Appendix 10 A

Blast Impact Assessment

Brandy Hill Expansion Project

Environmental Impact Statement

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Appendix Section	Description
10 A	Blast Impact Assessment

Brandy Hill Expansion Project

Environmental Impact Statement

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Hanson Heidelberg Cement Group

Hanson - Brandy Hill Quarry

Blast Impact Assessment

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Hanson - Brandy Hill Quarry

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EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Heidelberg Cement Group to conduct a Blast Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW. Ground vibration and airblast are two common environmental effects of blasting that can cause human discomfort.

The proposed expansion will involve extending the life of the quarry to allow for extraction of additional resources up to 1.5 million tonnes per annum. The proposed extraction area extension is approximately 1,000m by 900m. In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 500m south of the current location...

All noise sensitive receivers are located 1,000m or more from the nearest future quarry pit boundary. Noise sensitive receivers are located to the west, south and east of the quarry.

This report presents the results of historical ground vibration and airblast overpressure measurements that have been carried out at Brandy Hill quarry and provides worst case predictions for future blasting based on this data. The future blast impacts are assessed according to the Environmental Conditions.

The assessment finds that blast impacts from the proposed quarry extension can be readily controlled within acceptable values using existing blast practices. This is because the minimum separation distance between the quarry pit and the nearest receiver is sufficient for adequate control of the propagation of ground vibration and overpressure. Analysis of historical data shows that compliance with the environmental conditions has been achieved. Consideration of future blast impacts shows that the acceptable levels can be achieved using typical blast designs and good blasting practice.

It is recommended that all blasting conducted at the proposed quarry site be monitored using best practices and permanent monitoring pads as much as possible, with monitors located as close as practical to the sensitive receivers, between the blast and the receiver.

A Blast Management Plan should be implemented to ensure compliance with EPA Conditions. It includes the use of routinely updated vibration and overpressure data in the design of blasts, which is a vital step in managing impacts in sensitive areas.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Heidelberg Cement Group to conduct a Blast Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW. According to AS2187.2 (Explosives -Storage and use Part 2: Use of explosives), ground vibration and airblast are two common environmental effects of blasting that can cause human discomfort.

This report presents the results of historical ground vibration and airblast overpressure measurements that have been carried out at Brandy Hill quarry and provides worst case predictions for future blasting based on this data. The future blast impacts are assessed according to the Environmental Conditions. Conclusions and recommendations are provided.

2 PROJECT DESCRIPTION

2.1 SITE LOCATION

The Brandy Hill Quarry is located at 979 Clarence Town Road, Seaham, which is a suburb within the Port Stephens local government area in the Hunter Region of New South Wales. The quarry site is located approximately 12km north-west of Raymond Terrace, 3.5km west of Seaham and approximately 175km north of Sydney.

2.2 EXISTING QUARRY OPERATION

The quarry is located on a property that is approximately 554 hectares in area of which 18.6ha is occupied by the pit, 11.1ha by the plant and 5.3ha occupied by the stockpile area. The surrounding area is predominately zoned as rural landscape with minimal primary production. The quarry produces approximately 620,000 tonnes of material per year. Approximately 20 to 25 blasts will occur per annum. Road access to the quarry site is off Clarence Town Road at the intersection with Brandy Hill Drive.

Vipac understands that the existing quarry is permitted to operate on a 24-hour basis if necessary but that this does not occur at present. The current typical operational hours of the quarry are detailed in ***Table 1***.

Table 1: Typical Operational Hours

Activities	Operation Hours
Sales	6am to 5pm , Monday to Friday 6am to 12pm , Saturday Sunday as required by market demand
Crushing Plant	6am to 6pm

2.3 PROPOSED EXPANSION

The proposed expansion will involve extending the life of the quarry to allow for extraction of additional resources up to 1.5 million tonnes per annum. The proposed extraction area extension (see ***Figure 1***) includes resources beneath part of the existing quarry infrastructure area. The proposed quarry pit is approximately 1,000m (East - West) by approximately 900m (North – South). In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 500m south of the current location, as shown in ***Figure 2***.

2.4 NOISE SENSITIVE RECEIVERS

A list of the nearest potentially affected noise sensitive receivers to the quarry is provided below in ***Table 2***. The table lists the minimum distance from the residential structure to the **maximum proposed future quarry pit**, as opposed to the overall quarry site boundary. All noise sensitive receivers are located 1,000m or more from the **nearest future quarry pit boundary**. A separation distance of 1,000m is usually an acceptable buffer for blast impacts from quarries. The location of the properties is illustrated in ***Figure 3*** and ***Figure 4***. Noise sensitive receivers are located to the west, south and east of the quarry.

It should be noted that the distances from the residential properties presented in ***Table 2*** below relate to the separation distance from the residential dwellings to the proposed future quarry pit boundary, as opposed to the overall quarry site boundary, which includes the processing areas, weighbridge and workshop/maintenance areas etc.

The distances presented in ***Table 2*** below therefore differ from the distances stated in the Noise & Vibration Impact Assessment report (refer to ***Table 3*** of the Noise & Vibration Impact Assessment report) as the distances presented in the Noise & Vibration Impact Assessment report refer to the separation distance from the residential properties to the overall site boundary of the quarry, and take account of the proposed expansion area of the quarry and the relocation of the processing plant to the south of the current positon of the processing plant.

For example, the receiver R16 (L05) will be situated approximately 1.4km (1,400m) to the southeast of the proposed quarry pit boundary but due to the relocation of the quarry processing plant to the designated area, which is located to the south of the existing plant area, the receiver R16 (L05) will be situated approximately 0.8km (800m) from the operational area of the quarry.

This Blasting Impact Assessment has taken into consideration the separation distances from the future quarry pit boundary as this delineates the extent of the area where blasting will be undertaken. No blasting is proposed to be undertaken in the designated area to which the fixed processing plant will be relocated. Therefore the distances from the properties to the overall quarry site boundary are not applicable to the Blasting Impact Assessment in this context, but have been taken into consideration as presented in the Noise & Vibration Impact Assessment report.

Table 2: Noise Sensitive Receivers

Property ID	Distance approx. (m)	Address	Description
L01 (R09)	1,100	13 Giles Road, Seaham	Residential property
L02 (R10)	1,000	13B Giles Road, Seaham	Residential property
L03 (R13)	1,300	994 Clarence Town Road, Seaham	Residential property
L04 (R14)	1,300	1034 Clarence Town Road, Seaham	Residential property
L05 (R16)	1,400	1094 Clarence Town Road, Seaham	Residential property and poultry farm to rear
L06 (R17)	1,400	1189 Clarence Town Road, Seaham	Residential property
L07 (R07)	1,450	13 Mooghin Road, Seaham	Residential property

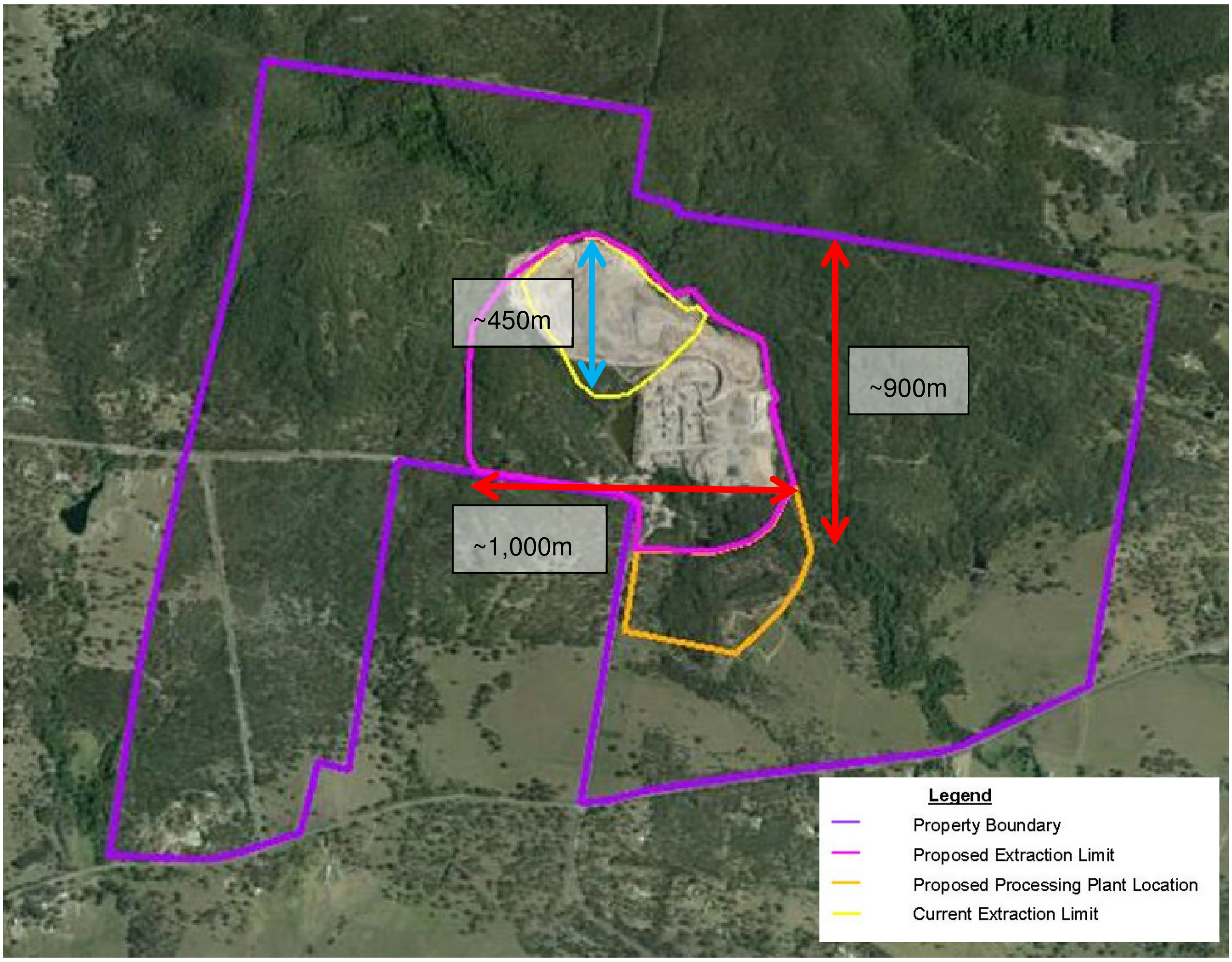

Figure 1: Current extraction area (yellow) with proposed extraction area (purple)

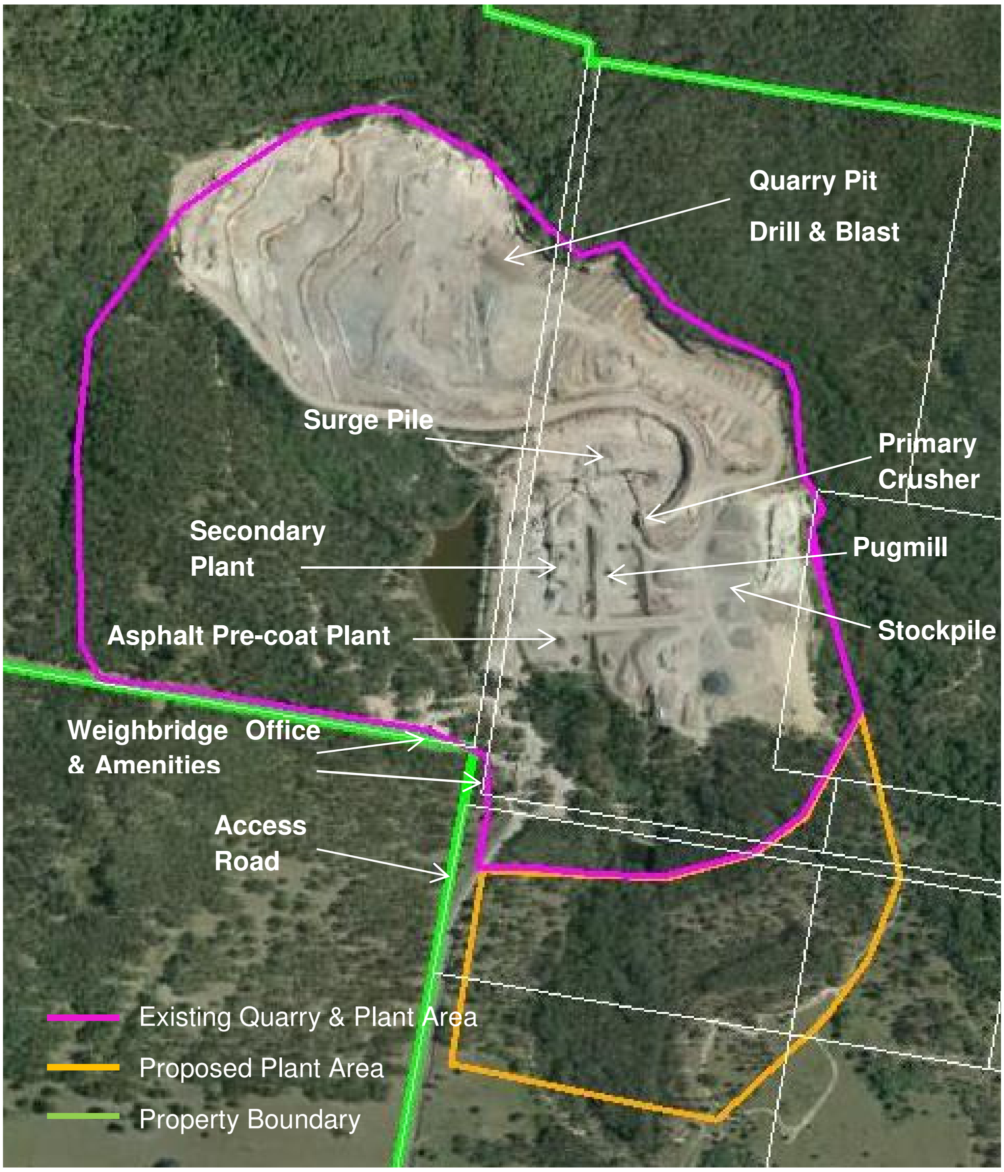

Figure 2: Current Infrastructure Area with proposed Plant Infrastructure Area

The location of the existing plant infrastructure is illustrated in the aerial photograph shown above in ***Figure 2***. It should be noted that as part of the proposed quarry expansion plans, the existing plant infrastructure will be relocated to the area outlined above in orange (i.e. the Proposed Plant Area).

Figure 3: Location of Sensitive Receptors (L01 (R09) & L02 (R10))

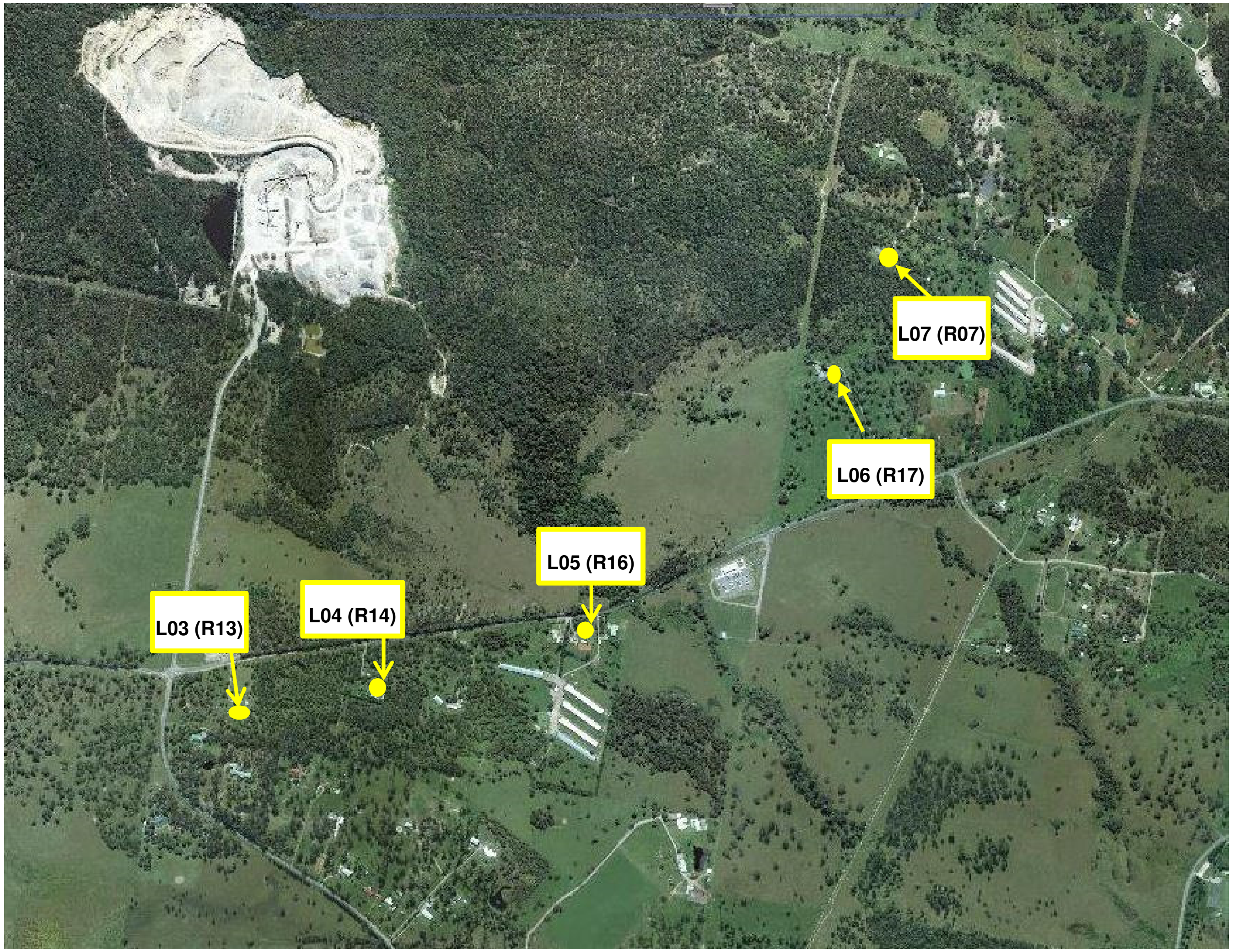

Figure 4: Location of Sensitive Receptors (L03 (R13), L04 (R14), L05 (R16), L06 (R17) & L07 (R07))

3 HISTORICAL BLAST IMPACT MEASURMENTS

Blast impacts from the quarry have been measured by an independent specialist monitoring company for several years. Data from the blasts has been reported and provided to Vipac for analysis. The records show that compliance with the Environmental Conditions has been achieved.

***Figure* 5** shows a graph of the measured ground vibration (Peak Particle Velocity, PPV in mm/s) versus the scaled distance from the blast. The 95th percentile relationship for the data is also shown in the figure. It corresponds to parameter values of K=4000 and n=1.6 for the standard ground vibration propagation equation (see AS2187.2) shown below:

$$PPV = K\left(\frac{Dist}{\sqrt{Wt}}\right)^{-n},$$

where *PPV* is the peak particle vibration level (vector sum, measured in mm/s),

Dist is the distance between the monitoring point and the nearest blasthole and

Wt is the maximum weight of explosive per blasthole (kg).

The data indicates that ground vibration will be less than 5mm/s at 1,000m for 95% of blasts when the MIC (mass instantaneous charge) of the blast is less than 230kg (see dotted line in ***Figure* 5**).

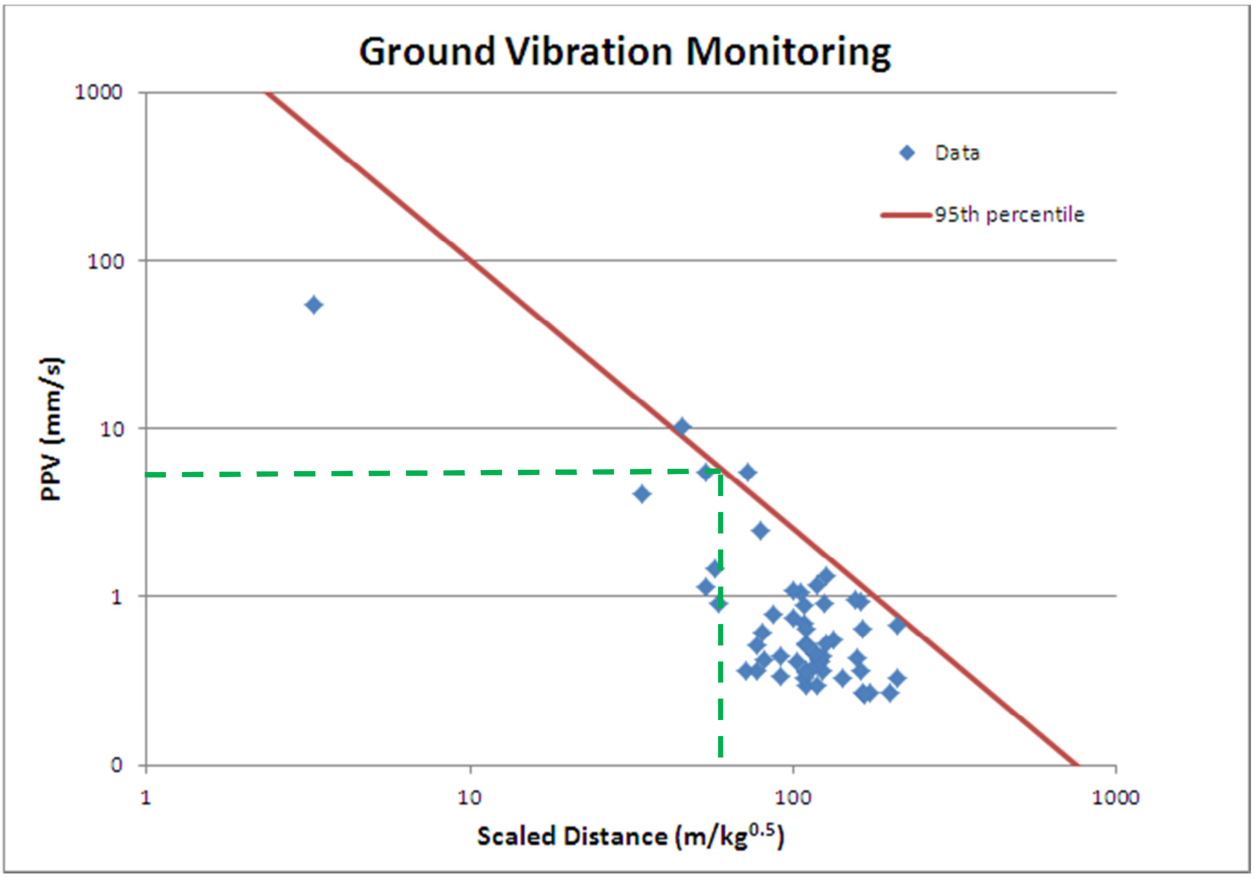

Figure 5: Vibration vs scaled distance for data collected during Brandy Hill blasts

Figure 6 shows a graph of the measured blast overpressure (in dB_{linear}) versus the relevant scaled distance (cubed root weighting) from the blast. The 95th percentile relationship for the data is also shown in the figure. It corresponds to parameter values of *dBL* = log Ks = 172 and *β* =log a =24 for the standard airblast overpressure propagation equation (see AS2187.2) shown below:

$$Op_{dBL} = dBL - \beta \times Log\left(\frac{Dist}{\sqrt[3]{Wt}}\right)$$

Typically, overpressure regression analysis provides poor predictability, primarily due to the many other factors which affect the peak measured levels, the most important of which include delay timing, direction of pattern initiation, topographical barriers, and direction of receiver relative to the free face. Considering that the blast face will be directed opposite to the nearest receivers, the parameter *dBL* has been modified to determine the acceptable MIC for airblast.

The data indicates that ground vibration will be less than 115dBL at 1,000m for 95% of blasts when the MIC (mass instantaneous charge) of the blast is less than 240kg (see dotted line in ***Figure 6***).

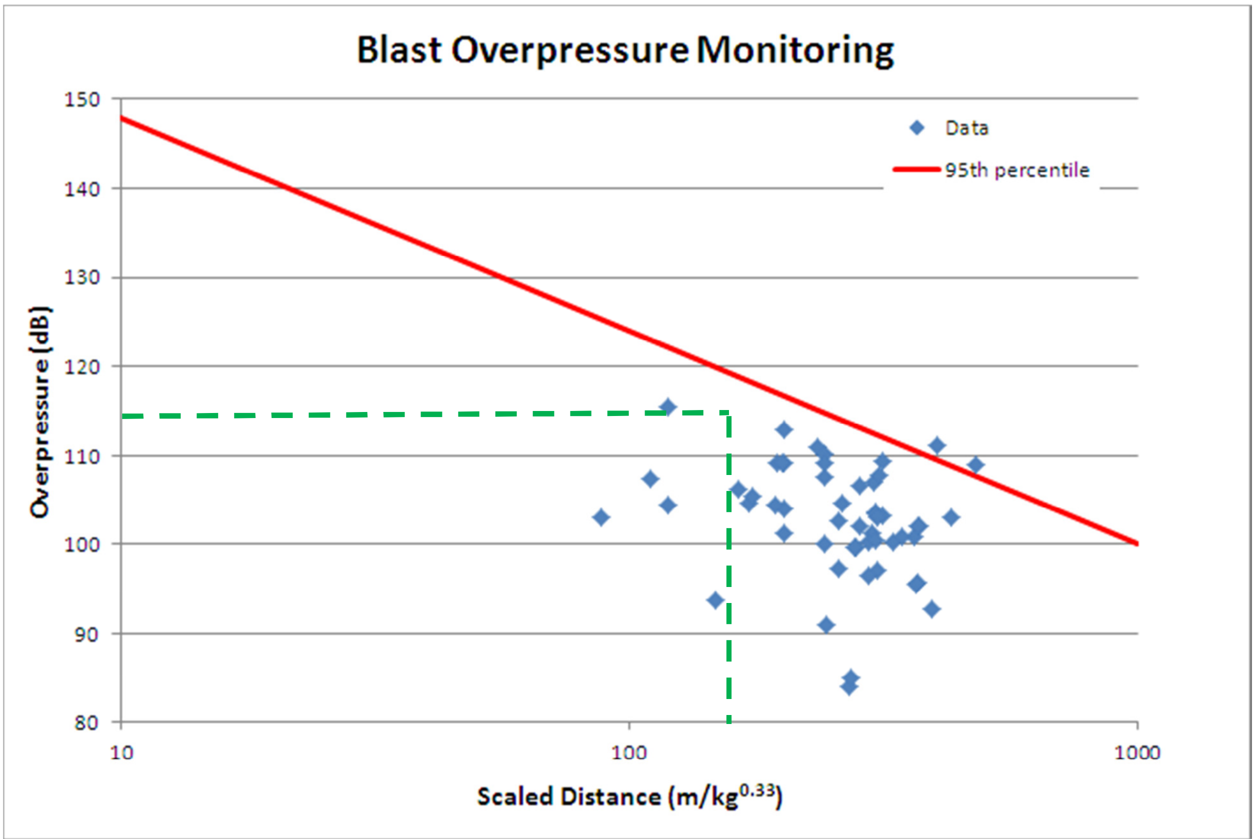

Figure 6: Overpressure vs scaled distance for data collected during Brandy Hill blasts

4 CRITERIA

4.1 EPA CONDITIONS

The Environmental Protection Licence conditions for the quarry specify limit conditions for blasting. The maximum overpressure level and maximum ground vibration peak particle velocity level are defined and are identical with the ANZEC guidelines (see Section 4.2).

The conditions also require that all blasts be monitored at or near the nearest residence or noise sensitive location that is likely to be most affected by the blast.

4.2 ANZECC

The Australian and New Zealand Environment Council (ANZEC) provides the following guidelines to minimise the annoyance due to blasting overpressure and ground vibration.

- The recommended maximum level for airblast overpressure is 115 dBL. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s peak particle velocity. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 10 mm/s peak particle velocity at any time.

4.3 AS2187.2

Appendix J of AS2187.2 provides information on ground vibration and airblast overpressure from blasting. Guidance is provided for the measurement, prediction and control of blast impacts. The importance of blast management and blast monitoring records in minimising blast impacts is stated.

5 BLASTING DETAILS

The assumed blast design parameters pertinent to the anticipated future vibration and overpressure impacts are:

- bench height = 10 to 15 m, sub-drill 0.5 m;
- blasthole diameter = 89 to 102 mm;
- explosive type = Rioflex (1.2 -1.3 density g/cc in hole);
- stemming length 3 to 3.5 metres.

Based on the information above, blasts will typically contain up to 145 kg of explosive per blasthole. The range is 55 to 145 kg. The maximum instantaneous charge (MIC) can therefore be kept below the required limit of 230 kg from Section 3.

6 BLAST IMPACT ASSESSMENT

Blast impacts from the proposed quarry extension can readily be controlled within acceptable values using existing blast practices. This is because the minimum separation distance between the quarry pit and the nearest receiver is sufficient for adequate control of the propagation of ground vibration and overpressure. Analysis of historical data shows that compliance with the environmental conditions has been achieved. Consideration of future blast impacts shows that the acceptable levels can be achieved using typical blast designs and good blasting practice.

It is recommended that all blasting conducted for the Project is monitored using best practices and permanent monitoring pads as much as possible, with monitors located as close as practical (between the blast and the receiver) to the sensitive receivers nominated for blast monitoring. Appropriate attention must also be directed to those receivers located forward of the free face which may experience peak overpressure levels higher than those measured at the nearest receiver located behind the free face. Where a roving monitor is used in response to community concerns, a permanent monitoring pad will not be required, but geophones must be well coupled to firm ground, or bonded to solid rock outcrops. A Blast Management Plan (BMP) should be implemented to ensure compliance with EPA Conditions. It is recommended that the BMP include current vibration and overpressure data in the design of blasts, which is a vital step in managing impacts in sensitive areas.