Fraser Earthmoving Construction Pty Ltd

ABN: 84 476 527 814

Part 5
Noise Modelling Assessment

for the

Howlong Sand and Gravel Expansion Project

State Significant Development 17_8804

Prepared by

Octave Acoustics Pty Ltd

November 2019

This page has intentionally been left blank

Octave Acoustics
ABN 60 615 372 873
Ph +61 3 9111 0185
Studio 1A, 3 Harris Street
Yarraville, Melbourne, Vic 3013

Memo

7 November 2019

Client: RW Corkery & Co Pty Ltd

Attention: Nick Warren

email: nick@rwcorkery.com

4343 Riverina Highway, Howlong

Noise Modelling

1 Introduction

Octave Acoustics was engaged by RW Corkery & Co Pty Ltd to undertake 3D computer modelling of noise impacts associated with the proposed ongoing and expanding operation of the alluvial sand and gravel quarry at 4343 Riverina Highway, Howlong. The information used to undertake this modelling was taken from *Howlong Sand and Gravel Quarry Proposed Increase Extraction Rate: Assessment of compliance with the New South Wales Noise Policy for Industry and the NSW Road Noise Policy* (Mar 2018) prepared by Audiometric and Acoustic Services (Acoustic Report), *Howlong Sand and Gravel Quarry Road Transport Assessment* (Oct 2019) prepared by The Transport Planning Partnership (Traffic Report), and *Environmental Impact Statement* (EIS) (Nov 2019) prepared by Rw Corkery and Co.

It is understood that extraction and processing at the quarry are expected to occur between 7:00AM and 5:00PM, only during the day period. Product loading and despatch is expected to occur from 7:00AM to 10:00PM, only during the day and evening periods. In addition, it is understood that up to three trucks may arrive on site from 6:30AM to 7:00AM, however no loading will occur before 7:00AM.

2 Noise Modelling

2.1 Road Noise Modelling

A 3-D Computer model of the Riverina Highway and the town of Howlong was built in CadnaA proprietary noise calculation software, implementing the United Kingdom Department of Transport Welsh Office Calculation of Road Traffic Noise, 1988 algorithms (CoRTN88). CoRTN88 calculates road traffic noise in terms of the $LA_{10,18hr}$ metric. This assessment assumes an L_{A10} to L_{Aeq} difference of minus 3dB(A), consistent with the *Noise Model Validation Guideline* by NSW Roads & Maritime Services. Four independent road sections were modelled;

- Riverina Hwy from Subject Site entry to Holbeach St
- Riverina Hwy/Hawkins St from Holbeach St to Sturt St

- Sturt St from Hawkins St to Black Swan Anabranch
- Sturt St from Hawkins St to Wilson St

These road sections can be seen in the plan view of the model in Figure 1 and Figure 2 below.

FIGURE 1 – VIEW OF ROADS SECTIONS MODELLED IN HOWLONG

FIGURE 2 – VIEW OF ROAD SECTIONS MODELLED ALONG RIVERINA HWY

2.1.1 Model Inputs

Inputs applied to the noise model were as presented in Table 1 below.

TABLE 1 - NOISE MODEL INPUTS

No.	Variable	Input
1.	Traffic volumes & percent heavy vehicles	Data sourced from the supplied Traffic Report.
2.	Traffic speeds	Data sourced from supplied Traffic Report, and local speed limits in the area +4km/hr.
3.	Road pavement type	As reported on-site.
4.	Road pavement corrections	As per NSW Noise Model Validation Guideline, May 2018: - 14mm chip seal +4.0 - 14/7mm chip seal +4.0 - 7mm chip seal +2.0 - Portland Cement Concrete (PCC) +3.0 - Next-gen diamond ground concrete +0.0 - Cold overlay +2.0 - Stone Mastic Asphalt 7 -1.0 - Open Graded Asphaltic concrete -2.5 to -4.5 - Worn open Graded Asphalt +0.0 to +2.5 - Dense Graded Asphalt (AC10, AC14) +0.0 - Stone Mastic Asphalt 10 +0.0 - Stone Mastic Asphalt 14 +1.0
5.	Topographical contours	Data sourced from DFSI SIX Maps of NSW.
6.	Ground absorption	0.50 over residential areas, 0.75 over open grass areas, 0.00 over water.
7.	Correction for façade reflections	+2.5dB(A) façade reflection at 1m from façade conditions.
8.	Aerial Imagery	Data sourced from Google Aerial Imagery.
9.	Building geometry	Data sourced from Google Aerial Imagery.
10.	Receiver height	1.5m and 4.5m above ground level for single and double story premises respectively.
11.	Source heights	0.5m for car exhausts / engines and car / truck tyre noise, 1.5m for truck engines, 3.6m for truck exhausts.
12.	Source location	Centre of each traffic lane.

2.1.2 Validation and Verification

With the noise model built and data entered, the results were compared to the noise levels measured in the supplied Acoustic Report. After undertaking this process, a road surface correction of -2dB(A) (consistent with Open Graded Asphalt) was applied along the section of Riverina Highway between the subject site and Sturt Street, to better correspond with the noise levels from the data collected (refer to Table 2 and Table 3)

TABLE 2 - COMPARISON OF DATA BETWEEN MEASURED AND MODELLED – DAY/EVENING

Address	Measured L_{Aeq} 15hr dB(A) Day/Evening	Modeled L_{Aeq} 15hr dB(A) Day/Evening	Difference dB(A)
113 Hawkins Street	54	54.1	+0.1

TABLE 3 - COMPARISON OF DATA BETWEEN MEASURED AND MODELLED – NIGHT

Address	Measured L_{Aeq} 9hr dB(A) Night	Modeled L_{Aeq} 9hr dB(A) Night	Difference
4364 Riverina Hwy Fence	60	57.5	-2.5
89 Sturt Street	55	53.4	-1.6

There is a notable discrepancy in the data between which was measured and that which was modelled over the Night period. The model appears to be underpredicting the L_{Aeq} sound level in the Night period, by a mean of approximately 2dB. As the traffic counts over the Night period are relatively low along this road (40 per hour), it is likely that the L_{A10} adjacent to the road will be lower than the L_{Aeq} + 3dB, providing less confidence in the standard L_{A10} to L_{Aeq} correction of 3dB.

Logging data supplied in the Acoustic Report supports this observation. The average measured L_{A10} during the Night at 113 Hawkins Street is 6 dB(A) lower than the average L_{A10} during the Day/Evening. At the same location, the model predicts the difference between the Day/Evening and Night periods as 6.3 dB(A). Yet, measured L_{A10} levels for the Night period are equal to, or less than the L_{Aeq} levels recorded at each location. During this night period, the assumption of reasonable traffic flow required for the standard L_{A10} to L_{Aeq} conversion is not met. As such, Octave Acoustics has deemed calibration necessary to reflect reality, and has included a correction factor of +2dB(A) to the modelled results for the Night period. This brings all modelling outputs to within ±0.5 dB(A) of that measured by Audiometric and Acoustic Services.

The Australian Road Research Board research report ARRB No. 122 *An Evaluation of the UK DoE Traffic Noise Prediction Method* (Saunders, Samuels, Leach, & Hall, 1983) sets out an evaluation of CoRTN88 conducted by the NAASRA Planning Committee Working Group on traffic noise prediction. The evaluation was based on systematically screened daily traffic noise data carefully collected at some 113 sites, of varying configuration and complexity, within three states in Australia. It was found that the CoRTN method tended to overpredict noise levels in the three states. The magnitude of this overprediction depended on whether or not a facade was present. For free field locations in Queensland, Victoria and Western Australia, the mean over-prediction was 0.7 dB(A) with an accompanying standard deviation of 1.8 dB(A). For locations at a facade in Victoria only, the corresponding mean and standard deviations were plus 1.7 dB(A) and 2.5 dB(A). This demonstrates that the noise model is robust and had generated valid results.

2.1.3 Results

Modelling of traffic noise during both the current day and after the proposed development yielded the results in Table 4 and Table 5.

2.1.3.1 Current Day

TABLE 4 - MODELLED RESIDENTIAL ROAD NOISE LEVELS - CURRENT DAY

Road Sections	Maximum[1] residential L_{Aeq} 15hr dB(A) Day/Evening	Maximum[1] residential L_{Aeq} 9hr dB(A) Night	Location of Residential Receiver with maximum[1] dB(A)	Complies with NSW Road Noise Policy?
Riverina Hwy from Subject Site entry to Holbeach St	60	55	4580 Riverina Hwy	✓
Riverina Hwy/Hawkins St from Holbeach St to Sturt St	58	53	85-87 Hawkins Street	✓
Sturt St from Hawkins St to Black Swan Anabranch	58	54	89 Sturt Street	✓
Sturt St from Hawkins St to Wilson St	58	54	131 Sturt Street	✓
Notes	*1. 'Maximum' refers to the highest dB L_{Aeq} at a dwelling along the road section of interest, the potentially most affected sensitive receiver.*			

2.1.3.2 After Development

TABLE 5 - MODELLED RESIDENTIAL ROAD NOISE LEVELS – AFTER PROPOSED DEVELOPMENT

Road Sections	Maximum[1] residential L_{Aeq} 15hr dB(A) Day/Evening	Maximum[1] residential L_{Aeq} 9hr dB(A) Night	Location of Residential Receiver with maximum[1] dB(A)	Complies with NSW Road Noise Policy?
Riverina Hwy from Subject Site entry to Holbeach St	60	55	4580 Riverina Hwy	✓
Riverina Hwy/Hawkins St from Holbeach St to Sturt St	58	54	85-87 Hawkins Street	✓
Sturt St from Hawkins St to Black Swan Anabranch	59	54	89 Sturt Street	✓
Sturt St from Hawkins St to Wilson St	59	54	131 Sturt Street	✓
Notes	*1. 'Maximum' refers to the highest dB L_{Aeq} at a dwelling along the road section of interest, the potentially most affected sensitive receiver.*			

Overall, the slight increase in traffic volume due to the proposed increased extraction rate at the quarry is expected to result in a negligible increase to road noise. On Sturt Street, between Wilson Street and Black Swan Anabranch, a 1dB(A) increase was predicted during the Day/Evening period. On Riverina Highway/Hawkins Street, between Holbeach Street and Sturt Street, a 1dB(A) increase was

predicted during the Night period. In subjective terms, a 1dB(A) increase in sound level is an imperceptible change.

2.1.3.3 Sleep Disturbance

Triggers for Sleep Disturbance are defined by the NSW Environmental Criteria for Road Traffic Noise 1999 (ECTRN). The ECTRN concludes that:

- *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep; &*
- *One or two noise events per night, with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly*

These triggers are usually only applied between the hours 10pm to 7am. Where residential windows may be open for ventilation, it is generally accepted that the noise reduction via the open window is 10dB(A). Therefore, external noise levels need to exceed sleep disturbance triggers by more than 10dB(A) to warrant further assessment. These outdoor trigger levels can be seen in Table 6 below.

TABLE 6 – SLEEP DISTURBANCE NOISE TRIGGERS

Bedroom Trigger Level, dB L_{Amax}	Correction for Outdoor Level	Associated Outdoor Trigger Level, dB L_{Amax}
50-55	+10 dB	60-65

It is expected that most of the quarry's truck movements will be outside of the Night period, but there may be a small number of truck movements during the Night period. This small increase in heavy vehicle movements along Riverina Highway, Hawkins Street and Sturt Street is expected to result in a negligible change to the number of events that could cause disturbance to sleep, and hence a negligible change to the health and wellbeing of roadside residents.

2.2 Industrial Noise Modelling

A 3-D Computer model of the Subject Site and its surrounds was built in CadnaA, implementing the ISO9613-2 algorithms. The ISO9613-2 algorithms calculate the propagation of noise considering:

- Geometrical spreading
- Wind
- Air absorption
- Ground absorption (set to 0.5 over residential areas, 0.75 over open grass areas, and 0 over water)
- Reflections (set to a 2dB loss)
- Noise barrier effects associated with topography and structures
- Source sound power

Topography of the site and its surrounds were sourced from a July 2017 site survey by CAF Consulting, and DFSI SIX Maps of NSW. The site plan, locations of equipment, and equipment models were

informed by Audiometric and Acoustic Services. Aerial imagery was sourced from Google. Noise sources incorporated into the model included:

a) Wash Plant
b) Vibratory Screener
c) Front-end loader activity
d) Generators
e) Vehicle drive-bys along the access road (peak rates from provided Traffic Report)
f) Dump truck activity
g) Excavator activity
h) Water tanker activity

It is understood that the operation may require periodic use of a mobile crusher. As this activity would occur for short periods on three or four occasions in a given year, its contribution to noise in the local setting would be limited and therefore was not included in the modelling. Source sound power levels integrated into the model were as presented in Table 7 below. All equipment on site was modelled as running contemporaneously, in various locations on the site, over the differing stages of the quarry's lifetime.

TABLE 7 - SOURCE SOUND POWER LEVELS, SWL DB RE10^{-12}W

Item	Source	OA	Octave Band Centre Frequency (Hz)							
		dB(A)	63	125	250	500	1k	2k	4k	8k
Wash plant	*Noise assessment of stone/aggregate mines: six case studies* (Aug 2007)	93	95	92	86	87	90	86	82	75
17t Screen	DEFRA (July 2006)	109	112	110	107	107	102	102	99	92
209kW Loader	DEFRA (2005)	107	115	110	105	106	101	98	92	85
232kW 39t Loader	DEFRA (July 2006)	108	112	116	109	102	102	99	94	93
Diesel Generator	DEFRA (2005)	92	97	99	96	89	85	79	74	72
350kW 36t Truck	DEFRA (July 2006)	109	120	110	105	104	105	100	96	91
128kW 23t Excavator	DEFRA (2005)	104	102	111	105	101	97	95	93	88
66 kw 14t Excavator	DEFRA (2005)	97	105	96	95	95	91	89	85	75
Water Tanker	DEFRA (2005)	107	109	110	95	100	99	102	101	94
309kW 37t Dump Truck	DEFRA (July 2006)	111	115	113	111	109	106	102	99	94

2.2.1 Results

It is understood that the quarry will extract material from four planned areas, during differing stages. As such, the quarry was modelled with excavation occurring at;

- Stage 1;
- Stage 2;
- Stage 3; &
- Stage 4.

These stages have been modelled with a 2.7m high levee surrounding each of the pits, to the extent shown in Figure 2.4 of the supplied EIS (levee elevation of 142.7m AHD with assumed ground level of 140m AHD). This levee, though primarily for flood protection, also provides approximately 4dB(A) of attenuation from noise generated by material extraction and processing.

The site topography used to create the 3D noise model, details a pit depth of 2.5m at both Stage 1 and 2. It is understood that once water is removed from these pits, they are likely to be substantially deeper (>10m). A deeper pit is expected to provide a greater level of noise attenuation, and hence this assessment is considered to be conservative.

Noise from the quarry has been assessed at three differing locations;

- The nearest residential receiver, a dwelling located at the same address as the quarry at 4343 Riverina Highway, approximately 500m to the north of the quarry;
- Camp Nelson Scout Camp, approximately 1.1km to the northeast of the quarry; &
- Heritage Seeds, approximately 1.4km to the northwest of the quarry.

The trigger levels used in this assessment have been derived from the supplied Acoustic Report, where noise monitoring was undertaken at 4343 Riverina Highway. These trigger levels are expected to be appropriate for Heritage Seeds, as it is a similar distance from the Riverina Highway. However, the Camp Nelson Scout Camp is considerably closer to the Riverina Highway than where noise monitoring has occurred. As such, it is expected that trigger levels for this location would be higher than that derived in the acoustic report, and hence have been referred to in this report with a greater-than sign.

2.2.1.1 Stage 1

The quarry was modelled with excavation occurring only at Stage 1, with all plant operating contemporaneously and trucks utilising the access road. The propagation modelling resulted in the noise levels in Table 8 at the three most affected sensitive receivers.

TABLE 8 – NOISE LEVELS FROM QUARRY AT RECEIVER LOCATIONS DURING STAGE 1

Receiver Location	Maximum modelled day/evening noise level, (dB L_{Aeq})	Day/Evening Trigger Level	Complies with Day/Evening Criteria?
4343 Riverina Highway	38	38	✓
Camp Nelson Scout Camp	36	> 38	✓
Heritage Seeds	33	38	✓

2.2.1.2 Stage 2

The quarry was modelled with excavation occurring only at Stage 2, with all plant operating contemporaneously and trucks utilising the access road. The propagation modelling resulted in the noise levels in Table 9 at the three most affected sensitive receivers.

TABLE 9 – NOISE LEVELS FROM QUARRY AT RECEIVER LOCATIONS DURING STAGE 2

Receiver Location	Maximum modelled day/evening noise level, (dB L_{Aeq})	Day/Evening Trigger Level	Complies with Day/Evening Criteria?
4343 Riverina Highway	38	38	✓
Camp Nelson Scout Camp	36	> 38	✓
Heritage Seeds	33	38	✓

2.2.1.3 Stage 3

The quarry was modelled with excavation occurring only at Stage 3, with all plant operating contemporaneously and trucks utilising the access road. The propagation modelling resulted in the noise levels in Table 10 at the three most affected sensitive receivers.

TABLE 10 – NOISE LEVELS FROM QUARRY AT RECEIVER LOCATIONS DURING STAGE 3

Receiver Location	Maximum modelled day/evening noise level, (dB L_{Aeq})	Day/Evening Trigger Level	Complies with Day/Evening Criteria?
4343 Riverina Highway	38	38	✓
Camp Nelson Scout Camp	36	> 38	✓
Heritage Seeds	33	38	✓

2.2.1.4 Stage 4

The quarry was modelled with excavation occurring only at Stage 4, with all plant operating contemporaneously and trucks utilising the access road. The propagation modelling resulted in the noise levels in Table 11 at the three most affected sensitive receivers.

TABLE 11 – NOISE LEVELS FROM QUARRY AT RECEIVER LOCATIONS DURING STAGE 4

Receiver Location	Maximum modelled day/evening noise level, (dB L_{Aeq})	Day/Evening Trigger Level	Complies with Day/Evening Criteria?
4343 Riverina Highway	38	38	✓
Camp Nelson Scout Camp	36	> 38	✓
Heritage Seeds	33	38	✓

2.2.1.5 Trucks utilising the access road to/from site during the evening/night period

It is understood that though the quarry will only operate during the Day period (from 7:00AM to 5:00PM), transport vehicles may access the site from Monday through to Saturday, between 6:30AM and 10:00PM. Vehicles entering and exiting the site outside of the Day period were modelled using the peak rates of traffic from the supplied Traffic Report, with all other items of plant in the quarry inactive. Propagation modelling resulted in the noise levels in Table 12 and Table 13 at the three most affected sensitive receivers.

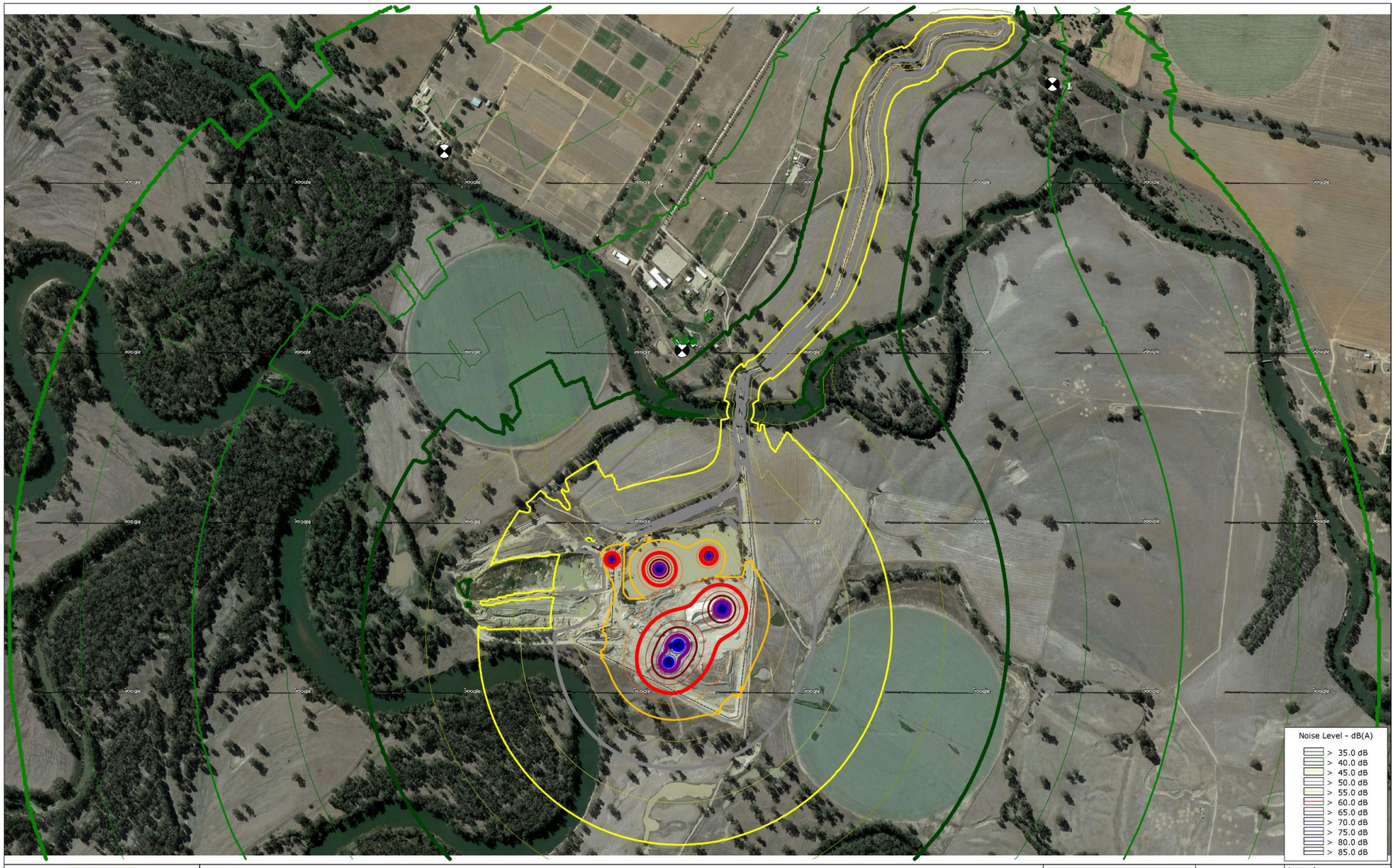
TABLE 12 – EVENING NOISE LEVELS AT RECEIVER LOCATIONS FROM VEHICLE PASS-BYS ON ACCESS ROAD (ALL STAGES)

Receiver Location	Maximum modelled evening noise level, (dB L_{Aeq})	Evening Trigger Level	Complies with Evening Criteria?
4343 Riverina Highway	37	38	✓
Camp Nelson Scout Camp	34	> 38	✓
Heritage Seeds	24	38	✓

TABLE 13 – NIGHT NOISE LEVELS AT RECEIVER LOCATIONS FROM VEHICLE PASS-BYS ON ACCESS ROAD (ALL STAGES)

Receiver Location	Maximum modelled night noise level, (dB L_{Aeq})	Night Trigger Level	Complies with Night Criteria?
4343 Riverina Highway	34	35	✓
Camp Nelson Scout Camp	31	> 35	✓
Heritage Seeds	21	35	✓

2.2.2 Noise contour map of quarry during Stage 2



3 Conclusion

Octave Acoustics has undertaken 3D computer modelling of noise impacts associated with the proposed increased extraction rate of material from the quarry at 4343 Riverina Highway. The additional traffic volume created by the proposed increased extraction rate is predicted to result in a negligible increase to road traffic noise, up to a maximum of 1dB(A). All items of plant operating on site and trucks utilising the access road as a result of the proposed increased extraction rate are generally expected to result in noise levels at or below the project noise trigger levels for the day and evening period. Vehicles arriving and leaving the site via the access road during the night period are expected to result in noise levels below the project noise trigger levels.

Revision	Date	Comment	Author	Reviewer
0	20.06.2019	Draft issued to client	TE	-
1	02.08.2019	Issued to Client	TE	RB
2	05.08.2019	Amended with operating hour changes	TE	-
3	31.10.2019	Amended with updated traffic data	TE	RB
4	07.11.2019	Amended with updated traffic data	TE	-