30 October 2020

MALABAR RESOUCES LIMITED
ABN 29 151 691 468
Level 26, 259 George Street
Sydney NSW 2000
PO Box R864
Royal Exchange NSW 1225
Ph: +61 2 8248 1272
Fax: +61 2 8248 1273
Website: www.malabarresources.com.au

Matthew Sprott
Director Resource Assessments
NSW Department of Planning, Industry and Environment
GPO Box 39
Sydney NSW 2001

via email matthew.sprott@planning.nsw.gov.au

Dear Matthew,

RE: MAXWELL PROJECT (SSD 9526) – ADDITIONAL BLASTING INFORMATION

Malabar understands that the NSW Independent Planning Commission (IPC) has sought further information from the NSW Department of Planning, Industry and Environment (the Department) regarding potential blasting impacts of the Maxwell Underground Project (the Project) at the Coolmore and Godolphin Woodlands thoroughbred studs (collectively referred to as 'the Studs' in this letter).

The Department has requested that Malabar provides further information regarding the magnitude and nature of any potential impacts from blasting at the Studs.

Importantly, as an underground mining operation, surface blasting would not occur as part of operational activities.

It is only during construction of the mine entry area and the transport and services corridor that blasting may be required. Indeed, Malabar would seek to eliminate or minimise the need with material preferentially "free dug" by excavators or ripped using dozers. Accordingly, blasting:

- May only be required intermittently during the construction of the Project (i.e. over a period of approximately 18 months at the start of the Project).
- Would be limited to a Maximum Instantaneous Charge (MIC) of 500 kg. This is substantially smaller than the MIC's permitted at the nearby open cut mining operations.
- Would be undertaken at a distance of at least 4.4 km from the boundary fence of the Studs.

Wilkinson Murray (2019) undertook a comprehensive assessment of construction blasting as part of the *Maxwell Project – Noise Impact Assessment* (Appendix I to the Maxwell Project Environmental Impact Statement). Wilkinson Murray (2019), predicted that vibration and overpressure associated with potential construction blasts for the Project would not be noticeable at the Studs. Notwithstanding, further information in response to the specific requests from the Department is provided below and in Enclosure 1.

Airblast overpressure and ground vibration levels associated with blasting are a function of the distance from the blast and the MIC of explosive used in the blast. Predictive curves for overpressure and ground vibration levels have been derived from measurements conducted at numerous sites, at distances varying between 2 and 7 km from a blast. Data have been used from over 7,600 records of blasts undertaken in the Hunter Valley to derive relationships between scaled distance and overpressure or vibration (Wilkinson Murray, 2019).

The predicted blasting effects of the Project are provided in Table 1, together with a comparison to other approved mines currently operating in the vicinity of the Studs.

Table 1
Comparison of Approved and Predicted Blasting Effects

Operation	Proximity to the Studs*	Maximum MIC	Overpressure at the Studs^	Vibration at the Studs^
Hunter Valley Operations North	4.5 km	3,575 to 6,030 kg	113.0 – 113.8 dBL	2.1 to 3.0 mm/s
Mt Arthur Coal Mine (North)	10 km	1,681 kg	111.1 dBL	0.4 mm/s
Mt Arthur Coal Mine (South)	6 km		111.5 dBL	0.8 mm/s
Maxwell Project (Mine Entry Area)	4.5 km	500 kg	111.3 dBL	0.5 mm/s
Human annoyance criteria	N/A	N/A	115 dB (95%ile) 120 dB (max)	5 mm/s (95%ile) 10 mm/s (max)

* Based on closest proximity of blasting area (e.g. open cut extent or construction area) to boundary fence of the Studs. Refer Figure 1.

^ Assumes maximum MIC used for blast being undertaken at closest point to the boundary fence of the Studs.

Source: Enclosure 1 (Wilkinson Murray, 2020).

The IPC's Site Inspection Notes from its Godolphin Locality Tour state the following[1] (emphasis added):

> *Blasting noise and low frequency vibrations will potentially impact on the horses – blasting vibrations are different to thunder and lightning associated with storm events, where the horses can sense weather changes and behave accordingly to prepare themselves, rather than an unexpected blast.* ***The Panel queried whether Mt Arthur or other existing mining operations had resulted in any issues and was told that this had not been a problem because those operations are further away than the proposed Maxwell development.***

[1] NSW Independent Planning Commission (2020) *Record of Site Inspection – Maxwell Underground Coal Mine project (SSD-9526)*. Accessed from: https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2020/09/maxwell-underground-coal-mine-project/site-inspection/201019_site-inspection-notes.pdf

The majority of the Maxwell Project mine entry area and transport and services corridor, where construction blasting may occur, are further from the boundary fences of the Studs than the existing extent of the Hunter Valley Operations North open cut pit. Further, the MIC of blasts that may be required for construction is significantly less than the approved MIC used for operational blasting at the Mt Arthur Coal and Hunter Valley Operations North open cut pits.

Accordingly, the predicted maximum overpressure and vibration associated with potential construction blasting at the Maxwell Project are less than the overpressure and vibration that Malabar understands would have occurred as a result of open cut mining activities at the Mt Arthur Coal and Hunter Valley Operations North open cut pits.

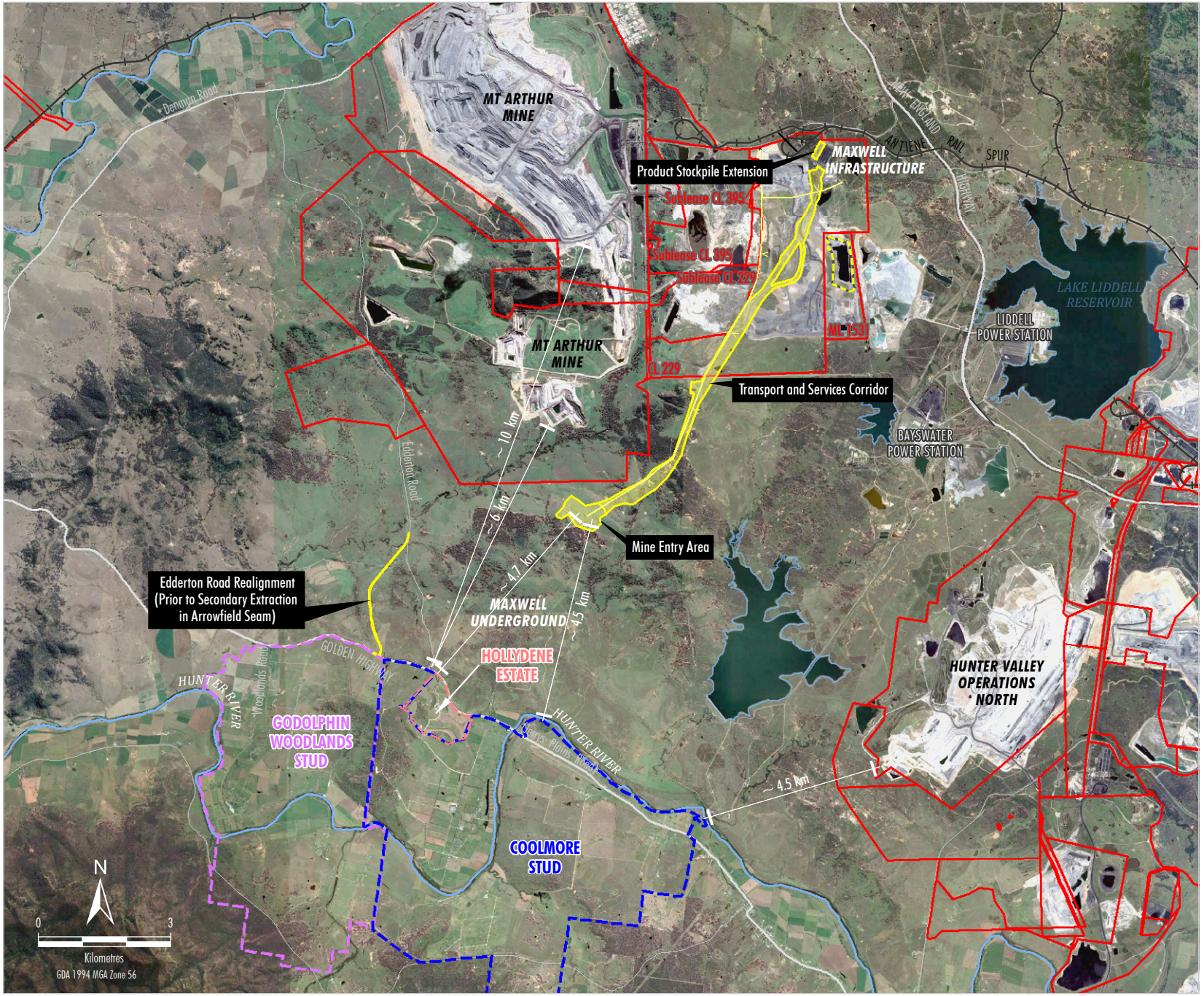
The observation that blasting at Mt Arthur Coal Mine and other existing mining operations has not resulted in blasting issues supports the findings of the Maxwell Project Environmental Impact Statement, which stated that "*vibration and overpressure associated with potential construction blasts for the Project would not be noticeable at the Coolmore and Godolphin Woodlands Studs"*.

Please do not hesitate to contact the undersigned should you wish to discuss.

Yours sincerely,

Bill Dean
General Manager – Projects
Malabar Resources Limited

Enclosure 1 Potential Blasting Effects of the Maxwell Project (Wilkinson Murray, 2020)



LEGEND

- Railway
- Mining and Coal Lease Boundary
- Indicative Surface Development Area
- CHPP Reject Emplacement Area
- Proposed 66 kV Power Supply

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019) Orthophoto: Google Digital Globe (2017)

MALABAR

MAXWELL PROJECT

Proximity of Mining Operations to Coolmore and Godolphin Woodlands Studs

SHM-18-03 Maxwell_Project_IPCB_214A

Enclosure 1

Potential Blasting Effects of the Maxwell Project (Wilkinson Murray, 2020)

WILKINSON MURRAY

29 October 2020

WM Project Number: 18226-D
Our Ref: MCL_291020RH_ltr
Email: wdean@malabarresources.com.au

Mr Bill Dean – Project Director
Malabar Resources Limited
PO Box R864 Royal Exchange
SYDNEY NSW 1225

Dear Bill

Re: Predicted Blasting Effects at Coolmore and Godolphin Woodlands Thoroughbred Studs

Wilkinson Murray prepared the Noise Impact Assessment for the Maxwell Project Environmental Impact Statement. Malabar Resources Limited (Malabar) has subsequently requested additional information regarding predicted blasting effects at the Coolmore and Godolphin Woodlands Thoroughbred Studs.

This letter provides an overview of potential blasting required for the Maxwell Project, a summary of our methodology for determining blast impacts and predictions of overpressure and vibration for the Maxwell Project and other mining operations in the vicinity of the two horse studs.

Maxwell Project Overview

As an underground mining operation, surface blasting would not occur as part of operational activities.

Malabar would seek to eliminate or minimise the need for blasting during construction activities, with material preferentially free dug using excavators or through the use of dozers to rip and push. Blasting of material may be required during construction activities associated with the Mine Entry Area (MEA) and the transport and services corridor. As such, potential overpressure and ground vibration impacts associated with blasting were considered in the *Noise Impact Assessment* prepared for the Maxwell Project Environmental Impact Statement.

Any blasts required for construction activities would be limited to a Maximum Instantaneous Charge (MIC) of 500 kilograms (kg). This is substantially smaller than blasting that would occur in an open cut mining operation (an MIC typically in the order of 2,000 kg to 4,000 kg).

Blasting Criteria and Prediction Methodology

The EPA guideline Assessing Vibration: a technical guideline (NSW Department of Environment and Conservation, 2006) refers to the Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration prepared by the Australian and New Zealand Environment Council (1990). Human annoyance criteria for blasting for any privately-owned receivers or other sensitive locations are:

- maximum overpressure due to blasting should not exceed 115 dB for more than 5% of blasts in any year, and should not exceed 120 dB for any blast; and
- maximum peak particle ground velocity should not exceed 5 millimetres per second (mm/s) for more than 5% of blasts in any year and should not exceed 10 mm/s for any blast.

It is noted that human annoyance criteria may not be applicable to how blast vibration and overpressure may be experienced by other animals.

Airblast overpressure and ground vibration levels from blasting are related to the "scaled distance" from the blast, which is defined as:

Scaled distance = $\frac{D}{W^{1/3}}$ for airblast overpressure; and

Scaled distance = $\frac{D}{W^{1/2}}$ for ground vibration.

- Where D is the distance from the blast (m) and W is the MIC of explosive (kg of ammonium nitrate fuel oil [ANFO] equivalent).

Predictive curves relating scaled distance to overpressure and ground vibration levels have been derived from measurements conducted at numerous sites, typically at a distance varying between 2 and 7 km.

For this assessment, Wilkinson Murray has used data from over 7,600 records of blasts undertaken in the Hunter Valley to derive relationships between scaled distance and overpressure or vibration. These relationships are designed to predict not the mean level of overpressure or vibration, as in a standard "site law", but the 95th percentile value, representing the level which would be exceeded by only 5% of blasts, given the use of current blast practice and the current level of variability in overpressure or vibration for the same scaled distance.

The raw data, and the derived prediction curves which are appropriate up to distances of 10 km, are shown in Appendix A.

For overpressure, a curvilinear relationship with log (Scaled Distance [SD]) was adopted as a best fit for the data:

Overpressure (dB) = $201.1 - 62.313 \log(SD) + 10.79 (\log(SD))^2$

- Where SD is the overpressure-scaled distance (as per formula given above).

For vibration, a linear relationship with log (Peak Particle Velocity) was derived:

Log (PPV) = $3.015 - 1.4359 \log(SD)$

- Where SD is the vibration-scaled distance (as per formula given above).

Overpressure is calculated in dBL (or Linear Peak), which is the maximum level of air pressure fluctuation measured in decibels without frequency weighting[1].

[1] Frequency weightings are often applied to sound measurements to ensure the measured parameter is indicative of the level experienced by the human auditory system (e.g. such as A-weighted decibels typically used for assessing noise impacts from developments).

Predicted Blasting Effects

Table 1 provides a summary of predicted blasting effects of the Project and other mines currently operating in the vicinity of the Coolmore and Godolphin Woodlands Thoroughbred Studs. The maximum MIC for the Mt Arthur Coal Mine and Hunter Valley Operations (North) have been determined as follows:

- **Mt Arthur Coal**: Based on MIC required for deep interburden/overburden at the Mt Arthur Coal Mine[i].
- **Hunter Valley Operations**: Based on MIC required to achieve blasting limits set for Jerrys Plains locations (Receptors 13 and 14)[ii].

Table 1 Comparison of Approved and Predicted Blasting Effects

Operation	Proximity to the Studs*	Maximum MIC	Overpressure at the Studs^	Vibration at the Studs^
Hunter Valley Operations North	4.5 km	3,575 to 6,030 kg	113.0 – 113.8 dBL	2.1 to 3.0 mm/s
Mt Arthur Coal Mine (North)	10 km	1,681 kg	111.1 dBL	0.4 mm/s
Mt Arthur Coal Mine (South)	6 km	1,681 kg	111.5 dBL	0.8 mm/s
Maxwell Project (Mine Entry Area)	4.5 km	500 kg	111.3 dBL	0.5 mm/s
Human annoyance criteria	N/A	N/A	115 dB (95%ile) 120 dB (max)	5 mm/s (95%ile) 10 mm/s (max)

* Based on closest proximity of blasting area (e.g. open cut extent or construction area) to boundary fence of the Studs. Based on aerial photography.
^ Assumes maximum MIC used for blast being undertaken at closest point to the boundary fence of the Studs.

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i. Wilkinson Murray (2013) *Mt Arthur Coal Open Cut Modification Noise & Blasting Assessment*. Accessed from: https://majorprojects.accelo.com/public/69852777788947ce15b3f922d7eb6fa4/10.%20Mt%20Arthur%20Coal%20Open%20Cut%20-%20Mod%201%20-%20EA%20-%20Appendix%20G%20-%20Noise%20and%20Blasting%20Assessment.pdf

ii. EMGA Mitchell McLennan (2010) Carrington West Wing Noise and Vibration Assessment. Accessed from: https://majorprojects.accelo.com/public/bb5a8779cce7451c49d761140dd148a8/Environmental%20Assessment%20-%20Volume%202.pdf

I trust this information is sufficient. Please contact us if you have any further queries.

Yours faithfully
WILKINSON MURRAY

Roman Haverkamp
Senior Engineer

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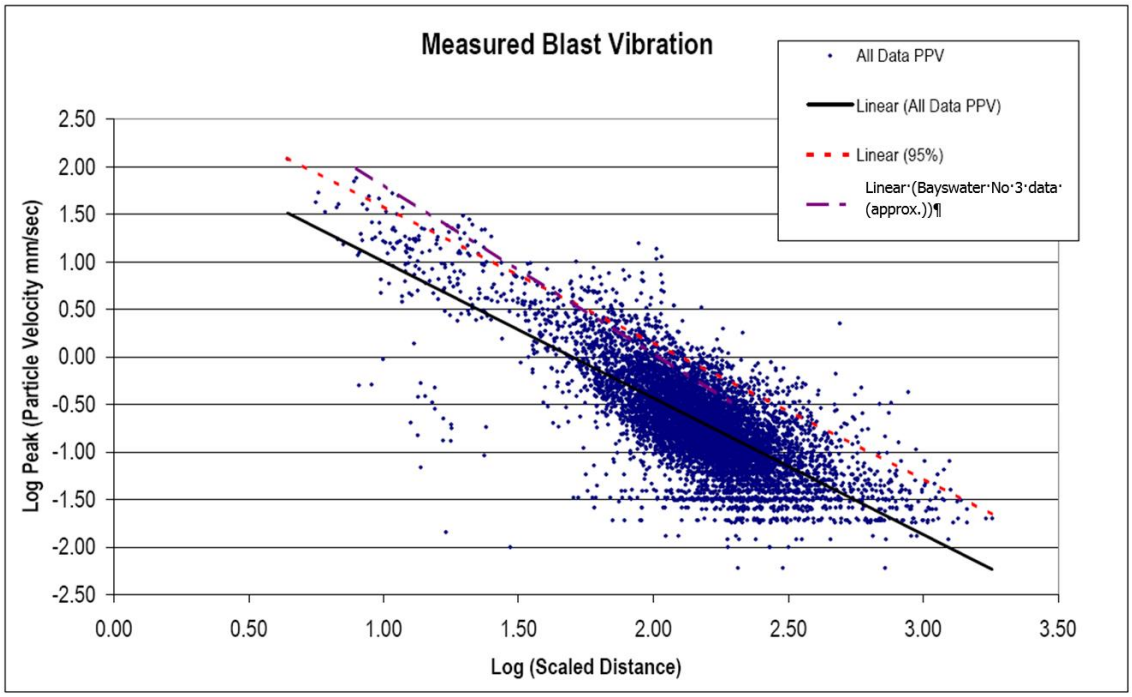
AAAC
This firm is a member firm of the Association of Australasian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

APPENDIX A

BLASTING PREDICTION CURVES

For this study, Wilkinson Murray has derived predictive equations for vibration and overpressure using measurement data from approximately 7,000 blasts. Figure A.1 illustrates the measured data and associated linear trend lines for vibration.

Figure A.1 Measured Peak Particle Velocity from Blasts at Mt Arthur North (logarithmic scale) and Comparison with Data from Bayswater No 3



The figure shows a revised best fit line, a 95 percentile line, and also the previously-adopted 95 percentile based on 1999 data from Bayswater No 3. The correlation with the old data is close, although the new 95 percentile shows slightly lower vibration levels at shorter scaled distance – in the order of 0.2 to 0.3 millimetres per second (mm/s).

Figure A.2 shows data for overpressure. Analysis of these data showed that the relationship between measured peak overpressure and scaled distance is better defined with a polynomial equation (blue) at close range rather than a standard linear equation (red). At relatively low values of scaled distance, the new polynomial 95 percentile curve is approximately 5 decibels (dB) lower than the linear trend line derived from the previous Bayswater No 3 data.

Figure A.2 Measured Peak Overpressure from blasts at Mt Arthur North, and Comparison with Data from Bayswater No 3