LAND COURT OF QUEENSLAND

REGISTRY: Brisbane

NUMBERS: EPA 495-15, MRA 496-15, MRA 497-15

Applicant:	**New Acland Coal Pty Ltd CAN 081 022 380**
	AND
Respondents:	**Frank Ashman & Ors**
	AND
Statutory Party:	**Chief Executive, Department of Environment and Heritage Protection**

JOINT REPORT OF NOISE EXPERTS

22 February 2016

Prepared for the Land Court of Queensland by:

Mr Shane Elkin, advising the Applicant, and

Mr John Savery, advising the Respondents.

1 BACKGROUND

1 The New Acland Coal Mine Stage 3 Project includes the expansion of an existing open-cut coal mine, located 14 km north-west of Oakey, west of Brisbane, and the construction of associated infrastructure. New Acland Coal Pty Ltd (**NAC**) is the proponent.

2 The mine currently produces 5.2 million tonnes per annum (**Mtpa**) of thermal product coal, which is forecast to be depleted by 2017.

3 The proposed expansion involves extending the mine's operating life to approximately 2029 and increasing production up to 7.5 Mpta by including open-cut mining of additional areas.

4 Approximately 1,466 hectares will be disturbed by the proposed expansion's open-cut mining activities. 1,361 hectares of this area is designated as strategic cropping land.

5 In May 2007, the Queensland Coordinator-General declared the proposed expansion a 'coordinated project' under the *State Development and Public Works Organisation Act1971*, for which an environmental impact statement (**EIS**) was required. In the same month, the Commonwealth Minister for the Environment declared the project a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**).

6 In October 2007, the Coordinator-General released terms of reference for the EIS. From 14 November 2009 to 3 February 2010, NAC published an EIS and invited public submissions.

7 In March 2012, the then incoming Queensland Government declared that it would not support the expansion as proposed. In November 2012, NAC submitted a revised proposal.

8 In March 2013, the Coordinator-General released new terms of reference for the EIS. From 18 January 2014 to 3 March 2014, NAC published a new draft EIS (**2014 EIS**) and invited public submissions.

9 In April 2014, and at the request of the Queensland and Commonwealth governments, the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) provided advice on the project. The IESC advice raised a number of concerns with the assessment.

10 During September 2014, NAC published additional information to the 2014 EIS (**AEIS**), including a response to the IESC advice, and published the final EIS, and again invited public submissions.

11 In December 2014, NAC provided final information on the AEIS. On 19 December 2014, the Coordinator-General released his report on the final 2014 EIS.

12 In February 2015, the Commonwealth Government extended the decision-making period for whether or not to approve the proposal under the EPBC Act to 30 April 2015.

13 In April 2015, NAC applied to Department of Environment and Heritage Protection (**DEHP**) under the Queensland *Environmental Protection Act 1994* to amend its environmental authority (**EA**) for the mine to include the proposed expansion.

14 In May 2015, NAC issued public notice of the EA application, and of applications for additional mining leases required, and invited public submissions.

15 In mid-June 2015, NAC replied to an information request from DEHP about the EA application.

16 On 28 August 2015, DEHP approved the EA amendment application subject to conditions, and issued NAC with a draft EA.

17 Objections to the MLAs and EAs were referred to the Queensland Land Court on or about 14 October 2015.

18 The Land Court made a directions order for the matter on 9 November 2015.

19 The experts met on Thursday 28th January 2016 to consider the proposed application and noise issues raised by the Respondents.

20 Mr Elkin provided additional information to the previously available information in the EIS, AEIS and other supplied documentation from the Applicant which related to acoustic aspects of the application (itemised in paragraph 38**.** below):

21 Mr Elkin has visited the mine site and observed the operations of the current mine from inside the boundary of the mine and liaised directly with mining personnel.

22 Mr Savery has visited the area surrounding the mine site and has conducted noise logging of ambient noise levels at a location to the north of the mine.

23 Mr Savery has inspected the workings of the existing mine from surrounding roads and also from aerial photographs available on the Near Maps and Google Earth websites.

24 Mr Savery has met some of the objectors during his inspections of the area surrounding the mine site.

25 Mr Savery has read the NAC Lay Witness statements and the Objector Lay Witness Statements submitted to the Land Court for this matter.

26 Mr Savery installed a real-time noise logger and weather station at sensitive receptor 10 to monitor ambient noise levels in December 2015. Monitoring was conducted initially from Dec 21, 2015 to Jan 1 2016 and then re-commenced on Jan 28 2016. Measurements of noise levels, one-third octave spectral data and audio files are recorded continuously and data is summarised as fifteen minute levels for wireless transmission to the Savery office. Further post-analysis of noise data from the monitoring system is also possible to investigate in detail particular monitoring periods or identified noise events.

2 DESCRIPTION OF PROJECT

27 The revised project description is provided in the 2014 EIS Chapter 3 and the AEIS. Sections of these documents that are relevant to the acoustic emissions from the Project are described in the following paragraphs.

28 The revised project layout for the internal train loading facility (TLF) and associated haulage roads, and light vehicle access road are shown in the AEIS Figure 3.1-A.

29 The mining method is described in 2014 EIS Section 3.6.1 with a schematic mining process overview shown in Figure 3-7.

30 The Life of Mine Schedule is outlined in the 2014 EIS Figures 3-8 and Figures 3-9 to 3-15 which identify the location of the mine pits and working areas over the life of the Project in 2015, 2017, 2019, 2021, 2023, 2025 and 2029, respectively.

31 Future Out-of-pit dumps (future elevated landforms) are described in the 2014 EIS Section 3.6.4.

32 Mining equipment to be utilised in the project are detailed in the 2014 EIS Section 3.6.6.

33 The proposed hours of operation, including reduction or cessation of mining in the Manning Vale East Pit, and blasting times are described in the 2014 EIS Section 3.6.7.

34 Details of the proposed use of blasting is described in the 2014 EIS Section 3.6.8.

35 The mine infrastructure and facilities required for the project are described in the 2014 EIS Section 3.7. The subsections of interest for the acoustic assessment are Section 3.7.1 Overview, Section 3.7.2 RoM and Raw Coal, Section 3.7.3 Coal handling and preparation, Section 3.7.4 Tailing Management, Section 3.7.5 Coarse Reject Management, Section 3.7.6 Materials Handling Facility (with Figure 3-24 showing the plan view of the material handling and stockpiling arrangement), Section 3.7.7 Train Loadout Facility, and Section 3.7.8 Mine Industrial Area.

36 Additional commitments in regard to noise and vibration monitoring and monthly reporting and complaint management and the new rail loop and train loading facility were provided in the AEIS Section 5.1.3.

37 Further information regarding noise monitoring and source sound power levels was presented in the form of a report prepared by SKM for submittal to DEHP, dated 30th April 2013.

38 Additional information was tabled by Mr Elkin for the experts to review relative to the project

description:

i Overview of New Acland Coal Mine's Noise "Live Dashboard", SLR Report No 620.10963, dated 2 July 2014

ii Appropriate Building Façade Noise Reduction for Residential Properties with Open Windows, extract from SLR Report, title and date not provided;

iii Predicted train noise levels results, using Notch 1 diesel, SLR calculation;

iv Spreadsheets showing utilisation impacts;

v Directional Noise Monitoring Validation Report, by Advitech, dated 8 July 2014.

3 LOCATION OF SENSITIVE RECEPTORS

39 Sensitive receptors are shown in the 2014 EIS Chapter 11, Figure11-1.

4 METEOROLOGICAL CONDITIONS

40 Annual and seasonal windroses were developed from two meteorological datasets that were measured at Oakey in 2011 and 2012. The windroses are shown in the AEIS Section 5.2.4.10. The wind roses show that the winds blow predominantly from the east in all seasons with some wind from the W-SW in winter.

41 Noise modelling using the CONCAWE method requires the meteorological conditions to be classified in accordance with the Pasquill-Gifford Stability Classes because conditions most conducive to noise propagation occur during temperature inversions or downwind conditions. The occurrence of stability classes by season and time of day for 2011 and 2012 is detailed in the AEIS Table 5.2_F and are shown in the following table:

Year	Season	Time period	A	B	C	D	E	F
2011	Summer	Day	6%	23%	42%	29%	0%	0%
		Evening	0%	0%	0%	38%	40%	22%
		Night	0%	1%	7%	19%	28%	45%
		Total	3%	11%	22%	37%	17%	20%
	Autumn	Day	3%	24%	36%	33%	2%	2%
		Evening	0%	0%	0%	4%	31%	65%
		Night	0%	0%	4%	10%	17%	69%
		Total	1%	11%	18%	20%	12%	38%
	Winter	Day	1%	55%	33%	34%	4%	4%
		Evening	0%	0%	0%	2%	23%	75%
		Night	0%	0%	1%	5%	15%	79%
		Total	0%	11%	15%	18%	11%	44%

Year	Season	Time period	A	B	C	D	E	F
	Spring	Day	4%	30%	40%	26%	0%	0%
		Evening	0%	0%	0%	13%	47%	40%
		Night	0%	1%	9%	12%	24%	53%
		Total	2%	14%	22%	19%	17%	27%
2012	Summer	Day	6%	24%	39%	32%	0%	0%
		Evening	0%	0%	1%	44%	43%	12%
		Night	0%	1%	7%	21%	36%	35%
		Total	3%	11%	21%	30%	21%	15%
	Autumn	Day	2%	26%	32%	37%	1%	2%
		Evening	0%	0%	0%	13%	38%	50%
		Night	0%	0%	1%	11%	18%	70%
		Total	1%	12%	17%	23%	14%	34%
	Winter	Day	1%	21%	29%	43%	4%	2%
		Evening	0%	0%	0%	9%	29%	62%
		Night	0%	0%	1%	11%	18%	70%
		Total	0%	10%	14%	25%	13%	38%
	Spring	Day	6%	30%	33%	31%	0%	0%
		Evening	0%	0%	0%	18%	48%	34%
		Night	0%	2%	7%	17%	26%	48%
		Total	3%	15%	18%	23%	18%	24%

42 Noise modelling conducted for the project used the Stability Classes D and F during the night period and stability Classes F for the day/evening period in the noise propagation calculations to represent the worst case meteorological conditions experienced by sensitive receptors near to the mine site.

43 Both experts agree that the worst case meteorological conditions were modelled appropriately in the 2014 EIS based upon the table above.

5 BACKGROUND NOISE LEVELS

44 Mr Savery states that current or recent background noise levels are the baseline for an EIS acoustic assessment because the background noise levels provide the context and benchmark upon which the impact of the intrusion of the new project noise to the existing ambient noise environment at sensitive receptor locations may be assessed.

45 Sensitive receptors surrounding a new project assess the effect of noise emissions upon them by what they hear. What they hear, in turn, is influenced by the degree of "masking" provided by the existing acoustic environment.

46 The subjective effect of increases in noise levels[1] is shown in the table below:

Increase in level, dB	Subjective effect
3	Just perceptible
5	Clearly perceptible
10	Twice as loud
20	Four times as loud

47 The effect of noise emissions upon a sensitive receptor is dependent not only upon the level, but also upon other factors, such as the temporal and spectral frequency characteristics of the noise (for example, tonal, impulsive, modulating, high pitched, low frequency), the timing and duration of the noise, and meanings and history associated with the noise (sometimes called non-acoustical factors[2], psycho-acoustics or psycho-social acoustics)[3].

48 It is also important in assessing background noise levels in very rural environments that the contribution of insects is removed. Insects, such as crickets and cicadas, can be dominant contributors to the noise in a rural environment.

49 Australian Standard AS1055.2-1997 confirms this approach and in Section 4.2.1, Note 3, recommends the exclusion of unusual extraneous noise, including insects, where it can be quantified, otherwise it can be noted.

50 The reason for identifying and excluding insects is that insects may not be present throughout the year. By identifying the insect's contribution to the measured background noise levels then

[1] *Bruel & Kjaer, Acoustic Noise Measurements, June 1988, page 34*

[2] *WHO Guidelines for Community Noise, Section 3,8 Effects of Noise on Residential Behaviour and Annoyance, paragraph 4, p33*

[3] *Australian Standard AS1055.2-1997, Acoustics – Description and measurement of environmental noise, Part 2: Application to specific situation, Section 4.3*

the underlying background level may be determined. Using older style noise instruments or loggers, it was common for baseline background noise levels to be recorded in each of the four seasons so that the worst case background noise level (in winter when there are generally minimal insect contributions) could be identified as the basis for determination of noise limits to protect sensitive receptors and to minimise the risk of non-compliance for the applicant.

51 A further reason for identifying and removing insects from background noise levels for sensitive receptors near a proposed mining project is that although insects may be part of the normal acoustic environment for much of the year, the insect noise has a high frequency characteristic (typically one or more of the third octave bands in the range 1000 Hz to 10,000Hz, the band is different for various insect species), the insect noise does not mask the typical mining noise which has spectral frequencies less than 600Hz (such as noise of large diesel engines).

52 The background noise level was measured at Sensitive Receptor 10 on 14th February 2016 at 3:30am for fifteen minutes by Mr Savery's noise logger. The time was randomly selected from the continuous noise recordings. Insect noise was dominant. The $L_{A90,\ 15min}$ levels were 34 dBA with insects and 23 dBA with the contribution of insects removed. The difference between the levels is a typical illustration of the insects' contribution to the overall noise level. The spectral plot is provided to simply indicate the potential contribution of insects to measured noise levels in very rural environments (in this case background noise levels). The spectra show how the insect noise spectral frequency characteristics are identified and how easy it is to identify and exclude the contribution from one-third octave spectral frequency levels. The one-third octave spectral frequency plot with and without the insect contribution is provided in Figure 1.

53 A similar spectral plot is prepared for the intrusive L_{Aeq} noise level for the same time period and the same location. The spectral plot is shown in Figure 2. It shows that the L_{Aeq} level with insects is 37dBA and with insects removed is only 28dBA. The insect contribution may be similarly identified in the L_{Aeq} plot and removed to identify the noise contribution from the mining activities.

54 This type of analysis to identify and remove insects has not been conducted by Mr Moore in any of the noise monitoring that he has conducted to date (since 2002) and is not included in the real-time noise monitoring and adaptive management system being applied by NAC at Acland (rather all frequencies above 630HZ band are excluded, without specific identification of individual bands related to insect noise).

55 The background noise level was measured at Sensitive Receptor 10 on 26th December 2015 at 11.45pm for fifteen minutes by Mr Savery's noise logger. The time was randomly selected from the continuous noise recordings. Insect noise was dominant. The $L_{A90,\ 15min}$ levels were 54 dB(A) with insects and 24 dB(A) with the contribution of insects removed. The difference between the levels is higher than what would normally be expected but is provided to simply

indicate the potential contribution of insects to measured noise levels in very rural environments (in this case background noise levels), and to show how the insect noise spectral frequency characteristics are identified and excluded from one-third octave spectral frequency levels. The one-third octave spectral frequency plot with and without the insect contribution is provided in Figure 1.

56 Mr Moore has been measuring background noise levels on behalf of the applicant (in the absence of mining noise) at a site near Kulpi approximately 10kms north of the mine on a monthly basis since April 2012. Reports from Mr Moore to NAC were provided by the applicant on February 12th 2016 to the experts following a request through EDO by Mr Savery on 13 November 2015.

57 A review of the measured background noise levels reported by Mr Moore[4] confirms that the background noise levels in the absence of mining are very low. Mr Moore has not identified the contribution of insects in any of the following measurements but has simply noted whether insects were dominant or present. The background noise levels in the following table were extracted from Mr Moore's monthly reports disclosed by the applicant.

Year	Month	Background noise level, $L_{A90, 1hour}$ dBA	Comments about contributing sources	Meteorological conditions
2012	April	24.6	Insects dominate, some distant traffic	12.0°C, calm
	May	24.1	Some distant traffic, some birds	-1.0°C, calm
	June	20.7	Some distant traffic, some birds	3.4°C, calm to 1 m/s S
	July	22.3	Distant cattle, some birds	1.0°C, calm to 0.5 m/s NE
	August	22.6	Distant cattle, some wind	11.0°C, 0.4 m/s NE
	September	19.5	Distant, dogs, sheep, birds	9.2°C, calm
	October	23.7	Insects	13.2°C, calm
	November	24.0	Insects dominate	14.3°C, 0.2 m/s NE
	December	23.9	Insects dominate, distant dog	17.4°C, calm
2013	January	24.5	Insects dominate	19.3°C, 0.4 m/s NE
	February	27.8	Insects, distant dog barking	15.4°C, 0.3 m/s NW
	March	43.0	Insects, wind in vegetation	19.4°C, 2.9-4.7 m/s W
	April	31.5	Insects, wind in vegetation	16.3°C, 0.4-1.3 m/s NE
	May	33.9	Insects, some wind in vegetation	18.7°C, 0.3-0.8 m/s NE

[4] *Disclosure documents (February 12, 2016), Noise Reports by D Moore*

Year	Month	Background noise level, $L_{A90, 1hour}$ dBA	Comments about contributing sources	Meteorological conditions
	June	19.3	Some wind in vegetation	16.1°C, 0.7-1.4 m/s E
	July	25.5	Wind in vegetation	10.8°C, 1.0-1.9 m/s E
	August	18.2	Some birds, distant cattle	3.7°C, calm
	September	18.5	Some birds	15.8°C, calm
	October	23.0	Some distant dogs, insects	17.5°C, calm
	November	37.2	Insects, some windmill creak	18.6°C, 0.5-2.4 m/s NNE
	December	23.4	Insects, some windmill creak	15.9°C, calm
2014	January	38.5	Wind in vegetation	25.2°C, 1.0-2.7 m/s NE
	February	29.6	Insects	24.2°C, 0.1-0.4 m/s S
	March	25.2	Insects, some wind in vegetation	19.8°C, 0.1-0.3 m/s ENE
	April	26.9	Wind in vegetation, some windmill creak	20.2°C, 0.4-1.5 m/s NE
	May	26.3	Wind in vegetation, some windmill creak	13.2°C, 1.8-2.7 m/s E
	June	19.6	Wind in vegetation, distant birds, dogs	9.1°C, 0.4-0.6 m/s S
	July	19.3	Birds, distant traffic	3.1°C, calm
	August	No report		
	September	17.3	Some windmill creak, distant cattle	11.1°C, calm
	October	24.6	Insects, wind in vegetation	21.7°C, 1.2-1.8 m/s N
	November	26.6	Wind in vegetation, insects, some windmill creak	21.7°C, 1.0-1.5 m/s N
	December	21.8	Insects, wind in vegetation, some windmill creak	19.5°C, 0.9-2.9 m/s E
2015	January	23.3	Insects, some distant cattle, dogs barking	17.5°C, 0.9-1.6 m/s E
	February	38.5	Wind in vegetation, windmill creaking and banging	21.6°C, 0.9-4.0 m/s ESE
	March	32.6	Wind in vegetation, windmill creaking and banging	20.0°C, 1.5-3.0 m/s E
	April	16.7	Some birds, low level insects	7.8°C, 3.6 m/s W
	May	17.4	Some distant cattle, frogs croaking and dog barking	6.2°C, 1.5 m/s NNE

Year	Month	Background noise level, $L_{A90, 1hour}$ dBA	Comments about contributing sources	Meteorological conditions
	June	18.3	Some birds, distant dogs	-0.8°C, 1.5 m/s NNE
	July	No report		
	August	18.9	Occasional windmill creak, some wind in vegetation	12.8°C, 3.1 m/s SSW
	September	17.3	Some birds, distant traffic	6.6°C, 2.1m/s NE
	October	31.5	Insects, wind in vegetation, some dogs, birds	17.2°C, 3.1m/s ENE
	November	26.0	Insects, some birds, dogs	16.0°C, 2.6m/s ESE
	December	32.8	Rain drops, insects, some dogs and bird	22.2°C, 3.6m/s NE

58 This measured noise data is very informative about the background noise levels that are typical of the area near the current and Stage 3 mine site and also for the background noise level that is expected for all sensitive receptors near the mine in the absence of mining.

59 If Mr Moore had utilised the one-third spectrum capabilities of the sound level meter that he used for the attended monitoring then he would have been able to exclude insects from the reported levels rather than simply noting their presence, dominance or absence. Exclusion of insects and wind in vegetation is expected to result in background noise levels (from the above set of data) that are approximately 20 dBA throughout the year.

60 It is not known why NAC did not disclose this information to the team preparing the 2014 EIS.

61 Mr Savery considers that the 2014 EIS is quite deficient in its reporting of background noise levels for sensitive receptors in the area potentially affected by the proposed mine, as discussed in the following paragraphs 62 to 65.

62 The 2014 EIS Chapter 11, Table 11-1 summarises background noise levels (both L_{A90} and rating background levels) measured by consultants in 1996 (four locations in winter), 1998 (one location in autumn) and in 2012-2013 (one location in summer).

63 The 1996 and 1998 measurements were recorded with older style instrumentation where the contribution of insects or other extraneous sources was not able to be quantified even if significant, but their presence was only noted[5]. The value of these two sets of measurements is therefore limited because the background noise levels are likely to be overstated because of

[5] *SKM report to DEHP, dated 30 April 2013, Table2, p5*

dominant extraneous noise contributions and were measured too long ago to be considered representative of current background levels.

64 The background noise measurement in summer in 2012-2013 by Mr Moore utilised modern noise monitoring equipment (i.e. Ngara - one third octave noise logger with audio) which enables one-third octave frequency data to be calculated from which the contribution of insects or other extraneous noises to the recorded levels may be determined. However, Mr Moore did not do this analysis to identify the contribution of insects, or any other extraneous noise to the measured levels. Mr Savery (through EDO) requested the raw data files of these measurements so that he could do the analysis of the insect noise contribution but this information has not been disclosed by the applicant to date.

65 It can therefore be concluded from Mr Moore's background noise measurements reported in the 2014 EIS Table 11-1 that the background noise level and RBLs[6] are lower than the levels reported in the 2014 EIS Chapter 11 due to dominant insect contributions during summer months.

66 Why are background noise levels important as a benchmark for a major project as proposed by NAC? The reasons are:

- The background noise levels per daily period (day, evening and night) provide the local context against which the impact of the intrusion of the new noise upon sensitive receptors may be assessed;
- The background noise levels per daily period may be used as the basis for setting noise limits where intrusive levels are to be compared with background noise levels (the background plus approach used by DERM and DEHP for many years for all EAs where day/evening noise limit is bg +5 and night is bg = 3 dBA, with a deemed minimum limit of 25 or 30 dBA);
- The background noise levels per daily period may be used to assess the reasonableness of rating levels, or other arbitrary noise limit levels (such as acoustic quality objectives) in a very rural environment. Such rating levels are recommended by policies, guidelines or codes to protect health, wellbeing and amenity, given the local context for the proposed project;
- The background noise levels per daily period may be used to set noise limits to prevent background creep by the addition of new developments/expansions to an existing mine operation;
- The background noise levels per daily period may be used to inform both regulators and mine operators as to why sensitive receptors lodge noise complaints, irrespective of

[6] Rating background level is defined as min$L_{A90,\ 1\ hour}$, which is the tenth percentile value of the background noise level $L_{A90,\ 1\ hour}$, assessed over a minimum period of one week (PNCG, p10)

whether there is compliance or not with the regulated noise limits at that time[7].

67 The background noise levels measured by Mr D Moore also provide a very valuable insight into the "continuous" noise level impact upon the sensitive receptors where background noise levels have been recorded. Mining noise emissions heard at receptor locations may be characterised by a continuous level (or "hum") from the accumulation of all operating noise sources within the mining lease, and the maximum variable noise levels due to the operation of the dominant mining noise sources heard at that sensitive receptor location.

68 The background noise level ($L_{A90\ 1hour}$) measured by D Moore in the presence of mining operations provides a measure of the continuous mining noise levels, provided that the level of extraneous noise due to insects, wind, etc is low.

69 For the months in the above table (paragraph 57) where the background noise levels at the remote Kulpi location were very low (i.e. minimal insect or wind noise contributions), the corresponding background noise levels were extracted from Mr Moore's reports for the other monitoring sites to assess the "continuous" L_{A90} noise contribution from the mine to these sensitive receptor locations in the absence of insects or strong winds. The results are presented in the following table:

Date	Reference background location, Kulpi (no mine noise)	Background noise level, L_{A90} dBA, including mining noise, at Sensitive Receptor Locations (no insects or wind noise)				
		Plant	Acland	Kuhl	Mason	Hansford
June 2014	19.6	31.4	32.0	27.1	22.3	18.1
July 2014	19.3	16.9	35.6	29.9	38.6	34.7
Sept 2014	17.3	35.6	25.5	43.1[2]	36.4	-
Apr 2015	16.7	22.0	19.1	35.4	22.5	26.9
May 2015	17.4	-	20.4	36.9	-	35.0
June 2015	18.3	36.5	30.8	36.5	38.4	32.2
Aug 2015	18.9	33.0	26.6	38.6	36.9	30.2
Sept 2015	17.3	24.8	39.2	25.8	28.4	17.7

Note: 1 Where levels are omitted in the table it is because the wind speeds reported during these measurements were high and measured noise levels were judged to be elevated due to the high wind speeds (i.e. background noise levels were measured on subsequent nights to Kulpi).

2 The D Moore Report concluded for this month that compliance with the 40dBA noise limit could

[7] *D Moore Report for October 2014 showing multiple discrete mine engine noise levels above 40dBA, even as high as 50dBA at the Kuhl receptor, where the compliance of the noise with the noise limit was judged to be unable to be determined by NAC's consultant, Mr Moore.*

not be determined for the Kuhl location due to extraneous noise from birds, truck on road and distant dogs barking). This conclusion is incorrect with mine engine noise levels listed in the report as 54, 50, 49, 46, etc. during the hour assessment period.

70 The results in the above table are not necessarily directly comparable because the levels were not all measured concurrently for the same hour on the same night. Some apparent discrepancies in the pattern of levels is due to changes in wind directions between the time of monitoring at the various locations on successive nights in the same month.

71 The background levels, however, indicate the significant continuous mining noise impact of the current mining operations upon the five sensitive receptors where monitoring has been undertaken.

72 It is expected that a similar pattern of continuous mining noise exposure occurs during all months but it is not able to be quantified so easily in the presence of extraneous noise from the D Moore reports, but it will be present nonetheless in the noise levels experienced at the sensitive receptors to a greater or lesser degree depending upon the activities being conducted on the mining lease and the prevailing meteorological conditions, mainly temperature inversions or wind speed and direction.

73 The impact of the current "continuous" mining operation noise quantified in the D Moore reports by the background noise levels has not been considered in the 2014 EIS, particularly in respect of the recommended lower noise limit of $L_{Aeq, adj, T}$ 37dBA and the more than doubling of plant and equipment operations on the RoM pad, the CHPP and the product pad envisaged on the northern portion of the mining leases for Stage 3. These background "continuous" mining noise levels indicate that a much more detailed noise mitigation study than is provided in the 2014 EIS, is required for the Acland, northern and north-western receptors to demonstrate that compliance with the 2014 EIS recommended noise limit of 37dBA is possible under the proposed mining operations of the Stage 3 mine.

74 Mr Elkin's view is that regardless of whether true backgrounds were obtained during the EIS process, health and wellbeing impacts are not reliant on a "background plus" approach. All of the following references support this position:

75 <u>Acoustic Quality Objectives</u> - The purpose of the EPP(Noise), which contains the acoustic quality objectives, is …"to achieve the object of the EP Act in relation to the acoustic environment". The purpose of the EPP(Noise) is achieved by:

- Identifying environmental values to be enhanced or protected;
- Stating the acoustic quality objectives for enhancing or protecting the environmental values; and
- Providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

76 The primary reasons that, in Mr Elkin's opinion, the EPP(Noise) is most appropriate to set the criteria for this project are:

- It is legislation (rather than a guideline),
- It has a clearly stated purpose in achieving the object of the EP Act (see above), and
- It has used the findings / recommendations of the World Health Organisation in setting internal noise levels appropriate to protect sleep amenity (during the night-time period that is the most critical/sensitive time period).

77 Part 3 of the EPP(Noise), which references the acoustic quality objectives, sets out the values and objectives that, if met, means the acoustic amenity for that place has been protected. As such, this is the highest piece of legislation in Qld that provides numerical limits.

78 The night-time acoustic quality objectives contained in the EPP(Noise) meet the World Health Organisation's (WHO) recommendations for avoiding sleep disturbance. WHO is the world's foremost organisation in relation to setting limits/standards in relation to human health. WHO have extensively researched sleep disturbance studies in reaching their recommendations.

79 Based on NAC's complaints history, the night-time period is the most critical time in relation to impacts on the community. Therefore, Mr Elkin fully supports the draft EA noise conditions as they will bring mine noise emissions back down to the WHO recommended levels to avoid sleep disturbance (the current EA night-time noise limit is 3 dB above WHO's recommended Leq level assuming open windows).

80 enHealth's The Health Effects of Environmental Noise – Other than Hearing Loss guideline states that "the WHO Guideline for Community Noise should be adopted as a primary reference level for environmental noise below which no health effects are expected". This is a Federal Government Department of Health publication.

81 Australian Standard 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* contains the following recommended (dBA Leq) internal design sound levels which (to quote) "take into account the function of the area(s)":

- 25 to 30 dBA Leq in sleeping areas for houses with negligible transportation (equivalent to 32 to 37 dBA Leq external assuming a 7 dB façade noise reduction for open windows), and
- 30 to 40 dBA Leq in living areas for houses and apartments near minor roads (equivalent to 37 to 47 dBA Leq external

82 The draft EA noise limits of daytime/evening (42 dBA Leq - external) and night-time (37 dBA Leq - external) fall within these recommended AS2107 ranges.

83 Therefore, it is Mr Elkin's opinion that achieving compliance with the above legislation, guidelines and standards – which all align with the draft EA noise conditions - means that human health and wellbeing will be preserved.

84 There is also the legal precedence set by the Land Court for the Wandoan Coal Mine. The Land Court made many conclusions about noise, with the conclusions pertinent to this JER documented below:

- While it is correct to say the explanatory notes to the EPP (Noise) say that it is not intended that the existing acoustic environment be allowed to deteriorate, there is actually nothing in the terms of the EPP (Noise) reflecting that intention;
- The EPP (Noise) defines an acoustic quality objective as the maximum level of noise that should be experienced in the acoustic environment of an area or place;
- Neither the Coordinator-General nor DERM misapplied the policy in setting the draft EA limits;
- In any event, the limits set in the draft EA cannot be altered because they were imposed by the Coordinator-General.

85 As such, the findings of the Wandoan case further support the use of the existing EA noise conditions.

86 For more details on the justifications provided by Mr Elkin in paragraphs 74 to 85, see Section 4 "Noise Limits, Health and Well Being".

87 Mr Savery notes that Australian Standard AS2107-2000 presents the design sound levels for various uses under two column headings, Satisfactory and Maximum. The headings re-inforce his arguments that the bedroom noise levels that are satisfactory for sleep quality in a very low noise rural environment are 25dBA, and not the maximum of 30dBA.

88 Mr Savery has reviewed the Wandoan Coal Judgement. He disagrees with Mr Elkins interpretation of the meaning of the judgement, in particular paragraph 47 of the judgement where it states: "*I consider therefore that the Court has power under the EPA to recommend conditions for the draft EA dealing with the same subject matter as conditions imposed by the Co-ordinator General, provided that the Court's recommended conditions do not contradict or lack harmony with the Co-ordinator General's conditions*". Whilst this is a legal matter it is Mr Savery's opinion that the Court will make a judgement based upon the evidence presented before it.

89 Mr Savery considers that approval of noise limits which are stricter than the limits recommended by the Co-Ordinator General (CG) does not contradict or lack harmony with the CG's conditions, but rather supports and enhances the intention of the CG in imposing

conditions that further protect the environmental values of the EPAct as stated in the EPP(Noise).

90 Mr Savery will respond to Mr Elkin's other points above in the following section of this JER which discusses health, well-being and amenity, and the setting of noise limits.

6. HEALTH, WELLBEING, AMENITY AND NOISE LIMITES

91 Mr Savery states that there is a growing body of evidence to support the contention that exposure to excessive amounts of environmental noise may result in adverse impacts upon health, wellbeing and amenity[8].

92 The progression of seriousness of adverse acoustic impacts can generally be observed in the following nominal progression of responses to intruding noise, the order may vary for individuals depending upon their own individual circumstances and relative locations to the source of intruding noise:

(i) low or moderate annoyance;
(ii) serious annoyance;
(iii) noise complaints by phone/email;
(iv) meetings/contact with source environmental officers and management;
(v) noise complaints by mail/petitions, including to Members of Parliament;
(vi) organised opposition activities, meetings, pamphlets; media campaigns;
(vii) perceived loss of amenity,
(viii) frustration,
(ix) stress,
(x) adverse impacts upon physical health or the wellbeing condition of sensitive receptors.

The potential for adverse impacts upon health, wellbeing and amenity arising from noise intrusion is generally accompanied by some or all of the above characteristic responses to the intruding noise, to a greater or lesser degree. The list is not necessarily exhaustive but is representative of the range of responses to noise considered to be having an adverse impact upon a sensitive receptor.

93 A key question for an acoustician assessing the impact of a mining project is whether the acoustic levels that trigger the above responses to intruding noise will be the same for a

[8] *WHO "Guidelines for Community Noise" and enHealth "The Health Effects of Environmental Noise – Other than Hearing Loss Guideline"*

sensitive receptor located in a very rural environmental area, such as near the proposed Stage 3 mine working areas, or a sensitive receptor located in a typical urban environment which is normally impacted throughout the day, evening and night, to a lesser or greater extent, by road traffic noise, train noise, aircraft noise, or some industry noise.

94 Mr Savery's opinion is that lower noise levels trigger an annoyance response for sensitive receptors located in very rural environments (this is the first step in the progression to adverse health, wellbeing and amenity impacts) compared to the noise levels required to trigger an annoyance response for sensitive receptors located in their urban environments in towns and cities.

95 The reason for the lower trigger levels in Mr Savery's opinion is that the normal acoustic environment experienced by sensitive receptors in very rural environments is typically 10 to 20 dB quieter during the day, evening and night than is normally experienced by sensitive receptors in urban environments. There is therefore less masking of intruding noise and the impact of the intruding noise is being subjectively assessed by the sensitive receptor against a lower "normal" base level.

96 In addition, in the night period, sensitive receptors in very rural environments are more attuned to the occurrence of an "out-of the normal" intruding noise because of inherent concerns about personal and property safety and security. Mr Savery's opinion is that pyscho-acoustic or physco-social factors can have more weight in a very rural environment than in an urban environment, such as safety (e.g. related to road traffic), degradation of amenity or environment (relating to nearby mining activities which are perceived to be an unreasonable imposition or non-compliant with approved conditions).

97 Mr Savery believes that research into the potential for adverse impacts upon human health, wellbeing and amenity has rightly been concentrated upon the large urban populations who are composed of the most people in first and third world countries who are potentially exposed to excessive levels of transportation and industrial noise, which may in turn cause adverse physical health, wellbeing and amenity impacts.

98 The focus of the WHO Guidelines for Community Noise (WHO Report) is upon the urban environment and associated community noise impacts. This is stated in the Preface to the WHO Report where it is stated:

"*Many countries have regulated community noise from road and rail traffic, construction machines and industrial plants by applying emission standards, and by regulating the acoustical properties of buildings. In contrast, few countries have regulations on community noise from the neighbourhood, probably due to the lack of methods to define and measure it, and the difficulty of controlling it. In large cities throughout the world, the general populations is*

increasingly exposed to community noise due to the sources mentioned above and the health effects of these exposures are considered to be more and more an important public health problem"

99 Mr Savery's opinion is that the focus of the WHO Report is the large population groups who are located in populous cities, towns and villages.

100 Mr Savery notes that the WHO Report actually recommends two concurrent noise limits, the equivalent sound levels should not exceed 30dBA for continuous background noise, AND individual noise events exceeding 45 dBA should be avoided. For sleep disturbance both noise limits must be satisfied[9] (refer to paragraphs 150 and 156 for further discussion).

101 The enHealth Report is similarly focussed upon the urban environment, and not the low noise rural environment. An excerpt from the Executive Summary states: "Environmental noise is increasingly becoming a community concern both internationally and in Australia. Considerable efforts have been made over about the last four decades to reduce noise impacts from transportation sources such as road and rail traffic and aircraft. Nonetheless, many of the benefits of these efforts have been lost due to increased traffic volumes (by all modes) for longer periods of the day and evening. At the same time increases in urban population have resulted in greater exposure of a larger percentage of the population to increased noise levels."

102 The Executive Summary goes on to state: "This report examines the range of environmental sources that may affect communities, with a focus on the primary sources of such noise (road, rail and air traffic, and industry).

103 Endorsement of the enHealth report or the WHO Report for setting noise limits for prevention of sleep disturbance in very low noise rural environments is not supported by Mr Savery for the same reasons as given in paragraph 96 above.

104 In regard to setting of noise limits to protect or enhance health, wellbeing and amenity, Mr Savery notes the overall approach recommended by AS1055, see below:

105 Australian Standard AS1055.2-1997, *Acoustics – Description and measurement of environmental noise – Application to specific situations*, in Section 4.1 recommends three fundamental approaches to assessing the noise impact of a new project,

The three methods are:
(1) comparison of intrusive noise level and background noise levels,
(2) setting of a rating level, and

[9] *Guidelines for Community Noise, WHO, Executive Summary, px*

(3) application of statistical acoustic levels.

106 AS1055.2 notes in Section 4.3 that "The methods of assessment described in this Standard involve the measurement of sound pressure levels in dB(A). This has been found to give a good correlation with annoyance caused by continuous broadband noise". Continuous broad band noise is not the character of the noise emissions from a mining operation but AS1055 gives no further guidance in regard to annoyance caused by noise with a generally variable mid-low frequency character other than stating that other factors may be involved in assessing noise annoyance.

107 The question then is which of these three methodologies, or which combination of these methodologies, is most appropriate for the proposed Stage 3 project where the noise emissions are not continuous broadband noise levels and where the sensitive receptors are all located in areas classified as very rural environment in PNCG[10]?

108 There are two noise criteria in Queensland which may be appropriate for the proposed development which are based on the comparison of intrusive noise level and background noise levels, namely the Planning for Noise Control Guideline (PNCG), dated August 2004 and the Model Mining Conditions Guideline EM944 version 5 (MMCG), dated November 2014. Both of these guidelines were published by the Queensland Government (Ecoaccess under DERM) and DEHP respectively.

109 The PNCG is referred in the 2014 EIS in Chapter 11 Noise. The MMC is not referenced in the 2014 EIS.

110 Noise assessment based upon the PNCG requires measurement of background noise levels (as RBLs, rating background levels) from which appropriate noise limits for the proposed project are determined.

111 Noise limits resulting from the PNCG for the day/evening and night periods respectively are 32, 28 and 28 dBA respectively, assuming a deemed minimum background noise level of 25dBA in each daily period (Reference 2014 EIS Chapter 11, Section 11.4.4)

112 The MMCG in Section D specifies noise limits, in Table D1, that are based upon Critical Values (CV), Adjustment Values (AV) and the background noise level (bg), (refer to Note 3 under Table D1).

113 MMCG notes (Note 4 under Table D1) that if the measured background noise level ($L_{A90,\ adj,\ 15mins}$) is less than 30dB(A), then 30 dB(A) can be substituted for the measured level.

[10] *PNCG, Table 1*

114 If it is assumed that the background noise level during all three daily periods at all sensitive receptors (in the absence of noise from the mine) is less than 30dB(A), then the applicable noise limits for the project, in accordance with the MMCG, are shown in the table below.

Noise levels measured as	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
$L_{A90, adj, 15mins}$	30	30	30	30	30	30
Sensitive receptor						
$L_{Aeq, adj, 15mins}$	35	35	30	35	35	30
$L_{A1, adj, 15mins}$	40	40	35	40	40	35

115 The Introduction to the MMCG outlines the role of the MMCG in setting conditions and environmental commitments in environmental authorities for mining.

116 Compliance with the noise limits for the day, evening and night periods are required for the proposed Stage 3 project. Normally compliance for a continuously operating plant is checked only for the night period because this period has the lowest noise limits and compliance within this period normally means compliance will occur in the other two daily periods. For the proposed Stage 3 mine development, however, there are reduced operating scenarios proposed for the night period compared to the day/evening and so in this instance it will be necessary to confirm compliance with the noise limits for both the night and the day/evening periods.

117 The noise limits to protect health, wellbeing and amenity using these two guidelines (based upon assessment of the background noise level) for a sensitive receptor in a low noise very rural environment, are shown in the following table and compared with the noise limits recommended by the 2014 EIS and the CG's draft EA conditions:

	Assessment time, T	Monday to Saturday, Noise limits, $L_{Aeq, adj, T}$		
		Day	Evening	Night
PNCG	1 hour	32	28	28
MMCG	15 minutes	35	35	30
2014 EIS	1 hour	42	42	37
CG Draft EA	15 minutes	42	42	37

118 Mr Savery's opinion is that the noise limits based upon the PNCG and the MMCG provide the best protection of health, wellbeing and amenity because the noise limits are determined following consideration of the local background noise level of the sensitive receptor in a low noise very rural environment.

119 The approach of comparing intrusive noise levels with background noise levels to determine noise limits to protect health, wellbeing and amenity is not restricted to just the PNCG and the MMCG but are commonly used in other Queensland and Australian state policies and guidelines, namely:

(i) Prescribing Noise Conditions for Environmental Authorities for petroleum activities (DEHP EM632 version 2, March 2015);
(ii) Qld Draft Wind Turbine Noise Policy 2014
(iii) NSW Industrial Noise Policy 2000
(iv) and others

120 The noise limits determined in the 2014 EIS are not based upon the background noise levels but rather upon selection of appropriate rating levels to protect health, well-being and amenity.

121 The setting of noise limits based upon a rating level (AS1055.2, refer to paragraph 105 above) is the main method applied in the 2014 EIS, Chapter 11 for the noise emissions of the Stage 3 project. The rating levels are the acoustic quality objectives stated in Schedule 1 of the EPP(Noise) 2008.

122 The Environmental Protection Policy (Noise) 2008 (EPP(Noise) is subordinate legislation to the Environment Protection Act 1994. It prescribes environmental values (Part 3, Section 7 (b) and (c) that relate to human health, well-being and amenity., namely

a. The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring suitable environment for individuals to do any of the following:
   (i) sleep;
   (ii) study or learn;
   (iii) be involved recreation, including relaxation and conversation; and

b. The qualities of the acoustic environment that are conducive to protecting amenity of the community.

123 The EPP(Noise) prescribes acoustic quality objectives for sensitive receptors for protecting or enhancing the stated environmental values stated in Schedule 1.

124 The intention of the EPP(Noise) is stated in Section 8 paragraph (3) where it states:

"It is intended that the acoustic quality objective be progressively achieved as part of achieving the purpose of this policy over the long term"

This section emphasizes the application of Schedule 1 to sensitive receptors where the intention is to achieve the acoustic quality objectives over the long term (eg where sensitive receptors are located close to a major industrial complex), or to implement the level as an upper limit immediately for sensitive receptors located near a proposed major industrial development.

125 The intention to protect existing ambient noise environments was more clearly stated in the previous version of the EPP(Noise) 1997 where it states in Section 11 Acoustic quality objective, part (3) that:

"It is not intended that, in achieving the acoustic quality objective, any part of the existing acoustic environment be allowed to significantly deteriorate".

126 The importance of not increasing existing background noise levels unreasonably as a result of a new project is also stated as a management intent in the EPP(Noise) in Section 10, **Controlling background creep**. Mr Savery believes that Paragraph (2) (b) is applicable to at least the Acland, northern and north-western sensitive receptors for the current application:

(b) for noise that varies over time measured by $L_{Aeq,\ adj,\ T}$ – more than 5 dB(A) greater than the existing acoustic environment measured by $L_{A90,\ T}$.

127 The acoustic quality objectives listed in Schedule 1 are based upon levels recommended by the WHO report[11]

128 Mr Savery believes that the WHO report noise limit recommendations are focussed upon the urban environment (refer to discussion in paragraphs 92 to 103 above) and therefore does not support the direct application of the Schedule 1 acoustic quality objectives to sensitive receptors located in low noise very rural environments, where the background noise levels are considerably quieter than in an urban environment.

129 Mr Savery believes that the acoustic quality objectives should not be applied as a one-size-fits all criteria across Queensland because this is probably satisfactory for most of the population in urban environments but ignores the local context for sensitive receptors located in low noise very rural environments.

130 Mr Savery's opinion is the acoustic quality objectives defined in the EPP(Noise) provide guidance as to what ambient noise levels should be achieved to protect the receiving environment and that a reduction of approximately 5 dB is necessary to bring the acoustic

[11] *WHO report, Section 4.4, Table 4.1, page 47*

quality objectives nearer to agreement with the noise limits based upon the background noise levels recommended by the PNCG or MMCG noise limits.

131 This view is supported by the Queensland Department of Environment and Heritage (DEHP) document entitled "Application requirements for activities with noise impacts guideline", EM962 version 2, dated February 2014. This guideline outlines the information to be provided to DEHP to support an environmental authority application for activities with noise impacts. It states, under the heading of "Noise Impact Assessment" (p9):

> *The acoustic quality objectives defined in the EPP(Noise) provide guidance as to what ambient noise levels should be achieved to protect the receiving environment*.

132 This statement indicates that the acoustic quality objectives in Schedule 1 are not mandated or specified in the Policy as the absolute noise limits to protect health and wellbeing but rather Schedule 1 provides guidance as to what acoustic quality objective levels may be appropriate for this purpose. Although not stated, this allows for consideration of context, i.e. background noise levels, which is particularly relevant for sensitive receptors in low noise very rural environments.

133 The reasonableness of reducing the acoustic quality objectives in low noise very rural environments may be seen in the following hypothetical case study examples.

134 **Case study 1**. In an urban environment where the background noise levels during the day/evening are in the range of 40-45dBA the outdoor acoustic quality objective (from Schedule 1) of $L_{Aeq,\ adj,\ 1\ hour}$ 50 dBA may be considered a reasonable noise limit to protect health, wellbeing and amenity. This L_{Aeq} objective level (5-10dB increase above background noise levels) is described in WHO[12] as a level where there is likely to be *moderate* annoyance. However, if the acoustic quality objective level was increased to 55dBA (a 10-15 dBA increase above background noise levels) then this would represent a level which WHO describes as *serious* annoyance, which is clearly not as reasonable for the sensitive receptor.

135 In a very rural environment where the background noise level is only 30dBA or less during the day/evening, then a Schedule 1 outdoor acoustic quality objective level of 50dBA represents an increase of 20dB or more above background noise levels. It is expected that WHO would describe this increased differential level as "very serious" annoyance (i.e. an additional 5dB greater than the *serious* annoyance level). It follows that *very serious* annoyance is not the intrusive noise level at which health, wellbeing and amenity will be protected in a low noise very rural environment and in this case, to be consistent, the Schedule 1 outdoor acoustic quality objective should be reduced by 5dB for the very rural environment.

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[12] *WHO Community Noise Guidelines*

136 **Case Study 2**. In an urban environment (Noise category Z4 – Medium density transportation (less than 600 vehicles per hour, or some commerce or industry[13]) the outdoor $L_{Aeq\ 1hour}$ level is estimated to be 50dBA at night. Using a 5-10dB noise reduction for an open window in a bedroom this equates to an internal level of 40-45dBA. In this situation achievement of the acoustic quality objective of 30dBA by noise mitigation to protect health, well-being and amenity would be considered a very desirable outcome which could have beneficial outcomes for amenity, health and wellbeing for the sensitive receptor.

137 Correspondingly, in a very rural residential environment with less than 40 vehicles per hour[12] the outdoor $L_{Aeq\ 1hour}$ level is estimated to be 30dBA. Again using the 5-10dB noise reduction for an open window in a bedroom this equates to an internal level of only 20-25dBA. In this situation specification of the acoustic quality objective of 30dBA as a limit to protect health, wellbeing and amenity would be considered an adverse impact due to the increase in noise levels by 5-10 dB permitted by the mandatory specification of the EPP(Noise) Schedule 1 acoustic quality objectives. A lower $L_{Aeq\ 1hour}$ level by 5dB would be more appropriate in this instance.

138 Mr Savery believes that these two case studies illustrate why the Schedule 1 acoustic quality objectives should be used for guidance and should be lower by 5dB for low noise very rural environments.

139 If outdoor noise limits at night were to be set by the direct application of the Schedule 1 indoor acoustic quality objectives then the next question that needs quantification is what is the noise reduction achieved with a fully open, or partially open windows in a typical bedroom?

140 The 2014 EIS Chapter 11, Section 11.4.2 develops external noise limits based upon the EPP(Noise) Schedule 1 indoor acoustic quality objectives and a noise reduction of 7dB from outside to inside for a dwelling with partially open windows

141 The reference for the 7 dB noise reduction for a partially open window in the 2014 EIS is given as the PNCG (Table 7). The free-field outdoor noise limit for an internal rating level of $L_{Aeq,\ adj,T}$ 30dBA will then be 37dBA (after allowing for 10dB partially closed window noise reduction and the façade reflection of 3dB). If the windows were fully open (i.e. 5 dB noise reduction according to PNCG Table 7) then the corresponding free-field outdoor noise limit would be only 32dBA.

142 A comparison of the noise limits using the EPP(Noise) Schedule 1 rating levels compared to the “background plus” approach is provided in the table below:

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[13] *Planning for Noise Control Guideline, Table 3*

	Windows	Assessment time, T	Monday to Saturday, Free-field outdoor noise limits, $L_{Aeq, adj, T}$		
			Day	Evening	Night
PNCG	-	1 hour	32	28	28
MMCG	-	15 minutes	35	35	30
2014 EIS[1]	Wide open	1 hour	37	37	32
Wandoan[2]	Partially closed (but slightly more open than 2014 EIS	15 minutes	-	35	35
EPP(Noise) Background creep[3]	-	15 minutes or 1 hour	40	35	35
2014 EIS	Partially closed	1 hour	42	42	37
CG Draft EA	Partially closed	15 minutes	42	42	37

Note: 1 Outdoor rating levels calculated by Mr Savery using the methodology of the 2014 EIS
2 Refer discussion below in paragraphs 144 and 145 below, day noise limit not stated in judgement;
3 Refer to discussion below in paragraphs 147 to 149, assuming a background noise level of 35dBA for day and 30dBA for evening and night periods

143 The tabulated noise limits show that there is not too much difference between the outdoor free-field noise limits for the wide open window condition compared to the partially closed window conditions. The question then is whether it is a reasonable impost upon the sensitive receptors for the draft EA noise limits to assume that windows of sensitive receptors will always be at least partially closed in the presence of mining noise for assessment of compliance.

144 The Wandoan Coal Mine judgement in the Land Court endorsed free field noise limits which assumed that windows were slightly more open than the 2014 EIS for Stage 3, because the noise limits are based upon a noise reduction of only 8dB for partially closed windows, compared to the 10dB noise reduction assumed in the PNCG Table 7, and compared with the 5dB noise reduction for wide open windows.

	Windows	Assessment time, T	Monday to Saturday, Free-field outdoor noise limits, $L_{Aeq, adj, T}$		
			Day	Evening	Night
Wandoan	Partially open	15 minutes	-[1]	35	35

Note: 1 Day noise limit is not stated in Wandoan judgement

145 The Wandoan noise limits are more reasonable for sensitive receptors in Mr Savery's opinion than the 2014 EIS noise limits in that the window open/closed condition is slightly more biased towards windows being more open, but still not wide open, compared to the 2014 EIS noise limit and draft EA $L_{Aeq, adj, T}$ condition of 37dBA.

146 Mr Savery also supports the CG Draft EA assessment time of 15 minutes because it is more reasonable than one hour for an industry with variable and not continuous noise levels. The fifteen minute assessment period means that there is less possibly of high noise levels followed by periods of quiet in the assessment period, which when averaged indicates that compliance with the noise limits has been achieved for the assessment period, even though the instantaneous noise levels measured may be up to 10 dB greater than the $L_{Aeq, adj, 1hour}$ noise limit. There are numerous examples of this situation occurring at the nearby sensitive receptors in the noise monitoring reports of D Moore from 2011 to 2015.

147 Mr Savery further believes that the background creep provisions of the EPP(Noise) (refer to paragraph 126 above) are applicable to the sensitive receptors located in Acland and to the north and north-west of the mine site. The background creep criteria are applied to situations where the noise of a new development (plant and equipment) is being approved to be added to the noise of existing plant and equipment. For the sensitive receptors located to the north and north-west of the mine site the dominant noise sources currently contributing to the mine noise levels at their locations are the CHPP, RoM pad haulage trucks and mobile equipment, conveyors and other plant on the product stockpile pad, and the mine infrastructure area (MIA).

148 The changes to the CHPP, RoM pad, production pad and MIA in Stage 3 are described in the 2014 EIS Chapter 3, Section 3.7 with the relevant subsections listed in paragraph 35 above. The Stage 3 project involves retention of the Module 2 CHPP and associated RoM plant and activities, plus the addition of a new Module 3 CHPP and its associated RoM plant and activities, a new product stockpile pad with associated conveyors, stackers and reclaimers, and an expansion of the existing MIA. Since substantial plant is being added to the existing plant the background creep provisions of the EPP(Noise) are applicable in setting the noise limit.

149 For sources with varying noise levels (varying mainly due to the activities on the RoM pad, the CHPP hopper and the product pad), the EPP(Noise) recommends the noise limit to be

background noise level plus 5dB. For evening/night operations the noise limit is therefore 30dBA or 35dBA, depending upon the deemed minimum background noise levels in accordance with the PNCG (25 dBA) or MMC (30dBA) respectively. The corresponding day limit will be 40 dBA (from background noise levels used in 2014 EIS, Chapter 11, Section 11.2.3, assumed to be nominally 35dBA for the purposes of the comparison of limits).

150 Noise limits to protect against sleep disturbance are statistical parameter limits in accordance with AS1055.2, methodology 3, as discussed above in paragraph 105. The noise limits are presented in the 2014 EIS in Chapter 11, Section 11.4.4 (PNCG) where it is recommended that the maximum internal noise levels, L_{Amax}, should not exceed 45 dBA more than 10-15 times per night. This indoor level is equivalent to L_{Amax} 52dBA if it is assumed that there is a 7 dB difference between outdoor and indoors, i.e. a partially closed window as discussed in paragraphs 140 to 141 above. This recommendation is based upon the WHO Report 1999.

151 The executive summary of the WHO guideline states:

"*For a good night's sleep, the equivalent sound level should not exceed 30dBA for continuous background noise, and individual noise events exceeding 45 dBA should be avoided. In setting limits for single night-time noise exposures, the intermittent character of the noise has to be taken into account. This can be achieved, for example, by measuring the number of noise events, as well as the difference between the maximum sound level and the background sound level. Special attention should also be given to: noise sources in an environment with low background sound levels; combinations of noise and vibrations; and to noise sources with low frequency components"*.

152 Mr Savery's opinion is that the difference between the continuous average noise level of 30 dBA and the individual maximum noise level of 45 dBA (i.e. 15 dB) should be used to set the sleep disturbance maximum noise level limit in a low noise very rural environment. For example, this would mean that for a low noise environment with a background noise level of 25 dBA the intrusive sleep disturbance level could be only 40 dBA and not 45 dBA, For a background noise level of 20 dBA the intrusive maximum noise level could only be 35dBA. A similar 5dB minimum reduction in the maximum noise level could apply if the noise was predominantly low frequency sound, e.g. for the receptors with dominant noise sources from the train loading facility, diesel powered equipment, or the RoM/CHPP.

153 Mr Savery's opinion is that sleep disturbance will occur in low noise very rural environments at lower maximum noise levels than for persons in an urban environment where the ambient noise level may be considerably higher (by as much as 20dB).

154 This view is supported by the WHO Report where it states "If noise is not continuous, sleep disturbance correlates best with L_{Amax} and affects have been observed at 45 dB or less. This is particularly true if the background level is low".[14]

155 Mr Savery believes that the draft EA L_{Amax} condition of 50dBA is consistent with the rating level ($L_{Aeq,\ adj,\ 15min}$ 35 dBA for equivalent continuous noise as recommended in the Wandoan judgement, based upon the difference of 15 dBA between the L_{Amax} and the L_{Aeq} levels in a bedroom determined by the WHO Report.

156 Mr Savery's opinion is that a more effective sleep disturbance noise limit to protect against sleep disturbance in a low noise very rural environment would be lower by up to 5dB compared to the 2014 EIS L_{Amax} limit for the Stage 3 project, i.e. outdoor free-field noise limit to protect against sleep disturbance of L_{Amax} 47 dBA., a reduction of 3dB of the draft EA L_{Amax} noise limit of 50dBA.

157 Noise limits for rail operations in a rail corridor are normally set as statistical parameter limits in accordance with AS1055.2, methodology 3, as discussed above in paragraph 105. The applicable noise limits are described in the 2014 EIS Section 11.4.6. The rail noise limits of 87 dBA L_{Amax} and 65 dBA $L_{Aeq\ (24hour)}$ are the noise limits applied by the QR Code of Practice for Railway Management 2007 to rail lines within Queensland. The Draft EA Conditions impose 56 dBA L_{Amax} and 50 dBA $L_{Aeq\ (24hour)}$ as the noise limits for the spur line.

158 Mr Savery does not believe that rail corridor statistical noise limits should apply to train movement and loading operations conducted within the mining lease. The noise emissions from heavy road haulage vehicles moving on internal haulage roads within the mining lease must comply with the noise limits that are approved for the mining lease operations. Similarly, it is consistent that train movements and loading operations within the mining lease boundary should also be subject to the same approved noise limits as for the remainder of the mining operational activities.

159 The train speed on the train loading rail loop will only be approximately 1kph and train loading noise will occur intermittently during the day, evening and night periods.

160 Mr Savery supports the application of the draft EA rail noise limits of 56 dBA L_{Amax} and 50 dBA $L_{Aeq\ (24hour)}$ for the spur line outside the boundaries of the mining lease.

161 Noise limits for road vehicles on public roads are normally set as statistical parameter limits in accordance with AS1055.2, methodology 3, as discussed above in paragraph 105 . Road noise limits for public roads external to the mining lease are described in the 2014 EIS Section

[14] *WHO Report, Section 3.4 Sleep disturbance, page 28 (last paragraph)*

11.4.7 where the TMR noise limit of $L_{A10(18\ hour)}$ of 68 dBA are recommended for sensitive receptors located near existing roads.

162 Mr Savery disagrees that the use of this "one size fits all" TMR noise limit will satisfactorily assess whether increased mine traffic on public roads causes an adverse impact upon nearby sensitive receptors. The choice of the statistical acoustic parameter by TMR for road noise emissions is an average of the maximum traffic noise levels assessed in each hour, for the eighteen hours from 6am to midnight. This noise limit may work well for major roads, such as the Gold Coast Motorway, but it is entirely unsuited for assessing noise impacts on a rural country road with typical rural traffic volumes. The traffic volumes and changes to traffic noise levels are generally too low on a rural road for an assessment in these terms to be meaningful for any sensitive receptor near the road.

163 For the sensitive receptors located to the north and west of the mine site, the traffic noise limit needs to consider whether there will be an adverse noise impact from an additional 100 vehicles per hour travelling at high speeds for nominally 30 minutes on either side of the change of shift time. For 50 of those vehicles the noise will also include the noise of rapid acceleration away from the mining access road entrance. This change of shift traffic noise impact will occur twice per day for every day that the mine operates.

164 It is not possible to impose a new noise limit on users of a public road to assess this twice daily impact, the first per day being in the night period. It is recommended, however, that NAC in association with its personnel and subcontractors, the local authority and police, explore ways to limit vehicle speeds on the sections of potentially affected public roads that are near to the mining leases to lessen the speed and therefore noise impact of light vehicles accessing and departing from the mine site at the change of shift times. A potential solution could include a mandatory installation of vehicle management software in all mine and contractor vehicles which monitors speeds and times. This has been commonly applied in the coal seam gas industry to control vehicle noise on local roads.

165 Noise limits for low frequency noise (LFN) are statistical parameter limits in accordance with AS1055.2, methodology 3, as discussed above in paragraph 105. Noise limits to control LFN[15] are described in 2014 EIS section 11.4.5 where a draft guideline prepared by DERM in 2002 is recommended. This guideline has not been formally approved but has been commonly applied for many projects since it was prepared. It requires an assessment of LFN to be conducted inside a sensitive receptor's dwelling where the Leq(Lin) level is assessed and if the level is greater than 50 dBL then a comparison of the dBA and dBL levels is conducted to determine whether a spectrum is unbalanced and to confirm whether LFN is likely to be an adverse

[15] *Low frequency noise is defined as noise below a frequency of 200Hz, often described as "rumble" or "a feeling of pressure".*

impact.

166 The problem with this draft LFN guideline is that although assessment inside a dwelling is the ideal location to assess LFN, at the planning level it requires detailed knowledge of each dwelling's construction (to determine the LFN sound transmission loss between outside to inside) for it to be accurately applied.

167 The potential sources of LFN for this project are the diesel engines of haulage vehicles and all diesel powered mobile plant, the diesel locomotive on the train loading loop, the screens, feeders and breakers in the CHPP, and the mobile basalt crushing plant.

168 Mr Savery recommends that a simple outdoor LFN $L_{Ceq,\ 15min}$ noise limit proposed by Broner[16] be applied for planning assessment purposes. The noise limit applicable to this project is $L_{Ceq,\ 15min}$ 60 dBC. This noise limit may be assessed by modelling and measured outside a sensitive receptor to assess compliance to provide an indication as to whether further indoor noise assessment and analysis is necessary.

169 The D Moore reports indicate that for sensitive receptor monitoring sites, the major mining noise sources that were subjectively identified are generally diesel engines, tracked dozers and rock impacts. Diesel engines are a source of acoustic energy from 50 Hz to 800Hz which includes the low frequency (<200Hz range). The noise of diesel engines may not be identified specifically as a low frequency problem but will exhibit low frequency tonal noise characteristics inside a dwelling, particularly when the windows are closed. In these circumstances the L_{Ceq} assessment conducted outdoors may be appropriate as an initial, non-intrusive screening of whether low frequency noise problems are likely.

170 Mr Elkin's view is that the draft EA noise limits are appropriate.

171 All of the following references support this position:

LEGISLATION

172 The purpose of the EPP(Noise) is …"to achieve the object of the EP Act in relation to the acoustic environment". The purpose of the EPP(Noise) is achieved by:

- Identifying environmental values to be enhanced or protected;
- Stating the acoustic quality objectives for enhancing or protecting the environmental values; and
- Providing a framework for making consistent, equitable and informed decisions about the

[16] *Broner N, A simple outdoor criterion for assessment of low frequency noise emission, Aooustics Australia, Vol39 April (2011) No 1*

acoustic environment.

173 The primary reasons that, in Mr Elkin's opinion, the EPP(Noise) is most appropriate to set the criteria for this project are:

- It is legislation (rather than a guideline),
- It has a clearly stated purpose in achieving the object of the EP Act (see above), and
- It has used the findings / recommendations of the World Health Organisation in setting internal noise levels appropriate to protect sleep amenity (during the night-time period that is the most critical/sensitive time period).

174 Part 3 of the EPP(Noise), which references the acoustic quality objectives, sets out the values and objectives that, if met, means the acoustic amenity for that place has been protected. As such, this is the highest piece of legislation in Qld that provides numerical limits.

175 Part 4 of the EPP(Noise), which references "background creep" criteria, outlines the management intent. The EPP(Noise) suggests these measures be implemented to the extent that it is reasonable to do so. Through the use of extensive management (TARP / live dashboard and associated equipment shutdowns/relocations) and mitigation (substantial noise reduction kits installed on existing fleet), all reasonable measures have (or will be) implemented and despite these initiatives, achieving a "background plus" limit is not reasonably achievable in Mr Elkin's opinion.

176 Mr Savery recommends that the "background creep" criteria contained in the EPP(Noise) are appropriate for the residences to the north of the mine. Mr Elkin would simply like to point out that these homes are currently sometimes exposed to noise levels of up to 40 dBA Leq (the existing EA conditions) whereas once Stage 3 is operational, the limit will come down by 3 dB. This suggests noise levels will diminish for these residents (to the north), not "creep" higher. Mr Elkin acknowledges this is not the true intent of this section of the EPP(Noise) however it is a real life fact for these northern residents that mining noise levels will need to be more tightly controlled once Stage 3 is operational.

177 Based on paragraphs 172 to 176, it is my opinion that the acoustic quality objectives are appropriate for setting EA conditions for this project.

178 In relation to paragraph 124, there are a number of assumptions made by Mr Savery that Mr Elkin does not agree with. Mr Savery makes the assumption that the intent of the acoustic quality objectives is, for example, in relation to receptors near major industrial complexes. This implies(at least to Mr Elkin) that the intent of the acoustic quality objectives does not apply to this project.

179 And another assumption is that the acoustic quality objectives should be implemented as an

upper limit for receptors located near proposed major industrial developments. Again, implying the acoustic quality objectives aren't applicable to this project.

180 Mr Elkin can find no evidence that these assumptions are true. Nowhere in the EPP(Noise) is there a reference to the acoustic quality objectives only being intended for residences adjacent to major industrial developments. It is just as plausible that the intent was to eventually (over time) get all government guidelines and policies in line with the acoustic quality objectives. For that matter, it may have been intended that all (mining or otherwise) EAs issued since the release of the EPP(Noise) should over the long term, given that so many existing EAs (some of which have no numerical limits) will be in place for many years, be in agreeance with the acoustic quality objectives.

181 The fact is that the EPP(Noise) states none of these assumptions. It simply states, as per Paragraph 174, that the acoustic quality objectives enhance or protect the environmental values (predominately the health and wellbeing of occupants) relevant to the type of sensitive receptor. This is quite unambiguous.

BUILDING FAÇADE NOISE REDUCTION (Open Windows)

182 Please find below the justification for the 7 dB façade noise reduction used by the 2014 EIS and Mr Elkin in this JER. This information has been provided now, prior to Mr Elkin's further justification for the proposed draft EA, so that a direct correlation can be made between internal noise levels and external noise levels.

183 The World Health Organisation's Guideline for Community Noise (WHO, 1999) and Night Noise Guidelines for Europe (WHO, 2009), consider a **15 dB** difference for a window "slightly open" when evaluating noise reduction outside to inside:

"At night, sound pressure levels at the outside facades of the living spaces should not exceed 45 dBA LAeq and 60 dB LAmax, so that people may sleep with the bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB".

… It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction from outside to inside of 15 dB).

184 The EPP(Noise) provides Acoustic Quality Objectives applicable at the external façade and within the internal environment of noise sensitive places. For residences, the difference between the external (outside) and internal (inside) Acoustic Quality Objectives is **15 dB**. It is thus inferred that the EPP(Noise) allows for a noise reduction from outside to inside of **15 dB**.

185 Section 3.2.1 of the Australian Standard AS 3671 Acoustics – Road traffic noise intrusion –

Building siting and construction nominates the noise reduction of a building façade to be 10 dB where windows and doors are open (where windows and doors do not comprise more than 10% of the building façade).

186 During construction of the Airport Link Tunnel, SLR measured noise reductions through the building façade of both "Queenslanders" and more modern residences. The measured values are shown in the table below. The 2nd last column shows the results for open windows and doors.

No.	House Type	Controlling Element Description	Measured Noise Reduction, dB	
			Element Open	**Element Closed**
1	Type 1[1]	Window 1: Small timber double-hung windows to bedroom, no seals	**13**	23
		Window 1: Small aluminium double-hung windows to study, no seals	**15**	27
2	Type 2[2]	Large timber folding doors to living area, acoustic seals to perimeters	**6**	24
3	Type 1	Queenslander, timber, split-double leaf door with mid-size glass inserts to bedroom, large perimeter gaps, no seals	**12**	22
4	Type 2	Large aluminium-framed sliding doors to living room, weather seals	**8**	22
5	Type 1	Window 1: Queenslander, timber-framed hinged windows to living area, no seals	**7**[3]	18[4]
		Door 1: Timber double doors to rumpus, timber frame, no seals, large glazing area	**11**	25

1 Type 1 - "Queenslander" (timber façade, older style timber frame windows/doors, often with significant gaps between the frame and window/door, no seals)
2 Type 2 - "Modern" (aluminium or timber frame with weather or acoustic seals, usually associated with brick, newer, or renovated buildings)
3 Result not considered representative based on other noise measurement results obtained for this study
4 Noise "flanking" likely resulting in lower than expected value

187 Research conducted by the School of the Built Environment at Napier University in 2006 on behalf of the Department of Environment, Food and Rural Affairs (DEFRA, UK), suggests that the insulation (in terms of sound level difference) of an open window is generally accepted as being 10-15 dBA. Tests conducted on a range of window sizes, style, open area and noise sources found the following noise reduction values:

- **12-17 dB** for road traffic noise
- **12-17 dB** for railway noise
- **14-18 dB** for aircraft noise
- **12-17 dB** for entertainment noise

188 The paper entitled Noise Reduction through Facades with Open Windows (ASK Consulting Engineers and Griffith University, Australian Acoustical Society (AAS) Conference 2011), presented the following noise reductions:

Dwelling Façade	Dwelling Room	Reduction LAeq - dB
Living Room	Timber	8.0
	Timber/Concrete	13.8
	Brick Veneer	6.1
	Double Brick	14.7
	Double Brick	12.4
Bedroom	Brick Veneer	10.8
	Brick Veneer	14.7
Nursery	Double Brick	12.3
Games Room	Timber	12.2
Bathroom	Timber	7.5
Empty Room	Timber	5.4[1]

1. This is uncharacteristically low given the absence of any furniture in this room. Furniture typically provides additional absorption within a room which then results in lower internal noise levels.

189 Finally, SLR has had numerous discussions with DEHP in relation to what they expect consultants to be using for a building façade noise reduction assuming open windows. The answer received for many years now has been 7 dB.

190 Based on all the above information, the experts agree that it is reasonable and (for all bar 2 examples of 6 dB if the empty room data is excluded from the analysis) conservative to use 7 dB as the overall noise reduction between indoor and free-field outdoor levels for a partially closed (or open) window, in accordance with the 2014 EIS Chapter 11, Section 11.4.2.

191 Using this 7 dB façade noise reduction (for open windows), the 30 dBA Leq internal acoustic quality objective for residences at night can be converted to the draft EA night-time noise limit of 37 dBA Leq.

192 Further evidence supporting the proposed draft EA noise limits are outlined below:

WHO GUIDELINES

193 The night-time acoustic quality objectives (Leq) contained in the EPP(Noise) meet the World Health Organisation's (WHO) recommendations for avoiding sleep disturbance. WHO is the world's foremost organisation in relation to setting limits/standards in relation to human health.

WHO have extensively researched sleep disturbance studies in reaching their recommendations.

194 Based on NAC's complaints history, the night-time period is the most critical time in relation to impacts on the community. Therefore Mr Elkin fully supports the draft EA noise conditions as they will bring mine noise emissions back down to the WHO recommended (Leq) levels to avoid sleep disturbance (the current EA night-time noise limit is 3 dB above WHO's recommended Leq level assuming open windows).

195 WHO also recommend an (internal) maximum noise level to protect sleep – 45 dBA Lmax.

196 Applying the 7 dB façade noise correction outlined above, this would equate to an external noise level of 52 dBA.

197 The draft EA contains a maximum (external) noise level limit of 50 dBA for the night time period. This is below the WHO's recommendation and therefore it is my opinion that the draft EA Lmax noise level should be maintained.

198 I disagree with the analysis provided by Mr Savery in paragraphs 152 to 156.

199 Section 4.2.7 (of WHO 1999) states that:

"Annoyance to community noise varies with the type of activity producing the noise. Speech communication, relaxation, listening to radio and TV are all examples of noise-producing activities. During the daytime, few people are seriously annoyed by activities with LAeq levels below 55 dB; or moderately annoyed with LAeq levels below 50 dB. Sound pressure levels during the evening and night should be 5–10 dB lower than during the day. Noise with low-frequency components require even lower levels. It is emphasized that for intermittent noise, it is necessary to take into account the maximum sound pressure level as well as the number of noise events. Guidelines or noise abatement measures should also take into account residential outdoor activities".

200 It is Mr Elkin's opinion that if daytime external noise levels are kept to below these levels, residents are protected against that level of annoyance. Or put another way, the majority of people will NOT be seriously annoyed under 55 dBA Leq or the majority of people will NOT be moderately annoyed under 50 dBA Leq.

201 This WHO Guideline states that (external) noise levels during the evening and night-time should be 5 to 10 dBA lower than the day time. Mr Elkin believes it is appropriate to apply a reduction of 5 dB to the evening period and then the 10 dB reduction to the night-time period. This would result in recommendations that evening and night-time noise levels do not exceed 45 dBA Leq (evenings) or 40 dBA Leq (night-time) in order to ensure that the majority of people are not moderately annoyed.

202 The nominated day criterion of 42 dBA Leq is 7 dBA lower than the level required to protect the majority of people from being moderately annoyed.

203 The nominated evening criterion of 42 dBA Leq is 3 dBA lower than the level required to protect the majority of people from being moderately annoyed.

204 The nominated night-time criterion of 37 dBA Leq is also 3 dBA lower than the level required to protect the majority of people from being moderately annoyed.

205 Lastly in relation to the WHO guidelines, Mr Elkin disagrees with the derivation used by Mr Savery in paragraph 156 to derive an alternative maximum (Lmax) sleep disturbance noise limit.

206 Based on Mr Elkin's review of sleep disturbance research (which was obviously more extensively reviewed by WHO prior to reaching their published recommendations), for sleep disturbance to occur, not only does the noise need to "emerge" above the background noise level by (at least) 15 dB, but it also needs to be above a certain minimum "absolute" level. It is Mr Elkin's understand that such (sleep disturbance) research has shown that maximum noise levels down around 35 dBA (as suggested by Mr Savery) do not result in sleep disturbance, despite "emerging" above background by 15 dB or more.

207 This is evidenced in the Horne et al paper which is referenced in the 1999 WHO report. It is a reproduction of data from Pearsons et al. Pearsons et al is a meta-analysis of a whole lot of studies, and compares results from laboratory and field tests. All the data goes down to maximum levels of 30 dBA, with the percentage awakened trending towards zero at lower maximum noise levels.

208 Given that the range of maximum noise levels covered in the references used by WHO go down to 30 dBA, Mr Elkin concludes that very quiet environments would have been applicable to some of the studies used by WHO when coming up with their recommended noise levels.

209 Griefahn et al (1998) is also referenced in the WHOP 1999 guideline. This is a field study that measured noise indoors and out, looking at road and rail traffic. The charts in this paper indicate that the measured indoor levels went down to about 27 dBA Leq. Whilst background (L90) noise levels were not specifically referenced, it is Mr Elkin's opinion that the background (L90) noise levels would be down in the low 20's given the likely difference between the Leq and L90 indices. Again, this evidences that fact that very quiet background noise environments were present in some of the papers considered by WHO in setting their recommendations.

enHEALTH GUIDELINE

210 enHealth's The Health Effects of Environmental Noise – Other than Hearing Loss guideline states that "the WHO Guideline for Community Noise should be adopted as a primary reference level for environmental noise below which no health effects are expected". This is a Federal Government Department of Health publication.

AUSTRALIAN STANDARD 2107

211 Australian Standard 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* contains the following recommended (dBA Leq) internal design sound levels which (to quote) "take into account the function of the area(s)"

- 25 to 30 dBA Leq in sleeping areas for houses with negligible transportation (equivalent to 32 to 37 dBA Leq external), and
- 30 to 40 dBA Leq in living areas for houses and apartments near minor roads (equivalent to 37 to 47 dBA Leq external)

212 The draft EA noise limits of daytime/evening - 42 dBA Leq (external) and night-time – 37 dBA Leq (external) fall within these recommended ranges.

AUSTRALIAN STANDARD 1055

213 In relation to Mr Savery's paragraph 105, AS1055 (Part 1) Section 1 states that *"(The scope of this standard) excludes the setting of environmental noise criteria. Such levels are set by regulations or organisational policy, not by Standards Australia"*.

214 As such, Mr Elkin's opinion is that AS1055 clearly steers away from setting criteria and instead recommends that criteria be taken from appropriate regulations and policies. The EPP(Noise) is one such policy.

DEHP's APPLICATION REQUIREMENTS FOR ACTIVITES WITH NOISE IMPACTS GUIDELINE

215 Mr Elkin takes a more literal view of this guideline, particularly the statement provided in paragraph 131 of this JER ….. *The acoustic quality objectives defined in the EPP(Noise) provide guidance as to what ambient noise levels should be achieved to protect the receiving environment*.

216 Here we have DEHP providing guidance to applicants on what noise emissions "*should be*

achieved to protect the receiving environment".

217 Mr Elkin acknowledges the word "guidance" in this statement. However, guidance in the form of alternative limits is not provided in the document. It Mr Elkin's opinion therefore that DEHP's guidance is primarily focussing applicants on the acoustic quality objectives.

CONCLUSION

218 It is Mr Elkin's opinion that achieving compliance with the above legislation, guidelines and standards – which all align with the draft EA noise conditions - means that human health and wellbeing will be preserved.

DEHP's PLANNING FOR NOISE CONTROL (PNC) AND MODEL MINING CONDITIONS (MMC) GUIDELINES

219 Firstly, it is Mr Elkin's understanding that for mining projects, MMC supersedes the PNC guideline. Furthermore, the PNC guideline is no longer published on DEHP's website. It is Mr Elkin's understanding that the MMC was specifically developed under the previous LNP Government as a guideline to assess mining noise in Queensland. As such, Mr Elkin does not consider the PNC guideline currently relevant in relation to the setting of noise criteria for this project.

220 In relation to the MMC, it is Mr Elkin's understanding that the MMCs are a "template" that may be adopted by an applicant. To quote from the introduction of the MMC *…."The following model conditions may be used as a basis for proposing environmental protection commitments in the application documents. They may also be used to expedite the process of developing appropriate conditions for an environmental authority for a mining project in consultation with the administering authority."*

221 The MMC then goes on to say …. *"The model conditions can be modified to suit the specific circumstances of a mining project subject to the assessment criteria outlined above"*. The assessment criteria outlined above are the Environmental Protection Regulation 2008 and the standard criteria contained in the EP Act.

222 The MMC states on Page 2 (under 'Applications for new projects in progress') …. *"If public notification has been completed on the basis of different draft conditions from the model conditions, the model conditions cannot be used unless the applicant wishes to re-notify"*.

223 Public notification for the New Acland Stage 3 has been completed and it is Mr Elkin's understanding that the draft EA conditions (containing noise conditions different to the MMC noise criteria) have been publicly notified. It is also Mr Elkin's understanding that NAC do not wish to re-notify for the Stage 3 project. Therefore, MMC is not applicable.

LEGAL PRECEDENCE

224 There is also the legal precedence set by the Land Court for the Wandoan Coal Mine. The Land Court made many conclusions about noise, with the conclusions pertinent to this JER documented below:

- While it is correct to say the explanatory notes to the EPP (Noise) say that it is not intended that the existing acoustic environment be allowed to deteriorate, there is actually nothing in the terms of the EPP (Noise) reflecting that intention;
  - The EPP (Noise) defines an acoustic quality objective as the maximum level of noise that should be experienced in the acoustic environment of an area or place;
  - Neither the Coordinator-General nor DERM misapplied the policy in setting the draft EA limits;
  - In any event, the limits set in the draft EA cannot be altered because they were imposed by the Coordinator-General.

225 As such, the findings of the Wandoan case further support the use of the existing EA noise limits, noting that a 7 dB façade noise reduction has been used to derive an external noise limit of 37 dBA Leq for this project (rather than a 5 dB façade noise reduction resulting in an external noise limit of 35 dBA Leq in the Wandoan case).

RAIL

226 Mr Elkin notes that the CG has set draft EA noise conditions for the rail spur but has not defined the extent of the rail spur. It is Mr Elkin's opinion that without further explanation, these rail noise EA conditions would apply to the whole rail spur, inclusive of the section of track within the mining lease.

227 Mr Elkin believes that when rail noise is "distinguishable" from other mining noise, and as such exhibits usual rail acoustic characteristics, then the draft EA rail noise conditions of 56 dBA L_{Amax} and 50 dBA $L_{Aeq\ (24hour)}$ should apply.

228 This will clearly be the case outside the mining lease boundary. Within the mining lease boundary, rail noise may or may not be as distinguishable, particularly when moving at very slow speed during loading of the wagons.

229 Given paragraphs 226 to 228, Mr Elkin does not believe there is a strong argument to amend the EA conditions to further define the term "rail spur".

ROAD

230 Mr Elkin agrees with Mr Savery that it is not possible to impose a new noise limit for public roads. Therefore, the applicable criteria (as stated in the EIS) is 68 dBA L10(18hr). Mr Elkin also notes Commitment No 691 (Appendix D – Commitments Register) where NAC have committed to regular 'tool box talks' where significant noise and vibration issues will be discussed with all staff. These 'tool box talks' could be used to address poor driving behaviours to and from work if required.

LOW FREQUENCY NOISE

231 In the time Mr Elkin has been practicing in acoustics, he is unaware of any specific low frequency noise problems from an open-cut coal mine.

232 In response to Mr Savery's query about low frequency noise from a slow-moving diesel locomotive during loading/unloading (see EDO Qld letter dated 27 November 2015), SLR recently undertook further modelling to determine if a low frequency noise problem was likely.

233 The highest predicted noise level for a diesel locomotive was 34 dBL (with a difference between the predicted A-weighted and unweighted noise levels of 13 dB) during the loading/unloading process.

234 DEHP's Low Frequency Noise guideline contains an "initial screening test" whereby no further assessment is required if predicted levels are below the values of the "initial screening test". The "initial screening test" values are 50 dBL <u>and</u> a difference between A-weighted and unweighted noise levels of 15 dB.

235 As documented in paragraph 233, the predicted unweighted (or dBL) noise level is 34 dBL. Therefore, no further assessment is required.

236 Given paragraphs 231 to 235, Mr Elkin does not agree with Mr Savery that the draft EA conditions need to be modified to include low frequency noise criteria.

OTHER MATTERS RAISED BY MR SAVERY

237 In relation to paragraph 119, Mr Elkin acknowledges there are guidelines in other states of Australia that use a "background plus" approach to setting limits. However, it is also important to note that there is no such "background plus" approach in legislation for Western Australia (WA Environmental Protection (Noise) Regulations 1997 under the Environment Protection Act 1986). WA uses an "absolute" noise level approach.

238 Victoria's relevant guideline (SEPP N1 - Industry Trade & Commerce) and South Australia's *Environment Protection (Noise) Policy 2007* under the *Environment Protection Act 1993* use a hybrid of both "background plus" and "absolute" levels.

239 Given that both approaches are used in states other than Queensland, there can be no conclusion drawn that Australia as a whole has a preferred method. It is therefore Mr Elkin's opinion that this discussion should be made fundamentally in the Queensland context.

7 NOISE MODELLING

240 The proponents have predicted the noise emitted from operations of the proposed mine using SoundPLAN software, topographical contours for the mine and surrounding area, worst case meteorological conditions and plant and equipment sound power levels, refer EIS Sections 11.7.1 to 11.7.6. The sound power levels will be discussed in Section 6 of this JER report.

241 Three representative mine operating scenarios were selected for assessment of noise emissions in years 2019, 2023 and 2029 for day and for night periods.

242 Mr Savery has inspected the Life of Mine Schedule operating scenarios shown in the 2014 EIS Chapter 3 and described in paragraph 29 above.

243 Mr Savery's opinion is that the three operating time periods selected for noise modelling to demonstrate compliance with noise criteria for the life of the proposed mining stage are inadequate. Selecting only three representative scenarios for the life of the mine means that some very significant noise emitting activities are not modelling or assessed. Omission of such significant noise emitting activities may mean that the noise modelling underestimates the noise emissions of the mining operations at critical times during the life of the mine,

244 Significant omissions include the construction of out-of-pit overburden dumps that will be major sources of noise due to the plant and equipment used and the elevated location of the sources above the natural ground level. Construction of the out-of-pit overburden dumps is not included in any modelled scenario in the 2014 EIS. A more comprehensive noise modelling exercise could have included noise model predictions for each of the two year periods illustrated in the Life of Mine Schedule in Chapter 3. This could be done very easily once the overall topographic model of the mining lease had been constructed.

245 For the three mine operating scenarios modelled and reported in the 2014 EIS, the noise sources from the plant and equipment list were distributed across the noise model as shown in the schematic plots for 2019 in Figure 3 and 4. In 2023 and 2029, the equipment distribution is similar to the 2019 plots with the main difference being that the operating pits are located further to the south than as shown for 2019.

246 In general, the noise models include the following sources and locations:

- Mining sources and haulage vehicle located within, or at the bottom of the pits;
- Road haulage vehicles and graders on the surface between each of the pits and CHPP;
- Road haulage on the surface between the CHPP stockpile area and the rail loading facility area;
- Drills on the surface located adjacent to the central and eastern pits during the day period.
- CHPP/Stockpile located above the ground surface and comprising coal washerys and conveyors.
- Bulldozers (x4) on an overburden mound to the north-east of the current pits for 2019 and 2023 operating scenarios only.

247 The predicted noise levels are given in the EIS Chapter 11 Tables 11-14 (Assessment of predicted noise levels against EPP(Noise) criteria at selected receptor locations) and Table 11-15 (Assessment of predicted night time L_{Amax} Stability Class F noise levels against PNCG's Sleep Disturbance Criteria).

248 It is very significant that a utilisation factor of -2dB has been applied to all predicted noise levels (reference EIS Chapter 11, page 11-26, paragraph 5). This paragraph states:

"*The overall operational noise modelling has been based on the assumption that not all of the proposed mining equipment will be operating at maximum engine speed or load. Some equipment may not be operational or may be in idle mode at various times during the operation. A -2dB(A) correction have been applied to the equipment SWL to account for the average noise levels (L_{Aeq}) from mining activities."*

By inclusion of this correction factor, i.e <u>reducing all of the overall predicted levels by 2dB</u>, the applicant is able to claim compliance with the noise limit of $L_{Aeq,\ adj,\ 1hour}$ 37 dBA at all sensitive receptor locations for the three development scenarios modelled. On the basis of the stated compliance the Co-ordinator General has stated in his report that:

"*The results confirm that for stability class D and F conditions, the mine can meet the EPP (Noise) objectives at nearby SRs*".

249 There is no justification provided in the 2014 EIS chapter 11 for the minus 2 dB adjustment.

250 Mr Savery does not accept the explanation provided by Mr Elkin for the need for the -2dB adjustment based upon the expected utilisation of plant at the mine. In most cases, the predicted noise levels at each sensitive receptor have a dominant noise source contribution (e.g. excavator), or for northern sensitive receptors (e.g. conveyor and washplants). It is well

known that achievement of a 2 dB noise reduction from predicted noise levels resulting from noise emissions from multiple sources can only be achieved if there is a reduction of 2 dB for the dominant contributing noise source(s) at that receptor location. Achievement of noise reductions to all other sources will have only minimal impact if the dominant sources are not reduced by at least the 2dB amount.

251 Mr Savery further states that the tabulated source levels used for noise modelling are generally representative average levels (i.e. L_{Aeq}) and do not necessarily represent the maximum or range of actual noise levels emitted by operations of the particular item of plant or equipment under fully loaded conditions.

252 The variability of sound power levels for a single item of equipment is illustrated in published noise testing conducted by Global Acoustics for Muswellbrook Coal in 2014 for three Caterpillar D10T bulldozers:

Plant ID	Make/Model	Test date	Test type	Sound power levels (dB)
				LWA
1436	CATD10T	17/06/2014	1st forward	115
			1st reverse	118
			2nd forward	123
			2nd reverse	124
1437	CATD10T	17/06/2014	1st forward	116
			1st reverse	119
			2nd forward	123
			2nd reverse	129[1]
1438	CATD10T	17/06/2014	1st forward	114
			1st reverse	116
			2nd forward	122
			2nd reverse	124

Note: 1 Mr Savery thinks that this level may be a transcription error with the correct level being 124dBA as for the other two dozers.

The test results show considerable variability due to various operational uses and also small variability between machines.

253 Only a single sound power level of 113 dBA is stated for tracked dozers in the noise source list for the Stage 3 project (2014 EIS Chapter 11, Table 11-12). Chapter 11, Table 11-10 indicates that a noise attenuation of 2dB has been applied to tracked dozer noise levels for the noise modelling. This suggests that the dozers listed in the above table are “unattenuated” dozers. The measured levels vary considerably from the nominal unattenuated level of 115dB which was used in the pre-noise mitigation noise modelling in the 2014 EIS.

254 Comparison of the modelled sound power level of 113 dBA with the test results (even if tested dozers were not noise attenuated) suggests that the modelled noise level has already been "averaged" compared to the ranges of noise emissions which can reasonably be expected from this type of equipment during normal usage and that further reduction for so-called "utilisation" is not appropriate nor reasonable.

255 Mr Savery rejects the utilisation argument since the dominant noise sources are generally not being reduced significantly by utilisation. In any event, even if the dominant sources were reduced as suggested by Mr Elkin, the purpose of noise modelling is to predict the noise levels under "worst case" conditions when all sources are operating. This is the conservative approach which is used during planning approval to provide protection to both the applicant and also to the noise sensitive receptors.

256 Mr Savery has never applied such a utilisation factor to noise modelling conducted for a proposed mine to artificially reduce predicted sensitive receptor noise levels. Mr Savery's standard approach has been to add a +2dB safety factor to predicted noise levels to cover the potential future contingency of some tonal or impulsive noise characteristics, or some minor variations in the assigned sound power levels used in the noise modelling. No such safety factor has been applied to the noise modelling conducted in the 2014 EIS report for the Stage 3 Project.

257 Mr Savery is not only concerned that removal of the -2dB correction will result in predicted non-compliance with the 37 dBA night noise limits but also notes that there are some serious omissions in the number of scenarios modelled for each nominal time period which are expected to also increase emitted noise levels at the most affected sensitive receptors. The omissions are described in the following paragraphs:

258 To the north of each of the three pits are three high out-of pit overburden dumps. The large overburden dumps are not included in the time intervals modelled for the 2014 EIS noise assessment. The first dump is constructed using multiple bulldozers and scrapers, as a minimum, in 2017 (refer to the Life Mine Schedule Figure 3-10 (Mining layout 2017). The other two overburden dumps are shown in Figure 3-11 (Mining layout 2019) but were not included with sources for construction in the noise model for 2019 or later years.

259 The multiple bulldozers and scrapers constructing the overburden dumps will operate without acoustic shielding, at heights equal to or substantially above the natural ground levels for an extended period of time that is expected to be months not weeks.

260 Previously during an earlier stage of the mine, a similar large earth mound was constructed in continuous day and night operations opposite the Mason dwelling (Sensitive Receptor 10) and was the subject of numerous noise complaints to the applicant. The omission of construction

of the three large out-of-pit overburden dumps is a serious omission in the day/evening and night noise modelling scenarios presented in the EIS in the opinion of Mr Savery.

261 There are also no day-time scenarios modelled for any yearly time frame where there is a drill rig operating on the surface near the edge of the Manning Vale West Pit, potentially understating emitted noise levels to the Acland sensitive receptors (Receptors 1 and 2) and to other sensitive receptors located to the west of the mine site.

262 An additional haul dump hopper, conveyor and washpant will be installed alongside the existing twin coal processing facilities. In addition, the coal stockpiling, and reclaim area will be located to the west of the washplants on the northern side of the site. It is common for the CHPP to include sound power levels and spectra for a washplant, as well as screening/feeder/breaker plants. It is noted that the noise model includes three washplants during the day and only one washplant at night. The omission of the additional screening/feed/breaker plants may mean that the predicted noise levels are understated at the northern sensitive receptors. There are nominal sound power levels listed for conveyors which have not been justified in the test of the 2014 EIS report.

263 Diesel engines from haulage vehicles, plant and equipment on the Rom pad and CHPP appear to be included in the sources noted from noise complaints by the nearest sensitive receptors to the north and north-west. It is not known whether the modelled noise sources on the RoM pad and CHPP are appropriate to represent the typical worst case night operations of the proposed Stage 3 mine.

264 The basalt mobile crushing and screening plant located on the large and elevated basalt out-of-pit dump is not included in the noise model, along with any associated bulldozers, haul trucks, loaders, etc required for this operation.

265 The rail loading facility is not included in any day or night noise models in the 2014 EIS. Sources which are expected to operate at this facility include side tipping trucks and trailers, conveyor, load out bin and feeders/vibrators. Loading of trains is expected to occur once per 2-3 hours throughout the day and night periods.

266 The noise emissions of the slowly moving locomotive (estimated to be only approximately 1kph) and empty and loaded coal wagons on the coal loading loop should also be quantified in a form which can be included in the noise modelling predictions for the mine site. The noise modelling should include the noise of the slow moving locomotive, the wagons moving and being loaded. The source sound power levels should include wagons during loading, as well as irregular wagon impacts and wheel squeal noise from the tight curves, if applicable. The source sound power levels are recommended to be measured on a representative rail balloon coal loading loop for inclusion in the noise modelling process.

267 Ideally the train loading noise will be measured as SEL and L_{Amax} levels from a central location within the balloon loop from which appropriate L_{eq} and L_{Amax} sound power levels may be determined and included at a similar representative location on the Stage 3 balloon loop. This type of noise modelling has not been conducted by the 2014 EIS or by Mr Elkin.

268 Mr Savery has not seen any information related to noise emissions from maintenance activities conducted in the MIA during regular mine vehicle or plant maintenance. The location of the maintenance facility is on the northern side of the mine site. The nature of the regular maintenance activities, the equipment utilised, the timing of the activities during the day or night is not known. The nature of maintenance conducted during the night period should be identified so that noise emissions, if applicable, can be included in the night noise prediction assessment, if appropriate, or appropriate management strategies documented in the noise and vibration management plan to control potentially excessive noise emission levels.

269 It is important that these additional operational scenarios are included in the noise modelling noise predictions for representative bi-annual time frames, or for each of the three yearly time frames, as appropriate. The Co-ordinator General's conclusion appears to indicate that the mine will be able to comply with the 37dBA noise limits and that all that is needed is for the mine to monitor the sensitive receptor levels to identify if any exceedences occasionally occur following which the part of the operation identified as the cause of the exceedance will be shut down until meteorological or daily time conditions are more conducive to that particular operation occurring in compliance with the noise limits.

270 Mr Savery view is that the conclusions of the 2014 EIS regarding compliance with the stated EPP(Noise) limit of 37dBA are incorrect, or yet to be proven when all omitted operating scenarios are included in the noise modelling for the day/evening and night periods. Mr Savery's view is that further detailed assessment is required before it can be stated confidently that under most day/evening or night operating and meteorological conditions that the noise modelling demonstrates that compliance with the noise limit of 37dBA is likely to be able to be achieved by the mining operations.

271 Noise modelling predictions should always be adjusted for adverse noise characteristics, such as tonality or impulsiveness, if these characteristics are typical of the plant noise emissions or the activities being modelled. There are no overall tonality or impulsiveness adjustments in the noise modelling conducted for the project. The monitoring conducted by Mr David Moore in 2011 to the end of 2015[17] indicates that a tonality adjustment of up to +2dB tonality (calculated using the one-third octave method) is required for the sensitive receptor at Acland and at the other sensitive receptor locations. The source of this tonality has not been stated in his reports. This tonality adjustment has not been included in the noise modelling noise

[17] *D Moore monthly reports disclosed to the noise experts, 2011 to 2015*

predictions or assessments conducted for the 2014 EIS.

272 Mr Savery's view is that the rejection of the -2dB utilisation correction, the lack of overall tonality or impulsive adjustments, or safety factors in modelling, and the omissions in the modelled operational scenarios, put the conclusions regarding expectation of compliance at risk. Further noise modelling that includes the missing operational scenarios and sources should be conducted to confirm that compliance with the noise limits under all significant noise emitting operating scenarios is possible. If compliance is not possible, then alternative time management or noise mitigation strategies may be developed by the applicant prior to the event, rather than as a reactive response to noise complaints from sensitive receptors following commencement of the project.

273 The Information Clarification to the AEIS, dated 2014, states in Section 12.1 that "the capital investment for the replacement of the key mining equipment to attenuated models over the next 3 to 5 years as the existing equipment is replaced as part of their end of life replacements". The noise model for 2019 is based upon the assumption that all mining equipment being used at the mine has been noise attenuated. Details of the timing of noise attenuation has not been released but it can be expected that actual noise levels will be greater than predicted until all of the noise attenuated plant and equipment is utilised at the mine.

274 The information Clarification to the AEIS, dated 2014, indicates in Section 8.2, paragraph 3, that " NAC believes …… all modelling completed for the revised Project's potential impacts has been based on the complete operational footprint and intensity plus a range of other interrelated factors (e.g. climatic conditions, sensitive receptor locations, etc)". In light of the issues with the noise modelling indicated in paragraphs 243 to 273 above, Mr Savery questions the validity of this statement about the noise modelling by NAC.

275 Mr Savery concludes that the noise emissions from the mine at sensitive receptors 1 and 2 are not expected to comply with the night criterion of 37dBA during the night period and may not comply during the day period when the omitted noise sources/activities listed in the paragraphs above are included in the noise modelling predictions. This conclusion may also be true at other sensitive receptors as well during the day or night periods and may only be confirmed with further noise modelling with input from the applicant as to the timing and the plant and equipment that each of the omitted activities will utilise during the activity.

276 Modelling of maximum noise levels has been conducted by the applicant by adding a nominal fixed amount to the L_{Aeq} sound power levels of most sources (refer 2014 EIS Table 11-12). The noise model then adds all of the "maximum" levels to predict the maximum noise levels experienced by each sensitive receptor. This approach does not actually model the instantaneous maximum level that occurs, perhaps coming from just a single source at that instance in time, or the L_{Amax} noise level which is the acoustic parameter used in the sleep

disturbance discussions in earlier paragraphs. Mr Savery states that modelling of maximum noise levels using the methodology used in the EIS noise modelling is inherently unreliable when compared to actual monitored L_{Amax} noise levels.

277 The variation in actual monitored L_{Amax} levels can be seen in the noise monitoring reported by Mr David Moore[18]. The maximum noise level reported near Sensitive receptors 1 and 2 at Acland on Saturday 5th January, 2013, 3am to 4am, from visually inspecting the sound level meter during the measurements, ranged between 41dBA and 47dBA for tracked dozers and ranged between 40dBA and 50dBA for diesel engines for nominally the same operations being conducted within the mine. Similar instantaneous maximum noise levels were reported for each of the subsequent noise monitoring periods. It is therefore recommended that the focus upon instantaneous maximum noise levels should be upon the real time noise monitoring rather than upon the noise modelling predictions.

278 Mr Savery's opinion is that the predicted maximum noise levels presented in the 2014 EIS Chapter 11 are not valid and are not representative of the actual maximum L_{Amax} (FAST response) noise levels which may be experienced by the nearest sensitive receptors due to operations of the proposed Stage 3 mining project, as demonstrated by the variability of dozer noise levels shown in paragraph 252 above.

279 Mr Elkin is of the following overarching opinion:

280 Whilst a certain level of scrutiny should be placed on the modelling undertaken to date (in order to be comfortable that engineering and management measures can reasonably and feasibly be implemented in order to comply with the EA noise conditions), it is impossible on a job of this size and complexity to model every possible operational scenario. There are literally millions of permutations that may occur over the life of the mine in relation to equipment locations at any one time and the operational state of such equipment (e.g. operating at full revs, idling etc).

281 Mr Elkin has seen evidence that NAC are prepared to implement management measures, such as switching certain machines off and locating equipment in shielded locations (e.g. within the pit) at night, as is required to achieve their EA conditions. Mr Elkin has stated that it is the most sophisticated and more importantly 'instant' monitoring system he has seen fully operational at a mine site in Queensland. NAC have already undertaken a number of noise control upgrades (e.g. buzzer type reversing alarms on mobile plant) and have committed to doing much more in readiness for the commencement of Stage 3 mining operations (when they need to achieve a lower noise limit than NAC currently have).

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[18] *SKM Report to DEHP dated 30 April 2013, Appendix J, D Moore report No R13017/D2728/Rev.0/12.02.2013, p8-17*

282 The ultimate "risk" in relation to the noise emissions rests with NAC provided that a credible noise monitoring and reporting system is implemented. Mr Elkin believes there will be a credible noise monitoring and reporting system (encapsulated in the required noise and vibration management plan) given:

- The CG's condition that noise monitoring results be released publically every month
- NAC's commitment to operating either 2 or 3 real-time directional noise monitoring station throughout the Stage 3 operations
- NAC have now been operating a sophisticated and successful Trigger Action Response Plan (TARP) for over 2 years now and it is Mr Elkin's understanding that this TARP system will continue to operate throughout the life of the Stage 3 mining operations.

283 Therefore, Mr Elkin places more emphasis on the noise and vibration management plan (as opposed to the modelling) which will outline, amongst other things, the monitoring and reporting requirements.

284 In response to paragraph 270, Mr Elkin disagrees that the chosen modelling scenarios were inappropriate apart from Mr Savery's comments in relation to the overburden pits. It is very common practice in the acoustic's fraternity to choose modelling scenarios at the beginning, middle and end of a mine life. Mr Elkin has undertaken numerous EIS noise modelling studies in this manner. As such, the philosophy of choosing these 3 time horizons is sound.

285 Mr Elkin does however agree with Mr Savery that modelling mobile plant during construction of the overburden pits would have provided further certainty. There are however three important reasons why this would likely only have a very marginal impact on the results of the EIS. The reasons relate to the large number of equipment operating on the site (60+ items of mobile plant), complexity of the site (in terms of its size, topography (including pits) and locations of the 60+ mobile plant) and Commitment No 301 (Appendix D – Commitments Register) that NAC will schedule nosier operations in-pit at night or during daylight hours only.

286 <u>Equipment Heights</u> – Mr Savery makes numerous references to the height at which mobile plant was modelled (see paragraphs 258, 259 and 261). More specifically that they were not modelled high enough (in relation to ground level).

287 Mr Savery points out in paragraph 246, there are multiple noise sources that have been modelled at ground level. Apart from excluding the overburden dumps, Mr Elkin is satisfied that the modelled heights are "representative" of the time horizons chosen (noting that these scenarios are only ever a "snapshot" within a particular stage of the operations).

288 <u>Equipment Rankings</u> – Mr Savery has stated one of his reasons for not accepting the "utilisation" justification put forward by Mr Elkin is that predicted noise levels at each sensitive

location have a dominant noise source. For large complex sites like Acland, the reality is that the overall noise emissions aren't dominated by a particular item of plant because of the overall acoustic energy associated with all of the other 60+ items of equipment. Such examples are:

289 Y2019 – Night – Worst-case Weather – Receiver 4

The overall noise prediction is 34 dBA. Loudest item predicted to be 26 dBA (8 dB below the overall level). The next loudest items are 4 x 23 dBA (totalling 29 dBA – 3 more than the loudest ranked item), 2 x 22 dBA, 2 x 21 dBA and 19 dBA.

290 Y2023 – Night – Worst-case Weather – Receiver 35

The overall noise prediction is 33 dBA. Loudest item predicted to be 25 dBA (8 dB below the overall level). The next loudest items are 24 dBA, 23 dBA, 2 x 22 dBA, 3 x 21 dBA, 18 dBA and 16 dBA.

291 Y2029 – Night – Worst-case Weather – Receiver 2

The overall noise prediction is 37 dBA. Loudest two items predicted to be 27 dBA each (10 dB below the overall level). The next loudest items are 2 x 26 dBA, 2 x 25 dBA, 24 dBA, 23 dBA, 22 dBA and 21 dBA.

292 As such, the utilisations of the various items of mobile plant will have a material influence over the overall noise emissions experiences at homes in the neighbouring community.

293 <u>NAC Commitment No 301</u> states that NAC will schedule nosier operations in-pit at night or during daylight hours only. The example given in Commitment No 301 is "dumping of overburden and dozer activity on overburden dumps at or above ground surface may be restricted during the night period (10pm to 7am). Mr Elkin has observed that NAC are willing and able to modify their operations in order to achieve their EA conditions through his education of how the TARP works.

294 NAC will have to continue with these management measures given the commitment made by NAC to use up to two more real-time directional noise monitors (which provide much more credible results than the on-going monthly monitoring undertaken by Moore and Associates) and that monitoring results need to be published monthly (CG Condition).

295 One possibility (subject to monitoring results) is that activity on the overburden dumps only occurs during the day period.

296 In paragraph 250, Mr Savery rejects the explanation put forward by Mr Elkin that the utilisation

rates for mobile plant are justification for the - 2 dB correction. Paragraphs 289 to 292 above confirm that the overall noise level predicted at a residence is the result of the total acoustic energy from a large number of noise sources. Therefore, it logically flows that if not all those items of plant are operating at the one time, the overall noise level will come down.

297 Mr Elkin received 2 sets of "machinery utilisations" from NAC. Both datasets were presented to Mr Savery during the conclave. Mr Elkin has absolutely no reason to doubt the data provided in those utilisation reports.

298 Mr Savery has not provided any evidence to Mr Elkin to counter the utilisation rates provided by NAC. As such, it is Mr Elkin's opinion that they are applicable to Acland Stage 3 operations.

299 The utilisation analysis Mr Elkin presented to Mr Savery was done via a spreadsheet and looked at the total acoustic energy from all items of plant. This broad approach was adopted due to the inordinate amount of time it would take to try and model such utilisations in the 3D SoundPLAN model (which would not be representative of normal practice in the acoustic fraternity anyway).

300 The analysis undertaken by Mr Elkin showed the following reductions in total acoustic energy:

- Effective Utilisations – reduction of (approx.) 1 dB
- Utilisations – reduction of (approx.) 3 dB
- Total Fleet (on/off):
- Mon to Fri (day - 6am to 1am) – reduction of (approx.) 1 dB
- Mon to Fri (night - 1am to 6am) – reduction of (approx.) 6 dB
- Sat and Sun (6am to 3:30pm) – reduction of (approx.) 1 dB
- Sat and Sun (3:30pm to 6am) – reduction of (approx.) 6 dB

301 Lastly, Mr Elkin has visited numerous mine sites over his professional career. In this time, it is clear to Mr Elkin that there are always certain items of plant that are either not in use or idling (e.g. a dump truck while being loaded) at an operational mine site. This is a qualitative observation however it does support the case that a "utilisation" adjustment is valid.

302 In paragraphs 251 to 254, Mr Savery calls into question the authenticity of the SWLs used in the EIS modelling. Mr Elkin makes the following responses to the issue of modelled SWLs:

303 The utilisation spreadsheets provided to Mr Savery contain analysis not only for the SWLs used in the EIS, but also SWLs from SLR's own extensive database of mining equipment and official data from IEEP (a reputable engineering firm based in the Hunter Valley who have installed noise mitigation to over 115 machines in the last 3 years.

304 The analysis provided in the spreadsheets show that when the total acoustic energy from the EIS SWLs is compared to the total acoustic energy from the (blended) SLR and IEEP SWLs, the numbers are comparable. Thus, the SWLs used in the EIS are justified.

305 Furthermore, in relation to the EIS SWLs, a significant amount of data justifying the SWLs is contained in SKM's report addressed to DEHP dated 30 April 2013. Some of the data presented comes from measurements SKM staff undertook at Acland. Other data presented is from catalogued information from suppliers (such as CAT) where the SWL data presented was measured in accordance with ISO 6393 and ISO 6395.

306 In relation to the SLR SWLs, our database of mining equipment noise levels contains measurement data from a very large number of field measurements. Some of these measurements have been conducted in accordance with ISO 6393 and ISO 6395 however there are also measurements that have not been conducted in accordance with these standards. The SLR data contained in the spreadsheet (presented to Mr Savery) takes into account the variability raised by Mr Savery.

307 In relation to the IEEP SWLs, Mr Elkin has no reason to question the validity of the stated SWLs given the reputation of IEEP in the marketplace and the sheer number of machines tested in recent years.

308 Apart from the table contained in paragraph 252, Mr Elkin has not been presented with any other evidence to justify his claim that the modelled SWLs don't take into account the variability in noise emissions during normal operation.

309 In paragraph 264, Mr Savery highlights that the basalt plant is not included in the EIS modelling. Mr Elkin makes the following responses:

310 The basalt plant was not included in the EIS modelling.

311 Basalt extraction and crushing/screening already occurs on site. Where it is currently used for stemming material mostly, but also for some roads on site.

312 Current practice is day shift only and only on weekdays (Monday to Friday) however some activity does occur on Saturdays during peak conditions. It is Mr Elkin's understanding that these timeframes will still be used during Stage 3 apart from some peak periods.

313 Given this activities already occurs on site and that the SWLs associated with this basalt activity are significantly less than the rest of the mining operations, it is considered that this activity will continue to be acoustically insignificant in terms of the overall mining activities.

314 The robust noise management plan (and associated real-time directional noise monitoring) will continue to evaluate the conclusion reached in paragraph 313 and if noise emissions from the basalt operations prove significant (resulting in potential exceedences of the EA conditions), noise mitigation/management should be implemented.

315 In paragraph 265, Mr Savery highlights that the rail loadout facility is not included in the EIS modelling. Mr Elkin makes the following responses:

316 A haul truck is located about 400m away from the rail load out facility in the model but not at the rail loadout facility itself. The other noise sources associated with a rail loadout facility (conveyors and associated drives and loadout bins) have not been modelled.

317 Mr Elkin has re-run the EIS model to determine what impact relocating the haul truck (right at the rail loadout facility) and including the extra rail loadout noise sources would have.

318 To the north-west of the rail loadout facility (residences 35 and 36 etc), the maximum increase in noise levels was 0.6 dBA.

319 To the south-west of the rail loadout facility (residences 34 etc), the maximum increase was 0.7 dBA.

320 As such, the omission of these extra sources has a negligible effect on the results presented in the EIS.

321 In paragraph 268, Mr Savery states he has not seen information in relation to noise emissions from the maintenance area. Mr Elkin's observations from his two site visits is that noise from maintenance activities was negligible compared to other noise sources (haul trucks and CHPP) in the area.

322 The robust noise management plan (and associated real-time directional noise monitoring) will continue to evaluate the conclusion reached in paragraph 321 and if noise emissions from the maintenance activities prove significant (resulting in potential exceedences of the EA conditions), noise mitigation/management should be implemented.

323 Mr Elkin provides the following reasons for why tonality and impulsive corrections may not have been applied to the EIS modelling (as raised by Mr Savery in paragraph 271):

324 NAC have already started replacing "beeper" reversing alarms with broad-band "buzzer" reversing alarms which are not tonal. Commitment No 301 says NAC will continue to use "buzzer" reversing alarms on site.

325 Commitment No 301 also makes the following statement "Noise emissions with tonal, impulsive and/or intermittent characteristics will be targeted for noise attenuation.

326 The robust noise management plan (and associated real-time directional noise monitoring) should be capable of assessing tonality and impulsivity (which is currently achieved by operators listening to the live feed from the sentinex system) and if noise emissions from the mine may potentially exceedences of the EA conditions when tonal or impulsive corrections are applied, noise mitigation/management should be implemented.

327 In relation to paragraph 275, Mr Elkin has received no (quantitative) modelling results to justify Mr Savery's statement that "….. noise emissions from the mine at sensitive receptors 1 and 2 are not expected to comply with the night criterion of 37dBA during the night period and may not comply during the day period …..".

328 Mr Elkin agrees with Mr Savery (in paragraph 276) that modelling of maximum (Lmax) noise levels from mining operations, particularly on an individual plant item basis, is problematic. SLR typically addresses this issue by looking at the difference between Leq and Lmax noise levels across the entire site.

329 SLR's extensive database of noise measurements, from both open-cut mines and quarries, fairly consistently shows the following relationship when measuring in the far-field:

Lmax = Leq +8 dB (or that maximum noise levels are typically 8 dB higher than Leq levels)

330 The draft EA noise conditions have a 13 dB difference between the night-time Leq limit (37 dBA) and the night-time Lmax limit (50 dBA).

331 Given paragraphs 329 and 330, it can be concluded that the limiting descriptor will be the Leq level for this project (which is the reason why most discussion in the JER relates to the Leq descriptor).

332 Mr Savery responds to Mr Elkins statements in paragraphs 306 to 307 above as follows:

333 Mr Savery does not question the sound power levels used in the noise modelling (as asserted by Mr Elkin in paragraphs 302 and 308) but rather the point that he is making is that sound power levels in the noise model are a single value representing the operation of an item of equipment which may not emit a constant noise level, as shown by the dozer example provided in paragraph 252 above. The claim of compliance with the noise limits will only occur when the noise emissions match the sound power level used in the noise model. At other times the noise level will be greater and potentially non-compliant if there is no safety factor predicted above the noise limit, as occurs for Sensitive Receptors 1 and 2 in this case, with

compliance only occurring if the 2dB noise reduction from the utilisation argument is valid.

334 Mr Savery disagrees with the utilisation arguments put forward by Mr Elkin (paragraphs 296 to 301) for the technical acoustic reason that any reduction in noise levels from an accumulation of multiple sources must be assessed at the sensitive receptors concerned, in this instance the sensitive receptors with the highest predicted noise levels. This must be done using SoundPLAN because only with such a sophisticated calculation tool can the source contributions from multiple sources be predicted at a particular location and the contributions ranked. A reduction in noise level at a particular location can only be justified if there is noise mitigation for the highest ranked source contributions at this location. This is the basis of noise mitigation planning for sites with multiple noise sources contributing to the noise level at a particular receptor location. Reductions in other less dominant sources will have only minimal impact, if any, at these locations if the dominant noise level is not reduced. Arguments based upon overall noise level reductions for the whole fleet of sources (such as in the spreadsheet supplied by NAC to Mr Elkin) have simply no basis in acoustic mitigation assessment for the particular sensitive receptors of interest.

335 Mr Savery states that the SoundPLAN noise model using the CONCAWE Method is a predictive tool which is based upon the accumulation of L_{eq}, or average levels from multiple sources. Maximum noise levels occur not from accumulation of “maximum” averages but rather are the result of discrete noise events from one or more sources, which are a function of the operation of the noise source, such as diesel engine revving under load, impacts caused by material being dumped in a hopper, etc. The effectiveness of Mr Elkin’s “rule of thumb” differential of 8dB between maximum and L_{Aeq} levels will be dependent upon the sound power levels selected for the particular source, which as demonstrated for the dozer (paragraph 252 above) can be quite variable depending upon its operation at any given time. Mr Savery maintains his view that predictions of maximum levels are unreliable and that reliance for compliance (at night) should be placed upon real time noise monitoring systems which must be able to measure using FAST response to capture noise levels that correspond to the sleep disturbance noise limits recommended by the WHO Report.

8 SOURCE SOUND POWER LEVELS

336 The 2014 EIS contains a list of sound power levels for noise mitigated plant and equipment (refer to Section 11.7.2, Table 11-12) for predicting L_{Aeq} and L_{Amax} noise levels using SoundPLAN software.

337 During the JER process Mr Elkin has supplied a spreadsheet with noise mitigated noise levels for plant and equipment to be applied at the coal mine that has different sound power levels for some items of plant and equipment compared to Table 11-12. When combined with the admission by NAC regarding timing of noise mitigation replacements Mr Savery considers that

a composite list of plant and equipment, the appropriate existing and mitigated sound power levels, and the nominal timing of implementation of such mitigation should be provided as part of this JER process for the Land Court so that there is formal statement of what is intended and a commitment from the applicant to it.

338 The presentation of the plant and equipment sound power level lists will (i) enable the noise modelling and predicted noise levels at receptor locations to be checked and verified, and (ii) will inform the NAC and the community of predicted noise levels for all operating scenarios. It will also identify the extent of further work required by the real-time monitoring system to achieve compliance with the noise limits at all sensitive receptor locations for all operational and meteorological conditions.

339 Mr Savery has commented in paragraph 276 above under the noise modelling discussion about the unreliability of predicting instantaneous maximum noise levels and of listing the maximum sound power levels per plant and equipment item.

340 Mr Elkin does not agree that further equipment lists (which NAC have developed following extensive mine planning) and sound power levels need to be prepared and presented to the experts. The information that has so far been provided to Mr Savery includes:

341 SKM's Report (dated 30 April 2013) to Dr Antoine David (DEHP) in support of the mitigated SWLs utilised in the EIS – this document contains (along with monitoring results) approximately 80 pages of (combined measurement and catalogue) data in relation to SWLs associated with the mining equipment to be used for Stage 3 operations.

342 A spreadsheet with SLWs for mitigated (where appropriate) plant from SLR 's extensive database of noise measurements. This SLR data provided to Mr Savery has been collected over many years and is used by SLR nationally for impact assessments of this nature.

343 In the same spreadsheet, proprietary information in relation to the mitigated SWLs that have been achieved by IEEP - a reputable engineering firm whose day-to-day business is silencing mining equipment.

344 The spreadsheet was supplied for cross-checking purposes and Mr Elkin believes this cross-check has proved that the EIS SWLs are satisfactory.

345 In contrast, the only SWL data presented by Mr Savery in this JER process has been the one table in paragraph 252.

346 Mr Elkin would be happy to review and comment on alternative SWL data provided by Mr Savery if there is reason to doubt the large quantity of data already provided. Mr Elkin is

satisfied with the data already provided.

347 It is Mr Elkin's opinion that NAC should not be required to provide a timing schedule for the mitigation of existing plant as it is their business how they utilise and upgrade their fleet to meet their EA obligations. For example, if NAC chose not up mitigate a certain item of plant and then only use that item of plant during the daytime, that is their business decision (provided the EA conditions are met).

348 Mr Savery responds to Mr Elkins paragraphs 340 to 347 as follows:

349 Mr Savery is not disagreeing with the sound power data, rather he is pointing out that the noise modelling upon which the compliance of the mine noise emissions is based has been prepared on the assumption that all of the noise mitigation measures proposed by NAC for its fleet of mining plant and equipment will be fully implemented from the first day of operations. This assumption does not appear to be true and it therefore follows that NAC should state, so that all parties are informed, the timing and scheduling of the proposed noise mitigation in the form of a noise mitigation management plan. This is not an unreasonable request as suggested by Mr Elkin but is simply a requirement for NAC to table information and plans that it already has considered for the benefit of the Court and other interested parties, since the claimed compliance by NAC is based upon implementation of this information.

9 REAL-TIME NOISE MONITORING

350 A real-time noise monitoring and adaptive noise management system is proposed by the applicant to control emitted noise levels at sensitive receptor locations, particularly during the night period when the noise limits are lower (Reference 2014 EIS Section 11.8, dot-points 1 and 3, Appendix J.11 Noise and vibration management plan, Section 3.3 and AEIS Section 5.2.4.13).

351 The monitoring system comprises a real-time noise logging station located near sensitive receptor 1 at Acland, as well as a separate directional noise monitoring system also installed at this location.

352 The operation of the monitoring system is outlined in the Information Clarification to the AEIS, dated December 2014, Section12.2. This Section states: The monitoring component of the tools consists of:

- Real-time monitoring undertaken at Acland;
- Noise levels recorded and analysed every 10 minutes;
- Analysis of low frequency noise levels (<600Hz) and noise recordings to determine if there is a risk of mining operations resulting in an exceedance of the EA conditions; and

- Isolation of source noises from an 'area of interest' (utilising the noise monitoring equipment directional noise source capability)

353 In the event that monitoring indicates noise levels from mining operations may exceed the EA conditions, NAC undertake the following actions:

- Communicate with operators to understand current operations and key sources of noise;
- Adjust operations (e.g. shut down plant, move equipment, suspend operations) to reduce noise levels;
- Determine if actions have reduced noise levels sufficiently to achieve compliance; and take further actions as required to achieve compliance.

354 Mr Elkin tabled a spreadsheet during the JER showing the acoustic parameters and 10 minute levels produced by the monitoring system during the trial operations, attached as **Figure 5** and a report prepared by SLR for the applicant reviewing the operation of the Noise Live Dashboard (including the TARP process).

355 Mr Elkin explained the operation of the system as he understands it as follows:

356 Noise levels at night are monitoring visually via the live dashboard.

357 When noise levels approach the EA conditions, the operator starts listening to the live audio to ascertain what plant is making the most noise or if other non-mine extraneous noise sources are affecting the results.

358 The rolling average Leq(1hr) noise levels in "Area of Interest 1" (which is the north-east quadrant from the noise logger location which is relevant to all of the mining activity currently undertaken) are monitoring for exceedence of the EA conditions along with the separation between the overall A-weighted noise level and the A-weighted 'low frequency' noise level (under 630Hz).

359 If the difference between the overall and low frequency noise levels remains 2 dB or less, then it is likely that noise at the logger location is dominated by mine noise (which is also confirmed by the operator).

360 Once an individual 10 minute interval exceeds the EA conditions, the operator commences liaison with mine management to take action on the dominant noise source(s).

361 This interaction (between operator and mine management) continues until the individual 10 minute noise levels in "Area of Interest 1" drop below the EA conditions.

362 Items of plant may re-commence operations after (approx.) 1 hour assuming this doesn't then push noise levels back above the EA conditions

363 The current single system uses a method based upon six moving averages each of 10 minutes duration where the L_{Aeq} noise level attributed to mining (<630Hz) is progressively updated.

364 Mr Savery notes that the noise of mining includes frequencies greater than 630Hz. The lower frequency cut-off for the system is necessary for the system to isolate the contribution of insects, in particular, and birds which have dominant noise in frequency bands above 630Hz (for birds) and 1000Hz for insects. The simplistic statistical analysis used by the monitoring system is unable to distinguish the contributions of mining noise, bird noise and insect noise, apart from the listening skills of the operator, unless the one-third octave spectra produced by the system are utilised. However, utilisation of this one-third octave data requires a skilled operator in acoustic spectral analysis and is not currently used by the operator.

365 Mr Savery also notes that this monitoring system is only used at night providing no protection to sensitive receptors in the day/evening periods, and only before 5am in the night period (according to the SLR report, spreadsheet shown on page 9). Considering that the proposed Stage 3 mine is proposing different operations for the day/evening and night periods it is very important that the real-time monitoring system can ascertain whether compliance is being achieved in the day/evening period as well as at night.

366 Mr Savery notes that the method used by the Sentinex system is a very simple one based upon overall level statistical acoustic parameters which is only effective if there are no other sources of noise (<630Hz) near the monitoring location. Other sources of noise (<630Hz) which will hamper the system working properly could include local passby traffic (e.g. light mine vehicles at the change of shift), some birds, such as crows, frogs, aircraft or strong winds. The system will not work effectively in the presence of such sources.

367 If the system excludes 10 minute samples when any of these sources are significant contributors to the noise levels, then if there are a series of samples when this situation occurs then the system may be ineffective for some time and provide no protection to the sensitive receptors during these periods.

368 Mr Savery believes that this weakness will mean that the real-time monitoring system will be ineffective if it does not also include spectral analysis capabilities so that further insight into the extraneous noise contributions may be obtained with further investigation or analysis, so that the mining noise can be identified for a greater part of the monitoring period.

369 Mr Savery does not believe the conclusion regarding the differential between L_{Aeq} and L_{AeqLF}

(reference SLR Report p6, para 3). The presence of insects in the acoustic environment (spectral frequencies greater than 1000Hz) does not affect the underlying L_{AeqLF} level dominated by mining noise. However, if there are trucks or light vehicles on the public roads nearby, frogs or birds with a mid-low frequency call component, or aircraft flying overhead, then the system will not work and will not provide a noise management benefit.

370 Mr Savery notes that the directional noise monitoring system may in future be added to the noise management system (reference, SLR Report, p13, para4). Mr Elkin has advised that the directional noise monitoring system has now been added to the noise management system. Directional noise monitoring systems find it difficult to provide accurate information if there are significant sources close to the monitor relative to the sources of interest that are further removed from the location. The directional monitoring station also has difficulty in handling constantly moving sources where sources are located in a depth of field, i.e. not all located at the same separation distance from the monitoring location.

371 Mr Savery is also concerned that the close spacing of the four microphones used for the installed directional noise monitoring system means that the frequency response of the directional monitoring system may exclude low frequency (less than 200Hz) noise from diesel engines and other sources. The low frequency cut-off expected from the microphone spacing is expected to be approximately 200Hz which is above the dominant spectral frequencies of diesel engines operating under load (refer spectra provided by Mr Savery in Figures 1 and 2 to see the frequencies unable to be measured by the directional noise monitoring system).

372 Mr Savery further notes that if the directional noise monitoring system is developed further so that it works effectively then it will only provide potentially useful information for the noise levels experienced at the two Acland sensitive receptors during the night period and may provide no real benefit to assessment and control of noise levels experienced by any other sensitive receptors surrounding the mine site at any particular time.

373 Mr Savery is very concerned about the performance of the real-time noise monitoring system if the statement in Appendix J.11, Section 3.3 is true, namely:

374 “This unattended monitoring system will not always be practical during the warmer months due to other intrusive noise sources (e.g. insect noise). However, it will be ideal during the cooler months when background noise levels are lower and temperature inversions are common. NAC will ensure use of the real-time monitoring equipment is appropriate and practical for the circumstances.”

375 It is expected that insects will be a significant contributor to the environmental noise levels at the monitoring locations for at least nine months per annum and the real-time monitoring system must be effective in differentiating between mining noise, insect noise and other

extraneous noise, if it is to achieve the objectives of NAC for the monitoring system.

376 Mr Savery's view is that the current Sentinex noise monitoring system is unable to effectively monitor mine noise levels during the night and day/evening periods unless its' application is further developed to include detailed analysis based upon spectral frequency analysis so that it can be used in the presence of other extraneous noise sources, such as insects, birds, frogs and passing traffic (road vehicles and aircraft).

377 Mr Savery is also concerned about the operation of the current noise monitoring system in that it relies heavily upon the subjective listening skills, subjective assessments and experience of the operator for it to be effective. The operator must be able to make subjective judgements about tonality and impulsiveness which may not be accurate over time due to familiarity and time pressures.

378 The experts agree that a single real-time monitoring station located at Acland is insufficient to protect the acoustic environment of all sensitive receptors from the mine site operations. The experts agree that the real time monitoring system should be expanded to include a minimum of three real-time noise monitoring stations so that the mine operational personnel have a more complete understanding of the noise emission levels at sensitive receptors 1 and 2 in Acland, as well as at locations representative of the nearest sensitive receptors located to the west and north of the mine site.

379 Mr Savery recommends that the real-time monitoring system at each location must as a minimum record one-third octave noise levels using fast response so that the contribution of insects, or other significant extraneous noise sources, may be identified and the contribution of mine noise and other extraneous noise may be evaluated at all times. A continuous audio recording is also desirable for all real-time monitoring stations so that the source and audible characteristics of particular events may be verified, if necessary, to support the spectral analysis of the noise event.

380 Mr Savery considers that it is also desirable for all of the real-time monitoring stations to be able to generate continuous noise level versus time graphs (with the contribution of insects and other extraneous noise sources excluded) so that the instantaneous maximum noise levels impacting upon the sensitive receptor location from mining sources may also be identified, as well as the number of significant instantaneous maximum noise levels per any given monitoring period.

381 A real-time noise monitoring system which has similar technical specifications to the remote noise logger temporarily installed by Mr Savery at Sensitive Receptor 10 is required for NAC to implement an effective noise monitoring system for the day/evening and night periods at any sensitive receptor. The installed noise logger has the capability of producing 15 minute

objective real-time reports (with audio back-up for subjective listening, if required) is the style of real-time noise logger which is required to monitor compliance of the mine noise emissions under most conditions of extraneous noise experienced in a very rural environment. This type of real-time noise monitoring system may be utilised for day/evening and night time monitoring.

382 The term "most" is used because under conditions of strong wind or rain the noise impact is broadband across a wide range of frequencies and it is not possible to separate out the mine and extraneous noise contributions under these conditions.

383 Mr Savery is concerned that if the current system is expanded to include a minimum of three noise monitoring stations then the noise reports upon which the operator is monitoring will become too difficult for a single person to effectively manage if the systems rely upon subjective listening.

384 Mr Savery does not believe that directional noise monitoring systems are necessary to install at sensitive receptor locations around the outside perimeter of the proposed Stage 3 mine. The reason is that there will be traffic on public roads and other "loud" local extraneous sources (e.g. crows) which will prevent such systems from operating reliably. This is Mr Savery's experience from a Hunter valley mine where eight directional real-time noise loggers were installed and the results were unreliable and had to be supplemented by attended monitoring to be certain that noise compliance was being achieved by the mining operations.

385 The currently installed real-time system only records L_{Aeq} noise levels per 10 minute period (i.e. average noise levels), as well as 1 minute averaged one-third octave spectra. Other statistical measures, such as L_{A1} and L_{A10} provide useful information but do not record the instantaneous L_{Amax} levels, or frequency of occurrence of L_{Amax} levels due to mining. Discrete instantaneous maximum noise levels occurring intermittently (which can be very intrusive and annoying to a sensitive receptor as well as being the primary contributor to sleep disturbance) are not recorded or reported, or considered in the adaptive noise management process.

386 The effectiveness of the proposed real-time monitoring system in preventing non-compliance with the noise limits is dependent upon the skill and acoustic expertise of the operator who is actively monitoring the real-time noise data feed of information and audio recordings, the time taken to assess the current noise levels at each location at a particular time and the management structure set in place to make decisions about the mine operations, such as stopping or moving particular items of plant or equipment from operating and when operations may be re-started again.

387 Equally important will be the decisions related to how long a management mitigation measure will be in place, and how that measure may be terminated, either on the same night or

subsequent nights.

388 The SLR report indicates that the proposed real-time noise monitoring system and adaptive noise management system would not be effective during the day or evening periods due to the presence of non-mining noise and extraneous noise in the acoustic environment. If non-compliances occurred during the day or evening period then a more complex real-time noise monitoring system involving monitoring of spectral analysis records will be required if it to be effective in achieving the objectives of NAC.

389 Mr Elkin does not agree with the statement that Mr Savery makes in paragraph 369 that the system will not work in the presence of mid-low frequency sources (such as local traffic passbys, animal noises, aircraft and strong winds for the following reasons:

390 The system works for car passbys because of the spectrum of a car passby (see **Figure 6**). It is evident that the >2 dB separation measure will be trigger given that most of the acoustic energy is greater than 630Hz. As such, this 10 minute interval would be excluded from the compliance analysis. Given the logarithmic nature of noise, this is a valid process as that 10 minute interval would be highly affected by a car passby which would be much louder than mine noise alone.

391 For any sources that are predominantly low frequency (and therefore don't trigger the 2 dB separation measure), the operator will need to be listening if the live dashboard is indicating an exceedence in a particular 10 minute interval. It is Mr Elkin's understanding that if the operator deems the extraneous noise to be dominant, that 10 minute interval is excluded from the compliance analysis.

392 Mr Elkin notes Mr Savery recommendation for 1/3 octave band frequency capabilities to further aid in this task. Mr Elkin agrees with Mr Savery that this would further add to the robustness of the monitoring system.

393 It is Mr Elkin's understanding that the existing Sentinex system records 1/3 octave band Leq data every minute. However, Mr Elkin is unaware if this information is being reviewed by the operator as they listen to the live audio. It is recommended that this 1/3 octave band data be utilised in the future if the operator is having difficulties distinguishing between various noise sources. Furthermore, if the Sentinex system (or an alternative system) can provide 1/3 octave band analysis in smaller time interval, ideally 1/8 of a second like most sound level meters, then this would be even more beneficial.

394 Mr Savery also mentions low frequency wind noise. The existing Sentinex system has an integrated weather station. Measurement data is excluded if it is raining or wind speeds are greater than 3 m/s (in line with DEHP's Noise Measurement Manual). As such, it is not

expected that (low frequency) wind noise will affect the performance of the monitoring system.

395 For the reasons stated in paragraphs 390 to 394 (not least of which is that an operator will be listening to the live audio feed if noise levels in a particular 10 minute interval exceed the EA conditions), Mr Elkin does not agree with the statement reached in paragraph 394 that the system will not work and will not provide a noise management benefit.

396 Mr Savery lists a number of concerns he has with the directional capabilities of the Sentinex monitor in paragraphs 370 to 372. Mr Elkin has reviewed both the specifications of the Sentinex system as well as a Directional Noise Monitoring Validation Report prepared by Advitech (dated 8 July 2014).

397 Based on Mr Elkin's review of these documents, he does not share the same concerns as Mr Savery. As such, Mr Elkin believes the Sentinex system is capable of providing the analysis required. Mr Elkin is not, however, specifically recommending the additional directional monitoring systems must be Sentinex systems. Other directional noise monitors are available in the marketplace.

398 Mr Elkin shares Mr Savery's concerns in relation to the quoted paragraph (from NAC commitments) in paragraph 374 in relation to the monitoring system not working in the presence of insects however this statement is inconsistent with the capabilities of the Sentinex system (or equivalent) in combination with the ongoing TARP process. Mr Elkin can only assume this statement was made in regards to the monthly monitoring undertaken by Moore and Associates.

399 In relation to paragraph 378, it is Mr Elkin's understanding that NAC have committed to purchasing (or hiring) up to two additional real-time directional noise monitors, thus enabling the recommendation for a 'western' and 'northern' monitoring location (for the Stage 3 operations) to be achieved.

400 In relation to Mr Savery's desire for the real time system to provide a continuous "noise level versus time" graph, Mr Elkin makes the following responses:

401 As stated in paragraph 329, Mr Elkin believes that for typical open-cut mining situations, the maximum (Lmax) noise levels (attributable to mining) will be around 8 dB higher than the Leq values. Given the difference between the Leq and Lmax draft EA conditions, a difference of 13 dB between the Lmax and Leq mine noise would be acceptable before Lmax noise emissions became the critical parameter.

402 Intermittent operator-attended noise measurements, say every 6 months, could be undertaken to confirm that relationship (between Leq and Lmax) stated in paragraph 329. This would be

an alternative to Mr Savery's recommendation.

403 Mr Elkin agrees that a continuous "noise level versus time" graph is desirable but is not mandatory. Furthermore, if a continuous "noise level versus time" graph was introduced into the monitoring regime, detailed attention would be required to ensure that extraneous maxima were differentiated from mine-related maxima. This could involve significant additional resources. For example, the Leq parameter might be sitting below EA conditions (which right now would mean that the operator doesn't have to be listening to the live audio) however if an extraneous Lmax goes above the Lmax limit, analysis would be required when it wouldn't otherwise be required from an Leq perspective.

404 This could be superfluous work if the option outlined in paragraph 402 continually shows that mining-related Lmax are less than 13 dB higher than mining-related Leq levels.

405 In relation to paragraphs 386 and 387, Mr Elkin is satisfied that NAC take noise control very serious and as such, are willing and able to quickly alter their mining operations (typically either switch plant off or relocate it to a shielded location such as deep in the pit) if indications are that they are going to exceed their noise limits.

406 Mr Elkin has seen a lot of evidence to support this view since he commenced his expert witness role.

407 In relation to paragraph 388, the issue with the existing system during the day (and possibly evening) period is that the overall and "low frequency" noise levels are almost always greater than 2 dB (based on the data reviewed to date). To exclude all (if not the majority of) measurement data on this one rule would likely render the system ineffective.

408 Further work is recommended to investigate this issue.

409 Mr Elkin would however like to point out that the vast majority of complaints (if not all) relate to the night-time period. This is not unexpected given (a) people are generally more sensitive to noise at night (e.g. for quality of sleep), (b) background noise levels diminish at night and therefore background noise levels do not "mask" mining-related noise to the same degree and (c) temperature inversion occur at night which enhance propagation. It is for these reasons that Mr Elkin believes night-time will continue to be the most critical period of the day in relation to the NAC's noise obligations to the surrounding community.

10 NOISE AND VIBRATION MANAGEMENT PLAN

410 The noise and vibration strategy proposed by NAC is outlined in 2014 EIS Appendix J.11, Section 3.

411 The existing monthly noise monitoring program is proposed to be continued and expanded in 2014 EIS Appendix J.11, Section 3.4.

412 Mr Savery is of the view that the current noise monitoring program has not been conducted using best practice methodology which has prevented NAC and sensitive receptors from having a better understanding and quantification of the noise emissions from the mine operations, particularly when dominant extraneous noise levels, such as insects were present.

413 This view is supported by review of the David Moore report attached to the SKM letter to DEHP which purports to monitor the background noise level in the absence of mine noise and compare it to the mine plus background noise level when the mine is operating. The methodology is flawed and the mine noise results are incorrect. This can be seen readily in the first table (Saturday 5th January 2013). In this table the first note states:

414 "Extraneous noise: some noise of wind in the vegetation and insects but not discernible from noise from the NAC mine".

415 The average level reported from all sources was L_{Aeq} 41.4 dBA. The above note suggests that the extraneous noise was of similar level to the mining noise. If this was true then it could be expected that the mine noise was approximately 38-39 dBA. Instead a much lower level of 34dB is incorrectly assigned to the mine by subtracting the average night noise level when the mine was not operating. The average L_{Aeq} noise level when the mine was not operating was significantly influenced by one reading of 47.5 dBA which negated the low levels of 35.2 and 37.5dBA. Another error was that the L_{Aeq} noise levels when the mine was not operating were arithmetically averaged over the 8 nights instead of being logarithmically averaged. No analysis of the audio records appears to have been conducted to identify the cause of the higher reported levels of 47.5dBA in this sample period. The comparative analysis using this data is flawed and provides an erroneous outcome. Comparison of L_{Aeq} levels from different time periods is not supported because the extraneous and natural sources contributing to the ambient L_{Aeq} levels on each occasion are not known and may be quite different.

416 Monitoring of noise levels has been conducted for NAC on a monthly basis since 2002. The conclusions from this round of monitoring are not supportable and it is not surprising that the request for the raw data from this campaign (through EDO) has not been released by NAC.

417 Mr Savery has reviewed the noise monitoring reports provided by disclosure by NAC for the

period 2011 to 2015. Some of this analysis was provided earlier in paragraphs 56 to 60 and 66 to 73. The monitoring utilised a simple statistical noise meter which was replaced sometime in 2013 with an improved sound analysis meter with one-third octave spectrum capabilities.

418 Unfortunately, the poor methodology and incorrect conclusions continued with this new meter because the one-third octave capabilities of the meter were not used to quantify the contribution of insects or other extraneous noise contributions. This lack of analysis meant that in most instances when the $L_{Aeq,\ adj,\ 1\ hour}$ noise levels exceeded the noise limit, or when numerous discrete exceedences of the noise limits were manually noted by Mr Moore during the monitoring, the monitoring report invariably reported that the compliance of the mine was not able to be determined due to extraneous noise sources.

419 Mr Savery believes that many of these conclusions were most likely incorrect (refer to discussion of background levels in paragraphs 66 to 73). The incorrect conclusions are due to the failure of Mr Moore's technology to identify and quantify the contribution of insects and other extraneous noise sources in the noise sample. This technology has been known for the past eight years at least. Mr Savery presented a paper at the International ICSV14 Conference in Cairns 2007 about this issue related to environmental noise assessment[19.]

420 Mr Savery's opinion is that the omission of one-third octave spectral analysis from the analysis of the noise monitoring conducted by Mr Moore has rendered most of what he has measured as worthless with respect to the objective of testing compliance for the mining noise emission levels. This is a very unfortunate conclusion for both NAC and particularly for the sensitive receptors for whom the noise monitoring was intended to assess compliance and protection of their health, wellbeing and amenity, insofar as could be gained by compliance with the approved EA noise limits.

421 Current best practice noise monitoring involves attended or unattended noise loggers which record not only statistical acoustical parameters but also statistical one-third octave analysis and digital level-time and audio recorders. Such instruments are available and enable the recorded noise data to be post-processed to identify or remove the contribution of extraneous noise, including insects from the source data.

422 If the monthly noise monitoring is to be continued and expanded then it is recommended that the style of monitoring be changed to one-third octave noise monitoring using a real-time analyser which is capable of identifying the contributions of insects, or periods when extraneous noise is present. With such an instrument the contribution of the mine noise may

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[19] *Caley M and Savery J, The Case for Spectral Baseline Noise Monitoring for Environmental Noise Assessment, 14th International Congress on Sound and Vibration, Cairns, 9-12 July, 2007*

be clearly identified and correctly reported to NAC and sensitive receptors alike. The monitoring locations should be increased to include the closest, or representative sensitive receptors on the western and northern boundaries of the mining leases to the current operations of the mine throughout the Stage 3 project..

423 NAC describe in 2014 EIS Appendix J.11, Section 3.5 Local Stakeholder Engagement in relation to noise concerns or noise complaints. Mr Savery agrees that the stated processes in this section are appropriate but notes that the response of NAC to complainants in past history, as noted in various Lay objector submissions to the Land Court, appears to have not been in full accord with these processes.

424 Mr Elkin agrees with the content put forward by Mr Savery in paragraphs 412 to 422.

425 It is Mr Elkin's opinion that the monthly noise monitoring currently undertaken by Moore and Associates should be discontinued, with the additional 2 real-time directional noise monitors replacing it.

11 NAC COMMITMENTS

426 NAC has committed to publically issue an environmental noise monitoring report on a monthly basis. The report will be made available to the public through the Proponents website.

427 Mr Savery recommends that an independent acoustic consultant, acting on behalf of the surrounding sensitive receptors, be appointed/approved by the sensitive receptors to review the proposed monthly noise report formats for an initial minimum six month period once mining operations commence so that the information presented from noise monitoring is as clear, open and unambiguous for a sensitive receptor and regulatory authority audience. The review role to be paid for by NAC.

428 From a technical perspective, Mr Elkin agrees that having a peer reviewer involved in the development of the monthly report format is advantageous, but not mandatory.

429 Mr Elkin's opinion is that who that is and who pays for this peer review service is a matter for future discussion and agreement between NAC and the community, if implemented.

CONCLUSIONS

430 The conclusions of Mr Savery for the Stage 3 Project are outlined below:

431 Background noise levels are a critical component in setting a noise baseline for a project from

which appropriate noise limits may be determined to protect the health, wellbeing and amenity of the potentially impacted sensitive receptors in accordance with the EPAct;

432 Noise limits should preferably be set in accordance with either the PNCG or the MMCG which are based upon the background noise levels at the sensitive receptor locations, based upon an assessment time of 15 minutes to provide the best protection of health, wellbeing and amenity;

433 If less strict noise limits (based upon an assessment time of 15 minutes) were to be approved in accordance with the EPP(Noise), then the noise limits are recommended to be based upon the background creep provisions which accord with the guidance provided by Schedule 1, and which also accord with the noise limits approved in the precedent Wandoan Land Court judgement; namely L_{Aeq} 35dBA during the night period;

434 The free-field maximum noise limit in the night period is recommended to be L_{Amax} 47dBA;

435 The 2014 EIS noise limits of LAeq 37dBA and LAmax 52dBA provided the least protection of health, well-being and amenity of the various noise limits considered and tabled in paragraph 142 of this JER.

436 The noise of rail loading operations within the mining lease is recommended to be assessed using the same noise limits as for all other mining noise sources;

437 The draft EA noise limits for the rail spur (external to the mining leases) are supported;

438 The noise of light vehicles on public road is assessed as causing an adverse impact upon the nearby sensitive receptors for a period of 30 minute on either side of the change of shift time, twice per day during operations. It is recommended that NAC, the regulatory authority and the police meet to formulate a noise control plan which will aim to reduce vehicle speeds, and the resultant adverse noise impact upon the sensitive receptors;

439 The noise modelling for the mining operations does not indicate compliance with the night 37dBA noise limit recommended by the 2014 EIS because the overall noise reduction of 2dB required to satisfy the utilisation argument is necessary to claim compliance with the noise limits. The utilisation argument is not supported and is not considered valid for the operations of the proposed mine with regard to predicted noise levels at sensitive receptor locations;

440 The noise modelling also omits critical mining operations from its predictions, such as the out-of-dump overburden pits, drilling on the western pit and other sources, which have the potential to increase noise emission levels during the day/evening and night periods. Such sources were not assessed in the modelling scenarios chosen for assessment by the 2014 EIS;

441 The real-time noise monitoring and directional monitoring system concept is supported for the Stage 3 development. However, the current system implemented at Acland is not considered satisfactory in its current state of development to effectively monitor compliance with noise limits in the presence of dominant extraneous noise sources. The current system relies upon a combination of objective and subjective assessments and does not include objective assessment based upon one-third octave analysis and other post-processing required to develop suitable acoustic parameters to compare with the noise limits.

442 The Acland real-time noise monitoring system is not suitable in its current form for monitoring noise emissions in the day/evening period to assess compliance with the noise limits.

443 A minimum of a further two permanent real-time noise monitoring systems are necessary to protect the health, wellbeing and amenity of sensitive receptors to the north and west of the mining lease. The systems must be based upon one-third octave spectral analysis and have sufficient post-processing capabilities to provide objective reports of the relevant acoustic parameters to assess compliance with the approved noise limits. Directional noise monitoring is not a mandatory requirement for the additional two locations.

444 The monthly reporting noted in the noise and vibration management plan is recommended to be replaced with additional monthly monitoring at a range of sensitive receptors to the north and west of the mining lease. The locations for the monitoring may change as the mining pits develop further to the south. The monitoring is to be attended and comprise one-third octave monitoring instrumentation from which the influence of insects and other extraneous contributions may be analysed to provide compliance reports to sensitive receptors and NAC.

445 The conclusions of Mr Elkin for the Stage 3 Project are outlined below:

446 The current draft EA noise conditions, based on the EPP(Noise) Acoustic Quality Objectives, are appropriate for this project as they will protect heath, wellbeing and amenity for the neighbouring community.

447 Paragraph 446 is supported by numerous other standards and guidelines, such as:

- WHO sleep disturbance guidelines
- AS2107 Acoustics – Recommended design sound levels and reverberation times for building interiors
- enHealth's The Health Effects of Environmental Noise – Other than Hearing Loss guideline
- DEHP's Application Requirements for Activities with Noise Impacts guideline, and
- The legal precedence set by the Wandoan Coal Mine Land Court Decision (taking into account a 7 dB façade noise reduction)

448 Whilst a certain level of scrutiny should be placed on the modelling undertaken to date (in order to be comfortable that engineering and management measures can reasonably and feasibly be implemented in order to comply with the EA noise conditions), it is impossible on a job of this size and complexity to model every possible operational scenario. The time horizons modelled for the EIS (start, middle and end of the project) are consistent with industry practice.

449 Mr Elkin's opinion is that the EIS modelling, in combination with:

(a) extensive noise control of acoustically significant plant and equipment (including specific treatment of tonal / impulsive sources), and

(b) evidence provided to me as part of my expert role as to NAC's ability to implement management measures "live" by either switching plant off or relocating noisy equipment to more shielded locations

provides sufficient evidence that the draft EA conditions can be met.

450 The –2dB utilisation justification analysis provided to Mr Savery does justify, in broad terms, the correction applied in the EIS given the legitimacy of the utilisations provided by NAC. The only other way to investigate the effects of these actual utilisation rates would be to undertake more 3D SoundPLAN modelling which would be a significant amount of extra work given the large number of possible permutations (hence the use of the spreadsheets instead).

451 It is Mr Elkin's opinion that a far more effective way (other than more noise modelling) of ensuring the neighbouring community is protected from adverse noise levels during Stage 3 operations is to develop and implement a thorough Noise and Vibration Management Plan, whereby actual noise levels, rather than predicted levels, can be monitored in real time and mitigation/management measures implemented as required.

452 The Stage 3 noise monitoring system, a critical element of the Noise and Vibration Management Plan, should include:

- 3 measurement locations (existing Acland location along with a new location to the north and a new location to the west)
- 1/3 octave band analysis
- Low frequency (< 630 Hz) noise analysis
- Audio recordings
- Directionality (assuming this is relevant given the relative locations of the mining activities and the measurement location)

453 Based on what Mr Elkin has seen of the existing Sentinex system (including Advitech's Directional Noise Monitoring Validation report dated 8 July 2014), he is of the opinion that the Sentinex monitor is capable of performing the required monitoring. However, Mr Elkin is not

wedded to the Sentinex system as there are other comparable noise monitors in the marketplace.

454 It should be noted that Mr Elkin has stated that the existing Sentixex system in combination with NAC's current TARP is the most sophisticated and more importantly 'instant' monitoring system he has seen fully operational at a mine site in Queensland.

455 Finally, as previously stated, the ultimate "risk" in relation to the noise emissions from Stage 3 operations rests with NAC provided that a credible noise monitoring and reporting system is implemented. Mr Elkin believes there will be a credible noise monitoring and reporting system (encapsulated in the required Noise and Vibration Management Plan) given:

- The CG's condition that noise monitoring results be released publically every month
- NAC's commitment to operating either 2 or 3 real-time directional noise monitoring stations throughout the Stage 3 operations, and
- NAC have now been operating a sophisticated and successful Trigger Action Response Plan (TARP) for over 2 years now and it is Mr Elkin's understanding and recommendation that this TARP system will continue to operate throughout the life of the Stage 3 mining operations.

SUMMARY OF AREAS OF AGREEMENT

456 The areas of agreement between the experts are summarised below:

457 Meteorological data used in the 2014 EIS noise assessment was appropriate;

458 AS1055.2 outlines possible methods of noise assessment but does not specify noise limits;

459 The assessment time for noise modelling and compliance monitoring is 15 minutes in accordance with the draft EA conditions;

460 Noise limits based upon PNCG or MMCG are not practical nor feasible for the Stage 3 project, given the proposed mining activities, the prevailing meteorological conditions near Acland and the relatively close locations of the sensitive receptors to the mining operations;

461 Achievement of any of the EPP(Noise) derived noise limits will be difficult for NAC to achieve at any of the near sensitive receptor locations, depending upon the meteorological conditions, and will require considerable attention to noise monitoring and continuous, ongoing adaptive noise management if it is to successfully achieve the objective of operating in compliance with the noise limits during all daily time periods;

462 The number of real-time noise monitoring stations should be increased to a minimum of three, namely at Acland, western location and northern location;

463 Real-time noise monitoring to be expanded to include spectral frequency analysis using one-third octaves;

464 Real-time noise monitoring systems must be able to be effective in the day/evening and night periods, implying that extraneous noise, particularly insects can be quantified in all daily periods;

465 Permanent and attended noise monitoring systems must be able to monitor L_{Amax} (FAST response) instantaneous noise levels during each 15 minute assessment period at night for protection of sleep disturbance;

466 The historical performance of NAC in responding to and investigating noise complaints prior to the TARP (and installation of the “real time” Sentinex monitor) was not satisfactory.

467 NAC’s recent historical performance in monitoring noise levels and implementing noise mitigation (since the implementation of the TARP) has improved significantly for the Acland sensitive receptors. Both experts agree that still further improvements in noise monitoring can

be made, particularly for all other sensitive receptors.

468 Continuation of the monthly noise monitoring and reporting in the form currently conducted by D Moore is not supported.

13 SUMMARY OF AREAS OF DISAGREEMENT

469 The areas of disagreement between the experts are summarised in the table below:

Issue	Mr Savery	Mr Elkin
1	Background noise levels provided local context for assessing annoyance (health, well-being and amenity)	Background noise level is not required to assess health, well-being and amenity impacts
2	WHO Report and enHealth reports focussed upon the urban environment.	WHO Report and enHealth reports are applicable to all environments
3	Recommended noise limits of these reports should be reduced by 5dB for low noise very rural environments	Recommended noise limits are appropriate
4	Noise limits derived from PNCG and MMCG (both based on exceedance of background noise levels) provide the best protection of health, well-being and amenity	Noise limits should be acoustic quality objectives from EPP(Noise) Schedule 1
5	Outdoor noise limits based upon EPP(Noise) should be based upon background creep requirements, i.e. $L_{Aeq, adj, 15min}$ 35 dBA at night and $L_{Aeq, adj, 15min}$ 40 dBA in the day/evening	Outdoor noise limits based upon EPP(Noise) should be based upon Schedule 1, i.e. $L_{Aeq, adj, 15min}$ 37 dBA at night and $L_{Aeq, adj, 15min}$ 42 dBA in the day/evening for a partially closed window
6	Outdoor noise limits of $L_{Aeq, adj, 15min}$ 37 dBA at night and $L_{Aeq, adj, 15min}$ 42 dBA in the day/evening are not appropriate because they provide the least protection of health, well-being and amenity of all noise limits considered by the experts.	Outdoor noise limits of $L_{Aeq, adj, 15min}$ 37 dBA at night and $L_{Aeq, adj, 15min}$ 42 dBA in the day/evening are appropriate
7	The minimum noise reduction recommended from the existing night noise limit of 40dBA is 5dBA to achieve a "clearly noticeable" noise reduction compared to the current Stage 2 noise emission levels, for the Acland, northern and north-western sensitive receptors.	A reduction of 3dB will provide a benefit to the sensitive receptors compared to the current noise emission limits.
8	Outdoor sleep disturbance limit of 47dBA	Outdoor sleep disturbance limit of 52dBA
9	Wandoan noise limits of $L_{Aeq, adj, 15min}$ 35 dBA at night accord with EPP(Noise) background creep requirements and are	Wandoan noise limits should be increased to $L_{Aeq, adj, 15min}$ 37 dBA at night to be appropriate for NAC Stage 3.

Issue	Mr Savery	Mr Elkin
	appropriate for NAC if rating criterion are applied to Stage 3.	
10	Noise of trains during loading on rail loop to be assessed using mine noise limits whilst trans are within the mining lease	Noise of trains during loading to be assessed using the draft EA noise limits of L_{Amax} 56 dBA and $L_{Aeq\ 24\ hours}$ 50dBA anywhere on the spur line from Jondaryan provided rail noise is distinguishable from other mining noise
11	Low frequency noise assessed from all sources using outdoor $L_{Ceq,\ 15min}$ 60dBC followed by indoor assessment, but only if LFN problem indicated.	Low frequency noise from locomotive assessed using indoor $L_{eq,\ 15min}$ 50dBL and balanced spectrum
12	Noise modelling does not indicate compliance with $L_{Aeq,\ adj,\ 15min}$ 37dBA at night	Noise modelling indicates compliance with $L_{Aeq,\ adj,\ 15min}$ 37dBA at night
12	Compliance in the day/evening and night is only achieved with noise reduction of 2dB as a result of “utilisation”	Utilisation provided by NAC is appropriate
13	Noise modelling must demonstrate compliance can be achieved for both day/evening and night periods, since different operations are planned for the day/evening and night periods	EIS noise modelling is sufficient for “planning” purposes. Thorough noise monitoring system then most appropriate for ensure EA conditions are met..
14	Noise modelling has omitted important and potentially significant sources in noise modelling conducted for the night and day/evening scenarios, such out-of-pit overburden bunds, etc	Noise modelling cannot cover all scenarios and is appropriate. Focus upon monitoring not modelling.
15	Noise modelling sound power levels already incorporate “averaging” of use and further utilisation noise reduction is not appropriate	Noise modelling sound power levels are appropriate
16	Noise modelling assumes that all of the NAC noise mitigation commitments have been implemented but NAC has not provided a timetable of proposed noise mitigation in its commitments.	NAC noise mitigation commitments are sufficient
17	Noise modelling contains no noise character adjustments to account for	NAC will focus upon engineering noise controls targeting tonal/impulsive noise (a

Issue	Mr Savery	Mr Elkin
	possible tonality, impulsiveness or a safety factor for operational variations or uncertainty	stated commitment), real –time monitoring and shut-down of plant or equipment if noise levels exceed EA conditions
18	Current real-time noise monitoring is ineffective during the night/day/evening period after 5am due to extraneous noise	Modifications to the existing monitoring system will be required to monitor noise during the day and evening periods however the current system has evolved because the vast majority (if not all) noise complaints happen at night.
19	Regular attended noise monitoring be continued and expanded based upon one-third octave noise analysis and suitable methods to quantify extraneous noise, particularly insects. Such monitoring to expand upon the three permanent real time monitoring location to include other potentially impacted sensitive receptors.	Given the expanded (to 3 locations) "real time" noise monitoring system, operator-attended monitoring can be reduced to (a) dealing with specific complaints not able to be assessed using the "real time" system, (b) for confirming the relationship between L_{eq} and L_{max} indices for this mine and/or for verification of "real time" monitoring system results.
20	Ultimate risk for Stage 3 rests with NAC for noise mitigation costs to comply but also rests with sensitive receptors who will suffer adverse health, well-being and amenity impacts while the noise mitigation requirements are being determined and in the necessary delays between determination and implementation of suitable and effective noise mitigation measures.	Ultimate "risk" for Stage 3 rests with NAC given the "live" nature of the proposed monitoring and the need to proactively release monthly noise monitoring reports
21	Unfortunately previous complaint and monitoring history for the Stage 2 project, as far as can be gleaned from relevant documents discovered, submitter statements and monitoring reports does not always appear to fully support the NAC commitments re sensitive receptors and noise emission levels, health, wellbeing and amenity for the new Stage 3 Project.	NAC are committed to turning sources off, etc and will do everything in their power to comply with noise limits and liaise/negotiate with sensitive receptors to minimise/prevent adverse health, wellbeing and amenity impacts from the Stage 3 project.

14 STATEMENT OF COMPLIANCE

In preparing this Joint Report, we acknowledge that (i) we have each been instructed in respect of an expert's duty to assist the Court in accordance with the Land Court Rules 2010 and (ii) we have understood and discharged that duty.

Furthermore, we confirm that no instructions have been given or accepted to adopt, or reject, any particular opinion when preparing this joint written statement.

Shane Elkin
Date: 22 February 2016

John Savery
Date: 22 February 2016

15 FIGURES

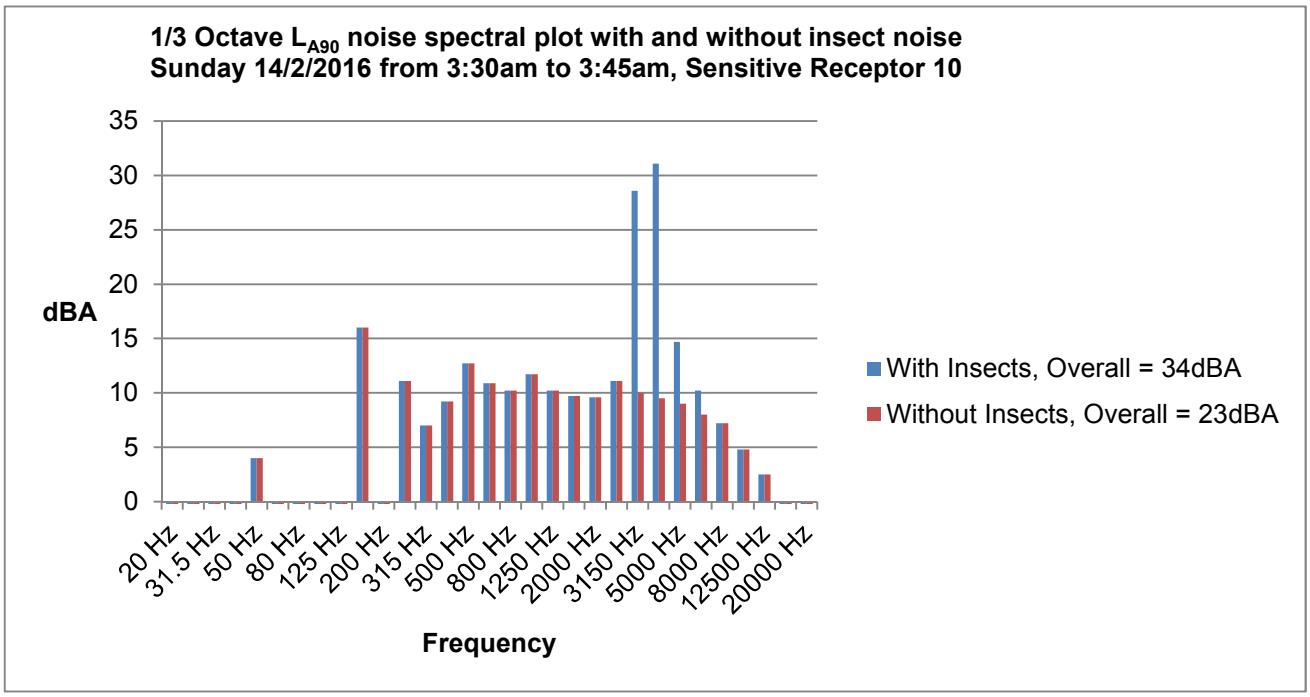

Figure 1 Background noise levels, L_{A90}, with and without insects (Savery at SR10)

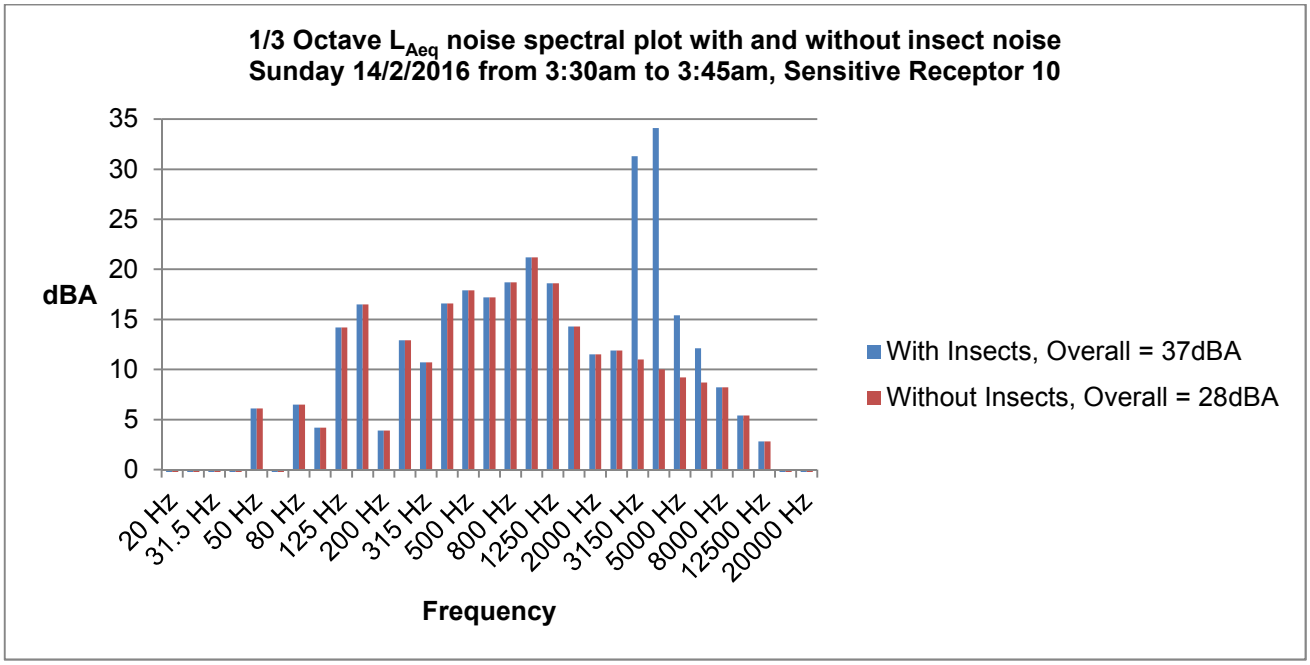

Figure 2 Intrusive noise levels, L_{Aeq}, with and without insects (Savery at SR10)

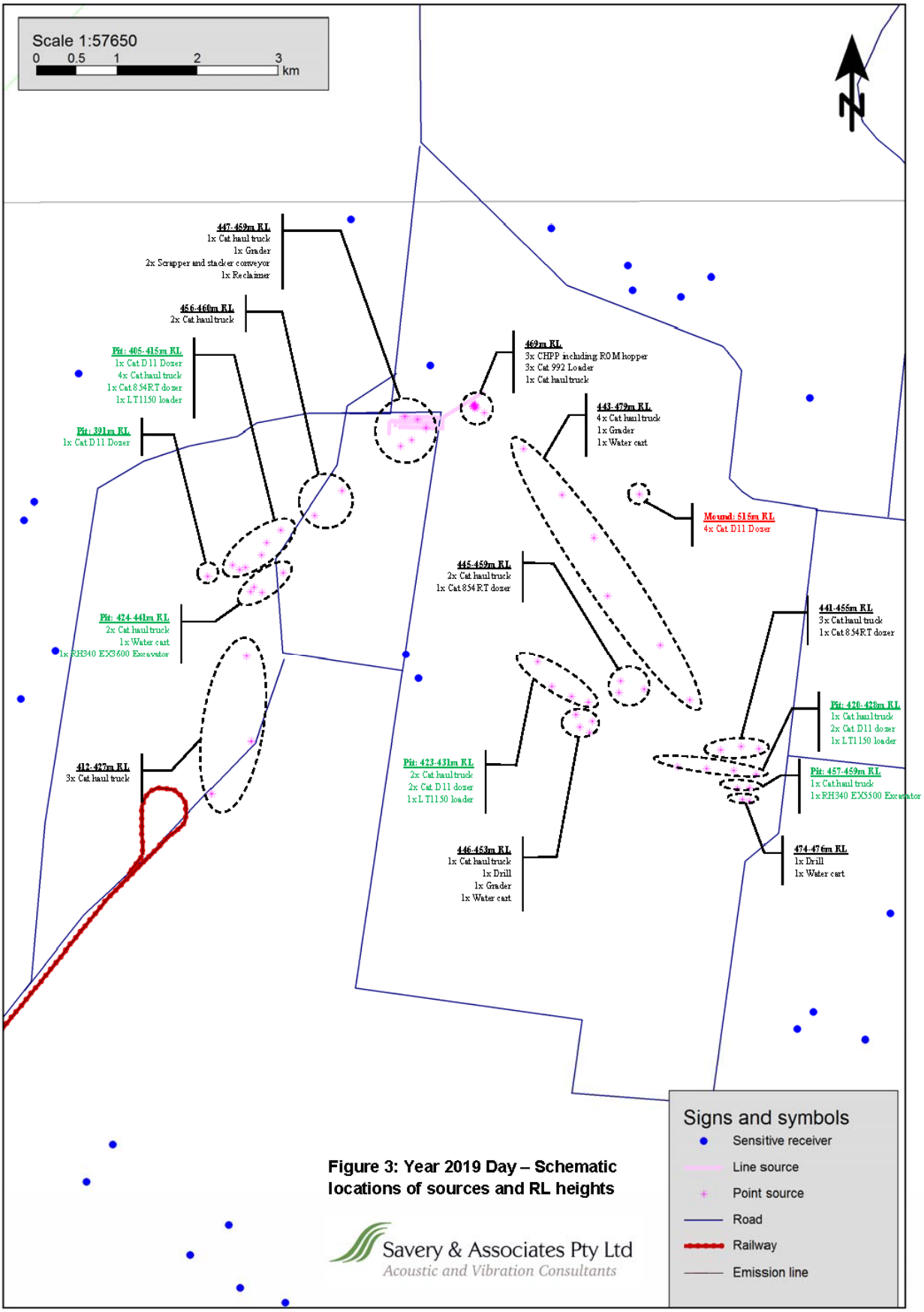

Figure 3: Year 2019 Day – Schematic locations of sources and RL heights

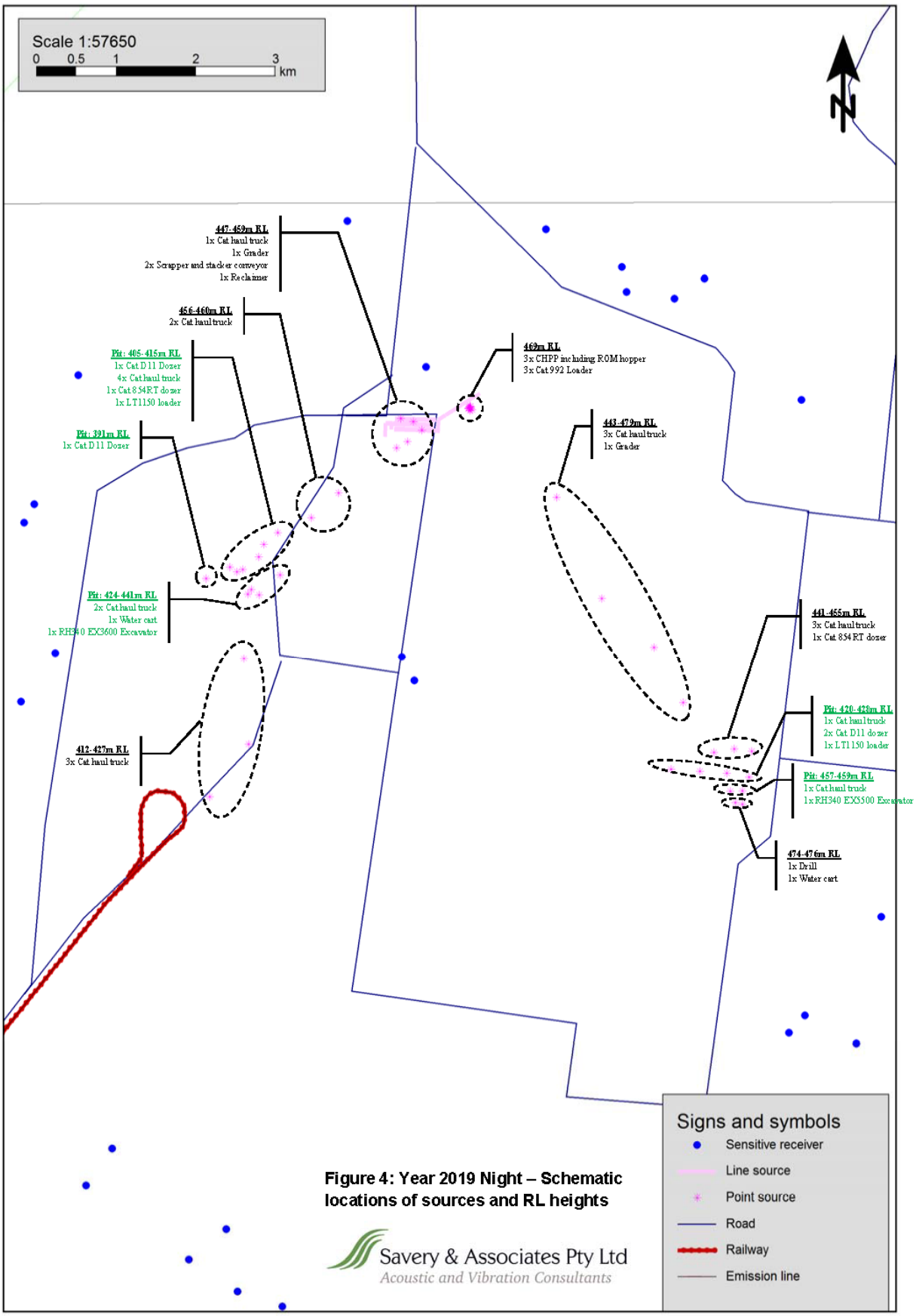

Figure 4: Year 2019 Night – Schematic locations of sources and RL heights

Date	Time	Laeq dB(A)	Laeq 1Hr dB(A)	LF dB(A)	LF 1Hr dB(A)	Laeq - LF Separation	AOI1 dB(A)	AOI1 1Hr dB(A)	Wind Speed (m/s)	Rain (mm)		LF 1Hr Max dB(A)	AOI 1Hr Max dB(A)
26-05-2015	11:00:00 PM	39.1	42.4	38.5	41.5	0.6	37.2	39.7	0	0	NC		
26-05-2015	11:10:00 PM	41.4	41.7	40.4	40.8	1	38.7	39.2	0	0	NC		
26-05-2015	11:20:00 PM	42.1	41.4	39.4	40.1	2.7	37.5	38.5	0	0	ND		
26-05-2015	11:30:00 PM	44.1	42.1	42.7	40.8	1.4	40.1	38.8	0	0	C		
26-05-2015	11:40:00 PM	44.6	42.7	43.9	41.4	0.7	41.4	39.3	0	0	NC		
26-05-2015	11:50:00 PM	46.8	43.7	46	42.6	0.8	42.5	40	0	0	NC		
27-05-2015	12:00:00 AM	43.1	44.1	42.4	43	0.7	40.5	40.4	0	0	NC		
27-05-2015	12:10:00 AM	38.6	43.9	37.8	42.8	0.8	37.6	40.3	0	0	NC		
27-05-2015	12:20:00 AM	42.6	43.9	41.1	43	1.5	38.8	40.4	0	0	NC		40.4
27-05-2015	12:30:00 AM	42.1	43.6	41.3	42.8	0.8	38.6	40.2	0	0	NC		
27-05-2015	12:40:00 AM	37.1	42.8	36.3	41.9	0.8	34.7	39.4	0	0	NC		
27-05-2015	12:50:00 AM	44.4	42	39.5	40.2	4.9	35.8	38.1	0	0	ND		
27-05-2015	1:00:00 AM	47.6	43.4	42.4	40.1	5.4	38.2	37.5	0	0	ND		
27-05-2015	1:10:00 AM	42.6	43.8	39.9	40.4	2.7	37.9	37.6	0	0	ND		
27-05-2015	1:20:00 AM	40.4	43.5	39.7	40.1	0.7	38.1	37.4	0	0	C		
27-05-2015	1:30:00 AM	42	43.5	40.2	39.9	1.8	38.5	37.4	0	0	C		
27-05-2015	1:40:00 AM	38.8	43.6	37.8	40.1	1	37.2	37.7	0	0	C		
27-05-2015	1:50:00 AM	39.1	42.9	38.2	39.9	0.9	37.2	37.9	0	0	C		
27-05-2015	2:00:00 AM	40.5	40.8	38	39.1	2.5	36.3	37.6	0	0	ND		
27-05-2015	2:10:00 AM	38.1	40	37	38.6	1.1	35.3	37.2	0	0	C		
27-05-2015	2:20:00 AM	36.9	39.6	35.6	38	1.3	33.5	36.6	0	0	C		
27-05-2015	2:30:00 AM	39	38.9	37.4	37.4	1.6	33.3	35.7	0	0	C		
27-05-2015	2:40:00 AM	36.9	38.6	35.4	37.1	1.5	32.5	35.0	0	0.2	ND		
27-05-2015	2:50:00 AM	38.7	38.5	35.7	36.6	3	33	34.2	0	0	ND		
27-05-2015	3:00:00 AM	35.4	37.7	34.1	36	1.3	32.7	33.5	0	0	C		
		Overall Noise Level	Overall "Rolling 1 hour Average" Noise Level	Low Frequency < 630 Hz Noise Level	Low Frequency <630 Hz "Rolling 1 hour Average" Noise Level	Difference Between Columns C & E (Difference between Overall and Low Frequency <630Hz Noise Levels)	Overall Noise Level in the North-East Quadrant (Area of Interest 1)	Overall "Rolling 1 hour Average" Noise level in The North-East Quadrant			Key to: NC - Non Conformance C - Conformance	Worst Hour of the whole night - Overall Noise Level	Worst Hour of the whole night - Overall Noise Level in The North-East Quadrant (Area of Interest 1)

Yellow shading indicates not an exceedence following analysis by the operator

"Figure 5 – Outline of the Real-Time Noise Monitoring Analysis Conducted at Night as part of NAC's TARP"

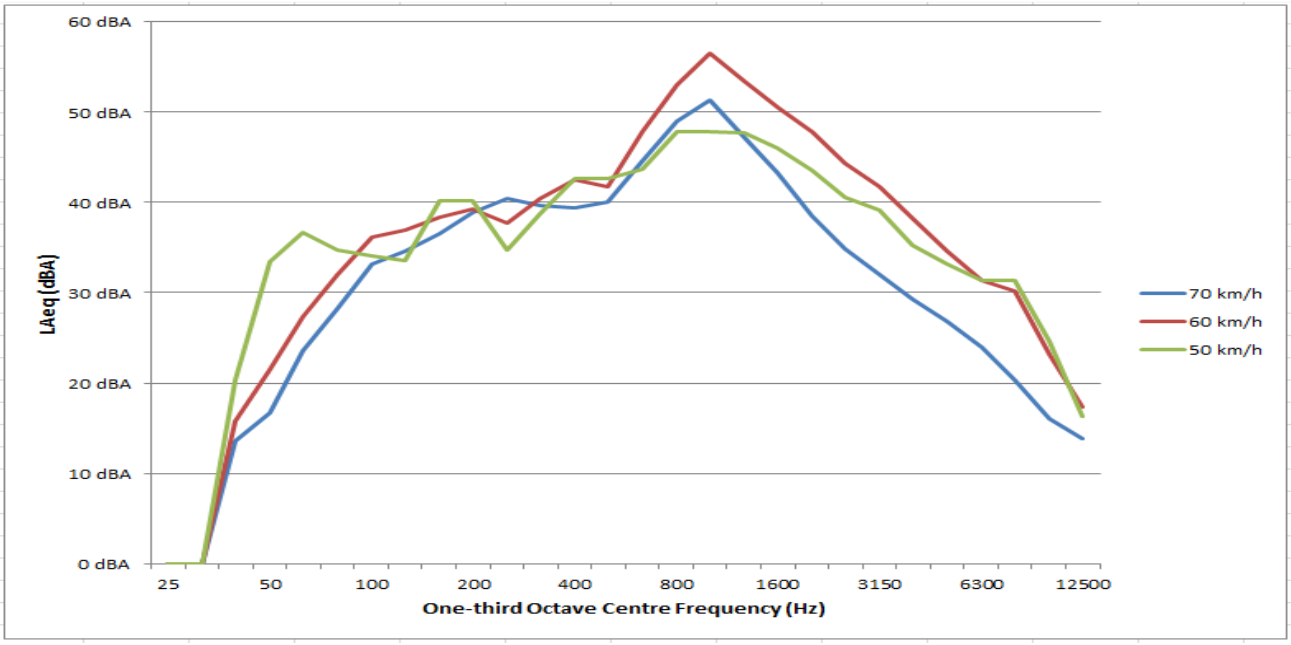

Figure 6 – Typical Light Vehicle Passby Frequency Spectrum

16 CURRICULUM VITAE

John Savery
Principal Acoustics, Managing Director, Savery and Associates Pty Ltd

Areas of Expertise	• Noise modelling assessment • Noise impact assessment • Noise measuring and monitoring assessments • Noise control assessment and design • Vibration monitoring and assessment • Instrumentation for acoustics and vibration measurement • Expert Witness	
Education	Bachelor of Electro-Mechanical Engineering (Monash) 1981 Diploma of Mechanical Engineering (Victoria University) 1968	
Affiliations	Fellow, Institution of Engineers, Australia (FIEAust) Chartered Professional Engineer, (CPER) Registered Professional Engineer, Queensland (RPEQ No 1795) Member, Australian Acoustical Society (MAAS) Member, International Institute of Acoustics and Vibration Associate, Noise Control Engineering Institute, USA	
Career Summary	*John Savery has 34 years' experience in noise and vibration consulting. His specialisation is noise modelling, impact assessment and control of noise from industrial, mining, coal seam gas, power plants, ports, transportation and community facilities utilising a broad range of acoustic instrumentation and noise modelling software and methods. His instrumentation skills and experience include advanced noise loggers, analysers and multi-channel sound and vibration data acquisition systems. His modelling skills involve the use of SoundPLAN and other software using a range of noise models. He has extensive field experience of noise and vibration in major processing, mining and utility plants, as well as transportation infrastructure and community facilities. He has prepared and reviewed Noise Guidelines for state government departments and local authorities in Queensland. He has prepared industry business cases regarding noise criteria and conditions for submission to the EPA. He has provided expert witness for local authorities and proponents for a wide range of noise amenity appeals. Applied industrial research in noise and vibration has been conducted for the coal mining industry and local authorities.*	
Career Experience	• Noise assessment for major noise emitting industrial plants in very quiet rural environments, related to mining or coal seam gas facilities and drilling, including fraccing in the Surat and Bowen Basins. Clients include QGC, Origin Energy and Conoco Philips at Curtis Island in Gladstone, Arrow Energy, Stanwell, APA, Stanmore Coal, Waratah Coal, Boulder Steel, Gladstone LNG and others. • Noise and vibration assessments, acoustic design and management for open cut mines, underground mines, coal seam gas drilling, LNG plants, processing plants, refineries, power stations, manufacturing, printing and concrete batching plants. Noise and vibration measurements, noise modelling and design of mitigation strategies.	

	• Noise impact assessments, modelling and noise control design for transportation infrastructure including major roads, railways, ports and airports. Design of control measures to satisfy criteria for residential or commercial uses in close proximity to transportation corridors and airports. • Noise impact assessments and acoustic design of residential developments near major roads, railways or airports, or other industrial or community facilities that emit noise. • Noise impact assessments of community facilities, including schools, child care centres, wedding reception centres, churches and entertainment venues.
	• Assessment and testing of architectural acoustic requirements and mechanical services noise control for industrial, commercial, educational, community and residential buildings. • Assessment and testing of speech privacy and intelligibility in sensitive spaces inside buildings. • Assessment and monitoring of construction noise and vibration from transport infrastructure and building construction sites. • Provision of expert witness for hearings in the Qld Planning & Environment Court, the Qld Land Court, the Qld Liquor Tribunal and the Victorian Town Planning Appeals Tribunal related to commercial, industrial or community facility developments located near to existing residential or community uses.
	• Assessment and monitoring of ground vibration and blast overpressure due to blasting, quarrying and mining and ground vibration from piling.
	• Assessment and monitoring of structurally transmitted noise in building structures from in-situ or nearby mechanical plant and equipment.
	• Assessment and mitigation of occupational noise exposure levels in industrial, mining, commercial and entertainment workplaces.
	• Assessment of mechanical vibration of machines, foundations and structures related to identification of causes for excessive vibration levels.
Acoustic Expert Witness	• Qld P&E Appeal re extension of haulage hours and increased truck noise along Hymix Road for Hanson (Hymix) Construction Materials. Represented Gold City Council(Minter Ellison) against the appellant. • Qld P&E Appeal re increased road haulage of quarry material (increase of 800 000 tonnes per annum) and increased truck noise through Beaudesert. Representing Scenic Rim Regional Council (Corrs chambers Westgarth) against appellant (Refaka).
	• Qld P&E Appeal re water cartage operations and truck traffic on Mount Tamborine. Acting for Scenic Rim Regional Council who are represented by Corrs Chambers Westgarth. Monitoring of truck noise levels at the water collection site and along roads throughout the mountain community. • Qld Land Court Appeal relating to the duplication and upgrade of the Bruce Highway at Eumundi. Representing the Appellant against Queensland Department of Transport and Main Roads. • Qld P&E Appeal re change of development conditions related to aircraft noise attenuation for a large residential development located south of the new parallel runway of the Brisbane airport. Representing the developer against Brisbane City Council.

	• Qld P&E Appeal re wedding reception centre and chapel and related noise emissions to neighbours at Cooroy. Representing Sunshine Coast Regional Council against the appellant. • Qld P&E Appeal re construction noise and vibration conditions related to mitigation of adverse impacts upon the mall traffic and outdoor eating facilities from the redevelopment of the Regent Theatre and Hilton Hotel in Brisbane. Representing Jimmys on the Mall(King & Co) against Brookfield Multiplex and Brisbane City Council. • Qld P&E Appeal re Rabbit Ridge Wind Farm near Stanthorpe. Representing proponent against the local authority and residents (current appeal).
	• Qld Land Court Appeal re land owners against QGC for coal seam gas drilling and plant on various properties. Represented QGC against landowners. • Qld P&E Appeal re shopping centre loading dock traffic noise for proposed shopping centre at Toowoomba. Represented Toowoomba city Council (Freehills) against appellant. • Qld P&E Appeal re child care centre noise to neighbouring residential dwellings. Represented Sunshine Coast Regional Council against appellant. • Qld P & E Appeal re mine workers accommodation camp near Blackwater. Represented Central Highlands Regional Council. • Qld P & E Appeal re proposed hard rock quarry at Represented Scenic Rim Regional Council. • Qld P&E Appeal re child care centre noise to neighbouring residential dwellings at Victoria Point. Represented appellant against Redland Shire Council. • Qld P&E Appeal re extension of backpacker facilities and associated noise emissions to neighbouring apartments in Fortitude Valley. Represented Brisbane City Council (City Legal) against the appellant. • Qld Supreme Court case involving structure-borne noise and vibration in two apartment towers on the Sunshine Coast. Represented a building component manufacturer (Allens Arthur Robinson) against the builder and developer. • Qld P& E Appeal re Barro quarry noise emissions at Mt Cotton in Brisbane. Represented the residents against the appellant. Other parties to the appeal included Redland Shire Council, Logan City Council and the EPA. • Qld P&E Appeal re road transport and maintenance depot in Rockhampton. Represented Rockhampton Regional Council (King & Co) against the appellant. • Qld P&E Appeal re road transport depot in Bowen. Represented the appellant. • Qld P&E Appeal re long haul road depot and warehouse operations in Rockhampton. Represented Rockhampton Regional Council (King & Co) against Toll NQX. • Qld P&E Appeal re railway freight depot and warehouse operations in Rockhampton. Represented Rockhampton Regional Council (King & Co) against Toll QRX. • Qld P&E Appeal (BD1814 of 2010) Beenleigh Pet Motel ats Logan City Council. Appeal concerned with non-approved use of a commercial kennel

	that occurred with noise complaints over many years. Acted for the local authority who were represented by Corrs Chambers Westgarth. • Victorian Town Planning Appeals Tribunal. Appeal concerned with proposed development of a commercial kennel facility at Arthurs Creek (approximately 35kms NE of Melbourne) in a very quiet rural environment. Acted for the proponent and presented the case for the kennels, including noise monitoring and noise modelling and presentation of expert reports and witness before the Tribunal.
Professional History	Savery & Associates, Managing Director & Principal Acoustics, 1997-present SAVTEK Pty Ltd, Managing Director, 2011-present HLA Environmental Science, Principal Acoustics, 1995-1997 Vipac Engineers & Scientists Ltd, Queensland State Manager, 1981-1995 Education Department, Victoria, 1970-1980 Government Aircraft Factories, Fishermans Bend, Victoria, 1968-1969

SHANE ELKIN

Technical Discipline Executive

Curriculum Vitae

QUALIFICATIONS

BE Mechanical (UQ 1993)

MEMBERSHIP

Member Australian Acoustic Society

Member of Institution of Engineers Australia

Registered Professional Engineer of Qld

Past Vice Chairman & Secretary of the Association of Australian Acoustic Consultants (AAAC)

BACKGROUND

Shane Elkin is an acoustic consultant with experience in environmental, mining, transportation and industrial noise assessment and control. In his nineteen years with SLR Consulting, he has worked on a large number of environmental, mining and transportation related assessments.

These projects have included measurement and analysis of noise and vibration emissions from construction and manufacturing industries, materials handling, road/rail vehicles and investigation of effects on people and land uses.

He is competent in the use of the SoundPLAN noise prediction model and in developing noise mitigation strategies for proposed transportation systems and large mining and industrial developments.

Shane has been involved on a large number of projects requiring varying degrees of community consultation and has utilised a number of key consultation initiatives to facilitate amicable outcomes.

Shane has also presented as an expert witness in the Land and Environment Court.

SPECIAL EXPERTISE

- Mining Noise and Vibration Assessment
- Transportation Noise and Vibration Control
- Environmental Noise Assessment and Control
- Architectural Acoustics
- Engineering Noise and Vibration Control
- Community Consultation
- Expert Witness

SELECTED PROJECT EXPERIENCE

Mining, Quarries and Construction

Mt Isa Mine Environmental Management Plans
Caval Ridge Coal Mine EIS
Saraji East Coal Mine EIS
BMA Bowen Basin Mine Noise Management Plans
Mt Isa Mine Site Wide Noise Models
Mt Isa Black Star Open Cut Deep MPV
Goonyella Riverside Mine Expansion
Ravenswood Gold Mine NIA
Blackwater South Coal Mine NIA
Duranbah Sand Quarry EIA

Major Rail Transportation Projects

Bus and Train (BaT) Tunnel EIS
Mayne to Virginia Track Quadruplication Upgrade
Virginia to Petrie Track Triplication Upgrade
Stuart Rail Yard Assessment
Moolabin Goods Yard Assessment
Implementation of NNMP for Cleveland Rail Line

Major Road Transportation Projects

Clem7, Airport Link and Legacy Way Road Tunnels
Gateway Upgrade Project
Northern Busway Project
South East Transit Project
Pacific Motorway Reassessment
Inner City Bypass NIA
Gladstone Port Access Road Noise Assessment
Toowoomba Range Crossing NIA

Industrial & Port Projects

Abbot Point Coal Terminal Cumulative Assessment
Review of CSG Noise Criteria Worldwide
Hay Point Coal Terminal Expansion
Aldoga Aluminium Smelter EIA
Mt Isa Sulphuric Acid Plant Assessment
Wiggins Island Coal Terminal EIS
Oakey Power Station NIA
Nickel/Cobalt Refinery, Calliope NIA
Kareeya Power Station Upgrade Works
SimsMetal Fragmentiser NIA

Training

DERM (EPA): Noise Office Training (2 days) 2005 & 2006 – Brisbane, Rockhampton and Cairns
DTMR: Noise Training (1 day) 2005 – Toowoomba, Rail Noise Training (1 day) 2011 - Brisbane
QR: Noise Measurement, Modelling and Assessment Training (1 day) 2012

Legal

New Acland Coal Mine Expansion
South Walker Creek Mine (Kemmis II) Expansion
Composting Facility, Oakey
Woolworths Supermarket, Maleny
Twin Waters West Residential Development
Tropical Pet Resort, Townsville