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TJ824-01F02 Independent Noise Advice (r10)

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Hume Coal Project & Berrima Rail Project - Noise & Vibration Assessments | Independent Noise Advice

1 Introduction

Hume Coal Pty Limited (**Hume Coal**) has lodged development applications for the **Hume Coal Project** and its associated **Berrima Rail Project** located to the west of Moss Vale in the Wingecarribee local government area (**Site**). A single Environmental Impact Statement for the two projects is on exhibition. Renzo Tonin & Associates was engaged by NSW Department of Planning & Environment (the **Department**) to give advice on key aspects of the Environmental Impact Statement in relation to noise impacts.

The noise assessment predicts that a number of exceedances of the recommended project specific noise levels as prescribed in the EPA's NSW Industrial Noise Policy are likely to occur. The Department scope of work requires:

- the noise predictions to be independently verified; and,
- commentary on whether any additional feasible and reasonable noise mitigation measures could be implemented to further mitigate the noise impacts of the project.

The primary documents the subject of this review are (**Briefing Documents**):

1) Hume Coal Project Environmental Impact Statement. Main Report. Volume 1 prepared by EMM Consulting Pty Ltd dated 8 March 2017 (**EIS**)

2) Hume Coal Project Noise and Vibration Assessment Report. Volume 7 Appendix I of the EIS prepared by EMM Consulting Pty Ltd dated 13 February 2017 (**Hume Coal NVA**)

3) Berrima Rail Project Environmental Impact Statement. Main Report. Volume 3A Appendix D of the EIS prepared by EMM Consulting Pty Ltd dated 9 March 2017 (**Berrima Rail EIS**)

4) Berrima Rail Project Noise and Vibration Assessment Report. Volume 3B Appendix D (Sub Appendix E) of the EIS prepared by EMM Consulting Pty Ltd dated 1 March 2017 (**Berrima Rail NVA**)

In addition to the Briefing Documents listed above, we have also referred to the documents outlined in the section marked "References" below.

This is a desktop review of the Briefing Documents in respect of noise and vibration. No calculations were performed.

The brief was extended to include a site visit and to attend a meeting with a number of residents who own land in proximity to the project site including some residents located immediately to the north of the project site who would qualify for land acquisition or mitigation under the Voluntary Land Acquisition and Mitigation Policy [8]. The meeting was held with residents and officers of the NSW Department of Planning & Environment on Tuesday 14th November 2017.

A glossary of acoustic terminology can be found in Appendix A.

The writer declares he has no vested interest in the project and has had no prior involvement with Hume Coal. The writer has read Division 2 of Part 31 of the Uniform Civil Procedure Rules 2005 and the Expert Witness Code of Conduct in Schedule 7 of the Uniform Civil Procedure Rules 2005) and has prepared this report in accordance with the terms of those documents.

The writer's curriculum vitae and experience with mines and quarries (both personal and company experience) are annexed hereto in Appendices B and C.

2 Approach

In accordance with the scope of work outlined in Section 1 above, the primary focus of this report is to address the predicted exceedences of the project specific noise levels and whether any additional feasible and reasonable noise mitigation measures could be implemented to further mitigate the noise impacts of the project. In other words, has the proponent investigated all feasible and reasonable noise mitigation measures which it could have adopted rather than settling on what is essentially the easy way out which is to provide acoustic treatment to residential premises (such as thicker glazing or double glazing and mechanical ventilation).

As this is not a peer review, there is no need to address every section of the Briefing Documents, only those sections which have a bearing on the predicted exceedences and the noise mitigation measures. In addition, we do not address any assertions in the Briefing Documents which are technically incorrect unless they bear on the predicted exceedences and the noise mitigation measures.[1]

[1] For example, at Section 3.1.7 Low frequency noise in the Hume Coal NVA, the statement is made that there is a "perverse outcome" arising from application of the INP procedure for low frequency noise. We do not agree with this because the author has failed to take into account the ambient noise other than from the source in question, however, this has no bearing on the predicted exceedences and the noise mitigation measures.

A two-phased approach was agreed to with the Department. The first phase involved the preparation of a set of questions to clarify various aspects of the reports. Annexed hereto in Appendix D are the questions sent to the proponent dated 1 Sept 2017.

The following documents were submitted to the Department in response to those questions:

1) Hume Coal Project - Noise and Vibration Assessment, Response to Independent Noise Review. EMM Consulting Pty Ltd dated 5 October 2017 (**Hume Response Report**)

2) Berrima Rail Project - Noise and Vibration Assessment, Response to Independent Noise Review. EMM Consulting Pty Ltd dated 5 October 2017 (**Berrima Response Report**)

Annexed hereto in Appendix E is a copy of those reports.

The second phase involved the preparation of this report incorporating the information contained in the Hume Response Report and the Berrima Response Report.

3 Description of proposed development

Hume Coal is seeking development consent to construct and operate an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales. The mine will produce up to 3.5 million tonnes per annum (Mtpa) which will require up to 50 train movements per week including 4 train movements per night (10:00pm-7:00am).

The Hume Coal Project will involve the construction and operation of the following mine infrastructure:

- one personnel and materials drift access and one conveyor drift access from the surface to the coal seam;
- ventilation shafts, comprising one upcast ventilation shaft and fans, and up to two downcast shafts installed over the life of the mine, depending on ventilation requirements as the mine progresses;
- a surface infrastructure area, including administration, bathhouse, wash-down and workshop facilities, fuel and lubrication storage, warehouses, laydown areas, and other facilities. The surface infrastructure area will also comprise the CPP and ROM coal, product coal and temporary emergency reject stockpiles;
- surface and groundwater management and treatment facilities, including storages, pipelines, pumps and associated infrastructure;
- overland conveyors;
- rail load-out facilities including a rail loop;
- a small explosives magazine;
- ancillary facilities, including fences, access roads, car parking areas, helipad and communications infrastructure; and,

- environmental management and monitoring equipment.

Product coal will be transported by rail via a new rail spur and loop, primarily to Port Kembla terminal for shipment to the international market, and possibly to domestic customers depending on market demand. The new rail spur and loop will be connected to the western end of the existing Berrima Branch Line; a privately owned line branching off the Main Southern Rail Line at the Berrima Junction approximately 2.5 km north of Moss Vale.

The existing Berrima Branch Line extends from the Boral Cement Ltd (**Boral**) site to Berrima Junction where it connects with the Main Southern Railway. It is used by Boral for the transportation of cement, limestone, coal and clinker to and from the Berrima Cement Works. It is also used by Inghams Enterprises Pty Limited (**Inghams**) for the transportation of grain to its feed mill east of the cement works, and by Omya (Australia) Pty Ltd (**Omya**) for the transportation of limestone to their Moss Vale plant at Berrima Junction. In addition to the construction and operation of the new rail spur and loop, an upgrade to the Berrima Branch Line and use of the upgraded rail infrastructure is proposed.

On the Berrima Branch Line, there are currently 120 train movements per week which will increase to (120+50=) 170 movements per week with the Hume Coal Project operating. Night-time train movements will increase from the current 12 movements per night to 16 movements per night.

The Berrima Rail Project will involve the following works:

- upgrades to Berrima Junction (at the eastern end of the Berrima Branch Line) to improve the operational functionality of the junction, including extending the number 1 siding, installation of new turnouts and associated signalling on the branch line. This does not involve any work at or beyond the interface with ARTC-controlled track;
- construction and operation of a railway bridge over Berrima Road;
- construction and operation of a new rail connection into the Berrima Cement Works from the railway bridge;
- decommissioning of the existing rail connection into the Berrima Cement Works including the Berrima Road level rail crossing;
- construction and operation of a new rail spur line from the Berrima Branch Line connection to the Hume Coal Project coal loading facility;
- construction and operation of a grade separated crossing (railway bridge) over the Old Hume Highway;
- construction and operation of maintenance sidings, a passing loop and basic provisioning facility on the western side of the Old Hume Highway, including an associated access road, car parking and buildings;
- construction and operation of the Hume Coal rail loop within the Hume Coal Project Area, adjacent to Medway Road; and

- construction and operation of associated signalling, services (including water, sewerage drainage), access tracks, power and other ancilliary infrastructure.

The Hume Coal Project and the Berrima Rail Project are the subject of separate development applications as the upgraded rail infrastructure will be used by a number of organisations including Hume Coal, as noted above.

4 Secretary's Environmental Assessment Requirements

The EIS and the Berrima Rail EIS must be prepared in accordance with the Secretary's Environmental Assessment Requirements issued by the Department (**SEARs**), The SEARs for the Hume Coal Project in respect of noise are [1]:

Noise - including:

- *an assessment of the likely operational noise impacts of the development (including construction noise) under the NSW Industrial Noise Policy, paying particular attention to the obligations in chapters 8 and 9 of the policy, and the Voluntary Land Acquisition and Mitigation Policy (DP&E);*
- *if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;*
- *an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy;*

The SEARs for the Berrima Rail Project in respect of noise are [2]:

Noise and Vibration - including:

- *an assessment of the likely rail noise and vibration impacts of the development under the Rail Infrastructure Noise Guideline (EPA, 2013) and Assessing Vibration a Technical Guideline (2006), and having regard to EPA's requirements (see Attachment 2);*
- *an assessment of the noise associated with the rail facilities under the NSW Industrial Noise Policy, if such an assessment is not undertaken as part of the Hume Coal Project;*
- *if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline (2009);*

The pertinent guidelines and policies in respect of noise and vibration are listed in references [3] - [8] in the References section at the end of this report.

The EPA's requirements referred to as "Attachment 2" in the SEARs for the Berrima Rail Project are as follows:

The EIS must address the following specific matters:

Noise and Vibration

- *Noise and vibration impacts from construction activities and operational sources including train movement and rail maintenance;*
- *The nature, sensitivity and impact to potentially affected receivers and structures (including heritage items);*
- *A strategy for managing construction noise and vibration and out of hours activities, with a particular focus placed on those activities having the greatest potential for adverse noise or vibration impacts;*
- *Noise and vibration impacts along the corridor due to changed rail operations from the upgraded track between the main southern line to Boral Cement.*
- *Details of any change in industrial noise levels likely as a result of improved rail access to industries including Hume Coal, Boral, Inghams and Omya.*
- *Noise and vibration impacts from areas proposed to be utilised for during coal loading operations and from idling locomotives during 'parking' interaction with passenger services.*
- *Assessment of all feasible and reasonable options to mitigate the impacts of operational rail noise, with particular focus on source control;*
- *Taking into account the Interim Construction Noise Guideline (2009), Rail Infrastructure Noise Guidelines (2013), and Assessing Vibration: A Technical Guideline (2006).*

5 Hume Coal NVA

The following sections discuss the Hume Coal NVA. In particular, the design of the background noise surveys, whether the appropriate guidelines for determining the project specific noise levels have been followed correctly, whether the predicted noise levels have been appropriately determined and finally whether the mitigation of adverse noise impacts are appropriately dealt with.

5.1 Section 3.1.8 Sleep disturbance

In Table 3.6 of the Hume Coal NVA, the sleep disturbance screening level is correctly shown as RBL+15. However, in the first paragraph on that page, it states that "*external noise levels in the order of 60 to 65dB LAmax calculated at the façade of a residence is unlikely to cause awakening effects*". This statement is used later in the report to justify an exceedence of the RBL+15 screening level.

In our opinion, this is an incorrect interpretation of the EPA guideline in respect of sleep disturbance. The EPA guidelines are stated at the bottom of page 29 of the Hume Coal NVA. The EPA guideline makes reference to additional information in the RNP. The RNP is quoted that "*maximum internal noise levels (LAmax) below 50 to 55dB are unlikely to awaken people from sleep*" (equating to an equivalent level outdoors of 60 to 65dB LAmax outdoors, as stated above). However, it is our submission that the RNP does mean this to imply that noise levels below 60 65dB LAmax outdoors do not cause sleep disturbance.

The preponderance of the technical evidence (including that cited by the EPA in the RNP) shows that sleep is also affected by changes to sleep state stages (particularly REM sleep which involves dreaming) and not only by physical awakenings. A physical awakening is the ultimate consequence of disturbance to sleep. However, changes to sleep state stages also causes sleep to be disrupted. [2] [3]

If it were the intention of the EPA to infer that noise levels up to 60 to 65dB LAmax were acceptable and do not cause sleep disturbance then its guidelines would have adopted a screening level of RBL+15 or 60 to 65dB LAmax measured outdoors, whichever is the higher. The guideline is not in that form.

The EPA guideline recommends a screening level of RBL+15 the exceedence of which may cause sleep disturbance (depending upon the circumstances) and, in addition, people are also physically awoken when the external level exceeds 60 to 65dB LAmax outdoors.

5.2 Sections 2.1-2.4 Background noise survey

The Site and the surrounding area are relatively flat with very low rolling hills and occasional elevated ridge lines. However, there are steeper slopes and deep gorges in the west in the Belanglo State Forest. The Hume Highway is located on the eastern boundary of the Site. Residential dwellings are scattered around the Site. The town of Berrima is located approximately 1-2m to the north-east of the Site.

The Boral, Inghams and Omya industrial sites are located approximately 2km to the east of the Site together with the Berrima Branch Line extending in an easterly direction from Boral to the Main Southern Railway. There are five residences situated close to the Berrima Branch Line.

Section 2.2 of the Hume Coal NVA states that there are 75 potentially noise sensitive assessment locations which are shown in Figure 2.1. However, it is clear from the predicted noise levels documented later in the Hume Coal NVA that most of these locations lie outside of the zone of affectation of both the Hume Coal Project and the Berrima Rail Project and their inclusion is superfluous.

There are three valid reasons for excluding those superfluous assessment locations:

1. As will be shown later, the impression is given (and indeed an assserted is made) that the "*majority*" of locations comply with the project specific noise levels giving the reader the impression that noise impacts are therefore minimal.

2. When assessing the impact of complicated assessments such as construction noise impact, it is very difficult for the reader to deal with the large data set in the tables, much of which is superfluous.

3. The proponent's consultant has not adequately dealt with the cumulative impacts of a multiplicity of construction events at so many assessment locations as will be shown later in this report.

[2] Chapter 5. Night Noise Guidelines for Europe. WHO 2009

[3] Chapter 3.4. Guidelines for Community Noise. WHO 1999

The study area was divided into seven noise catchment areas NCA1 to NCA7 which are shown in Figure 2.2 of the Hume Coal NVA. Noise catchment NCA4 is inappropriately large and does not reflect the different ambient noise levels at residences 25-29 close to industries (Boral, Ingham and Omya) as distinct from other residences located much further away. This is reflected in Table 2.2, for example where for NCA4, the estimated existing industrial noise contribution is stated to be 39 LAeq which would be incorrect for residences located further to the south (such as 58-60 and possibly 75-76).

Ambient noise levels were measured using unattended noise loggers in 2014-15 at 12 locations denoted in Figure 2.2 as BG-1 to BG-12 for typically 10-14 days per location.

It is stated in Section 2.3 of the Hume Coal NVA that "*an extensive long term background noise survey commenced by Hume Coal in 2011 which comprised noise monitoring at 17 locations surrounding the project area*" was undertaken and that "*long term background noise surveys were conducted on a quarterly basis to establish seasonal changes in noise levels*". However, we are unable to see any data extending back to 2011 nor any calculation of seasonal changes in noise levels. For the reasons explained below, this criticism is not critical to the noise assessment and is therefore not raised as a query.

The noise logger data is shown in Appendix B of the Hume Coal NVA. In accordance with EPA guidelines, noise levels affected by wind speeds greater than 5m/s at microphone height are excluded from the calculations. For this reason, the wind speed graph is superimposed on the noise graphs. It was confirmed in the Hume Response Report that the wind speeds shown in Appendix B noise logger charts are referenced to meteorological mast height (10m) instead of microphone height.[4]

Having regard for the applicable terrain category for the site, the wind speed at 1.5m height is approximately 0.8x the value at 10m height. For a wind speed of 5m/s at the microphone, this would equate to 6.25 m/sec at 10m height. Therefore, the line shown in the noise logger charts at 5 m/sec should have been drawn at 6.25 m/sec or the wind data recalculated to microphone height. Despite this, there remain irregularities in Appendix B of the Hume Coal NVA which remain unresolved. For example, in Table B.2 the result for Wed 23-09-15 is wind affected and should have been discarded. Similarly, Fri 25-09-15 is wind affected, Sun 04-10-15 is wind affected, Sun 11-10-15 should not be wind affected. There are also instances in the other tables.

The Hume Response Report asserts that the data analysis is nevertheless valid and in accordance with the INP.[5] However, no explanation has been given for the discrepancies noted above.

A summary of the measured Rating Background Level (RBL) at each monitoring location appears in Table 2.1 of the Hume Coal NVA. The final adopted RBLs for each catchment area are shown in Table 2.2 of that report. However, whilst the discrepancies noted above should have been resolved in the Hume Response Report, the point is mute because the predicted exceedences of operational noise level

[4] Query 1

[5] Query 2

in Table 5.1 of the Hume Coal NVA are at locations where the minimum INP project specific noise level have been adopted and therefore any change to the RBLs would not affect the assessment.

It is noted in Table 2.2 of the Hume Coal NVA that that only 5 of the 12 noise monitoring locations were used to represent the RBLs for the catchment areas. It appears that higher values of RBL were not used so as to present a conservative assessment. For example, for NCA1, the lowest RBLs were measured at BG1 and BG4 and the RBLs for BG2 and BG3 were discarded presumably because they were high and not representative of the area. There is no explanation provided as to why those RBLs are high, especially given that nothing unusual is reported in the attended measurements for BG1-BG4 (Section 2.3.2 of the Hume Coal NVA).

One could surmise that the noise loggers had been placed next to a local noise source (such as a pump or transformer) which would indicate a lack of experience of the field engineer, thereby putting into doubt the location of the other noise loggers. Nevertheless, the final adopted RBLs in Table 2.2 of the Hume Coal NVA are either at the INP minimum of 30dB(A) or appear to be correct for the other noisier locations (such as NCA3 being in the Berrima residential area and NCA6-NCA7 being close to the Hume Highway).

Nevertheless, whilst it is noted that there remain issues with the RBLs, the consequences are immaterial in respect of the assessment of noise impacts for this project and we have therefore proceeded on the basis that Table 2.2 in the Hume Coal NVA is accurate.

5.3 Section 3.1.3 Project specific noise levels

The Project Specific Noise Levels (PSNL) for the Hume Coal Project are shown in Table 3.2 of the Hume Coal NVA. These take into account the adopted RBLs in Table 2.2 and the contribution from existing industrial noise where appropriate. Despite the criticism in the previous section regarding the varying level of industrial noise contribution within NCA4, this makes no difference to the final selected PSNL of 35LAeq,15min which is the minimum INP value.

Therefore, it is our opinion that the adopted PSNLs in Table 3.2 appear correct.

5.4 Section 3.3 Construction noise

This section deals with the appropriate Noise Management Levels (NMLs) for construction noise impact assessment. Table 3.8 establishes the construction NMLs for the project and it is our opinion that the adopted NMLs appear correct.

5.5 Section 4.2.2 Operating scenarios and equipment noise levels

Noise predictions were made using 3D acoustic modelling software. The Sound Power Level (Lw) used for each noise source are documented in Table 4.2 of the Hume Coal NVA.

No information is provided in the Hume Coal NVA in respect of locations or heights of noise sources and the locations of any bunding used in the model which may act as acoustic barriers.[6] The Hume Response Report has provided supplementary information in Table 1 and Figures 2a and 2b of that report and has confirmed the following noise bunds are to be constructed:

1. a 3.5m high noise bund around the reject load hopper as indicated in Figure 2a and 2b;
2. stockpiles to be placed as required to act as noise barriers for some assessment locations to the north; and,
3. a 4m high rail noise barrier as depicted in Figure 2a and 2b.

The acoustic model therefore appears to be appropriate for the assessment with the exception of the modelling of the rail loop. In Table 1 of the Hume Response Report, the height 2m for a locomotive is considered inappropriate and a 4m height should be used instead because the most significant noise source from a locomotive is the engine and exhaust which are typically at that height. In addition, it is apparent from Figure 2a and 2b that the locomotive and wagons were modelled adjacent the 4m high noise barrier. At this location, the noise barrier would be at its most effective, however, the noise barrier does not encompass the whole of the rail loop. A description of the methodology describing the design procedure for the rail loop noise barrier is required.

Recommendation 1: The effective source height for locomotives should be 4m requiring a reassessment of predicted noise levels. A description of the noise modelling methodology should be provided justifying the design of the rail loop noise barrier.

In the Hume Coal NVA, the sound power level Lw for "*Locomotives idle to slow moving <10km/h)*" of 101dB(A) is appropriate for idle, however, this would appear to be low for slow moving trains. An Lw of 106-111dB(A) has been used in other noise assessments. Whilst the note in the table indicates the use of "*latest generation locomotives*", the value of 101dB(A) for slow moving trains is low in our opinion. In response to this query,[7] the Hume Response Report states that it has assumed two trains are on the loop contemporaneously with one train idle and one train entering at approximately 20km/h. It appears that the locomotive and freight wagons are not modelled separately but a combined sound power level (LAeq,15min) of 80dB(A)/m was used. This is satisfactory according to our calculations, however, that approach does not account for the source height of the locomotive being higher than freight wagons. Therefore, Recommendation 1 above is pressed.

In accordance with the RING Appendix 3, noise from the rail loop operations are assessed as industrial noise sources under the INP. It is noted that there is no figure in the Hume Coal NVA showing the rail loop on the Site.[8] The Hume Response Report states that the boundary between the Hume Coal Project and the Berrima Rail Project is the point where product coal exits the train load out chute and enters the rail wagon on the rail loop. Nevertheless, the report asserts that noise emission from trains

[6] Query 3

[7] Query 4 and Query 6

[8] Query 5

on the rail loop including loading and unloading operations has been assessed in accordance with the INP. As both the rail loop and the 4m high rail noise barrier are now depicted in Figures 2a and 2B of the Hume Response Report, this query has been satisfactorily addressed.

No information is provided in the Hume Coal NVA in respect of rail squeal noise and how this was accounted for in the Site INP noise sources.[9] In our opinion, rail squeal noise should be considered according to the recommendations contained in Basutu *et al*. [10]

The Hume Response Report states that rail squeal corrections were not considered given the operational parameters of the rail loop and Hume Coal's commitment to best practice track/rail noise mitigation. It states that the curve gain corrections in Basutu *et al* do not apply to the rail loop because:

1. the train speed on the curved section of the rail track will be less than 10km/h;
2. it is a private rail line, whereby Hume Coal can manage the train speed without impacting other users; and
3. Hume Coal is committed to best practice rail/track noise mitigation including grinding, lubrication, and top-of-rail friction modifiers. Hanson *et al* [11] suggests that rail wheel squeal can be reduced significantly with track lubrication and top-of-rail friction modifiers. Measurements of track lubrication by Hanson *et al* specifically demonstrated a greater than 90% reduction in wheel squeal. Hanson *et al* report that more recent discoveries have found that the ability for three piece bogies (under wagons) to negotiate tight curves has been a key factor to wheel squeal due to poor rotation of the centre plate and high levels of bogie (or wagon) warp. The paper by Hanson *et al* goes on to state that this can be mitigated by using cross bracing or steering arms to reduce the warping affect.

The literature does not support the proposition that wheel squeal can be resolved only by reducing train speed [12] and therefore further measures are required incorporating track grinding, track lubrication, and the use of wagons that incorporate best available noise technology such as the use of steering bogies fitted with cross-bracing.

Recommendation 2: A comprehensive modelling and assessment of rail squeal noise impact associated with rail curves that are less than 500m radius is recommended. This would involve:

- Prediction of rail squeal noise levels for the project;
- Assessment of cumulative noise including rail squeal for rail operations within the site boundary in accordance with the INP and outside of the site boundary in accordance with the RING;
- Re-assessment of sleep disturbance including rail squeal noise contribution;

[9] Query 7

[10] L Basutu, D Hanson, C Schulten. Modelling Curve Gain in NSW. Acoustics Australia (2015) 43: 245-250

[11] D Hanson, J Jiandong, B Dowdell, R Dwight. Curve Squeal: Causes, Treatments and Results. internoise 2014

[12] J Jiang, D Hanson, B Dowdell. At-Source Control of Freight Rail Noise: A Case Study. Acoust Aust (2015) 43: 233-243

- Assessment of feasible and reasonable mitigation measures to mitigate rail squeal; and,
- Preparation of a rail noise management plan addressing noise monitoring and mitigation of rail noise including rail squeal.

In Table 4.3 of the Hume Coal NVA, the LAmax noise levels for intermittent sources are documented and it was confirmed in the Hume Response Report that these represent LAmax sound power levels. The location on Site of those noise sources is not described. In response to our query, [13] the location of the rail noise sources was described but not the other sources.

Recommendation 3: The Site location and heights of all noise sources assessed for sleep disturbance and the resulting noise levels at the most affected residential receivers should be provided.

5.6 Section 4.3 Construction noise

On page 44 of the Hume Coal NVA it is states that Appendix C details the construction scenarios and equipment considered in the construction noise assessment along with associated sound power levels, hours of operation and indicative scheduling. However, Appendix C shows no information regarding the equipment to be used, the numbers of equipment nor their locations. [14]

In response to that query, supplementary information was provided in Appendix A of the Hume Response Report which satisfactorily addresses the issue.

5.7 Section 5.1 Operational noise modelling results

Table 5.1 and Figures 5.1-5.3 of the Hume Coal NVA show the modelling results. The results indicate that VLAMP mitigation or acquisition is triggered for 11 dwellings numbered from 4 to 16 (with the exception of dwelling 7 and including 14A and 14B as two dwellings).

In our opinion, subject to a satisfactory response to the recommendations in this report, the modelling methodology appears appropriate and accords with INP guidelines.

In response to our query,[15] noise contours have been provided for the day-time and night-time periods (see Figures 3-5 in the Hume Response Report).

The noise contours show the predominant affected receivers are to the north of the Site. At these locations, the project specific noise level is 35 LAeq,15min for day, evening and night (see Table 5.1 of the Hume Coal NVA). The 35 LAeq,15min contour is shown in blue, the outer extremity of that contour representing 35dB(A). Comparing Figure 3 and Figure 5 shows the day-time and night-time adverse impacts are about the same.

[13] Query 8

[14] Query 9

[15] Query 10

An enquiry was made to the NSW EPA and the Department regarding interpretation of the VLAMP thresholds, whether an exceedence of 0.1dB(A) of the INP criteria triggers the requirement for treatment. For example, where the predicted level is "more than 5dB(A) above the project specific noise level" then the voluntary land acquisition rights are triggered. Does a level of 5.1dB(A) represent an exceedence? The response of both departments was that the predicted level is first to be rounded to the nearest integer before comparing with the threshold (for example, 5.1dB(A) is rounded down to 5dB(A) and 5.5dB(A) is rounded up to 6dB(A)).

It is evident from the figures that the area centred around the CPP is the predominant source of noise and that the rail loop and rail loop loading area are a significant contributor to noise emission. These two areas therefore should form the primary focus for noise mitigation treatment.

This is addressed in Recommendation 4 below.

5.8 Section 5.2 Summary of operational noise impacts

The 11 dwellings said to require noise mitigation treatment or acquisition are listed in Table 5.2 of the Hume Coal NVA. Noise mitigation treatments include the provision of mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity and, in certain circumstances, the upgrading of façade elements like windows, doors, roof insulation etc.

Under VLAMP, mitigation treatment is triggered when the PSNL is exceeded by 3dB(A) or more and voluntary land acquisition is triggered when the PSNL is exceeded by 5dB(A) or more, or when the INP maximum amenity levels are exceeded on more than 25% of any privately owned land where there is a dwelling or where a dwelling could be built.

A consent authority should only consider the application of VLAMP mitigation treatment and land acquisition rights where the proponent demonstrates that the noise levels exceed the PSNL "*even with the implementation of best practice management*". In Section 6 off the Hume Coal NVA, it states that the Site has committed to leading noise mitigation and management measures. The following table provides a commentary in respect of whether those measures represent "*best practice management*" and the response provided in the Hume Response Report. [16]

[16] Query 11

Table 1 Statement of commitments and commentary on best practice

Stated commitment	Does this commitment represent best practice management (reviewer's response)?	Hume Response Report
overall site design to reduce the height of acoustically significant plant and equipment wherever practicable	Not demonstrated	The following measures were implemented: • Stackers and reclaimers have been used on run-of-mine and product stockpiles rather than skyline conveyors and dozers on stockpiles which are commonly seen on coal mines. The product stacker operates at variable height, with most of the stockpile loading occurring close to the ground. • The head end of the drift conveyor and the tail end of the overland conveyor have been placed underground, rather than on the surface. The drift conveyor drives, the transfer point and the overland conveyor boot end will all be underground. This reduces noise and air quality impacts. • height of the train loading facility, including the associated product coal conveyor and bin was lowered by 4 to 5m following a more detailed assessment of grades around the balloon loop. This also meant that the rail embankment around the northern part of the loop was able to be lowered. This improves noise and visual amenity. • the main ventilation fan evasees will be horizontally rather than vertically oriented, reducing their height, and enabling them to be directed away from sensitive receptors.
highly considered placement of the surface infrastructure in coordination with other environmental constraints and flood levels as to maximise distance to surrounding residential properties	Not demonstrated	The surface infrastructure design was developed through several iterations of environmental constraints analysis. Preliminary noise modelling was undertaken for several design iterations in order to quantify the level of impact and inform changes in the mine design where feasible and reasonable. The surface infrastructure options that were considered are explained in Section 6.3 of the main EIS. Based on experience, this process is typically not followed in mine design process. Typically a noise impact assessment would be prepared on a prefeasibility or a final mine plan design. This offers little opportunity for wholesale changes, for example, to the surface infrastructure layout, which has been possible on the Hume Coal Project through the constraints analysis exercise.
automated coal handling using stackers and reclaimers to minimise the reliance on mobile plant and equipment (e.g. dozers)	Accepted, however, it needs to be demonstrated that the use of additional noise mounds or noise barriers are not feasible or reasonable	Stackers and reclaimers drives are fully enclosed. These are not highly ranked noise sources and do not warrant additional noise barriers or bunding. Notwithstanding, the use of noise mounds or noise barriers would very unlikely be feasible as the height would have to be significant in order to be effective during adverse weather and given the relative position of plant, any noise barrier and receivers.
machined steel idlers on all conveyors	Not demonstrated	This is demonstrated in the sound power level that has been adopted 75 dBA/m. Based on measurements conducted by EMM, conveyors with standard idlers would typically generate a sound power level of 81 dBA/m at the proposed belt speed of 5 m/s.
enclosures on conveyor drives, crushing plant, tertiary screens, paste plant and CPP	This is standard equipment	This is good practice. In our experience, many mines have open crushing and screening plant, conveyor drives and conveyors. This provides typical reductions of 10 dBA for conveyor drives, crushing plant, tertiary screens and paste plant, and approximately 20 dBA for the CPP.
low frequency noise mitigation to the CPP, including variable voltage variable frequency (VVVF) drives, concrete platforms for screens, increased steelwork to stiffen the structure and bespoke cladding system	The use of VVVF drives is standard equipment. Vibration isolation of machinery is standard practice.	VVVF drives are not adopted on all screens within CPPs in our experience. This includes a number of coal mines in the Hunter Valley for example that we have assessed. The collective design of the CPP including concrete platforms to accommodate screens and the increased stiffness in the base structure are additional to standard design. Such details are not commonly considered at the EIS stage and the design will be developed further throughout the next phase of the project.

Stated commitment	Does this commitment represent best practice management (reviewer's response)?	Hume Response Report
ventilation fan attenuation	This is standard equipment. It has not been demonstrated that the use of additional silencing treatment is not feasible or reasonable.	Attenuation on fans (by definition) is not standard equipment. In any case ventilation fans are not a highly ranked noise source with the stated mitigation (which includes horizontal discharge). Overall sound power level of a single fan has been significantly reduced with consideration also given to eliminating low frequency noise.
dozer operation during the day-time only	Accepted, however, if the dozer is a highly ranked noise source during the day-time, the use of local mounding or noise barriers should also be considered.	The rejects stockpile is 30 m high. Local mounding is neither feasible nor practical from an operational perspective. As part of the site Noise Management Plan (developed in post approvals phase), management strategies will be implemented to ensure dozer operations are not conducted during adverse weather conditions such as high wind conditions or temperature inversions.
limited workshop activities during the evening and night periods	Not demonstrated. Are these highly ranked noise sources?	Not highly ranked but nonetheless a commitment from Hume Coal.
procurement of latest generation low noise emission AC locomotives with electronically controlled pneumatic brakes	Not demonstrated	Latest generation AC locomotives that will be purchased by Hume Coal will be fitted as standard with electronically controlled pneumatic brakes. The brakes synchronously apply brake force to each wagon. This limits the potential for the brake force to be varied between wagons and therefore decelerating at different rates, limiting the bunching affect. Conversely this also applies to when trains accelerate where stretching of wagons is minimised.
constructing a rail noise barrier to the north of the rail loop to attenuate noise levels from loading and rail loop activity	Not shown in the report, no assessment presented.	A 4m high noise barrier will be constructed at the rail loop at the location shown in Figure 1, 2a and 2b herein. This was explained in Section 2.3.5 and shown in Figure 2.4 of the Berrima Rail Project EIS, noting again that the rail loop falls within the Berrima Rail Project scope, however, it was assessed in accordance with the INP along with the Hume Coal Project.

In our opinion, the response provided is insufficient. In order to demonstrate the implementation of best practice management, the following steps are required:

1) rank order the major noise sources in terms of noise level at representative residences;

2) for each noise source, determine feasible and reasonable options for reducing the emitted sound level; and,

3) recalculate the final noise levels to determine if the PSNLs can be complied with.

Only upon implementing this methodology can it be satisfactorily claimed that all feasible and reasonable options have been considered and implemented in the Hume Coal Project.

Recommendation 4: The use of VLAMP treatment and land acquisition rights is premature as it has not been demonstrated that best practice management has been implemented in the Hume Coal Project.

5.9 Section 5.5 Sleep disturbance assessment

Table 5.4 of the Hume Coal NVA shows an assessment of sleep disturbance. It was noted in Section 5.5 above that there is a concern that the source locations are not shown and also impulsive or intermittent noise sources such as haul wagon impacts and rail squeal noise are not included in the assessment. Importantly, the effect of any intervening noise mounds or walls (for example, the 4m high rail noise barrier) are not documented.

The Hume Response Report asserts that the latest generation AC (alternating current) locomotives will be purchased by Hume Coal and will be fitted as standard with electronically controlled pneumatic (**ECP**) brakes. The brakes apply brake force to each wagon instantaneously. This limits the potential for the brake force to be varied between wagons and therefore decelerating at different rates, limiting the bunching affect. Conversely this also applies to when trains accelerate where stretching of wagons is minimised. The issue of haul wagon impacts is therefore satisfactorily resolved.

Irrespective of those observations, the table shows exceedences of the sleep disturbance screening level particularly at dwellings 16 and 17 for which there are a 3-6dB and 3dB exceedence respectively. In the Berrima Rail Project it is stated that there are up to 4 train movements per night.

As a consequence of the Hume Coal NVA adopting an acceptability criterion of 60 to 65dB(A) outside (which are not exceeded in Table 5.4), it concludes that sleep disturbance from the project are considered unlikely. For the reasons stated in Section 5.1 of this report above, we do not agree with that assessment.

If there are four rail movements a night and rail squeal is not mitigated, then there is a strong possibility that there will be a significant issue of sleep disturbance. There is no assessment of this issue in the Hume Coal NVA. [17]

[17] Query 12 and 13

The Hume Response Report states that a slow movement of a train on the rail loop at a crawl speed of less than 10 km/h "*will not register a LAmax 'event' of the same magnitude to the sleep disturbance level when observed at residences*". We accept this, given that short duration impulsive sounds are more likely to cause sleep disturbance than sounds having a slow rise and fall time. However, the sound level produced by wheel squeal can be significant if not adequately mitigated.

In respect of wheel squeal, the Hume Response Report states that this occurrence will be unlikely because Hume Coal are committed to implementing additional noise mitigation should this occur. We refer to Recommendation 2 above.

5.10 Section 5.7 Construction noise

In Appendix C of the Hume Coal NVA, construction scenarios are presented, however, as previously stated in Section 5.6 above of this report there is a lack of information, which was raised as a query.

The predicted construction noise levels are presented in Appendix D of the Hume Coal NVA.

The first criticism is that the results in Appendix D of the Hume Coal NVA are cluttered with data relating to residences far removed from the Site for which it should be abundantly clear that noise impacts would be minimal. This is evident in Appendix D of the Hume Coal NVA which shows a multiplicity of zeros and "n/a" in the columns. The result is that the reader is left with a confusing presentation of the results and the important locations experiencing noise impacts are obscured, especially in this case where there are multiple scenarios involved. One would need to track a residence through every table to determine noise impacts arising from the different scenarios.

The Hume Response Report has now provided (in Appendix B of that report) an abridged set of tables for each phase of construction which is acceptable.

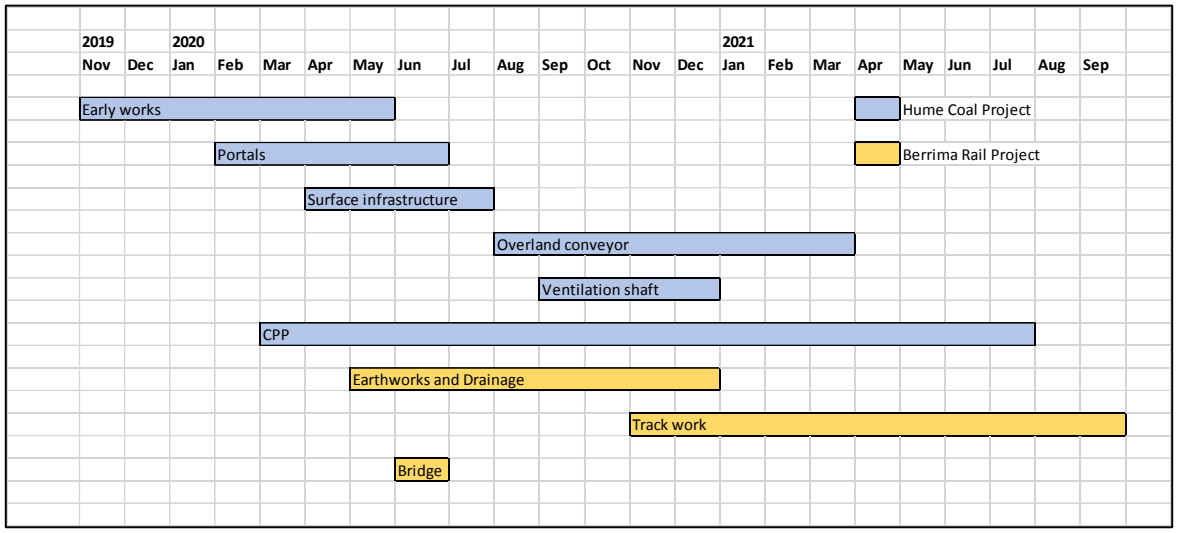
The second criticism is that there is very little discussion on how noise impacts can be mitigated. For example, in Table D.1 Early Works, there are significant noise impacts up to 16dB above the NML during construction of the CPP access road and temporary construction facility (TCF). The residents affected are the group 4-16 to the north of the site (as shown in Figure 2.2). Whilst Appendix C indicates this phase of the works occurs for about 6 months, it is not clear for how long the 16dB exceedence will occur. There is no discussion about what residents will hear and for how long.

The Hume Response Report states that this detail will be provided in a construction noise and vibration management plan (**CNVMP**). We accept that a CNVMP is the appropriate document for a detailed noise and vibration assessment and recommend a strongly worded condition to ensure that the CNVMP will be effective in mitigating construction noise and vibration to reasonable levels in accordance with the guidelines contained in the EPA's ICNG.

The third criticism is that the calculations in Appendix D of the Hume Coal NVA relate to one scenario occurring at the one time. There is no consideration of cumulative noise impacts when multiple scenarios occur as evidenced in the following query.

Figure 1 below shows the interleaving nature of the construction works extracted from the timing information provided in Appendix C of the Hume Coal NVA. In Appendix D of the Hume Coal NVA, noise impacts at each dwelling from each of the construction scenarios are determined independently (such as from Early Works, Portals, Surface Infrastructure etc). However, at any point in time, the cumulative noise impacts from a multiplicity of scenarios is not considered. For example, in June 2020, construction involves the Portals, Surface infrastructure, CPP, Berrima Rail Earthworks and Drainage and the Rail Bridge construction). This is true also of the cumulative construction activity from the Hume Coal Project and the Berrima Rail Project which is shown as overlapping in Figure 1 below. Whilst the assessment is complicated in that noise from two scenarios may not impact on the same residential receiver, the point is that a cumulative assessment has not been made to determine whether there are likely to be additional construction noise impacts.

Figure 1 Staging of construction scenarios



Fourthly, there is no appreciation from the point of view of each receptor dwelling as to what noise levels they will be exposed to during the course of the construction.

A time-line perspective of noise impact was therefore requested from the point of view of each class of receivers, for example, the nearest receiver to the north of the site, the nearest to the south, etc. A time-line of noise levels was requested for both night-time and daytime so that a proper assessment of the perceived noise levels can be made. [18]

The time-line requested is provided in Figures 7-12 of the Hume Response Report for receptor locations 10, 17 and 54. These figures provide a realistic appraisal of construction noise impacts at these receptor locations.

Fifthly and finally, there is very little information provided in regards to methods of reducing construction noise impacts. Other than the use of a localised noise barrier for the blind bore rig used during the Surface Infrastructure scenario there is very little information provided on feasible and

[18] Query 14 and 15

reasonable methods of reducing construction noise impacts. For example, the recommendations in Section 6 Work Practices in the ICNG could be referred to and where appropriate incorporated into the project. [19]

The Hume Response Report contends that this information will ultimately be provided in a CNVMP and we refer to Recommendation 5 above.

Recommendation 5: We recommend the preparation of a comprehensive construction noise and vibration management plan (CNVMP) to be submitted to the Department for review and approval. The CNVMP should incorporate the following key elements:

i. prepared in accordance with the EPA's ICNG;

ii. establish construction management noise levels;

iii. a cumulative assessment of construction noise impacts from all phases of works;

iv. a comprehensive schedule of noise measurement;

v. a plan for responding to complaints and noise exceedences;

vi. a comprehensive plan for stakeholder engagement and negotiation of respite periods in accordance with the ICNG;

vii. assess and recommend reasonable and feasible noise mitigation measures; and,

viii. monitoring the effectiveness of the noise mitigation measures.

Recommendation 6: It is recommended that the CNVMP address construction noise impacts in terms of the time-line form depicted in Figures 7-12 of the Hume Response Report.

6 Berrima Rail NVA

This section discusses the Berrima Rail NVA. Much of Section 2 and Section 3 of the Berrima Rail NVA addressing the existing environment and describing applicable criteria is common with the Hume Coal NVA and therefore does not need to be addressed again in this report.

The Berrima Rail Project includes the construction and operation of a rail maintenance facility located between the Hume Highway and the Old Hume Highway immediately to the east of the Site. Noise from the rail maintenance facility is assessed in accordance with the INP. Noise from the non-network rail track from the Site to Berrima junction (where it connects with the Main Southern Railway) is assessed in accordance with the RING.

The VLAMP mitigation and voluntary acquisition provisions apply to the non-network rail operations. These are discussed in Section 3.4.2 of the Berrima Rail NVA. In addition, an assessment is also required

[19] Query 16

of the increase in rail noise level on network rail lines attributable to the project in accordance with Appendix 2 of the RING which is discussed in Section 3.4.3 of the Berrima Rail NVA.

6.1 Section 4.1 Overview

This section deals with the acoustic model used in the Berrima Rail NVA for prediction of rail noise at the nearest affected receivers. In response to our query, it was confirmed in the Berrima Response Report that noise modelling was undertaken in accordance with ISO 9613 Standard Parts 1 and 2.[20] In addition, the Bruel & Kjaer Predictor software program used by Hume Coal's consultant implements the CONCAWE algorithms to predict wind and temperature inversion enhancement. This is an acceptable methodology.

The Berrima Response Report describes the calibration process used to determine the sound power level per meter of train resulting in an Lw/m,15min of 80dB(A) which is accepted as being appropriate for the class of locomotives and freight wagons to be used on the spur link.

It is assumed that the LAmax noise levels from train movements has been determined from the attended and non-attended noise monitoring (Table 4.5 of the Berrima Rail NVA).

The Berrima Rail NVA describes the proposed 4m high rail noise wall located north of the rail loop but is otherwise devoid of detail.[21] However, this was discussed in detail and dealt with in Section 5.5 above.

6.2 Section 4.3 Construction noise

As in the Hume Coal NVA, the assessment of construction noise is poorly described. In particular, Table 4.2 of the Berrima Rail NVA is devoid of detail in respect of what equipment is used in the modelling, how long it operates for and where it is placed. Furthermore, the assessment of cumulative construction noise is not undertaken as previously described. Similarly, there is no appreciation of what noise level residences will be exposed to over the period of construction and what feasible and reasonable noise mitigation treatments are to be applied. [22]

The Berrima Response Report repeats the information in the Hume Response Report.

Reference is made to Section 5.10 of this report where this issue is dealt with.

6.3 Section 4.4 Operational noise - maintenance facility

There is no description in the Berrima Rail NVA of the acoustic model used for predicting noise impacts from the maintenance facility, whether shielding from buildings was included in the model nor any

[20] Query 17

[21] Query 18

[22] Query 19

description in respect of the heights of noise sources. In addition, the Lw for slow moving locomotives is considered low and the noise contribution from the movement of haul wagons is not included in the table. [23]

The Berrima Response Report provides a detailed description of the acoustic model including heights of noise sources. However, we press the sound power level of a single locomotive in motion should be 108dB(A) with a source height of 4m.

Recommendation 7: The maintenance facility should be remodelled and reassessed with a locomotive in motion having a sound power level of 108dB(A) with a source height of 4m whilst that locomotive is located within the maintenance facility boundary.

6.4 Section 4.6.1 Non-network rail noise

Table 4.5 of the Berrima Rail NVA presents results of attended noise measurements of haul trains on the existing Berrima Branch Line at a position which is close to residential location 28. A more detailed description of the measurement location was requested as these noise measurements appear to have been used to validate the noise model. In particular, the train speed, train length, a description of the existing track construction and maintenance condition, a plan showing the location of the noise measurement with reference to the nearest residences, distance to the rail tracks, details of the sound level meter used, the prevailing weather conditions during testing and a photograph showing the absence of any obstructions between the measurement location and the rail line was requested.[24]

The Berrima Response Report provides a detailed description of the noise measurement calibration including a photograph as requested above and a plan showing the noise measurement location.

As a point of clarification, the Berrima Response Report explains that the relevance of Figure 4.1 showing a sample of unattended train passby noise levels at the noise measurement location is to demonstrate that the noise levels measured during the day of calibration were typical of that experienced during normal operation. [25]

In the text following Figure 4.1, it states that the modelled speed of trains on the private rail line is up to 20km/h and this speed has been confirmed based on data obtained from current users. As speed is an important variable in the prediction of noise emission, corroborating data was requested.[26] The Berrima Response Report explained that the assumed operating speed of 20km/h on the rail spur is limited by operational constraints on the line which we accept.

[23] Query 20

[24] Query 21

[25] Query 22

[26] Query 23

6.5 Section 5.1 Construction noise assessment

In Section 5.2 of this report above, we are critical of the inclusion of 75 potentially noise sensitive assessment locations as depicted in Figure 2.1 of the Hume Coal NVA and Figure 2.1 of the Berrima Rail NVA. The reason is that most of these locations lie outside of the zone of affectation of both the Hume Coal Project and the Berrima Rail Project and their inclusion is superfluous, clutters the results and gives the reader the impression that a majority of locations comply with the NMLs.

In fact, not only an impression, but it is overtly stated in the paragraph below Table 5.1 of the Berrima Rail NVA that:

"Construction noise levels are predicted to satisfy noise management levels for the majority of the assessment locations (ie at two-thirds or 50 of them). However, exceedences of up to 26dB above the standard construction hours NMLs is predicted at location 28. …"

This is misleading because the only reason why a majority of assessment locations comply with the NMLs is because they are not in the zone of affectation. In reality, there are a significant number of residential locations which exceed the NMLs. [27]

Construction noise impacts are discussed in Section 5.10 above.

6.6 Section 5.5 Sleep disturbance

The advice provided in our interim report dated 1 Sept 2017 is retracted. It is confirmed the EPA's approach to sleep disturbance differs for industry, road and rail. Therefore, an assessment relating to the INP sleep disturbance screening level is inappropriate. [28]

The EPA's policy in the RING in respect of sleep disturbance caused by rail traffic is as follows: [29]

When developing the Night noise guidelines for Europe (WHO 2009), the WHO European office reviewed available research to examine the effects of night noise on sleep and the relationship between sleep and health. The review concluded there is sufficient evidence to indicate night noise is related to sleep disturbance and disturbed sleep is associated with a number of adverse effects on health. Based on this review, the WHO recommends an interim target of 55 dB(A) for airborne noise. This is an indicator of long-term health effects and is a representation of a one year external LAeq over an eight-hour (night) period and cannot be compared directly with the noise trigger levels within this guideline.

LAeq, which is the energy average level of a noise signal over a given period, accounts for the number and level of the louder events in a signal. This is due to the high amount of energy such events carry. However, the consensus is that LAeq by itself is an inadequate predictor of the potential of a varying noise to disturb

[27] Query 24

[28] Query 25

[29] Section 5.2 RING. This policy should not be confused with the EPA's sleep disturbance policy for industrial noise contained in the application notes to the INP. http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm

people. The LAmax descriptor addresses the maximum noise level due to individual pass-by events and provides a way to account for the potential disturbance from such individual events. For the time being, the LAmax noise level descriptor and the number of anticipated LAmax events during the night-time period will continue to be included in rail-noise assessments.

While research is making considerable advances towards building a whole picture of the relationship between noise exposures and human health, it has some way still to go before these can be translated into practical and justifiable criteria. Research will continue to be monitored.

Therefore, what is required is an assessment of LAmax noise levels based on existing and anticipated LAmax events. As previously stated, night-time train movements will increase from the current 12 movements per night to 16 movements per night. A noise level of 56 LAmax is predicted at the nearest residence from train passbys (Section 5.5 Berrima Rail NVA). However, this does not include rail squeal noise on sections of rail where this might occur.

Therefore, whilst the new rail traffic will not increase the LAmax currently being experienced by nearby residents, there will be an increase in the number of movements from 12 to 16 per night.

In Table 5.3 of the Berrima Rail NVA, the existing LAeq,night currently exceeds the rail noise trigger level of 40 LAeq,night at location 28 and 29. As the table shows, there will be an increase in the LAeq,night arising from the proposal. In such circumstances, consideration should be given to whether the increase in LAeq,night is significant and, in the absence of a specific guideline in Appendix 3 of the RING for non-network rail traffic, the relative increase criteria in Appendix 2 of the RING for network rail traffic might be relied upon.

This is discussed further in Section 6.8 below with a recommendation.

6.7 Section 6.1.1 Feasible and reasonable measures

The following commitments are stated to be offered for leading noise mitigation and management together with commentary and the response from the Berrima Response Report:[30]

[30] Query 26

Table 2 Statement of commitments and commentary on best practice

Stated commitment	Does this commitment represent best practice management ?	Berrima Response Report
highly considered lateral placement of the new elements of the project, taking into consideration potential sensitive noise receivers as well as other environmental and physical constraints, and topography	Not demonstrated	The placement of all project elements was developed through several iterations of environmental constraints analysis. Preliminary noise modelling was undertaken for several design iterations in order to quantify the level of impact and inform changes in the design where feasible and reasonable.
use of latest generation AC locomotives, as well as wagons with electronically controlled pneumatic brakes	Not demonstrated	Latest generation AC locomotives that will be purchased by Hume Coal will be fitted as standard with electronically controlled pneumatic brakes. The brakes apply brake force to each wagon instantaneously. This limits the potential for the brake force to be varied between wagons and therefore decelerating at different rates, limiting the bunching affect. Conversely this also applies to when trains accelerate where stretching of wagons is minimised.
minimisation of rail squeal through avoiding tight rail curves (where possible), and effective curve design and construction (eg rail grinding and gauge widening)	Not demonstrated	This is good practice. If wheel squeal is still found to be an issue, there are a number of measures that Hume Coal are able to implement to minimise wheel squeal.
construction of a noise wall to the north of the rail loop, to attenuate noise levels from rail activities, as shown in Figure 1.3	Not relevant to noise from the non-network rail line	Not relevant to noise from the non-network rail line.
construction of a locomotive shed at the northern provisioning point to minimise noise from idling locomotives	Not demonstrated	This is good practice.

6.8 Section 6.1.2 Voluntary mitigation

It is stated in Section 5.4.1 of the Berrima Rail NVA that there would be an exceedence of the VLAMP rail noise voluntary mitigation criterion of 3-5dB for location 28 which would trigger voluntary mitigation rights at this location. However, it has not been demonstrated that there are no other feasible and reasonable mitigation options available for this residential location. For example, would a noise barrier constructed on rail land be feasible and reasonable to mitigate those noise impacts? [31]

In the Berrima Response Report, the justification for not constructing a noise barrier at location 28 is that the increase in the LAeq,period is only 1dB and therefore a negligible increase. However, if one were to apply the methodology in Appendix 2 of the RING for network traffic, a 1dB increase warrants feasible and reasonable consideration.

According to Appendix 2 of the RING for network traffic, land-use developments other than rail projects that are likely to generate additional rail traffic on an existing rail network should be assessed against the following requirements:

…

- *Implement all feasible and reasonable noise mitigation measures where the cumulative noise level exceeds the noise assessment trigger levels and project-related noise increases are predicted.*
- *Where the LAeq noise level increases are more than 2 dB(A), which is equivalent to approximately 60 per cent of the total line or corridor rail traffic, and exceeds the relevant noise assessment trigger level, strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.*

Notes

1. A project-related noise increase is an increase of more than 0.5 dB over the day or night periods.

…

In other words, project related increases of more than 0.5dB up to 2dB(A) warrant consideration of feasible and reasonable mitigation measures.

Whilst this guideline relates specifically to network traffic, given EPA's stated intent that a more stringent noise trigger level should be applied to non-network rail lines as the activity is not public infrastructure,[32] then there is no reason why the guideline in Appendix 2 would not be relevant in circumstances where these is an exceedence of the noise trigger level associated with non-network rail traffic and there is no other relevant guideline in Appendix 3.

[31] Query 27

[32] Page 30 RING

Recommendation 8: A detailed investigation should be conducted into rail noise at residential locations 28 and 29. The principle in Appendix 2 of the RING (for network traffic) should be applied in respect of the exceedence of the rail trigger noise level and the increase in the LAeq,night arising from the proposal. Feasible and reasonable justification should be provided as to why at-source mitigation treatment (in the way of construction of a noise barrier and/or a regular program of rail grinding, for example) would not be feasible or reasonable.

6.9 Section 6.2 Construction

The text in this section states that a CEMP that will address noise and vibration management and mitigation options (where required), will be produced prior to construction.

This issue has been dealt with in Section 5.10 above.

7 Conclusion

Renzo Tonin & Associates was engaged by NSW Department of Planning & Environment to give advice in respect of noise impacts associated with the construction and operation of two projects, namely the Hume Coal Project and the Berrima Rail Project. The noise assessments presented in the combined Environmental Impact Statement for those projects predict a number of exceedances of the recommended project specific noise levels, as prescribed in the EPA's guidelines, are likely to occur.

A detailed list of queries was submitted and responded to by Hume Coal.

Our review finds that rail squeal on the rail loop and on the spur line has not been adequately assessed and recommends a set of conditions to ensure rail squeal is mitigated.

In our opinion, there is an inadequate consideration of sleep disturbance impact, especially from rail movements on site.

Construction will occur for a period exceeding twelve months with multiple scenarios and with work occurring at multiple locations on the Site. Both the Hume Coal Project and the Berrima Rail Project will be constructed at the same time and the cumulative assessment of construction noise and time-line of noise exposure presented here-in as viewed from selected residential dwellings demonstrates the need to consider feasible and reasonable noise mitigation measures.

Finally, in our opinion, there is no detailed consideration given to feasible and reasonable noise mitigation options and reliance is instead placed on VLAMP mitigation treatment and land acquisition rights which involve fairly low cost treatments to be applied to the dwellings to the disadvantage of the occupants. There is no demonstration that all feasible and reasonable options have been exhausted before the VLAMP rights are applied.

The following recommendations are made:

Recommendation 1: The effective source height for locomotives should be 4m requiring a reassessment of predicted noise levels. A description of the noise modelling methodology should be provided justifying the design of the rail loop noise barrier.

Recommendation 2: A comprehensive modelling and assessment of rail squeal noise impact associated with rail curves that are less than 500m radius is recommended. This would involve:

- Prediction of rail squeal noise levels for the project;
- Assessment of cumulative noise including rail squeal for rail operations within the site boundary in accordance with the INP and outside of the site boundary in accordance with the RING;
- Re-assessment of sleep disturbance including rail squeal noise contribution;
- Assessment of feasible and reasonable mitigation measures to mitigate rail squeal; and,
- Preparation of a rail noise management plan addressing noise monitoring and mitigation of rail noise including rail squeal.

Recommendation 3: The Site location and heights of all noise sources assessed for sleep disturbance and the resulting noise levels at the most affected residential receivers should be provided.

Recommendation 4: The use of VLAMP treatment and land acquisition rights is premature as it has not been demonstrated that best practice management has been implemented in the Hume Coal Project.

Recommendation 5: We recommend the preparation of a comprehensive construction noise and vibration management plan (CNVMP) to be submitted to the Department for review and approval. The CNVMP should incorporate the following key elements:

i. prepared in accordance with the EPA's ICNG;
ii. establish construction management noise levels;
iii. a cumulative assessment of construction noise impacts from all phases of works;
iv. a comprehensive schedule of noise measurement;
v. a plan for responding to complaints and noise exceedences;
vi. a comprehensive plan for stakeholder engagement and negotiation of respite periods in accordance with the ICNG;
vii. assess and recommend reasonable and feasible noise mitigation measures; and,
viii. monitoring the effectiveness of the noise mitigation measures.

Recommendation 6: It is recommended that the CNVMP address construction noise impacts in terms of the time-line form depicted in Figures 7-12 of the Hume Response Report.

Recommendation 7: The maintenance facility should be remodelled and reassessed with a locomotive in motion having a sound power level of 108dB(A) with a source height of 4m whilst that locomotive is located within the maintenance facility boundary.

Recommendation 8: A detailed investigation should be conducted into rail noise at residential locations 28 and 29. The principle in Appendix 2 of the RING (for network traffic) should be applied in respect of the exceedence of the rail trigger noise level and the increase in the LAeq,night arising from the proposal. Feasible and reasonable justification should be provided as to why at-source mitigation treatment (in the way of construction of a noise barrier and/or a regular program of rail grinding, for example) would not be feasible or reasonable.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
06.08.2017	Issued as draft for comment	0-3	4	RT	RT	
01.09.2017	Issued as final interim report		5	RT	RT	RT
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04.12.2017	Issued as final		9	RT	RT	RT
04.12.2017	Issued as amended final		10	RT	RT	RT

References

[1] Secretary's Environmental Assessment Requirements for the Hume Coal Project. SSD 7172 dated 20 August 2015

[2] Secretary's Environmental Assessment Requirements for the Berrima Rail Project. SSD 7171 dated 20 August 2015

[3] NSW Industrial Noise Policy. EPA. Jan 2000 (**INP**)

[4] Interim Construction Noise Guideline. Dpt of Environment & Climate Change NSW. July 2009 (**ICNG**)

[5] NSW Road Noise Policy issued by the EPA. Mar 2011 (**RNP**)

[6] Assessing Vibration: a Technical Guideline issued by the EPA. Feb 2006 (**Vibration Guideline**)

[7] Rail Infrastructure Noise Guideline, NSW EPA. May 2013 (**RING**)

[8] Voluntary Land Acquisition and Mitigation Policy issued by the Dpt of Planning and Environment. Dec 2014 (**VLAMP**)

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Curriculum vitae of Renzo Tonin

RENZO TONIN & ASSOCIATES
inspired to achieve

Curriculum Vitae

Renzo Tonin

Consultant

Qualifications

- Ph.D. (Mech Eng), B.Sc (Hons.) University of Adelaide
- Fellow Australian Acoustical Society
- Fellow Engineers Australia
- Member Acoustical Society of America
- NPER, RPEQ
- NATA Accredited Signatory

Appointments

- Honorary Affiliate and Member - Woolcock Institute of Medical Research Limited
- Standards Committee AV-002 Acoustics – Instrumentation and Measurement Techniques.

Awards

- Australian Acoustical Society Award for Excellence in Acoustics 1988 . "New Studios for Radio 2EA"
- Australian Acoustical Society Award for Excellence in Acoustics 1992. "Victoria Barracks 2nd Military District Band Practice Facility

Key Skills and Competencies

Dr Tonin's belief that high technology acoustics and dynamics engineering should form part of every day consulting has found acceptance with many clients. This is reflected in a strong company growth rate from private practice in November 1982 to one of the largest consulting companies specialising in acoustics engineering today.

His sponsored studies encompass such diverse activities as radio and TV studios, commercial buildings, ships, motor vehicles, trains, industrial complexes, power stations, product development, material handling plant, machine health monitoring, coal washeries, public buildings and auditoria.

His special interest is in the use of computer technology to solve problems in the fields of acoustics and dynamics.

He is a contributing author to the book "Environmental Modeling" which is a publication designed to bring together current expertise on modeling of the environment using computer based techniques.

His doctorial thesis addressed the use of laser 3D holography for the study of vibration. A distinguished international journal honored his work in this field by presenting one of his papers as a featured article.

His sponsored studies include the following; Industrial noise, construction noise & vibration, occupational noise, structural vibration, acoustic research & development, architectural acoustics, building mechanical services and expert representation in legal cases.

Relevant Experience

ROADS AND MOTORWAYS

M5 and M5 East EIS, M4 motorway, Silverwater Road Extension, Princes Highway - Oak Flats to Dunmore EIS, Tomerong Bypass EIS, F2 Castlereagh Freeway, Phillip Parkway EIS, Liverpool to Hornsby Highway Strategy Study, Elizabeth Drive Upgrade, Western Sydney Orbital and Badgery's Creek Highway, M2 Motorway Noise Barriers, Albury Wodonga National Highway, M4 Western Motorway Via-Duct, Church Street to James Ruse Drive, Granville.

RAIL INFRASTRUCTURE

Epping to Chatswood Rail Line (ECRL); Very Fast Train (VFT); Perisher SkiTube; Tangara double-deck train acoustics; assessment and design of noise and vibration isolation systems of multiple suburban and inner city residential and commercial developments alongside or above railway lines and railway tunnels.

South-West Rail Link, SWRL Glenfield to Leppington Rail Line, GLRL (D&C);

Southern Sydney Freight Line ONVMP (Peer Review); Epping to Chatswood Rail Line, ECRL (Design Review); Very Fast Train (VFT); Perisher SkiTube;.

RAIL CORRIDOR DEVELOPMENTS

Assessment and design of multiple suburban and inner city residential and commercial developments alongside or above railway lines and railway tunnels

RAIL ROLLING STOCK

Tangara double-deck train acoustics.

PUBLIC HEARINGS AND INQUIRIES

Possum Brush Quarry Inquiry, Mt Arthur South Inquiry, Rix's Creek Inquiry, F2 Castlereagh Freeway Inquiry, Bulga Mine Inquiry, Mt Flora Quarry Hearing, Cleary Bros Sand Mine Hearing.

WIND FARMS

Taralga Wind Farm NSW, Toora Wind Farm VIC, Winchelsea Wind Farm VIC, Glen Innes Wind Farm NSW, Gullen Range Wind Farm NSW, Cullerin Range Wind Farm NSW, Capital Wind Farm NSW, Woodlawn Wind Farm NSW, Crudine Ridge Wind Farm NSW.

GOVERNMENT BUILDINGS

Sydney Entertainment Centre sound reinforcement system, the Glebe Remand Centre floating floor project, Applied Arts & Sciences Stage II expansion, Geological & Mining Museum, the Mint and Barracks building refurbishment, Sydney Football Stadium and the Darling Harbour Development.

HOTELS

Observatory Hotel, Sydney Hilton, Sydney Regent, Ritz/Carlton, Sheraton Hyde park, Country Comfort Central, World Square, Hyde Park Plaza, Sheraton Hobart, Campbell St Hotel, Novotel Darling Harbour, Bullecourt place, La Galleria Kings Cross, Bayswater Hotel, Park Hyatt, Parramatta Hotel, Sheraton Airport Central, Chatswood Connection.

COMMERCIAL TOWERS

QV1 development Perth, Robt Jones Tower Auckland NZ, 135 King St, Australia Square refurbishment, Landmark, 545 Kent St, Metroplaza North Sydney, Airport Central Commercial, Chatswood Connection, Chatswood Interchange, 45 Clarence St.

APARTMENT/RESIDENTIAL

Raleigh Park, Quay West, Frenchs Forest, Port Jackson Tower, HighGate Kent St, Northborne Ave Canberra, Crown Street Apartments, Crown Gardens, Villa Development, 19-21 George St North Strathfield, Mark Foys Warehouse Apartments, Frenchs Forest Medium Density, Linda St Hornsby, Camden Retirement Village, The Elan, 37 Glen St Milsons Point, Hawthornden Estate, Rockwall Apartments, Pavilion On The Harbour.

SOUND SYSTEM DESIGN

Sydney Entertainment Centre, Darling Harbour Convention Centre and Exhibition Halls, Darling Harbour Park Sound System, Baulkham Hills Entertainment Centre, Sydney Sports Stadium, Hallstrom Park Sports Complex, Homebush Sports Centre, NSW.

ROTATING MACHINERY VIBRATION

Electricity Commission of NSW - Liddell Generating Station: Unit 2 multi-plane balance, Electricity Generating Authority - Investigation of high vibration levels of both Boiler Feed Pump and Turbine, Electricity Generating Authority - Investigation of cause of shaft bow and severe bearing damage in vertical cooling water pumps ,ICI Olefines Plant – Sydney, APCL - Kandos NSW, CIG, Shell Clyde Refinery, Alcan Kurri Kurri, Water Board.

STRUCTURAL DYNAMICS

Munmorah Power Station – High density modal analysis of generator casing to locate source of excessive high frequency casing vibration, Hail Creek Coal Preparation Plant – FEA analysis of structural vibration in 7 storey industrial structure with respect to human vibration exposure and structural damage criteria, Vales Point Generating Station: Unit 3 fatigue investigation, Snowy Mountains Hydro-Electric Authority - Murray 2 Power Station - Pipeline vibration investigation, Electricity Generating Authority – Condenser tube vibration analysis, Electricity Generating Authority – Boiler feed pump booster low frequency vibration analysis, Gas Supply Authority – Pipework vibration analysis

Professional History

- 2016 - Consultant, Renzo Tonin & Associates (NSW) Pty Ltd
- 1982-2016 - Director and Principal, Renzo Tonin & Associates Pty Ltd
- 1979-1982 - Associate Director and Sydney Office Manager, Vipac & Partners Pty Ltd
- 1976-1978 - Post graduate studies, University of Adelaide Mechanical Engineering Department

Books

- Environmental Modeling - Vol 1. Chapter 7. Environmental Noise Modeling. P Zannetti ed. Computational Mechanics Publications. 1993.

Publications

- Time-Averaged Holography For The Study of Three-Dimensional Vibrations. Journal of Sound and Vibration (1977) 52 (3), 315-323.
- General Theory of Time-Averaged Holography for the Study of Three- Dimensional Vibrations at a Single Frequency. Journal of the Optical Society of America (1978) 68 (7), 924-931.
- Analysis of 3-D Vibrations from Time-Averaged Holograms. Applied Optics (1978) 17 (23), 3713-3721. (Featured Article).
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- Application of Modelling Techniques to Resolving a Dynamics Problem in a Building Structure. The First Australasian MSC Users Conference, June 1987.
- Vibration Isolation of Impacts in High-Rise Structures. The Second Australasian MSC Users Conference, Nov 1988.
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- Acoustic and Vibration Insulation in Buildings. Building Science Forum of Australia Seminar. 'Insulation, Thermal, Acoustic'. Aug 25, 1993.
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- Validation of Environmental Noise Model (ENM Windows). Acoustics Australia Vol 25 (1997) No 2 pp 75-79.
- Acoustical Research in Australia. Acoustics Australia Vol 25 (1997) No 2 pp 49-63 (contributing editor).
- Heavy Vehicle Noise Reduction Study. Fifth International Congress on Sound and Vibration, Adelaide, South Australia, Dec, 1997, P Karantonis, N Ishac and R Tonin.
- Comparison of Occupational Noise Exposure Results Acquired from an In-Ear Probe Tube and an Artificial Ear, for Users of Tele-Communication Headsets. Seventh International Congress on Noise as Public Health Problem, 'Noise Effects '98', Sydney, NSW, November 1998, P Karantonis and R Tonin.
- Occupational Noise Management - Educating the Workforce. Australian Acoustical Society Conference Nov 1999. Pages 71-88. N Koolik, D Eager, R Tonin
- Sensitivity of Frequency Response to Type of Tubing, 11 AWES Workshop, Darwin 2004, A.W.Rofail, R.Tonin and D.Hanafi
- The BCA 2004 – A Plan For The Future. (Invited Paper) Australian Acoustical Society, Acoustics 2004 Proceedings, November 2004.
- What is offensive noise? A case study in NSW. Acoustics Australia 38(1) 2010
- Offensive Noise in Planning & Enforcement: Is there a Difference? Environmental Law News (55) 2010
- Sources of Wind Turbine Noise and Sound Propagation. Acoustics Australia 40(1) 2012
- RONDA - CPX Trailer Initial Test Results. R Tonin, A Szabo. Inter-noise 2014 Melbourne Australia
- Response to Simulated Wind Farm Infrasound Including Effect of Expectation. Wind Industry Forum 2015. Renzo Tonin and James Brett.
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- RONDA open frame CPX trailer - results of first trials. R Tonin, M Chung, M Gange. Inter-noise 2015 San Francisco USA
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- Quiet Road Pavements: Design and Measurement - State of the Art. Renzo Tonin. Acoustics Australia (2016) 44: 235-247
- Comparison of CPX and OBSI noise measurements for different road surfaces. R Tonin, T. Saurer. Internoise 2017, Hong Kong

APPENDIX C Company experience with mines and quarries

Caroona Coal Mine	Caroona Coal Project - EIS	
Baralaba North Coal Mine, Queensland	 Cockatoo Coal Limited (CCL) operates the Baralaba Coal Mine, an existing open cut mining operation located approximately 115 km west of Rockhampton, in the lower Bowen Basin region of central Queensland (QLD), just north of the township of Baralaba. The Baralaba North Continued Operations Project provides for the continuation and expansion of open cut coal mining and introduction of processing activities at the existing Baralaba Coal Mine. Up to 3.5 Mtpa of product coal would be produced to meet CCL's full allocation requirement at the Port of Gladstone. Operations are to be conducted 24 hours per day, seven days per week for 15 years using a conventional truck and shovel mining method. An EIS was produced for the proposal and our involvement, and our involvement has been to conduct a thorough peer review to address whether or not the Noise and Vibration Assessment has adequately and satisfactorily met the Project's Terms of References.	
Murray Darling Basin Coal Mine	Murray Darling Basin Operations Modification & Expansion – EIS Noise & Vibration Assessment	
Spur Hill Coal Mine	 Spur Hill Underground Coal Project - Noise and Blasting Impact Assessment.	
Moolarben Coal Mine	The NSW Minister for Planning directed that an Independent Hearing and Assessment Panel (IHAP) be constituted to assess subsidence, groundwater and noise impacts associated with the Moolarben Coal Project at Ulan NSW. The Department of Planning (DoP) engaged Renzo Tonin & Associates director Peter Karantonis to stand as the noise expert on the panel. The Moolarben Coal Mine project involves the construction and operation of a coal mine and associated infrastructure at Ulan, New South Wales. This proposed mining development is located between the existing operations of Ulan Coal Mines Ltd and Wilpinjong Coal Pty Ltd. The new mine development comprises:- • The construction and operation of three open cut and one underground coal mine to produce approximately 10 million tonnes pa of product coal; • Coal handling facilities incorporating conveyors, coal stockpiles, coal preparation plant, workshops, administrative and amenities buildings; • Rail spur and rail loop;	

- Water management infrastructure including water supply bores, water surface storages, treatments systems and associated pipelines; and
- Relocation and construction of utility infrastructure impacted by coal mining operations.

The IHAP undertook site inspections and the public hearing took place and over 500 individual submissions were received, with 32 organisations and persons presenting to the IHAP. The primary concerns expressed in the submissions related to:

- cumulative impacts of mining in the region on groundwater, noise, dust and traffic;
- accuracy in modelling and predictions in the MCP Environmental Assessment (EA);
- noise impacts on the village of Ulan, particularly in regards to the local school, and on properties adjoining the proposed mining operations;
- mine subsidence induced damage to the "The Great Dripping Wall" (the Drip), the Goulburn River Corner Gorge (Corner Gorge) and Aboriginal archaeological sites;
- impacts of changed groundwater conditions on the Triassic aquifer system, flows in local rivers and streams, the water supply to the Drip, and stock and domestic groundwater sources; and,
- impacts of the combination of the above factors on the local tourism industry.

BHP Dendrobium Coal Mine	Preparation of a noise and vibration impact study for a coal mine covering an extensive area in the Illawarra region. The issues addressed in this study include noise and vibration emissions during the construction and operational phases of the project, including plant operating on site above and below ground level, transportation noise including rail and road traffic noise, ventilation shaft fans and motors, mechanical services plant of buildings on sites and blasting.	
Anvil Hill		Assist residents in the vicinity of the mine, through the Environmental Defenders Office, in the preparation of a submission to the IHAP hearing held for the Anvil Hill coal mine project. Provide the submission by phone at the IHAP hearing and follow up with the provision of advice and attending meetings in negotiating favourable outcomes for a key resident in the area.
Bloomfield Colliery - Rix's Creek	Preparation of noise impact study for open cut coal mine near Singleton. Noise sources include electric mining shovel, front end loaders, coal haul trucks, crushing and screening plant. Prediction of noise and vibration from blasting operations. On-site ambient noise study.	
Bulga Open Cut	Preparation of noise impact study for open cut coal mine south of Sydney including impact of coal haul road, conveyor noise and train loading.	

Electricity Commission - Cross Roads Facility Noise Study	Environmental impact assessment of turbine generating plant located at Cross Roads NSW. Development of new methodology for taking into account meteorology in the assessment process.
Colliery Expansion Hunter Valley	 Preparation of environmental impact study for noise and blasting associated with both underground and open cut coal mining operation. Identification of noise control measures in principle for reduction of blasting noise and vibration, transportation noise and noise from coal handling equipment.
Open Cut and Underground Coal Mine Newcastle	Environmental Impact Study prepared for large scale coal mining operation near Newcastle. This project includes extensive noise monitoring on site as well as design of a trial blast program to ascertain site variables. Vibration and airblast monitoring simultaneously at three sites. Comprehensive examination of production noise and blasting impact on nearby homes and chicken farm.
Hunter Valley No 1	Noise impact assessment of extension to open cut mine. Use of existing noise levels to determine change in noise contours.
Mitchell's Flat Coal Mine	Noise impact study for new coal mine in Hunter Valley including effect of mine operations, processing works, transportation and loading. 
Windellama Land Management Project	Environmental noise impact assessment for the expansion of its existing clay extraction operations and reclamation of some of its existing clay extraction areas, approximately 160 hectares, located along Oallen Ford Road, approximately 6km south south-west of Windellama, NSW, by landfill and rehabilitation. Also included is a new concrete recycling facility to produce material suitable for road base and for other local construction purposes, from concrete waste.
Others	Furthermore, the following is a short list of other mines and quarry projects completed by our company: • Gerroa Sand Quarry (Cleary Bros) • Possum Bush Quarry (MMA) • Boystown Quarry (GHD) • Maroota Quarry (MMA) • CSR Mt Flora (MMA) • Avocado Heights (Residents Association) • Mardi Quarry (Enviros ciences) • Bellingen Gravel (Bellingen Shire Council) • Dorrigo Quarry (Bellingen Shire Council) • Albion Park Quarry (Cleary Bros) • Packards Quarry Expansion - Tumut Council • Wondalga Quarry Expansion Tumut Council 

	• Wagga Wagga Quarry Expansion D M McMahon Pty Ltd • Euberta Quarry Expansion D M McMahon Pty Ltd • Top Flat Pit Quarry Expansion Tegra Australia Pty Ltd

APPENDIX D Compendium of queries sent to the proponent dated 1 September 2017

Hume Coal NVA

Sections 2.1-2.4 Background noise survey

Query 1: It is not stated whether the wind speeds in the Appendix B logger data are referenced to microphone height (1.5m) or meteorological mast height (10m).

Query 2: There appear to be irregularities in the Appendix B logger data summary. For example, in Table B.2 the result for Wed 23-09-15 is wind affected and should have been discarded. Similarly, Fri 25-09-15 is wind affected, Sun 04-10-15 is wind affected, Sun 11-10-15 should not be wind affected. There are also instances in the other tables.

Section 4.2.2 Operating scenarios and equipment noise levels

Query 3: No information is provided in respect of locations or heights of noise sources and the locations of any bunding used in the model which may act as acoustic barriers. A detailed description of the acoustic model is required.

Query 4: The Lw for "*Locomotives idle to slow moving <10km/h)*" of 101dB(A) is appropriate for idle, however, this would appear to be low for slow moving trains. An Lw of 106-111dB(A) has been used in other noise assessments. Whilst the note in the table indicates the use of "*latest generation locomotives*", the value of 101dB(A) for slow moving trains needs to be substantiated.

Query 5: In accordance with the RING Appendix 3, noise from the rail loop operations are to be assessed as industrial noise sources under the INP. There is no figure in the Hume Coal NVA showing the rail loop on the Site nor the "*Noise Wall*" (as depicted in Figure 1.3 of the Berrima Rail NVA) along the northern part of that rail loop.

Query 6: No information is provided in respect of how noise from the rail loop was modelled. Whilst in Query 4 above, an Lw for the locomotive is provided, the Lw/m relating to haul wagons is not documented. Nor does there appear to be a description of the height of the "*Noise Wall*" used in the modelling in the Hume Coal NVA (although a height of 4m is referred to in the Berrima Rail NVA).

Query 7: No information is provided in respect of rail squeal noise and how this was accounted for in the Site INP noise sources. Rail squeal noise should take into account the recommendations contained in Basutu *et al.* [33]

[33] L Basutu, D Hanson, C Schulten. Modelling Curve Gain in NSW. Acoustics Australia (2015) 43: 245-250

Query 8: In Table 4.3 of the Hume Coal NVA, the LAmax noise levels for intermittent sources are documented. It is inferred from the paragraph below the table that these are in fact maximum A-weighted sound power levels Lw(max) dB(A). Shunting noise for haul wagons or wheel squeal are not included in the table. In the paragraph following Table 4.3 it states that, in respect of calculating the LAmax noise levels at receivers, worst case equipment placements were used. Where are these placement locations?

Section 4.3 Construction noise

Query 9: On page 44 of the Hume Coal NVA it is stated that Appendix C details the construction scenarios and equipment considered in the construction noise assessment along with associated sound power levels, hours of operation and indicative scheduling. In fact, in Appendix C, there is no information regarding the equipment to be used, the numbers of equipment nor their locations. The total sound power level presented in the table for each activity (presumably meant to be dB(A) Lw,15min) is not helpful in understanding whether noise from the activity is conservatively modelled.

Section 5.1 Operational noise modelling results

Query 10: Noise contours are not shown. Noise contours are helpful in understanding the noise modelling assumptions, the effect of any interposed noise barriers used and the influence of equipment location. Noise contours also assist in evaluating the opportunity for feasible and reasonable noise mitigation treatments.

Section 5.2 Summary of operational noise impacts

Query 11: A consent authority should only consider the application of VLAMP mitigation treatment and land acquisition rights where the proponent demonstrates that the noise levels exceed the PSNL "*even with the implementation of best practice management*". In Section 6 off the Hume Coal NVA, it states that the Site has committed to leading noise mitigation and management measures. The following table provides a commentary in respect of whether those measures represent "*best practice management*".

Table 3 Statement of commitments and commentary on best practice

Stated commitment	Does this commitment represent best practice management ?
overall site design to reduce the height of acoustically significant plant and equipment wherever practicable	Not demonstrated
highly considered placement of the surface infrastructure in coordination with other environmental constraints and flood levels as to maximise distance to surrounding residential properties	Not demonstrated
automated coal handling using stackers and reclaimers to minimise the reliance on mobile plant and equipment (e.g. dozers)	Accepted, however, it needs to be demonstrated that the use of additional noise mounds or noise barriers are not feasible or reasonable
machined steel idlers on all conveyors	Not demonstrated

Stated commitment	Does this commitment represent best practice management ?
enclosures on conveyor drives, crushing plant, tertiary screens, paste plant and CPP	This is standard equipment
low frequency noise mitigation to the CPP, including variable voltage variable frequency (VVVF) drives, concrete platforms for screens, increased steelwork to stiffen the structure and bespoke cladding system	The use of VVVF drives is standard equipment. Vibration isolation of machinery is standard practice.
ventilation fan attenuation	This is standard equipment. It has not been demonstrated that the use of additional silencing treatment is not feasible or reasonable.
dozer operation during the day-time only	Accepted, however, if the dozer is a highly ranked noise source during the day-time, the use of local mounding or noise barriers should also be considered.
limited workshop activities during the evening and night periods	Not demonstrated. Are these highly ranked noise sources?
procurement of latest generation low noise emission AC locomotives with electronically controlled pneumatic brakes	Not demonstrated
constructing a rail noise barrier to the north of the rail loop to attenuate noise levels from loading and rail loop activity	Not shown in the report, no assessment presented.

In order to demonstrate the implementation of best practice management, the following steps are required:

1) rank order the major noise sources in terms of noise level at representative residences;

2) for each noise source, determine feasible and reasonable options for reducing the emitted sound level; and,

3) recalculate the final noise levels to determine if the PSNLs can be complied with.

Section 5.5 Sleep disturbance assessment

Query 12: It is stated the sleep disturbance exceedences in Table 5.4 relate to train passby events which will occur twice per night. However, in the Berrima Rail Project it is stated that there are up to 4 train movements per night.

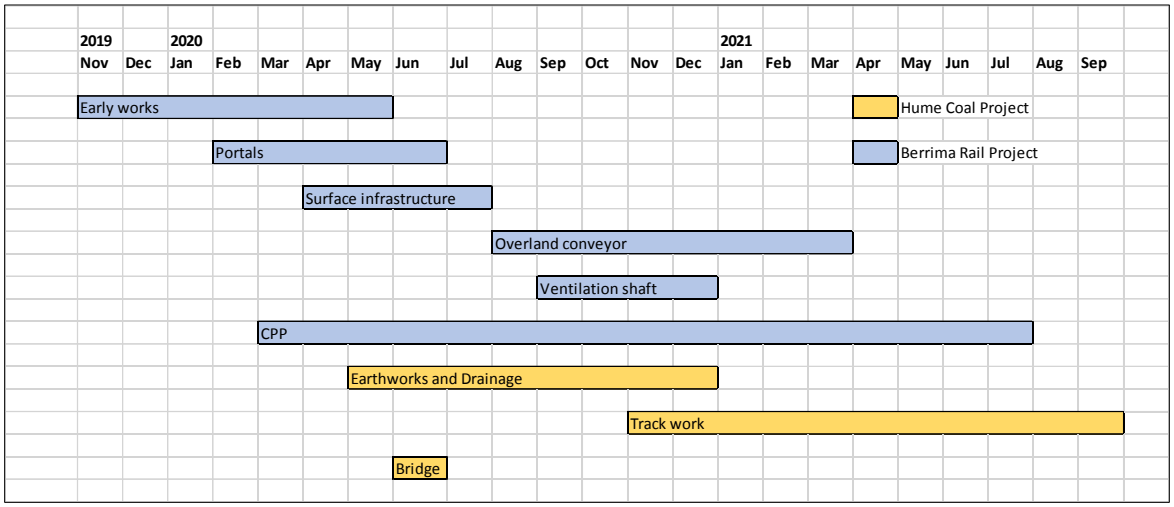
Query 13: If there are four rail movements a night and rail squeal is involved together with multiple impacts from haul wagons (not one event per train movement as alluded to in the Hume Coal NVA) and multiple occurrences of wheel squeals, then there is a strong possibility that there will be a significant issue of sleep disturbance. There is no assessment of these noise sources in the Hume Coal NVA.

5.7 Construction noise

Query 14: Figure 1 below shows the interleaving nature of the construction works extracted from the timing information provided in Appendix C. In Appendix D, noise impacts at each dwelling from each of the construction scenarios are determined independently (such as from Early Works, Portals, Surface Infrastructure etc). However, at any point in time, the cumulative noise impacts from a multiplicity of

scenarios is not considered. For example, in June 2020, construction involves the Portals, Surface infrastructure, CPP, Berrima Rail Earthworks and Drainage and the Rail Bridge construction). This is true also of the cumulative construction activity from the Hume Coal Project and the Berrima Rail Project which is shown as overlapping in Figure 1 below. Whilst the assessment is complicated in that noise from two scenarios may not impact on the same residential receiver, the point is that a cumulative assessment has not been made to determine whether there are likely to be additional construction noise impacts.

Figure 2 Staging of construction scenarios



Query 15: A time-line perspective of noise impact should be provided from the point of view of each class of receivers, for example, the nearest receiver to the north of the site, the nearest to the south, etc. A time-line of noise levels should be provided for both night-time and daytime so that a proper assessment of the perceived noise levels can be made.

Query 16: Other than the use of a localised noise barrier for the blind bore rig used during the Surface Infrastructure scenario there is very little information provided on feasible and reasonable methods of reducing construction noise impacts. For example, the recommendations in Section 6 Work Practices in the ICNG could be referred to and where appropriate incorporated into the project.

Berrima Rail NVA

Section 4.1 Overview

Query 17: It is stated that rail noise modelling was undertaken based on the ISO 9613.1 algorithm. Firstly, the reference to part 1 of the standard is incorrect as that part only relates to the calculation of the absorption of sound in the air. Presumably it is part 2 of the ISO standard relating to the general method of calculation that was meant to be referred to. Whilst ISO 9613.2 may be used to model rail noise, this should be done with caution because variables such as the length of train and its speed must be predetermined so that the correct source strength in units of Lw/m can be input into a line source. It is more common, and indeed best practice, in the acoustic engineering profession to use a rail noise

model such as NORD 2000 which enables those variables to be directly input thereby minimising the chance of error. It is stated in the text that the rail model was calibrated to noise measurements undertaken of existing trains on the Berrima Branch Line (reference is made to Section 4.6.1 of the Berrima Rail NVA). There is no information provided which verifies this calibration process nor the methodology for calculating the Lw/m.[34] There is no information provided as to the results of the validation (comparing the modelled levels with the measured levels in Section 4.6.1). There is no information provided as to the final modelling parameters used for both the spur and rail loop.

Query 18: It is stated in the text that the proposed 4m high noise wall located north of the rail loop was included in the noise model. As the height of the noise source is an important factor when dealing with attenuation of sound by noise walls, there is no explanation provided as to whether the train noise model included the different source heights of the wheel/rail interfaces, the centre of engine openings and the exhaust outlet.

Section 4.3 Construction noise

Query 19: As in the Hume Coal NVA, the assessment of construction noise is poorly described. In particular, Table 4.2 is devoid of detail in respect of what equipment is used in the modelling, how long it operates for and where it is placed. Furthermore, the assessment of cumulative construction noise is not undertaken as previously described. Similarly, there is no appreciation of what noise level residences will be exposed to over the period of construction and what feasible and reasonable noise mitigation treatments are to be applied. Refer to Query 14-16 above.

Section 4.4 Operational noise - maintenance facility

Query 20: There is no description of the acoustic model used for predicting noise impacts from the maintenance facility, whether shielding from buildings was included in the model and the heights of noise sources. In addition, the Lw for slow moving locomotives is considered low and the noise contribution from the movement of haul wagons is not included in the table. Refer to Query 4 and Query 6 above.

Section 4.6.1 Non-network rail noise

Query 21: Table 4.5 of the Berrima Rail NVA presents results of attended noise measurements of haul trains on the existing Berrima Branch Line at a position which appears to be close to residential location 25. A more detailed description of the measurement location should be provided as these noise measurements appear to have been used to validate the noise model. In particular, the train speed, train length, a description of the existing track construction and maintenance condition, a plan showing the location of the noise measurement with reference to the nearest residences, distance to the rail tracks, details of the sound level meter used, the prevailing weather conditions during testing and a

[34] H G Jonasson, S Storeheier. Nord 2000. New Nordic Prediction Method for Rail Traffic Noise. SP Report 2001:11. 21 Dec 2001

photograph showing the absence of any obstructions between the measurement location and the rail line should be provided.

Query 22: Figure 4.1 shows a sample of unattended noise data at a location which should have been specified. The text preceding the figure indicates that the figure shows rail noise levels that are consistent with those captured during the attended monitoring. We fail to see the relevance of that statement other than to demonstrate that on the unattended day, train noise levels were about the same as on the attended day.

Query 23: In the text following Figure 4.1, it states that the modelled speed of trains on the private rail line is up to 20km/h and this speed has been confirmed based on data obtained from current users. As speed is an important variable in the prediction of noise emission, corroborating data should be provided. In addition, if a speed limit of 20km/h is assumed, this should be committed to.

Section 5.1 Construction noise assessment

Query 24: In Table 5.1 Predicted construction noise levels, for residential locations 25, 28, 29 and 63, there are substantial exceedences of the NMLs for both day and night. It would appear from the table that these dwellings would be exposed to continuous day and night-time noise without respite. However, this may or may not be the case because the day-time impacts might occur at a different time to the night-time impacts. There is no time-line which enables the reader to determine whether this is the case. There is no description provided as to the cause of these very high noise levels and there is no discussion regarding feasible and reasonable means of mitigating those noise impacts other than the motherhood type statements provided in Section 6.2.

Section 5.5 Sleep disturbance

Query 25: The text states that external noise levels of up to 56 LAmax are predicted to occur at location 19 which is approximately 640m from the rail line and location 62 which is approximately 450m from the rail line provided there is no rail squeal. These LAmax noise levels exceed the EPA's screening level. Furthermore, the number of high noise level events is not one per train movement as there is likely to be a multiplicity of intermittent noise events (including possibly squeal) occurring for the duration of the train passby. It is noted in the statement of commitments in Section 6.1.1 of the Berrima Rail NVA there is no commitment to minimise rail squeal, should it occur, by engineering means such as by use of friction modifiers.

Section 6.1.1 Feasible and reasonable measures

Query 26: The following commitments are stated to be offered for leading noise mitigation and management together with commentary:

Table 4 Statement of commitments and commentary on best practice

Stated commitment	Does this commitment represent best practice management ?
highly considered lateral placement of the new elements of the project, taking into consideration potential sensitive noise receivers as well as other environmental and physical constraints, and topography	Not demonstrated
use of latest generation AC locomotives, as well as wagons with electronically controlled pneumatic brakes	Not demonstrated
minimisation of rail squeal through avoiding tight rail curves (where possible), and effective curve design and construction (eg rail grinding and gauge widening)	Not demonstrated
construction of a noise wall to the north of the rail loop, to attenuate noise levels from rail activities, as shown in Figure 1.3	Not relevant to noise from the non-network rail line
construction of a locomotive shed at the northern provisioning point to minimise noise from idling locomotives	Not demonstrated

Section 6.1.2 Voluntary mitigation

Query 27: It is stated in Section 5.4.1 of the Berrima Rail NVA that there would be an exceedence of the VLAMP rail noise voluntary mitigation criterion of 3-5dB for location 28 which would trigger voluntary mitigation rights at this location. However, it has not been demonstrated that there are no other feasible and reasonable mitigation options available for this residential location. For example, would a noise barrier constructed on rail land be feasible and reasonable to mitigate those noise impacts?

Section 6.2 Construction

Query 28: The text in this section states that a CEMP that will address noise and vibration management and mitigation options (where required), will be produced prior to construction. This is relegating important issues to a later time. There is no description or assessment of feasible and reasonable measures to reduce construction noise impacts of the Berrima Rail Project. As evidenced in Section 6.5 above in this report, there is no real understanding of the extent of noise impacts as no time-line has been provided at the residential receivers. The commitment provided in the Berrima Rail NVA to "*address noise and vibration management and mitigation options*" is therefore devoid of substance.

APPENDIX E Response to independent noise review prepared by EMM 5 October 2017

(A) Hume Coal Project - Noise and Vibration Assessment, Response to Independent Noise Review. EMM Consulting Pty Ltd dated 5 October 2017 (**Hume Response Report**)

(B) Berrima Rail Project - Noise and Vibration Assessment, Response to Independent Noise Review. EMM Consulting Pty Ltd dated 5 October 2017 (**Berrima Response Report**)