ERM

Level 15 309 Kent Street
Sydney NSW 2000
Locked Bag 3012
Australia Square NSW 1215

Telephone: +61 2 8584 8888
Fax: +61 2 9299 7502

www.erm.com

Technical Memorandum – Noise and Vibration Impact Assessment: Sancrox Quarry Expansion Project – Response to EPA Noise Impacts Comments

To	NSW Environment Protection Authority (EPA)
From	Environmental Resources Management Pty Ltd (ERM)
Date	06 October 2021
Reference	0418291 Sancrox - NVIA Memo F01.docx
Subject	Noise and Vibration Impact Assessment – Response to EPA Noise Impacts Comments

1. OVERVIEW

Environmental Resources Management Australia Pty Ltd (ERM) prepared an updated Noise and Vibration Impact Assessment (revised NVIA) which accompanied the Response to Submission Report (RtS Report) for the proposed Sancrox Quarry Expansion Project (the Project) (SSD 7293).

The NSW Environment Protection Authority (EPA) has reviewed the revised NVIA and has provided additional comments and recommendations to consider. (Ref.: EPA Advice on Response to Submissions Report, DOC21/426604-04; EF13/3037, dated 22 June 2021).

This memorandum contains ERM's response to comments 4, 5 and 6 of the EPA advice specifically related to noise impacts, as summarised below in **Table 1.1**.

Table 1.1 – EPA comments and summary of ERM Response

Comment No. (Refer to EPA Advice Letter)	Comment / Clarification Required	ERM Response
#4	**Background Noise** *The EPA previously noted that the measured background noise levels are close to the existing noise levels from the operating quarry. This is likely to affect the measured background noise levels at the measurement locations, which then changes the Project Specific Noise Level (PSNL).* *In response to that query, the proponent undertook operator attended measurements to determine if the quarry contributed to the long-term unattended monitoring that was adopted for this development. The RtS document reports that the noise from the quarry was occasionally audible with an estimated contribution of 35-39 dBA.* *The EPA notes that these levels, which are consistent with the predicted noise levels for the existing operation in Table 7.3 of the NVIA, represent a significant contribution to the background noise. Table 3.7 of the NVIA states that the existing Rating Background Levels (RBLs) are 37, 36 and 32 dBA for day, evening and night periods, respectively.* *There has not yet been enough evidence provided to show that the existing operation of the quarry did not affect the PSNLs for this development.*	Refer to Section 2

Comment No. (Refer to EPA Advice Letter)	Comment / Clarification Required	ERM Response
#5	**Noise Enhancing Meteorological Conditions and Noise Modelling** *The EPA's previous advice made reference to the meteorological conditions selected by the proponent for a worst-case noise assessment, and how that was represented by the selected noise model. The EPA does not believe that sufficient information has been provided to clarify how the adverse meteorological conditions have been modelled using ISO 9613-2, specifically the F class inversion scenario during the night time period.* *ISO 9613-2, clause 5, states the following with reference to the inversion conditions able to be modelled using the standard for adverse meteorological conditions:* *"These equations also hold, equivalently, for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights" (emphasis added).* *The EPA requires further information on how the worst-case F-class meteorological conditions stated within section 2.10 of the NVIA have been integrated into the ISO 9613 assessment, or how the ISO assessment is representative of the worst-case weather conditions on site.*	Refer to Section 3
#6	**Modifying Characteristics and Fact Sheet C of the Noise Policy for Industry (NPfI)** *Page 59 of the NVIA states that no modifying factors or penalties have been applied to the noise levels at the receiver. The EPA requires that calculations be provided to show the lack of modifying characteristics in the noise emission from the development. This is specifically relevant for Fact Sheet C of the NPfI, which deals with low frequency noise. Given that the development deals with extraction activities, in our experience this can give rise to significant low frequency impacts at nearby receivers. Due to the risk this presents, the EPA requires further evidence that there are no annoying characteristics from the development, especially with regards to low frequency noise.*	Refer to Section 4

2. EPA COMMENT #4

2.1 Discussion – Unattended Noise Logging Results

As discussed in Section 3.3.2 of the revised NVIA, the results of the noise logging at the four locations (L1 to L4) are considered representative of the surrounding noise environment. The results of the continuous unattended noise logging show levels typical of rural receptors in close proximity to the Pacific Highway during the daytime, evening and night-time. The dominant noise source contributing to the RBLs was observed to be the Pacific Highway traffic, wind-blown vegetation, some local traffic, birds and insects. The noise from the quarry operations was inaudible at the monitoring locations during installation, demobilisation and attended measurements. It should be noted that the operational hours of the quarry during noise logging and attended monitoring was 7am to 3pm, i.e. the site did not operate during the evening and night time periods.

The RBLs adopted for this assessment and observations onsite were also compared to the Sancrox RBLs from noise logging in the SLR (2016) *Pacific Highway Upgrade – Oxley Highway to Kundabung Operational Noise Management* report. In all cases, it is apparent that RBLs of the Sancrox area are heavily influenced by the Pacific Highway traffic noise. As the noise logging locations adopted for this assessment were further from the highway than locations in the SLR, 2016 report, the RBLs presented here are lower, however they are considered representative of the receptors identified for the assessment.

Based on the observations of the operator onsite and discussion provided in the revised NVIA, it is clear that the dominant noise source at the unattended noise logging location L1 to L4 is road traffic noise from the Pacific Highway. Noise from the quarry was inaudible and did not influence the measured levels at L1 to L4.

2.2 Discussion – Operator Attended Noise Measurement Results

As presented and discussed in Section 3.3.3 of the revised NVIA, EPA correctly pointed out that the operator estimated the noise from the quarry to be 35 dBA $L_{eq,15min}$ at measurement location A3 and 39 dBA $L_{eq,15\ min}$ at measurement location A4 at the time of measurements. It is important to note that locations A3 and A4 are different locations to the unattended noise logging locations L1 to L4, and were not used to establish the RBLs for the assessment. Location A3 and A4 were selected for observational purposes only.

The measurement at location A3 was conducted in the day-time period at 9.43am start time for 15 minutes. The results show measured noise levels of 64 dBA $L_{eq,15min}$ and 45 dBA $L_{90,15min}$. In the discussion, it is noted that the dominant noise source is road traffic noise from Pacific Highway, wind-blown vegetation, some local traffic, birds and insects. The operator determined from onsite observations and further analysis that for this particular measurement, the estimated noise contribution from the quarry was 35 dBA $L_{eq,15min}$. The noise contribution is observed to be 29 dB below the overall measured L_{eq} of 64 dBA, and 10 dB below the overall measured L_{90} of 45 dBA. From the measured noise levels, it is clear that noise from the quarry had an insignificant impact on the measured levels.

Similarly for the measurement at location A4 conducted in the day-time period at 10.02am start time for 15 minutes, the results show measured noise levels of 55 dBA $L_{eq,15min}$ and 47 dBA $L_{90,15min}$. The operator determined from onsite observations and further analysis that for this particular measurement, the estimated noise contribution from the quarry was 39 dBA $L_{eq,15min}$. The noise contribution is observed to be 16 dB below the overall measured L_{eq} of 55 dBA, and 8 dB below the overall measured L_{90} of 47 dBA. From the measured noise levels, it is again clear that noise from the quarry had an insignificant impact on the measured levels.

It is important to note that operator attended measurements for 15 minutes only provides a snapshot of the acoustic environment at the measurement locations. Attended measurements are used for observational purposes only and assist in quantifying or estimating instantaneous noise levels for observed noise sources, such as car or truck pass-bys, birds, insects, etc. These snapshots will vary significantly and do not represent the long-term or average acoustic environment at the site. As discussed in Section 3.3.3, the attended measurements vary significantly due to the influence of road traffic noise from Pacific Highway. The 15-minute attended measurements at locations A3 and A4 were not used to establish the RBLs for the assessment.

We also note that all other operator attended measurements, as presented in Section 3.3.3, concluded that the estimated noise contribution from the quarry could not be determined and was therefore considered inaudible. The estimated noise of 35 dBA $L_{eq,15min}$ at measurement location A3 and 39 dBA $L_{eq,15\ min}$ at measurement location A4 from the quarry operations were determined from analysis and comparison of attended measurements conducted by ERM in November 2017 and provided to inform the assessment.

Based on the above findings, it is clear that noise from the quarry was insignificant during all operator attended measurements and did not influence the overall measured levels, with the dominant noise source being road traffic noise from the Pacific Highway. The estimated noise contribution from the quarry does not impact the background noise levels in the area.

3. EPA COMMENT #5

3.1 Noise Enhancing Meteorological Conditions

The EPA has requested further information on how the worst-case F-class meteorological conditions stated within Section 2.10 of the revised NVIA, was modelled.

As described in Table 2.3 of the revised NVIA, the noise modelling software used for the assessment is the Brüel and Kjær's Predictor 7810 (Version 12) noise modelling software package. For modelling purposes, the software is setup to predict/calculate noise levels using ISO 9613:2, 1996 noise propagation algorithms (international method for general purpose, 1/1 octaves).

Meteorological corrections to the ISO 9613 algorithm are then calculated via the CONCAWE method (*Report no. 4/18, The propagation of noise from petroleum and petrochemical complexes to neighbouring communities*, Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981). The calculated corrections are applied to the ISO model to predict noise enhancing MET conditions, including the worst-case F class stability with 2 m/s wind speed.

In summary, the following MET conditions, representing different calculated modelling corrections, were included in the operational noise model for each period:

- **Daytime**: Calm wind conditions and a Pasquill–Gifford stability Category D, representing a neutral condition.
- **Evening**: 3 m/s wind condition for the westerly prevailing direction and Pasquill–Gifford stability Category D condition.
- **Night time (and morning shoulder)**: 2 m/s wind condition for the two prevailing directions and Pasquill–Gifford stability Category F, representing a temperature inversion.

For the construction noise model a Pasquill–Gifford stability Category D was adopted (representing a neutral condition) for all scenarios.

In summary, the noise modelling software calculates the meteorological corrections for the worst-case F-class conditions and applies them to the predicted noise levels using ISO 9613:2, thus outputting the impact from the worst-case F-class conditions.

4. EPA COMMENT #6

4.1 Modifying Factors

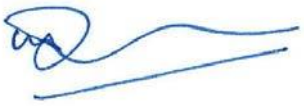
Modifying factors (penalties) for annoying noise characteristics such as tonality and low frequency components etc. were considered as per the requirements of Fact Sheet C of the NPfI. Based on the noise source data presented in this assessment and model outputs, penalties were not applied to the results in this assessment. The spectral data from attended measurements and predicted levels used to identify modifying factors are presented in Appendix A.

5. CLOSURE

ERM has reviewed, discussed and addressed comments 4, 5 and 6 of the EPA advice. As requested by the EPA, ERM has provided further clarification and information specifically related to noise impacts.

Please do not hesitate to contact ERM if you have any inquiries regarding the content of this report.

For Environmental Resources Management Australia Pty Ltd



Keshav Dhayam
Senior Acoustics Consultant

Murray Curtis
Partner

REFERENCES

CONCAWE – Report no. 4/18; The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

International Organisation for Standardisation (ISO) 9613-2:1996 (**ISO 9613:2**, 1996) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation

International Organisation for Standardisation (ISO) 17534 2015 – (**ISO 17534**, 2015) – Acoustics - Software for the Calculation of Sound Outdoors, as achieved by the modelling software referenced in this report

NSW Environment Protection Authority – **Noise Policy for Industry** (NPI, 2017), October 2017

APPENDIX A NOISE FREQUENCY SPECTRA (1/3 OCTAVE BAND)

Description – At Modelling Prediction Points	Frequency (Hz) - Linear Spectral Data																											Total Noise Level (dBZ)	Total Noise Level (dBA)
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000		
Calibration Point - North	57	52	47	58	54	51	49	46	44	41	39	37	44	43	42	44	43	43	41	41	41	31	31	32	18	19	21	63	52
Calibration Point - East	54	49	44	54	50	47	47	44	42	38	36	34	38	37	36	37	36	36	30	30	30	20	20	21	7	8	10	60	45
Calibration Point - South	57	52	47	57	53	50	50	47	45	49	47	45	51	50	49	49	48	48	47	47	47	42	42	43	34	35	37	64	58
Calibration Point - West	54	49	44	54	50	47	45	42	40	36	34	32	39	38	37	39	38	38	37	37	37	27	27	28	9	10	12	60	47
13 - Unoccupied Residential	48	43	38	45	41	38	36	33	31	29	27	25	27	26	25	20	19	19	11	11	11	2	2	3	-19	-18	-16	52	31
14 - Residential	44	39	34	43	39	36	34	31	29	27	25	23	30	29	28	27	26	26	18	18	18	1	1	2	-45	-44	-42	49	35
1 - Residential Receptor	41	36	31	41	37	34	31	28	26	24	22	20	27	26	25	23	22	22	15	15	15	-8	-8	-7	-74	-73	-71	46	32
16 – Residential Receptor	42	37	32	42	38	35	33	30	28	26	24	22	28	27	26	24	23	23	16	16	16	-4	-4	-3	-63	-62	-60	47	33
2 – Residential Receptor	41	36	31	41	37	34	31	28	26	24	22	20	27	26	25	23	22	22	14	14	14	-8	-8	-7	-78	-77	-75	46	31
17 - Residential Receptor	41	36	31	40	36	33	32	29	27	25	23	21	27	26	25	22	21	21	13	13	13	-7	-7	-6	-73	-72	-70	46	31
4 - Residential Receptor	42	37	32	42	38	35	33	30	28	26	24	22	28	27	26	23	22	22	15	15	15	-3	-3	-2	-61	-60	-58	47	32
18 - Residential Receptor	38	33	28	37	33	30	27	24	22	20	18	16	23	22	21	20	19	19	9	9	9	-21	-21	-20				43	28
19 - Residential Receptor	39	34	29	38	34	31	29	26	24	22	20	18	25	24	23	19	18	18	10	10	10	-11	-11	-10				44	29
24 - Residential Receptor	37	32	27	37	33	30	28	25	23	20	18	16	23	22	21	19	18	18	7	7	7	-23	-23	-22				42	27
20 - Residential Receptor	44	39	34	42	38	35	30	27	25	21	19	17	23	22	21	20	19	19	10	10	10	-13	-13	-12				48	28
6 - Residential Receptor	36	31	26	36	32	29	27	24	22	19	17	15	20	19	18	15	14	14	2	2	2	-38	-38	-37				41	24
30 - Residential Receptor	37	32	27	37	33	30	27	24	22	18	16	14	20	19	18	16	15	15	2	2	2	-38	-38	-37				42	25
11 - Residential Receptor	40	35	30	40	36	33	29	26	24	21	19	17	23	22	21	20	19	19	9	9	9	-17	-17	-16				45	28
33 - Residential Receptor	42	37	32	44	40	37	29	26	24	21	19	17	23	22	21	22	21	21	10	10	10	-19	-19	-18				48	29
38 - Residential Receptor	43	38	33	42	38	35	30	27	25	22	20	18	23	22	21	21	20	20	10	10	10	-22	-22	-21				48	29
7 - Cassegrain Winery – Commercial	47	42	37	47	43	40	40	37	35	30	28	26	32	31	30	31	30	30	23	23	23	10	10	11	-11	-10	-8	53	38

Description – At Modelling Prediction Points	Frequency (Hz) - Linear Spectral Data																											Total Noise Level (dBZ)	Total Noise Level (dBA)
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000		
47 - Potential Future Industrial Receptor	48	43	38	48	44	41	41	38	36	32	30	28	34	33	32	34	33	33	27	27	27	17	17	18	-1	0	2	54	41
34 - Residential Receptor	47	42	37	46	42	39	33	30	28	25	23	21	28	27	26	27	26	26	19	19	19	-3	-3	-2	-63	-62	-60	52	34
35 - Residential Receptor	47	42	37	48	44	41	33	30	28	26	24	22	27	26	25	27	26	26	18	18	18	-5	-5	-4	-71	-70	-68	53	34
8 - Industrial Receptor	48	43	38	48	44	41	36	33	31	27	25	23	31	30	29	32	31	31	24	24	24	9	9	10	-31	-30	-28	53	39
46 - Expressway Spares - Commercial	49	44	39	49	45	42	38	35	33	29	27	25	33	32	31	35	34	34	29	29	29	16	16	17	-10	-9	-7	54	42
9 - Industrial Receptor	50	45	40	50	46	43	41	38	36	30	28	26	34	33	32	36	35	35	31	31	31	22	22	23	6	7	9	56	43
10 - Industrial Receptor	46	41	36	46	42	39	38	35	33	29	27	25	33	32	31	32	31	31	25	25	25	13	13	14	-11	-10	-8	52	39

Description – Attended Measurement Locations	Frequency (Hz) - Linear Spectral Data																																	Total Noise Level (dBZ)	Total Noise Level (dBA)
	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000		
Onsite (West)	54	60	48	50	50	47	49	50	48	51	44	47	42	41	44	42	43	42	41	41	39	39	38	33	28	26	24	20	19	15	11	10	12	63	50
Onsite (South)	57	59	52	52	54	64	60	63	53	48	46	44	41	41	39	39	41	40	41	41	38	37	35	38	39	34	27	25	22	20	16	13	11	69	50
Onsite (East)	66	74	62	63	66	71	74	75	68	65	60	60	57	56	57	53	53	56	58	58	58	59	57	54	53	49	46	42	40	37	32	26	19	81	67
Onsite (North)	45	49	50	50	51	53	52	53	56	47	45	42	37	36	39	43	45	45	45	44	40	37	33	26	22	21	20	20	18	15	12	9	10	62	51
A7	41	44	45	51	43	42	50	42	45	43	42	42	36	34	33	34	35	33	32	33	31	32	32	31	27	24	21	19	16	12	10	8	10	56	43
A6	44	46	46	45	44	44	48	53	49	45	48	43	43	44	42	43	44	45	47	46	44	42	39	35	32	30	26	24	20	18	14	10	9	60	53
A1	43	46	44	44	44	44	46	49	48	44	44	43	41	39	38	38	39	40	41	39	35	32	29	26	24	22	20	18	16	13	11	9	9	57	47
A2	43	44	44	44	44	47	51	46	44	42	44	43	41	39	37	39	41	43	46	45	40	37	34	30	27	23	20	17	15	13	11	9	9	58	50
A5	45	48	49	50	59	69	56	55	64	56	58	54	49	51	49	50	51	52	51	50	49	49	48	46	46	40	36	32	28	24	19	14	11	72	60
A3	47	50	50	51	49	49	47	48	54	49	48	48	44	43	41	43	48	47	46	45	43	41	37	32	30	28	24	22	18	15	12	9	9	62	53
A4	49	52	54	51	49	50	49	47	50	44	41	43	40	43	44	45	43	45	44	41	36	31	24	23	21	16	13	12	13	10	9	8	9	61	50
A9 (E of A4)	49	52	52	49	48	48	48	47	49	45	43	41	41	44	45	45	45	47	46	44	41	36	33	29	26	22	21	18	15	13	10	8	9	60	52
A9	47	51	49	51	48	48	47	48	54	47	51	48	44	43	40	41	45	46	47	45	40	36	30	22	17	15	15	12	11	10	8	7	9	61	52
A4	54	52	51	51	50	53	53	52	56	47	42	42	41	40	38	39	43	44	45	45	41	37	34	31	29	30	27	26	22	18	14	9	10	63	51
A7	44	45	42	42	41	41	42	42	44	39	38	37	31	28	27	28	30	28	27	24	22	21	22	22	25	27	22	20	18	14	10	8	9	53	37
A6	43	44	42	40	38	37	40	39	41	37	35	34	29	30	31	32	30	28	27	24	21	21	22	22	23	22	21	19	18	13	10	8	10	51	36
A1	43	43	42	42	40	42	40	42	45	37	37	38	34	31	30	31	32	31	30	28	27	27	28	28	29	28	27	25	23	20	16	11	10	53	40
A2	42	43	40	40	40	41	48	42	42	40	40	38	35	36	35	37	37	39	41	40	38	36	33	30	26	24	22	20	18	14	11	8	11	54	47
A5	48	49	49	50	51	52	56	63	54	56	67	57	56	63	56	59	58	55	57	56	55	53	51	47	47	47	43	41	34	30	25	18	13	72	65
A3	67	69	63	61	64	62	62	62	58	56	55	53	49	46	47	49	50	53	55	55	53	52	52	48	46	43	40	34	26	22	19	16	13	75	62
A7	57	62	51	52	56	56	54	55	57	51	47	43	40	40	39	38	41	41	43	43	41	39	36	34	31	29	29	27	20	17	14	8	10	67	50

Description – Attended Measurement Locations	Frequency (Hz) - Linear Spectral Data																																Total Noise Level (dBZ)	Total Noise Level (dBA)
	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000		
A6	50	49	45	46	46	48	47	47	46	45	41	38	35	33	32	32	33	34	33	35	37	39	33	35	32	32	28	26	21	17	13	9	9	58	46
A1	52	50	48	50	50	49	52	54	51	53	50	46	45	44	44	44	45	48	51	50	48	45	43	40	37	34	33	32	29	26	22	17	14	63	56
A2	52	52	49	51	52	50	49	50	47	49	43	42	42	41	41	41	42	44	46	46	43	43	41	37	36	34	33	30	26	21	17	12	10	61	53
A5	50	52	46	46	46	49	53	51	46	47	45	46	46	44	45	43	44	46	50	50	48	46	43	40	38	33	29	27	23	19	15	11	10	62	56
A3	58	57	53	56	56	59	61	68	68	55	57	57	55	55	60	57	56	56	56	56	54	53	51	49	50	49	44	41	39	35	30	23	17	73	64
A4	57	59	53	52	51	51	54	54	54	51	48	49	46	45	44	44	44	45	48	49	46	44	41	37	37	35	31	29	26	23	19	14	12	65	55
A9 (SE of A8)	60	60	55	54	53	53	50	49	50	48	45	44	44	44	43	45	45	44	46	45	43	41	39	36	34	31	28	27	24	20	16	12	10	66	53

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
The Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM Sydney
Level 15, 309 Kent Street
Sydney NSW 2000 Australia

Telephone +61 2 8584 8888
Facsimile +61 2 9299 7502

www.erm.com

The business of sustainability

ERM