21 August 2024

Illawarra Metallurgical Coal
South32
Port Kembla Coal Terminal
Port Kembla Road
Inner Harbour
PORT KEMBLA 2502
New South Wales
Australia

Jessie Evans
Director Resource Assessments
Department of Planning, Industry and Environment

Dear Jessie,

RE: Blasting Limits MP08_0150-Mod-6 - Request for Additional Information

Background

The EPA response stated "*The EPA does not consider that sufficient justification has been provided for increasing the hours and frequency of blasting. The predicted noise levels will be just within the acceptance criteria at the five closest residential receivers. However, these receivers may be exposed to two blasts occurring every day up to 10 pm in the evening, six days per week. No quantitative indication has been given as to the duration of blasting, the expected reduction in timeframes of blasting, or whether any agreement has been reached with those most likely to be affected by the changes*".

Illawarra Metallurgical Coal (IMC) considers there is considerable robust justification as outlined below.

Response

1. **Duration and timeframes of blasting.** The pre-sink phase (where shaft sinking down to a depth of ~ 50 m occurs) for both VS7 and VS8 has been successfully completed. The main sink is expected to commence in Q4 2024 in VS8 and Q1 2025 in VS7 if other regulatory approvals are forthcoming. Estimating the duration of blasting for the Project is inherently complex and difficult due to the numerous shaft sinking factors involved and constraints of blasting hours and frequency. If the Project can transition to 24/7 blasting within several months which requires demonstrating noise compliance against the maximum noise trigger level criteria (Condition 5, Schedule 4A of the BSO Approval), then a duration in the order of twelve to fifteen months is expected. The Mod 6 application referred to an estimate that approval of the proposed extended hours and two blasts per day per shaft could expedite the AMVA Project schedule by around twenty percent (20%) compared to the current hours. This would likely be in the order of several months. Constraining the Project to the current blasting hours rather than the proposed extended hours would result in a reduced blasting window of 61 hours in a typical week, i.e., 44 hours (current blasting hours) vs 105 potential blasting hours (proposed extended hours) in a typical week, and would slow shaft sinking rates accordingly, with little environmental or social benefit.
2. **Agreements with potentially affected receivers.** The three nearest receivers have been acquired or agreed to negotiated noise agreements. IMC has entered into written noise agreements with receivers identified as R2 and R16 and purchased R3 (refer Figure 1).
3. **Current blasting complaint status.** No complaints relating to blasting have been received through the community hotline or the Menangle Advisory Panel (MAP) to date. It is therefore considered that blasting impacts to the community have been minor.

4. **Current Project Blasting Performance and potential for annoyance from the extended hours proposed**. Appendix 2 to the MOD 6 application and Appendix 1 to this response letter outline the results for VS8 and VS7 pre-sink phase overpressure and vibration results respectively. The results demonstrate that overpressure and vibration measurements have complied with the BSO Project Approval criteria for every blast, with vibration measurements being negligible. It is important to note that these pre-sink blast measurements are likely to be the *worst-case* blast impacts from the Project as noise attenuating infrastructure had not yet been constructed, and noise mitigation measures were restricted to a rubber blast cover elevated above the shaft.

   For the next campaign of blasting in the main sink phase, IMC has invested significant effort in designing and implementing noise mitigation measures into the construction of the shaft headframe building, such as:

   - Double skin (2 x 0.55 mm Custom Orb steel sheet) internal and external cladding (i.e. four layers of cladding) with minimum 150 mm cavity with 100 mm of acoustic insulation inside the wall cavity.
   - Heavy-duty collar and collar doors to contain the blast inside the shaft.
   - Underground concrete encased shaft ventilation system will be blocked at the shaft and at the outlet to the environment during each night-time blast. The ventilation shaft is blocked by a series of acoustic doors separated by the fan room – effectively creating an airlock been the Vent Shaft and the environment. Refer Plates 1 to 6 below.

   The headframe buildings are expected to provide significant attenuation of L_{Zpeak} and L_{AFmax} levels. RUC's acoustic consultant (Waves Acoustic Consulting) have indicated that this attenuation is likely to exceed 30 dB. Therefore, compliance with the L_{Zpeak} overpressure criteria is likely to continue and compliance with the "night time" L_{AFmax} criterion is likely to be achieved during the main sink phase. With the abovementioned noise mitigation measures in place, it is unlikely that any more than negligible additional annoyance would be caused by the proposed increases to blasting hours and frequency.

   Appendix 2 provides a review by noise specialist, SoundIN, of noise monitoring at Receivers R4 and R10 during blasting for the VS7 pre-sink and concludes that many of the blasts measured were indistinguishable from the ambient noise environment which is dominated by louder and more frequent transient noise sources such as vehicles on Menangle Road and passing aircraft. *Only two of the blasts over the monitoring periods were audible in the recorded audio files from L2. This is largely due to the high levels of ambient noise at L2, associated with traffic on Menangle Road.*

   We note that while conservative overpressure and $L_{A\ Max}$ predictions were provided in Appendix 1 of the MOD 6 application demonstrating predicted blasting compliance in the main sink phase, the abovementioned recent measurements (Appendix 2) indicate that the blast overpressure actually experienced by nearby receivers were demonstrably lower than the conservative models prediction, well below the relevant overpressure criteria (by 16 dB or more) and therefore at levels that are unlikely to cause annoyance.

   In respect to the EPA's response, we also note that the stringent "night time' L_{AFmax} criteria of 54 dB applies only to the night period (10pm – 7am Monday to Saturday, 10pm – 8am Sunday and Public Holidays) and therefore is not applicable to the MOD 6 proposal.

We also reiterate that:

- Blast overpressure/noise will continue to attenuate with depth.

- There will be several days per week with no blasts in a day when concrete lining activities are taking place inside each shaft (i.e. the nature of the shaft construction cycle inherently provides periods of respite from blasting).

Plate 1: Acoustics designed VS8 Headframe building

Plate 2: Heavy duty shaft blast doors

Plate 3: Heavy duty headframe doors

Plate 4: Double skin cladding and noise insulation

Plate 5: Underground concrete encased shaft ventilation system

Plate 6: Acoustic doors in VS8 underground concrete encased ventilation system

Conclusion

An extension of blasting hours as requested would:

- Facilitate more efficient blasting cycles, using the bench blasting method described above (where required).
- Expedite the Project schedule.
- Reduce the duration of blasting impacts on the community.
- Facilitate continued blast cycle efficiency (up to 2 cycles per day) in gassy zones requiring permitted explosives (lower power explosive).
- Facilitate a smoother transition to proposed 24/7 blasting at the consent L_{Amax} noise levels.

IMC will be implementing the following:

- Real-time automated blast monitoring at three locations around the site as per the Project CEMP.
- Targeted blast compliance monitoring at/near receivers.
- For main sink – integrated design measures for blast noise mitigation including the shaft headframe building facade design and shaft heavy duty collar doors (Plates 1-6).
- If non-compliances are identified, adjustment of blasting (reduced explosive loads, alternative methods, additional stemming etc) to reduce noise levels if necessary.
- Proactive consultation with potentially affected neighbouring residents to discuss current onsite noise attenuation and options for noise mitigation treatment at their property.
- Ongoing periodic consultation with the MAP via meetings and other updates.
- Project activity updates with residents within 1 km of site.
- General information via the IMC Community Portal.
- The Project's Community and Environment Officers will be available to manage any queries during the period.

IMC is of the view that proposed extended blasting hours and increased blasting frequency can be carried out with minimal impact to the community and would result in significant benefits to the project and community, including a reduced construction period.

IMC takes its environmental responsibilities seriously and will continue to monitor Project activities to ensure compliance.

If you have any queries, please don't hesitate to contact Chris McEvoy (Chris.McEvoy@south32.net) or myself.

Yours sincerely
SOUTH32 LIMITED

Gary Brassington
Manager Approvals
Illawarra Metallurgical Coal – South32

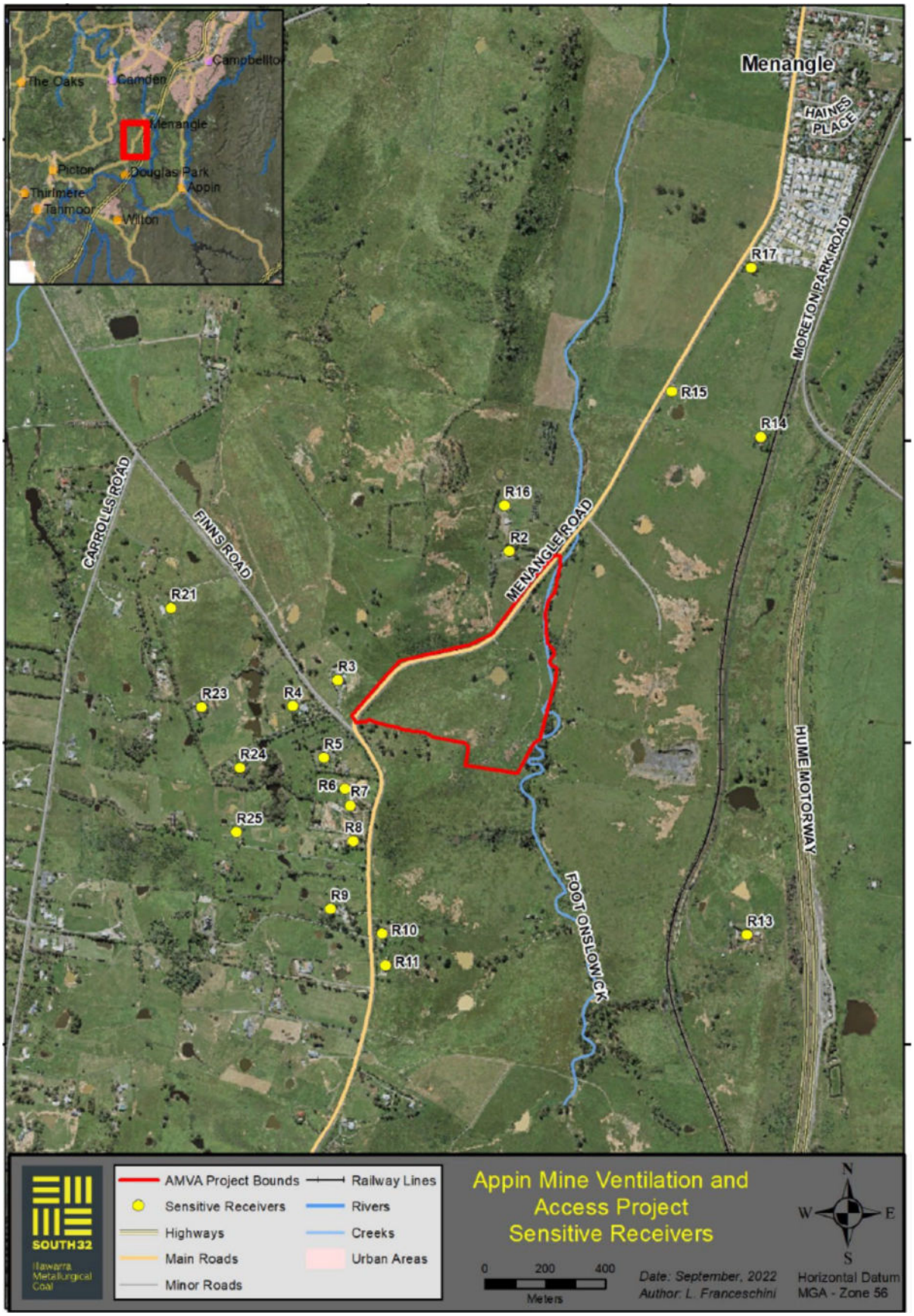

Figure 1. Project Sensitive Receivers

Note: IMC has entered into written noise agreements with receivers identified as R2 and R16 and purchased R3.

Appendix 1

Vent Shaft 7 Pre-sink Blasting Review

07 August 2024
Document No. 60.00915.01 LTR7R1.docx

RUC Cementation Mining Contractors Pty Ltd
3/138 Abernethy Road
Belmont
Perth
WA 6104

Attention: Bronson Baynham

Dear Bronson

Consultant Advice Notice
Appin Mine Vent Shaft Construction
Pre-Sink VS7 - Blasting Overpressure & Vibration Review

1 Introduction

The Appin Mine Vent Shaft Construction project requires controlled blasting to progress excavation of the vent shaft. The consent conditions for the project stipulate the following Airblast Overpressure and Ground Vibration criteria are met at the nearest residential receivers for each blast:

CONSTRUCTION BLASTING

Blasting Criteria

3. The Proponent must ensure that the construction blasting at the Appin Mine Ventilation and Access Site does not cause exceedances of the criteria in Table 11.

Table 11: Construction blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Residence on privately owned land	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

However, these criteria do not apply if the Proponent has a written agreement with the relevant owner and the Proponent has advised the Department in writing of the terms of this agreement, or if other criteria is agreed by the Planning Secretary

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Vent Shaft 7 started blasting on 22 March 2024 and has undertaken a total of 30 blasts through to the end of June 2024. All of the blasts have occurred at Vent Shaft 7 (VS7).

It's not possible to measure at all the receivers for each blast; however, measurement data can be used to validate noise / airblast predictions at all of the receivers with acceptable accuracy. Three (3) permanent airblast overpressure monitors have been deployed by Waves Consulting on behalf of RUC at key locations surrounding the VS7 site. These measurements have been used to establish a 'site law' (ie validation) for Airblast Overpressure predictions to the nearest receivers.

2 Site Overview

Figure 1 and Table 1 illustrate the location of the site and the nearest residential receivers.

Figure 1. Site Location and Surrounding Area

Aerial photography courtesy of NSW Imagery

The site is situated in a rural location and is surrounded by rural residential dwellings in all directions. Table 1 below illustrates the offset distances from VS7 to the nearest residential receivers.

Table 1. Summary of Receiver Distance to VS7

Receiver ID	Receiver Address	Distance (m)
R2	310 Menangle Road, Menangle	423
R4	15 Finns Road, Menangle	670
R5	3 Finns Road, Menangle	649
R6	430 Menangle Road, Menangle	645
R7	436 Menangle Road, Menangle	664
R8	450 Menangle Road, Menangle	741
R9	470 Menangle Road, Menangle	941
R10	475 Menangle Road, Menangle	921
R11	485 Menangle Road, Menangle	1030
R12	486 Menangle Road, Menangle	1162
R13	775 Moreton Park Road, Menangle	1152
R14	251 Menangle Road, Menangle	1153
R15	235 Menangle Road, Menangle	1114
R16	310 Menangle Road, Menangle	570
R17	195 Menangle Road, Menangle	1579
R18	110 Finns Road, Menangle	1405
R19	25 Carrolls Road, Menangle	1358
R20	47 Carrolls Road, Menangle	1240
R21	45 Finns Road, Menangle	1306
R22	45 Carrolls Road, Menangle	1159
R23	35 Finns Road, Menangle	1164
R24	5 Finns Road, Menangle	1006
R25	454 Menangle Road, Menangle	943
R26	460 Menangle Road, Menangle	1025
R27	474 Menangle Road, Menangle	1117
R28	514 Menangle Road, Menangle	1277
R29	490 Menangle Road, Menangle	1300
R30	510 Menangle Road, Menangle	1230
R31	520 Menangle Road, Menangle	1314
R32	530 Menangle Road Douglas, Park	1354
R33	516 Menangle Road, Menangle	1396
R34	165 Carrolls Road, Menangle	1433
R35	115 Carrolls Road, Menangle	1490

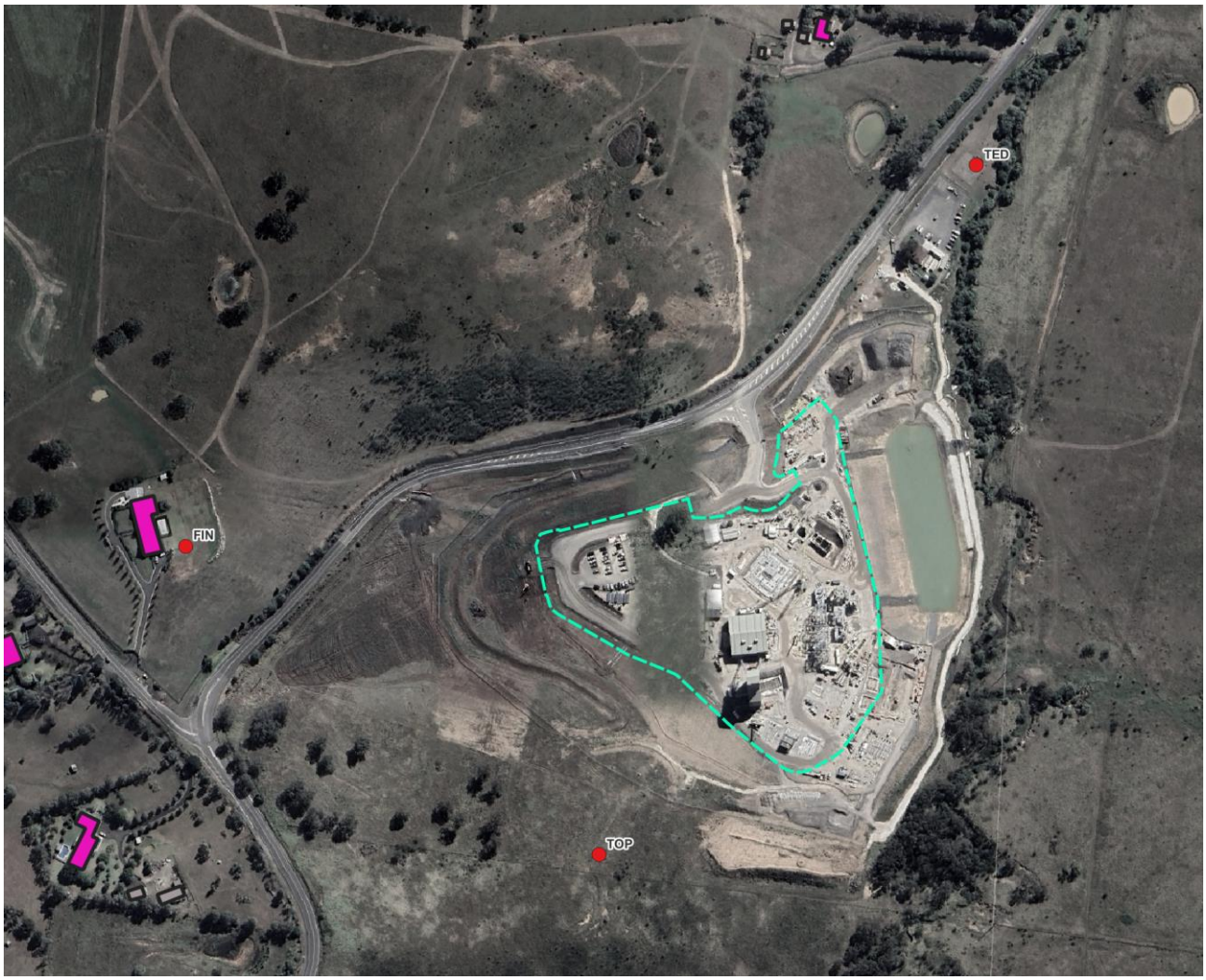
Note: 1. Receiver R3 from Figure 2 is not required to be assessed.

3 Blast Monitoring

3.1 Monitor Locations

Waves Consulting installed three (3) permanent blast monitors surrounding the site at key locations. The blast monitoring locations and names are shown in Figure 2 below.

Figure 2. Blast Monitoring Locations



The blast monitor distances to the VS7 shaft are given below:

- TOP: 315 m.
- FIN: 510 m.
- TED: 343 m.

3.2 Blast Monitoring Equipment

All noise monitoring was conducted in the free-field to eliminated extraneous noise sources (ie residential occupant noise or air conditioning units etc) and to eliminate unusual reflections from building structures and nearby out-buildings such as garages and sheds.

All noise measurement instrumentation used in the survey have valid calibration certificates and are designed to comply with the requirements of:

- Australian Standard AS IEC 61672.1—2004 - *Electroacoustics—Sound level meters, Part 1: Specification*.
- Australian Standard AS 2187.2 – 2006 - *Explosives—Storage and use. Part 2: Use of explosives*.

The equipment was set up with microphones at 1.2 metres above the ground level. All microphones were fitted with wind shields.

The field calibration of the loggers was checked every few weeks throughout the survey period. The variation (or drift) in calibration at all locations was found to be within the allowable tolerance of ±0.5 dB.

3.3 Blast Measurement Summary

Table 2 below summarises the blast monitoring undertaken between March and June 2024 for each of the monitoring locations. The table shows the date, monitor name, the Maximum Instantaneous Charge (MIC) of the blast, the depth of the blast, Overpressure (also called the L_{Zpeak}) and the Ground Vibration measured as the Vector Peak Particle Velocity VPPV (in mm/s).

Table 2. Summary of the Blast Measurements

Date & Time	Blast Depth	MIC (kg)	Overpressure L_{Zpeak} (dB)			Ground Vibration – VPPV (mm/s)		
			TOP	FIN	TED	TOP	FIN	TED
22/03/2023 15:57	11.6	1.05	98.3	92.0	96.0	0.104	0.137	0.147
25/03/2023 11:39	13.5	1.05	106.9	108.9	98.0	0.126	0.206	0.118
2/04/2024 11:48	15.3	0.84	96.5	91.8	93.4	0.116	0.214	0.109
4/04/2024 13:08	17.1	1.05	102.2	112.0	100.2	0.075	0.112	0.115
8/04/2024 11:22	18.9	1.05	99.2	93.8	95.8	0.075	0.108	0.125
12/04/2024 09:00	20	1.05	98.3	96.7	99.3	0.105	0.126	0.177
16/04/2024 09:02	22.4	1.05	99.6	97.1	100.8	0.08	0.115	0.091
20/04/2024 10:45	23.6	1.05	118.9[1]	119.0[1]	105.0	0.127	0.226	0.15
22/04/2024 12:30	25.3	1.05	102.8	101.0	100.0	0.106	0.104	0.095
24/04/2024 11:44	27.1	2.1	101.3	97.7	96.9	0.094	0.127	0.11
29/04/2024 16:40	28.5	3.36	99.9	90.9	108.9	0.1	0.149	0.089
2/05/2024 11:51	29.9	4.2	107.5	106.3	105.7	0.122	0.157	0.127
3/05/2024 16:30	29.9	3.16	100.4	100.4	102.8	0.105	0.11	0.128
7/05/2024 11:45	31.4	6.3	108.1	105.9	108.5	0.146	0.134	0.179
10/05/2024 11:53	33	6.3	109.7	107.8	107.5	0.165	0.129	0.298
13/05/2024 16:30	34.6	6.3	104.8	100.3	103.9	0.113	0.136	0.241
15/05/2024 12:00	35.5	0.63	99.4	98.3	96.8	0.098	0.138	0.112
18/05/2024 12:45	37.1	6.3	112.0[1]	110.4[1]	106.8	0.08	0.104	0.112
20/05/2024 16:22	37.45	6.3	99.4	98.8	101.1	0.102	0.128	0.223

Date & Time	Blast Depth	MIC (kg)	Overpressure L_{Zpeak} (dB)			Ground Vibration – VPPV (mm/s)		
			TOP	FIN	TED	TOP	FIN	TED
22/05/2024 13:00	38.6	2.52	106.7	100.8	104.1	0.105	0.156	0.223
27/05/2024 12:57	40.1	6.3	105.6	102.3	104.4	0.129	0.172	0.214
29/05/2024 12:57	41.9	6.3	101.4	98.1	99.1	0.109	0.142	0.137
1/06/2024 12:28	43.6	6.3	106.7	106.7	109.1	0.108	0.108	0.131
3/06/2024 12:36	45.1	6.3	102.7	95.7	101.9	0.104	0.117	0.142
5/06/2024 12:30	46.6	6.3	109.1	102.1	104.9	0.101	0.157	0.154
12/06/2024 09:57	48.3	6.3	110.2[1]	113.6[1]	108[2]	0.114	0.179	0.142[2]
19/06/2024 09:21	50.1	6.3	108.1	103.6	107.6	0.105	0.169	0.126
21/06/2024 16:34	51.7	6.3	100.8	96.5	103.1	0.085	0.205	0.123
24/06/2024 12:00	53.5	6.3	92.9	100.9	98.0	0.092	0.17	0.109
26/06/2024 12:30	55.2	6.3	101.4	98.6	100.6	0.122	0.166	0.155

Note: 1. High wind speeds / gusts leading to affecting overpressure results at elevated monitor positions FIN and TOP which are more exposed to environmental wind conditions. Actual overpressure results likely to be 2 – 5 dB lower than measured.
2. Logger battery failed so direct measurement data was not available. This data has been estimated based on the historical average differences between the blast levels at each of the three blast monitors during the survey.

None of the measured results exceed the consent conditions for airblast overpressure or ground vibration. Airblast overpressure measurements on 20/04/2024, 18/05/2024 and 12/06/2024 were potentially affected by high wind conditions at the elevated monitoring locations TOP and FIN. Beureaof Meterology Data for these dates shows wind gusts of > 6 m/s. For these wind affected measurements the airblast overpressure results are likely to be 2 – 7 dB lower than measured (based on the data for similar sized blasts in this monitoring period).

The ground vibration measurements are very low at all monitoring locations for all blasts. The risk of exceedance of the ground vibration criteria at any of the residential receivers is negligible as a result.

4 Site Law Calculations

From the blast monitoring data in Table 2 it is possible to establish a relationship between the blast depth, the blast MIC and Overpressure at each receiver using Appendix J7 of AS 2187.2-2006 Equation J7.2 as presented below.

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^a$$

Where:
P = pressure, in kilopascals
Q = explosives charge mass, in kilograms
R = distance from charge, in metres
K_a = site constant
a = site exponent

For this project the site exponent, a, was fixed at -1.45. The site constant, K_a, can be calculated for each blast using the Overpressure measurements for validation. It is then possible to use the same formula to provide validated predictions to each receiver (by changing the distance, R) for each blast.

Table 3 summarises the maximum site constant, K_a, for each blast calculated as part of this validation assessment.

Table 3. Summary of the Blast Validation / Site Law

Date & Time	Blast Depth (m)	MIC (Kg)	Site Constant K_a
22/03/2023 15:57	11.6	1.05	8
25/03/2023 11:39	13.5	1.05	21
2/04/2024 11:48	15.3	0.84	7
4/04/2024 13:08	17.1	1.05	12
8/04/2024 11:22	18.9	1.05	10
12/04/2024 09:00	20	1.05	11
16/04/2024 09:02	22.4	1.05	12
20/04/2024 10:45	23.6	1.05	15
22/04/2024 12:30	25.3	1.05	19
24/04/2024 11:44	27.1	2.1	9
29/04/2024 16:40	28.5	3.36	13
2/05/2024 11:51	29.9	4.2	18
3/05/2024 16:30	29.9	3.16	10
7/05/2024 11:45	31.4	6.3	14
10/05/2024 11:53	33	6.3	17
13/05/2024 16:30	34.6	6.3	8
15/05/2024 12:00	35.5	0.63	18
18/05/2024 12:45	37.1	6.3	22
20/05/2024 16:22	37.45	6.3	6
22/05/2024 13:00	38.6	2.52	15

Date & Time	Blast Depth (m)	MIC (Kg)	Site Constant K_a
27/05/2024 12:57	40.1	6.3	9
29/05/2024 12:57	41.9	6.3	6
1/06/2024 12:28	43.6	6.3	15
3/06/2024 12:36	45.1	6.3	6
5/06/2024 12:30	46.6	6.3	13
12/06/2024 09:57	48.3	6.3	14
19/06/2024 09:21	50.1	6.3	11
21/06/2024 16:34	51.7	6.3	5
24/06/2024 12:00	53.5	6.3	8
26/06/2024 12:30	55.2	6.3	6

The site constant, Ka, shows little variation with blast size or depth. For the predictions at the surrounding receivers this assessment will use a worst-case (conservative) site constant, K_a of 22 (ie highest site constant from all the blasts).

5 Overpressure Results

The worst-case (conservative) site constant, K_a of 22 has been used to evaluate the Overpressure results at each receiver for each measured blast. The results are presented in Table 4 to Table 6 below.

Table 4. Summary of the Overpressure Results (L_{Zpeak} dB) for Each Blast at Each Receiver Between March and April 2024

Receiver	Dist (m)	Blast Date										
		22/03/23	25/03/23	2/04/24	4/04/24	8/04/24	12/04/24	16/04/24	20/04/24	22/04/24	24/04/24	29/04/24
R2	423	105	105	104	105	105	105	105	105	105	108	110
R4	670	99	99	98	99	99	99	99	99	99	102	104
R5	649	99	99	99	99	99	99	99	99	99	102	104
R6	645	100	100	99	100	100	100	100	100	100	102	104
R7	664	99	99	98	99	99	99	99	99	99	102	104
R8	741	98	98	97	98	98	98	98	98	98	101	103
R9	941	95	95	94	95	95	95	95	95	95	98	100
R10	921	95	95	94	95	95	95	95	95	95	98	100
R11	1030	94	94	93	94	94	94	94	94	94	97	99
R12	1162	92	92	91	92	92	92	92	92	92	95	97
R13	1152	92	92	91	92	92	92	92	92	92	95	97
R14	1153	92	92	91	92	92	92	92	92	92	95	97
R15	1114	93	93	92	93	93	93	93	93	93	96	98
R16	570	101	101	100	101	101	101	101	101	101	104	106
R17	1579	88	88	87	88	88	88	88	88	88	91	93
R18	1405	90	90	89	90	90	90	90	90	90	93	95
R19	1358	90	90	89	90	90	90	90	90	90	93	95
R20	1240	91	91	90	91	91	91	91	91	91	94	96
R21	1306	91	91	90	91	91	91	91	91	91	94	96
R22	1159	92	92	91	92	92	92	92	92	92	95	97
R23	1164	92	92	91	92	92	92	92	92	92	95	97
R24	1006	94	94	93	94	94	94	94	94	94	97	99
R25	943	95	95	94	95	95	95	95	95	95	98	100
R26	1025	94	94	93	94	94	94	94	94	94	97	99
R27	1117	93	93	92	93	93	93	93	93	93	96	98
R28	1277	91	91	90	91	91	91	91	91	91	94	96
R29	1300	91	91	90	91	91	91	91	91	91	94	96

Receiver	Dist (m)	Blast Date										
		22/03/23	25/03/23	2/04/24	4/04/24	8/04/24	12/04/24	16/04/24	20/04/24	22/04/24	24/04/24	29/04/24
R30	1230	91	91	90	91	91	91	91	91	91	94	96
R31	1314	91	91	90	91	91	91	91	91	91	94	95
R32	1354	90	90	89	90	90	90	90	90	90	93	95
R33	1396	90	90	89	90	90	90	90	90	90	93	95
R34	1433	90	90	89	90	90	90	90	90	90	92	94
R35	1490	89	89	88	89	89	89	89	89	89	92	94

Table 5. Summary of the Overpressure Results (L_{Zpeak} dB) for Each Blast at Each Receiver During May 2024

Receiver	Dist (m)	Blast Date										
		2/05/24	3/05/24	7/05/24	10/05/24	13/05/24	15/05/24	18/05/24	20/05/24	22/05/24	27/05/24	29/05/24
R2	423	111	109	112	112	112	103	112	112	109	112	112
R4	670	105	104	107	107	107	97	107	107	103	107	107
R5	649	105	104	107	107	107	97	107	107	103	107	107
R6	645	105	104	107	107	107	97	107	107	103	107	107
R7	664	105	104	107	107	107	97	107	107	103	107	107
R8	741	104	102	105	105	105	96	105	105	101	105	105
R9	941	101	99	102	102	102	93	102	102	98	102	102
R10	921	101	100	103	103	103	93	103	103	99	103	103
R11	1030	99	98	101	101	101	92	101	101	97	101	101
R12	1162	98	97	100	100	100	90	100	100	96	100	100
R13	1152	98	97	100	100	100	90	100	100	96	100	100
R14	1153	98	97	100	100	100	90	100	100	96	100	100
R15	1114	98	97	100	100	100	91	100	100	96	100	100
R16	570	107	106	109	109	109	99	109	109	105	109	109
R17	1579	94	93	96	96	96	86	96	96	92	96	96
R18	1405	96	94	97	97	97	88	97	97	93	97	97
R19	1358	96	95	98	98	98	88	98	98	94	98	98
R20	1240	97	96	99	99	99	89	99	99	95	99	99
R21	1306	96	95	98	98	98	89	98	98	94	98	98
R22	1159	98	97	100	100	100	90	100	100	96	100	100
R23	1164	98	97	100	100	100	90	100	100	96	100	100
R24	1006	100	99	101	101	101	92	101	101	98	101	101
R25	943	101	99	102	102	102	93	102	102	98	102	102
R26	1025	100	98	101	101	101	92	101	101	97	101	101
R27	1117	98	97	100	100	100	90	100	100	96	100	100

Receiver	Dist (m)	Blast Date										
		2/05/24	3/05/24	7/05/24	10/05/24	13/05/24	15/05/24	18/05/24	20/05/24	22/05/24	27/05/24	29/05/24
R28	1277	97	96	98	98	98	89	98	98	95	98	98
R29	1300	97	95	98	98	98	89	98	98	94	98	98
R30	1230	97	96	99	99	99	89	99	99	95	99	99
R31	1314	96	95	98	98	98	88	98	98	94	98	98
R32	1354	96	95	98	98	98	88	98	98	94	98	98
R33	1396	96	94	97	97	97	88	97	97	94	97	97
R34	1433	95	94	97	97	97	87	97	97	93	97	97
R35	1490	95	94	97	97	97	87	97	97	93	97	97

Table 6. Summary of the Overpressure Results (L_{Zpeak} dB) for Each Blast at Each Receiver During June 2024

Receiver	Distance (m)	Blast Date							
		1/06/24	3/06/24	5/06/24	12/06/24	19/06/24	21/06/24	24/06/24	26/06/24
R2	423	112	112	112	112	112	112	112	112
R4	670	107	107	107	107	107	107	107	107
R5	649	107	107	107	107	107	107	107	107
R6	645	107	107	107	107	107	107	107	107
R7	664	107	107	107	107	107	107	107	107
R8	741	105	105	105	105	105	105	105	105
R9	941	102	102	102	102	102	102	102	102
R10	921	103	103	103	103	103	103	103	103
R11	1030	101	101	101	101	101	101	101	101
R12	1162	100	100	100	100	100	100	100	100
R13	1152	100	100	100	100	100	100	100	100
R14	1153	100	100	100	100	100	100	100	100
R15	1114	100	100	100	100	100	100	100	100
R16	570	109	109	109	109	109	109	109	109
R17	1579	96	96	96	96	96	96	96	96
R18	1405	97	97	97	97	97	97	97	97
R19	1358	98	98	98	98	98	98	98	98
R20	1240	99	99	99	99	99	99	99	99
R21	1306	98	98	98	98	98	98	98	98
R22	1159	100	100	100	100	100	100	100	100
R23	1164	100	100	100	100	100	100	100	100
R24	1006	101	101	101	101	101	101	101	101
R25	943	102	102	102	102	102	102	102	102

Receiver	Distance (m)	Blast Date							
		1/06/24	3/06/24	5/06/24	12/06/24	19/06/24	21/06/24	24/06/24	26/06/24
R26	1025	101	101	101	101	101	101	101	101
R27	1117	100	100	100	100	100	100	100	100
R28	1277	98	98	98	98	98	98	98	98
R29	1300	98	98	98	98	98	98	98	98
R30	1230	99	99	99	99	99	99	99	99
R31	1314	98	98	98	98	98	98	98	98
R32	1354	98	98	98	98	98	98	98	98
R33	1396	97	97	97	97	97	97	97	97
R34	1433	97	97	97	97	97	97	97	97
R35	1490	97	97	97	97	97	97	97	97

The results from Table 4, Table 5 and Table 6 show that the consent conditions were satisfied at each receiver for each blast, with the Overpressure results consistently below the 95% 115 dB L_{Zpeak} criteria.

6 Ground Vibration

The ground vibration measurements from Table 2 are very low at all monitoring locations for all blasts. The risk of exceedance of the ground vibration criteria at any of the residential receivers is negligible as a result. The ground vibration for each blast would be significantly below the 5 mm/s consent criteria for all blasts.

7 Conclusion

This review has demonstrated that the consent criteria for both airblast overpressure and ground vibration have been satisfied for all blasts throughout the Pre-Sink period of March to June 2024 for Vent Shaft 7 (VS7).

Therefore, no remedial measures are required, and the site is considered compliant with the conditions of consent.

I trust this letter provides sufficient detail for your current requirements. If you have any questions, please do not hesitate to contact me.

Yours sincerely

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Waves Acoustic Consulting Pty Ltd

Appendix 2

R4 & R10 Blast Monitoring

APPIN MINE VENTILATION AND ACCESS PROJECT

R4 & R10 BLAST MONITORING

REPORT NO. 17209-E
VERSION 1.2

AUGUST 2024

PREPARED FOR

ILLAWARRA METALLURGICAL COAL
PO BOX 514
UNANDERRA NSW 2526

DOCUMENT CONTROL

Version	Notes	Status	Date	Prepared	Reviewed	Approved
0.1	-	Draft	15/08/2024	NH		NH
1.0	-	Final	19/08/2024	NH		NH
1.1	-	Final	19/08/2024	NH		NH
1.2	-	Final	20/08/2024	NH		NH

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. The most common of these noise descriptors are defined below.

L_{AFmax} The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time.

L_{A90} The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This descriptor is a common measure of environmental noise.

ABL The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day.

RBL The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

L_{Zpeak} The highest instantaneous sound pressure level, in decibels, with a “Z” frequency weighting. The Z-weighting response replaces the “flat” and “linear” responses. This descriptor is used to measured airblast overpressure from blasting activities.

1 INTRODUCTION

1.1 Background

The Appin Mine is an existing underground coal mine in the Southern Coalfield of New South Wales (NSW) approximately 25 kilometres (km) north-west of Wollongong. Appin Mine, Cordeaux Colliery and Dendrobium Mine (and associated facilities) collectively operate as Illawarra Metallurgical Coal (IMC).

In April 2022 a modification of the Project Approval (MOD 3) was granted to allow for the construction and operation of two ventilation shafts (VS), mine access infrastructure and improved site access at 345 Menangle Road, Menangle NSW, herein referred to as the Appin Mine Ventilation and Access Project (AMVA Project or the Site).

RUC Cementation Mining Contractors Pty Ltd (RUC) have been engaged by IMC to construct the ventilation shafts for the AMVA Project. The AMVA Project has recently completed the pre-sink (excavation down to ~ 50 m below ground level) in both Vent Shaft 7 (VS7) and Vent Shaft 8 (VS8).

Following placement of the sinking stage in the shaft and completion of the shaft headframe building and winder building, VS8 will commence the main sink phase (expected 2024) where excavation will continue to a target depth of ~560 m. The same process will be undertaken in VS7 (to a target depth of ~590 m).

1.2 Purpose of this Report

This report has been prepared by SoundIN Pty Ltd (SoundIN) to document the results of unattended blast noise monitoring conducted at two sensitive receivers during June 2024. This report:

- Presents measured overpressure and L_{Amax} noise levels associated with the blasts and assesses these levels against relevant limits.
- Compares the measurement results with those from the network of real-time blast monitoring equipment deployed on the site.
- Discussed the implications of the measurement results for the main sink phase, when VS7 and VS8 will be covered by headframe buildings which incorporate specific acoustic treatments to mitigate impacts from blasting.

2 BLAST NOISE/OVERPRESSURE CRITERIA

The Project Approval for the AMVA Project stipulates noise limits for construction blasting as follows:

> *The Proponent must ensure that the construction blasting at the Appin Mine Ventilation and Access Site does not cause exceedances of the criteria in Table 11.*
>
> *However, these criteria do not apply if the Proponent has a written agreement with the relevant owner and the Proponent has advised the Department in writing of the terms of this agreement, or if other criteria is agreed by the Planning Secretary*
>
> *Unless the Planning Secretary agrees otherwise, the Proponent must only carry out blasting on the Appin Mine Ventilation and Access Site Monday to Friday 9 am to 5 pm and Saturday 9 am to 1 pm. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Planning Secretary unless an additional blast is required following a blast misfire.*
>
> *If the Proponent decides to seek the Planning Secretary's approval to carry out blasting outside of the hours specified in condition 5 above, then it must demonstrate that the airblast overpressure levels from the blasting complies with the night-time L_{Amax} sleep disturbance maximum noise trigger level criteria specified in Table 2B of condition 2C, Schedule 4.*
>
> *The Proponent may carry out a maximum of 1 blast per 24 hour period at each of the Appin Mine Ventilation and Access Site ventilation shafts, unless an additional blast is required following a blast misfire.*
>
> *This condition does not apply to blasts required to ensure the safety of the mine or its workers. Note: For the purposes of this condition, a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a ventilation shaft of the site.*

The noise criteria for construction blasting set out in Table 11 from the Project Approval are presented in **Table 2-1**. The night-time L_{AFmax} sleep disturbance maximum noise trigger level criteria specified in Table 2B of condition 2C, Schedule 4 is 54 dBA.

Table 2-1 Construction Blasting Criteria

Receiver	Airblast overpressure dB(Lin Peak)	Allowable exceedance
All privately owned residences	120	0%
	115	5% of the total blasts over a period of 12 months

The overpressure criteria in the Project Approval (see **Table 2-1**) are expressed in decibels (dB) with a linear (Lin) frequency weighting. As noted in the glossary, the Z frequency weighting has replaced the linear (Lin) frequency weighting. In this report, the "L_{Zpeak}" noise descriptor is used to describe overpressure impacts from blasts and is consistent with the dB (Lin Peak) nomenclature used in the Project Approval.

3 MONITORING METHODOLOGY

3.1 Permanent Blast Monitors

Monitoring of acoustic impacts associated with blasting project is carried out by a network of blast monitors. The locations of the blast monitors are shown in **Figure 3-1**.

The blast monitors measure both L_{AFmax} and L_{Zpeak} levels from blast events. The measured L_{AFmax} and L_{Zpeak} levels during blasts from the blast monitors have been provided to SoundIN by IMC.

3.2 Unattended Blast Monitoring

During the period of 30 May – 13 June 2024, and again on 24 June 2024, SoundIN conducted unattended noise monitoring at receivers R4 and R10. The locations of SoundIN's loggers are shown in **Figure 3-1**.

Monitoring location L1, situated on the property of R4, is representative of the most potentially affected receivers on the western side of Menangle Road (R4 – R8). These receivers are situated behind a ridge, along the top of which runs Menangle Road.

Monitoring location L2, situated on the property of R10, is representative of the most potentially affected receivers further to the south of the site.

The SoundIN loggers incorporate NTi XL2 sound level meters. This sound level meter conforms to *Australian Standard 1259 Acoustics – Sound Level Meters* as a Type 1 precision sound level meter which has an accuracy suitable for field and laboratory use.

A large rain event on 6 and 7 June resulted in some erroneous data thereafter and some apparent drift in the calibration of the sound level metres. After being dried out, the calibration of the equipment showed no significant drift from the calibration conducted prior to the monitoring.

The noise loggers were set to measure L_{AFmax} and L_{Zpeak} levels at 100ms intervals with contemporaneous audio files.

L_{AFmax} and L_{Zpeak} levels measured by the loggers during blasts over the monitoring periods have been identified from the 100ms data. Aural analysis of the audio data has been conducted to ensure that the measured levels correspond to blasting events and not extraneous sources such as traffic, wildlife, etc.

It should be noted that noise and overpressure levels associated with blasts were at times difficult to distinguish from the ambient noise environment, particularly at location L2 (R10).

Figure 3-1 Monitoring Locations

4 RESULTS & DISCUSSION

The results of the noise measurements are summarised in **Table 4-1**. The results indicate that:

- The measured L_{Zpeak} levels at all monitoring locations comply with the 115 dBL limit for all measured blasts. In fact, the results were well below the criteria (99 dB or below).
- The measured L_{Zpeak} levels at L1 were 8 – 14 dB lower than those at the nearest and most representative permanent blast monitor (FIN). This difference is not explained by the additional distance from the blast. Therefore, some degree of topographical shielding is taking place. The highest difference (14 dB) coincides with moderate winds from the WSW direction which are likely to provide additional attenuation.
- The measured L_{AFmax} levels at L1 were 8 – 22 dB lower than those at the nearest and most representative permanent blast monitor (FIN). The highest difference (22 dB) coincides with moderate winds from the WSW direction which are likely to provide additional attenuation.
- Only two of the blasts over the monitoring periods were audible in the recorded audio files from L2. This is largely due to the high levels of ambient noise at L2, associated with traffic on Menangle Road. For example, L_{AFmax} noise levels at L2 associated with cars passing by on Menangle Road are typically in the range of 53 – 56 dBA.
- The measured L_{Zpeak} and L_{AFmax} levels at L2 were 8 – 22 dB lower than the corresponding levels measured at the nearest and most representative permanent blast monitor (TOP).
- The audible blasts at L2 exhibited an L_{AFmax} level of 46 – 51 dBA, which is well within the range of typical ambient noise levels from sources such as traffic and wildlife.
- Measured L_{AFmax} levels were typically 40 dB or more below their corresponding L_{Zpeak} levels at both monitoring locations.

4.1 Implications for Main Sink Phase

The monitoring results presented herein indicate that L_{Zpeak} levels comply with the criteria at both the permanent blast monitors and at sensitive receivers.

The consent (Table 2B of condition 2C, Schedule 4) imposes a sleep disturbance criterion of 54 dBA L_{AFmax}, which would apply to any blasts undertaken during the night time period. This criterion is not relevant for the measurements taken, which were in the day period, however L_{AFmax} levels were measured to provide valuable data to further inform the likelihood or otherwise of blasts exceeding the night time L_{AFmax} criterion in the main sink phase of the Project (once the shaft headframe building and associated noise mitigation is in place). Although the pre-sink blasts measured were largely unmitigated by noise attenuation infrastructure, measured L_{AFmax} levels at sensitive receivers (R4) have

only slightly exceeded the night time L_{AFmax} criterion by up to 3 dB (in three out of five measurements).

The headframe buildings are expected to provide significant attenuation of L_{Zpeak} and L_{AFmax} levels. RUC's acoustic consultant (Waves Acoustic Consulting) have indicated that this attenuation is likely to exceed 30 dB. Therefore, compliance with the L_{Zpeak} criteria is likely to continue and compliance with the L_{AFmax} criterion is likely to be achieved during the main sink phase.

Table 4-1 Noise Monitoring Results

	01/06/2024 12:28 pm	03/06/2024 12:36 pm	05/06/2024 12:30 pm	12/06/2024 9:57 am	24/06/2024 12:00 pm
L_{Zpeak} (limit = 115 dB)					
L1 (R4)	96	84	94	99	92
L2 (R10)	-	-	95	-	90
TOP	107	103	109	110	99
FIN	107	96	102	114	101
TED	109	102	105	108	98
L_{AFmax} (limit = 54 dBA [1])					
L1 (R4)	57	44	56	55	48
L2 (R10)	-	-	46	-	51
TOP	65	61	68	68	60
FIN	65	58	65	77	58
TED	74	58	62	63	60
Weather Conditions					
Wind speed	3.13	0.45	0.89	5.81	0.89
Wind direction	SE	SSE	SSE	WSW	SSE

1. L_{AFmax} limit applies only at night (10pm – 7am Monday to Saturday, 10pm – 8am Sunday and Public Holidays)

5 CONCLUSION

This report has been prepared by SoundIN to document the results of unattended noise monitoring of a blast conducted in June 2024. This report:

- Presents measured overpressure and L_{Amax} noise levels associated with the blasts and assesses these levels against relevant limits.
- Compares the measurement results with those from the network of real-time blast monitoring equipment deployed on the site.
- Discussed the implications of the measurement results for the main sink phase, when VS7 and VS8 will be covered by headframe buildings which incorporate specific acoustic treatments to mitigate impacts from blasting.

The measurement results indicate that:

- The measured L_{Zpeak} levels at all monitoring locations comply with the 115 dBL limit for all measured blasts. In fact, the results were well below the criteria (99 dB or below).
- The measured L_{Zpeak} and L_{AFmax} levels at receivers R4 and R10 are at least 8 dB lower than those at the nearest and most representative permanent blast monitors.
- Only two of the blasts over the monitoring periods were audible in the recorded audio files from L2. This is largely due to the high levels of ambient noise at L2, associated with traffic on Menangle Road.
- The audible blasts at L2 exhibited an L_{AFmax} level of 46 – 51 dBA, which is well within the range of typical ambient noise levels from sources such as traffic and wildlife.
- Measured L_{AFmax} levels are typically 40 dB or more below their corresponding L_{Zpeak} levels.

Noting the likely attenuation from the headframe buildings, L_{Zpeak} and L_{AFmax} levels during the main sink phase of VS7 and VS8 are likely to comply with criteria at all sensitive receivers, except in those locations where negotiated agreements are in place.