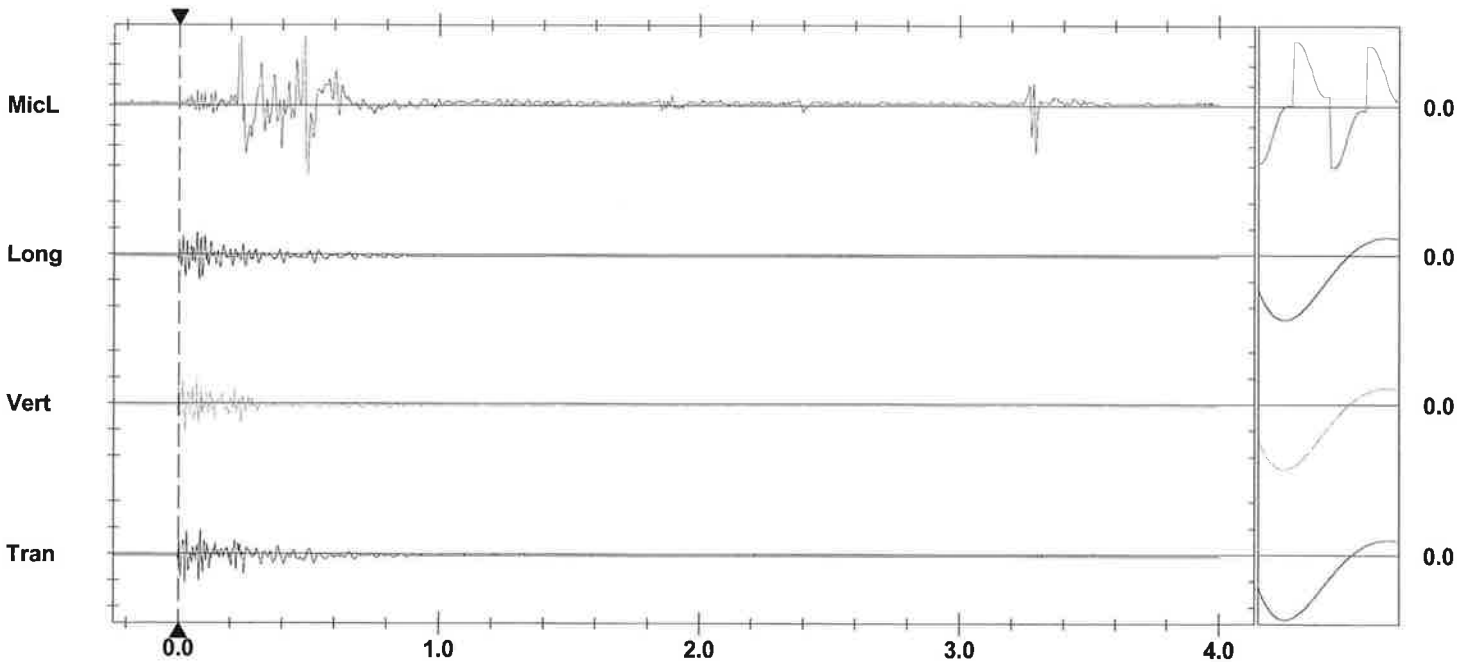
Microphone Linear Weighting
PSPL 13.0 pa.(L) at 0.998 sec
ZC Freq 12 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 267 mv)

USBM RI8507 And OSMRE



	Tran	Vert	Long	
PPV	4.37	4.10	4.76	mm/s
PPV (Ponderated)	1.12	0.984	1.13	mm/s
ZC Freq	47	51	51	Hz
Time (Rel. to Trig)	1.084	1.004	0.875	sec
Peak Acceleration	0.197	0.197	0.229	g
Peak Displacement	0.0125	0.0124	0.0149	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	8.0	8.0	Hz
Overswing Ratio	4.1	3.9	3.7	

Peak Vector Sum 5.67 mm/s at 1.001 sec



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 5.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 13:45:58 April 4, 2012
Trigger Source Geo: 1.00 mm/s
Range Geo :254 mm/s
Record Time 3.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091E848.WM0
Scaled Distance 78.3 (350.0 m, 20.0 kg)

Notes

Location: civic # 2467 Unity Rd
 Client: Elginburg Quarry
 User Name: Rob Poulin
 General:

Extended Notes

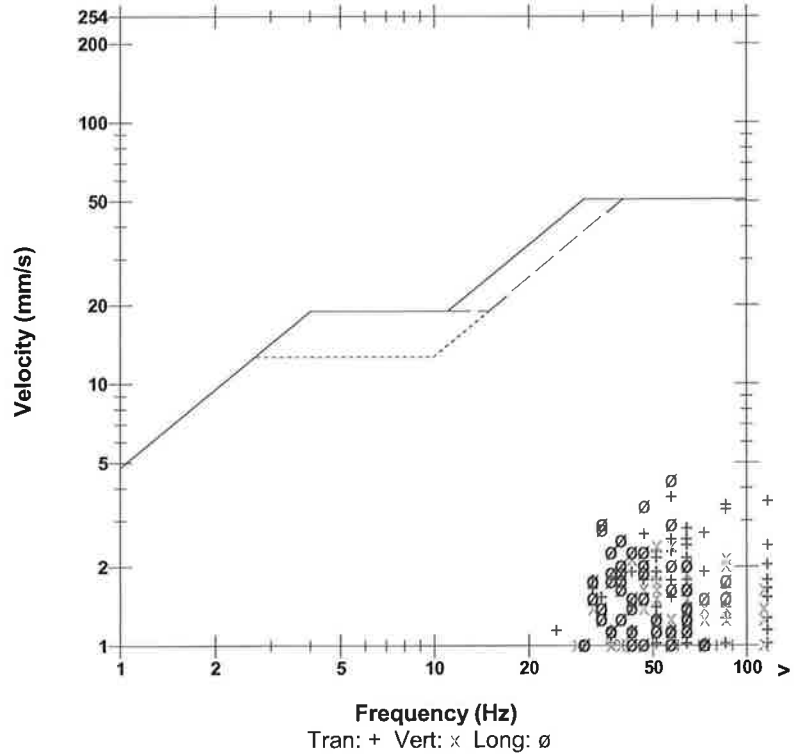
8' x8' pattern 3.5" holes 110 holes at 17' average
 Cloudy with west wind

Post Event Notes

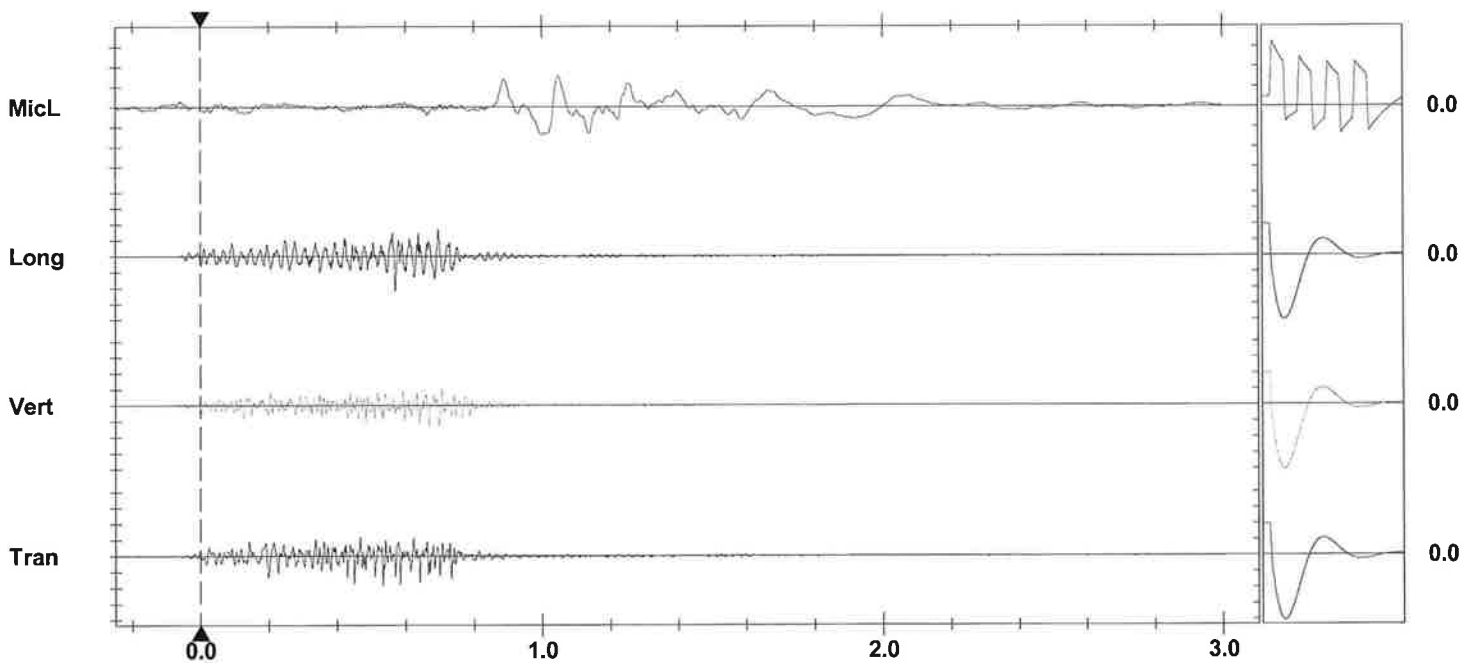
Microphone Linear Weighting
PSPL 15.5 pa.(L) at 1.045 sec
ZC Freq 12 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 537 mv)

	Tran	Vert	Long	
PPV	3.68	2.41	4.32	mm/s
ZC Freq	57	57	57	Hz
Time (Rel. to Trig)	0.532	0.668	0.568	sec
Peak Acceleration	0.252	0.146	0.159	g
Peak Displacement	0.00812	0.00719	0.0117	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.6	7.5	Hz
Overswing Ratio	3.9	3.9	4.1	

USBM RI8507 And OSMRE



Peak Vector Sum 5.11 mm/s at 0.568 sec



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 12:37:49 May 31, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by Instantel
File Name J087EB1P.R10
Scaled Distance 65.8 (400.0 m, 37.0 kg)

Notes

Location: AT RES. UNITY Rd CIVIC # 2467
 Client: ELGINBURG QUARRY
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

148 Holes 8 ft x 8 ft pattern, 18 ft deep, 37 kg MAX.
 P.CLOUDY with NW Wind

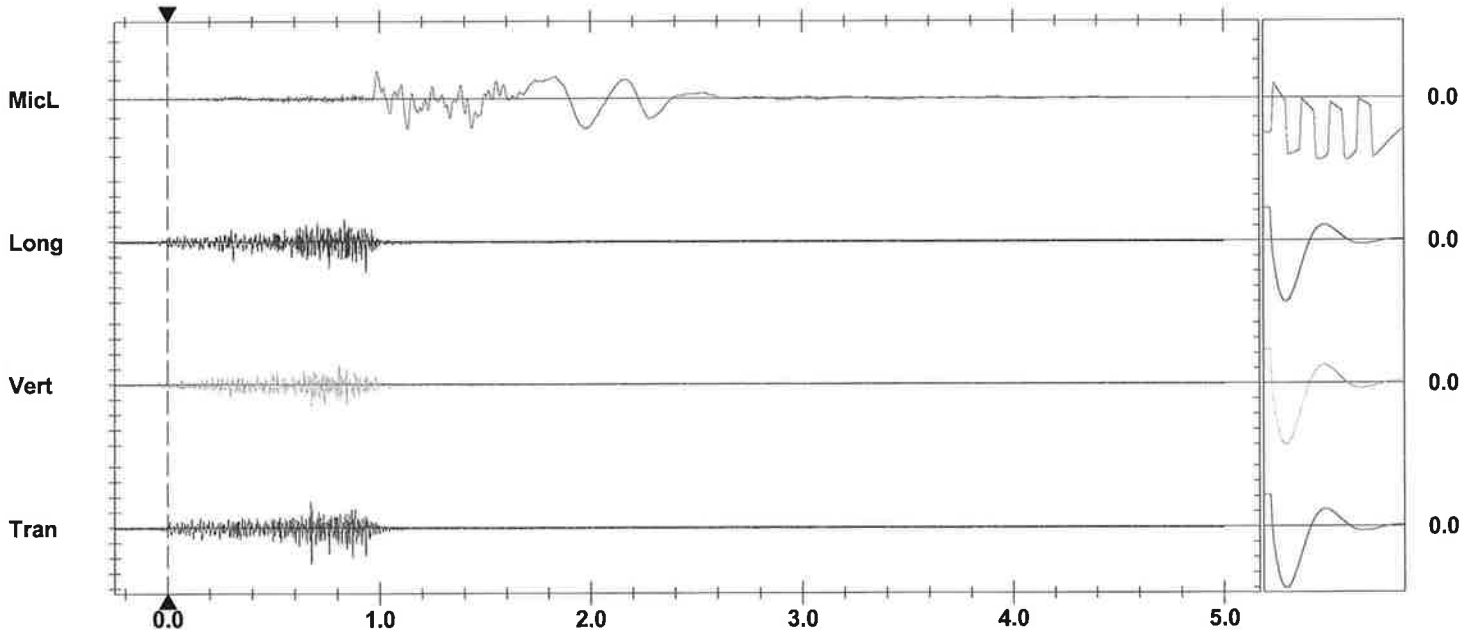
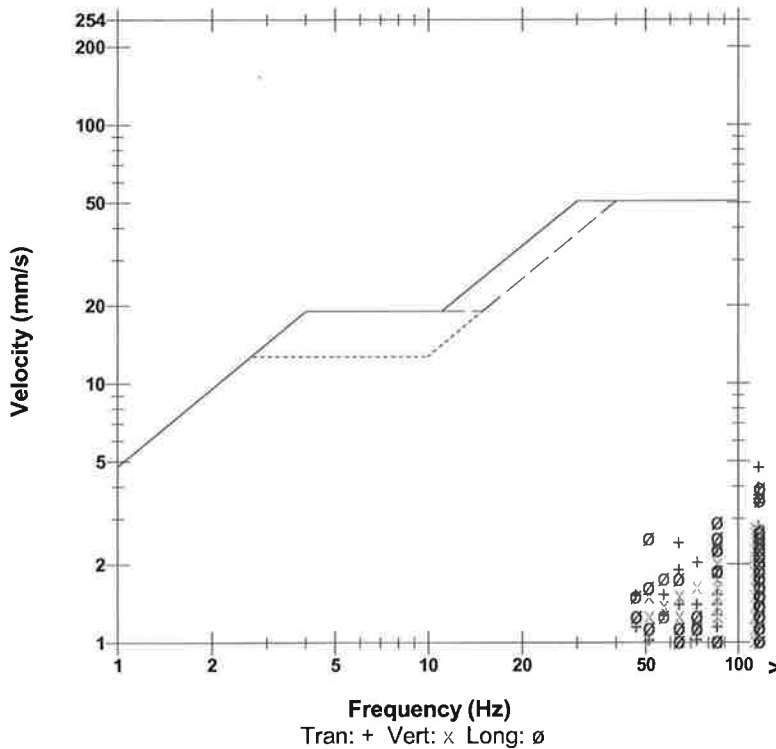
Post Event Notes

Microphone Linear Weighting
PSPL 15.8 pa.(L) at 1.132 sec
ZC Freq 14 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 642 mv)

	Tran	Vert	Long	
PPV	4.70	2.79	3.94	mm/s
ZC Freq	>100	>100	>100	Hz
Time (Rel. to Trig)	0.677	0.677	0.935	sec
Peak Acceleration	0.331	0.252	0.278	g
Peak Displacement	0.00558	0.00422	0.00589	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.4	Hz
Overswing Ratio	3.7	3.5	4.1	

Peak Vector Sum 5.68 mm/s at 0.677 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Tran at 12:03:38 June 4, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by Instantel
File Name J087EB92.U20
Scaled Distance 67.4 (410.0 m, 37.0 kg)

Notes

Location: AT RES. UNITY Rd CIVIC # 2467
 Client: ELGINBURG QUARRY
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

143 Holes 8 ft x 8 ft pattern, 18 ft deep, 37 kg MAX.
 .CLOUDY with NW Wind

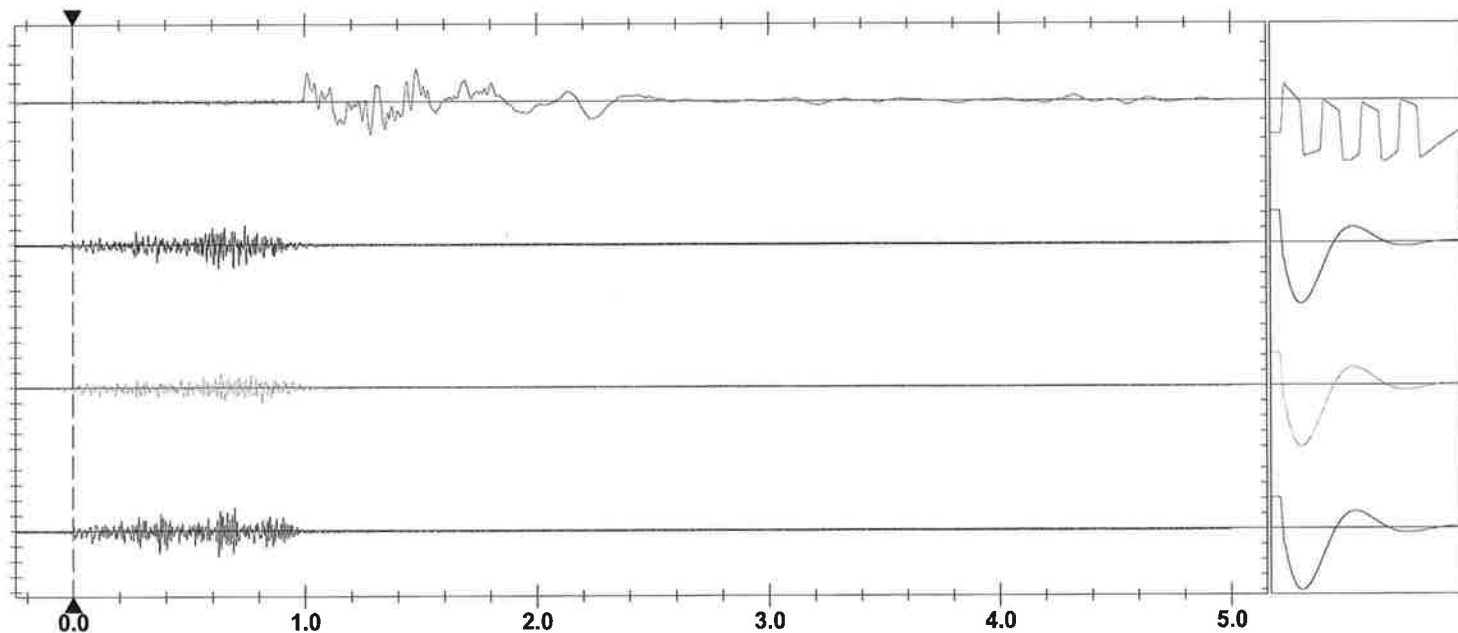
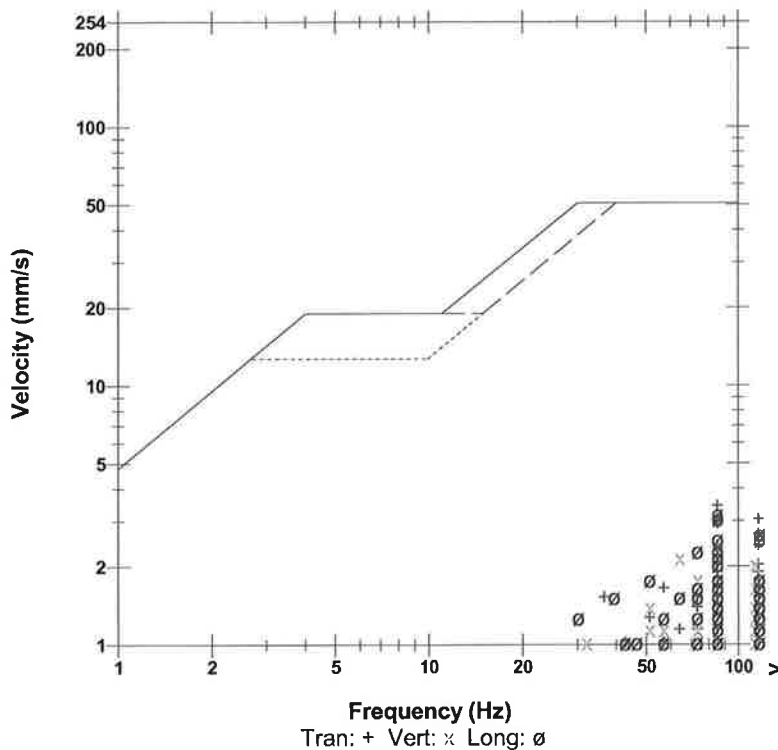
Post Event Notes

Microphone Linear Weighting
PSPL 17.3 pa.(L) at 1.282 sec
ZC Freq 15 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 626 mv)

	Tran	Vert	Long	
PPV	3.43	2.16	3.17	mm/s
ZC Freq	85	64	85	Hz
Time (Rel. to Trig)	0.627	0.813	0.627	sec
Peak Acceleration	0.186	0.133	0.172	g
Peak Displacement	0.00633	0.00515	0.00608	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.5	Hz
Overswing Ratio	3.7	3.5	4.1	

Peak Vector Sum 4.73 mm/s at 0.627 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:59:08 June 11, 2012
Trigger Source Geo: 1.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.3 Volts
Calibration February 16, 2012 by Instantel
File Name J091EBM1.AK0
Scaled Distance 71.2 (450.0 m, 40.0 kg)

Notes

Location: AT RES. UNITY Rd CIVIC # 2467 450 m NW
 Client: ELGINBURG Quarry
 User Name: REMI TREMBLAY
 General:

Extended Notes

8' x8' pattern 101 holes at 27' average 40KG MAX
 SUNNY with SE wind

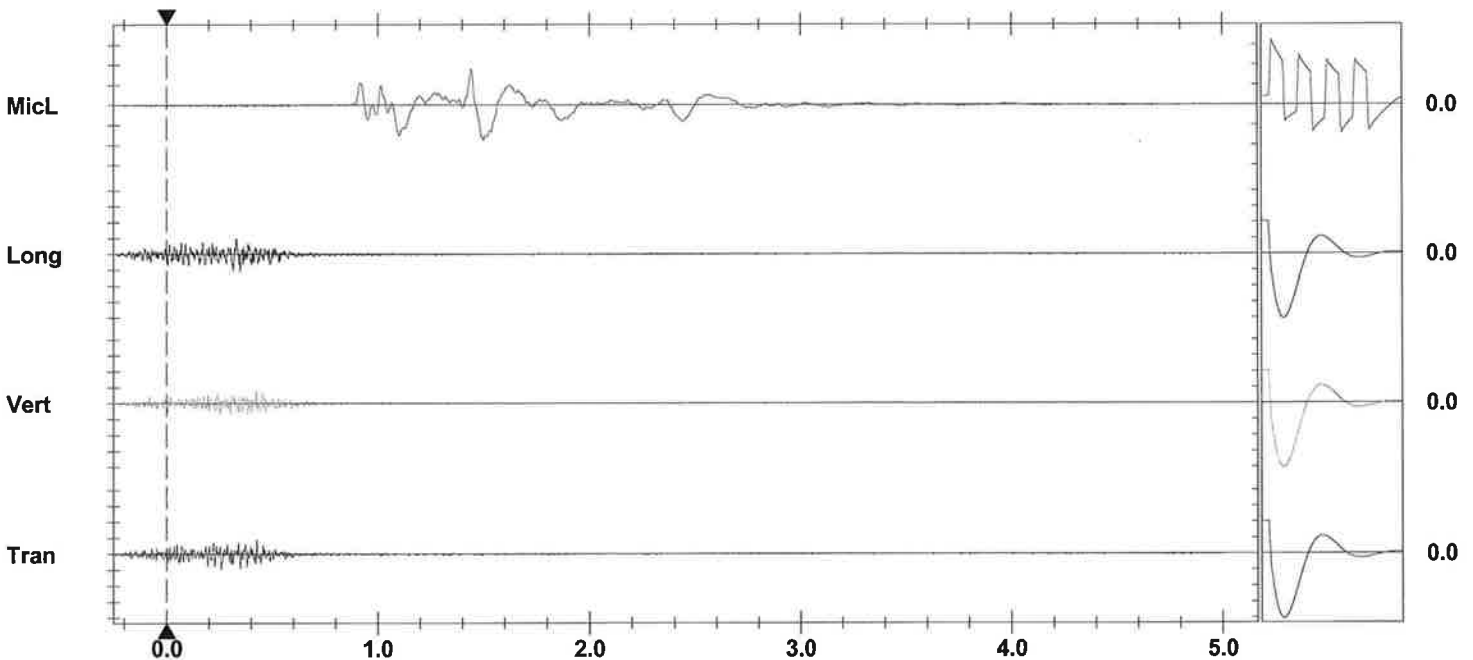
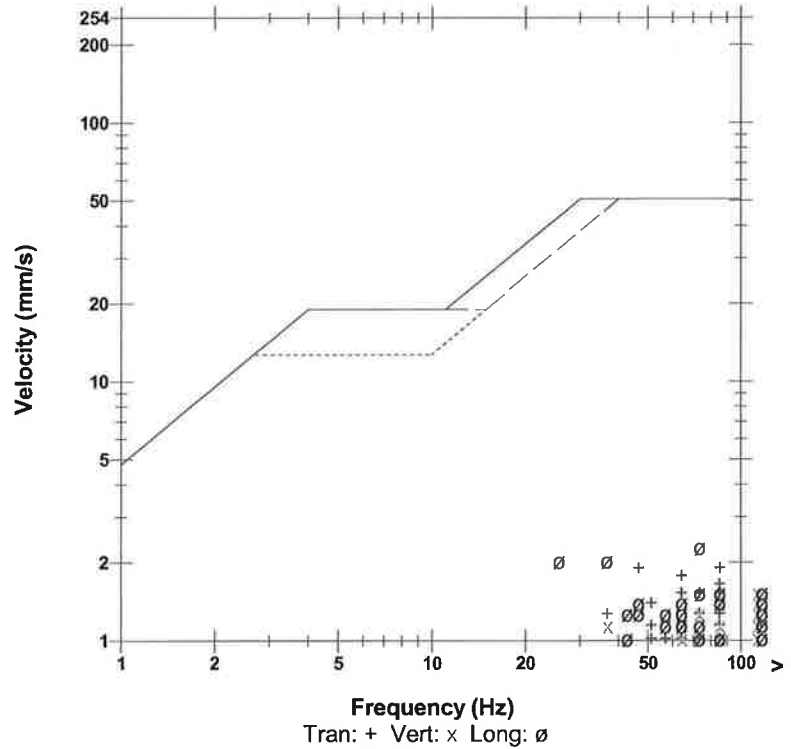
Post Event Notes

Microphone Linear Weighting
PSPL 18.0 pa.(L) at 1.441 sec
ZC Freq 9.1 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 551 mv)

	Tran	Vert	Long	
PPV	1.90	1.52	2.29	mm/s
ZC Freq	47	>100	73	Hz
Time (Rel. to Trig)	0.258	0.423	0.349	sec
Peak Acceleration	0.0928	0.0928	0.0928	g
Peak Displacement	0.00577	0.00415	0.00918	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.6	Hz
Overswing Ratio	3.8	3.7	3.8	

Peak Vector Sum 3.07 mm/s at 0.349 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Tran at 10:54:03 June 12, 2012
Trigger Source Geo: 1.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.3 Volts
Calibration February 16, 2012 by Instantel
File Name J091EBNS.Y30
Scaled Distance 67.1 (450.0 m, 45.0 kg)

Notes

Location: AT RES. UNITY Rd CIVIC # 2467 450 m NW
 Client: ELGINBURG Quarry
 User Name: REMI TREMBLAY
 General:

Extended Notes

8' x8' pattern 88 holes at 28' average 40KG MAX
 RAIN with SE wind

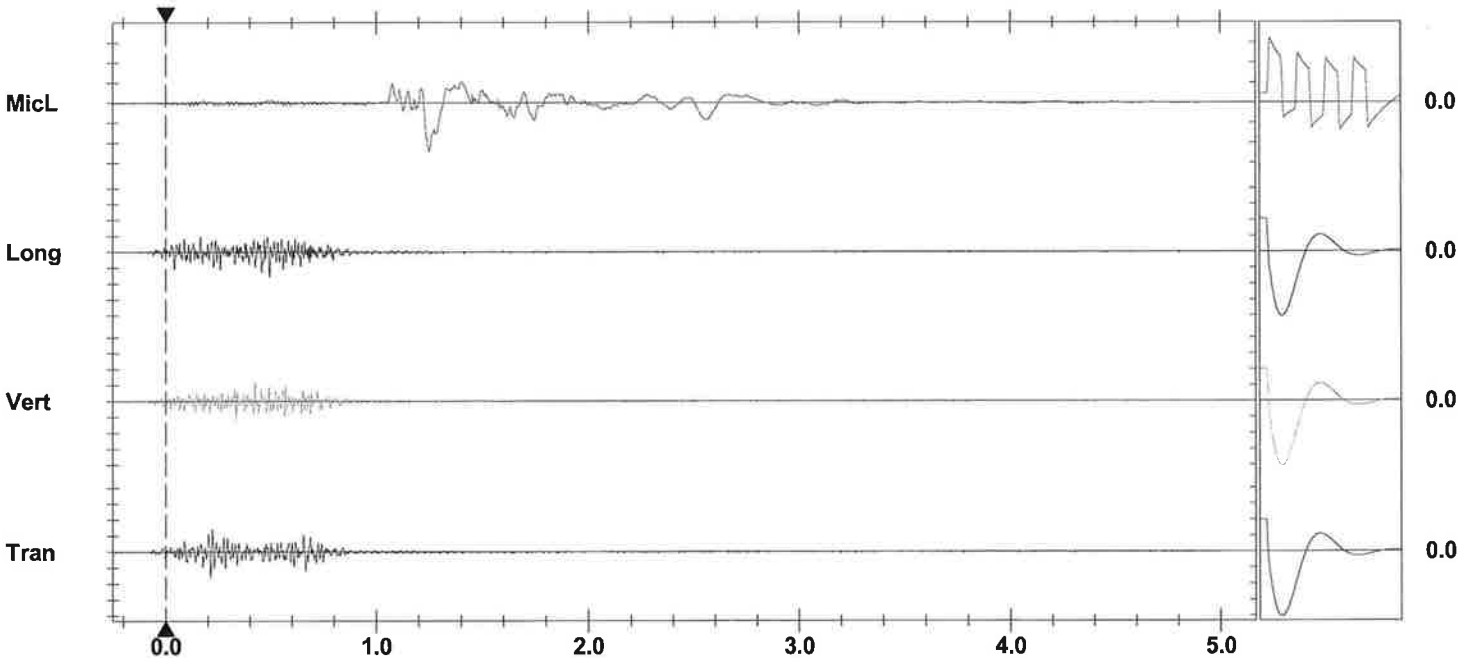
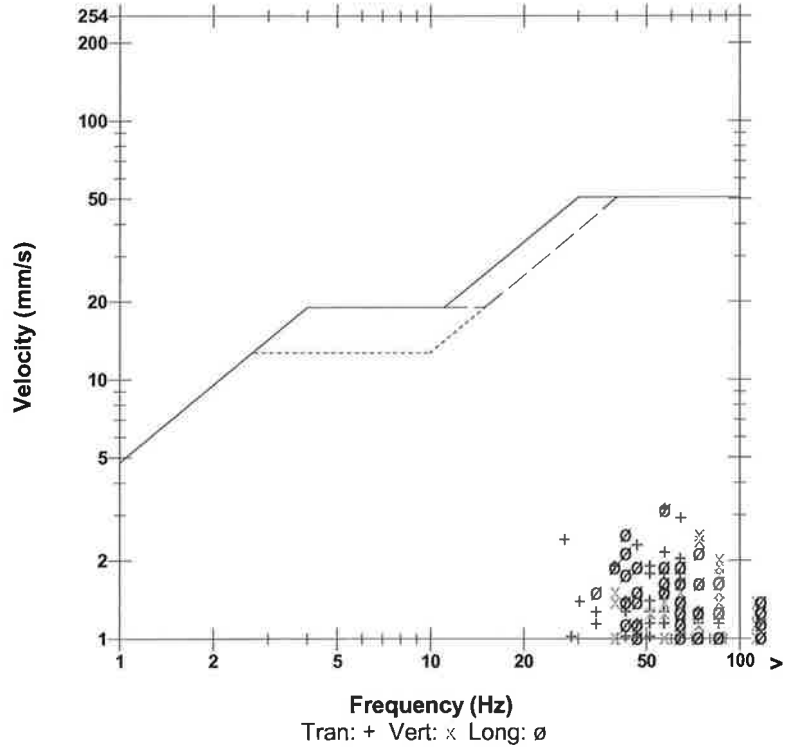
Post Event Notes

Microphone Linear Weighting
PSPL 24.3 pa.(L) at 1.249 sec
ZC Freq 5.5 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 558 mv)

	Tran	Vert	Long	
PPV	3.17	2.54	3.17	mm/s
ZC Freq	57	73	57	Hz
Time (Rel. to Trig)	0.211	0.333	0.492	sec
Peak Acceleration	0.106	0.133	0.119	g
Peak Displacement	0.00936	0.00533	0.00862	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.7	7.7	Hz
Overswing Ratio	3.8	3.8	3.9	

Peak Vector Sum 3.45 mm/s at 0.492 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 10:47:20 June 13, 2012
Trigger Source Geo: 1.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by Instantel
File Name J091EBPN.AW0
Scaled Distance 66.4 (420.0 m, 40.0 kg)

Notes

Location: AT RES. UNITY Rd CIVIC # 2467 420 m NW
 Client: ELGINBURG Quarry
 User Name: REMI TREMBLAY
 General:

Extended Notes

8' x8' pattern 92 holes at 26' average 40KG MAX
 CLOUDY with NW wind

Post Event Notes

Microphone Linear Weighting
PSPL 2.50 pa.(L) at 2.331 sec
ZC Freq 8.3 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 557 mv)

	Tran	Vert	Long	
PPV	0.254	0.635	2.03	mm/s
ZC Freq	>100	N/A	N/A	Hz
Time (Rel. to Trig)	0.074	0.001	0.000	sec
Peak Acceleration	0.0133	0.0133	0.0133	g
Peak Displacement	0.00012	0.0	0.0	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.6	Hz
Overswing Ratio	3.8	3.8	3.9	

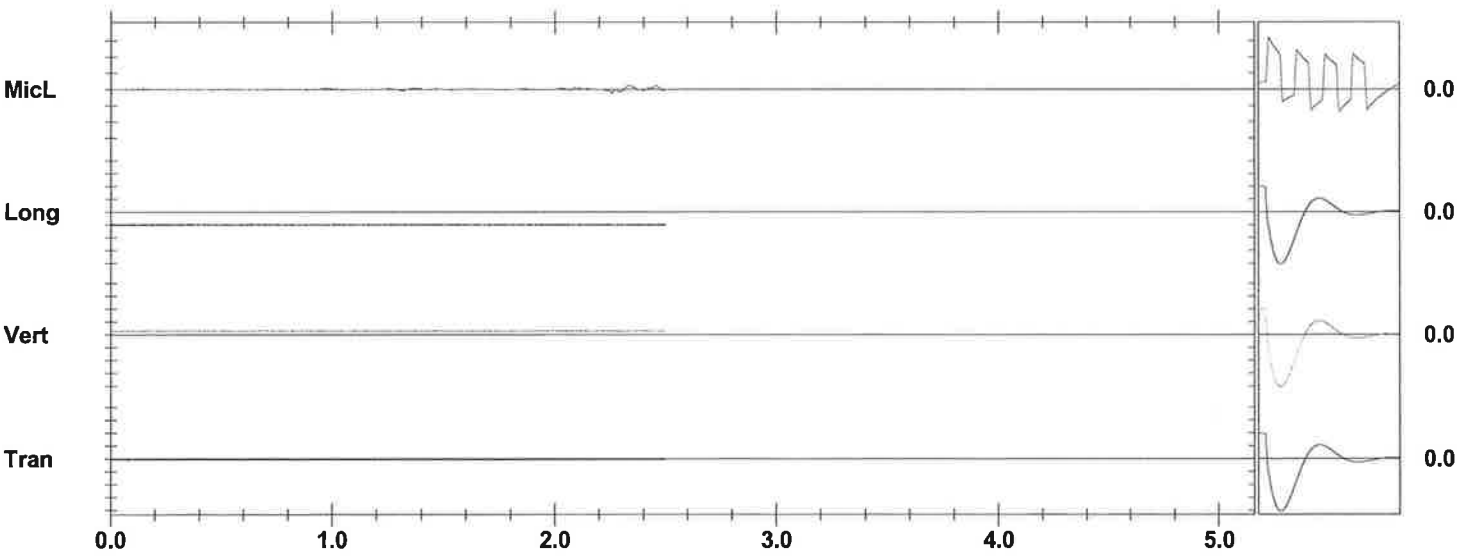
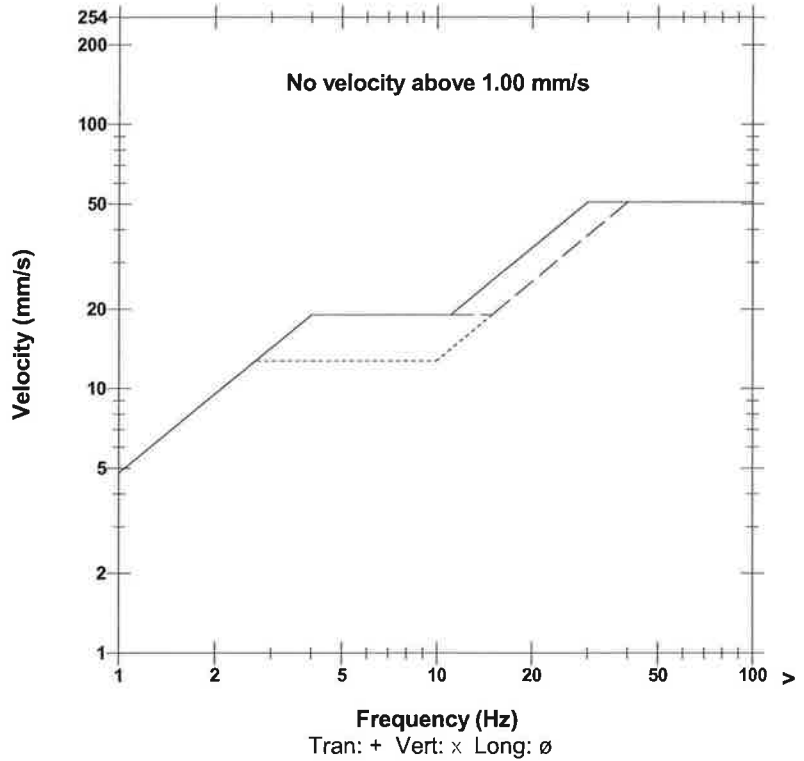
Peak Vector Sum 2.14 mm/s at 0.079 sec

N/A: Not Applicable

Monitor Log

Jun 13 /12 10:47:20 Jun 13 /12 10:47:22 Event recorded. (Keyboard Exit)

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div

Sensorcheck

Date/Time Long at 10:43:08 June 19, 2012
Trigger Source Geo: 1.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps
Job Number: 4333

Serial Number BE8349 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration December 1, 2011 by Instantel
File Name J349EC0R.3W0
Scaled Distance 126.7 (850.0 m, 45.0 kg)

Notes

Location: CIVIC# 2440 AT HAMILTON SHOP 850 M
 Client: ELGINBURG QUARRY
 User: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

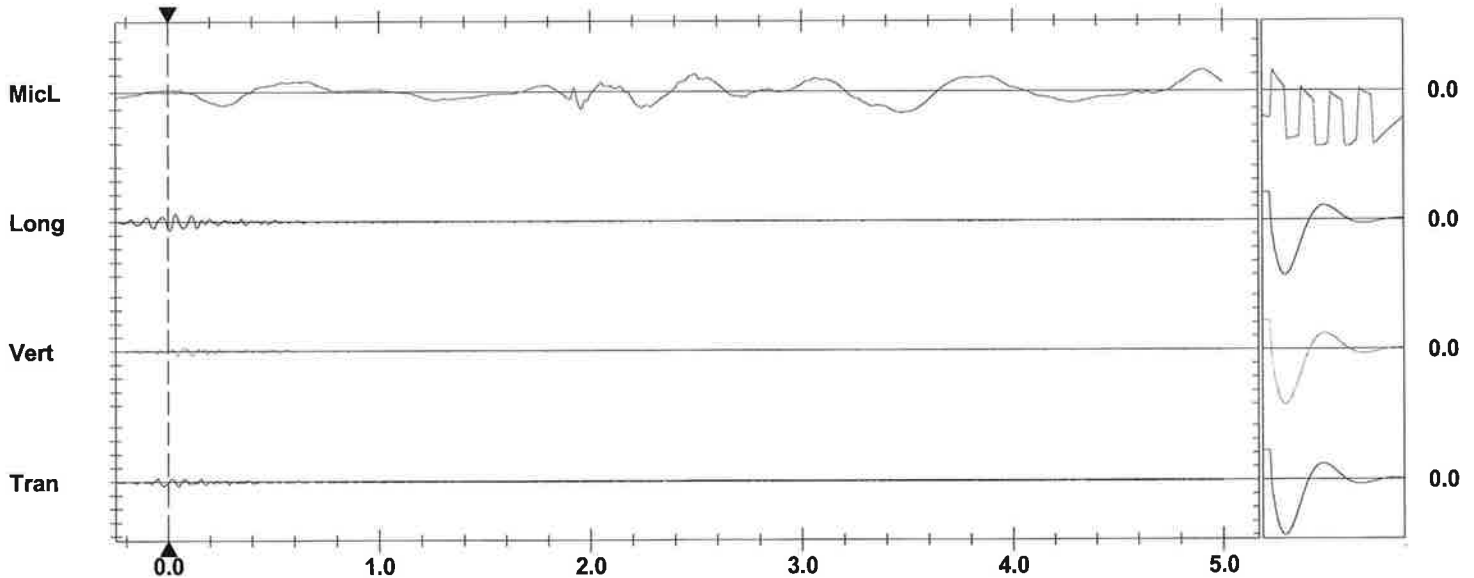
72 Holes 10 ft x 10 ft Pattern 26 FT deep 45kg max.
 CLOUDY SW WIND

Post Event Notes

Microphone Linear Weighting
PSPL 12.8 pa.(L) at 3.471 sec
ZC Freq 1.2 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 675 mv)

	Tran	Vert	Long	
PPV	0.635	0.635	1.27	mm/s
ZC Freq	14	30	17	Hz
Time (Rel. to Trig)	-0.024	0.044	0.004	sec
Peak Acceleration	0.0133	0.0265	0.0265	g
Peak Displacement	0.00744	0.00571	0.0133	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.5	3.6	3.9	

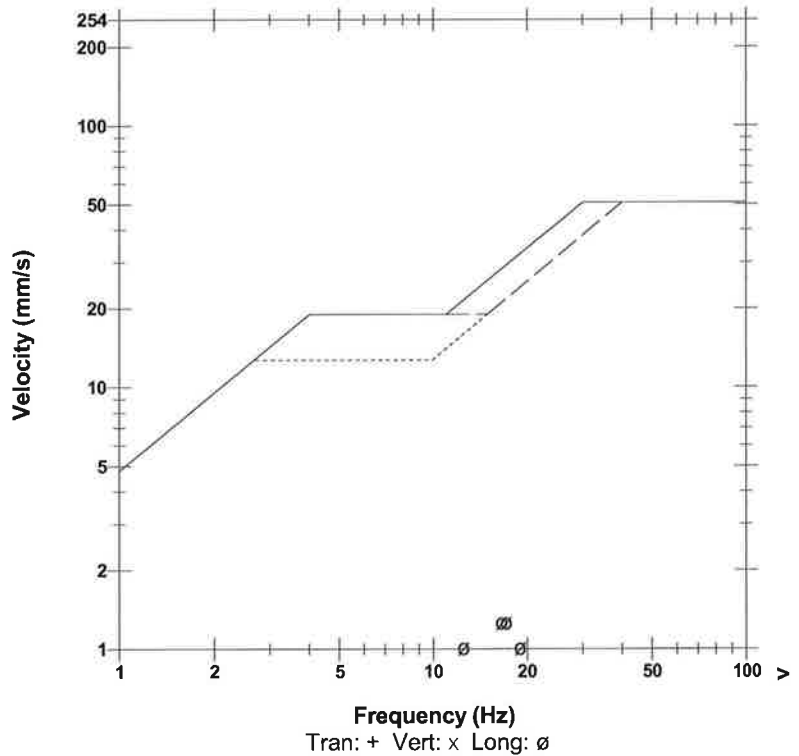
Peak Vector Sum 1.33 mm/s at 0.010 sec



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

USBM RI8507 And OSMRE



Date/Time Long at 13:25:07 September 17, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by Instantel
File Name J091EGNM.LV0
Scaled Distance 61.7 (390.0 m, 40.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 390 m SE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

7 x8' pattern 104 holes 26 FT average 40 KG MAX
 SUNNY with SW wind

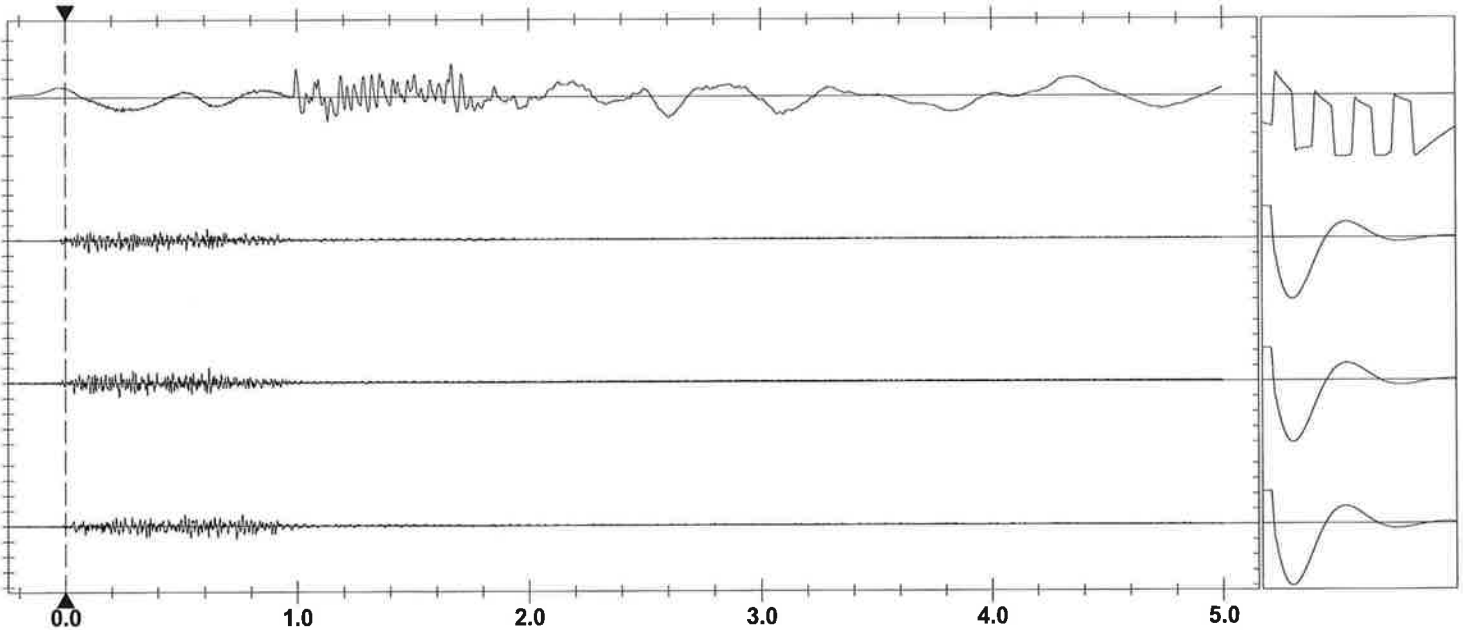
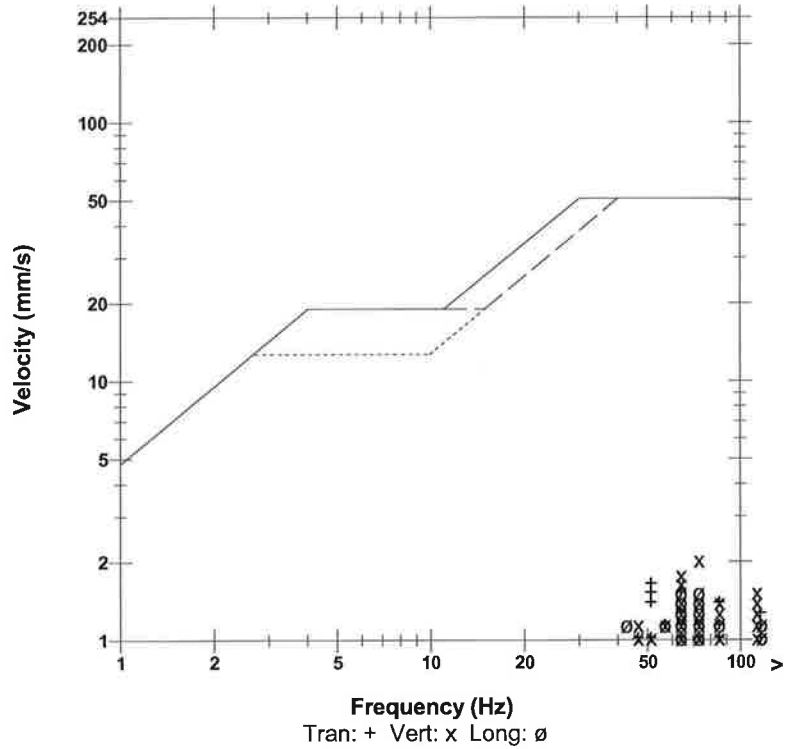
Post Event Notes

Microphone Linear Weighting
PSPL 17.3 pa.(L) at 1.663 sec
ZC Freq 13 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 628 mv)

	Tran	Vert	Long	
PPV	1.65	2.03	1.52	mm/s
ZC Freq	51	73	73	Hz
Time (Rel. to Trig)	0.737	0.619	0.102	sec
Peak Acceleration	0.0928	0.106	0.0795	g
Peak Displacement	0.00484	0.00415	0.00403	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.5	7.5	Hz
Overswing Ratio	3.6	3.6	4.0	

Peak Vector Sum 2.29 mm/s at 0.619 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Tran at 12:48:40 September 20, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EGT4.X40
Scaled Distance 61.7 (390.0 m, 40.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 390 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

7 x8' pattern 100 holes 21 FT average 40 KG MAX
 P.CLOUDY with SE wind

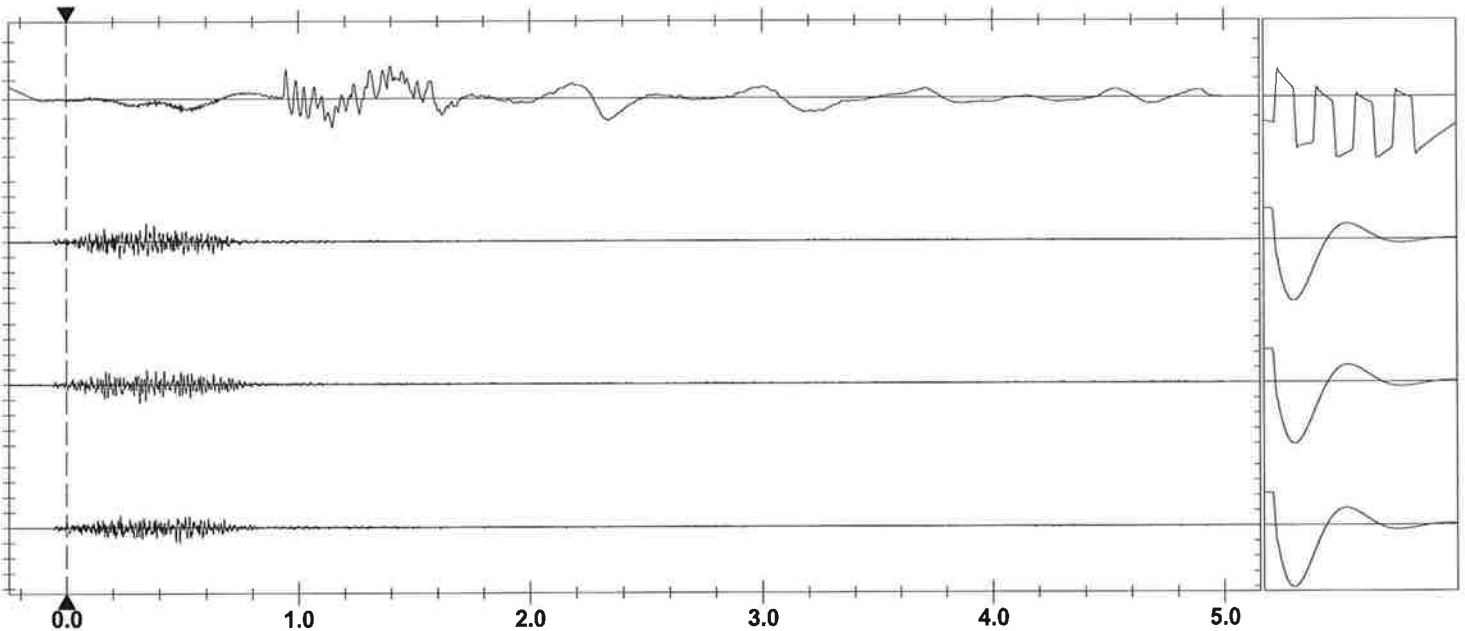
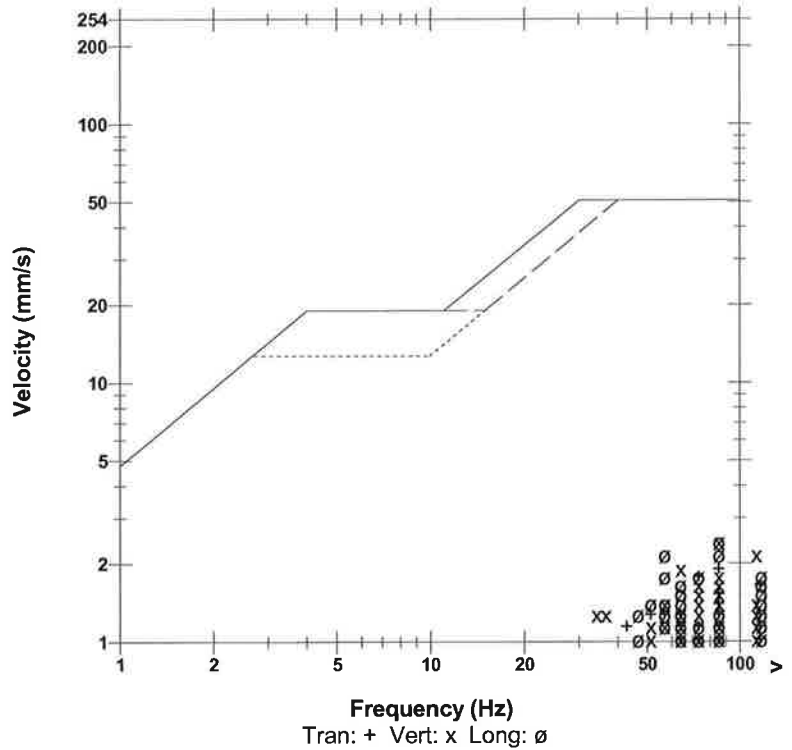
Post Event Notes

Microphone Linear Weighting
PSPL 17.3 pa.(L) at 1.396 sec
ZC Freq 2.6 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 668 mv)

	Tran	Vert	Long	
PPV	1.90	2.41	2.41	mm/s
ZC Freq	85	85	85	Hz
Time (Rel. to Trig)	0.486	0.315	0.344	sec
Peak Acceleration	0.0928	0.146	0.133	g
Peak Displacement	0.00415	0.00446	0.00533	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.5	Hz
Overswing Ratio	3.7	3.7	4.1	

Peak Vector Sum 2.69 mm/s at 0.315 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 13:16:26 September 24, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration February 16, 2012 by Instantel
File Name J091EH0K.VE0
Scaled Distance 61.7 (390.0 m, 40.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 390 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

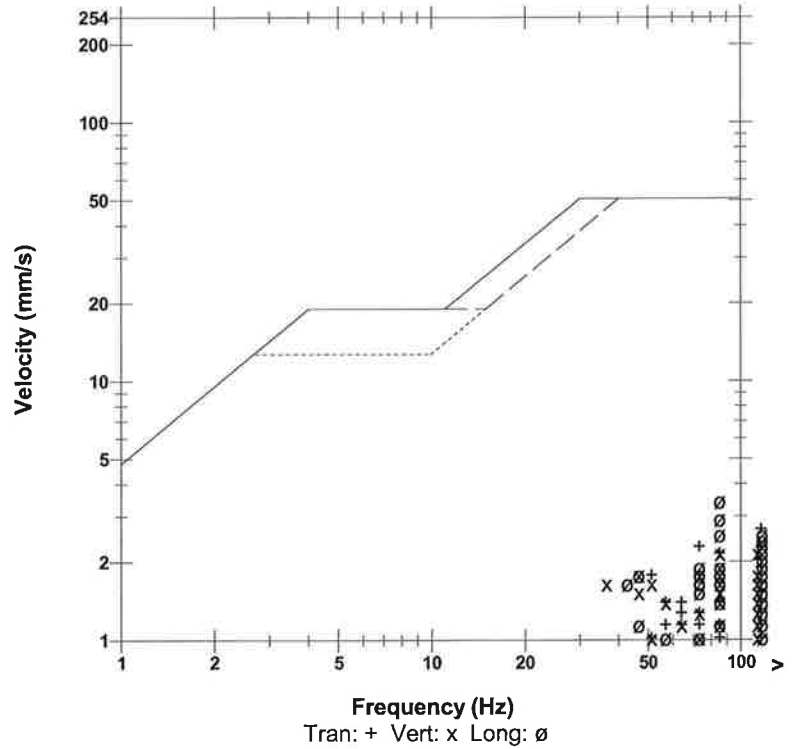
7 x8' pattern 112 holes 19 FT average 40 KG MAX
 P.CLOUDY with SW wind

Post Event Notes

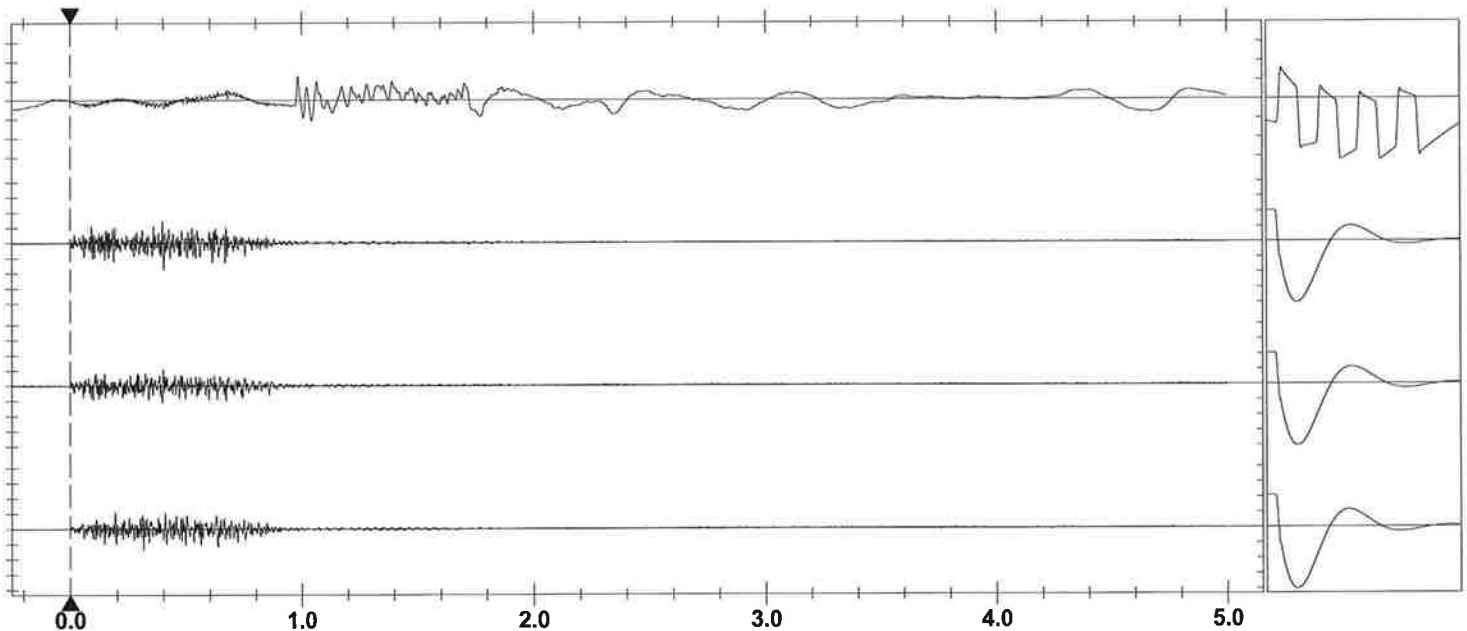
Microphone Linear Weighting
PSPL 12.8 pa.(L) at 0.983 sec
ZC Freq 27 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 689 mv)

	Tran	Vert	Long	
PPV	2.67	2.16	3.43	mm/s
ZC Freq	>100	85	85	Hz
Time (Rel. to Trig)	0.314	0.395	0.400	sec
Peak Acceleration	0.172	0.146	0.212	g
Peak Displacement	0.00502	0.00546	0.00589	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.7	3.7	4.1	

USBM RI8507 And OSMRE



Peak Vector Sum 3.87 mm/s at 0.400 sec



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 12:17:25 September 25, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EH2C.T10
Scaled Distance 61.1 (410.0 m, 45.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 410 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

7 x8' pattern 80 holes 29 FT average 45 KG MAX
 .CLOUDY with SW wind

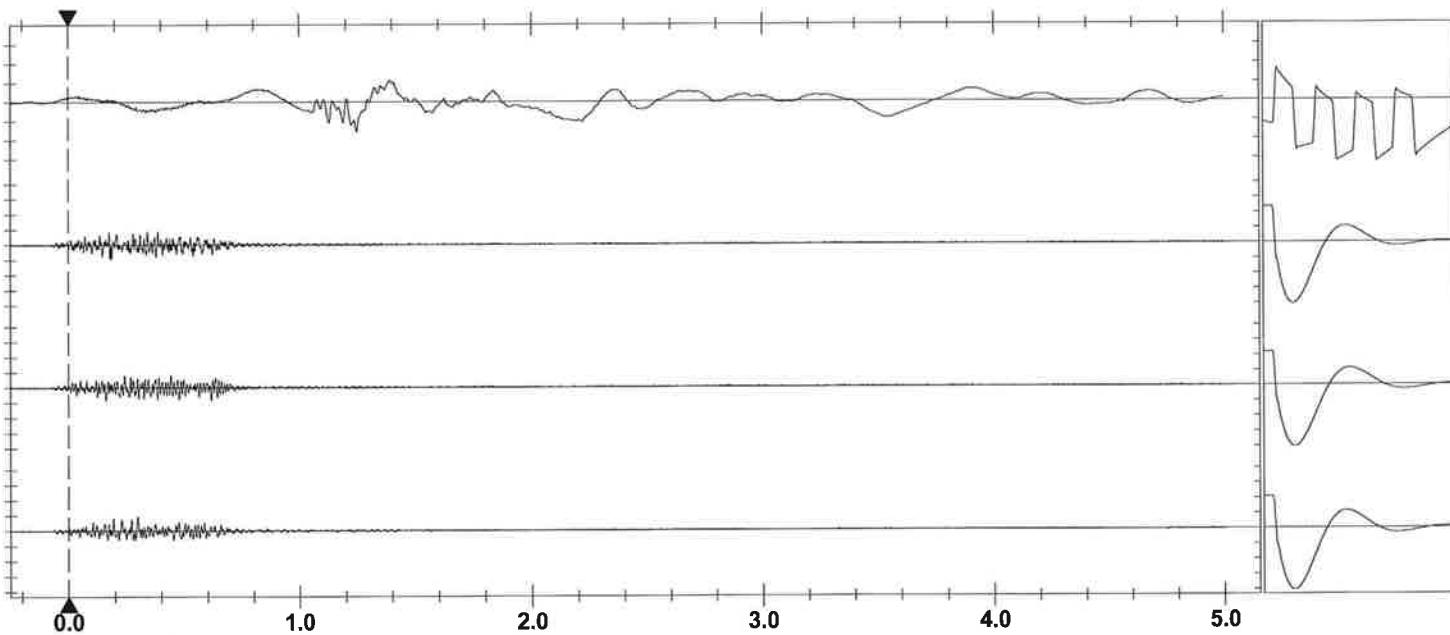
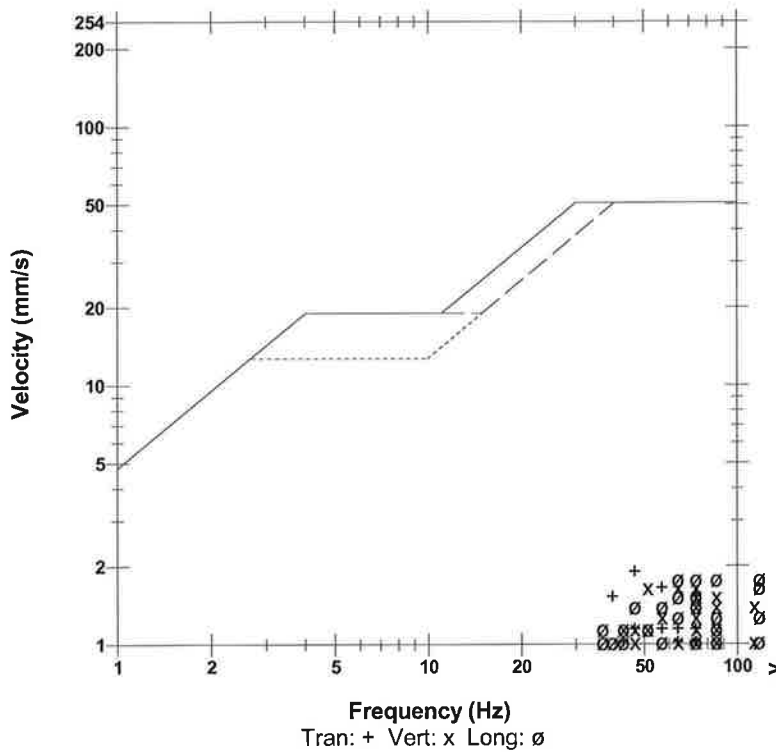
Post Event Notes

Microphone Linear Weighting
PSPL 15.5 pa.(L) at 1.247 sec
ZC Freq 6.0 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 662 mv)

	Tran	Vert	Long	
PPV	1.90	1.65	1.78	mm/s
ZC Freq	47	64	>100	Hz
Time (Rel. to Trig)	0.297	0.161	0.180	sec
Peak Acceleration	0.0663	0.0928	0.133	g
Peak Displacement	0.00577	0.00440	0.00490	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.3	7.7	Hz
Overswing Ratio	3.6	3.7	3.9	

Peak Vector Sum 2.35 mm/s at 0.297 sec

USBM R18507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 10:47:42 September 26, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EH43.B10
Scaled Distance 58.1 (390.0 m, 45.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 390 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

7 x8' pattern 60 holes 28 FT average 45 KG MAX
 .CLOUDY with SW wind

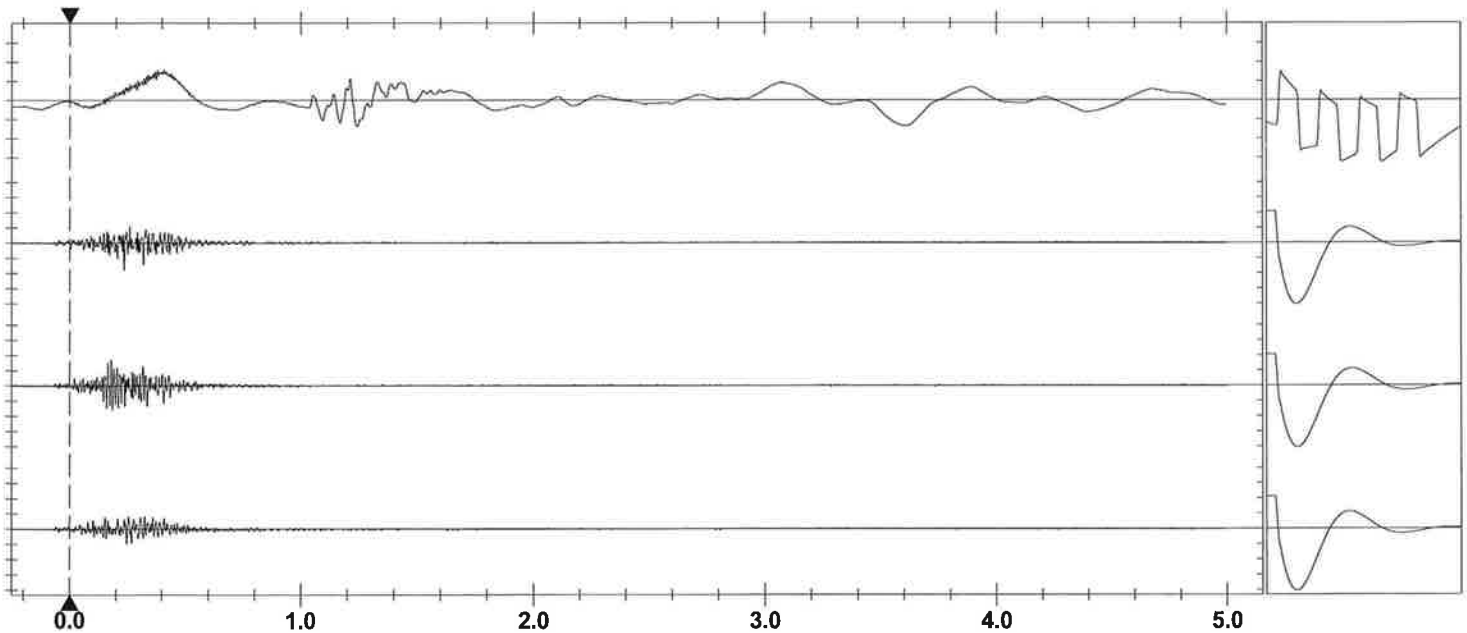
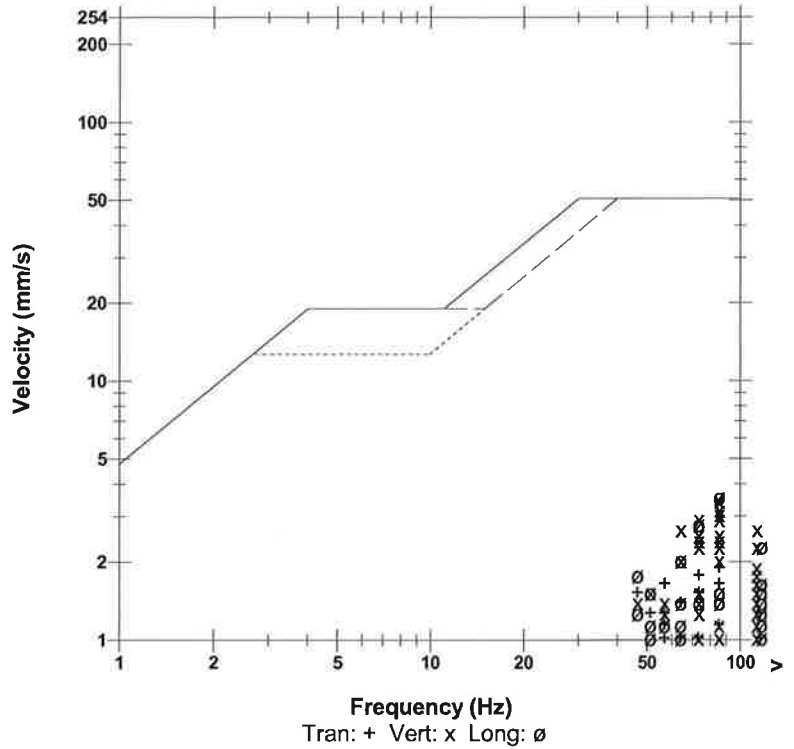
Post Event Notes

Microphone Linear Weighting
PSPL 15.8 pa.(L) at 0.380 sec
ZC Freq 1.3 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 649 mv)

	Tran	Vert	Long	
PPV	1.90	3.43	3.56	mm/s
ZC Freq	85	85	85	Hz
Time (Rel. to Trig)	0.247	0.179	0.235	sec
Peak Acceleration	0.0928	0.186	0.186	g
Peak Displacement	0.00490	0.00583	0.00633	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.6	Hz
Overswing Ratio	3.6	3.7	4.0	

Peak Vector Sum 3.77 mm/s at 0.235 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger = ▶ ◀

Sensorcheck

Date/Time Vert at 10:37:53 September 27, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EH5X.J50
Scaled Distance 61.1 (410.0 m, 45.0 kg)

Notes

Location: AT RES.UNITY Rd CIVIC # 2467 410 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General:

Extended Notes

7 x8' pattern 57 holes 32 FT average 45 KG MAX
 SUNNY with SE wind

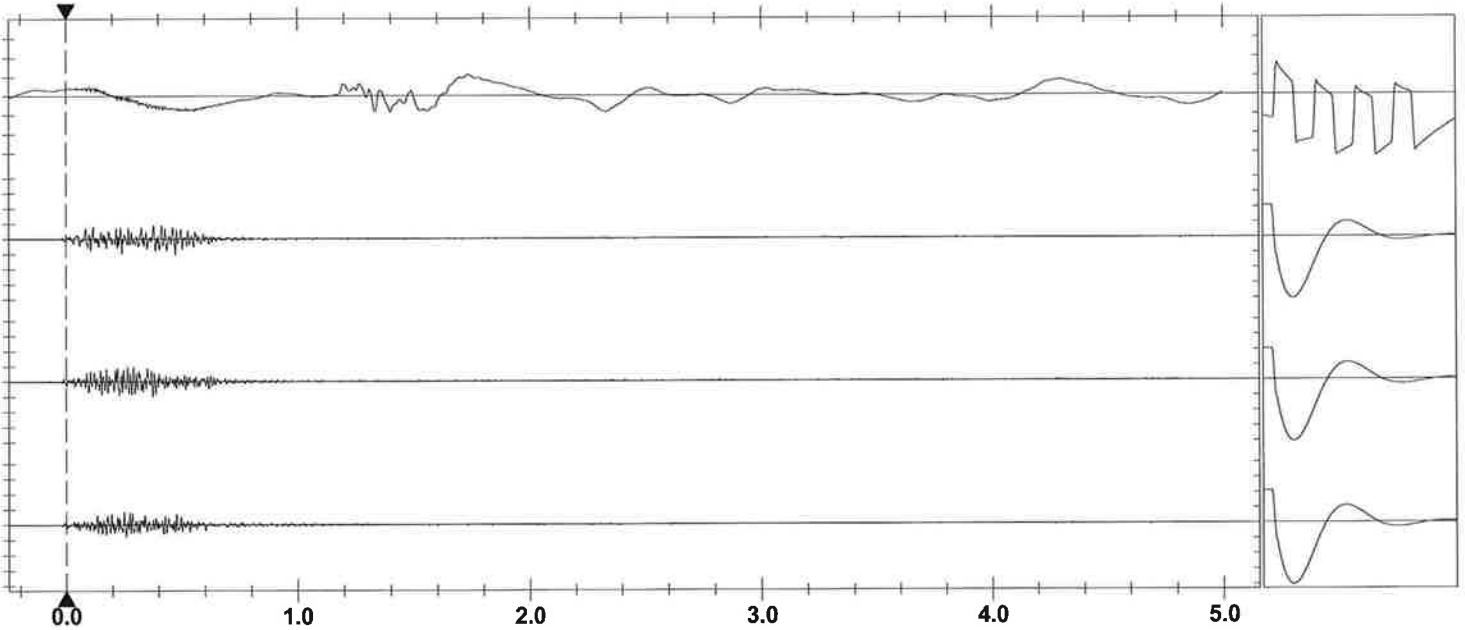
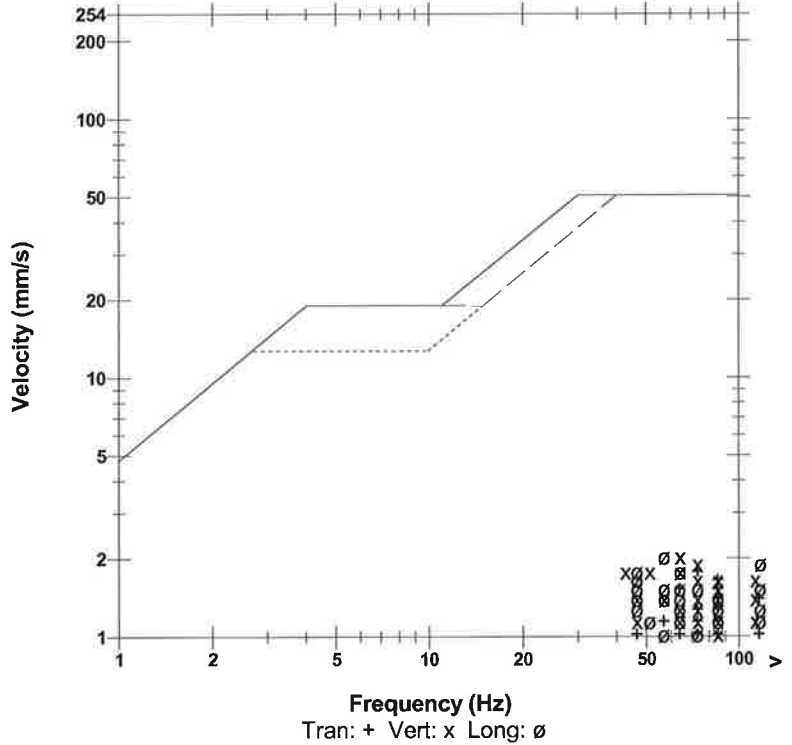
Post Event Notes

Microphone Linear Weighting
PSPL 11.3 pa.(L) at 1.731 sec
ZC Freq 1.1 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 636 mv)

	Tran	Vert	Long	
PPV	1.78	2.03	2.03	mm/s
ZC Freq	73	64	57	Hz
Time (Rel. to Trig)	0.250	0.266	0.473	sec
Peak Acceleration	0.0928	0.106	0.106	g
Peak Displacement	0.00360	0.00564	0.00583	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.7	3.7	4.1	

Peak Vector Sum 2.35 mm/s at 0.222 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Tran at 12:36:03 November 15, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.3 Volts
Calibration February 16, 2012 by Instantel
File Name J091EJOT.O30
Scaled Distance 114.8 (770.0 m, 45.0 kg)

Notes

Location: Kingston Quarry - 160 m north of blast
 Client: Cruickshank Construction
 User Name: DST Consulting Engineers
 General: Blast Vibration Monitoring

Extended Notes

seismograph installed on Enbridge gas line 160 m north of the blast area.

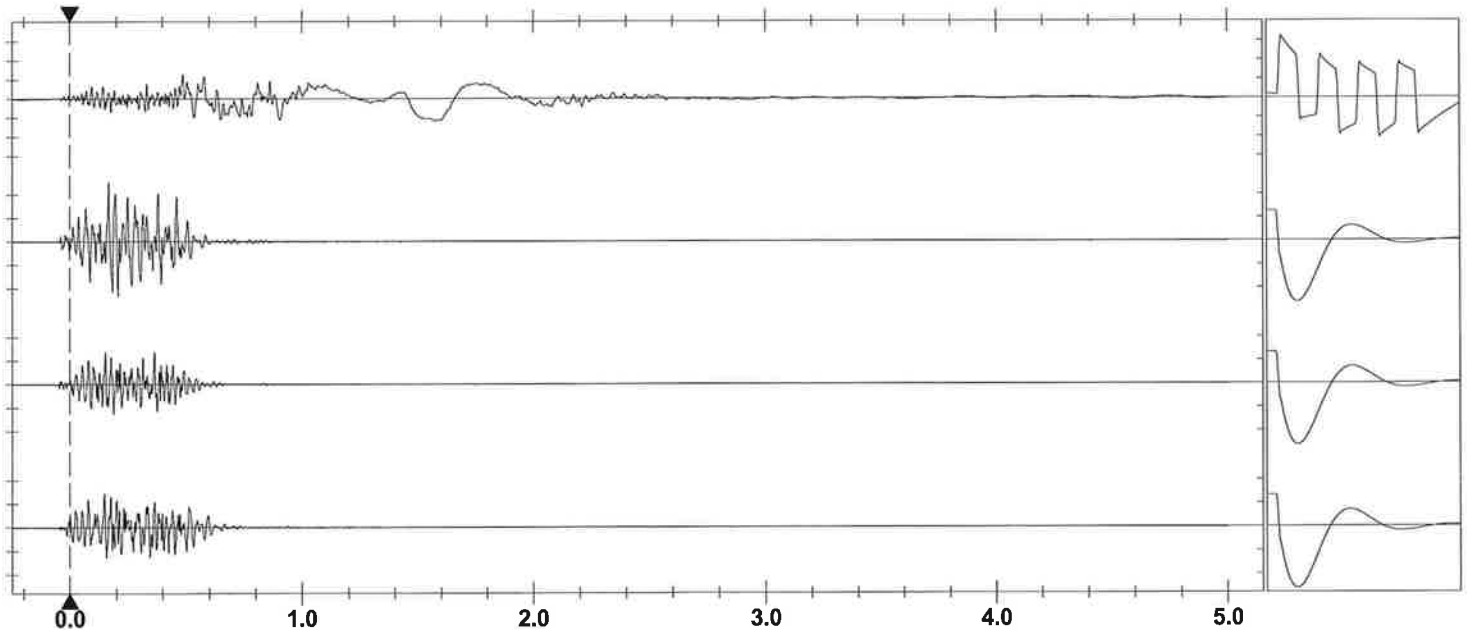
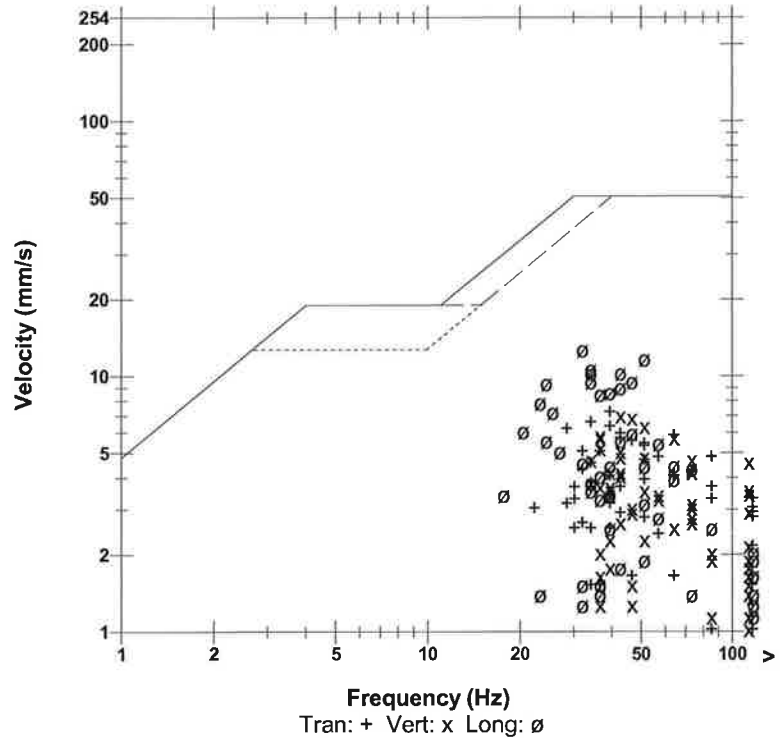
Post Event Notes

Microphone Linear Weighting
PSPL 12.8 pa.(L) at 0.486 sec
ZC Freq 20 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 662 mv)

	Tran	Vert	Long	
PPV	7.24	6.98	12.7	mm/s
ZC Freq	39	43	32	Hz
Time (Rel. to Trig)	0.147	0.152	0.166	sec
Peak Acceleration	0.265	0.411	0.437	g
Peak Displacement	0.0284	0.0215	0.0505	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.3	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 13.3 mm/s at 0.166 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger = ▶ — ◀

Sensorcheck

Date/Time Tran at 12:36:03 November 15, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.3 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EJOT.O30

Notes

Location: Kingston Quarry - Unity Road
 Client: Cruickshank Construction
 User Name: DST Consulting Engineers
 General: Blast Vibration Monitoring

Extended Note

Seismographs installed on the Engbridge Gas line.

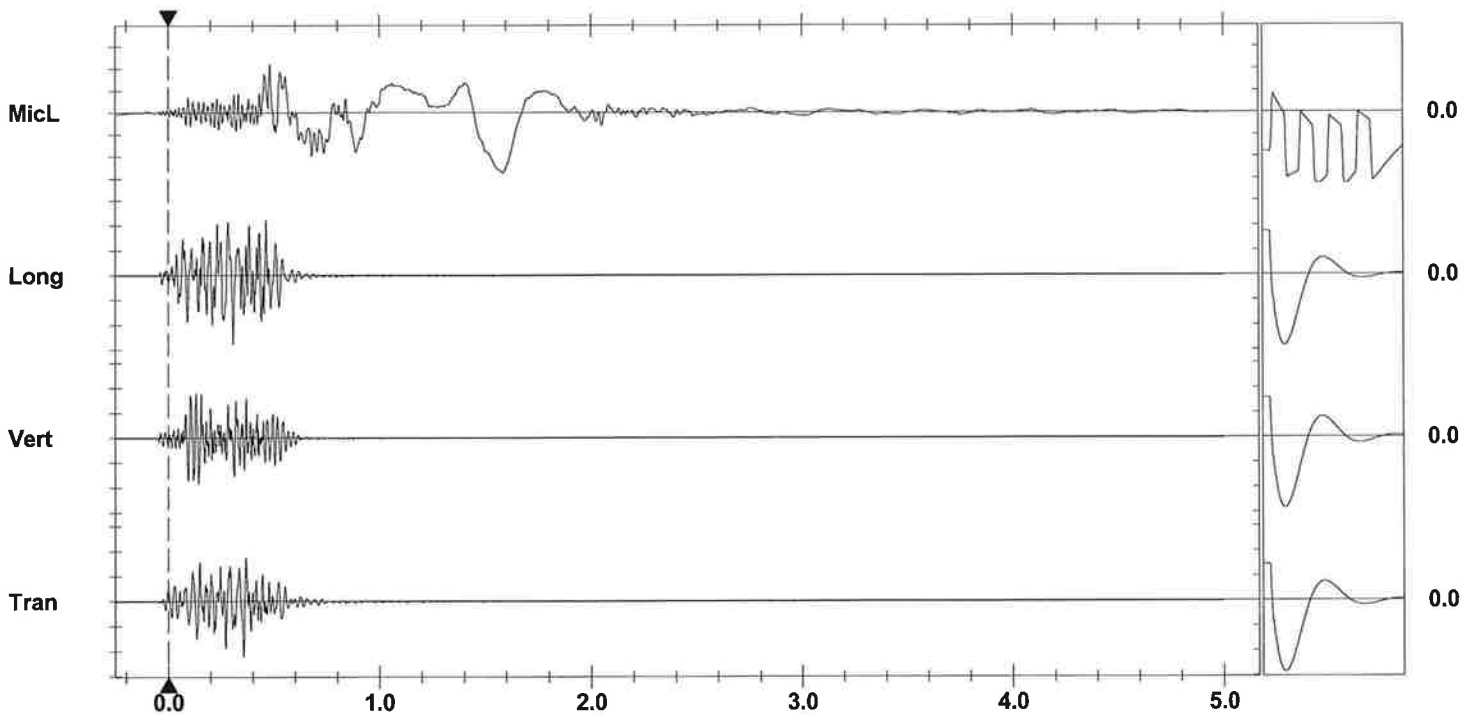
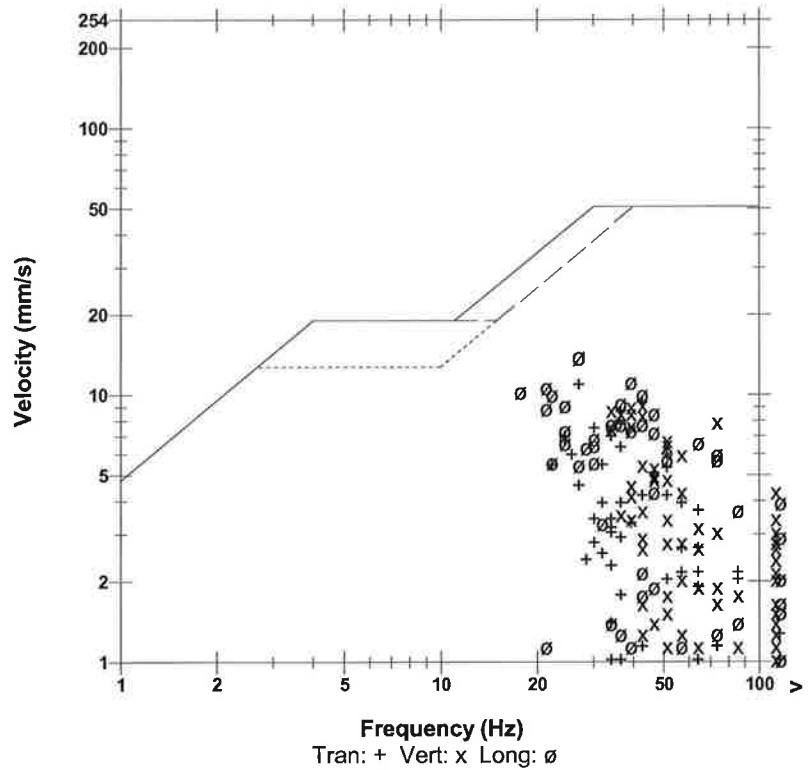
Post Event Notes

Microphone Linear Weighting
PSPL 27.3 pa.(L) at 1.583 sec
ZC Freq 2.2 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 629 mv)

	Tran	Vert	Long	
PPV	10.9	9.14	13.8	mm/s
ZC Freq	27	43	27	Hz
Time (Rel. to Trig)	0.355	0.143	0.307	sec
Peak Acceleration	0.345	0.504	0.371	g
Peak Displacement	0.0500	0.0348	0.0764	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.5	Hz
Overswing Ratio	3.9	3.6	4.3	

Peak Vector Sum 15.4 mm/s at 0.308 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 10:07:19 November 20, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by Instantel
File Name J091EJXW.470
Scaled Distance 30.4 (180.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 180 m NE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

65 HIS 23 ft 9 x 10 35 kg MAX. PD
 P.CLOUDY NE WIND.

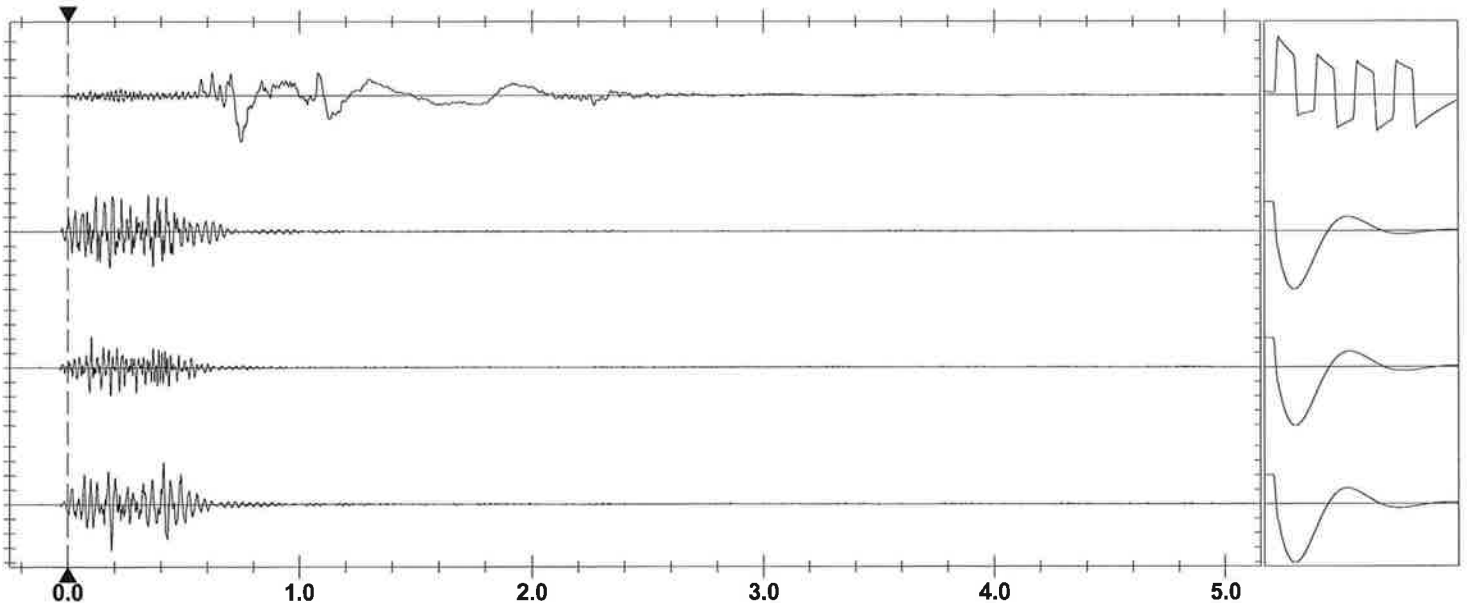
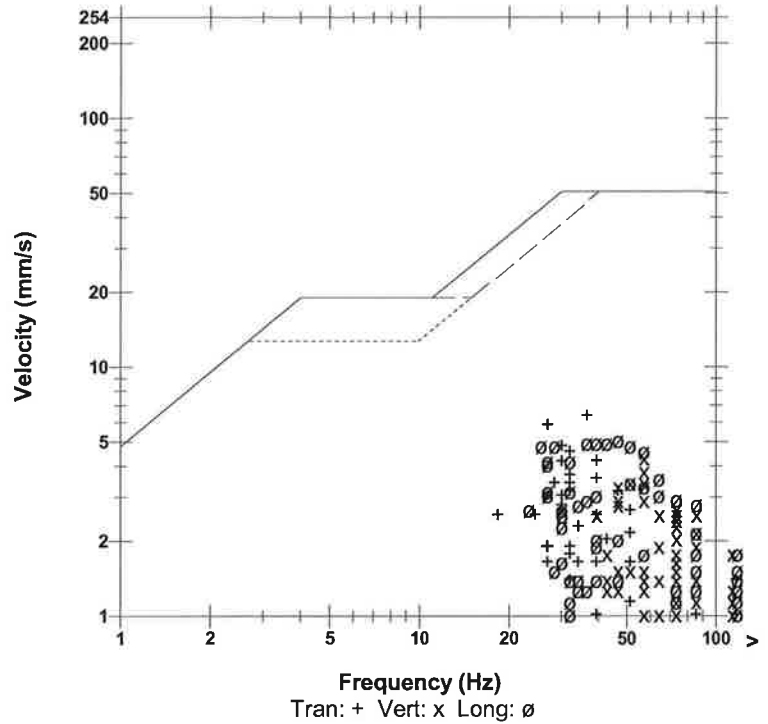
Post Event Notes

Microphone Linear Weighting
PSPL 25.5 pa.(L) at 0.746 sec
ZC Freq 5.2 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 659 mv)

	Tran	Vert	Long	
PPV	6.35	4.32	5.08	mm/s
ZC Freq	37	57	47	Hz
Time (Rel. to Trig)	0.188	0.102	0.346	sec
Peak Acceleration	0.146	0.186	0.186	g
Peak Displacement	0.0267	0.0110	0.0228	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.5	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 7.35 mm/s at 0.188 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 10:34:50 November 21, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EJZS.220

Notes

Location: Elginburg Quarry - 145m NE of Blast
 Client: Cruickshank Construction
 User Name: DST Consulting Engineers
 General: Blast Vibration Monitoring

Extended Note

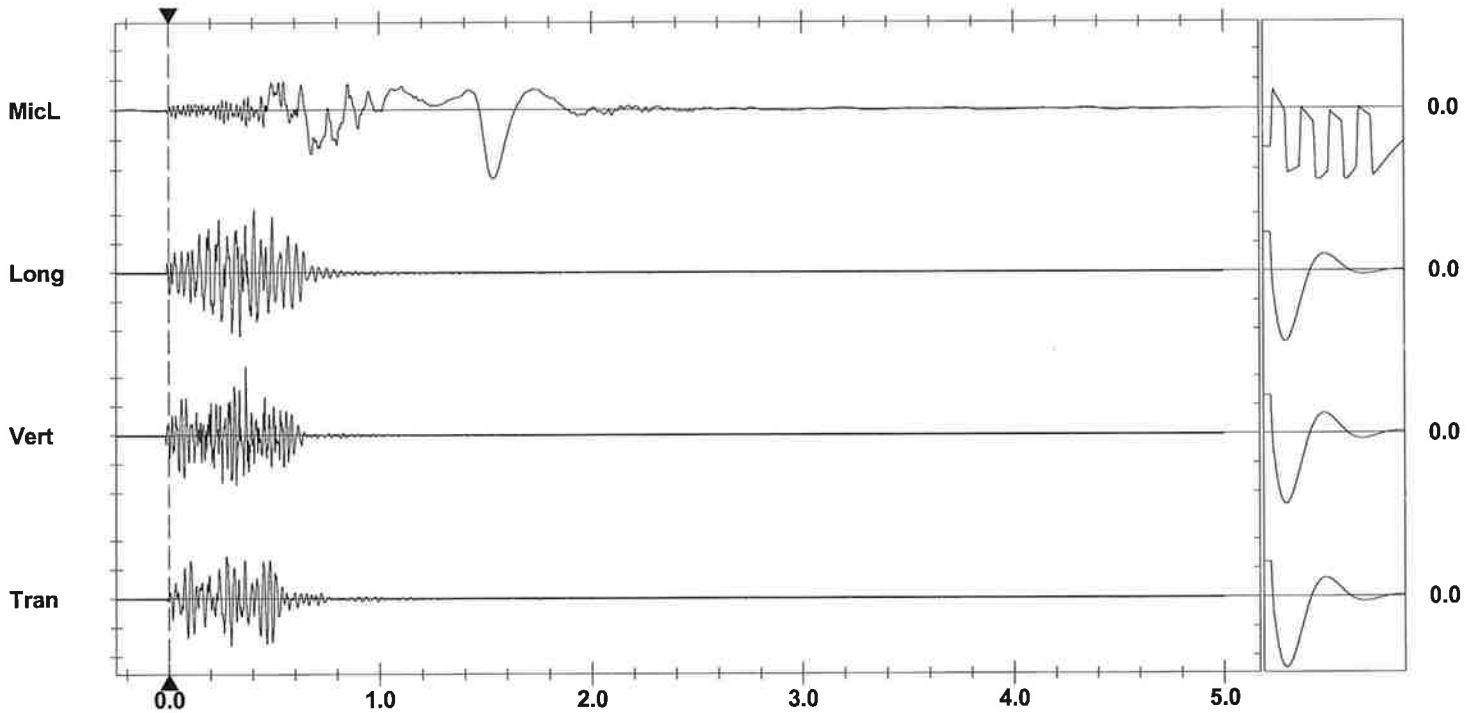
seismograph installed on Enbridge Pipeline NE of the blast site

Post Event Notes

Microphone Linear Weighting
PSPL 45.8 pa.(L) at 1.536 sec
ZC Freq 3.0 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 590 mv)

	Tran	Vert	Long	
PPV	8.13	11.9	11.0	mm/s
ZC Freq	34	51	39	Hz
Time (Rel. to Trig)	0.296	0.366	0.339	sec
Peak Acceleration	0.278	0.477	0.358	g
Peak Displacement	0.0372	0.0337	0.0574	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.3	7.6	7.4	Hz
Overswing Ratio	3.9	3.6	4.3	

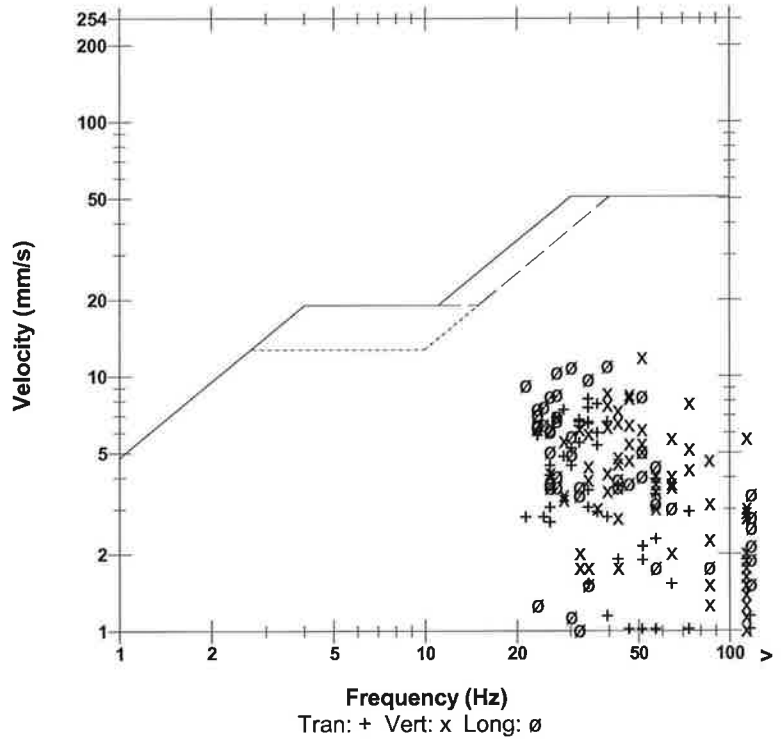
Peak Vector Sum 14.6 mm/s at 0.366 sec



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 20.0 pa.(L)/div
Trigger =

Sensorcheck

USBM R18507 And OSMRE



Date/Time Long at 10:34:51 November 21, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by Instantel
File Name J091EJZS.230

Notes

Location: Elginburg Quarry - 155 m NE of Blast
 Client: Cruickshank Construction
 User Name: DST Consulting Engineers
 General: Blast Vibration Monitoring

Extended Notes

seismograph is installed on the Enbridge Pipeline north east of the blast site..

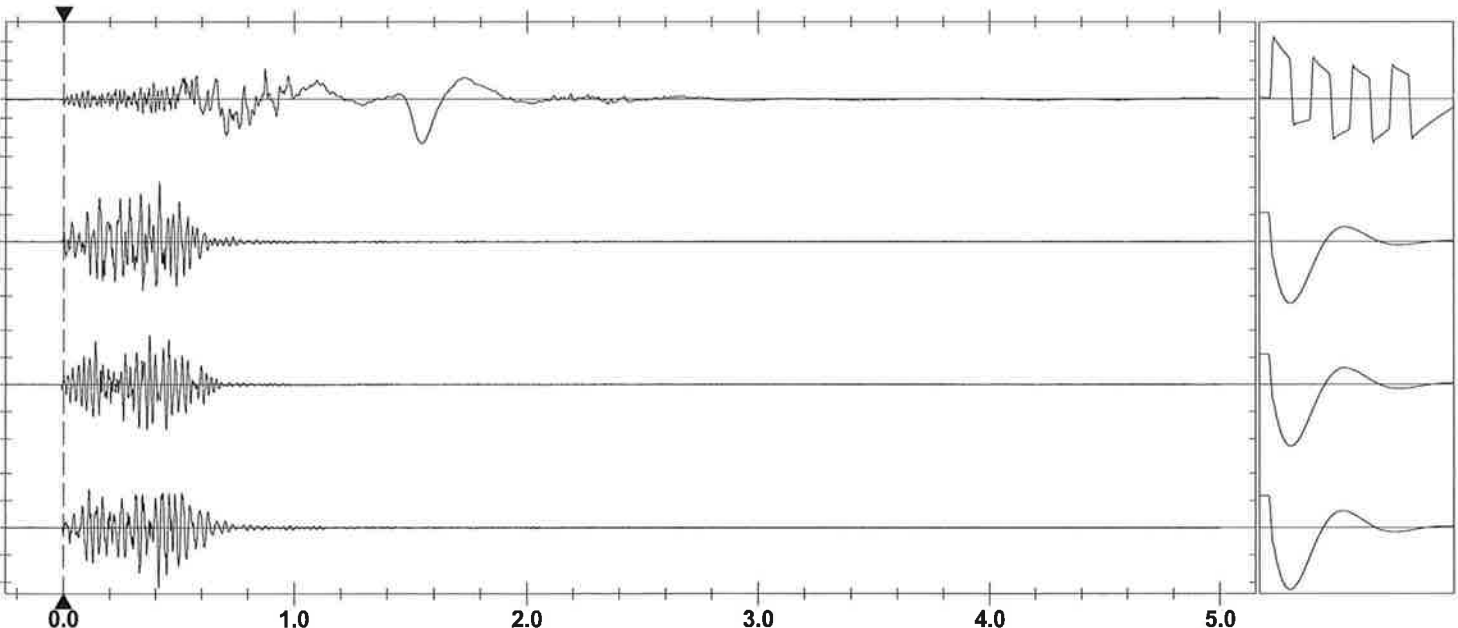
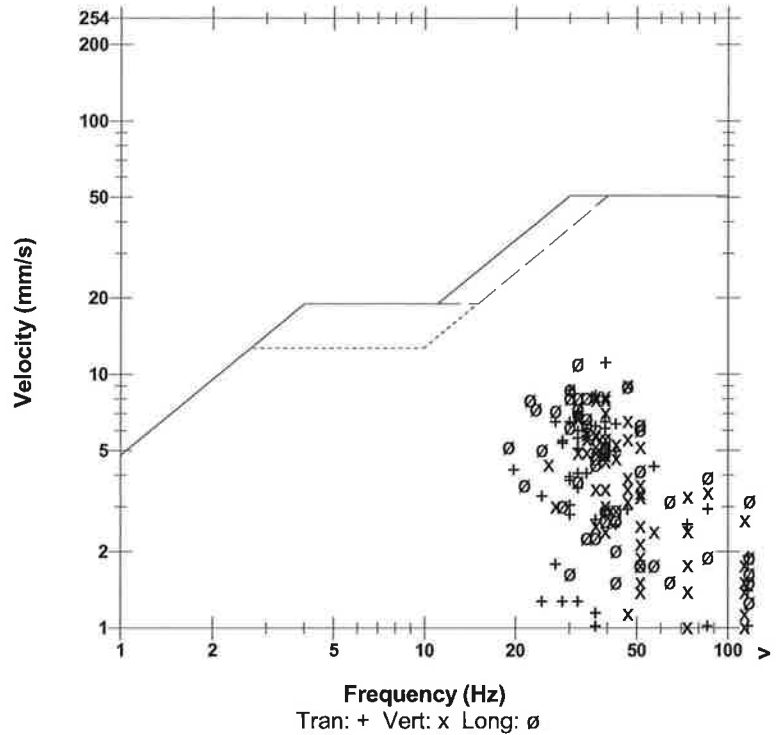
Post Event Notes

Microphone Linear Weighting
PSPL 23.3 pa.(L) at 1.545 sec
ZC Freq 3.2 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 688 mv)

	Tran	Vert	Long	
PPV	11.0	9.14	11.0	mm/s
ZC Freq	39	47	32	Hz
Time (Rel. to Trig)	0.413	0.373	0.416	sec
Peak Acceleration	0.318	0.278	0.345	g
Peak Displacement	0.0399	0.0345	0.0476	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.3	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 13.5 mm/s at 0.414 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:35:08 November 22, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EK1P.IK0
Scaled Distance 43.9 (260.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 260 m N
 Client: ELGINBURG QUARRY
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

99 HIS 18 ft 9 x 10 35 kg MAX. PD SUNNY SW WIND.

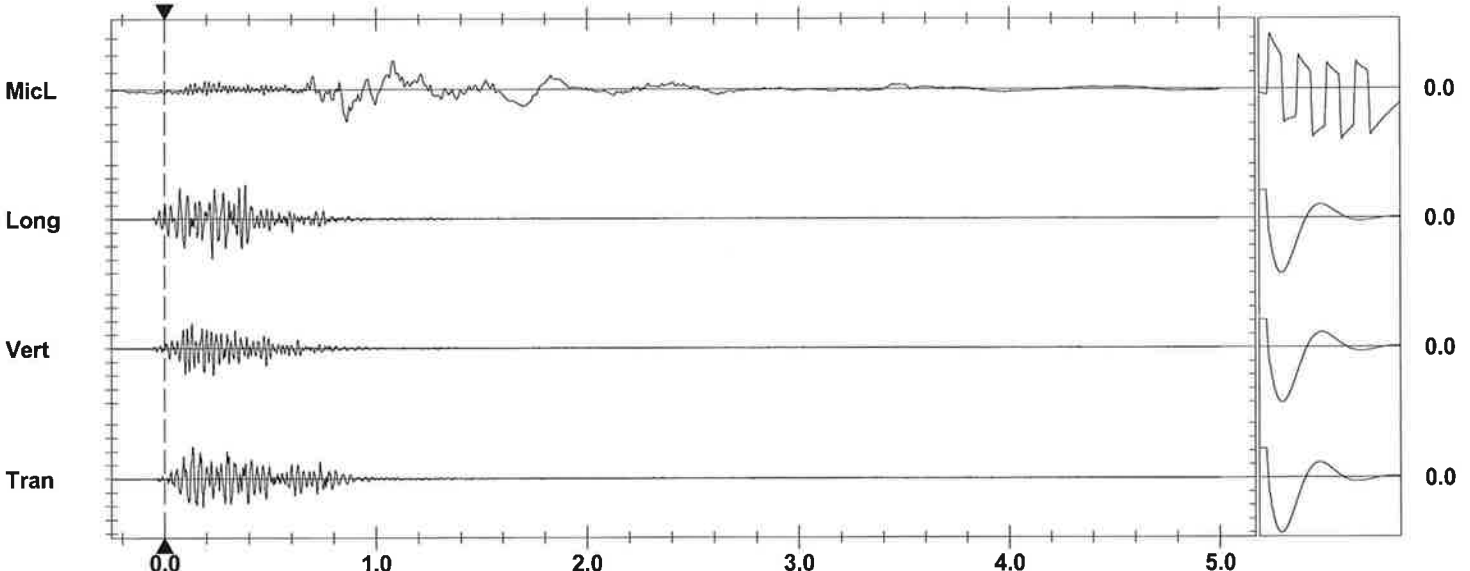
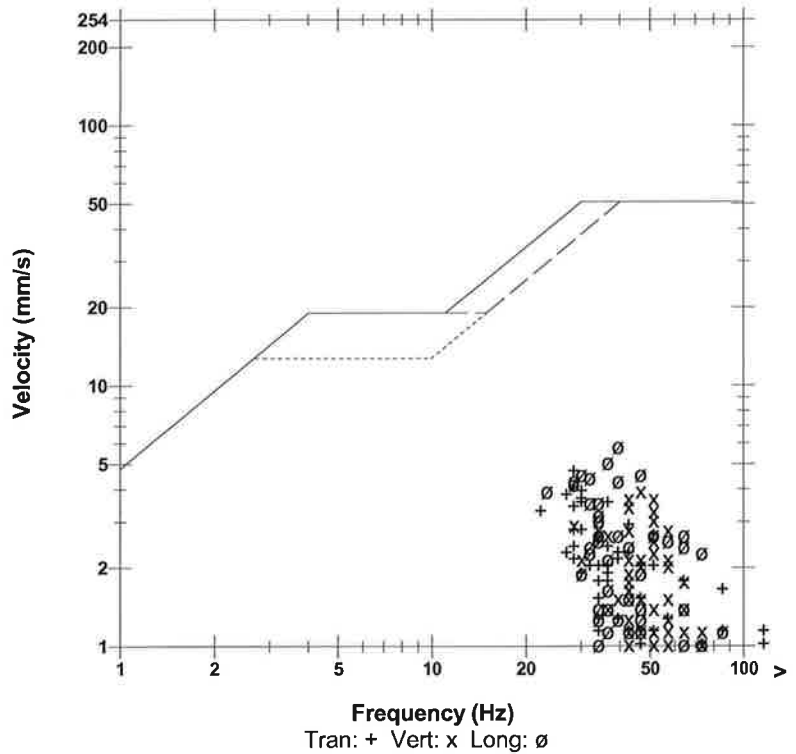
Post Event Notes

Microphone Linear Weighting
PSPL 18.5 pa.(L) at 0.860 sec
ZC Freq 4.9 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 675 mv)

	Tran	Vert	Long	
PPV	4.70	3.94	5.84	mm/s
ZC Freq	28	47	39	Hz
Time (Rel. to Trig)	0.133	0.230	0.226	sec
Peak Acceleration	0.172	0.133	0.159	g
Peak Displacement	0.0250	0.0141	0.0227	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.7	3.8	4.2	

Peak Vector Sum 6.07 mm/s at 0.226 sec

USBM R18507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:35:07 November 22, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EK1P.IJ0
Scaled Distance 45.6 (270.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 270 m NE
 Client: ELGINBURG QUARRY
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

99 HIS 18 ft 9 x 10 35 kg MAX PD SUNNY SW WIND

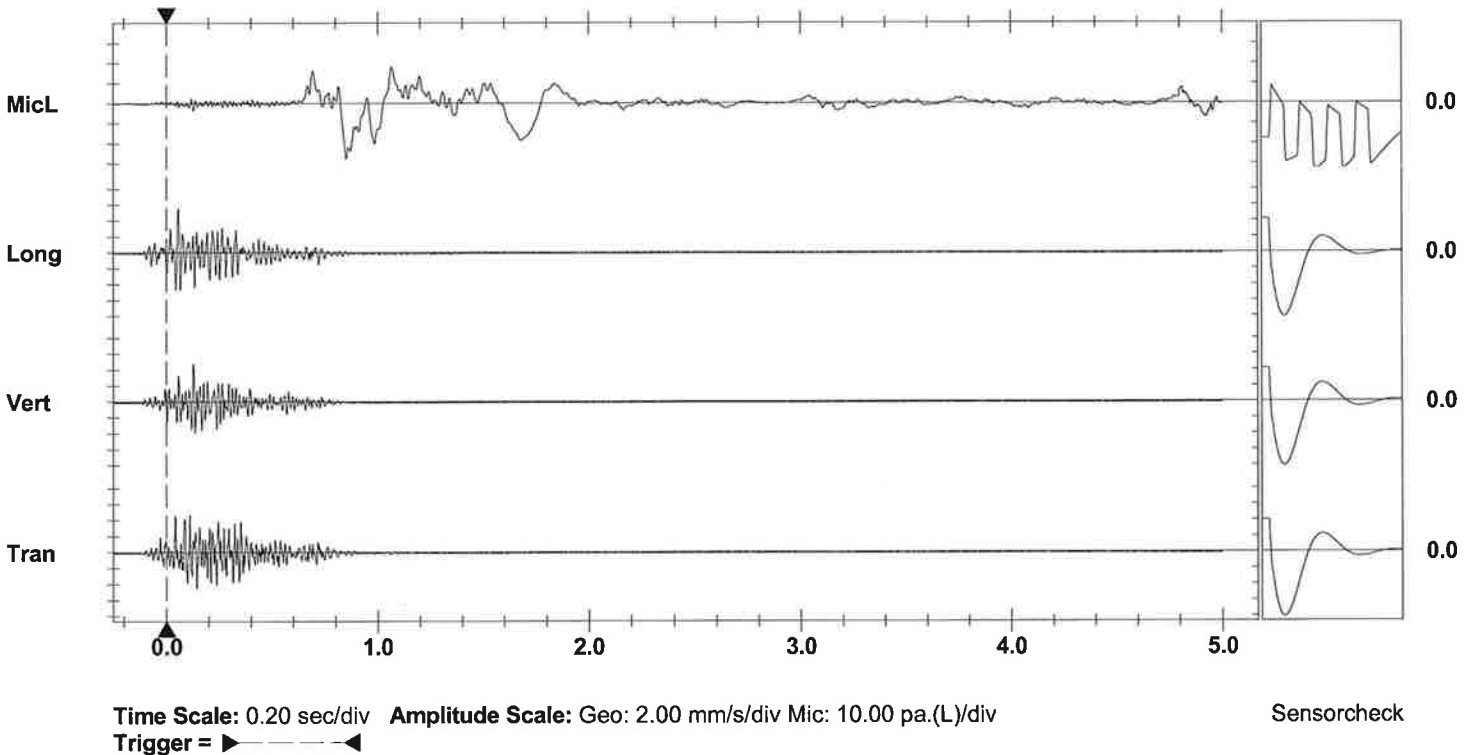
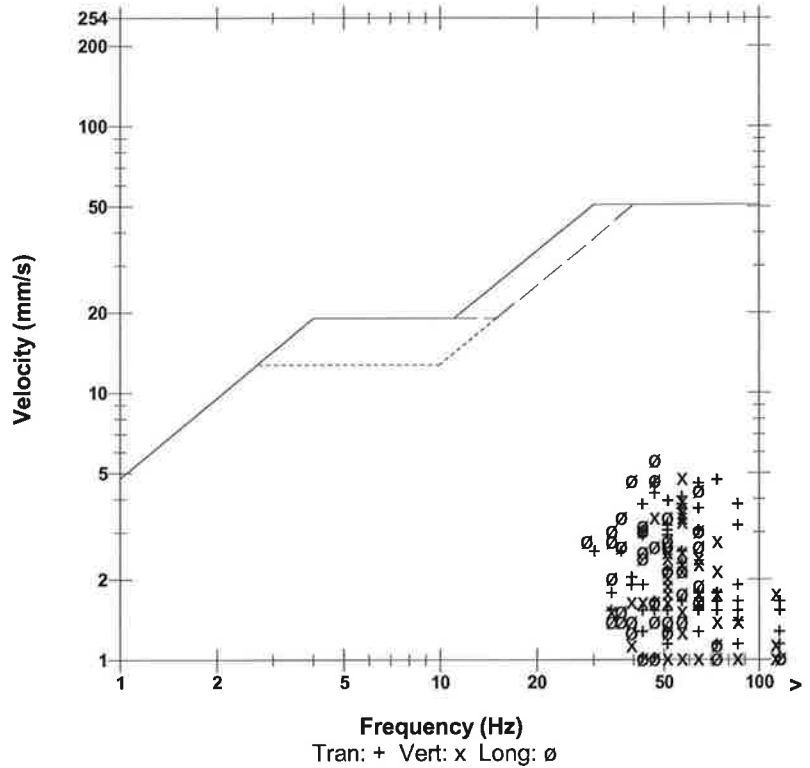
Post Event Notes

Microphone Linear Weighting
PSPL 27.5 pa.(L) at 0.850 sec
ZC Freq 4.3 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 562 mv)

	Tran	Vert	Long	
PPV	4.70	4.83	5.59	mm/s
ZC Freq	73	57	47	Hz
Time (Rel. to Trig)	0.109	0.126	0.055	sec
Peak Acceleration	0.212	0.199	0.172	g
Peak Displacement	0.0167	0.0140	0.0189	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.7	3.6	4.3	

Peak Vector Sum 6.53 mm/s at 0.056 sec

USBM R18507 And OSMRE



Date/Time Long at 11:27:00 November 26, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EK93.T00
Scaled Distance 33.8 (200.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 200 m N
 Client: ELGINBURG QUARRY
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

82 HIS 22 ft 9 x 10 35 kg MAX PD SUNNY SE WIND

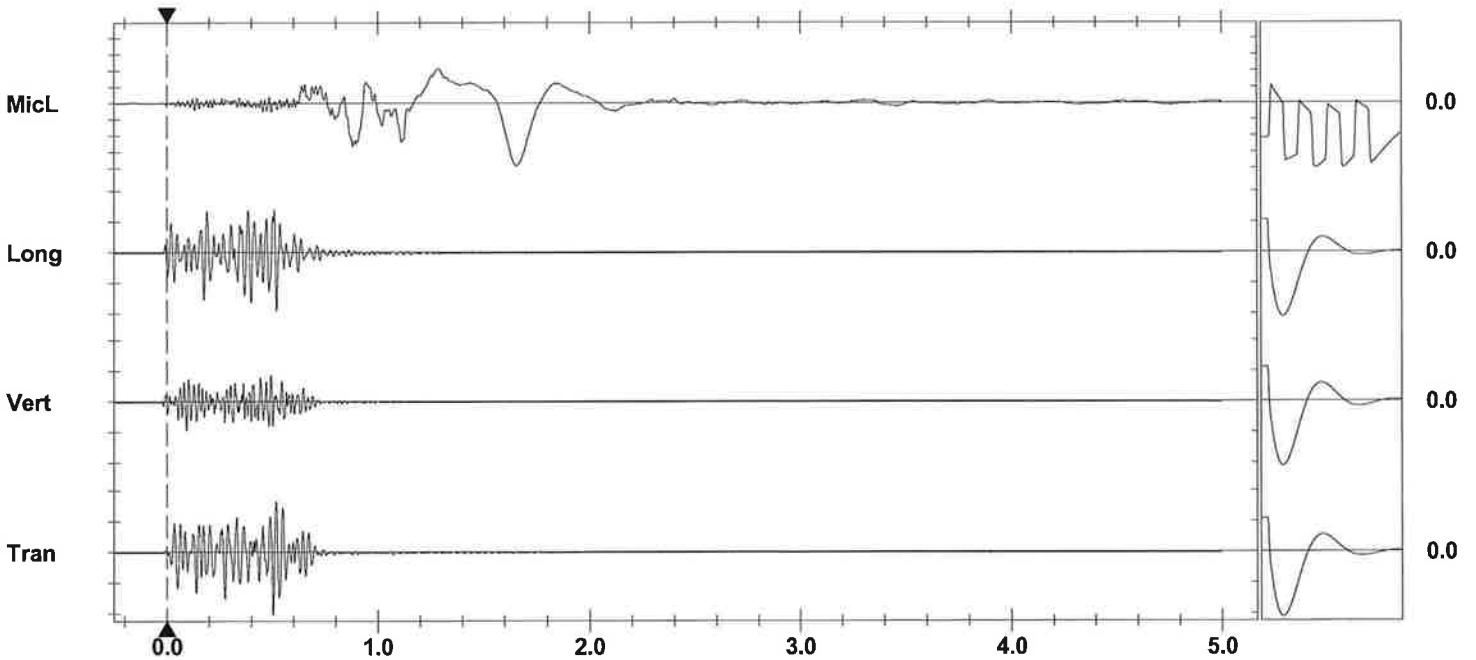
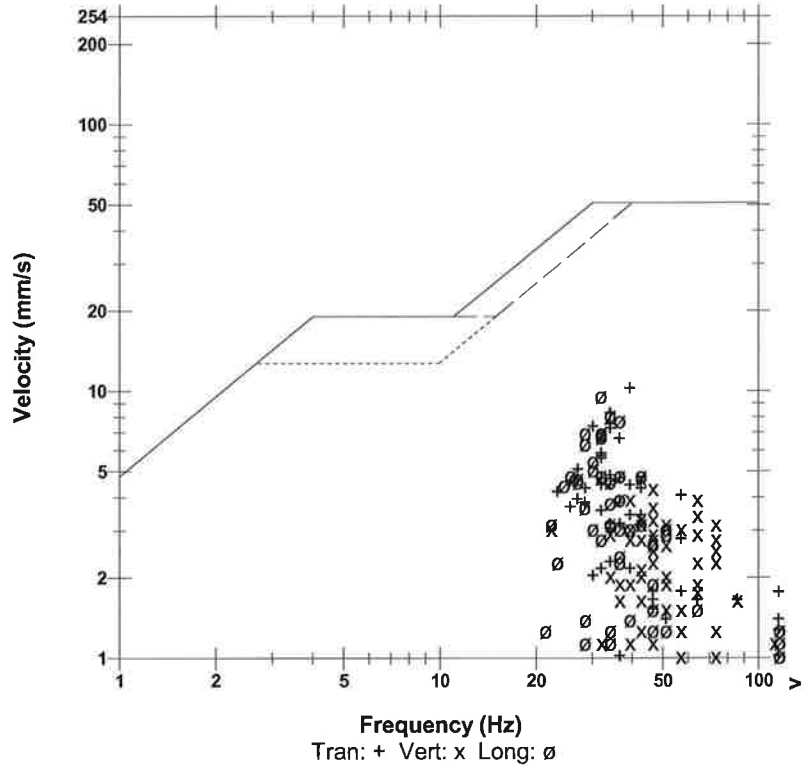
Post Event Notes

Microphone Linear Weighting
PSPL 38.5 pa.(L) at 1.652 sec
ZC Freq 2.6 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 621 mv)

	Tran	Vert	Long	
PPV	10.2	4.70	9.52	mm/s
ZC Freq	39	43	32	Hz
Time (Rel. to Trig)	0.502	0.092	0.518	sec
Peak Acceleration	0.265	0.186	0.252	g
Peak Displacement	0.0423	0.0172	0.0416	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.3	Hz
Overswing Ratio	3.9	3.6	4.5	

Peak Vector Sum 12.5 mm/s at 0.518 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Vert at 12:04:34 November 27, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8349 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration December 1, 2011 by Instantel
File Name J349EKB0.7M0
Scaled Distance 27.0 (160.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE #064 160 m N
 Client: ELGINBURG QUARRY JOB # 10350033
 User: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

80 Holes 9 ft x10 ft Pattern 22 FT deep 35 kg MAX.
 SUNNY NE WIND

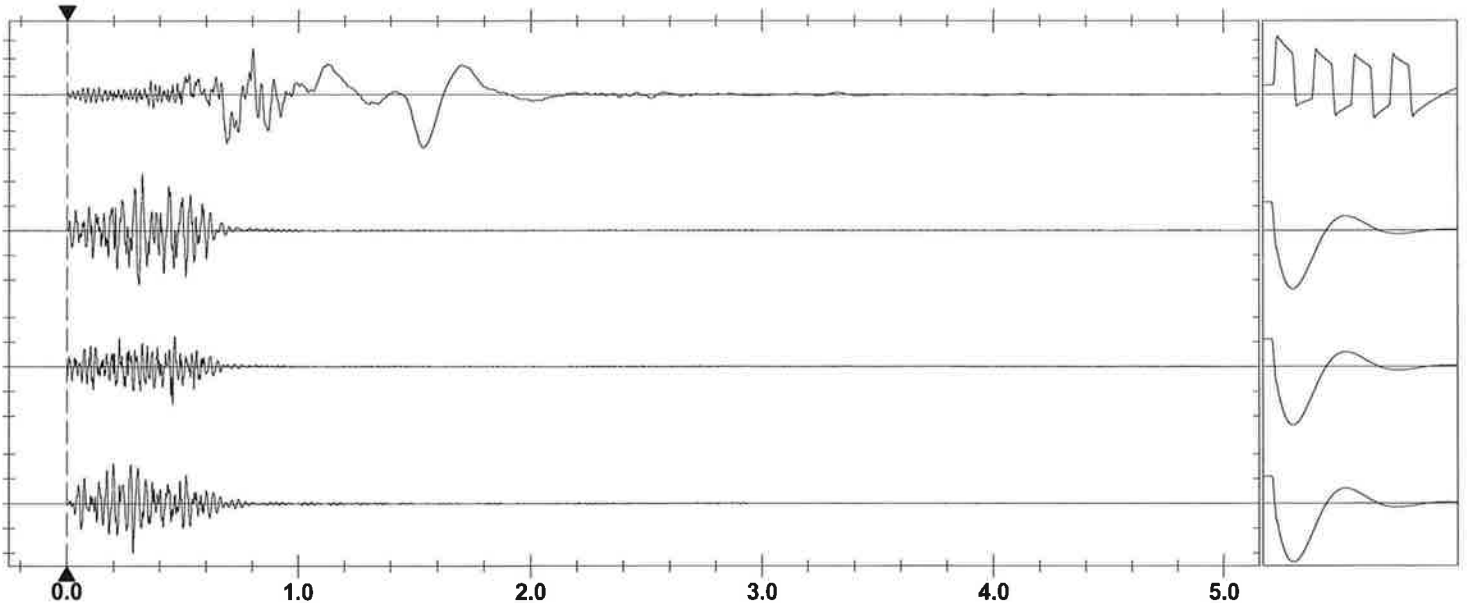
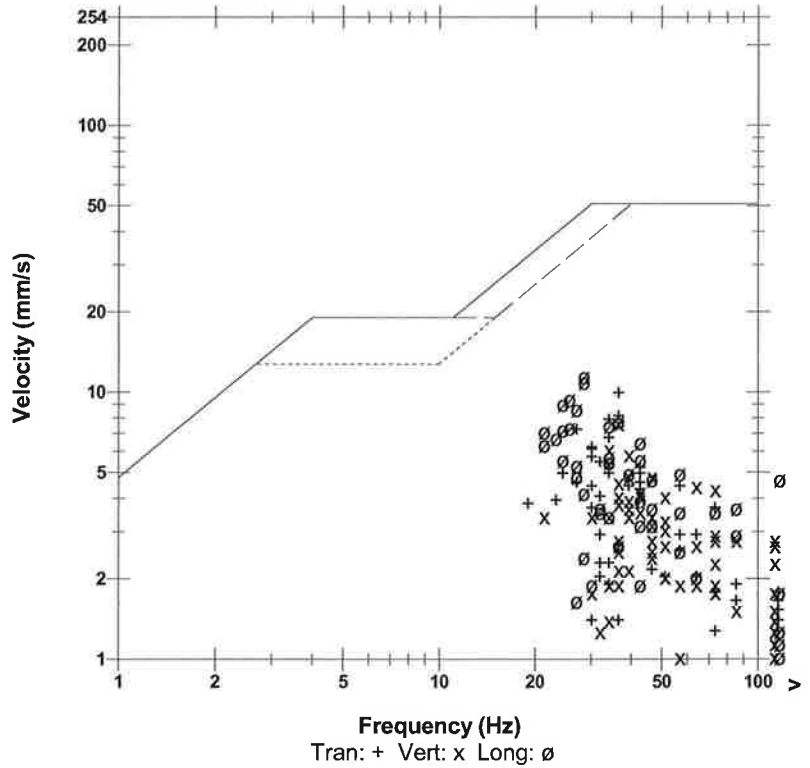
Post Event Notes

Microphone Linear Weighting
PSPL 29.3 pa.(L) at 1.537 sec
ZC Freq 2.9 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 591 mv)

	Tran	Vert	Long	
PPV	9.91	7.62	11.4	mm/s
ZC Freq	37	37	28	Hz
Time (Rel. to Trig)	0.284	0.455	0.323	sec
Peak Acceleration	0.305	0.371	0.331	g
Peak Displacement	0.0380	0.0299	0.0660	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.6	7.6	Hz
Overswing Ratio	3.9	4.0	4.1	

Peak Vector Sum 12.9 mm/s at 0.323 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:17:54 November 27, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EKAY.1U0
Scaled Distance 28.7 (170.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 170 m NE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

80 HIS 22 ft 9 x 10 35 kg MAX PD SUNNY NE WIND

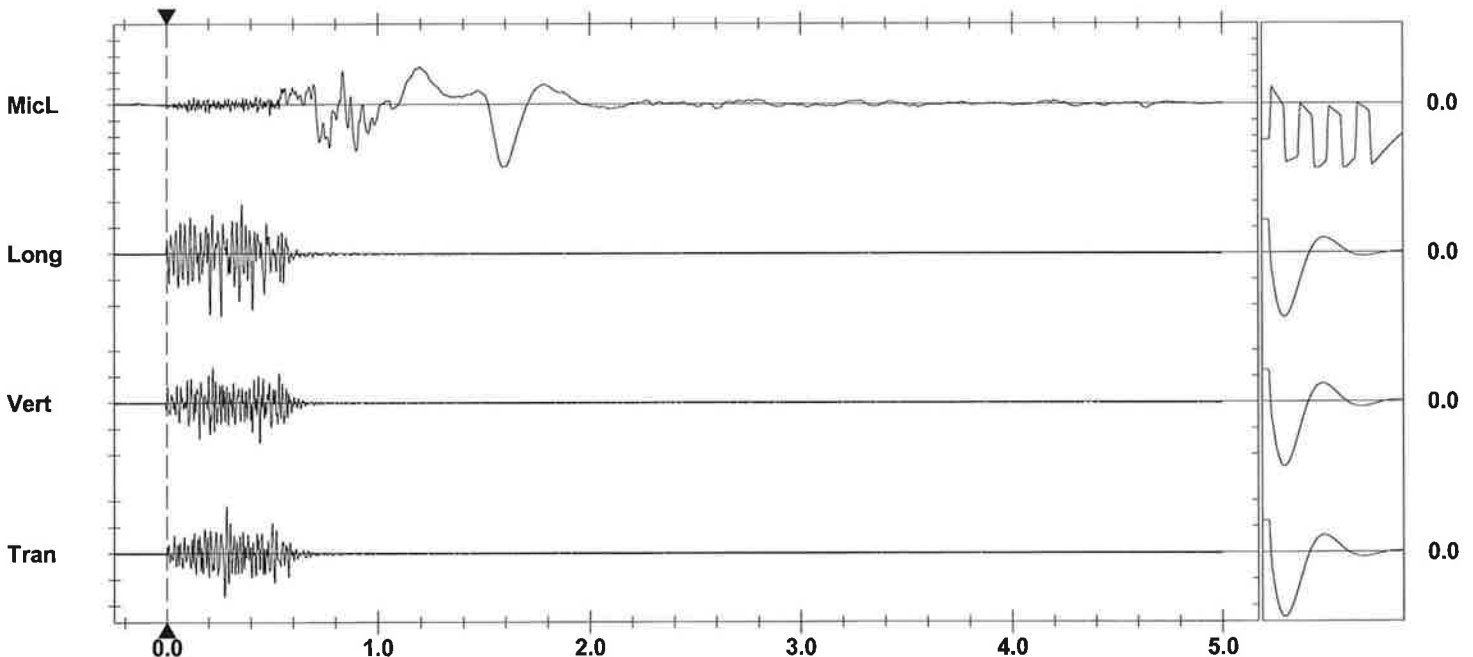
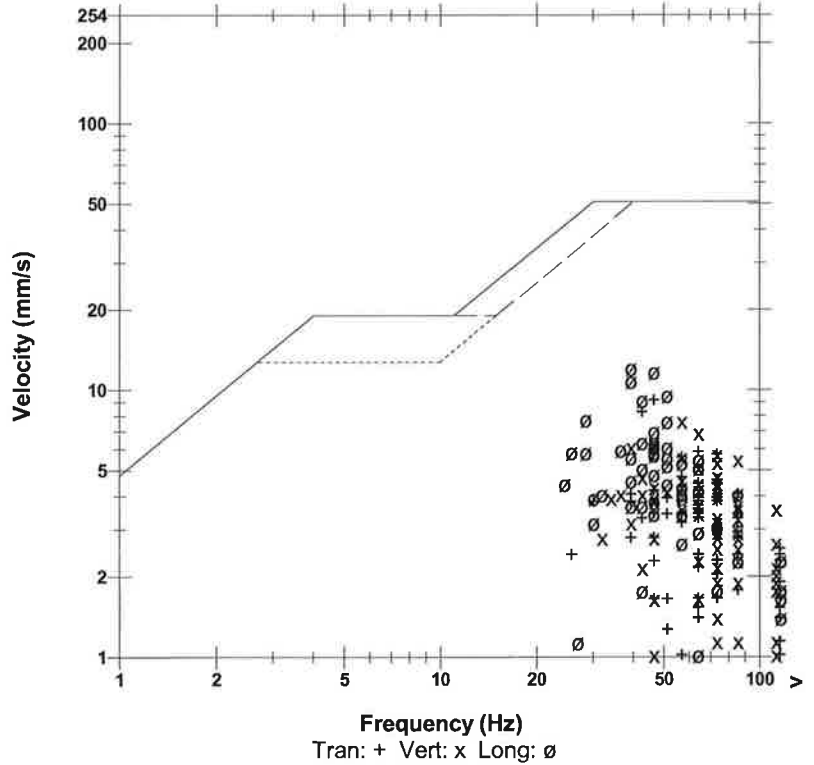
Post Event Notes

Microphone Linear Weighting
PSPL 39.0 pa.(L) at 1.583 sec
ZC Freq 2.7 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 601 mv)

	Tran	Vert	Long	
PPV	9.14	7.62	12.1	mm/s
ZC Freq	47	57	39	Hz
Time (Rel. to Trig)	0.284	0.441	0.258	sec
Peak Acceleration	0.331	0.305	0.345	g
Peak Displacement	0.0301	0.0213	0.0419	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.6	7.3	Hz
Overswing Ratio	3.9	3.6	4.4	

Peak Vector Sum 13.6 mm/s at 0.206 sec

USBM R18507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Vert at 11:48:42 November 28, 2012
Trigger Source Geo: 0.700 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration November 28, 2011 by Instantel
File Name J087EKCUI.560
Scaled Distance 25.4 (150.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 150 m N
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

76 HIS 22 ft 9 x 10 35 kg MAX PD CLOUDY SW WIND

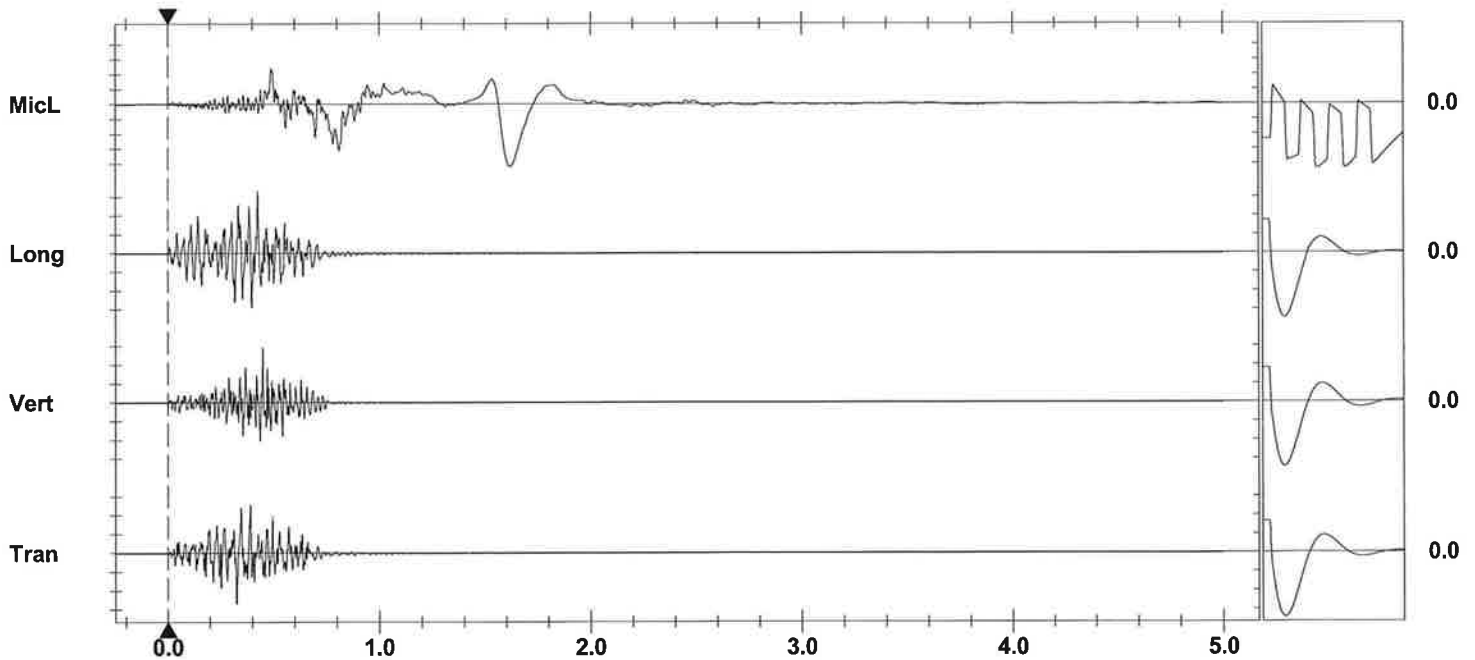
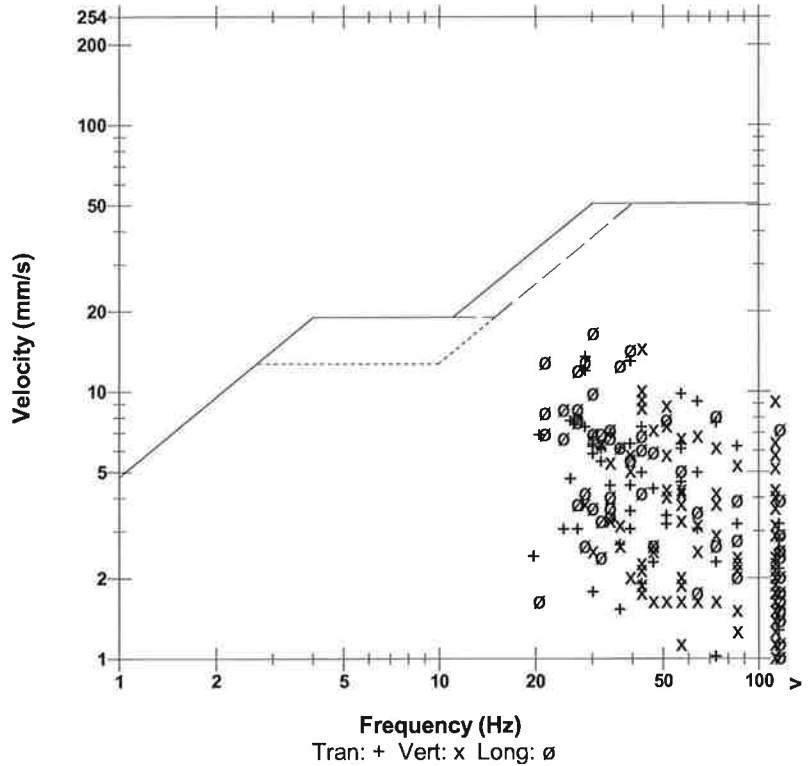
Post Event Notes

Microphone Linear Weighting
PSPL 42.0 pa.(L) at 1.612 sec
ZC Freq 3.1 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 644 mv)

	Tran	Vert	Long	
PPV	13.5	14.6	16.6	mm/s
ZC Freq	28	43	30	Hz
Time (Rel. to Trig)	0.326	0.449	0.425	sec
Peak Acceleration	0.530	0.623	0.437	g
Peak Displacement	0.0480	0.0370	0.0698	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.4	7.7	7.8	Hz
Overswing Ratio	3.9	3.6	4.4	

Peak Vector Sum 17.2 mm/s at 0.425 sec

USBM R18507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:48:41 November 28, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.2 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EKCU.550
Scaled Distance 27.0 (160.0 m, 35.0 kg)

Notes

Location: AT PIPE LINE 160 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

76 HIS 22 ft 9 x 10 35 kg MAX. PD CLOUDY
 SW WIND.

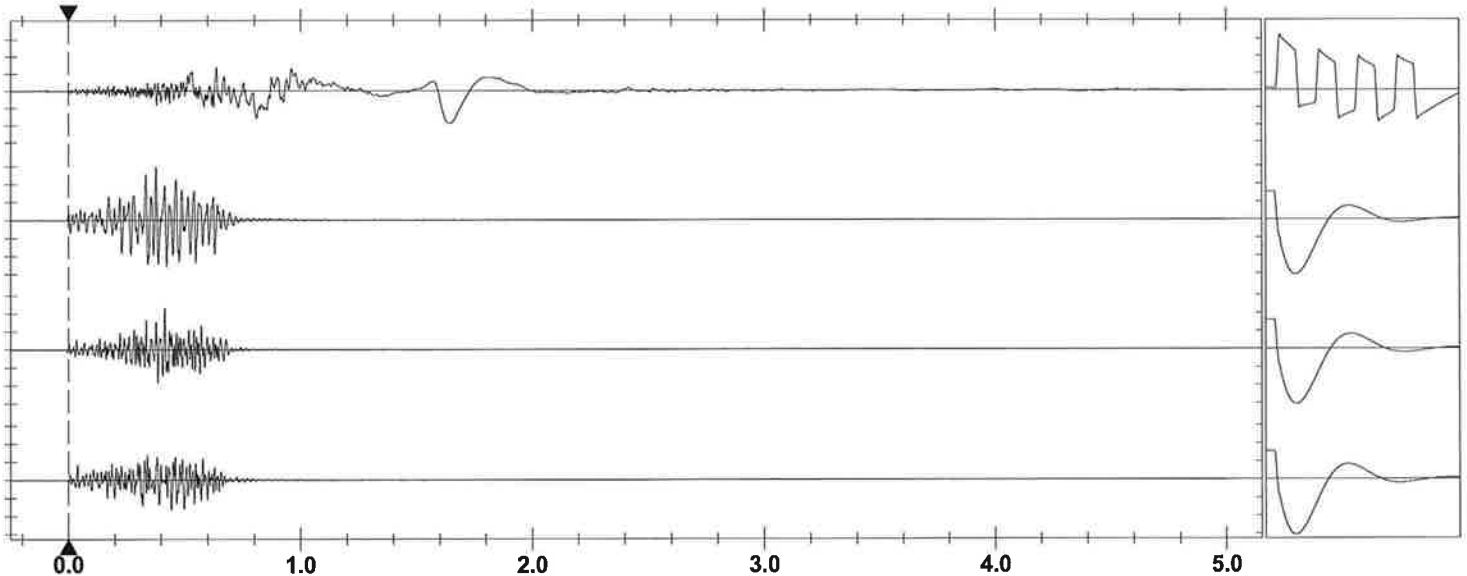
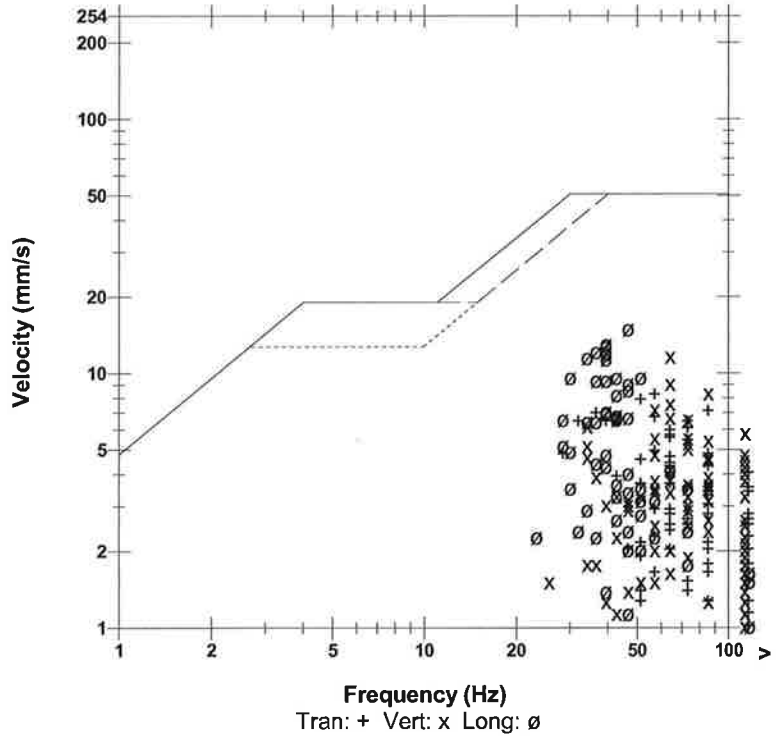
Post Event Notes

Microphone Linear Weighting
PSPL 19.0 pa.(L) at 1.646 sec
ZC Freq 3.7 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 651 mv)

	Tran	Vert	Long	
PPV	8.25	11.7	15.0	mm/s
ZC Freq	57	64	47	Hz
Time (Rel. to Trig)	0.443	0.415	0.378	sec
Peak Acceleration	0.371	0.464	0.544	g
Peak Displacement	0.0287	0.0300	0.0552	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	7.4	7.6	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 17.2 mm/s at 0.378 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 12:35:47 November 29, 2012
Trigger Source Geo: 0.700 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration November 28, 2011 by InstanTel
File Name J087EKEQ.ZN0
Scaled Distance 35.4 (150.0 m, 18.0 kg)

Notes

Location: AT PIPE LINE 150 m NE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Note

66 HIS 23 ft 9 x 10 18 kg MAX PD CLOUDY SW WIND.
 1 DECK COMPLETE SHOT

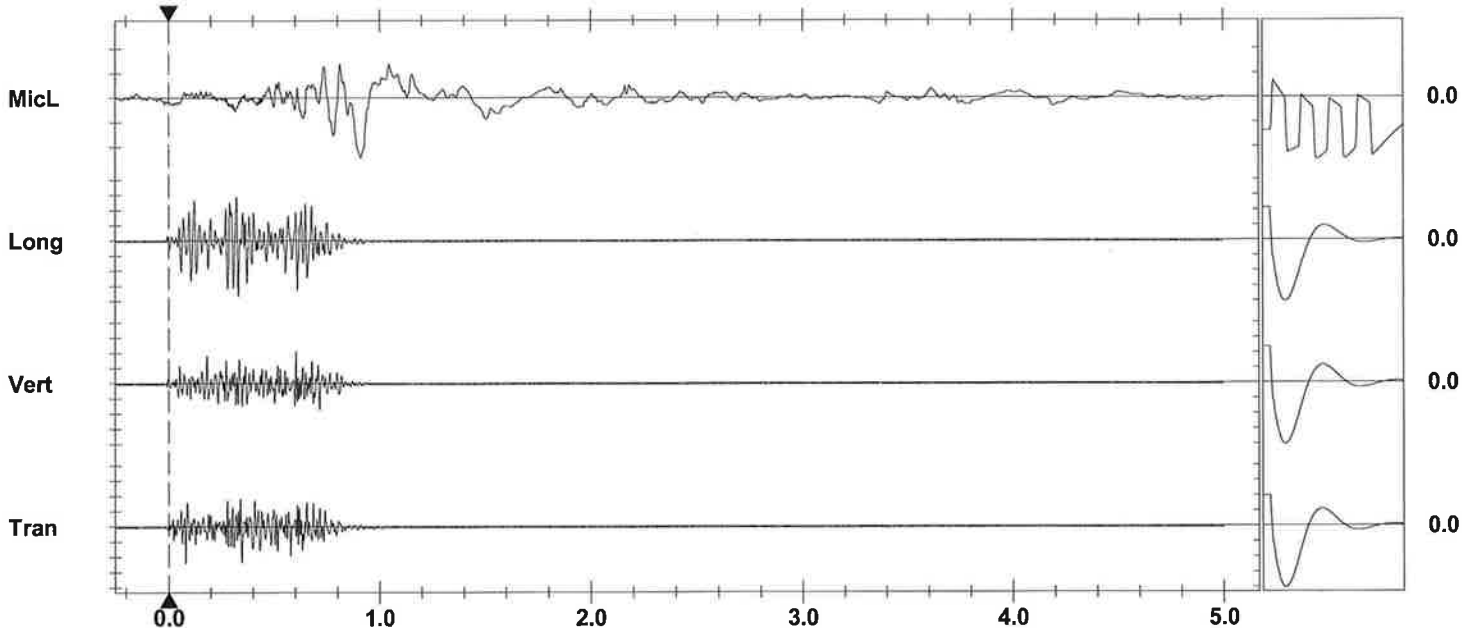
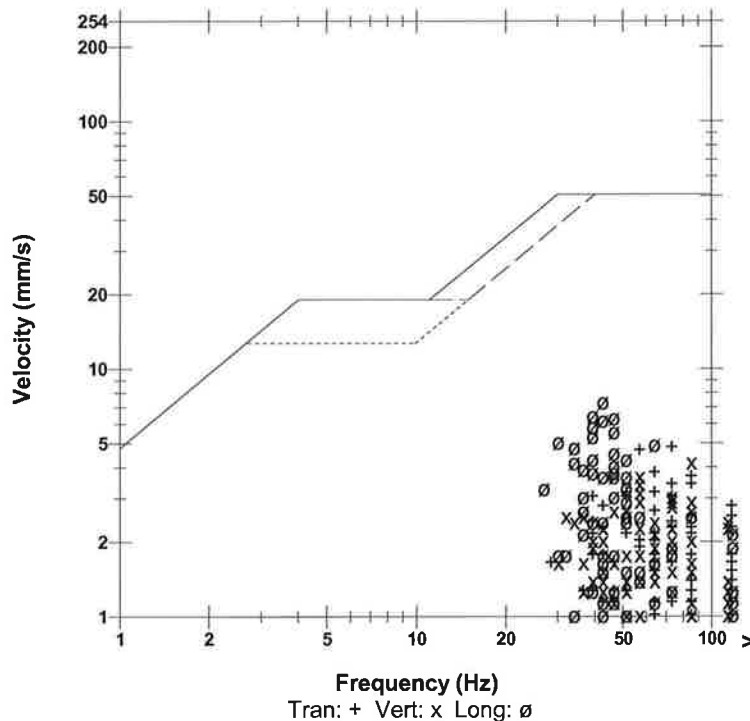
Post Event Notes

Microphone Linear Weighting
PSPL 48.5 pa.(L) at 0.908 sec
ZC Freq 4.4 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 649 mv)

	Tran	Vert	Long	
PPV	4.83	4.19	7.37	mm/s
ZC Freq	73	85	43	Hz
Time (Rel. to Trig)	0.079	0.604	0.330	sec
Peak Acceleration	0.199	0.212	0.278	g
Peak Displacement	0.0122	0.0107	0.0267	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	7.7	7.3	Hz
Overswing Ratio	3.8	3.6	4.4	

Peak Vector Sum 7.80 mm/s at 0.330 sec

USBM R18507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 20.0 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 12:35:46 November 29, 2012
Trigger Source Geo: 2.00 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8091 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration February 16, 2012 by InstanTel
File Name J091EKEQ.ZM0
Scaled Distance 30.6 (130.0 m, 18.0 kg)

Notes

Location: AT PIPE LINE 130 m NW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

66 HIS 22 ft 9 x 10 18 kg MAX. PD CLOUDY
 SW WIND. 1 DECK COMPLETE SHOT

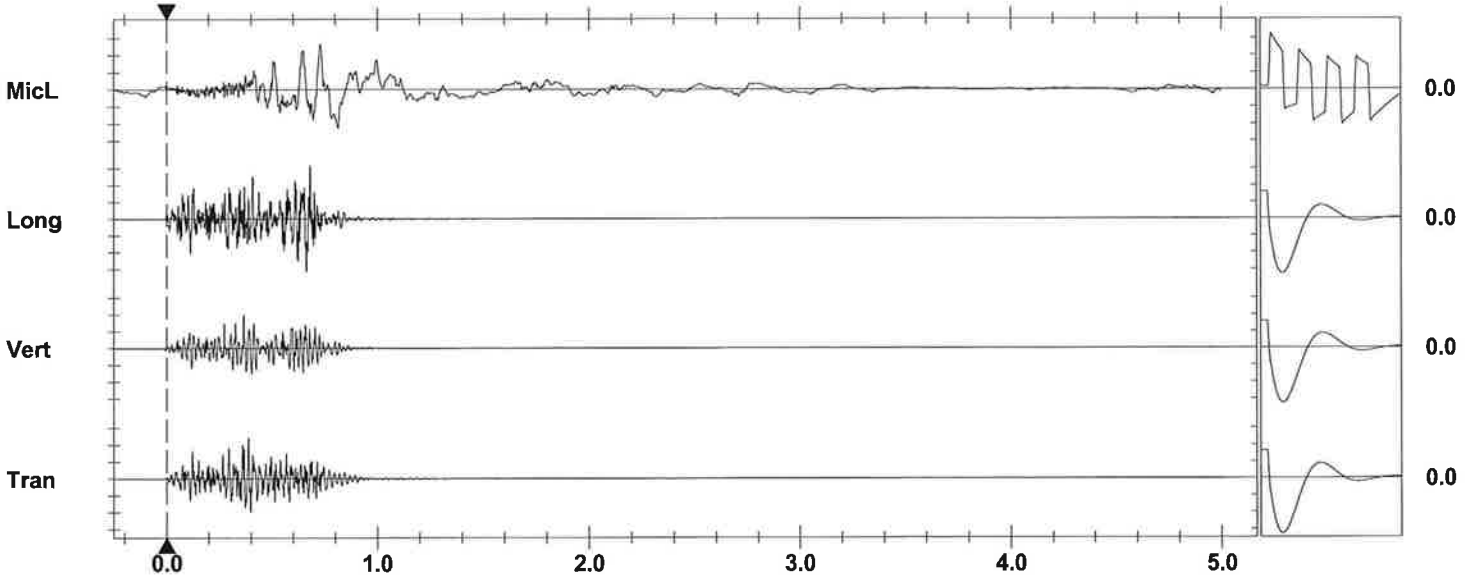
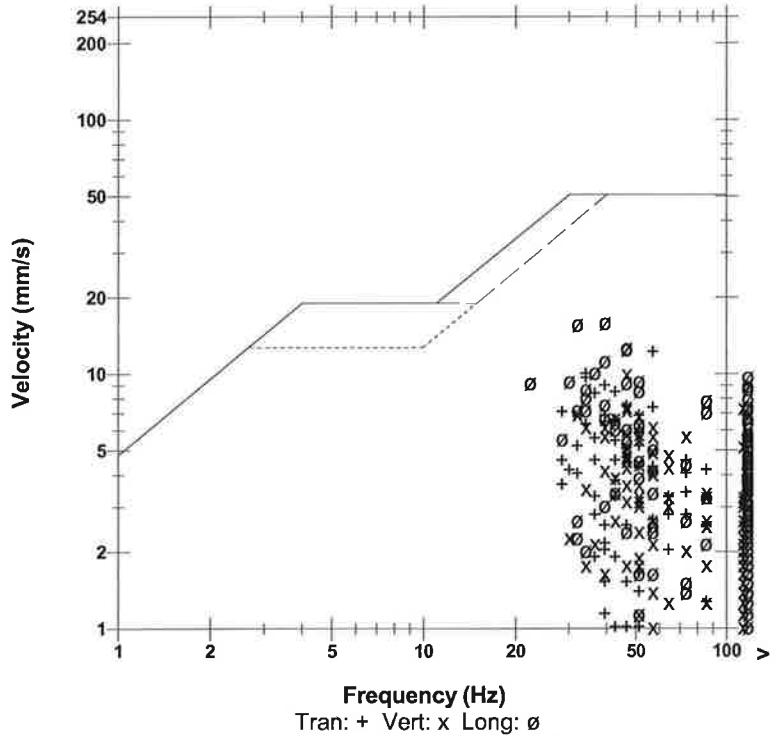
Post Event Notes

Microphone Linear Weighting
PSPL 26.8 pa.(L) at 0.729 sec
ZC Freq 12 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 684 mv)

	Tran	Vert	Long	
PPV	12.2	10.0	16.0	mm/s
ZC Freq	57	47	39	Hz
Time (Rel. to Trig)	0.386	0.364	0.682	sec
Peak Acceleration	0.583	0.504	0.795	g
Peak Displacement	0.0389	0.0288	0.0671	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.6	7.4	7.5	Hz
Overswing Ratio	3.8	3.9	4.3	

Peak Vector Sum 16.6 mm/s at 0.682 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Vert at 12:37:16 November 29, 2012
Trigger Source Geo: 0.510 mm/s
Range Geo :254 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8349 V 10.30-8.17 MiniMate Plus
Battery Level 6.1 Volts
Calibration December 1, 2011 by Instantel
File Name J349EKER.240
Scaled Distance 33.0 (140.0 m, 18.0 kg)

Notes

Location: AT PIPE LINE #064 140 m N
 Client: ELGINBURG QUARRY JOB # 10350033
 User: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

66 Holes 9 ft x10 ft Pattern 23 FT deep 18 kg MAX.
 CLOUDY SW WIND
 1 DECK COMPLETE SHOT

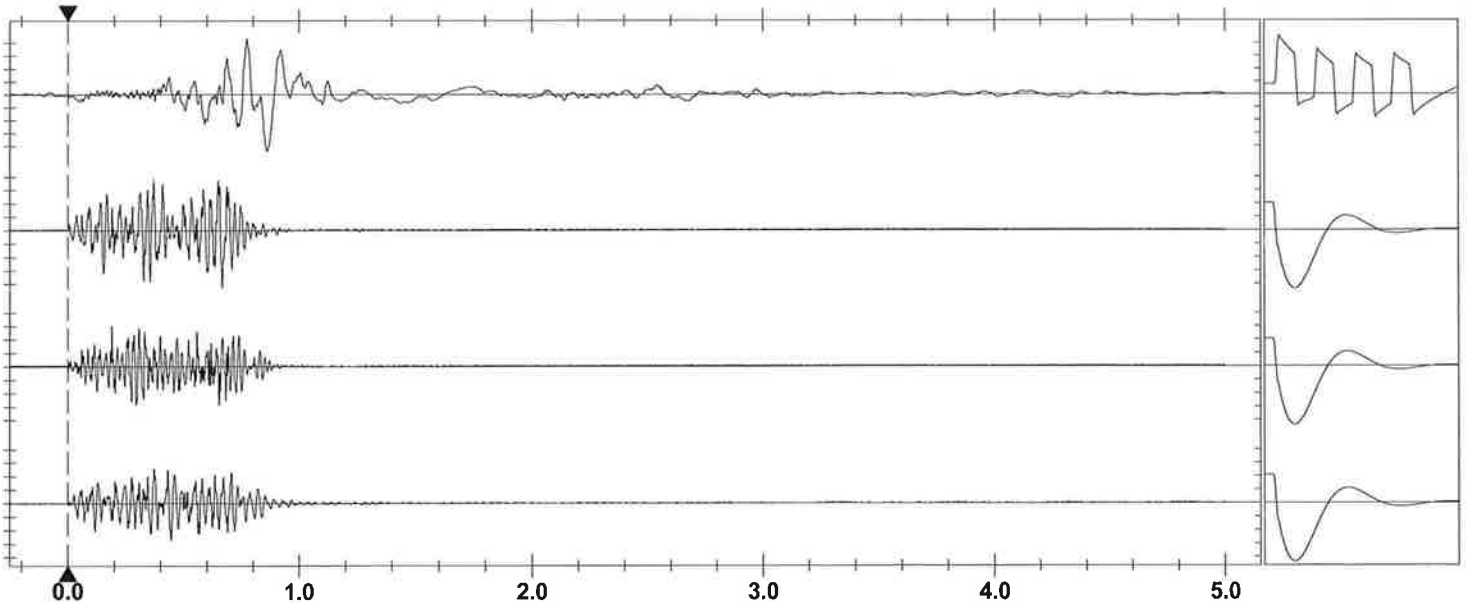
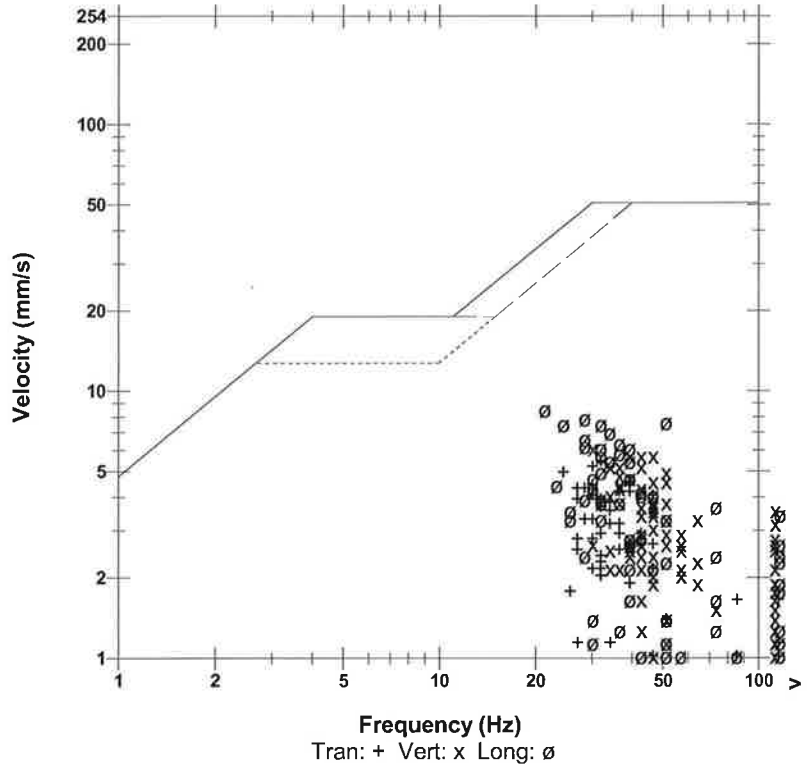
Post Event Notes

Microphone Linear Weighting
PSPL 44.0 pa.(L) at 0.860 sec
ZC Freq 5.0 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 496 mv)

	Tran	Vert	Long	
PPV	5.46	6.10	8.51	mm/s
ZC Freq	32	30	21	Hz
Time (Rel. to Trig)	0.445	0.188	0.666	sec
Peak Acceleration	0.212	0.371	0.305	g
Peak Displacement	0.0277	0.0200	0.0463	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.5	7.6	7.6	Hz
Overswing Ratio	4.0	4.1	4.1	

Peak Vector Sum 9.44 mm/s at 0.370 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.00 mm/s/div Mic: 10.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 10:53:51 March 21, 2013
Trigger Source Geo: 0.492 mm/s
Range Geo :254 mm/s
Record Time 1.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 5.8 Volts
Calibration December 27, 2012 by Instantel
File Name C528EQ7V.LR0
Scaled Distance 114.3 (767.0 m, 45.0 kg)

Notes

Location: HAMILTON SHOP CIVIC2440 BURBROOK Rd
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: March 28, 2013 15:25:59 (V8.12)

Extended Notes

60 HIS 26 ft 9x10 1 HPD 45 kg MAX.PDP.CLOUDY SE WIND.
 767 m SW

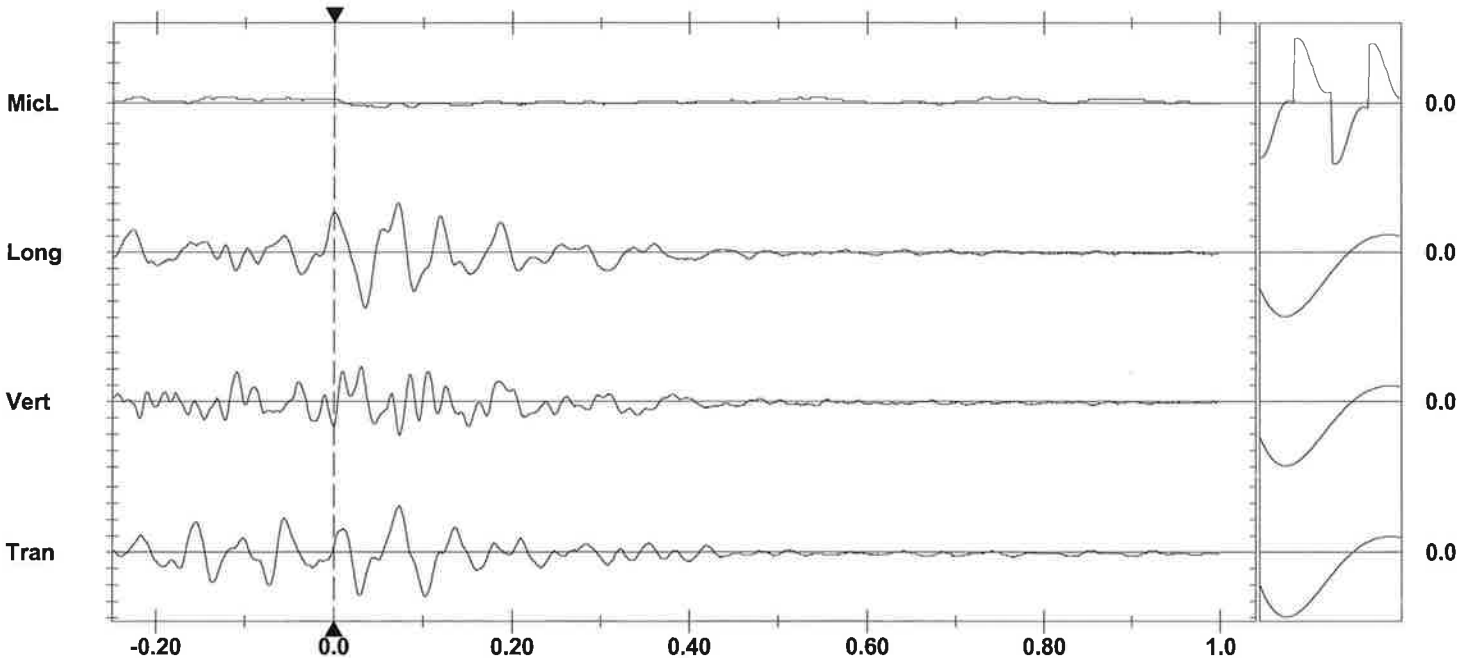
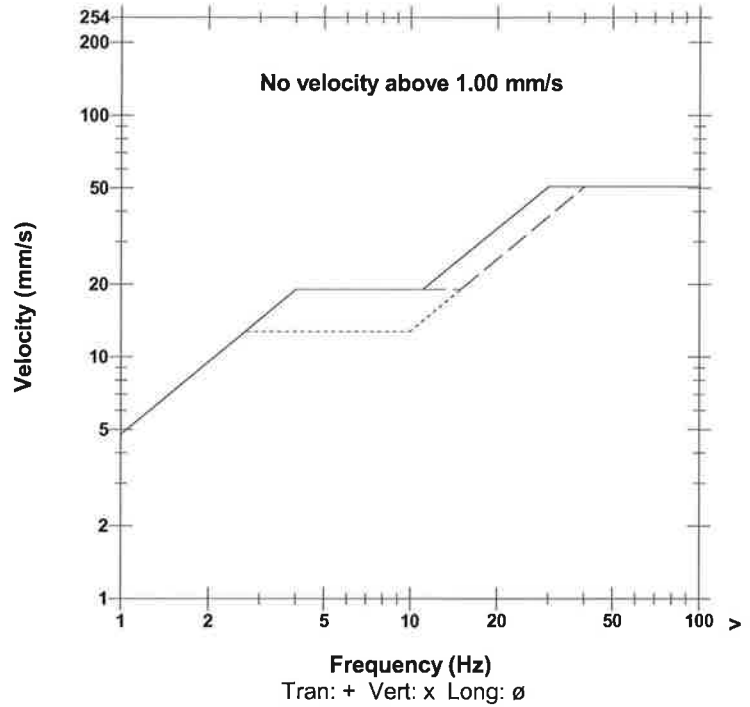
Post Event Notes

Microphone Linear Weighting
PSPL 1.50 pa.(L) at -0.050 sec
ZC Freq 11 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 265 mv)

	Tran	Vert	Long	
PPV	0.572	0.429	0.683	mm/s
ZC Freq	17	15	18	Hz
Time (Rel. to Trig)	0.074	0.031	0.035	sec
Peak Acceleration	0.00829	0.0116	0.00994	g
Peak Displacement	0.00466	0.00371	0.00579	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.8	7.8	8.1	Hz
Overswing Ratio	4.0	4.1	4.0	

Peak Vector Sum 0.921 mm/s at 0.074 sec

USBM RI8507 And OSMRE



Time Scale: 0.10 sec/div **Amplitude Scale:** Geo: 0.200 mm/s/div Mic: 5.00 pa.(L)/div
Trigger =

Sensorcheck

Date/Time Long at 11:17:08 March 22, 2013
Trigger Source Geo: 0.492 mm/s
Range Geo :254 mm/s
Record Time 1.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 5.8 Volts
Calibration December 27, 2012 by InstanTel
File Name C528EQ9R.CK0
Scaled Distance 113.3 (760.0 m, 45.0 kg)

Notes

Location: HAMILTON SHOP CIVIC2440 BURBROOK Rd
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: March 28, 2013 15:25:59 (V8.12)

Extended Notes

85 HIS 25 ft 9x10 1 HPD 45 kg MAX.PDP.CLOUDY NW WIND.
 760 m SW

Post Event Notes

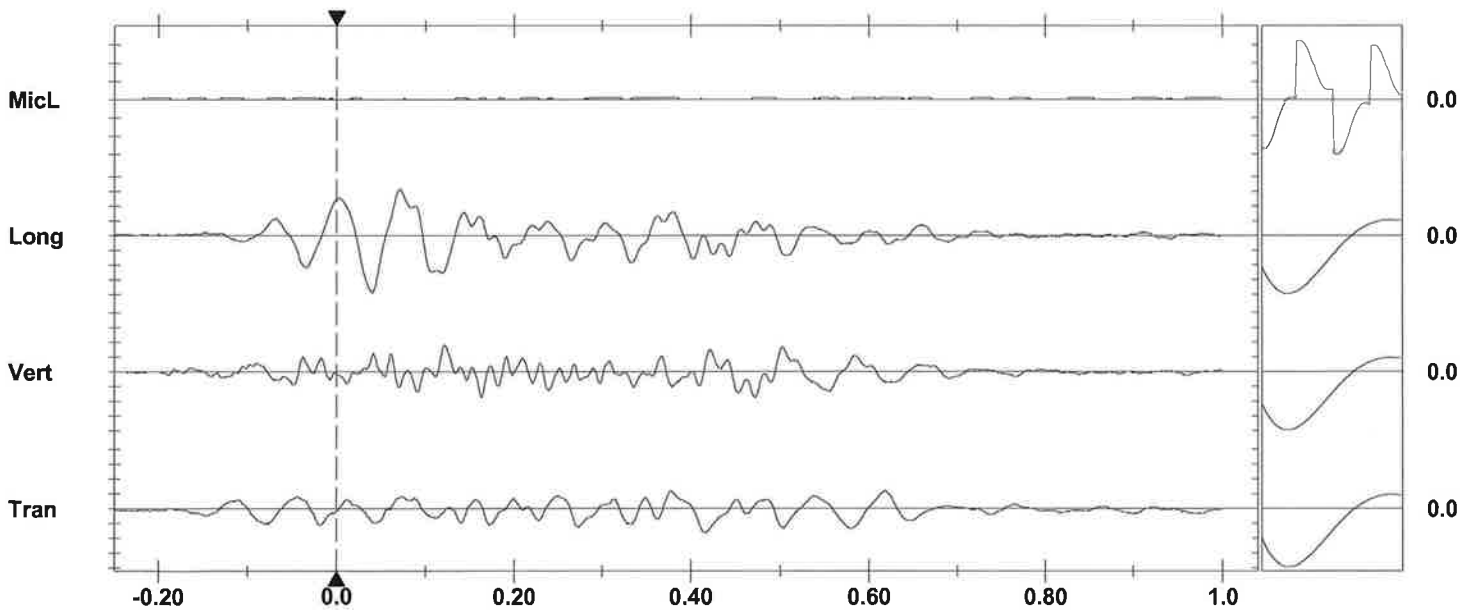
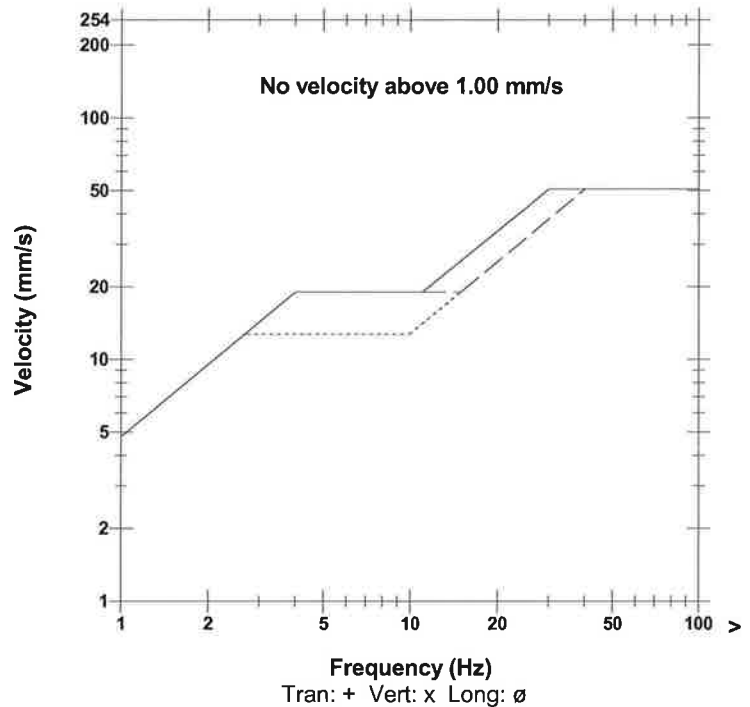
Microphone Linear Weighting
PSPL 0.500 pa.(L) at -0.004 sec
ZC Freq N/A
Channel Test Passed (Freq = 20.0 Hz Amp = 266 mv)

	Tran	Vert	Long	
PPV	0.333	0.365	0.778	mm/s
ZC Freq	12	28	16	Hz
Time (Rel. to Trig)	0.417	0.122	0.041	sec
Peak Acceleration	0.00497	0.00829	0.00829	g
Peak Displacement	0.00342	0.00402	0.00782	mm
Sensorcheck	Passed	Passed	Passed	
Frequency	7.7	7.8	8.0	Hz
Overswing Ratio	4.0	4.0	3.9	

Peak Vector Sum 0.826 mm/s at 0.041 sec

N/A: Not Applicable

USBM R18507 And OSMRE



Time Scale: 0.10 sec/div Amplitude Scale: Geo: 0.200 mm/s/div Mic: 5.00 pa.(L)/div
 Trigger =

Sensorcheck

Date/Time Tran at 11:49:56 August 11, 2014
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 29, 2014 by Instantel
File Name C528FGCO.V80
Scaled Distance 106.5 (790.0 m, 55.0 kg)

Notes

Location: AT HAMILTON SHOP CIVIC#2440 790 m SW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: January 8, 2018 09:38:03 (V10.72)

Extended Notes

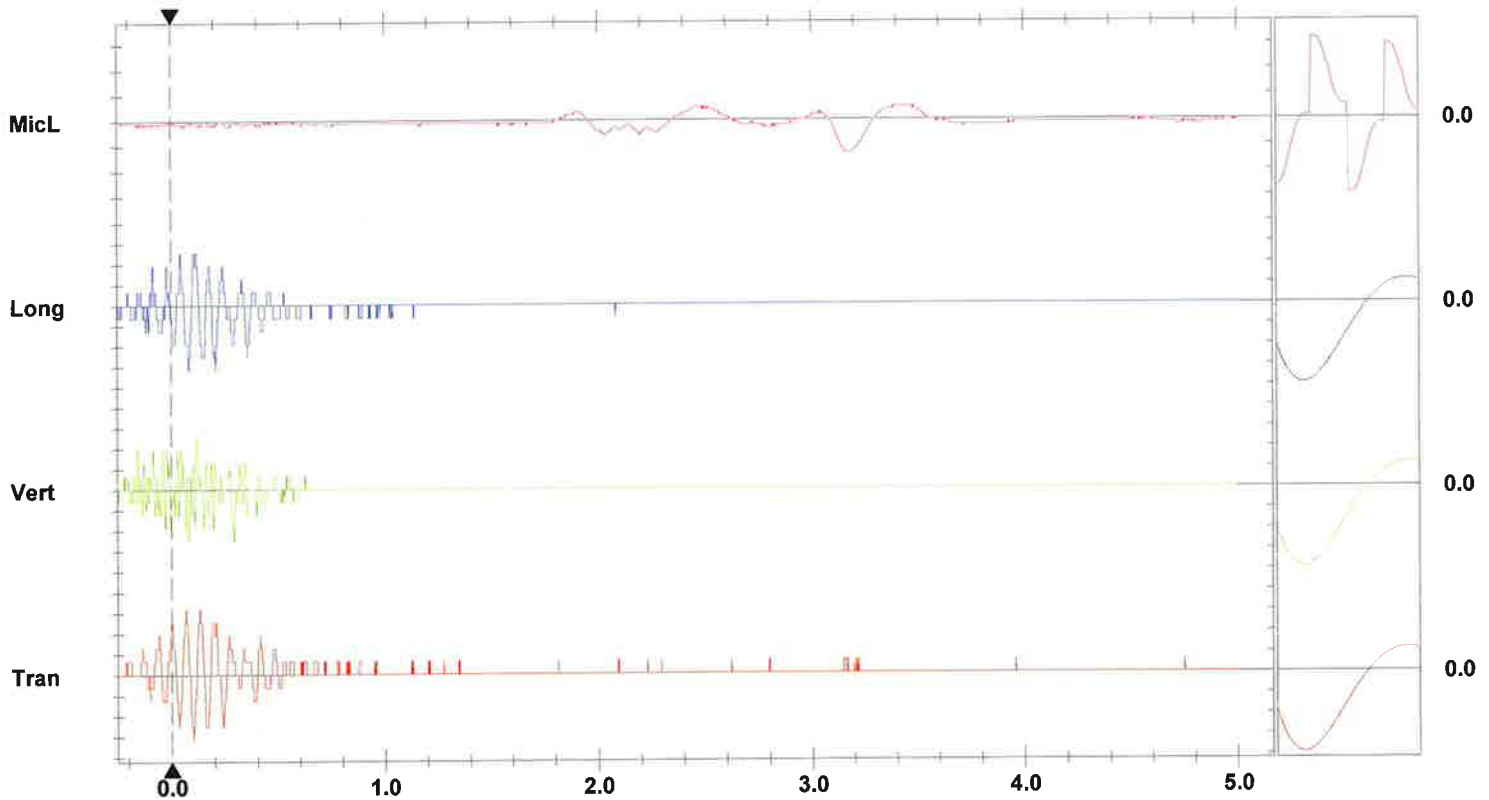
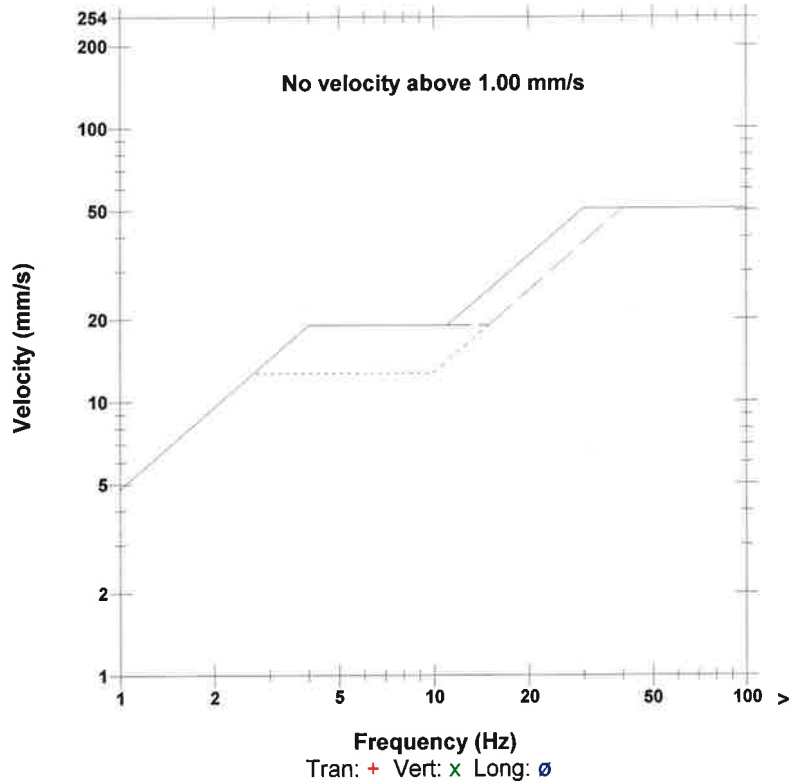
94 HIS 31 ft 9 10 1 HPD 55 kg MAX. SUNNY SE WIND.

Microphone Linear Weighting
PSPL 6.500 pa.(L) at 3.159 sec
ZC Freq 3.0 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 273 mv)

	Tran	Vert	Long	
PPV	0.635	0.508	0.635	mm/s
ZC Freq	18	51	17	Hz
Time (Rel. to Trig)	0.065	0.080	0.080	sec
Peak Acceleration	0.013	0.027	0.013	g
Peak Displacement	0.005	0.002	0.004	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	8.0	8.0	Hz
Overswing Ratio	3.5	3.6	3.6	

Peak Vector Sum 0.826 mm/s at 0.066 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.200 mm/s/div Mic: 5.000 pa.(L)/div
 Trigger = <--->

Sensor Check

Date/Time Long at 14:02:06 April 21, 2015
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.72-8.17 MiniMate Plus
Battery Level 6.1 Volts
Unit Calibration June 2, 2014 by InstanTel
File Name J087FTBI.Z10
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes

Location: RES.CORDUKES Rd CIVIC #2130 1280 m SW
Client: ELGINBURG QUARRY # 10350033
User Remi Tremblay
General: Blast Vibration Monitoring

Extended Notes

110 holes @ 30' deep 10 x 10 pattern 55 kg MAX. PD 1
 HPD
 P.CLOUDY SE WIND.

Microphone Linear Weighting

PSPL 2.750 pa.(L) at -0.134 sec

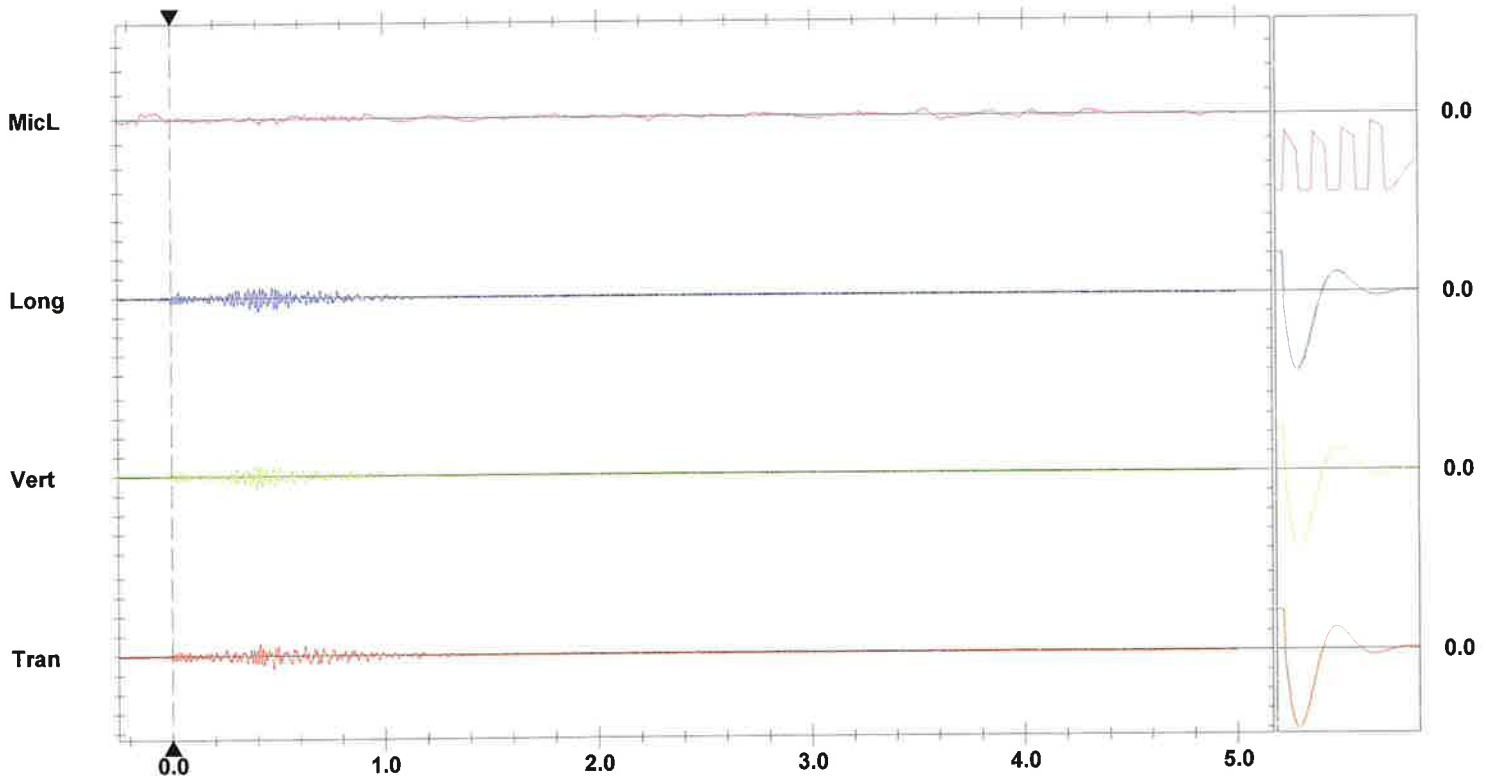
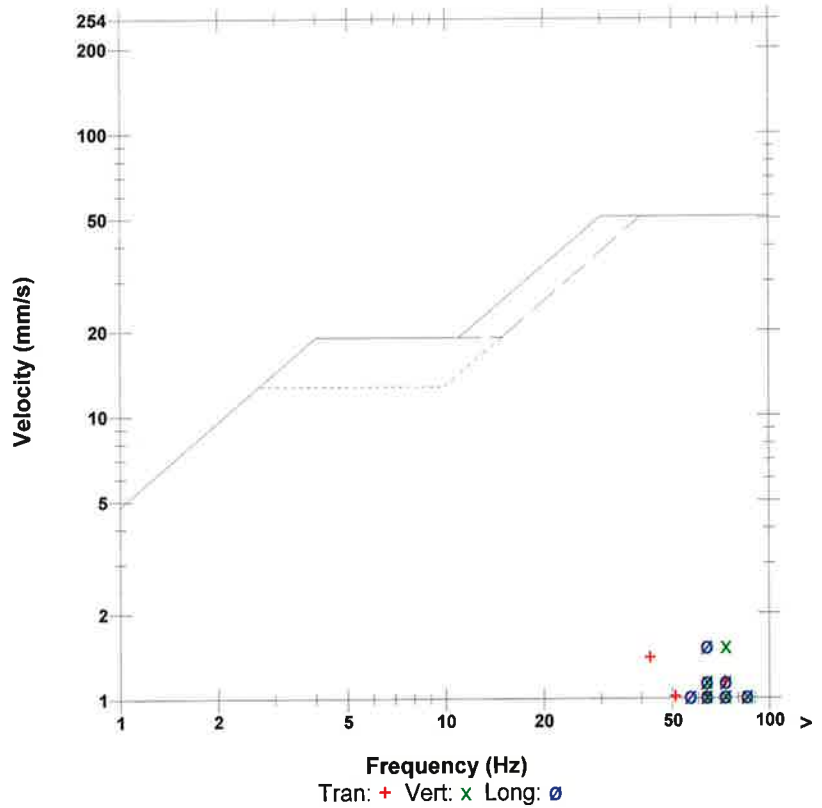
ZC Freq 4.3 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 544 mv)

	Tran	Vert	Long	
PPV	1.397	1.524	1.524	mm/s
ZC Freq	43	73	64	Hz
Time (Rel. to Trig)	0.474	0.397	0.410	sec
Peak Acceleration	0.053	0.053	0.066	g
Peak Displacement	0.006	0.003	0.005	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.8	3.7	4.2	

Peak Vector Sum 2.052 mm/s at 0.410 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

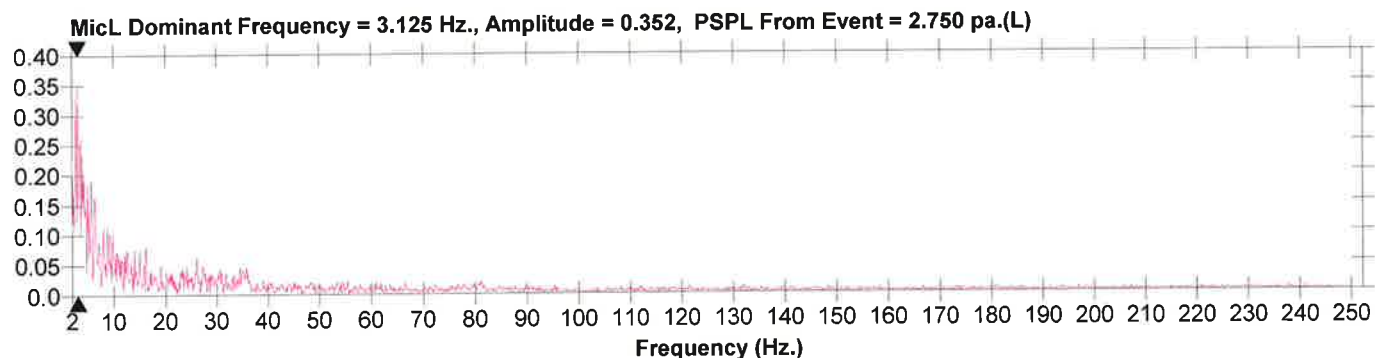
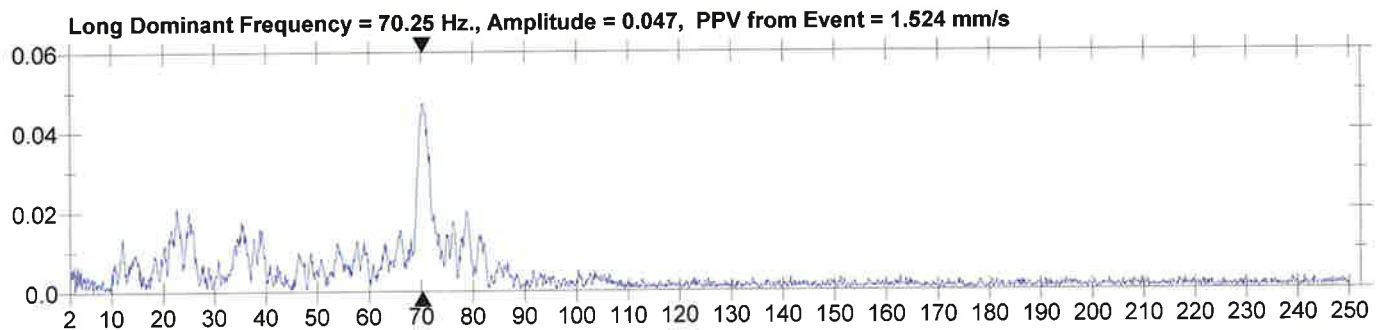
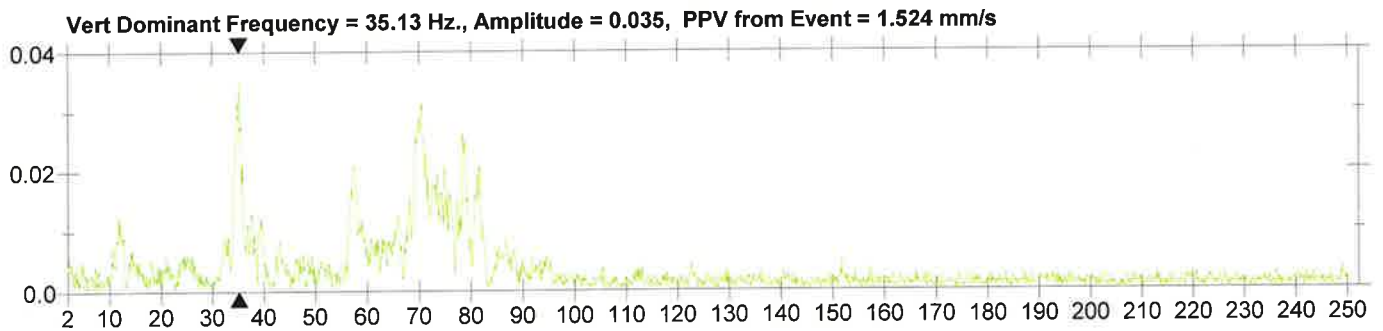
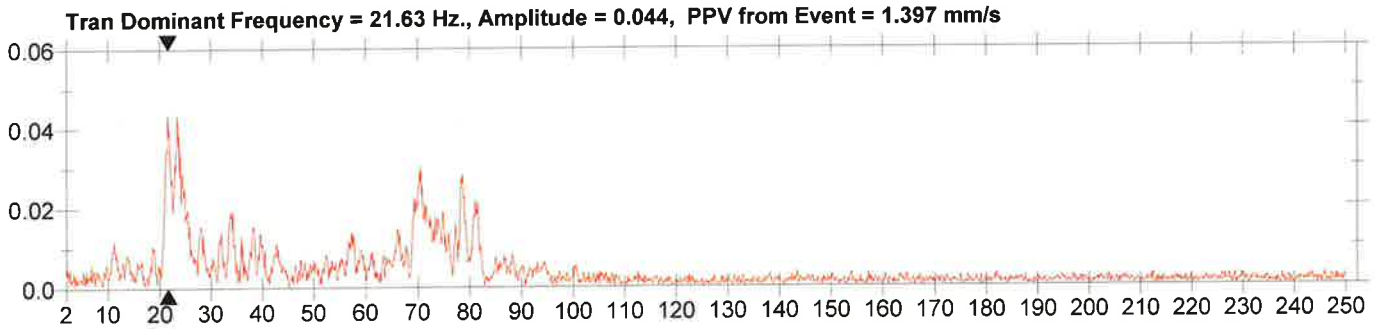
Sensor Check

Date/Time Long at 14:02:06 April 21, 2015
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.72-8.17 MiniMate Plus
Battery Level 6.1 Volts
Unit Calibration June 2, 2014 by Instantel
File Name J087FTBI.Z10
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes
 Location: RES.CORDUKES Rd CIVIC #2130 1280 m SW
 Client: ELGINBURG QUARRY # 10350033
 User: Remi Tremblay
 General: Blast Vibration Monitoring

Extended Notes
 110 holes @ 30' deep 10 x 10 pattern 55 kg MAX. PD 1
 HPD
 P.CLOUDY SE WIND.



Date/Time Vert at 14:19:22 April 21, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 29, 2014 by InstanTel
File Name C528FTDE.GA0
Scaled Distance 132.3 (981.0 m, 55.0 kg)

Notes

Location: RES.BURBROOK Rd CIVIC # 2362 981 mSE
Client: ELGINBURG QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 6, 2015 16:06:08 (V10.72)

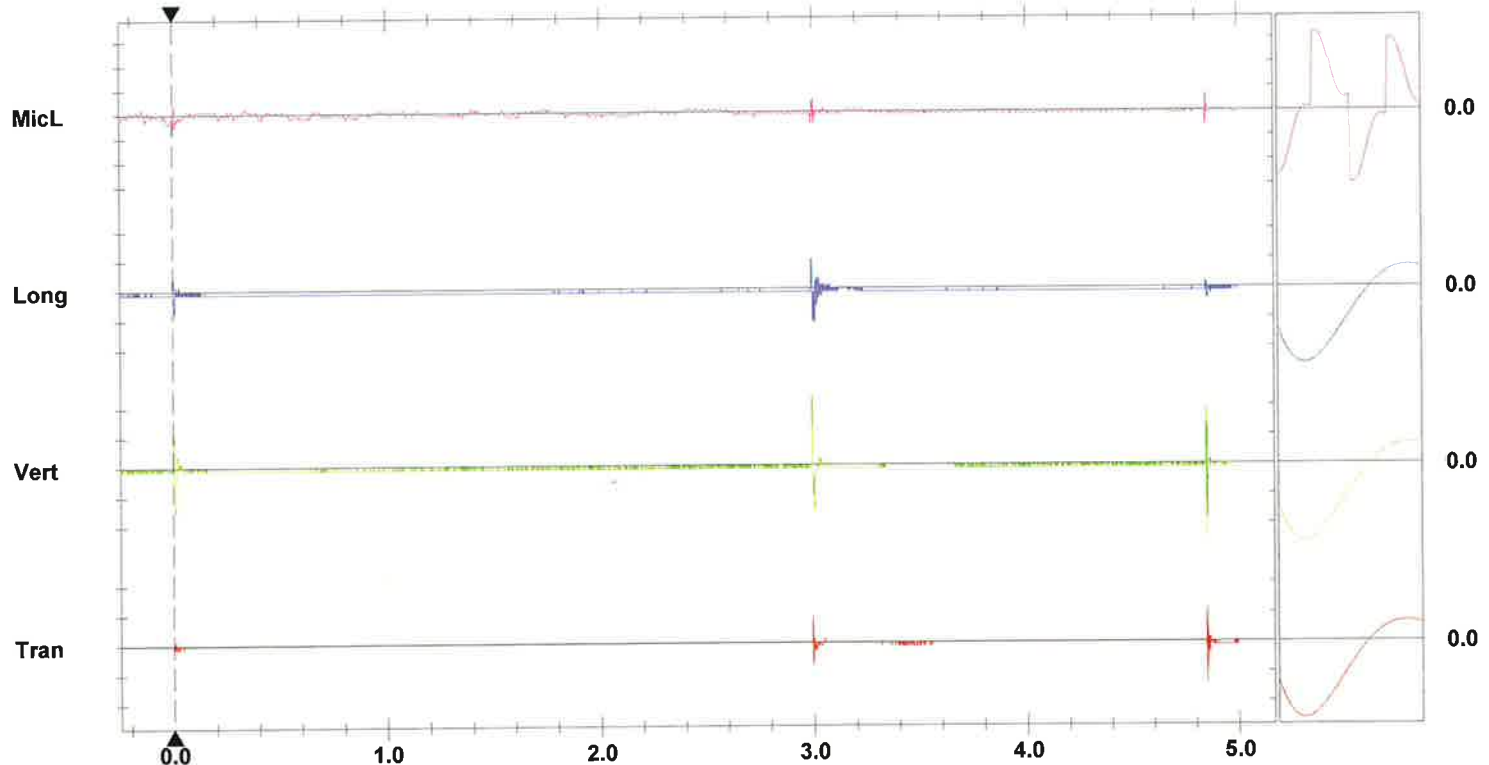
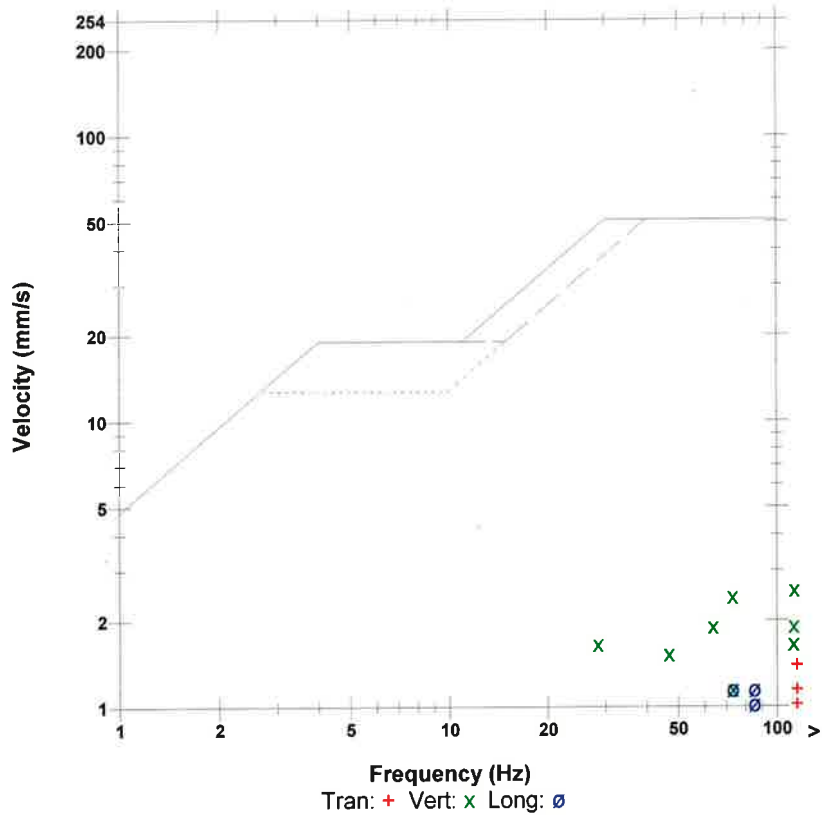
Extended Notes

Microphone Linear Weighting
PSPL 4.000 pa.(L) at 0.003 sec
ZC Freq 73 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 272 mv)

	Tran	Vert	Long	
PPV	1.397	2.540	1.143	mm/s
ZC Freq	N/A	>100	85	Hz
Time (Rel. to Trig)	4.850	4.849	3.000	sec
Peak Acceleration	0.172	0.292	0.066	g
Peak Displacement	0.001	0.006	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	8.1	8.0	8.0	Hz
Overswing Ratio	3.7	3.8	3.8	

Peak Vector Sum 2.604 mm/s at 2.994 sec
N/A: Not Applicable

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 1.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Vert at 14:19:22 April 21, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

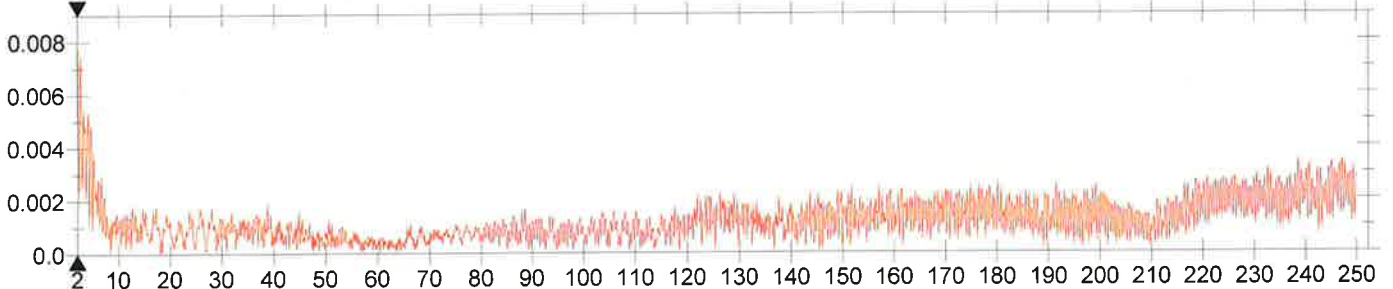
Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 29, 2014 by InstanTel
File Name C528FTDE.GA0
Scaled Distance 132.3 (981.0 m, 55.0 kg)

Notes

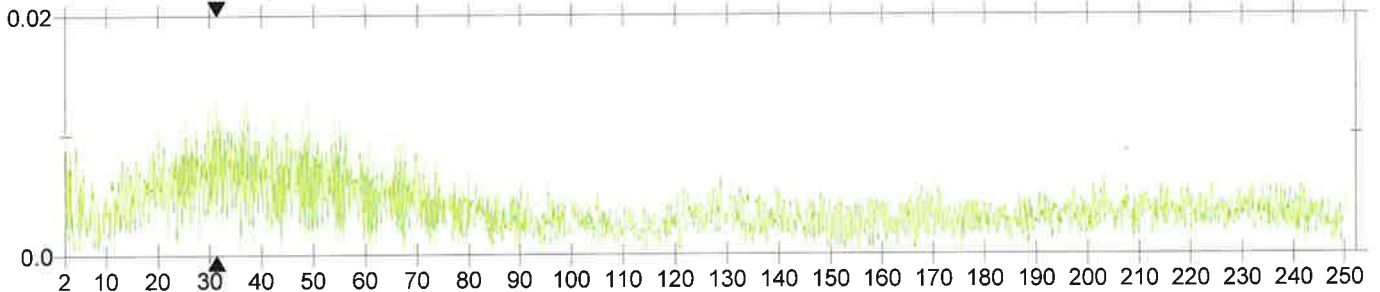
Location: RES.BURBROOK Rd CIVIC # 2362 981 mSE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: May 6, 2015 16:06:08 (V10.72)

Extended Notes

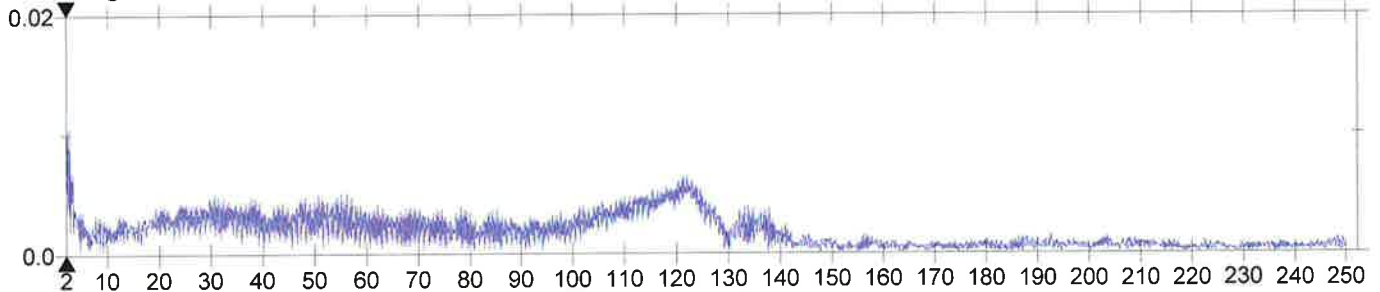
Tran Dominant Frequency = 2.000 Hz., Amplitude = 0.008, PPV from Event = 1.397 mm/s



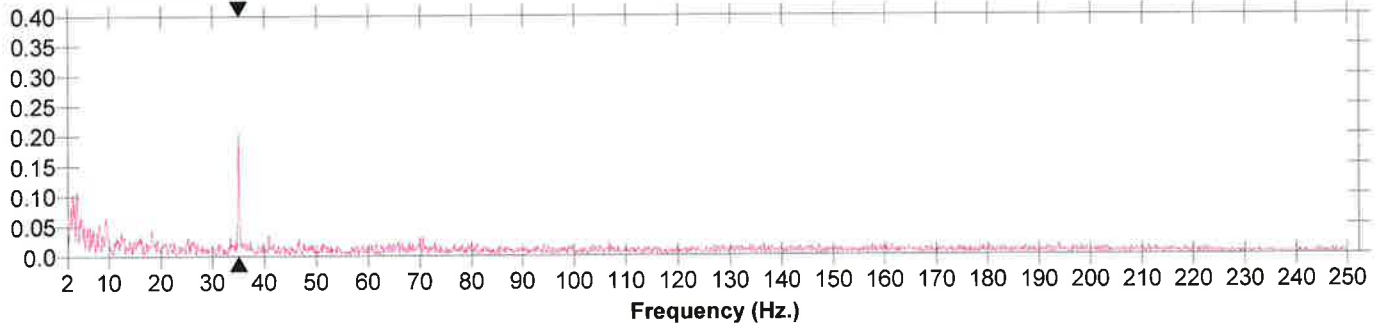
Vert Dominant Frequency = 31.38 Hz., Amplitude = 0.013, PPV from Event = 2.540 mm/s



Long Dominant Frequency = 2.000 Hz., Amplitude = 0.012, PPV from Event = 1.143 mm/s



MicL Dominant Frequency = 35.00 Hz., Amplitude = 0.206, PSPL From Event = 4.000 pa.(L)



Date/Time Long at 11:26:05 April 23, 2015
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8087 V 10.72-8.17 MiniMate Plus
Battery Level 6.0 Volts
Unit Calibration June 2, 2014 by InstanTEL
File Name J087FTF1.3H0
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes

Location: RES. CORDUKES Rd CIVIC #2130 1280 m SW
 Client: ELGINBURGH QUARRY # 10350033
 User Remi Tremblay
 General: Blast Vibration Monitoring

Extended Notes

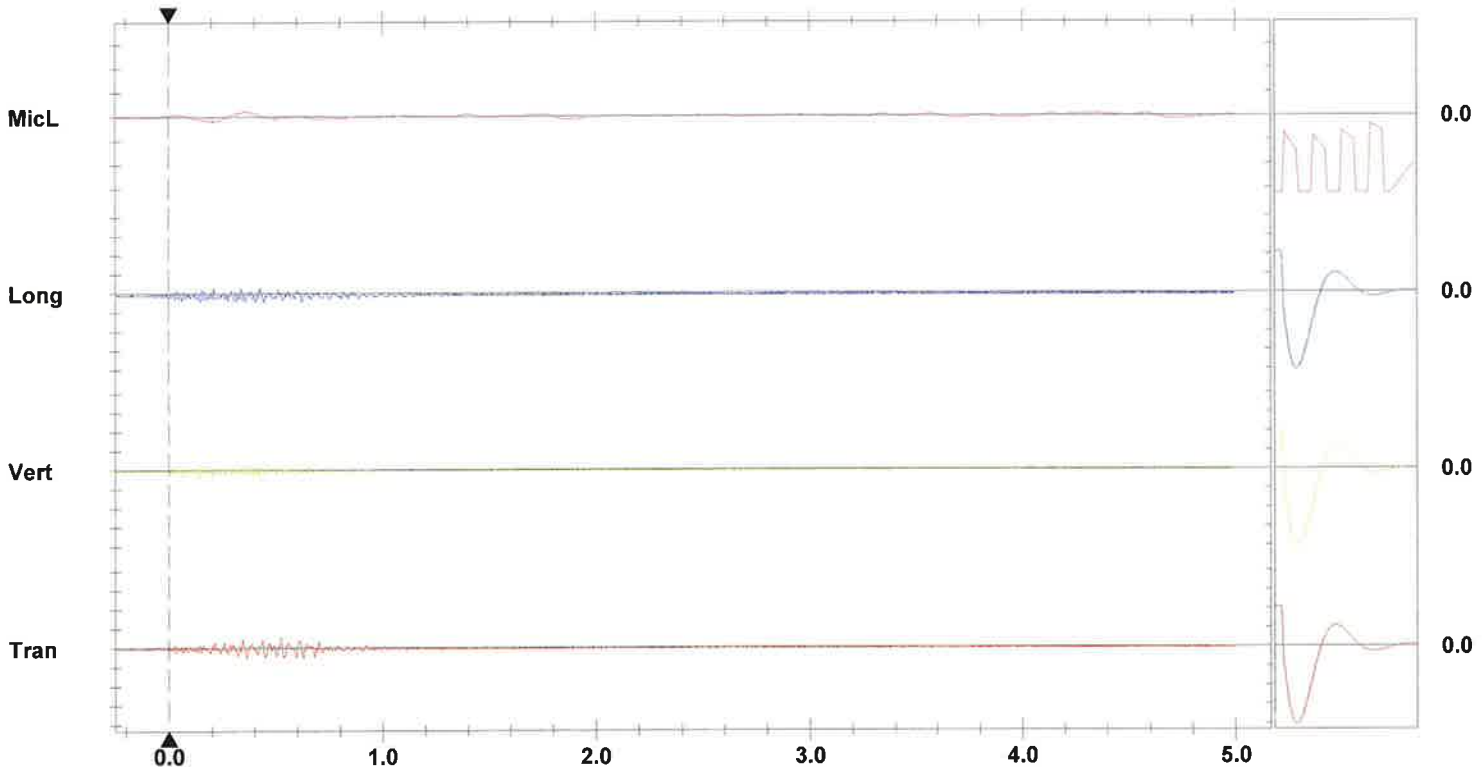
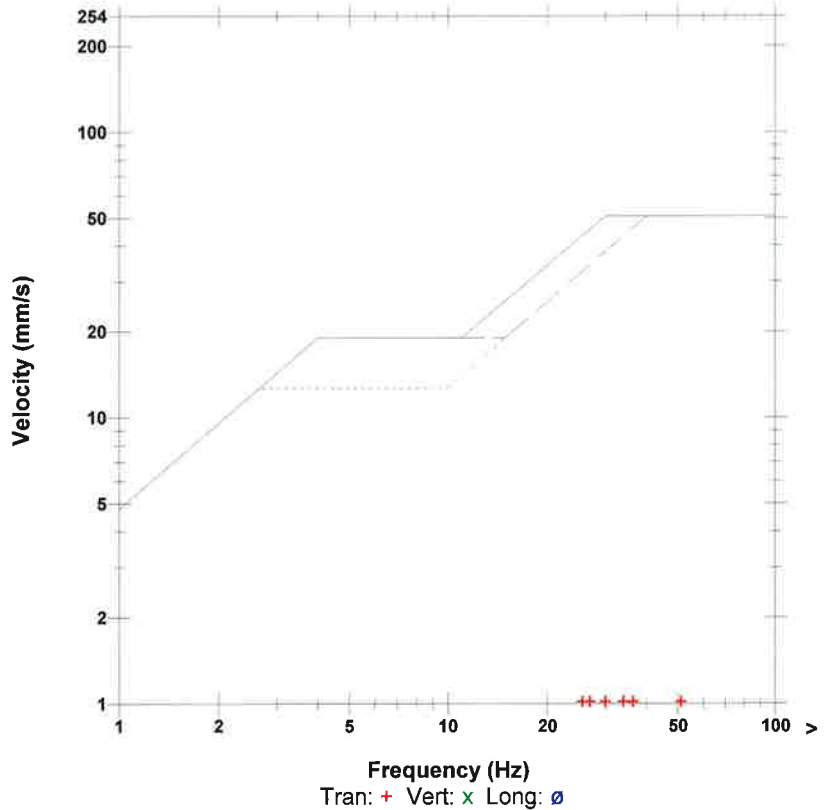
81 holes @ 30' deep 10 x 10 pattern 55 kg MAX. PD 1
 HPD
 .CLOUDY SW WIND.

Microphone Linear Weighting
PSPL 2.500 pa.(L) at 0.352 sec
ZC Freq 3.3 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 579 mv)

	Tran	Vert	Long	
PPV	1.016	0.762	0.889	mm/s
ZC Freq	34	64	57	Hz
Time (Rel. to Trig)	0.362	0.147	0.146	sec
Peak Acceleration	0.040	0.027	0.040	g
Peak Displacement	0.007	0.002	0.009	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.6	7.4	7.6	Hz
Overswing Ratio	3.8	3.8	4.1	

Peak Vector Sum 1.368 mm/s at 0.362 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Long at 11:26:05 April 23, 2015
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

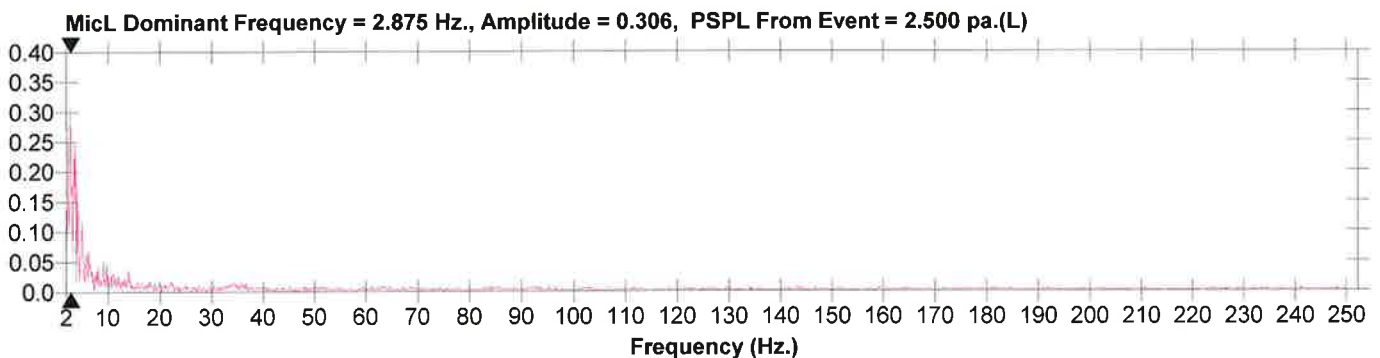
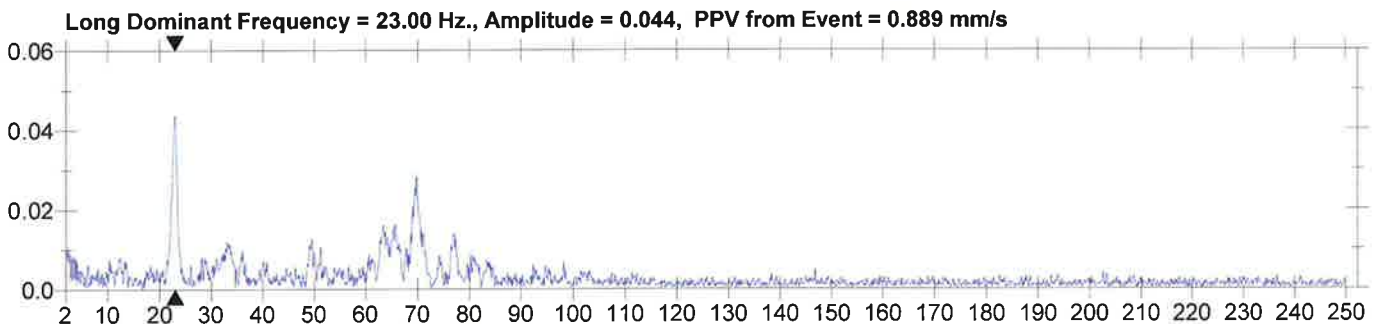
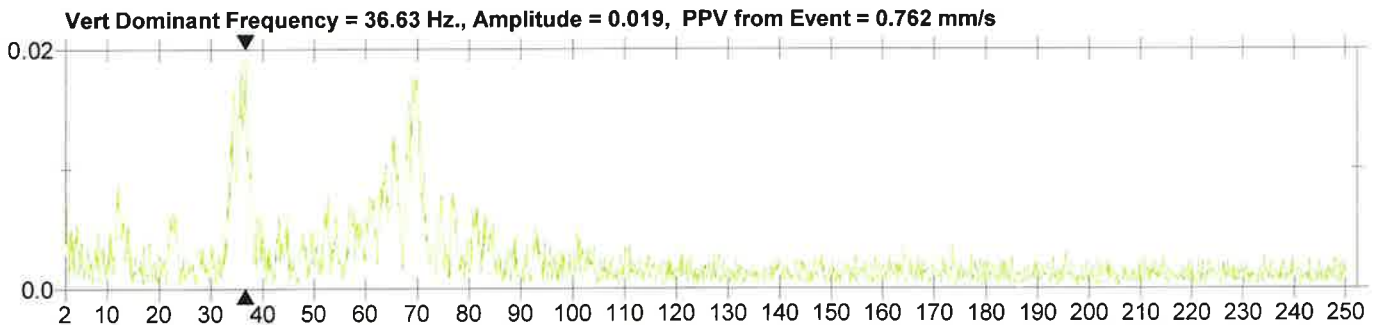
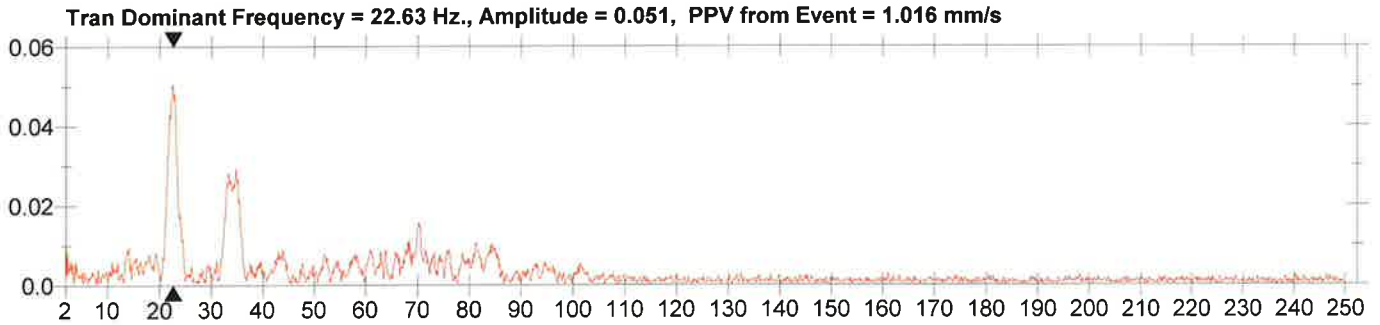
Serial Number BE8087 V 10.72-8.17 MiniMate Plus
Battery Level 6.0 Volts
Unit Calibration June 2, 2014 by Instantel
File Name J087FTF1.3HO
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes

Location: RES. CORDUKES Rd CIVIC #2130 1280 m SW
Client: ELGINBURGH QUARRY # 10350033
User: Remi Tremblay
General: Blast Vibration Monitoring

Extended Notes

81 holes @ 30' deep 10 x 10 pattern 55 kg MAX. PD 1
 HPD
 .CLOUDY SW WIND.



Date/Time Long at 11:26:07 April 23, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 29, 2014 by Instantel
File Name C528FTGV.RJ0
Scaled Distance 132.3 (981.0 m, 55.0 kg)

Notes

Location: RES.BURBROOK Rd CIVIC #2362 981 mSE
Client: ELGINBURGH QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 6, 2015 16:06:08 (V10.72)

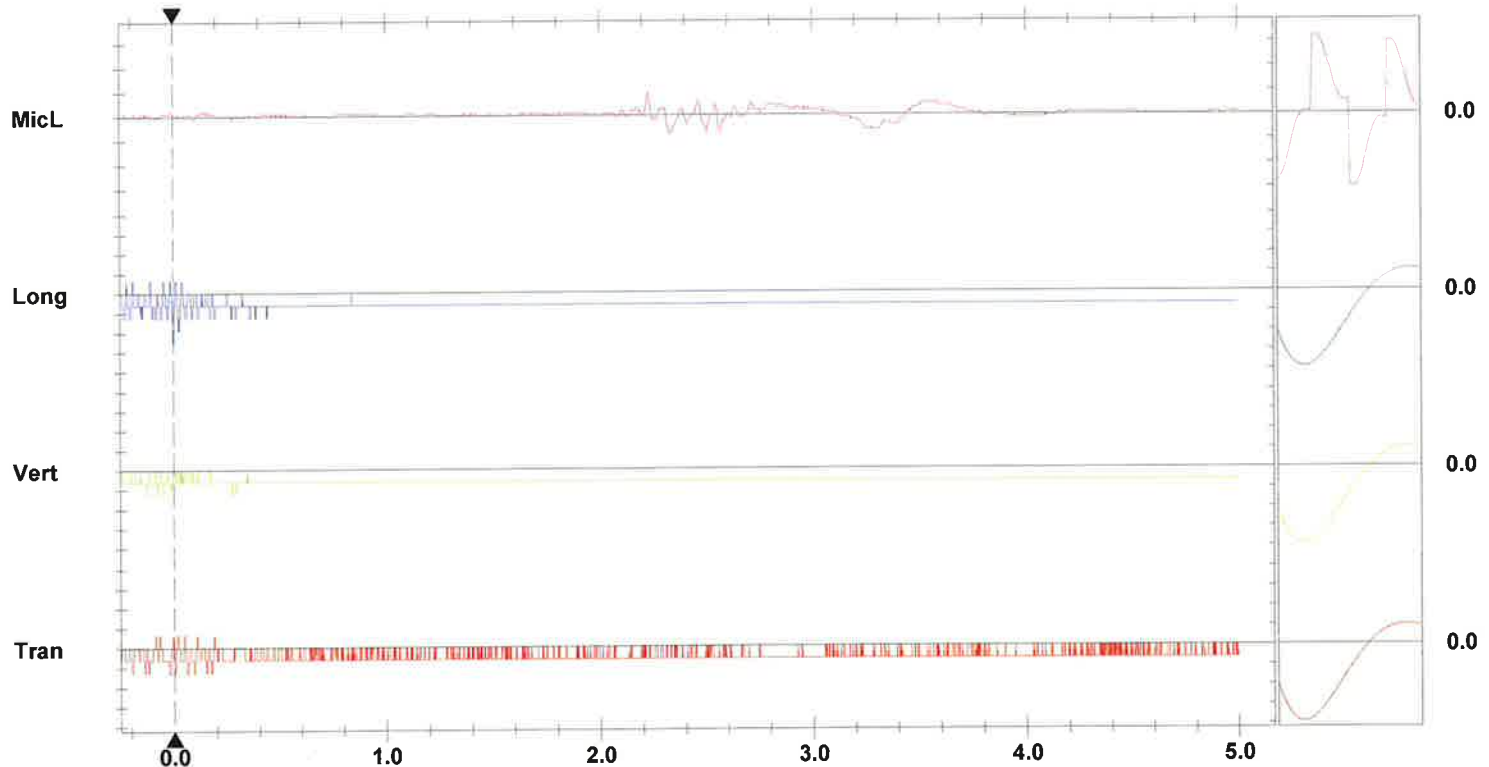
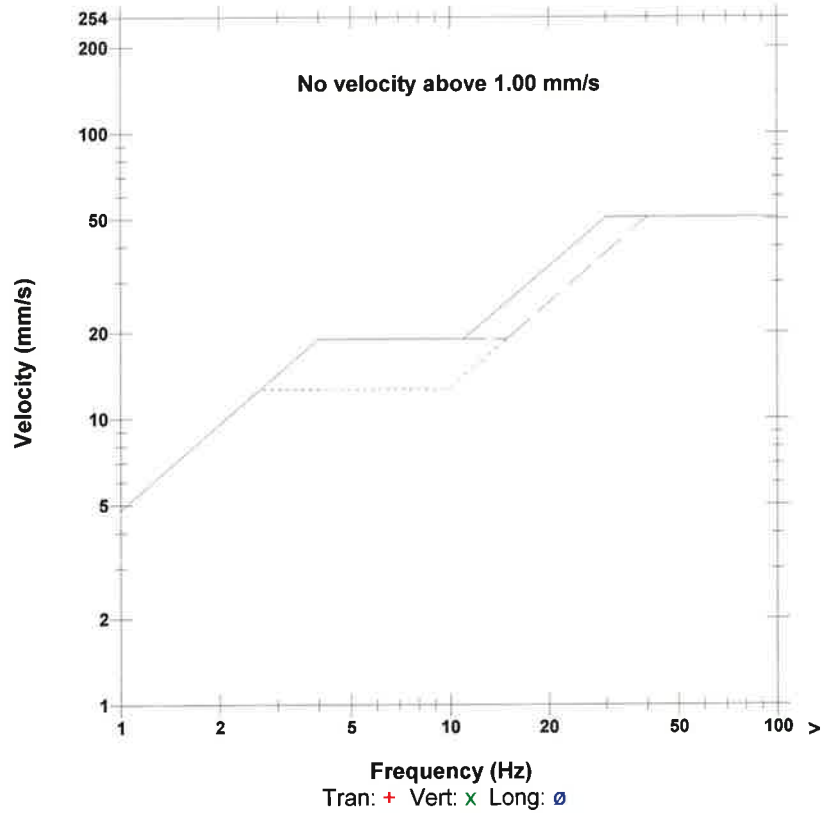
Extended Notes

Microphone Linear Weighting
PSPL 4.500 pa.(L) at 2.229 sec
ZC Freq 20 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 270 mv)

	Tran	Vert	Long	
PPV	0.254	0.254	0.508	mm/s
ZC Freq	51	>100	43	Hz
Time (Rel. to Trig)	-0.016	-0.011	0.003	sec
Peak Acceleration	0.013	0.013	0.013	g
Peak Displacement	0.000	0.000	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	8.1	8.0	8.0	Hz
Overswing Ratio	3.9	3.8	4.0	

Peak Vector Sum 0.572 mm/s at 0.003 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.200 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

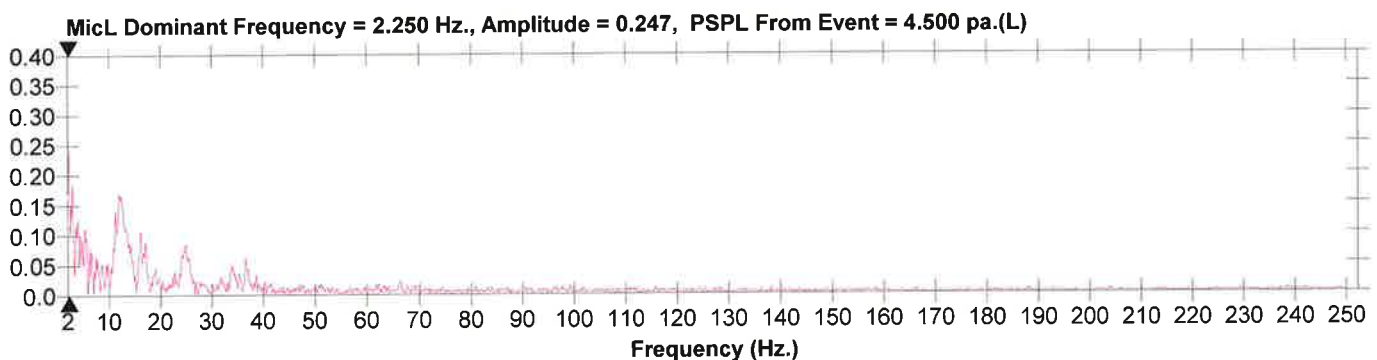
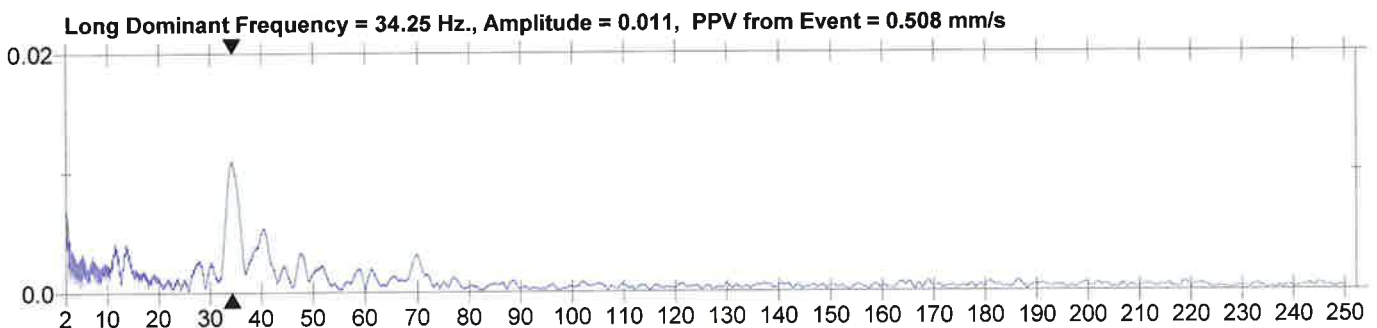
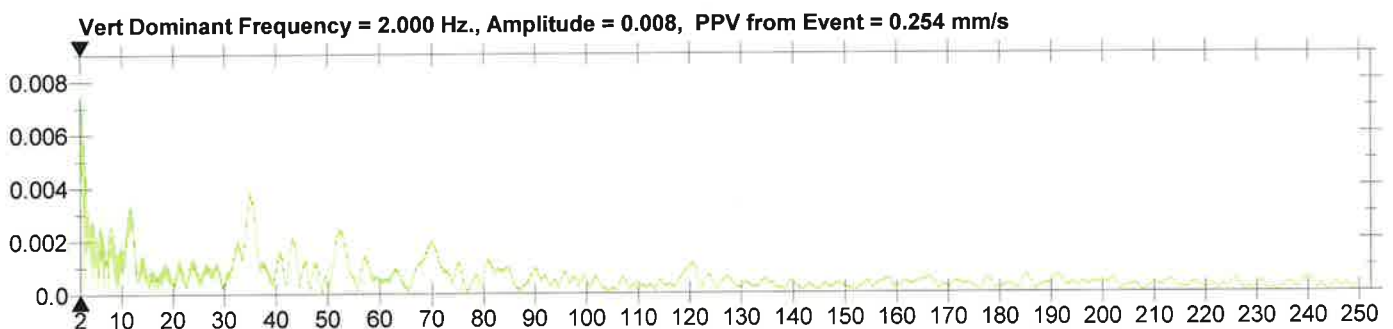
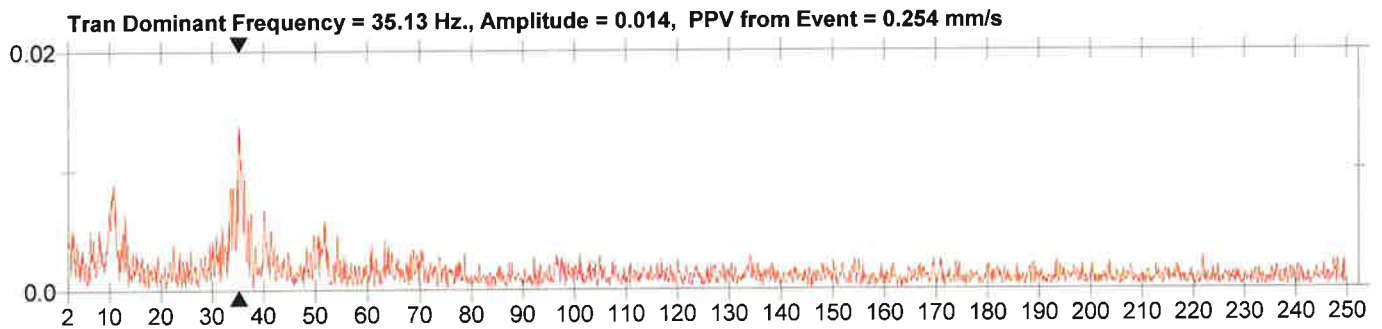
Date/Time Long at 11:26:07 April 23, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 29, 2014 by Instantel
File Name C528FTGV.RJ0
Scaled Distance 132.3 (981.0 m, 55.0 kg)

Notes

Location: RES.BURBROOK Rd CIVIC #2362 981 mSE
Client: ELGINBURGH QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 6, 2015 16:06:08 (V10.72)

Extended Notes



Date/Time Long at 11:13:17 April 29, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.0 Volts
Unit Calibration January 29, 2014 by Instantel
File Name C528FTRZ.650
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes

Location: RES.CORDUKES RD CIVIC#2130 1280 mSW
Client: ELGINBURGH QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 6, 2015 16:06:08 (V10.72)

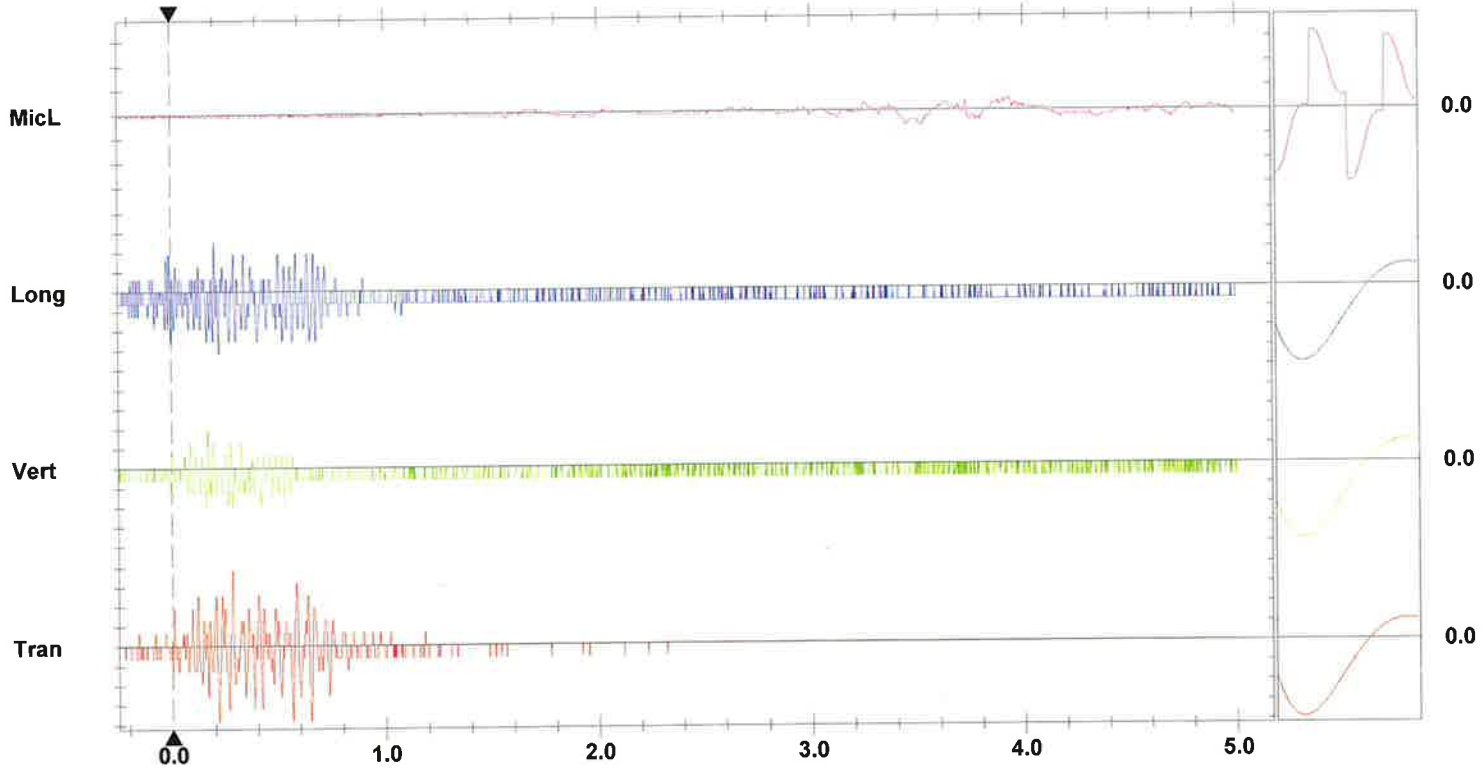
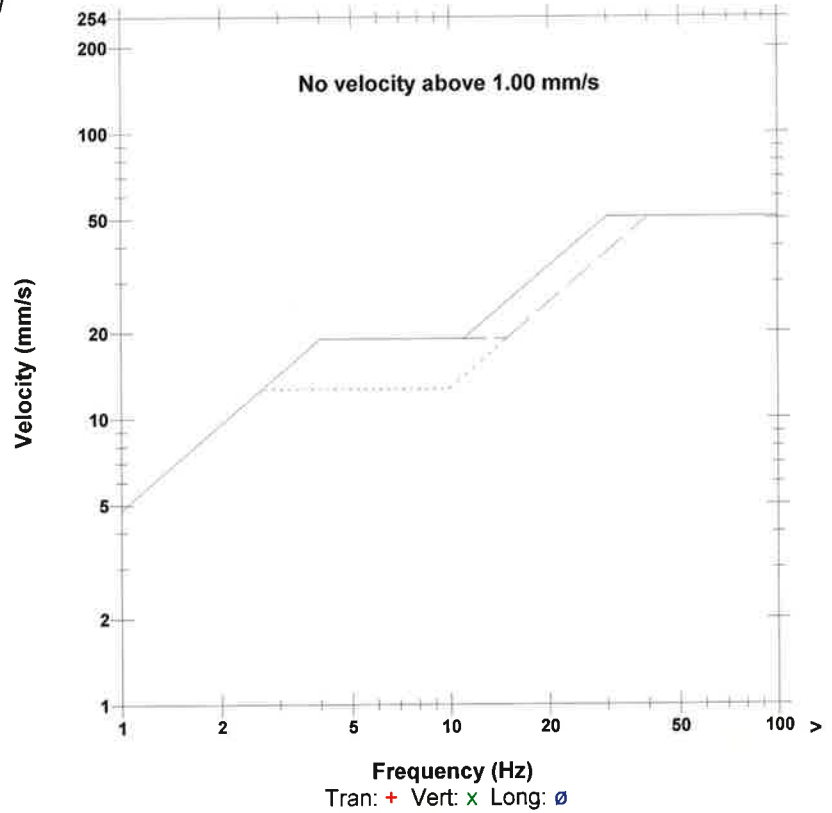
Extended Notes

Microphone Linear Weighting
PSPL 3.000 pa.(L) at 3.448 sec
ZC Freq 3.0 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 272 mv)

	Tran	Vert	Long	
PPV	0.762	0.381	0.635	mm/s
ZC Freq	32	51	57	Hz
Time (Rel. to Trig)	0.216	0.158	0.224	sec
Peak Acceleration	0.027	0.013	0.027	g
Peak Displacement	0.004	0.000	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	8.0	7.8	Hz
Overswing Ratio	3.7	3.6	3.7	

Peak Vector Sum 0.921 mm/s at 0.652 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.200 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

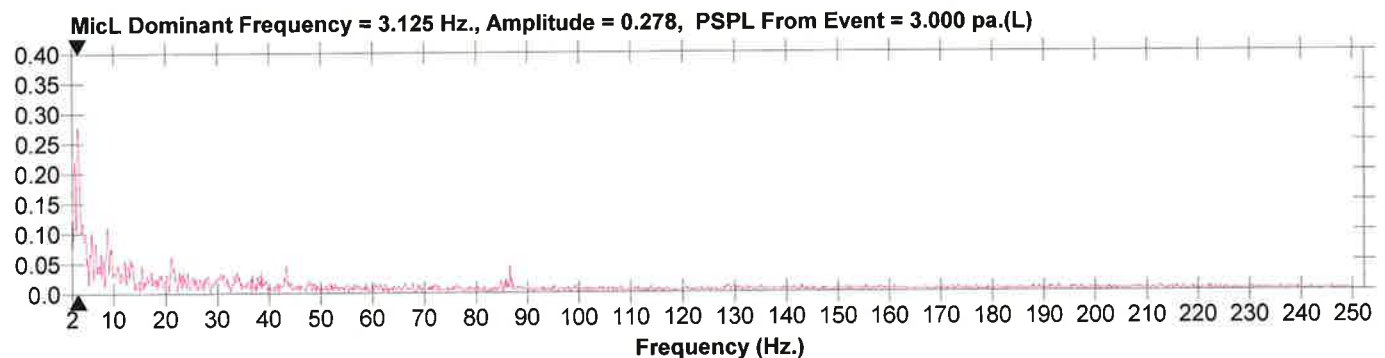
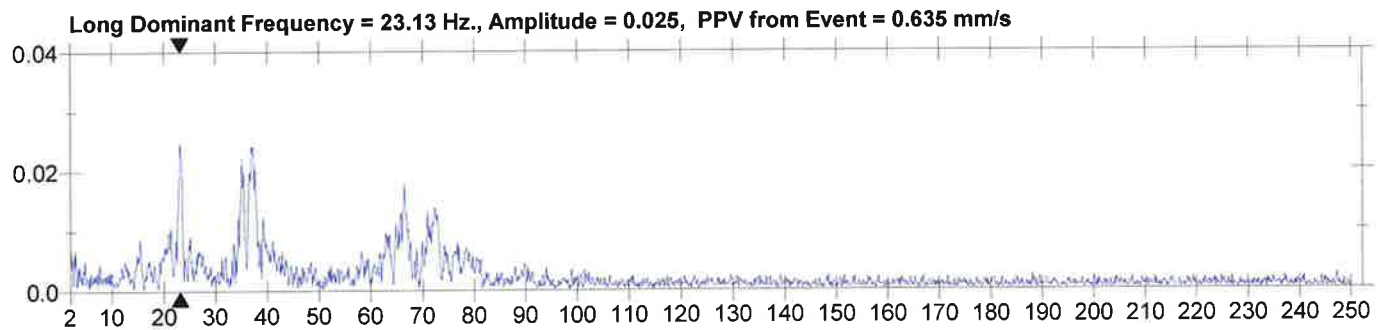
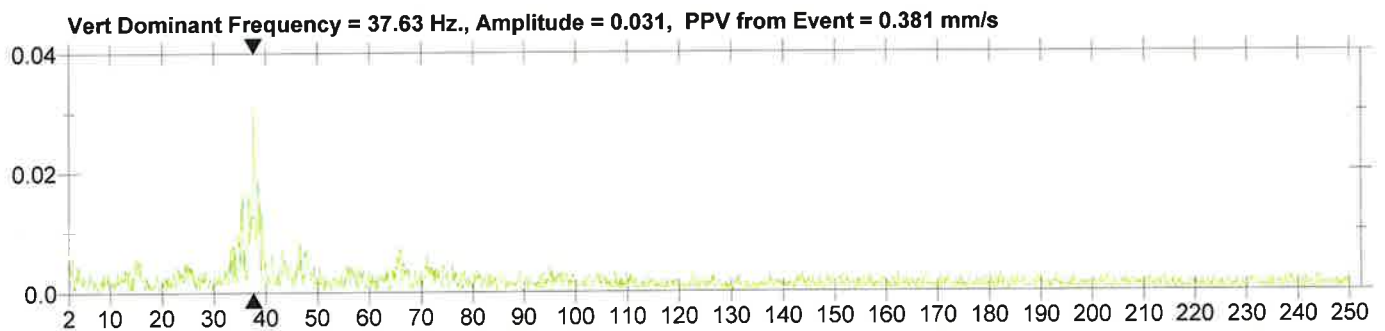
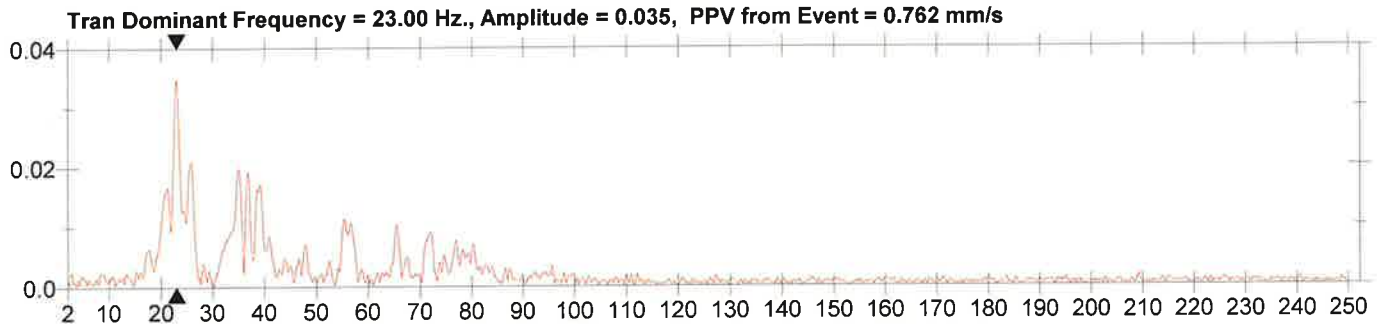
Date/Time Long at 11:13:17 April 29, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.0 Volts
Unit Calibration January 29, 2014 by Instantel
File Name C528FTRZ.650
Scaled Distance 172.6 (1280.0 m, 55.0 kg)

Notes

Location: RES.CORDUKES RD CIVIC#2130 1280 mSW
Client: ELGINBURGH QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 6, 2015 16:06:08 (V10.72)

Extended Notes



Date/Time Tran at 12:58:58 May 13, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.3 Volts
Unit Calibration January 29, 2014 by InstanTel
File Name C528FU11.EA0
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

Notes

Location: RES.CORDUKES Rd CIVIC#2130 1280 mSW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: May 15, 2015 12:55:46 (V10.72)

Extended Notes

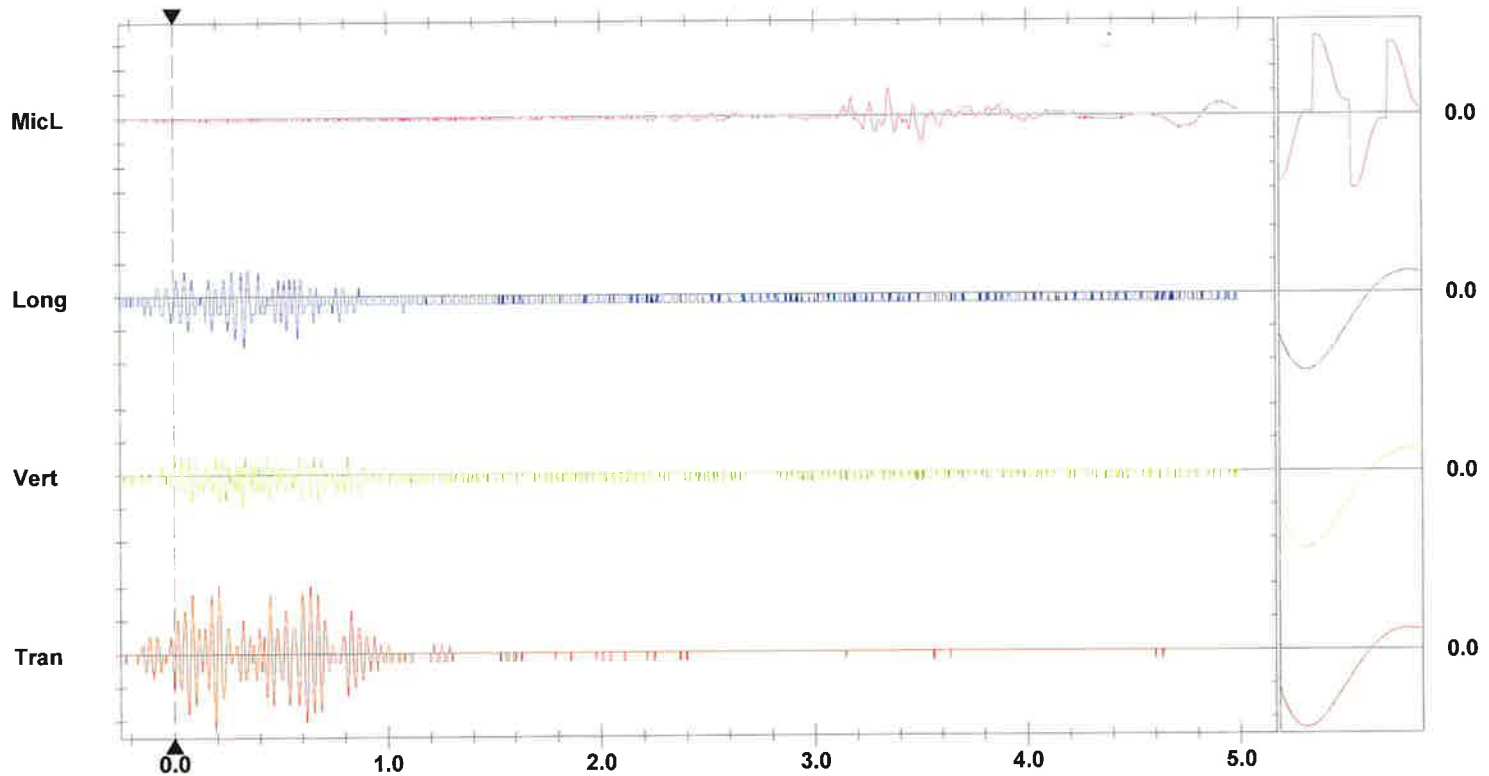
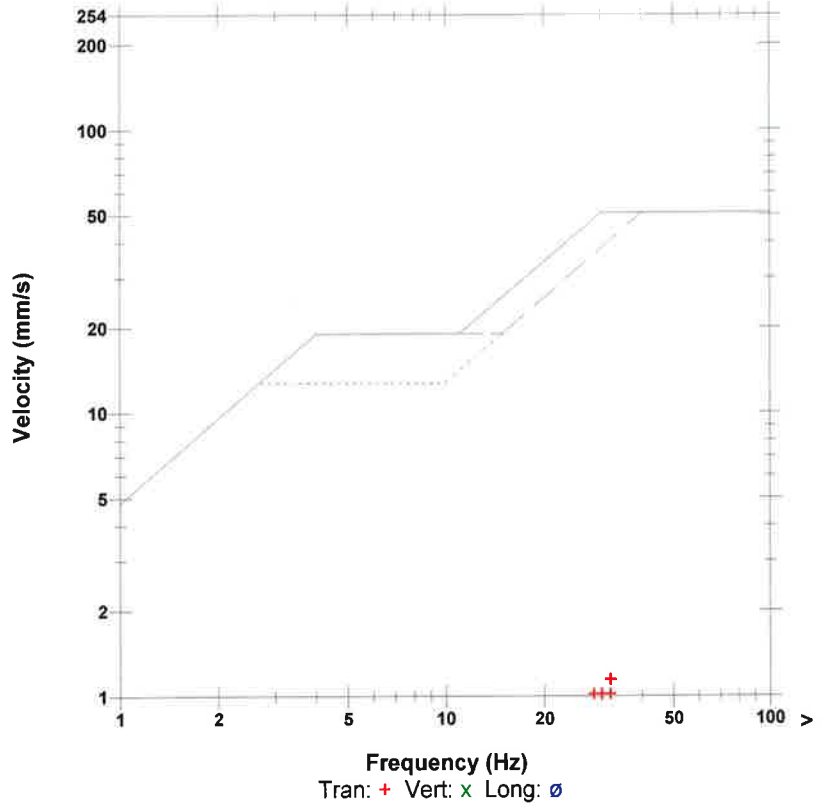
193 HIS 6 ft 5x5 5kg
 118 HIS 31 ft 9x10 1HPD 60 kgMAX. SUNNY NW WIND.

Microphone Linear Weighting
PSPL 5.500 pa.(L) at 3.353 sec
ZC Freq 18 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 273 mv)

	Tran	Vert	Long	
PPV	1.143	0.508	0.762	mm/s
ZC Freq	32	51	32	Hz
Time (Rel. to Trig)	0.192	0.319	0.330	sec
Peak Acceleration	0.027	0.013	0.013	g
Peak Displacement	0.006	0.001	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	8.0	8.0	7.8	Hz
Overswing Ratio	3.7	3.7	3.8	

Peak Vector Sum 1.175 mm/s at 0.193 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Tran at 12:58:58 May 13, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.3 Volts
Unit Calibration January 29, 2014 by InstanTel
File Name C528FU11.EA0
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

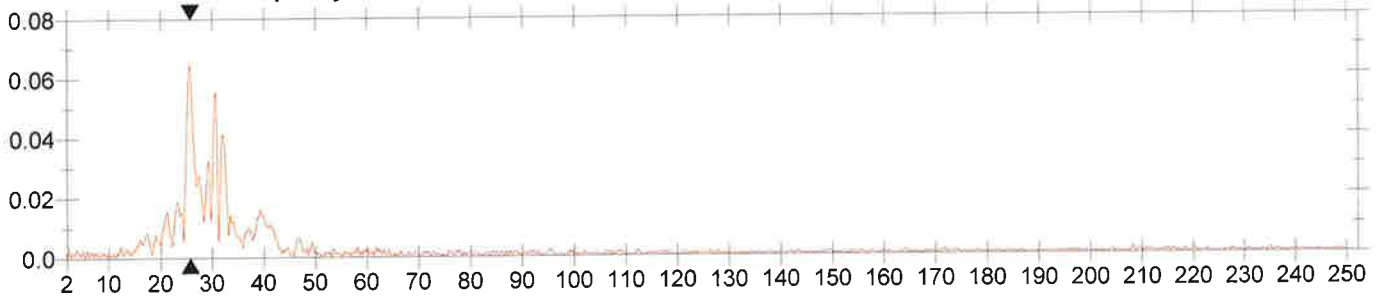
Notes

Location: RES.CORDUKES Rd CIVIC#2130 1280 mSW
Client: ELGINBURG QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: May 15, 2015 12:55:46 (V10.72)

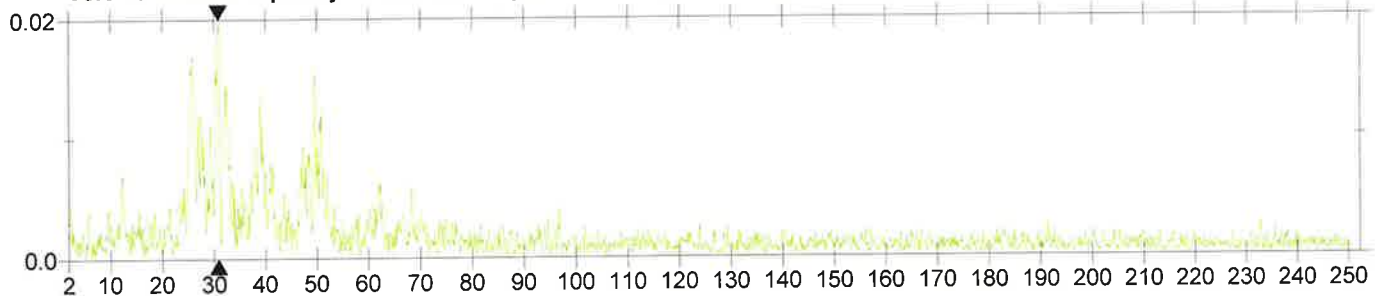
Extended Notes

193 HIS 6 ft 5x5 5kg
 118 HIS 31 ft 9x10 1HPD 60 kgMAX. SUNNY NW WIND.

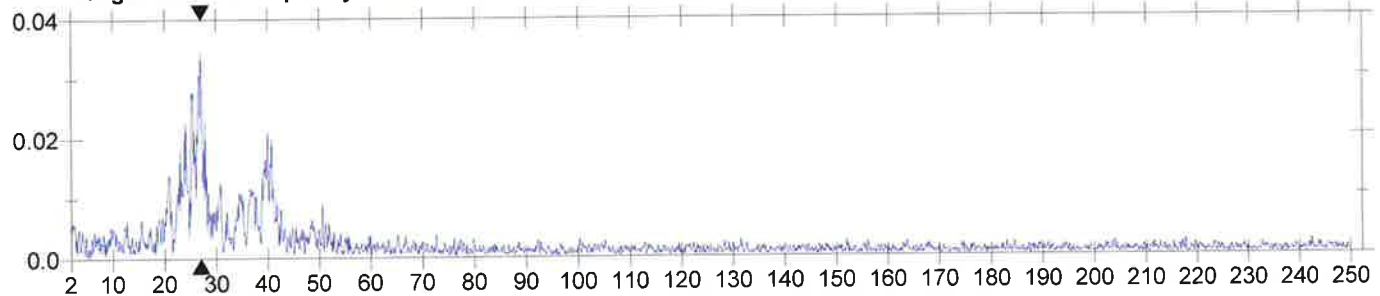
Tran Dominant Frequency = 25.75 Hz., Amplitude = 0.065, PPV from Event = 1.143 mm/s



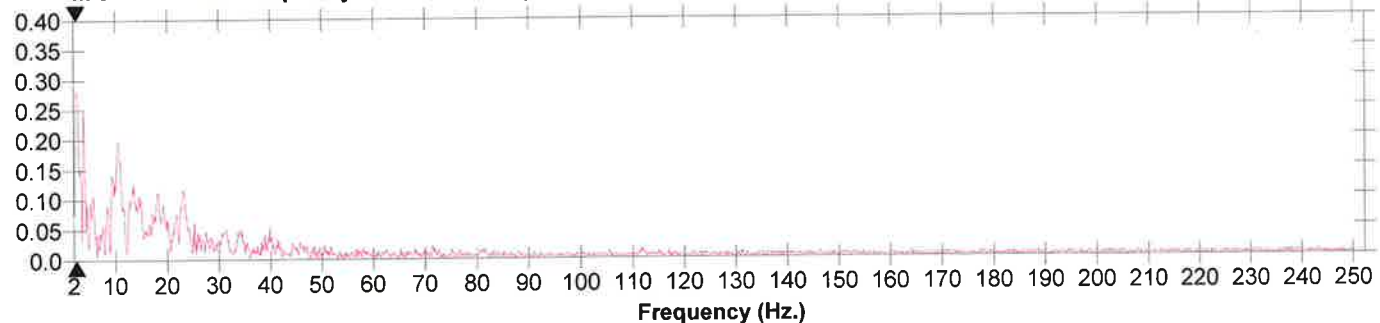
Vert Dominant Frequency = 30.88 Hz., Amplitude = 0.020, PPV from Event = 0.508 mm/s



Long Dominant Frequency = 27.00 Hz., Amplitude = 0.034, PPV from Event = 0.762 mm/s



MicL Dominant Frequency = 2.500 Hz., Amplitude = 0.282, PSPL From Event = 5.500 pa.(L)



Date/Time Tran at 13:35:37 May 20, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.3 Volts
Unit Calibration January 29, 2014 by InstanTEL
File Name C528FUV1.RD0
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

Notes

Location: RES.CORDUKES Rd CIVIC# 2130 1280 mSW
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: June 11, 2015 15:27:35 (V10.72)

Extended Notes

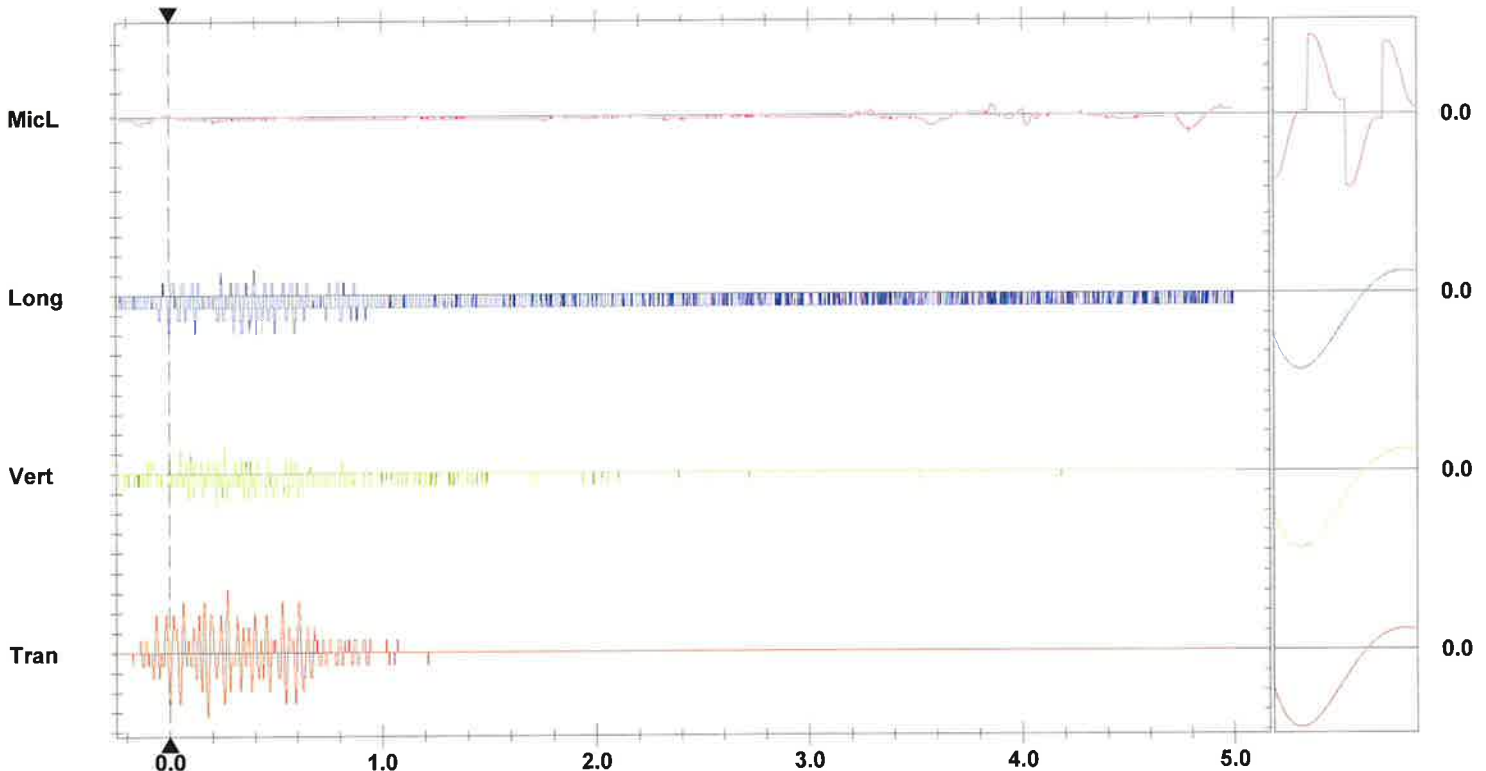
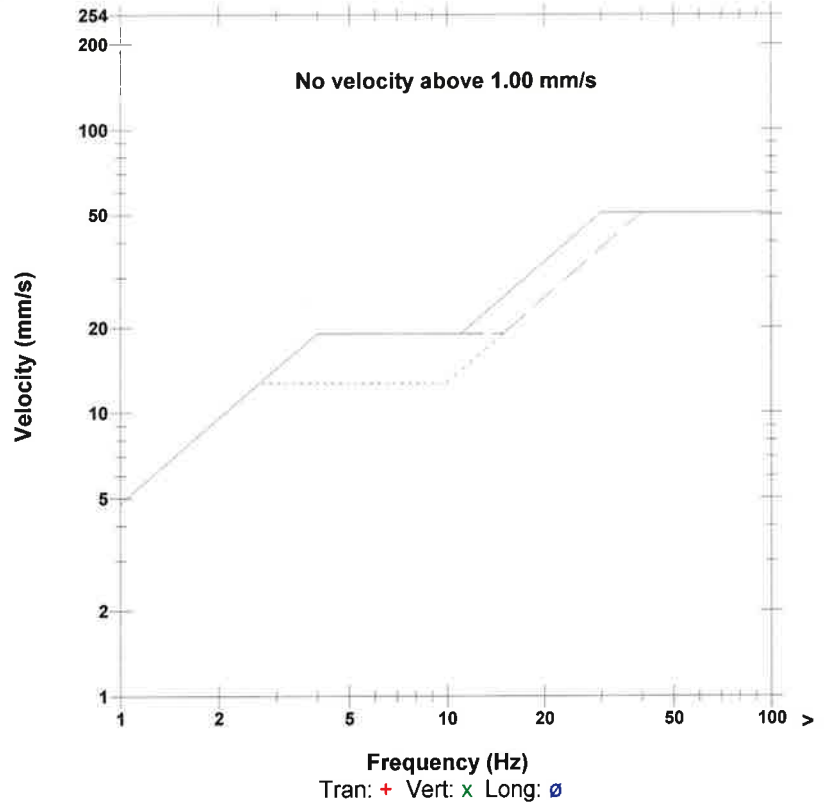
135 HIS 30 ft 9x10 1HPD 60 kgMAX. SUNNY NW WIND.

Microphone Linear Weighting
PSPL 3.500 pa.(L) at 4.787 sec
ZC Freq 4.0 Hz
Channel Test Passed (Freq = 20.0 Hz Amp = 274 mv)

	Tran	Vert	Long	
PPV	0.635	0.381	0.381	mm/s
ZC Freq	34	85	39	Hz
Time (Rel. to Trig)	0.178	0.219	0.003	sec
Peak Acceleration	0.013	0.013	0.013	g
Peak Displacement	0.002	0.000	0.000	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	8.0	8.0	Hz
Overswing Ratio	3.7	3.7	3.8	

Peak Vector Sum 0.667 mm/s at 0.272 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.200 mm/s/div Mic: 5.000 pa.(L)/div
 Trigger =

Sensor Check

Date/Time Tran at 13:35:37 May 20, 2015
Trigger Source Geo: 0.508 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

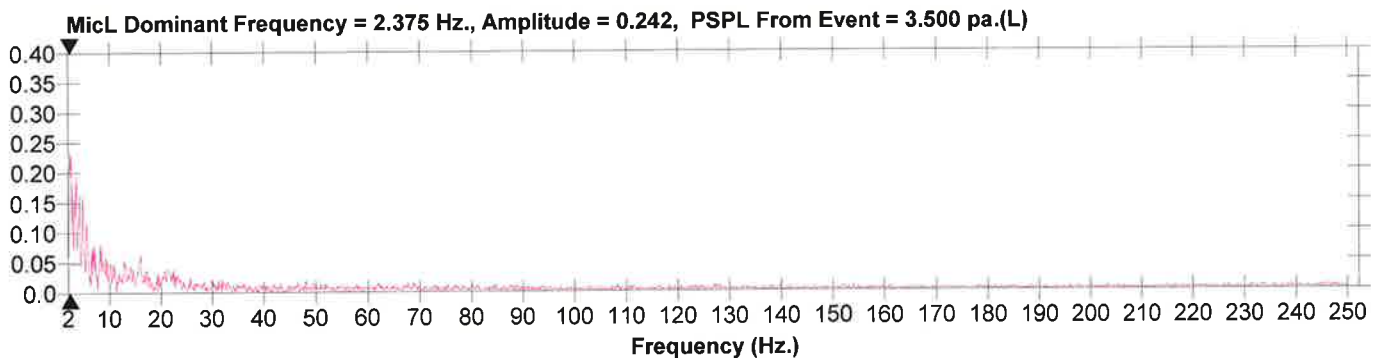
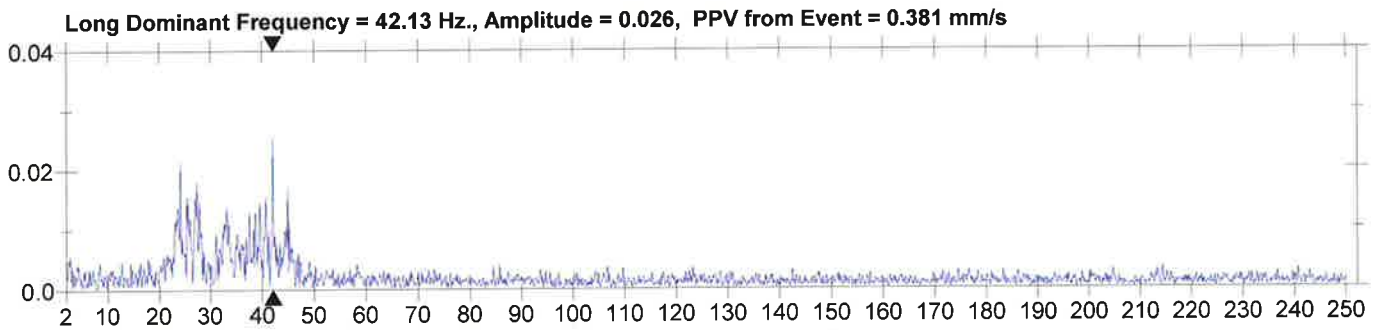
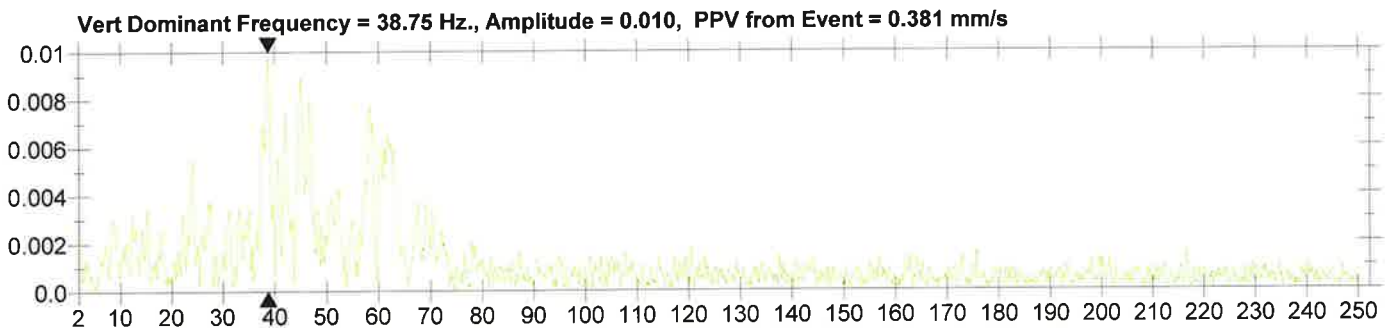
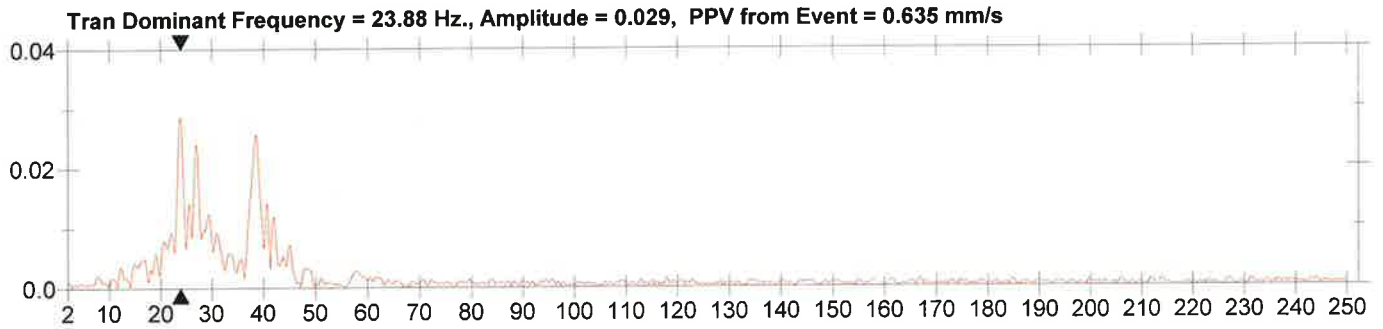
Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.3 Volts
Unit Calibration January 29, 2014 by Instatel
File Name C528FUV1.RD0
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

Notes

Location: RES.CORDUKES Rd CIVIC# 2130 1280 mSW
Client: ELGINBURG QUARRY # 10350033
User Name: REMI TREMBLAY
Converted: June 11, 2015 15:27:35 (V10.72)

Extended Notes

135 HIS 30 ft 9x10 1HPD 60 kgMAX. SUNNY NW WIND.



Date/Time Tran at 10:43:19 May 26, 2016
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8349 V 10.72-8.17 MiniMate Plus
Battery Level 6.2 Volts
Unit Calibration March 23, 2016 by Instantel
File Name J349GD XV.470
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

Notes

Location: RES CORDUKES RD CIVIC #2130 1280 M SW
Client: ELGINBURG QUARRY #10350033
User: REMI TREMBLAY
General: Blast Vibration Monitoring

Extended Notes

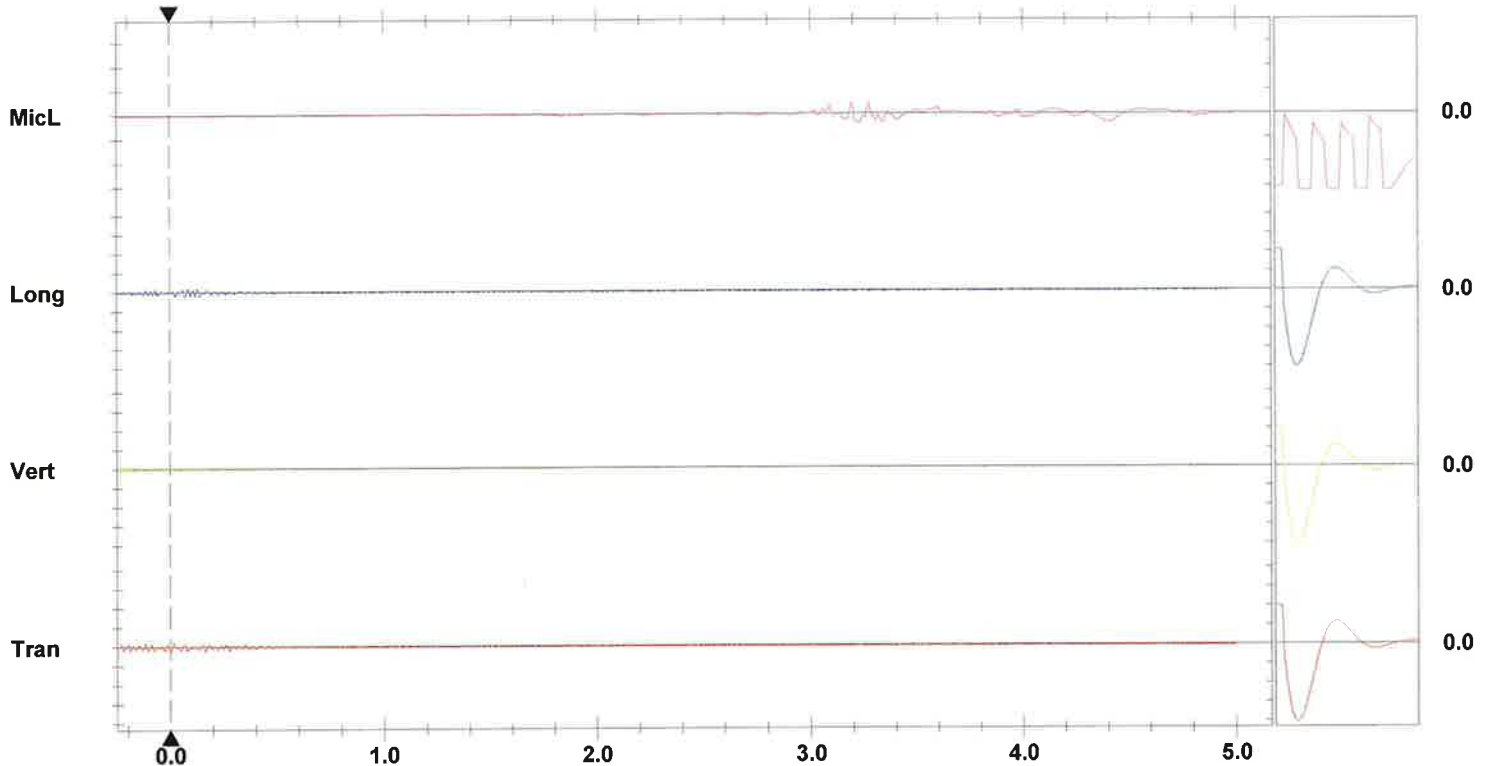
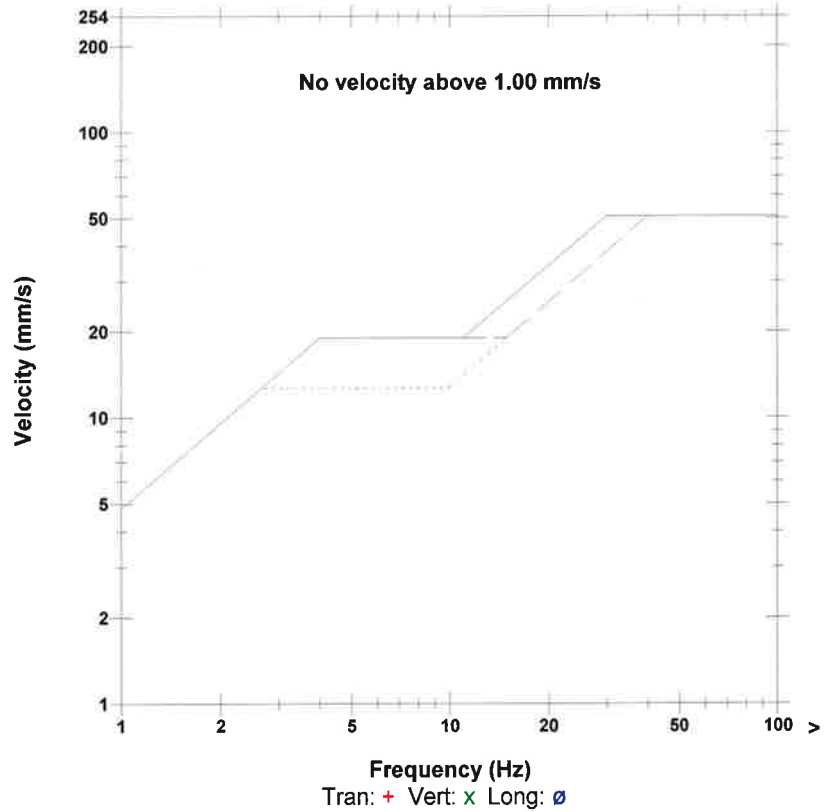
72 Holes 33 ft 9 x 10 Pattern 60 kg MAX.
 1 HPD SUNNY NE WIND.

Microphone Linear Weighting
PSPL 4.750 pa.(L) at 3.276 sec
ZC Freq 23 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 691 mv)

	Tran	Vert	Long	
PPV	0.508	0.381	0.508	mm/s
ZC Freq	34	64	43	Hz
Time (Rel. to Trig)	0.000	-0.247	0.071	sec
Peak Acceleration	0.013	0.013	0.027	g
Peak Displacement	0.003	0.001	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.6	7.7	7.7	Hz
Overswing Ratio	3.8	3.8	3.8	

Peak Vector Sum 0.596 mm/s at -0.077 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Tran at 10:43:19 May 26, 2016
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

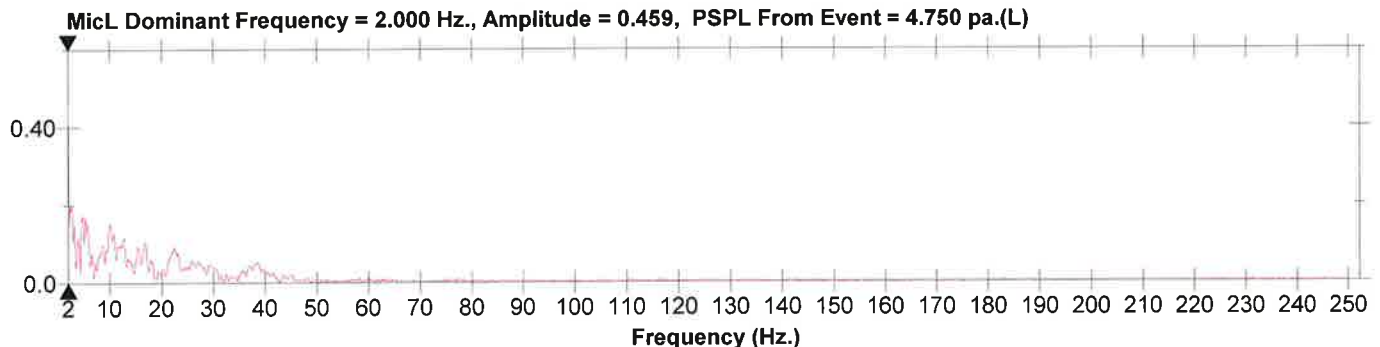
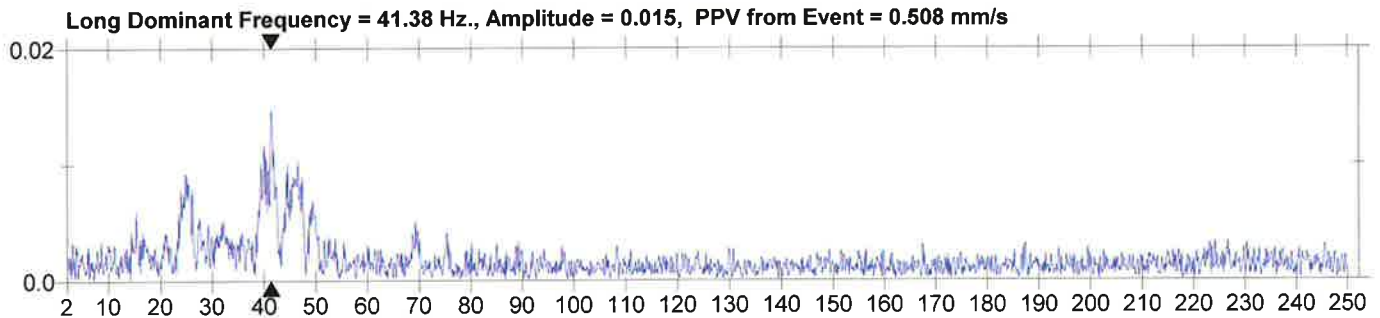
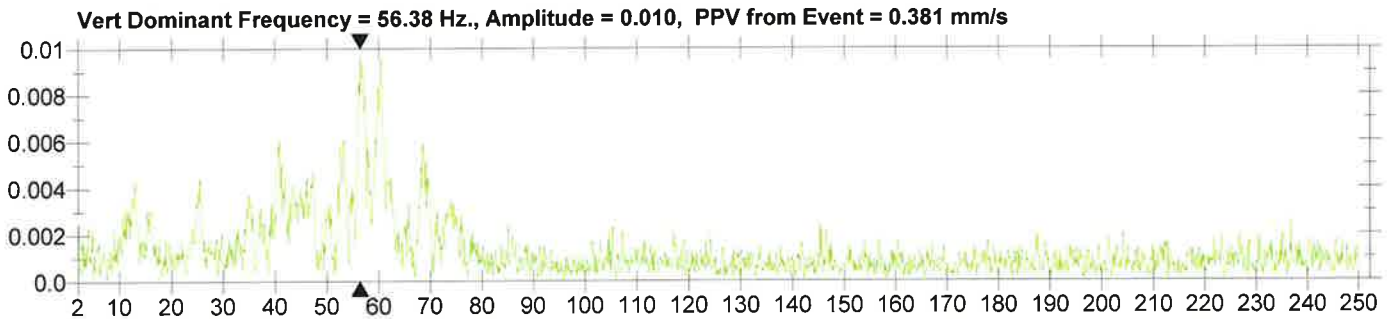
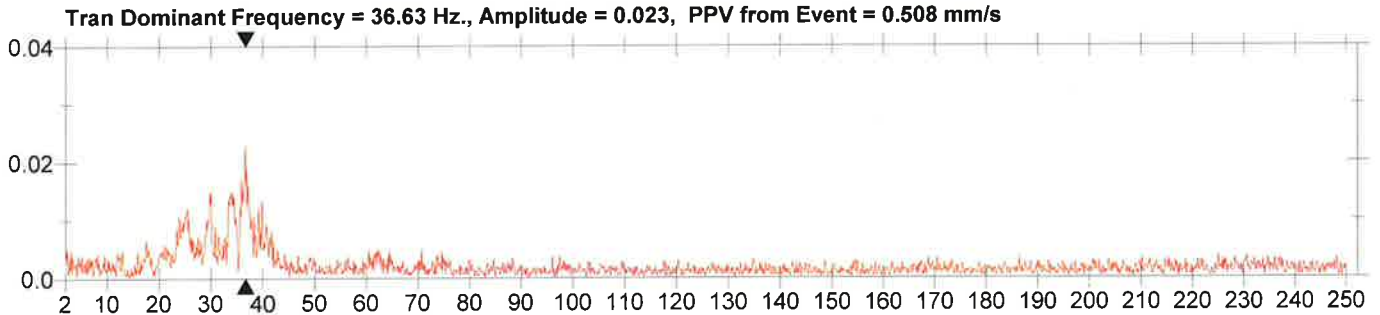
Serial Number BE8349 V 10.72-8.17 MiniMate Plus
Battery Level 6.2 Volts
Unit Calibration March 23, 2016 by Instantel
File Name J349GDXV.470
Scaled Distance 165.2 (1280.0 m, 60.0 kg)

Notes

Location: RES CORDUKES RD CIVIC #2130 1280 M SW
Client: ELGINBURG QUARRY #10350033
User: REMI TREMBLAY
General: Blast Vibration Monitoring

Extended Notes

72 Holes 33 ft 9 x 10 Pattern 60 kg MAX.
 1 HPD SUNNY NE WIND.



Date/Time Long at 14:08:52 June 21, 2016
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number BE8349 V 10.72-8.17 MiniMate Plus
Battery Level 6.2 Volts
Unit Calibration March 23, 2016 by InstanTel
File Name J349GFA9.YS0
Scaled Distance 160.0 (1290.0 m, 65.0 kg)

Notes

Location: RES CORDUKES Rd CIVIC # 2130 1190 m SW
 Client: ELGINBURG QUARRY # 10350033
 User: REMI TREMBLAY
 General: Blast Vibration Monitoring

Extended Notes

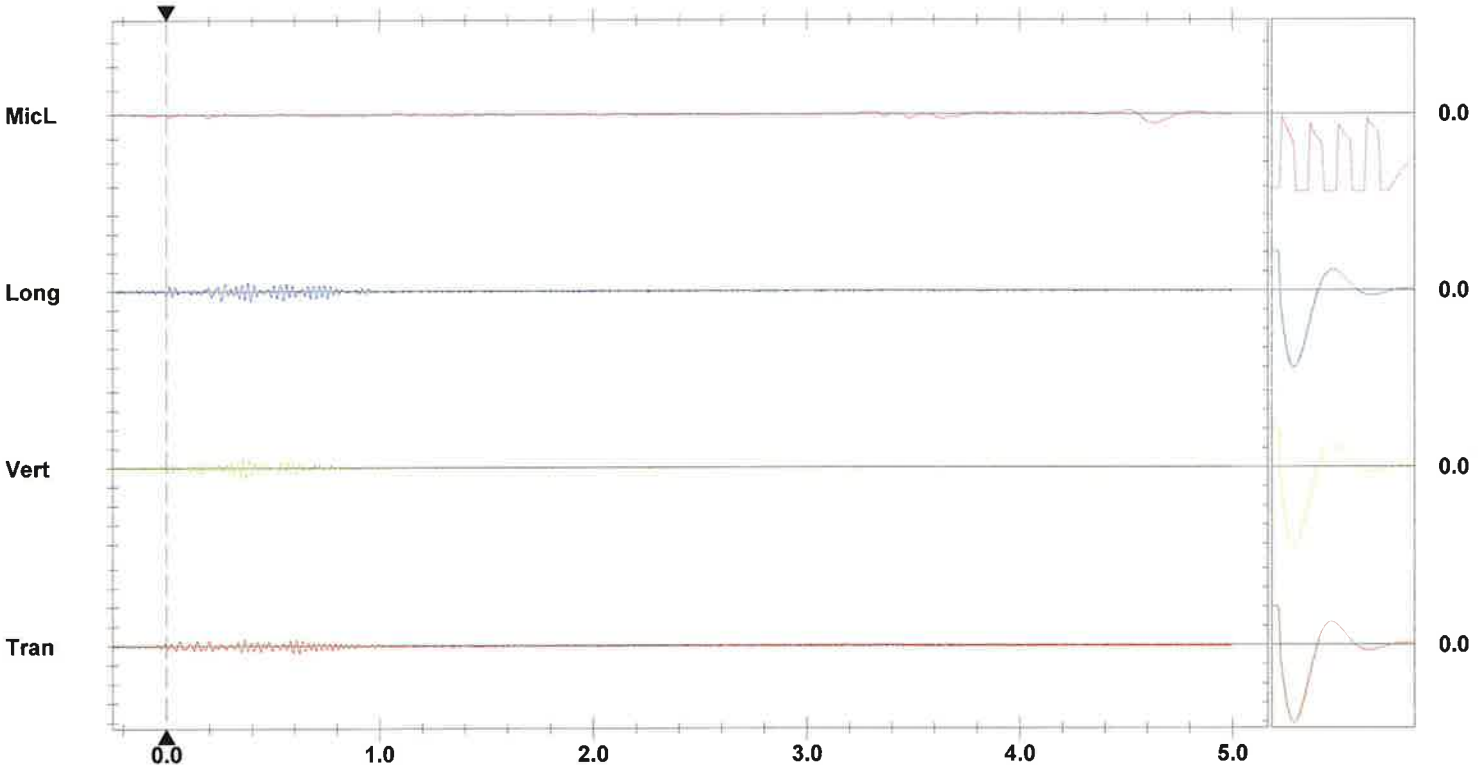
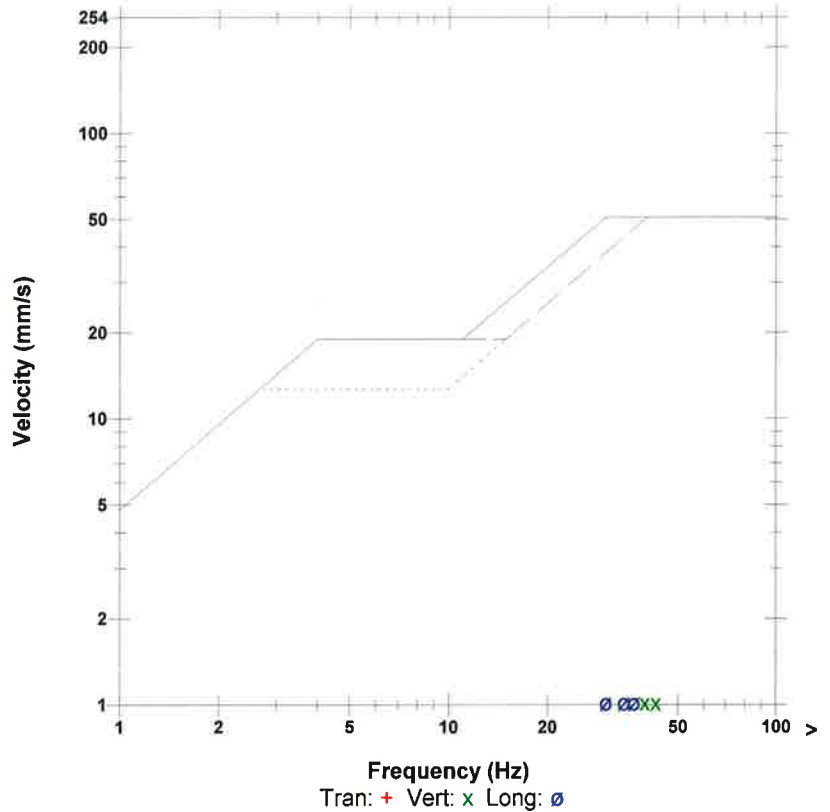
105 Holes 37 ft 9 x 10 Pattern 65 kg MAX.
 1 HPD SUNNY NW WIND.

Microphone Linear Weighting
PSPL 4.000 pa.(L) at 4.626 sec
ZC Freq 2.7 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 668 mv)

	Tran	Vert	Long	
PPV	0.762	1.016	1.016	mm/s
ZC Freq	37	43	30	Hz
Time (Rel. to Trig)	0.595	0.355	0.256	sec
Peak Acceleration	0.027	0.040	0.027	g
Peak Displacement	0.004	0.004	0.005	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.7	7.6	7.6	Hz
Overswing Ratio	3.7	3.8	3.9	

Peak Vector Sum 1.356 mm/s at 0.367 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Long at 14:08:52 June 21, 2016
Trigger Source Geo: 0.510 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

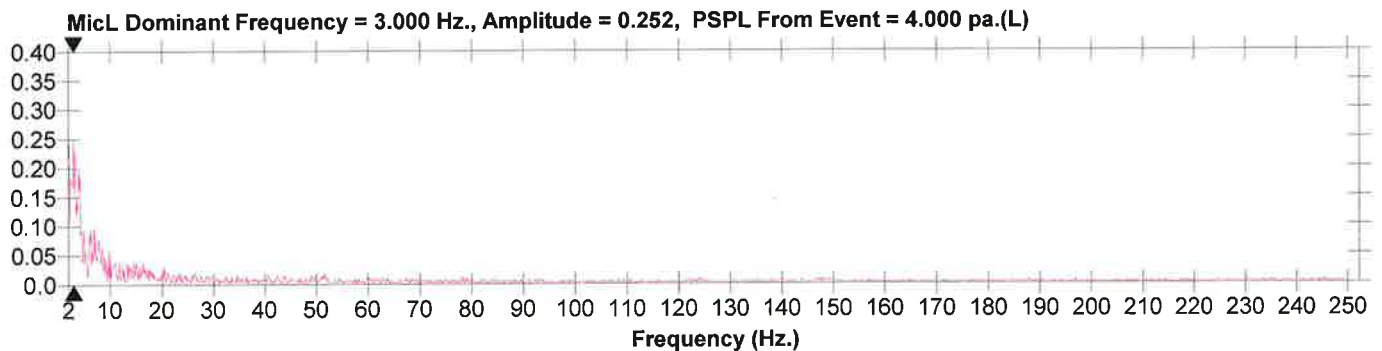
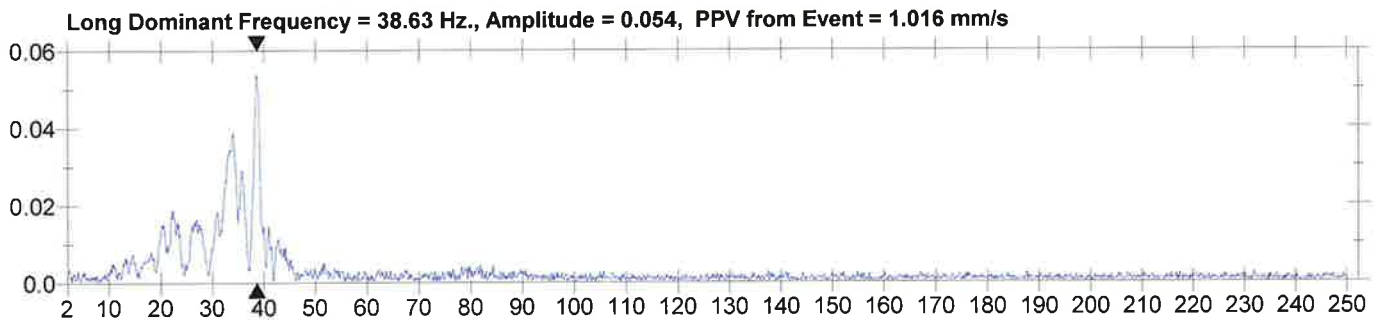
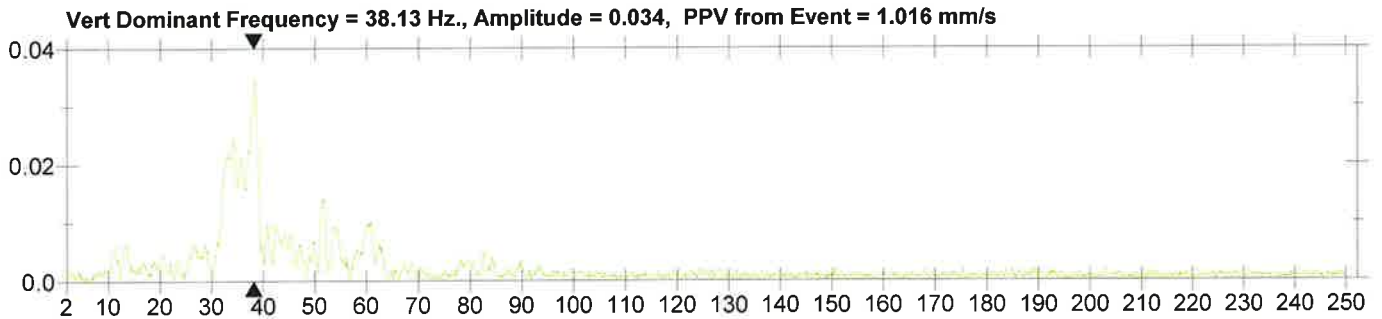
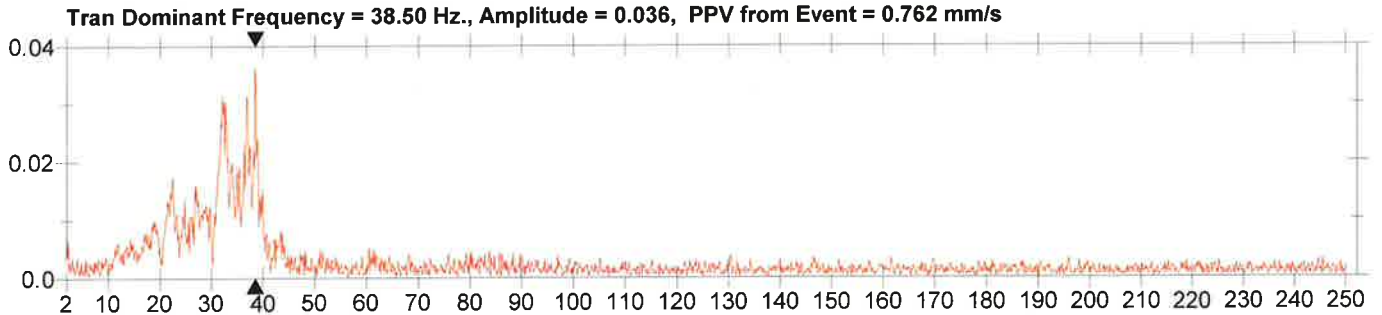
Serial Number BE8349 V 10.72-8.17 MiniMate Plus
Battery Level 6.2 Volts
Unit Calibration March 23, 2016 by Instantel
File Name J349GFA9.YS0
Scaled Distance 160.0 (1290.0 m, 65.0 kg)

Notes

Location: RES CORDUKES Rd CIVIC # 2130 1190 m SW
Client: ELGINBURG QUARRY # 10350033
User: REMI TREMBLAY
General: Blast Vibration Monitoring

Extended Notes

105 Holes 37 ft 9 x 10 Pattern 65 kg MAX.
 1 HPD SUNNY NW WIND.



Date/Time Long at 13:11:58 December 19, 2017
Trigger Source Geo: 0.730 mm/s
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 1024 sps

Serial Number 1528 V 5.52 BlastMate II/477
Battery Level 6.1 Volts
Unit Calibration January 16, 2017 by Instantel
File Name C528H7F5.ZY0
Scaled Distance 220.0 (1100.0 m, 25.0 kg)

Notes

Location: RES.BURBROOK Rd CIVIC# 2440 1100M SE
 Client: ELGINBURG QUARRY # 10350033
 User Name: REMI TREMBLAY
 Converted: January 9, 2018 08:08:21 (V10.72)

Extended Notes

142 HIS 17 ft 9x1025 kg MAX PD 1 HPD CLOUDY W WIND

Microphone Linear Weighting

PSPL 21.00 pa.(L) at 0.813 sec

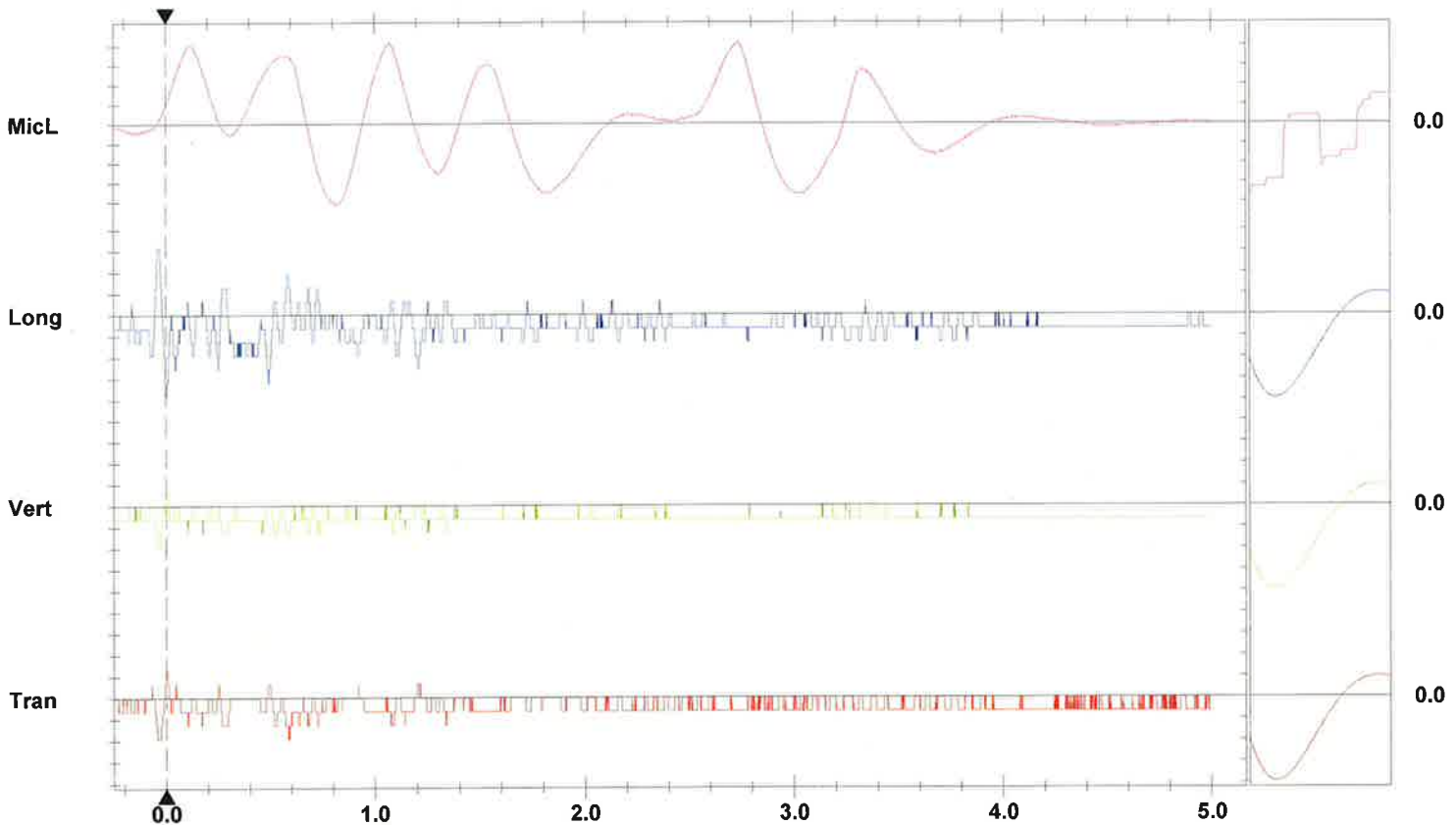
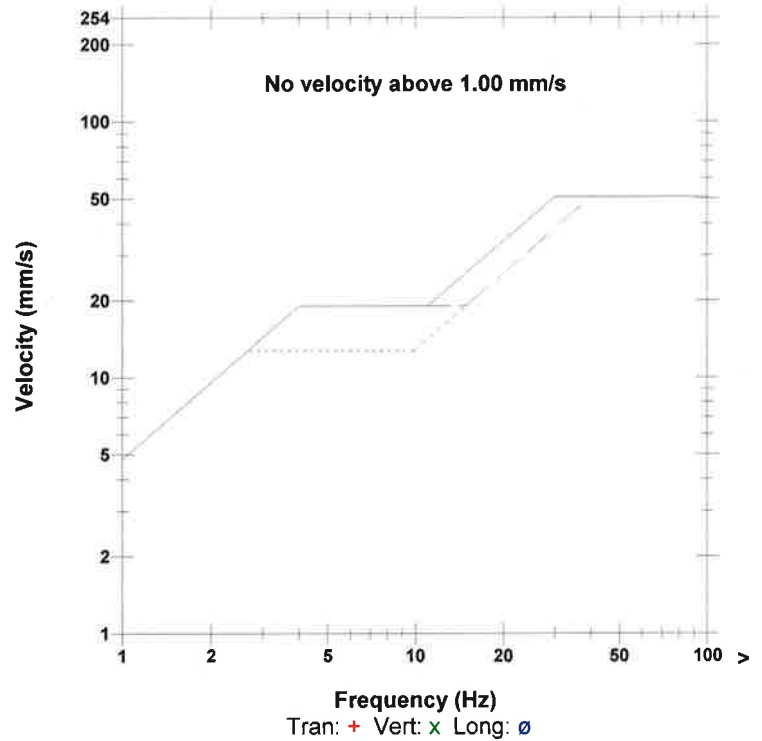
ZC Freq 2.0 Hz

Channel Test Check (Freq = 0.0 Hz Amp = 8 mv)

	Tran	Vert	Long	
PPV	0.381	0.381	0.762	mm/s
ZC Freq	16	16	17	Hz
Time (Rel. to Trig)	-0.026	-0.026	0.005	sec
Peak Acceleration	0.013	0.013	0.013	g
Peak Displacement	0.000	0.000	0.006	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	7.8	7.8	Hz
Overswing Ratio	4.0	3.9	4.0	

Peak Vector Sum 0.826 mm/s at -0.040 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.200 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Appendix “D”

Proposed Elginburg Quarry Expansion

CALCULATION OF MAXIMUM ALLOWABLE EXPLOSIVES/DELAY PERIOD

$$W_{max} = ((K * (d^e))/PPV)^{-1.25}$$

ISEE's D50 for 12.5 mm/s - Sensitive Receptors

K	d (m)	e	PPV mm/s	w (kg)
1140	50	-1.6	12.50	8.87
1140	75	-1.6	12.50	19.96
1140	100	-1.6	12.50	35.48
1140	125	-1.6	12.50	55.44

1140	150	-1.6	12.50	79.83
1140	175	-1.6	12.50	108.66
1140	200	-1.6	12.50	141.93
1140	225	-1.6	12.50	179.63
1140	250	-1.6	12.50	221.76
1140	275	-1.6	12.50	268.33
1140	300	-1.6	12.50	319.34
1140	325	-1.6	12.50	374.78
1140	350	-1.6	12.50	434.65
1140	375	-1.6	12.50	498.96
1140	400	-1.6	12.50	567.71
1140	425	-1.6	12.50	640.89
1140	450	-1.6	12.50	718.51
1140	475	-1.6	12.50	800.56
1140	500	-1.6	12.50	887.05

ISEE D95 for 12.5 mm/s Limit - Sensitive Receptors

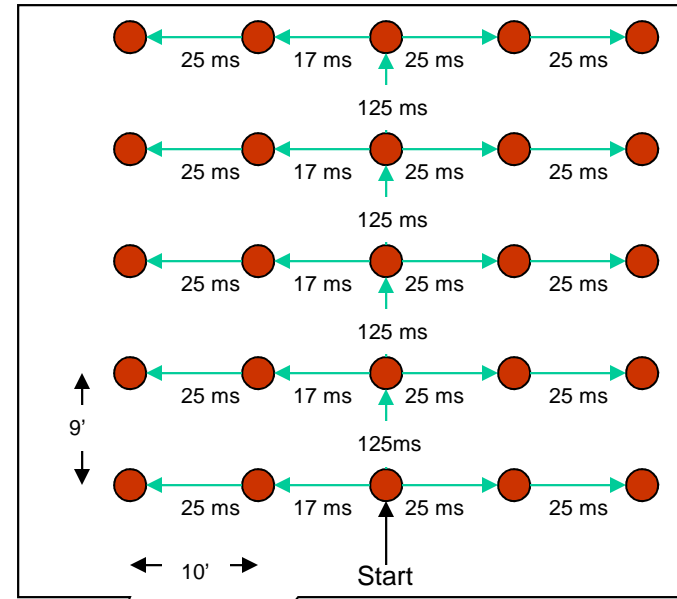
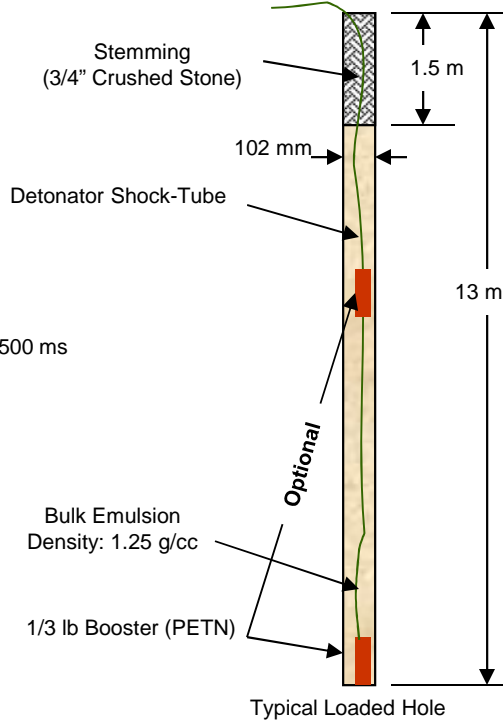
K	d (m)	e	PPV mm/s	w (kg)
1725	50	-1.6	12.50	5.29
1725	75	-1.6	12.50	11.89
1725	100	-1.6	12.50	21.14
1725	125	-1.6	12.50	33.03

1725	150	-1.6	12.50	47.57
1725	175	-1.6	12.50	64.75
1725	200	-1.6	12.50	84.57
1725	225	-1.6	12.50	107.03
1725	250	-1.6	12.50	132.14
1725	275	-1.6	12.50	159.89
1725	300	-1.6	12.50	190.28
1725	325	-1.6	12.50	223.31
1725	350	-1.6	12.50	258.99
1725	375	-1.6	12.50	297.31
1725	400	-1.6	12.50	338.28
1725	425	-1.6	12.50	381.88
1725	450	-1.6	12.50	428.13
1725	475	-1.6	12.50	477.02
1725	500	-1.6	12.50	528.56

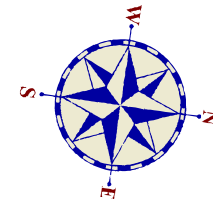
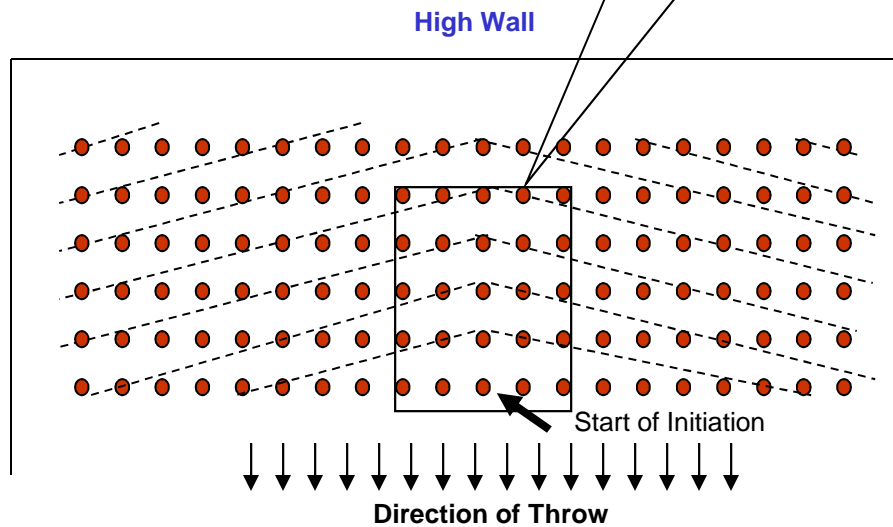
Typical Blasting Plan (PROPOSED) Elginburg Quarry

Blast Design Parameter Details

- Pattern: 2.75 m Burden X 3.0 m Spacing
- Hole Diameter: 102 mm
- Explosive: ANFO, d=0.85g/cc poured
- Detonators: Non-electric Handi-Det 25 ms/500 ms
- Surface Connectors: 17 ms, 125 ms
- Delay Between Holes: 25 ms
- Delay Between Rows: 125ms
- Max. Hole Depth: 13 m Incl. Sub-drill
- Collar: Min. 1.5 m
- Explosive Wt./Delay: 76+/- Kg.
- Primer: 1/3 lb Booster (PETN)
- No. of Holes: 120
- Direction of Throw: East/Northeast
- Weather Condition:
- Wind:
- Blaster-In-Charge:



Sample Detonator/Sequencing Layout



NOT TO SCALE

Appendix “E”

Education & Training

- B.Sc. Mining Engineering, Laurentian University, Sudbury, Ontario. (1984)
- M.Sc. Applied Physics, Laurentian University, Sudbury, Ontario. (1990)

Memberships:

- Association of Professional Engineers of Ontario (PEO)
- Association of Professional Engineers and Geoscientists of New Brunswick (APEGNB)
- Designated Consultant by PEO
- International Society of Explosives Engineers (ISEE)
- Canadian Institute of Mining, Metallurgical and Petroleum Engineers (CIMM)
- Licensed Surface Blaster in the Province of Ontario
- Licensed Surface Blaster in the Province of New Brunswick
- Licensed Surface Blaster in the Province of Alberta
- Licensed Surface Blaster in the Yukon Territory

Roles:

Ray Jambakhsh has underground and surface mining experience and has been involved in numerical modeling as a rock mechanics engineer for a major Canadian mining firm. He has also been instrumental in design, introduction, and implementation of electric and non-electric sequential blasting techniques for underground (VCR/VRM), open pit and quarry applications, building demolition by blasting, pipeline blasting, marine blasting, and highway blasting projects. He has handled blast vibration monitoring, vibration risk analysis, vibration and noise impact analysis, blasting audits, and blast damage complaints for insurance companies, law firms, government agencies, and contractors. Ray specializes in explosives, explosives demolition, explosion impact analysis, rock fragmentation, rock-face stability, rock blasting and vibrations.

Selected Professional Experience

DST Consulting Engineers Inc., Sudbury ON 2004 to Present

Role: Senior Principal and Senior Rock & Blasting Engineer

Responsibilities: Recognised both nationally and internationally for his blasting expertise, with over 20 years of experience. Responsible for senior review, project management and delivery of blasting and vibration services to the construction, demolition, mining, pipeline, energy and public service sectors, including: blast design; modelling, control and monitoring, vibration and overpressure monitoring, locally and remotely; damage criteria development for vibration; overpressure and flyrock; pre-blast and post-blast surveys; blast damage claim investigation; expert testimony; blast design to optimise fragmentation; dilution and environmental impact; vibration signature analysis and diagnostics; blast performance evaluation and optimization; fragmentation analysis; rock-face stabilization analysis; environmental impact analysis; blast safety and general blast information, training; blast demolition design.

Ray-Tech Engineering Limited, Sudbury ON 2003 to 2004

Role: President – Blasting Services to the Underground and Surface Mining Industries

Responsibilities: Rock mechanics engineering including numerical modelling. Instrumental in the design, introduction and implementation of electric and non-electric sequential blasting

techniques for underground (VCR/VRM) open pit and quarry applications, building demolition, blasting, pipeline blasting, marine blasting and highway blasting projects. Blast monitoring, risk analysis, vibration and noise impact analysis, blasting audits and blast damage complaints investigation for major blasting consultants, insurance companies, law firms, and contractors. Specialties include explosives, explosives demolition, explosion impact, blasting and vibrations. Responsible for business development and project acquisition. Technical responsibility for blast design and review, sequencing, charge placement and blasting on demolition projects, drilling and blasting operations, blast design, vibration control and wall control, seismic monitoring and blasting safety advice, blast consulting services, impact analysis, pre-blast surveys, impact attenuation design and vibration impact prediction to a variety of industry sectors. Extensive project experience with mining and exploration companies, highway construction, and site preparation for private industry.

Other Professional Experience 1986 to 2003:

- *Golder Associates Limited*, Senior Blasting Engineer
- *Explotech Engineering Ltd.*, General Manager
- *Explotech Engineering Ltd.*, Project Engineer
- *B.H.M Consultants Limited*, Field Engineer
- *Kidd Creek Mines Limited*, Engineer in Training
- *Centre in Mining and Mineral Exploration Research*, Researcher

Selected Project Experience

Key Demolition Projects:

- Client – Rakowski Cartage & Wrecking Limited – Demolition of Robertson Headframe Building, Yellowknife, Northwest Territories. Site blasting engineer responsible for design, implementation and supervision of the demolition by blasting, October 29, 2016.
- Client – Cambrian Blasting Co. Ltd. – Demolition CP Rail Transcona Smokestack, Winnipeg, Manitoba. Site blasting engineer responsible for design, implementation and supervision of the demolition by blasting, October 23, 2016.
- Client – Rakowski Cartage & Wrecking Limited – Demolition of Traffic Bridge, Saskatoon, Saskatchewan. Site blasting engineer and blaster-in-charge responsible for design, implementation and supervision of the demolition by blasting, January 10, 2016.
- Client – Rakowski Cartage & Wrecking Limited – Demolition of P&H Grain Elevator, Saskatoon, Saskatchewan. Site blasting engineer and blaster-in-charge responsible for design, implementation and supervision of the demolition by blasting, June 24, 2015.
- Client – Quantum Murray LP – Demolition of PCS Potash Cassidy Lake Dry-mill & Load-out Buildings in New Brunswick by blasting. Site blasting engineer responsible for the explosive demolition of the structures, April 23, 2015.

- Client – JMX Demolition Contractors - Demolition of the 150' Stack at the North Bay Psychiatric Hospital. Site blasting Engineer in charge of blast design, explosives loading, blasting and vibration monitoring, February 23, 2013.
- Client – Rakowski Cartage & Wrecking Limited - Demolition of St. Jean Baptist Bridge over Red River, St. Jean Baptist, Manitoba. Site blasting engineer responsible for design, implementation, vibration monitoring and pre-blast survey, February 16, 2013.
- Client – Delsan-AIM Demolition Group – Demolition of the 250' Stack at the New Brunswick Power Grand Lake GS. Site blasting Engineer in charge of blast design, explosives loading, blasting, vibration monitoring and pre-construction surveys, April 20, 2012.
- Client – Rakowski Cartage & Wrecking Limited - Demolition of Cargill Grain Elevator, Calgary, Alberta. Site blasting engineer and blaster-in-charge responsible for design, implementation and supervision of the demolition by blasting, October 16, 2011.
- Client – Goldcorp – Paymaster Mine Head Frame demolition by blasting. Responsible for design, sequencing preparation, charge placement and blasting. Timmins, Ontario, May 27, 2011.
- Client – Goldcorp – Old Hollinger Mine Head Frame demolition by blasting. Responsible for design, sequencing preparation, charge placement and blasting. Timmins, Ontario, February 20, 2011.
- Client – Rakowski Cartage & Wrecking Limited - Demolition of North Main Head Frame, Hudson Bay Mining & Smelting Company, Flin Flon, Manitoba. Site blasting engineer responsible for design, implementation and supervision of the demolition by blasting, December 5, 2010.
- Client – Goldcorp – Broulan Head Frame demolition by blasting. Responsible for design, sequencing preparation, charge placement and blasting. Timmins, Ontario, December 22, 2009.
- Client – Rakowski Cartage & Wrecking Limited – Demolition of South Main Head Frame, Hudson Bay Mining & Smelting Company, Flin Flon, Manitoba. Site blasting engineer responsible for design, implementation and supervision of the demolition by blasting, July 27, 2009.
- Client – Delsan - AIM Demolition and Environmental Services – Xstrata Gaspé Mine Site, Murdochville, Quebec. Responsible for design, sequencing, charge placement and blasting of steel ore bin building, December 9, 2008.
- Client - City of Ottawa – Frank Clair Stadium Demolition by Blasting – Responsible for specification writing, site supervision and blasting safety, July 16, 2008.
- Client – Delsan - AIM Demolition and Environmental Services – Abitibi Stephenville Paper Mill Site, Newfoundland. Responsible for design, sequencing, charge placement and blasting of multiple structures on site, June 3, 2008.
- Client – B. Curry & Sons Limited – Phalen Mine Rotary Crusher Building demolition by blasting, Sydney, Nova Scotia. Responsible for design, sequencing, charge placement and blasting, June 18, 2007.
- Client – Rakowski Cartage & Wrecking Limited – Winnipeg Arena demolition by blasting, Winnipeg, Manitoba. Responsible for design review, sequencing, charge placement and blasting, March 26, 2006.

- Client – Lac des Iles Mines Limited – Old Mill Transfer House Building demolition by blasting, Thunder Bay, Ontario. Responsible for design, sequencing, charge placement and blasting, June 16, 2005.
- Client - Rakowski Cartage & Wrecking Limited – AGPRO Grain Storage Building demolition by blasting, Winnipeg, Manitoba, June 12, 2005.
- Client – Noranda Inc. – Noranda Inc. Gaspé Site, Murdochville, Quebec. A 550-foot Smoke Stack demolition by blasting. Responsible for design, sequencing, charge placement and blasting, October 13, 2003.
- Client - Aim Waste Management Group – London Health Science Centre Incinerator Stack demolition by blasting, London, Ontario. Responsible for design, sequencing, charge placement and blasting, May 10, 2003.
- Client - Denison Environmental Services –Inco's Shebandowan # 2 Shaft Head-frame demolition by blasting, Shebandowan, Ontario. Responsible for design, sequencing, charge placement and blasting, August 18, 2001.
- Client - Cambrian Blasting Limited – Lafarge Twin-Stack demolition by blasting, Winnipeg, Manitoba. Responsible for design, sequencing, charge placement and blasting, June 10, 2001.
- Client - Rakowski Cartage & Wrecking Limited - Canada Packers Building demolition by blasting, Winnipeg Manitoba. Responsible for design, sequencing, charge placement and blasting, March 4, 2001.
- Client - Rakowski Cartage & Wrecking Limited – Centragas Steel Propane Storage Tank demolition by blasting, Winnipeg Manitoba. Responsible for design review, sequencing, charge placement and blasting, October 22, 2000.
- Client - Maceron Limited – Inco's Little Stobie Mine, Reinforced Concrete Head Frame demolition by blasting, Sudbury, Ontario. Responsible for design, loading, sequencing and blasting, December 1999.
- Client - Techplode Limited – Robie Street Water Reservoir Dome demolition by blasting, Halifax, Nova Scotia. Responsible for design review, approval, loading, sequencing and blasting, October 1999.
- Client - A & E Enterprises – Demolition of the Proctor & Gamble Building by means of blasting, Hamilton, Ontario. Designated site blasting engineer and consultant, responsible for the blast design review, approvals, and site supervision, October 1999.
- Client - LebRun Northern Contracting Limited – Ontario Hydro's 110 m Smoke Stack demolition by blasting, Mission Island, Thunder Bay, Ontario. Responsible for blast design review, pre-blast survey, seismic monitoring, impact attenuation design and vibration impact prediction, September 1998.
- Client - Stanley Buildings and Alberta Public Works Commission – Bow Valley Centre (Calgary General Hospital) demolition by blasting, Calgary Alberta. Responsible for blast design review, blast impact analysis, safety review and seismic monitoring, October 1998.
- Client - Abitibi Consolidated, Fort William Division – Triple Tower Acid Silo demolition by blasting, Thunder Bay, Ontario. Responsible for blast design, explosives loading, blasting sequence, seismic monitoring and blasting safety, December 1998.

- Client - Corona Inc. – Denison Mine Pebble Bin and Ore Silo demolition by blasting, Elliot Lake, Ontario. Responsible for blast design, explosives loading, blasting sequence, seismic monitoring and blasting safety, September 1995.
- Client - Matthews Group – Portage Dam demolition by blasting, Dokis, Ontario. Responsible for blast design, explosives loading, blasting sequence, seismic monitoring and blasting safety, November 1992.
- Client - Various Contractors – St. Lawrence Seaway (Welland Canal) demolition by blasting, St. Catharines, Ontario. Site blasting engineer in charge of blast design implementation, explosives loading, blasting sequence, seismic monitoring and blasting safety, January 1990, 1991, 1992/

KEY CIVIL PROJECTS

- Client – Various Quarry Operators – Blast Impact Analysis and Assessment, various quarries in Ontario, 1999 to present.
- Client – Various Contractors – MTO 400 Series Highway Constructions – Consulting on rock blasting and rock-face stability, various MTO contracts along old Hwy 69, 17, and 11, 2002 to present.
- Client – Kiewit-Alarie, A Partnership (KAP) – Blast Consulting Services at the Hound Chute and Sandy Falls Hydro Electric Project – September 2008.
- Client – Consbec Inc., Leo Alarie and Sons Limited, SNC Lavalin – Blast Consulting Services at the Ear Falls OPG new hydro dam construction, 2004 to 2006.
- Client – Consbec Inc. – Blast Consulting Services at the Wuskwatim GS, Manitoba Hydro, Thompson, Manitoba, June – November, 2008.
- Client - Union Gas – Installation of Lateral and Distribution Gas Lines, various locations in Ontario. Blasting consultant responsible for blast design review, approvals, pre-blast surveys, vibration monitoring and blasting safety, 1997 – 2010.
- Client – Laurentian University and Dennis Consultants – Site preparation blasting for Laurentian Health Science Centre. Responsible for preparing blasting specifications, blast vibration monitoring audit and site risk assessment on several contracts. 2003 – 2005.
- Client - Castonguay Blasting Limited - Proposed Highway 400 Four Lane Project, various MTO contracts. Blast consulting engineer responsible for risk analysis, blast design approvals, vibration monitoring, and pre-blast survey requirements. 2003- 2010.
- Client - Belanger Construction Limited – Laurentian Hospital Expansion Project. Blast consulting engineer responsible for blast design, vibration monitoring and site supervision during rock excavation phase of the project. 1999 – 2007.
- Client - Interpaving Limited – Dynamic Earth Project in Sudbury Ontario. Responsible for blast design, vibration control and wall control. Summer 2001.
- Client - Home Depot – Responsible for the drilling and blasting operations for site preparation of the Home Depot building in Sudbury, Ontario, August – November, 2000.
- Client - Castonguay Blasting Limited – Proposed Highway 400 Four Lane Project, Parry Sound, Ontario. Blast consulting engineer responsible for risk analysis of drilling and blasting operations, November 2000 – 2002.

- Client - Dyna-Con Explosive Technologies – Proposed Highway 400 Four Lane Project, Parry Sound, Ontario. Blast consulting engineer responsible for all aspects of drilling and blasting operations, November 1999 – 2003.
- Client - TransCanada PipeLines Limited (TCPL) – High Pressure Gas Line Installation, along TCPL's right-of-way, in Ontario and Manitoba. Associate consulting engineer responsible for blast design review, approvals, blasting safety, vibration monitoring and public relations, 1990 – 1999.
- Client - Lindsey Morden Limited and representing MTO – Traffic Vibration Impact Analysis, Northern Ontario. Analysis of vibrations induced by vehicular traffic on residential buildings, 1997.
- Client - Peter Kiewit Sons Company Limited – Ontario Hydro's Matabitchuan Power Station Rehabilitation Project, North Cobalt, Ontario. Consulting engineer responsible for, blast design review, approvals, pre-blast survey, vibration monitoring and blast supervision, September 1995.
- Client - John Bianchi Limited – South Falls Power Generating Station, Heron Bay, Ontario. Consulting engineer responsible for, blast design review, approvals, pre-blast survey, vibration monitoring and blast supervision, October 1995.
- Client - Arcam Engineering – E.B.Eddy Power Plant Installation, Espanola, Ontario. Consulting engineer responsible for, blast design review, approvals, pre-blast survey, vibration monitoring and blast supervision, 1993.
- Client - Bruce Evans Limited – Ontario Hydro's Big Chute Hydroelectric Generating Station, Port Severn, Ontario. Consulting engineer responsible for, blast design review, approvals, pre-blast survey, vibration monitoring, and blast supervision, May – December 1992.
- Client - International Pipeline Engineering Limited (IPEL) – Bell Canada Fiber Optics Transmission Project, along Trans-Canada Highway, Ontario. Site blasting engineer responsible for implementation of blast design, blasting safety, vibration monitoring and explosives loading, 1987 – 1989.
- Client - Matthews Group – Sturgeon Falls Water Treatment Plant, Sturgeon Falls, Ontario. Site blasting engineer responsible for blast design, excavation sequence, supervision of explosives loading, pre-blast survey, vibration monitoring and blasting safety, May 1985.

KEY MARINE PROJECTS

- Client - TransCanada PipeLines Limited – Lake and River Crossings, various locations in Ontario and Manitoba. Associate consulting engineer responsible for blast design review, approvals, blasting safety, underwater blast over-pressure and vibration monitoring and public relations, 1990 – 1999.
- Client - Ontario Hydro – Dear Lake Powerhouse Project, Dear Lake, Ontario. Blast consulting engineer responsible for determination of explosive quantities used in marine blasting operation, March 1998.
- Client - Ontario Trap Rock Limited – Shipping Dock Construction, Bruce Mines, Ontario. Blast consulting engineer responsible for blast design, ice blasting, explosives loading, underwater blast over-pressure and seismic monitoring, blasting safety and blast data logging, 1995.

- Client - Peter Kiewit and Sons Company Limited – Little Chute Channel Expansion Project, Port Severn, Ontario. Blast consulting engineer responsible for blast design, blast design implementation, application of sequential blasting techniques, underwater blast over-pressure and seismic monitoring, blasting safety and blast data logging, 1993.
- Client - Hugh Cole Limited – Port Colborne Bridge Pier Blasting, Port Colborne, Ontario. Site engineer responsible for blast design, explosive selection and loading, blast supervision, underwater blast over-pressure and seismic monitoring, blasting safety and blast data logging, September 1992.
- Client - Peter Kiewit and Sons Company Limited – Lemieux Island Development Project, Ottawa, Ontario. Site blasting engineer responsible for implementation of blast design, explosives loading, sequential sequencing, vibration monitoring, blast tie-up, and execution, October 1990.

KEY MINING PROJECTS

- Client – Vale Canada Limited – Blast consulting services provided on a special project for the development of a service tunnel under the Garson Mine Shaft Bottom, August, 2011 – April, 2012.
- Client – BH Martin Consultants Limited – Blast impact analysis and risk Assessment for proposed reopening of gold mines in the Timmins area mining properties, 2007.
- Client – Superior Aggregate Company – Blast Impact Analysis and Risk Assessment, 2003 to 2008.
- Client – Inco Limited – Underground VRM Blasting Audits and Special Projects, 2003 – 2007.
- Client - Goldcorp Incorporated – Red Lake Mining Division, Balmertown, Ontario. Blast consulting specialist responsible for drilling and blasting operations for crown pillar remediation projects, September 2003.
- Client - Inco Limited – Blast Vibration Monitoring Program, Ontario Division, Sudbury, Ontario. Blast consulting engineer responsible for implementation of third-party blast induced vibration-monitoring program, 1990 - 2003.
- Client - Goldcorp Incorporated – Red Lake Grinding Complex construction, Balmertown, Ontario. Blast consulting engineer responsible for drilling and blasting operations for expansion and installation of new grinding complex, 1999.
- Client - Rainbow Concrete Industries Limited – Hick’s Quarry, Sudbury Division, Sudbury, Ontario. Blast consulting engineer responsible for all aspects of drilling and blasting operations, 1996 – 2003.
- Client - Rainbow Concrete Industries Limited – Sudbury, Ontario. Blast consulting engineer responsible for all aspects of drilling and blasting operations in their quarries, 1990 - 2011.
- Client - Placer Dome Limited – Timmins Super Pit Development, South Porcupine, Ontario. Consulting engineers responsible for establishing vibration attenuation curves, recommending blast parameters affecting mining operations, seismic monitoring and blast impact analysis, January 1994.
- Client - Monenco – Sudbury Neutrino Observatory (SNO) Project, Creighton Mine, Sudbury, Ontario. Consulting engineer responsible for blasting operations required for the SNO cavity development, 1993 – 1994.

- Client - Inco Limited – Pillar Recovery at Sudbury Area Mines, Sudbury, Ontario. Instrumental in design, introduction and implementation of combined electric/non-electric sequential blasting techniques in underground Vertical Retreat Mining (VRM) stopes, 1989 – 1995
- Client - Inco Limited – Long Hole Blind Slot Raise Development, Sudbury Area Mines, Sudbury, Ontario. Responsible for design and introduction of blind inverted raises. Development of raises 18 meters long with production holes in the same blast was achieved. This technique is now being widely implemented as a mining method, 1989 - 1990
- Client - Inco Limited – Inco Garson Ore/waste Segregation Project, Garson, Ontario. Responsible for introduction of sequential blasting techniques at the open pit mine. Segregation of ore from waste was achieved within the blasting operations, 1988 – 1989.

RESEARCH AND DEVELOPMENT

- Evaluation of methods to control flyrock in quarry and open pit mining operations.
- Evaluation of prototype electronic detonators in underground mining applications. Analyses of time domain and frequency domain vibrations induced by blasting using electronic detonators. Research conducted at Inco's Sudbury area mines.
- Timing evaluation of prototype non-electric detonators for Ensign-Bickford Limited at several underground mine sites.
- Velocity of Detonation (VOD) measurements of explosive products for quality control purposes in production and controlled test blasting sites, 1999.
- Research in modification of new high-frequency geophones for near-field blast monitoring applications. 1997
- Research in development of high-pressure sensors for determining in-situ rock properties in mining applications, 1996.
- Research on rock fragmentation fatigue using ultra-sonic cyclic loading techniques, 1986 – 1987.

TRAINING AND TEACHING

- Lecturing and training of drillers and blasters for Sudbury area blasting companies, 2003 to present.
- Lecturing and field training for the Surface Blaster Apprenticeship and Licensing Program, Sir Sandford Fleming Collage, Lindsey, Ontario. Training blasters and new candidates on specialized blasting techniques, 1997 – 1999.
- Lecturing and training the TransCanada PipeLine Blasting Inspectors in all aspects of pipeline drilling and blasting operations, 1999.
- Annual lecturing and training the Union Gas Blasting Inspectors in all aspects of drilling and blasting operations, 1999 - 2016.
- Lecturing and training engineers at the Inco Thompson Mine for all aspects of advanced drilling, blasting, vibration monitoring, vibration waveform analysis, and blast diagnostics procedures, 1997.

- Lecturer, post diploma program in ground control, sponsored by the Mining Research Directorate (MRD) at the Ontario Centre for Ground Control Training, Sudbury, Ontario. Provided hands on training in the application of new technology in explosives, rock fragmentation by blasting and controlled blasting techniques to engineers and planner from Northern Ontario mines, 1997.
- Lecturing and field training of candidates for drilling and blasting course sponsored by the Corporation of the Town of Nickel Centre in Sudbury, Ontario, 1994.

PUBLICATIONS

- Bourget, G., Jambakhsh, R.M., "Ontario Hydro T.G.S. Chimney Demolition, Thunder Bay, Ontario, Canada", Proceedings of the Twenty Sixth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers, Anaheim, California, 2000.
- Jambakhsh, R.M., Copping, C., "Improved Methods of Blasting Concrete for Welland Canal Rehabilitation", Proceedings of the Twentieth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers, Austin, Texas, 1994.
- Jambakhsh, R.M., Okell, J., "Blast Vibrations and Overpressure Control Using Sequential Blasting Techniques at Inco's McCreedy West Mine", Proceedings of the Nineteenth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers, San Diego, California, 1993.
- Jambakhsh, R.M., Cameron, E.A., Richardson, S., "Development of Upper Blind Raises By Long hole Carbide Drilling (LCD) Methods", Proceedings of the Eighteenth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers, Orlando, Florida, 1992.
- Jambakhsh, R.M., Stephen, G., Muzzeral, B., Hamill, D., "Blast Design and Vibration Analysis in Trench Blasting for Bell Canada's Fibre Optics Line Project across Ontario", An Internal Publication, May 1989.