LAKE VERMONT MEADOWBROOK PROJECT

DRAFT Noise and Vibration Impact Assessment

BOWEN BASIN COAL PTY LTD

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Report
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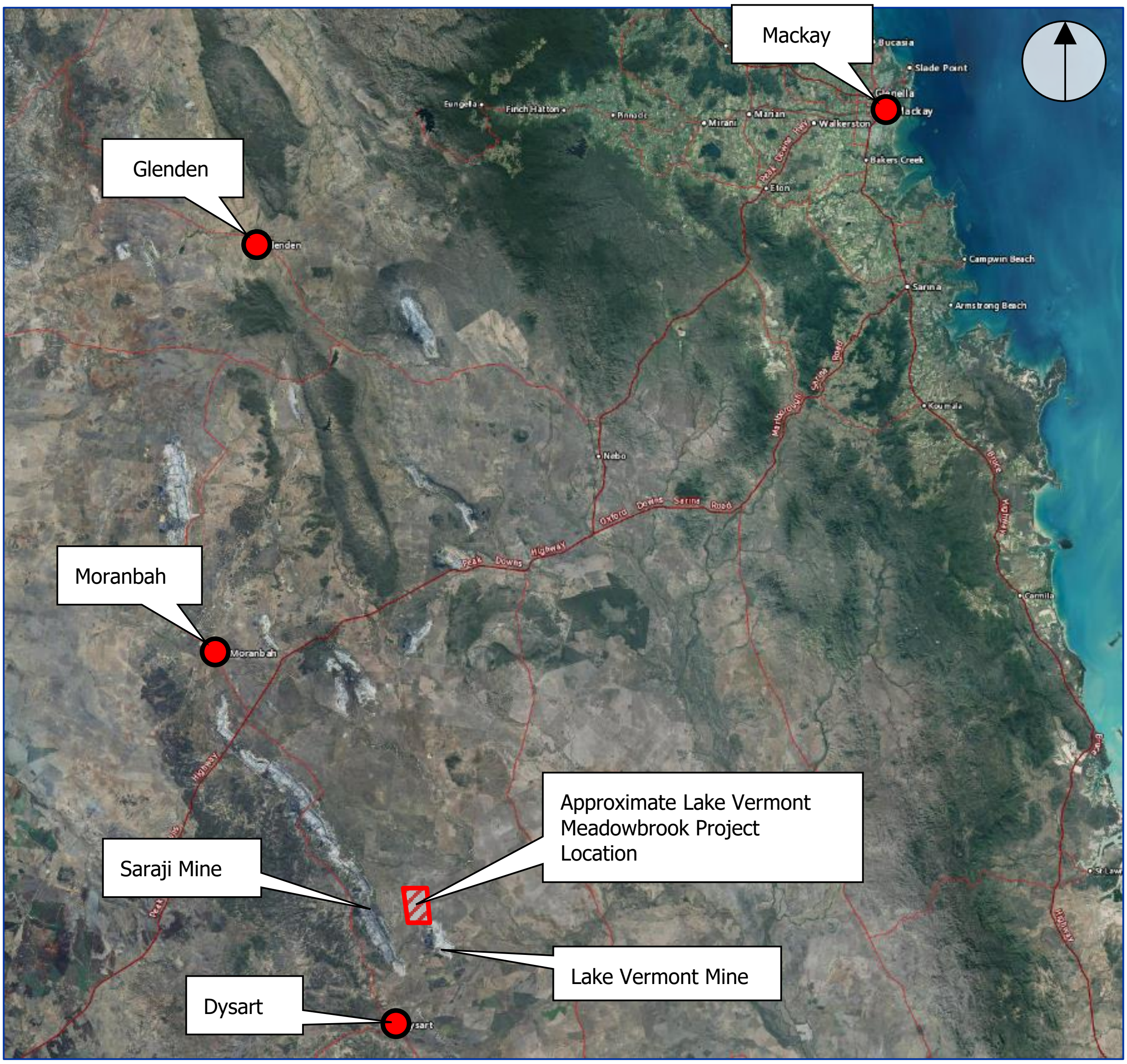
APPENDICES

1. INTRODUCTION

Trinity Consultants Australia (Trinity) was commissioned by Bowen Basin Coal Pty Ltd to undertake a noise and vibration assessment for the proposed Lake Vermont Meadowbrook Project. The proposed Project location is approximately 25 kilometres (km) north of Dysart and 160 km southwest of Mackay as shown in **Figure 1.1**.

Figure 1.1: Lake Vermont Meadowbrook Project Site Location (Image from QLD Globe)



This report presents an assessment of the noise and vibration impacts associated with the proposed Project. This report is based on the following tasks:

- Review the project and the associated potential noise emissions.
- Review existing noise monitoring data applicable to the Project site.
- Model the noise emissions based on proposed activities using SoundPLAN to calculate noise levels at sensitive receivers and develop contours over the modelling area.

- Analyse the results of noise modelling and compare modelling results with the relevant noise criteria selected to protect the acoustic environment.
- Assess blast information for vibration and airblast.
- Provide recommendations on control measures, where required.

To aid in the understanding of the terms used in this report, a glossary is included in **Appendix A**.

2. PROJECT DESCRIPTION

2.1 Overview

The Proponent for the Project is Bowen Basin Coal Pty Ltd. Bowen Basin Coal is a private company owned by the Lake Vermont Joint Venture, an unincorporated Australian joint venture operating in Queensland. Bowen Basin Coal proposes to extend the existing Lake Vermont Mine by developing the Lake Vermont Meadowbrook Project (the Project).

The Project addresses the forecast reduction in coal production that will occur at the Lake Vermont Mine, by combining output from the existing open cut operations and the Project extension. This will enable total coal production to be maintained at the currently approved output for an additional period of up to 30 years. The Project area adjoins to the immediate north of the existing Lake Vermont Mine.

The Project was determined to be a controlled action (per EPBC Referral 2019/8485) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) on 22 November 2019. The EIS for the proposed Project will be assessed under the EP Act, in accordance with the assessment bilateral agreement between the Australian Government and the State of Queensland.

The existing Lake Vermont Mine operates on Mining Lease (ML) 70331, ML 70477 and ML 70528 under Environmental Authority (EA) No. EPML00659513. The proposed Project lies on Mineral Development Licence (MDL) 303 and MDL 429 as shown in **Figure 2.1**.

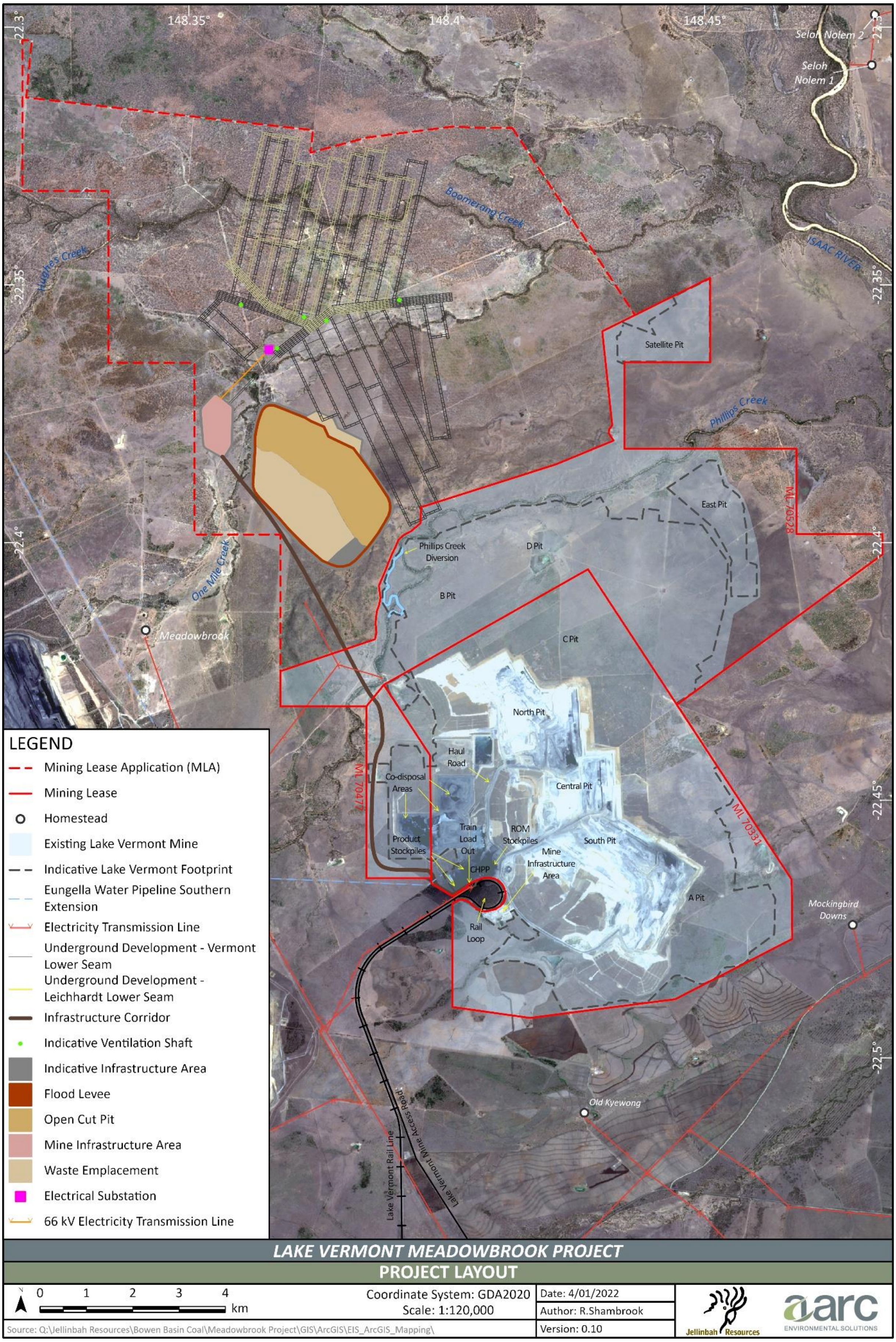
2.2 Mining Activities

The Lake Vermont Meadowbrook Project represents an extension of mining activities at the existing Lake Vermont Mine. The key components of the proposed project include:

- Underground longwall mining of the Leichardt Lower Seam and Vermont Lower Seam; noting that the depth and thickness of the coal seams in the Project area means the coal resource can be extracted using underground mining methods.
- An open cut pit to mine the Vermont Seam, the Vermont Lower Seam and the Leichardt Seam.
- Development of a new infrastructure corridor linking the new mining area to existing infrastructure at the Lake Vermont Mine.
- Development of a Mine Infrastructure Area (MIA).
- Construction of a drift and shafts to provide access and ventilation to underground operations.
- Development of other supporting infrastructure and associated activities.

The proposed Project involves the extraction of up to 6.5 Million tonnes per annum (Mtpa) of ROM coal, equivalent to approximately 5.5 Mtpa of metallurgical product coal (for the export and domestic market). The Project would therefore enable the existing coal output from the Lake Vermont Mine to be maintained at approximately 9 Mtpa, with an anticipated increase to the mine life of approximately 30 years.

Figure 2.1: Project Layout



2.3 Plant and Production Quantities

An indicative annual mining schedule is provided in **Table 2.1**.

Table 2.1: Indicative Mining Schedule (Modelled Years are Highlighted Blue)

Year	Meadowbrook Underground		Meadowbrook Open Cut	
	Total ROM Coal (tpa)	Total Product (tpa)	Total ROM Coal (tpa)	Total Product (tpa)
1	120,599	104,829		
2	407,558	373,109		
3	3,854,215	3,403,760		
4	6,389,931	5,733,715		
5	6,707,875	6,056,206		
6	6,928,790	6,234,064		
7	6,340,317	5,688,199		
8	5,337,080	4,725,249		
9	5,356,817	4,468,218		
10	4,868,204	4,059,046		
11	5,446,513	4,498,854		
12	3,931,421	3,282,333		
13	4,861,426	4,108,503		
14	5,377,038	4,539,002		
15	5,931,230	5,049,339		
16	4,490,033	3,928,561		
17	4,739,102	4,181,096		
18	5,065,826	4,458,430		
19	4,577,298	4,006,933		
20	4,733,743	4,085,390	258,707	200,436
21	5,725,404	4,820,442	1,066,768	844,570
22	4,410,978	3,594,433	1,321,576	1,072,284
23	2,965,948	2,322,704	1,276,587	1,063,526
24			1,401,996	1,136,094
25			1,488,154	1,157,223
26			1,442,902	1,034,341
27			1,316,800	956,998
28			1,451,066	1,148,838
29			1,924,539	1,577,244
30			395,669	324,386

Note: Indicative 'Year 1' is currently anticipated as calendar year 2026.

The following indicative mining equipment fleet that will be active on the surface is proposed for the Project:

- Meadowbrook Underground mining (MDB UG)
    - 1 x CATD11 Dozer

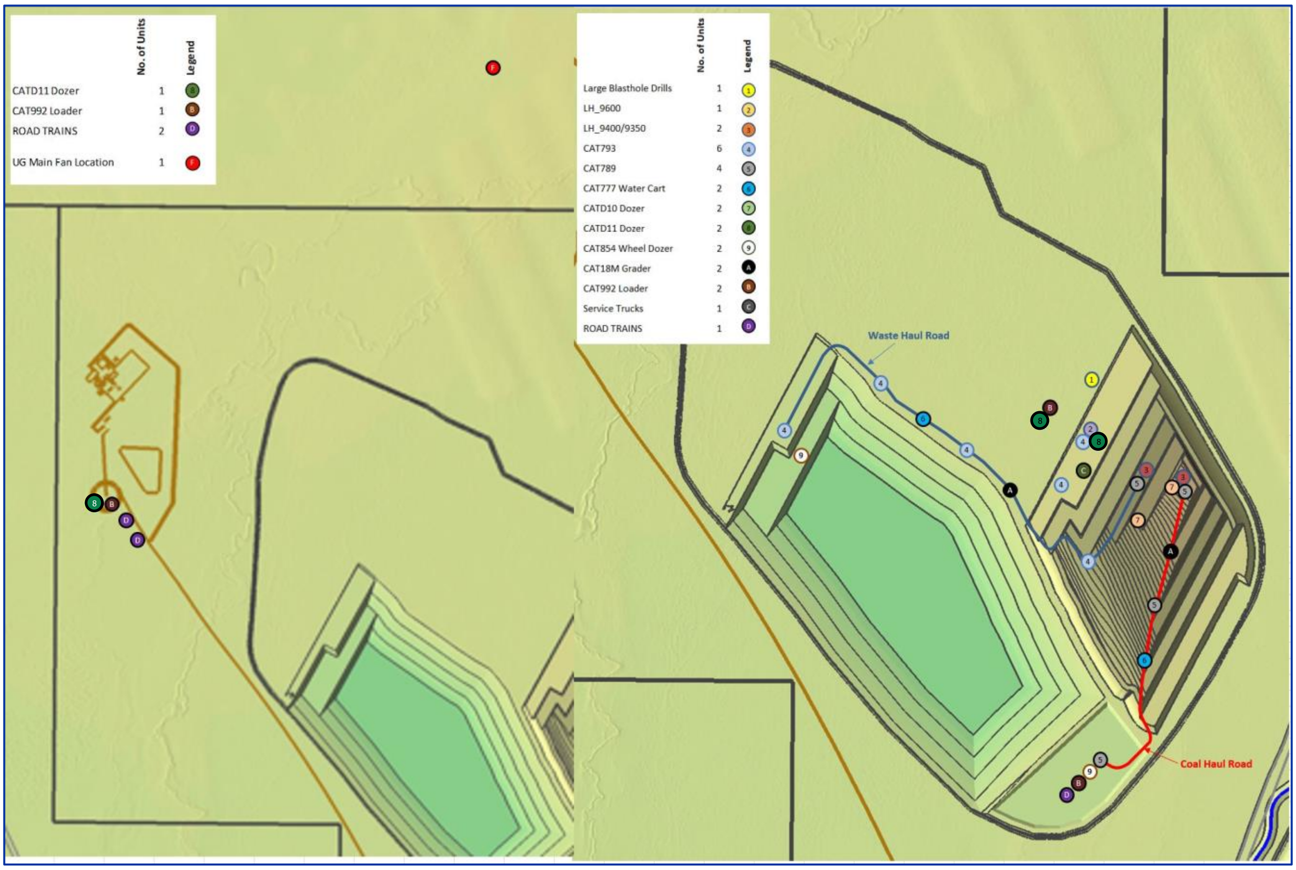
    - 2 x CAT992 Loader
    - 1 x Service truck
    - 3 x Road trains
    - 2 X Ventilation Fans
- Meadowbrook Open Cut mining (MDB OC)
    - 1 x Large Blasthole Drills
    - 1 x LH 9600 Excavator
    - 2 x LH 9400/9350 Excavator
    - 6 x CAT793 Trucks
    - 4 x CAT789 Trucks
    - 2 x CAT777 Water cart
    - 2 x CAT D10 Dozers
    - 2 x CAT D11 Dozers
    - 2 x CAT854 Wheel dozers
    - 2 x CAT 18M Grader
    - 2 x CAT992 Loader
    - 1 x Service truck
    - 1 x Road trains
    - 5 x Large dewatering pumps

It is noted that other vehicles and equipment are also proposed for underground operations. However, they are not assessed in this study due to marginal impacts on surrounding receivers. Further it is noted that no new CHPP is proposed with the expansion (Project) as it is proposed to use existing CHPPs in the Lake Vermont Mine. In order to consider potential CHPP noise impacts with new expansion, an existing CHPP operation in the Lake Vermont Mine is included in the model.

The location of mining equipment for Year 7 and 22 are included in **Figures 2.3** and **2.4**.

Figure 2.2: Year 7 Mining Equipment Locations

Figure 2.3: Year 22 Mining Equipment Locations



2.4 Upset Conditions

Potential upset conditions and their effect on noise emissions are discussed as follows:

- If a piece of equipment malfunctions, this could result in an increased noise level for that item of equipment, although the overall effect on noise emissions from the whole site would likely be minor. When equipment malfunctions, it will be quickly taken out of operation, and adverse noise impacts are not expected to occur. In addition, all equipment will be maintained routinely, and malfunctions that increase noise levels are expected to be rare.
- Severe weather conditions could cause mining activity to reduce or stop. This would result in lower noise emission levels. Strong winds blowing from the Project towards sensitive receivers could increase the mining noise levels but would also likely increase the background noise levels significantly such that mining noise would be masked.

Overall it is not expected that upset conditions pose a risk of additional noise impact, and further assessment of such cases is not considered to be warranted.

2.5 Decommissioning

Closure of the project will include decommissioning and rehabilitation of the facilities onsite. Rehabilitation measures to be conducted progressively and noise and vibration impacts from closure will predominantly occur concurrent with operational impacts. The emissions are likely minimal in comparison to mining operations and will be short-lived.

3. STUDY AREA DESCRIPTION

3.1 Overview

The Project area is located within the Bowen Basin of Central Queensland, within a local landscape dominated by flat to gently undulating grazing land. The site is located in a rural area, adjoining other mining operations (both existing and proposed). The nearest sensitive receivers are summarised in **Table 3.1**.

Table 3.1: Sensitive Receivers

Sensitive Receiver ID	Receiver Type	Name	Easting (m)	Northing (m)	Distance from MIA centroid (km) and direction
R1	Residential	Pownalls	653025	7512686	18.1 NW
R2	Residential	Seloh Nolem 1	652696	7532404	15.2 SW
R3	Residential	Old Kyewong	646743	7509949	16.5 NW
R4	Residential	Mockingbird Downs	652135	7513934	16.6 W
R5	Residential	Meadowbrook Homestead (*owned by BMA – unoccupied)	638086	7520400	4.6 N&E
R6	Residential	Lake Vermont Homestead (*owned by BMA)	640116	7516958	7.9 N&E
R7	Residential	Willunga	666958	7529954	27.9 W
R8	Residential	Leichardt	656328	7515670	19.1 W
R9	Residential	Seloh Nolem 2	652770	7533482	15.8 SW
R10	Residential	Old Bombandy	657506	7516682	29.1 W
R11	Residential	Vermont Park	647231	7537824	15.1 S
R12	Residential	Saraji Homestead 1	629574	7519126	11.5 E
R13	Residential	Saraji Homestead 3	630689	7522987	9.0 E
R14	Commercial	BMA Saraji	631499	7520239	9.3 E
R15	Residential	Iffley	647326	7539855	16.9 S
R16	Residential	Tay Glen	635322	7509100	16.3 NE
R17	Residential	Semple Residence	649876	7506696	20.8 NW
R18	Residential	Saraji homestead 2	630424	7523432	9.2 E

Note: * Meadowbrook and Lake Vermont homesteads are owned by BMA.

Distance and directions provided are from the centre point of the Project MIA.

It is noted that the BHP Billiton Mitsubishi Alliance (BMA) proposed to develop Saraji East construction camps to house construction workers for the neighbouring Saraji East Project. BMA has advised that these camps will be removed in 2023, being temporary camps to support the Project construction. As such, these camps will not exist at the time that the Lake Vermont Meadowbrook Project is developed. Therefore, these camps are not considered as a sensitive receiver in this study.

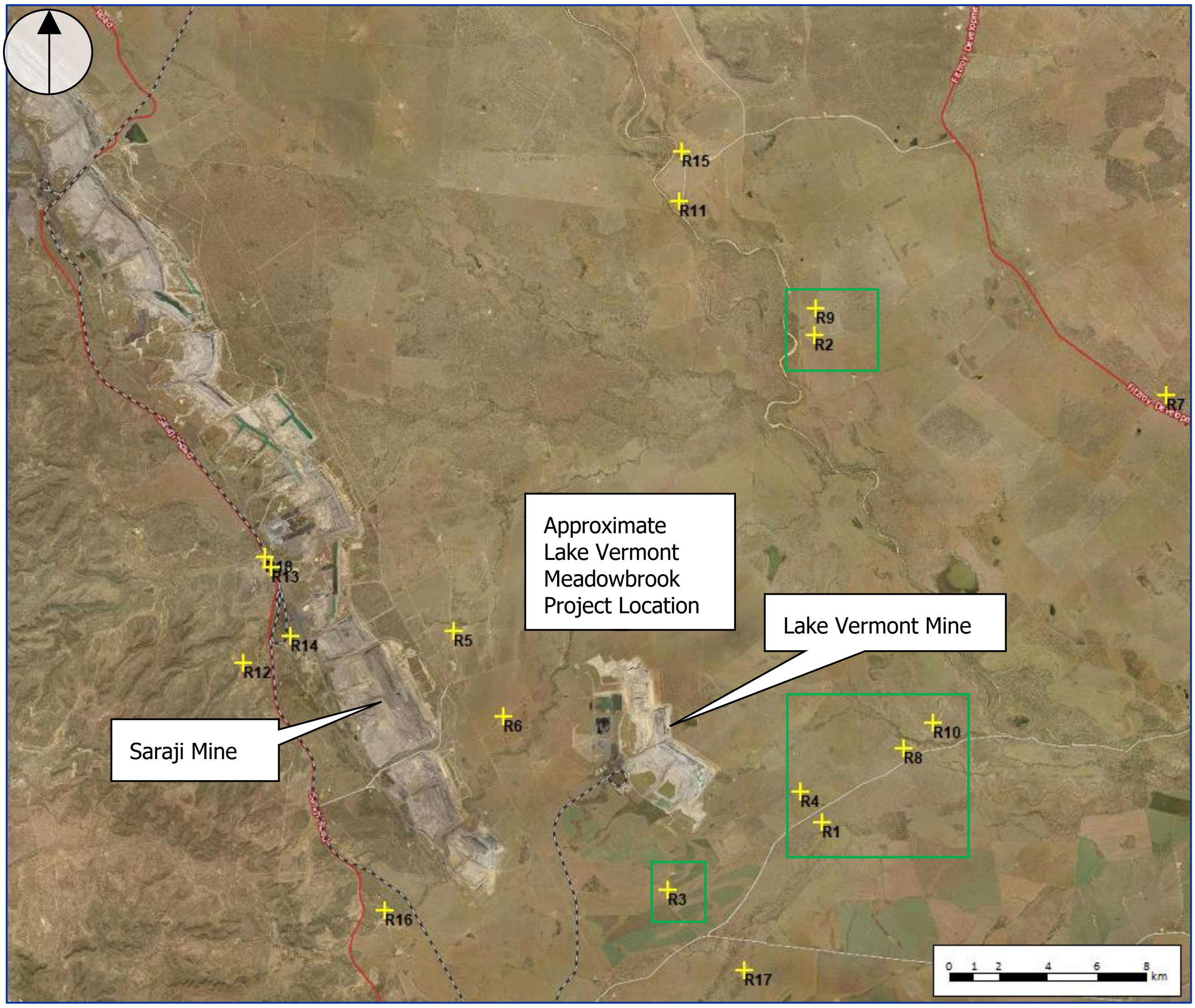
Some of the receivers listed in **Table 3.1** are not included in the modelling for the following reasons:

- R5 and R6: These receivers are both homesteads owned by BMA. The Meadowbrook Homestead (R5) is currently unoccupied, and BMA has confirmed that this will not be used as a residence in future. The Lake Vermont Homestead (R6) is occupied by employees of BMA, however with appropriate conditions in place with the residents. Hence, neither homestead is included as a sensitive receiver in this noise assessment.

- R7, R11, and R15: These receivers are over 15 kilometres from the MIA centroid and thus will not be impacted by the Project.
- R12, R13, R14, R16 and R18: These receivers are over 9 kilometres from the MIA centroid and on the opposite (western) side of the Saraji Mine.
- R17: This receiver is over 20 kilometres from the MIA centroid and on the opposite (southern) side of Lake Vermont Mine.

If the predicted noise levels are compliant at the selected receivers (i.e. R1 to R4 and R8 to R10, as shown in green rectangles in **Figure 3.1**), it is considered that noise levels are complaint at all receivers.

Figure 3.1: Sensitive Receiver Locations (Receivers in Green Rectangles are Included in Noise Modelling)



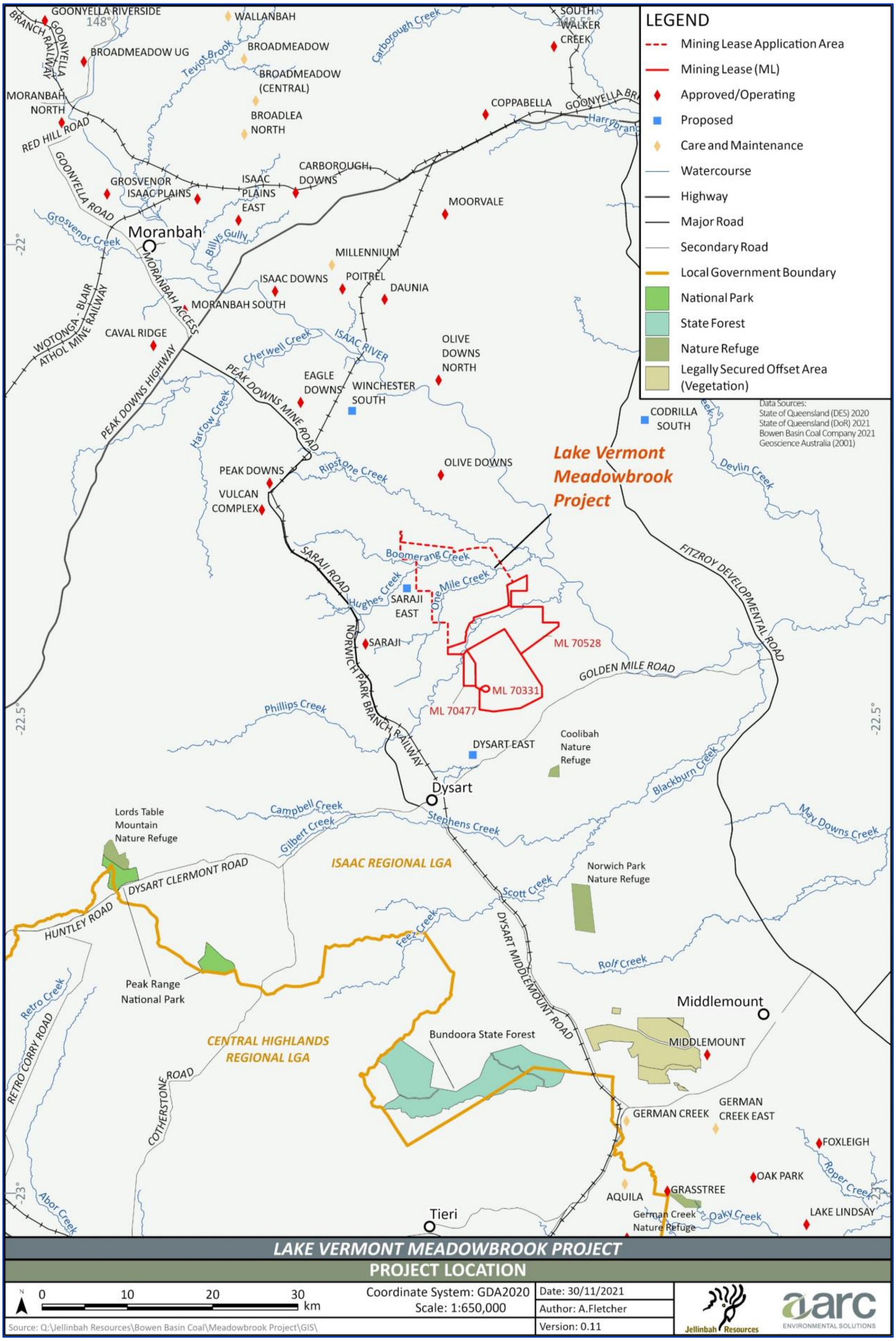
It is noted that several existing and proposed mines are located in close proximity to the proposed project as shown in **Figure 3.2** and also listed below.

- Saraji, approximately 5 km to the west.
- Saraji East Project (proposed), located on land adjoining the western boundary of the Project.
- Olive Downs, approximately 2 km to the north and Olive Downs North, approximately 40 km to the north.

- Winchester South Project (proposed), approximately 8 km to the north north-west.
- Eagle Downs, approximately 13 km to the north-west.
- Vulcan Complex, approximately 20 km to the north-west.
- Peak Downs, approximately 25 km to the north-west.
- Dauhnia, approximately 35 km to the north.
- Caval Ridge, approximately 45 km to the north-west.
- Poitrel, approximately 35 km to the north.
- Millennium, approximately 40 km to the north.
- Isaac Downs, approximately 40 km to the north-west.
- Moranbah South, approximately 45 km to the north-west.
- Isaac Plains East and Isaac Plains East expansion, approximately 50 km to the north-west.

Given the Project is surrounding by other mines, it is possible that the sensitive receivers can incur cumulative noise impacts. Therefore, any possible cumulative noise impacts are discussed in the latter sections of this report.

Figure 3.2: Surrounding Mine Locations



4. ACOUSTIC CRITERIA

4.1 Overview

Noise and Vibration criteria are required to assess the potential impacts of the proposed mine operations on sensitive receivers.

The relevant Department of Environment and Science (DES) noise and vibration criteria have been considered and are listed as follows:

- Environmental Protection Act 1994;
- Environmental Protection (Noise) Policy 2019;
- Guideline "Noise and Vibration - EIS Information Guideline", Department of Environment and Science, 28 May 2020;
- Guideline "Planning for Noise Control", Department of Environment and Science, 20 July 2004;
- Guideline "Noise and Vibration from Blasting", Department of Environment and Science, 18 March 2020;
- Guideline "Model Mining Conditions", Department of Environment and Science,07 March 2017: and
- Guideline "Application requirements for activities with noise impacts", Department of Environment and Science, v3.05 21 September 2021.

4.2 Existing EA for Lake Vermont Project

The Environmental Authority (EA) for the existing lake Vermont project is EPML00659513, last updated on 26 May 2021. The noise and vibration conditions within this EA are summarised in following.

Figure 4.1: Conditions of Environmental Authority – Noise Limits

Sensitive Place						
Noise level dB(A) 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
$L_{Aeq, adj, 15 mins}$	40	40	35	40	40	35
$L_{A1, adj, 15 mins}$	45	45	40	45	45	40
Commercial Place						
Noise level dB(A) 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
$L_{Aeq, adj, 15 mins}$	45	45	40	45	45	40

Notes: 1. In the event that measured bg (LA90, adj, 15mins) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level.
2. bg = background noise level (LA90, adj, 15mins) measured over 3-5 days at the nearest sensitive receptor.
3.If the project is unable to meet the noise limits as calculated above alternative limits may be calculated using the processes outlined in the "Planning for Noise Control" guideline.

Figure 4.2: Conditions of Environmental Authority – Blasting Limits

Blasting Noise Limits	Sensitive or Commercial Blasting Noise Limits	
	7am to 6pm	6pm to 7am
Airblast overpressure	115dB (Linear) Peak for nine (9) out of ten (10) consecutive blasts initiated and not greater than 120dB (Linear) Peak at any time	No blasting to occur.
Ground vibration peak particle velocity (PPV)	5mm/second PPV of nine (9) out of ten (10) consecutive blasts and not greater than 10mm/second PPV at any time	No blasting to occur.

4.3 Environmental Protection Act

In Queensland, the environment is protected under the Environmental Protection Act 1994.

Section 3 of the EP Act states that the object of the Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

Section 12 of the EP Act defines noise as including "vibration of any frequency, whether emitted through air or another medium" and thus includes underwater noise.

Section 319 of the EP Act relates to General Environmental Duty and states that a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm.

Section 14(1) of the EP Act defines environmental harm as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.

Section 15 of the EP Act defines environmental nuisance as an unreasonable interference or likely interference with an environmental value caused by (a) ... noise.

The EP Act refers to the Environmental Protection Policies as being subordinate legislation to the Act.

4.4 Environmental Protection (Noise) Policy

4.4.1 Overview

With respect to the acoustic environment, the object of the EP Act is achieved by the Environmental Protection (Noise) Policy 2019 (EPP (Noise)). This policy identifies environmental values to be enhanced or protected, states acoustic quality objectives, and provides a framework for making decisions about the acoustic environment.

4.4.2 Acoustic Quality Objectives

The EPP (Noise) contains a range of acoustic quality objectives for a range of receivers. The objectives are in the form of noise levels, and are defined for various periods of the day, and use a number of acoustic parameters.

Schedule 1 of the EPP(Noise) includes the following acoustic quality objectives to be met at residential dwellings:

- Outdoors
  - Daytime and Evening: 50 dBA $L_{Aeq,adj,1hr}$, 55 dBA $L_{A10,adj,1hr}$ and 65 dBA $L_{A1,adj,1hr}$
- Indoors

- Daytime and Evening: 35 dBA $L_{Aeq,adj,1hr}$, 40 dBA $L_{A10,adj,1hr}$ and 45 dBA $L_{A1,adj,1hr}$
- Night: 30 dBA $L_{Aeq,adj,1hr}$, 35 dBA $L_{A10,adj,1hr}$ and 40 dBA $L_{A1,adj,1hr}$

In the DEHP EcoAccess Guideline "Planning For Noise Control" documentation it is proposed that the noise reduction provided by a typical residential building façade is 7 dBA assuming open windows. Based on a façade reduction of conservative 5 dBA reduction in noise levels from outside a house to inside a house when windows are fully open, the indoor noise objectives noted above could be converted to the following external objectives (with windows open) for monitoring:

- Daytime and Evening: 40 dBA $L_{Aeq,adj,1hr}$, 45 dBA $L_{A10,adj,1hr}$ and 50 dBA $L_{A1,adj,1hr}$
- Night: 35 dBA $L_{Aeq,adj,1hr}$, 40 dBA $L_{A10,adj,1hr}$ and 45 dBA $L_{A1,adj,1hr}$

4.4.3 Background Creep

The current 2019 version of the EPP (Noise) no longer contains criteria for background creep, but states that background creep should be prevented or minimised, to the extent that it is reasonable to do so.

Background creep is defined as "a gradual increase in the total amount of background noise in the area or place as measured under the document called the 'Noise measurement manual' published on the department's website" (Section 9(4) of EPP Noise). This is understood to require consideration of cumulative impacts, including other developments.

4.5 Guideline – Planning for Noise Control

DES had previously published a guideline titled "Planning for Noise Control, 2004". The Planning for Noise Control guideline is currently listed as being "under review" according to the DES website. As such, it is not proposed to utilise the noise criteria contained within the document.

This document contains a method for determining the minimum background noise level using the lowest tenth percentile methodology. This method is consistent with that used in NSW and by some Queensland Councils, and has been used in the analysis of measured background noise levels in this report.

4.6 Guideline – Noise & Vibration from Blasting

The DES Guideline "Noise and vibration from blasting, 2020" contains criteria and procedures that are applicable to noise and vibration emitted from blasting. It applies to activities such as mining, quarrying, construction and other operations which involve the use of explosives for fragmenting rock.

The noise and vibration criteria for blasting are presented in **Table 4.1**. These criteria address human comfort and apply at residential and commercial receivers.

Table 4.1: Blasting Vibration and Airblast Criteria

Issue	Criteria
Airblast	Airblast overpressure of 115 dB (linear peak) for nine (9) out of ten (10) consecutive blasts initiated and not greater than 120 dB (linear peak) at any time.
Vibration	5 mm/s peak particle velocity for nine (9) out of ten (10) consecutive blasts and not greater than 10 mm/s peak particle velocity at any time.

It is noted that higher limits would typically be used for prevention of structural damage.

4.7 Guideline – Assessment of Low Frequency Noise

The DES Guideline "Assessment of Low Frequency Noise, 2004" contains methods and procedures that are applicable to low frequency noise emitted from industrial premises and mining operations for planning purposes. Items such as boilers, pumps, transformers, cooling fans, compressors, oil and gas burners, foundries, wind farms, electrical installations, diesel engines, ventilation and air-conditioning equipment, wind turbulence and large chimney resonance may comprise sources of high level noise having frequency content less than 200 Hz.

These sources may exhibit a spectrum that characteristically shows a general increase in sound pressure level with decrease in frequency. Annoyance due to low frequency noise can be high even though the dBA level measured is relatively low. Typically, annoyance is experienced in the otherwise quiet environments of residences, offices and factories adjacent to or near low frequency noise sources. Generally, low level/low frequency noises become annoying when the masking effect of higher frequencies is absent. This loss of high frequency components may occur as a result of transmission through the fabric of a building, or in propagation over long distances.

Where a noise immission occurs exhibiting an unbalanced frequency spectrum, the overall sound pressure level inside residences should not exceed 50 dBZ to avoid complaints of low frequency noise annoyance. A spectrum is considered unbalanced when the un-weighted overall noise level is more than 15 dB higher than the A-weighted overall noise level.

4.8 Proposed Criteria

4.8.1 Noise Emissions

It is proposed to maintain the existing EA L_{Aeq} noise criteria for Lake Vermont Mine, but it is recommended to increase the L_{A1} noise criteria by 5 dB in line with the EPP(Noise) Acoustic Quality Objectives. That is, the EPP(Noise) Acoustic Quality Objectives include a 10 dBA difference between the L_{A1} and L_{Aeq} objectives and this should be reflected in the Project noise limits. The proposed noise limits are included in **Table 4.2**.

Table 4.2: Proposed Noise Limits

Noise Limits for Sensitive Places						
Noise level dBA 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
$L_{Aeq,adj,1hour}$	40	40	35	40	40	35
$L_{A1,adj,1hour}$	50	50	45	50	50	45
Noise Limits for Commercial Places						
Noise level dBA 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
$L_{Aeq,adj,1hour}$	45	45	40	45	45	40

Note 1: For receivers subject to mining noise from other mine operations and/or ambient noise levels in excess of the nominated noise limits, alternative noise limits may be proposed with due consideration for cumulative noise impacts.

4.8.2 Blasting

It is proposed to maintain the existing EA blasting criteria for Lake Vermont Mine which are copied as follows in **Table 4.3**.

Table 4.3: Proposed Blasting Vibration and Airblast Limits

Parameter	Blasting Limits Applicable at Sensitive or Commercial Place	
	7am to 6pm	**6pm to 7am**
Airblast Overpressure	Airblast overpressure of 115 dB (linear peak) for nine (9) out of ten (10) consecutive blasts initiated and not greater than 120 dB (linear peak) at any time.	No blasting to occur
Ground Vibration Peak Particle Velocity	5 mm/s peak particle velocity for nine (9) out of ten (10) consecutive blasts and not greater than 10 mm/s peak particle velocity at any time.	No blasting to occur

5. EXISTING NOISE ENVIRONMENT

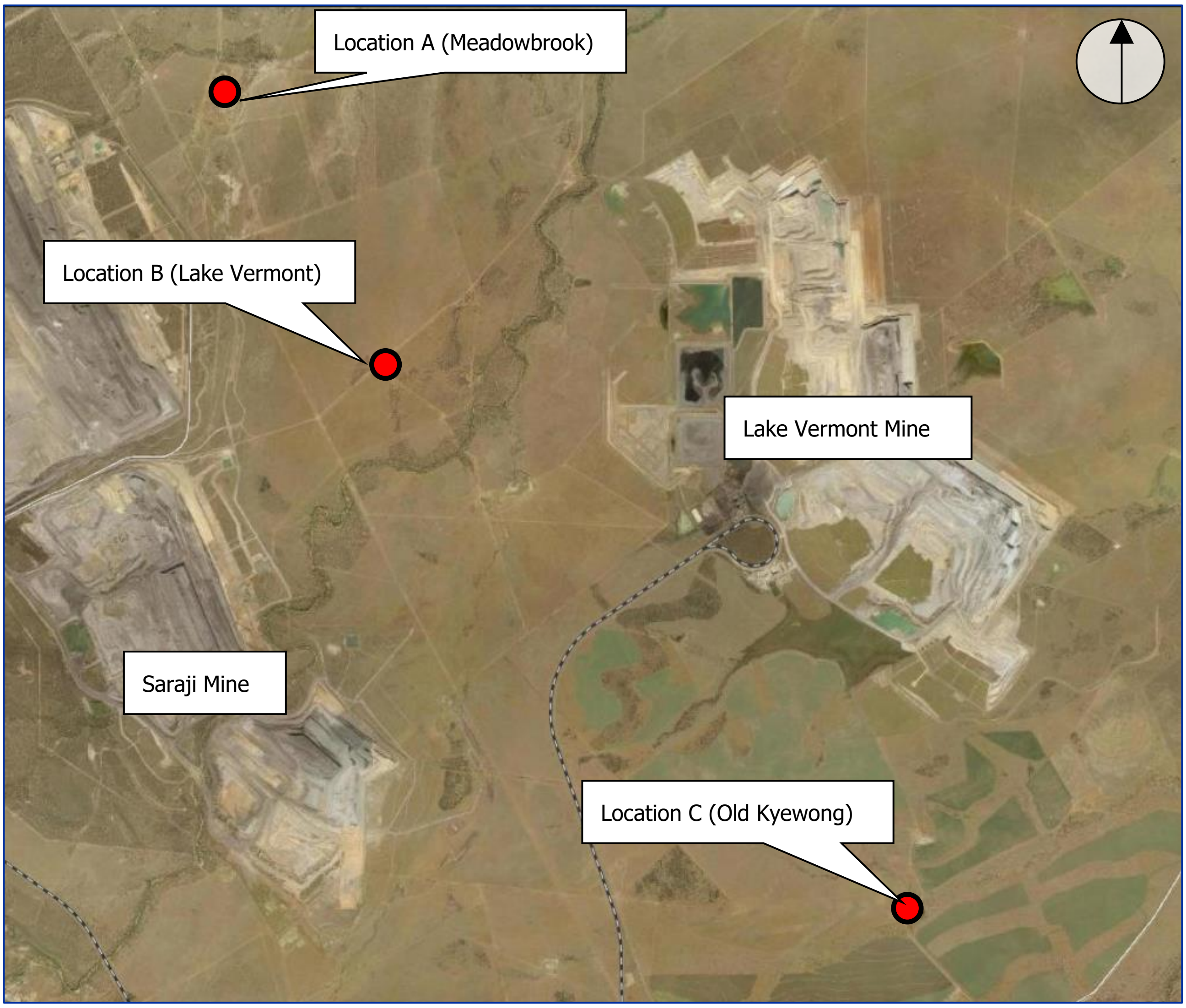
5.1 Overview

Attended noise measurements and noise logging were undertaken at the following locations:

- Location A – Residence (Meadowbrook): Located in an open-field, approximately 50 metres south west of the homestead (637962.68 E, 7520210.57 N). This is the same location as R9 (refer **Table 3.1**).
- Location B – Residence (Lake Vermont): Located in an open-field, approximately 75 metres south west of the homestead (640064.15 E, 7516887.70 N). This is the same location as R10 (refer **Table 3.1**).
- Location C – Residence (Old Kyewong): Located in an open-field, approximately 50 metres south west of the homestead (646683.91 E, 7509865.55 N). This is the same location as R7 (refer **Table 3.1**).

The noise monitoring was undertaken in general accordance with Australian Standard AS1055 Acoustics - Description and measurement of environmental noise and the DES Noise Measurement Manual 2020.

Figure 5.1: Aerial View of Monitoring Locations



5.2 Attended Noise Measurements

Attended noise measurements were undertaken at Locations A, B and C. The measurements were undertaken on 9th and 10th February 2021 over 15 minute periods using a field and laboratory calibrated Norsonic sound level meter. The microphone height was approximately 1.3 m above natural ground level and was located in the free field. Weather during the time of monitoring was generally moderate with a breeze in the day and night. The weather conditions during measurements were as follows:

- Location A (Meadowbrook)
  - Day (10th February 2021): 32 °C with a 0 to 1 m/s (NW) slight breeze and full cloud cover
  - Night (10th February 2021): 23 °C with a 0 to 2 m/s (E) slight breeze and no cloud cover
- Location B (Lake Vermont)
  - Day (9th February 2021): 28 °C with a 0 to 3.5 m/s (NW) breeze, slight shower, thunder, and half cloud cover
  - Night (10th February 2021): 23 °C with a 0 to 4 m/s (NE) breeze and full cloud cover
- Location C (Old Kyewong)
  - Evening (9th February 2021): 27 °C with a 0 to 3.5 m/s (N) breeze, and 1/8 cloud cover
  - Night (9th February 2021): 24 °C with a 0 to 3 m/s (N) breeze and no cloud cover

The measured noise levels are summarized in **Table 5.1**.

Table 5.1: Attended Noise Measurements

Location	Date & Time	Period (Minutes)	Results & Notes
Day/ Evening Noise Monitoring			
A (Meadowbrook)	04:02pm 10/02/2021	15	Statistical noise level: L_{10} 43 dBA, L_{eq} 39 dBA, L_{90} 33 dBA ATV vehicle in the field 32 to 44 dBA Birds 40 to 45 dBA Cow in distance 33 to 34 dBA Insects 31 to 37 dBA at 4 to 8 kHz Mine noise not measurable – faint humming noise in distance
B (Lake Vermont)	05:45pm 09/02/2021	15	Statistical noise level: L_{10} 43 dBA, L_{eq} 41 dBA, L_{90} 33 dBA Thundering 40 to 50 dBA Continuous water dropping from tank 32 to 33 dBA Birds 37 to 40 dBA Plane in distance 38 to 39 dBA Mine noise not measurable – faint noise in distance
C (Old Kyewong)	07:09pm 09/02/2021	15	Statistical noise level: L_{10} 52 dBA, L_{eq} 51 dBA, L_{90} 45 dBA Continuous bird noises 46 to 75 dBA Wind in trees 42 to 47 dBA Insects 45 dBA at 4 to 8 kHz Dog barking 52 to 53 dBA No mine noise audible
Evening/ Night Noise Monitoring			
A (Meadowbrook)	09:37pm 10/02/2021	15	Statistical noise level: L_{10} 44 dBA, L_{eq} 43 dBA, L_{90} 43 dBA Insects/frogs 42 to 44 dBA at 4 to 8 kHz

Location	Date & Time	Period (Minutes)	Results & Notes
			Mine noise – low rumbling noise from SE (Lake Vermont Mine) approximately 20 dBA at 63 to 500 Hz No audible noise from Saraji mine direction
A (Meadowbrook)	09:55pm 10/02/2021	15	Statistical noise level: L_{10} 44 dBA, L_{eq} 44 dBA, L_{90} 43 dBA Insects/frogs 39 to 44 dBA at 4 to 8 kHz Mine noise – low rumbling noise from SE (Lake Vermont Mine) approximately 15 to 25 dBA at 63 to 500 Hz Truck from Saraji mine direction – approximately 20 dB at 125 Hz
A (Meadowbrook)	10:11pm 10/02/2021	15	Statistical noise level: L_{10} 44 dBA, L_{eq} 43 dBA, L_{90} 41 dBA Insects/frogs 38 to 43 dBA at 4 to 8 kHz Mine noise – low rumbling noise from SE (Lake Vermont Mine) approximately 15 to 30 dBA at 63 to 250 Hz
B (Lake Vermont)	10:58pm 10/02/2021	15	Statistical noise level: L_{10} 45 dBA, L_{eq} 42 dBA, L_{90} 38 dBA Insects 30 to 45 dBA at 4 to 8 kHz Continuous frog noise 20 to 30 dBA at 1kHz Mine noise – rumbling noise from E (Lake Vermont Mine) approximately 20 to 40 dBA at 63 to 500 Hz No audible noise from Saraji mine direction
B (Lake Vermont)	11:15pm 10/02/2021	15	Statistical noise level: L_{10} 47 dBA, L_{eq} 46 dBA, L_{90} 44 dBA Insects 36 to 45 dBA at 4 to 8 kHz Continuous frog noise 20 to 30 dBA at 1kHz Mine noise – rumbling noise from E (Lake Vermont Mine) approximately 20 to 30 dBA at 63 to 500 Hz No audible noise from Saraji mine direction
B (Lake Vermont)	11:30pm 10/02/2021	15	Statistical noise level: L_{10} 44 dBA, L_{eq} 39 dBA, L_{90} 34 dBA Insects 20 to 35 dBA at 4 to 8 kHz Continuous frog noise 20 to 30 dBA at 1kHz Mine noise – rumbling noise from E (Lake Vermont Mine) approximately 20 to 33 dBA at 63 to 500 Hz No audible noise from Saraji mine direction
C (Old Kyewong)	10:06pm 09/02/2021	15	Statistical noise level: L_{10} 44 dBA, L_{eq} 42 dBA, L_{90} 39 dBA Insects 40 to 43 dBA at 4 to 8 kHz Continuous insect/bird noise 30 dBA at 1kHz Cows 41 to 45 dBA Mine noise not measurable – faint noise in distance
C (Old Kyewong)	10:22pm 09/02/2021	15	Statistical noise level: L_{10} 46 dBA, L_{eq} 43 dBA, L_{90} 39 dBA Insects 39 to 45 dBA at 4 to 8 kHz Continuous insect/bird noise 30 dBA at 1kHz Cows 44 to 45 dBA Mine noise not measurable – faint noise in distance
C (Old Kyewong)	10:39pm 09/02/2021	15	Statistical noise level: L_{10} 47 dBA, L_{eq} 46 dBA, L_{90} 43 dBA Insects 42 to 47 dBA at 4 to 8 kHz Continuous insect/bird noise 20 to 30 dBA at 1kHz Mine noise not measurable – faint noise in distance Mine truck 30 dBA at 63 to 125 Hz

5.3 Noise Logging

Noise logging was undertaken at Locations A, B, and C (per **Figure 5.1**). Logging was undertaken from Wednesday 10th to Wednesday 17th February 2021 at Location A, Tuesday 9th to Tuesday 16th February 2021 at Location B, and Tuesday 9th to Tuesday 23rd February 2021 at Location C using field and laboratory calibrated B&K 2250 environmental noise loggers. Noise logging was undertaken in the free field.

Data from the Bureau of Meteorology (BoM) (Moranbah) indicates that weather during the monitoring period was generally fine and warm, but with light rainfall on Tuesday 9th (0.8mm), Friday 12th (0.4mm), Monday 15th (0.4mm), and Saturday 20th (1.6mm). Overall, the noise monitoring data is considered acceptable for use in this report.

Photos of the noise monitoring locations are shown in **Figures B.1** to **B.3** in **Appendix B**.

The measured noise levels are shown graphically in **Figures C.1** to **C.6** in **Appendix C**. The statistical results from the noise logging have been summarised in **Tables C.1** to **C.3** in **Appendix C**.

The background noise levels at Location A, B and C were affected by mining noise and significant insect noise. As the insect noise is likely a seasonal influence, the noise level data has been filtered to remove the insect noise. Background noise levels have not been filtered for rain or high wind periods, and as such, the background noise levels could be marginally higher than would be calculated using filtered data. Given the data is not used for determination of noise limits, the marginal difference is not considered of significance.

The resulting background noise levels calculated using the lowest tenth percentile method are shown in **Table 5.2**.

Table 5.2: Background Noise Levels at Locations A, B and C

Period	Background Noise Level L_{90}, dBA			Filtered (less insect noise) Background Noise Levels L_{90}, dBA		
	Location A (Meadowbrook)	Location B (Lake Vermont)	Location C (Old Kyewong)	Location A (Meadowbrook)	Location B (Lake Vermont)	Location C (Old Kyewong)
Day (7am to 6pm)	35	28	33	26	25	24
Evening (6pm to 10pm)	39	30	36	27	26	26
Night* (10pm to 7am)	37	32	31	23	25	24

Note: * Background Noise Levels have been calculated for the standard DES time periods, which include a night period of 10pm to 7am. The EA noise periods includes a night period of 10pm to 9am for Sunday mornings, but as the EA limit is not dependent on the background noise levels, the 'Saturday night – Sunday morning' background noise level has not been calculated or presented in this table.

From the results above, the following comments on background noise are made:

- Location A (Meadowbrook): Continuous mine noise from Lake Vermont Mine direction is audible at this location and intermittent truck noise from Saraji mine direction. Other noise sources are natural (insects/frogs, birds, wind in trees), farm related (ATV vehicle, livestock).
- Location B (Lake Vermont): Continuous mine noise from Lake Vermont Mine direction is audible at this location. Other noise sources are natural (insects/frogs, birds, wind in trees), farm related (farm machinery, livestock).
- Location C (Old Kyewong): Continuous mine noise from Lake Vermont Mine direction is audible at this location. Other noise sources are natural (insects/frogs, birds, wind in trees), farm related (farm machinery, livestock, dogs).

Overall, the background noise levels (less insect noise) were below 30 dBA L_{90} at all three locations. Typically, it would be proposed that the background noise level be considered to be 30 dBA L_{90} at all three locations as the minimum background noise level proposed by DES (refer to Note 1 in **Figure 4.1**).

5.4 Seasonal Variability

Ambient noise levels are affected by many noise sources including mine noise, wind, rustling leaves, insects, birds and other animals.

The noise monitoring was conducted in Summer (February) when insect noise levels can be relatively high. During colder months, the noise from insects will tend to be quieter. However, it is not normally necessary to conduct monitoring across warmer and cooler months as insect noise can be filtered from the noise data, as has occurred in **Section 5.3**. In this instance, significant insect noise was identified at all monitoring locations and was removed accordingly as shown in **Table 5.2**.

It is noted that the background noise levels are already below the minimum background noise level of 30 dBA L_{90}, and therefore additional noise monitoring in another season (e.g. winter) is not proposed.

6. NOISE ASSESSMENT

6.1 Model Description

Noise modelling was carried out using the CONCAWE algorithm, which is widely used and accepted for noise modelling and is approved by DES. The CONCAWE algorithm allows for modelling a number of discrete meteorological scenarios.

The SoundPLAN V8.2 program was used to develop a three-dimensional digital terrain noise model of the project Area and the surrounding area including the location of sensitive receivers. The model incorporates terrain data for the proposed Project and the existing surrounding topography.

6.2 Meteorology

The mining noise levels at residential receivers can vary significantly depending upon the meteorology and the mining activities. Meteorology has a significant effect on the noise levels, particularly due to wind speed and direction and vertical temperature gradients, which include temperature inversions.

It is possible to measure noise variations of the order of 15 to 20 dBA due to changes in meteorology. Assessment is required under worst-case meteorological conditions according to the DES Planning for Noise Control guideline.

The SoundPLAN model was setup to predict noise levels under neutral and adverse meteorological conditions. The conditions used in the noise model are shown in **Table 6.1**.

Table 6.1: Meteorological Scenarios

Parameter	Day Meteorological Scenario		Night Meteorological Scenario	
	Scenario D1	Scenario D2	Scenario N1	Scenario N2
Pasquill Stability Class	D	D	F	F
Temperature (°C)	25	25	10	10
Wind Speed (m/s)	0	2	0	2
Wind direction	-	Towards receiver	-	Towards receiver
Relative Humidity (%)	40	40	70	70

These meteorological scenarios are presented to give an indication of the range of noise levels from neutral to adverse conditions and are assessed against the criteria corresponding to the periods when they will be most likely to occur. The most critical predictions are the night scenarios, since this assesses the highest predicted noise levels against the most stringent night-time criteria.

The SoundPLAN model assumes the wind direction is from the source to each receiver and thus modelling for multiple wind directions is not required.

6.3 Noise Source Data

The model uses the sound power level (L_w) of each noise source to predict noise emissions. The sound power levels used in the model were based on noise source data obtained from previous mining projects and are inclusive of tonality and impulsiveness penalties. The sound power levels for the mobile and fixed equipment proposed for the Project are presented in **Table 6.2**.

Table 6.2: Noise Source Sound Power Levels

Equipment	Data Source	Octave Band Sound Power Level $L_{w,eq}$ dBZ								Overall $L_{w,eq}$	
		63	125	250	500	1k	2k	4k	8k	dBZ	dBA
Large Blasthole Drills	4	109	111	111	110	110	109	106	101	118	115
LH_9600	2,3	117	111	107	107	106	102	92	82	119	110
LH_9400/9350	2,3	117	111	107	107	106	102	92	82	119	110
CAT793	3,4	115	125	120	118	113	111	104	96	127	120
CAT789	3,4	115	125	120	118	113	112	104	96	127	120
CAT777 Water Cart	3,4	122	122	115	110	109	105	102	99	126	114
CATD10 Dozer	2,3	111	119	117	119	113	114	105	93	124	120
CATD11 Dozer	4	111	119	117	119	113	114	105	100	124	120
CAT854 Wheel Dozer	4	112	120	118	120	114	115	106	94	125	121
CAT18M Grader	3,4	108	115	112	104	104	102	98	90	118	110
CAT992 Loader	3,4	120	114	111	107	106	108	103	96	122	113
Service Trucks	3,4	97	95	93	93	93	90	83	78	102	97
Road Trains	3,4	108	106	104	103	104	101	95	84	113	108
Ventilation fans	4	122	121	117	120	109	105	101	90	127	119
CHPP[1]	1,3	126	120	114	114	111	108	102	94	128	117
Large Pumps - Pit dewatering	3,4	105	103	99	98	99	98	93	89	109	104

Note 1: The CHPP is located at the existing Lake Vermont mine but is included in this modelling assessment. The model does not include the remainder of the Lake Vermont mine operations, though that is addressed later in the report with respect to cumulative operations.

The sources of data used to compile the sound power level data in **Table 6.2** are presented in **Table 6.3**.

Table 6.3: Source of Data for Equipment Sound Power Levels

Source #	Data Source
1	Data based on measurements undertaken by Trinity at another coal mine.
2	Manufacturer's noise data.
3	Trinity database, based on sound power level calculated from measurements at another coal mine for the same/similar equipment.
4	Data for these sources was extracted from another similar coal mine project. Generally, this data is similar to noise data for similar equipment at other mine sites and is considered suitable for noise modelling purposes.

The equipment modelled has been chosen to closely reflect the anticipated mining fleet. However, there is potential for alternate makes and models of equipment to be used in the operating mine. If the equipment model is changed, the sound power level of the alternative model could be reviewed to determine if noise level increases are expected.

6.4 Modelling Scenario

Mining noise emissions from the Project have been predicted for Year 7 and Year 22 of the Project, as these are considered worst case scenarios for underground (Year 7) and open cut (Year 22) operations.

Modelling of the nominated Year 7 and Year 22 Project scenarios has included ground elevations, equipment numbers and equipment locations based on information provided by the Proponent. The mobile equipment numbers for the modelled Project years are presented in **Table 6.4**. The equipment locations were shown in **Figures 2.3** and **2.4**.

Table 6.4: Mobile Equipment Fleet in Modelled Project Years

Equipment	Number of Items	
	Year 7	Year 22
Meadowbrook Underground		
CATD11 Dozer	1	1
CAT992 Loader	2	1
Service Trucks	1	1
Road Trains	3	2
Ventilation fans	2	1
CHPP	1	1
Meadowbrook Open Cut		
Large Blasthole Drills	-	1
LH_9600	-	1
LH_9400/9350	-	2
CAT793	-	6
CAT789	-	4
CAT777 Water Cart	-	2
CATD10 Dozer	-	2
CATD11 Dozer	-	2
CAT854 Wheel Dozer	-	2
CAT18M Grader	-	2
CAT992 Loader	-	2
Service Trucks	-	1
Road Trains	-	1
Large Pumps - Pit dewatering	-	5

The overall sound power levels of the equipment modelled in the night scenarios are presented in **Table 6.5**.

Table 6.5: Overall Mine Noise Source Sound Power Levels

Project Year	Octave Band Sound Power Level $L_{w,eq}$ dBZ								Overall $L_{w,eq}$	
	63	125	250	500	1k	2k	4k	8k	dBZ	dBA
Year 7	130	127	123	125	118	117	111	104	134	126
Year 22	133	137	132	132	126	126	118	111	140	133

6.5 Predicted Noise Levels & Assessment

The predicted noise levels at nearby sensitive receivers for Year 7 and 22 of the Project are presented in **Table 6.6**.

Table 6.6: Predicted A-weighted Noise Levels

Sensitive Receiver	Predicted Noise Emissions Levels L_{eq} dBA							
	Year 7				Year 22			
	D1	D2	N1	N2	D1	D2	N1	N2
Noise Criteria L_{eq}:	40	40	35	35	40	40	35	35
R1 - Pownalls	8	13	17	14	11	17	21	18
R2 - Seloh Nolem 1	6	12	17	13	12	18	23	19
R3 - Old Kyewong	14	20	24	22	16	22	25	23
R4 - Mockingbird Downs	10	16	20	17	14	20	24	20
R8 - Leichardt	5	10	15	11	10	16	21	17
R9 - Seloh Nolem 2	5	11	16	12	12	18	22	18
R10 - Old Bombandy	4	9	14	10	10	15	20	16

Based on the results in **Table 6.6**, predicted noise levels at the sensitive receivers are at least 10 dB below the proposed noise limits in **Table 4.2**.

Compliance with the proposed L_{Aeq} limits is expected to result in compliance with the L_{A1} limits based on noise levels measured from coal mines.

It is noted that low frequency (i.e. Z-weighted) noise levels have not been assessed as the current EA and proposed limits do not include low frequency noise limits. It is Trinity's experience with coal mine noise assessments and measurements that compliance with the A-weighted noise limits in **Table 4.2** would result in compliance with low frequency (Z-weighted) noise limits that may be imposed by DES.

The predicted noise levels are also shown graphically as noise contours in **Appendix D** for the worst-case meteorological conditions, as follows:

- **Figure D.1** Year 7 Day Scenario D2
- **Figure D.2** Year 22 Day Scenario D2
- **Figure D.3** Year 7 Night Scenario N1
- **Figure D.4** Year 22 Night Scenario N1

Note: Noise contours have not been prepared for the D1 and N2 scenarios, as they would have less noise impact than the results included in the figures provided.

6.6 Cumulative Noise Impacts

As described in **Section 3**, several existing and approved mines are located surrounding the Project and they could impact sensitive receivers which are potentially impacted by the Project. Therefore cumulative noise impacts are to be considered.

As per **Section 3.1**, the sensitive receivers of interest (i.e. R1 to R4, and R8 to R10) are located at distances of over 15 kilometres from the Project.

From **Table 6.6**, the highest predicted noise level at receivers to the south-east (i.e. R1, R3, R4, R8 and R10) is 25 dBA L_{Aeq}. Given the highest predicted level is at least 10 dB below the Lake Vermont night noise limit (i.e. 35 dBA $L_{Aeq,15min}$), the mine noise contribution from the Project is relatively insignificant. That is, a noise level of 25 dBA has negligible contribution to a mine noise limit of 35 dBA, or mathematically, 35 dBA + 25 dBA = 35 dBA. Therefore, the Project is unlikely to cause any cumulative noise impacts towards the receivers to the south-east (i.e. R1, R3, R4, R8 and R10).

From **Table 6.6**, the highest predicted noise level at receivers to the north-east (i.e. R2 and R9) is 23 dBA L_{Aeq}. Given the highest predicted level is at least 12 dB below the nearby Olive Downs[1] mine night noise limit (i.e. 35 dBA $L_{Aeq,15min}$), the mine noise contribution from the Project is relatively insignificant. That is, a noise level of 23 dBA has negligible contribution to a mine noise limit of 35 dBA, or mathematically, 35 dBA + 23 dBA = 35 dBA. Therefore, the Project is unlikely to cause any cumulative noise impacts towards the receivers to the north-east (i.e. R2 and R9).

In summary, the Project is not considered to cause adverse cumulative impacts.

[1] Renzo Tonin Ron Rumble, Olive Downs Coking Coal Project - Noise and Vibration Assessment, QB025-01F03 Noise Report (r2) dated 06.07.2018.

7. BLASTING ASSESSMENT

7.1 Overview

It is anticipated that the existing vibration levels around the Project and at the location of sensitive receivers will generally be negligible, except at locations which are close (e.g. within 100m) to roads, rail lines or near major items of fixed plant. No sensitive receivers for the Project are within this range.

The only vibration source of significance from the proposed mining activities would be blasting. Blasting activities within the pits have been assessed for both ground vibration and airblast. The relevant criteria for ground vibration and airblast have been presented and discussed in **Section 4.8.2** and **Table 4.3**.

7.2 Predictions

Ground vibration and airblast levels caused by blasting activities have been predicted based on the formulas and methodology of Australian Standard AS2187.2 "Explosives - Storage Transport and Use - Use of Explosives", which predicts the peak particles velocity (PPV) in mm/s and the airblast over pressure (peak pressure) in dB.

7.2.1 Ground Vibration

In accordance with the criteria presented in **Section 4.8.2**, ground vibration levels are to achieve 5mm/s PPV for nine out of ten blasts and not greater than 10mm/s PPV at any time. Ground vibration can be calculated at various distances from a blast using the following formula from AS2187.2:

$$V = K\ (R\ /\ Q^{1/2})^{-B}$$

Where: V = ground vibration as peak particle velocity (PPV) (mm/s)

K = site constant

R = distance between charge and point of measurement (m)

Q = effective charge mass per delay or maximum instantaneous charge (kg)

B = site exponent or attenuation rate

Ground vibration from blasting generally increases with an increase in charge mass and reduces with distance.

A site exponent (-B) (attenuation rate) of –1.6 has been estimated for the site based on Trinity's experience with similar mining projects. The site constant (K) was assumed to be in the range 800 to 1600. The typical maximum instantaneous charge mass will be 1600 kg. **Table 7.1** contains the calculated ground vibration levels (mm/s) at various distances from the blast.

Table 7.1: Ground Vibration Levels at Various Distances from the Blast

Distance from Blast, km	Vibration Level mm/s	
	K = 800	K = 1600
1.0	4.6	9.3
1.5	2.4	4.8
2.0	1.5	3.1
2.5	1.1	2.1
3.0	0.8	1.6
3.5	0.6	1.2
4.0	0.5	1.0

Distance from Blast, km	Vibration Level mm/s	
	K = 800	K = 1600
4.5	0.4	0.8
5.0	0.4	0.7
5.5	0.3	0.6
6.0	0.3	0.5
6.5	0.2	0.5
7.0	0.2	0.4
7.5	0.2	0.4
8.0	0.2	0.3
8.5	0.2	0.3
9.0	0.1	0.3
9.5	0.1	0.3
10.0	0.1	0.2

Table 7.1 shows that the 10 mm/s PPV criterion would not be exceeded at distances greater than 1.0 kilometre from the blast. The 5 mm/s PPV criterion would not be exceeded at distances greater than 1.5 kilometres from the blast.

The nearest sensitive receiver is approximately 10 kilometres away from the nearest pit within the proposed Project area. Therefore, ground vibration due to blasting is predicted to be compliant with the nominated criteria at all sensitive receivers.

7.2.2 Airblast

In accordance with the criteria presented in **Section 4.8.2**, airblast pressure levels are to achieve 115 dBZ for nine out of ten blasts and not greater than 120 dBZ at any time. For blasting in an open-cut mine, the distance to the 120 dBZ Lpeak contour line from the blast can be calculated using the following formula:

$$D120 = (k * h / \text{maximum}(B, S))^{2.5} * m^{1/3}$$

Where: D120 = distance to the 120 dBZ Lpeak contour (m)

k = a site constant determined from the ratio S/B and S/h which requires local calibration

h = hole diameter (mm)

B = burden (mm)

S = stemming height (mm)

m = charge mass (kg)

The site constant, k, has been assumed to be equal to 180 based on Trinity's experience with other mining projects.

The following blast information has been provided:

- h = 229 mm
- S = 8000 mm
- B = 7100 mm
- m = 16000 kg

Table 7.2 contains the separation distances and the reduction of noise levels due to distance.

Table 7.2: Airblast Noise Levels at Various Distances from the Blast

Distance from Blast, km	Airblast Level. dBZ
1.0	115.5
1.5	110.2
2.0	106.5
2.5	103.6
3.0	101.2
3.5	99.2
4.0	97.5
4.5	95.9
5.0	94.6
5.5	93.3
6.0	92.2
6.5	91.2
7.0	90.2
7.5	89.3
8.0	88.5
8.5	87.7
9.0	86.9
9.5	86.2
10.0	85.6

The distance to the 120 dBZ contour line is calculated to be 700 metres. The distance to the 115 dBZ contour line is calculated to be 1,030 metres.

The nearest sensitive receiver is approximately 10 kilometres away from the nearest pit within the proposed Project area. Therefore, airblast overpressure due to blasting is predicted to be compliant with the nominated criteria at all sensitive receivers.

8. NOISE AND VIBRATION MANAGEMENT

8.1 Overview

Noise and vibration complaints are not expected as a result of the Project given the relatively large distance to most sensitive receivers and the modelled noise outputs predicted. Therefore, whilst a specific noise and vibration management plan is not warranted for the project, the following information is provided for assistance in the event of a non-vexatious noise or vibration complaint.

8.2 Monitoring

8.2.1 Short-Term Monitoring

In the event of a non-vexatious noise and/or vibration complaint it is recommended that noise and/or vibration level compliance be confirmed by monitoring at the noise affected receiver/s and/or complainant's location.

Noise monitoring should include setup of a noise logger for a minimum 5 day period and should report one-third octave band noise levels (including L_{eq}, L_{1}, L_{10} and L_{90}) over 15 minute periods, and should also provide audio recording/snapshots and 1 second time period noise levels. In addition to the noise logging, it is also recommended that attended noise measurements be conducted at night over a minimum 1 hour period to confirm the characteristics of the night time noise environment.

Vibration monitoring should occur over a period which captures at least one mine blast and preferably more. The instrumentation should record parameters relevant to the EA criteria, i.e. PPV (mm/s) and Airblast, as a minimum.

Should targeted noise or vibration monitoring identify an exceedance(s) of an EA limit, a report should be prepared to identify the monitoring results, overview the source of the emission(s), and propose mitigation measures to restore compliance. Longer-term monitoring may also be required in such circumstances, as may ongoing auditing of data / noise performance.

8.2.2 Long-Term Monitoring

Should the short-term monitoring assessment indicate exceedances of the limits within the EA, with consideration to the source of the noise and the cumulative impacts, then a long-term monitoring system should be considered. This system would record the same parameters as stipulated above for short-term monitoring, but should also have the capability to email, sms or otherwise transmit alerts to mine operators to enable the mine to react to potential exceedances, and the noise monitoring system should ideally also provide a web portal interface where mine operators can track the noise trends during night periods.

8.3 Addressing a Noise Exceedance

8.3.1 Overview

Should the short-term monitoring assessment indicate exceedances of the limits within the EA, then in addition to a long-term monitoring system, noise management opportunities should be reviewed, including:

- Ceasing operations at times of the day that are predicted to result in exceedances.
- Ceasing operations under meteorological conditions that are predicted to result in exceedances.
- Moving mine equipment further from the receivers.
- Reducing quantity of mine equipment, i.e. lower production.
- Incorporating noise mitigation measures to equipment, particularly the mobile fleet.

- Providing acoustic or ventilation upgrades to the receivers.
- Relocating the receivers further from the mine.

The first five of the above opportunities could be considered by the mine, whereas the last two opportunities would require acceptance from the residents.

8.3.2 Ceasing Operations in Various Time Periods

Usually, noise complaints occur at night, and therefore reducing operations in that time period may reduce impacts.

8.3.3 Ceasing Operations under Particular Meteorological Conditions

From **Table 6.6,** it can be seen that modelled meteorological conditions affect noise levels at sensitive receivers.

It would be possible to setup real time noise monitors, so that the mine can alter operations according to measured noise levels, and thus react to meteorological conditions. However, this does not appear necessary on the basis of the noise emissions modelled. Indeed, it is preferable to have operations that meet noise limits under most, if not all, meteorological conditions.

8.3.4 Moving Mine Equipment Further from the Receivers

Moving noisy equipment away from affected sensitive receivers can reduce noise impacts. This is unlikely to be necessary given modelled noise emissions, however can be a mitigation considered if necessary.

8.3.5 Reduce Quantity of Mine Equipment, i.e. Lower Mine Output

If mine output was reduced, then the quantity of mine equipment could also be reduced, thereby resulting in lower noise emission levels.

A halving of equipment would be expected to provide a reduction of 3 dBA, assuming the shutdown equipment was spread around the mine operations. Similarly, reducing to a quarter of the equipment would be expected to provide a reduction of 6 dBA. If the equipment to be shutdown was the equipment located closest to the receiver, then the reduction could be greater.

Considering the modelled noise emissions for the Project, reducing mine output is not considered applicable.

8.3.6 Noise Mitigation of Equipment

Noise mitigation measures can be applied to equipment, including all the mobile equipment which is located near to the receivers. The noise reductions can be of the order of 3 to 8 dBA, and the costs can be of the order of a $250,000 to $750,000 per item of equipment.

Considering the modelled noise emissions for the Project, reducing mine output is not considered applicable.

8.3.7 Noise Mitigation between Equipment and Receivers

Noise mitigation measures can include bunding constructed between equipment and the receivers. Noise bunding is generally most effective when constructed near the source, e.g. adjacent a haul road, or near the receivers. Noise reduction via this technique is likely to be limited to less than 5 dBA even with quite significant bunding heights. Considering the modelled noise emissions for the Project, reducing mine output is not considered applicable.

8.4 Summary

Noise and vibration complaints are not expected as a result of the Project given the relatively large distance to most sensitive receivers and the modelled noise outputs predictions. Never-the-less in the event of a non-vexatious noise or vibration complaint, monitoring would be recommended. In the event of monitoring indicating an exceedance of EA limits, then noise and/or vibration management measures should be implemented in conjunction with long-term monitoring until such time as complaints and/or exceedances have been resolved.

9. RECOMMENDATIONS AND CONCLUSIONS

A noise and vibration impact assessment has been conducted for the proposed Lake Vermont Meadowbrook Project. Noise monitoring was conducted at three receiver sensitive receiver locations and presented in **Section 5**.

A noise model has been developed for proposed mining activities for the Project years 7 and 22 to predict noise emission levels at nearby sensitive receivers. Calculations have also been made to predict noise and vibration levels due to blasting.

From this assessment, the following conclusions are made:

- Noise limits for the Project have been proposed in **Section 4.8.1** and **Table 4.2**.
  - Noise limits of 40 dBA $L_{Aeq,adj,1hr}$ in the day and evening and 35 dBA $L_{Aeq,adj,1hr}$ in the night at residential sensitive receivers are adopted from the current EA for the existing Lake Vermont mine.
  - The proposed L_{A1} limits are 10 dB above the L_{Aeq} limits as per the DES Acoustic Quality Objectives. The proposed L_{A1} limits are 5 dB above the L_{A1} limits in the current EA for the existing Lake Vermont mine.
  - Compliance with the proposed L_{Aeq} limits is expected to result in compliance with the L_{A1} limits based on noise levels measured from coal mines.
  - The noise limit **Table 4.2** includes the following recommended note: For receivers subject to mining noise from other mine operations and/or ambient noise levels in excess of the nominated noise limits, alternative noise limits may be proposed with due consideration for cumulative noise impacts.
  - It is noted that low frequency (i.e. Z-weighted) noise levels have not been assessed as the current EA and proposed limits do not include low frequency noise limits. It is Trinity's experience with coal mine noise assessments and measurements that compliance with the A-weighted noise limits in **Table 4.2** would result in compliance with low frequency (Z-weighted) noise limits that may be imposed by DES.
- Vibration limits for the Project have been proposed in **Section 4.8.2** and **Table 4.3**. The limits are adopted from the current EA for the existing Lake Vermont mine.
- From the predicted noise levels in **Section 6.5**, exceedances at sensitive receivers are not predicted. It is noted that predicted noise levels at the sensitive receivers are well below the criteria.
- A review of cumulative impacts is undertaken in **Section 6.6**. Given the low noise contribution from the Project it is not expected to result in adverse cumulative noise impacts at sensitive receivers.
- Based on the blasting parameters and calculations in **Section 7**, the ground vibration and airblast levels from blasting are predicted to be acceptable at the nearest sensitive receivers.
- Noise and vibration complaints are not expected as a result of the Project, however, advice on addressing such complaints has been provided in **Section 8**.

APPENDIX A GLOSSARY

Parameter or Term	Description
'A' Weighted	'A' Weighted Frequency filter applied to measured noise levels to represent how humans hear sounds.
dB	The decibel (dB) is the unit measure of sound. Most noises occur in a range of 20 dB (quiet rural area at night) to 120 dB (nightclub dance floor or concert).
dBA	Noise levels are most commonly expressed in terms of the 'A' weighted decibel scale, dBA. This scale closely approximates the response of the human ear, thus providing a measure of the subjective loudness of noise and enabling the intensity of noises with different frequency characteristics (e.g. pitch and tone) to be compared.
Frequency	The number of vibrations, or complete cycles, that take place in one second. Measured in hertz (Hz), where one Hz equals one cycle per second. A young person with normal hearing will be able to perceive frequencies between approximately 20 and 20,000 Hz. With increasing age, the upper frequency limit tends to decrease.
dB, dB(linear) or dBZ	Noise levels are sometimes expressed in terms of the linear, Z or un-weighted decibel scale – they all take the same meaning. The value has no weighting applied to it and is the same as the dB level.
Octave band	Ranges of frequencies where the highest frequency of the band is double the lowest frequency of the band. The band is usually specified by the centre frequency, i.e. 31.5, 63, 125, 250, 500 Hz, etc.
Day	The period between 7am and 6pm.
Evening	The period between 6pm and 10pm.
Night	The period between 10pm and 7am.
Free-field	The description of a noise receiver or source location which is away from any significantly reflective objects (e.g. buildings, walls).
Noise sensitive receiver or Noise sensitive receptor	The definition can vary depending on the project type or location, but generally defines a building or land area which is sensitive to noise. Generally it includes residential dwellings (e.g. houses, units, caravans, marina), medical buildings (e.g. hospitals, health clinics, medical centres), educational facilities (e.g. schools, universities, colleges),
L_1	The noise level exceeded for 1% of the measurement period.
L_{10}	The noise level exceeded for 10% of the measurement period. It is sometimes referred to as the average maximum noise level.
L_{90}	The noise level exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L_{eq}	The equivalent continuous sound level, which is the constant sound level over a given time period, which is equivalent in total sound energy to the time-varying sound level, measured over the same time period.
$L_{eq,1hour}$	As for Leq except the measurement intervals are defined as 1 hour duration.
$L_{eq,adj,T}$	The Leq adjusted for tonal or impulsive noise characteristics and with a measurement interval of 'T' duration (e.g. 15 minutes, 1 hour).
Sound power level (L_W)	The sound power level of a noise source is its inherent noise, which does not vary with distance from the noise source. It is not directly measured with a sound level meter, but rather is calculated from the measured noise level and the distance at which the measurement was undertaken.

APPENDIX B NOISE MONITORING LOCATIONS

Figure B.1: Noise Monitoring Location A (Meadowbrook)

Figure B.2: Noise Monitoring Location B (Lake Vermont)

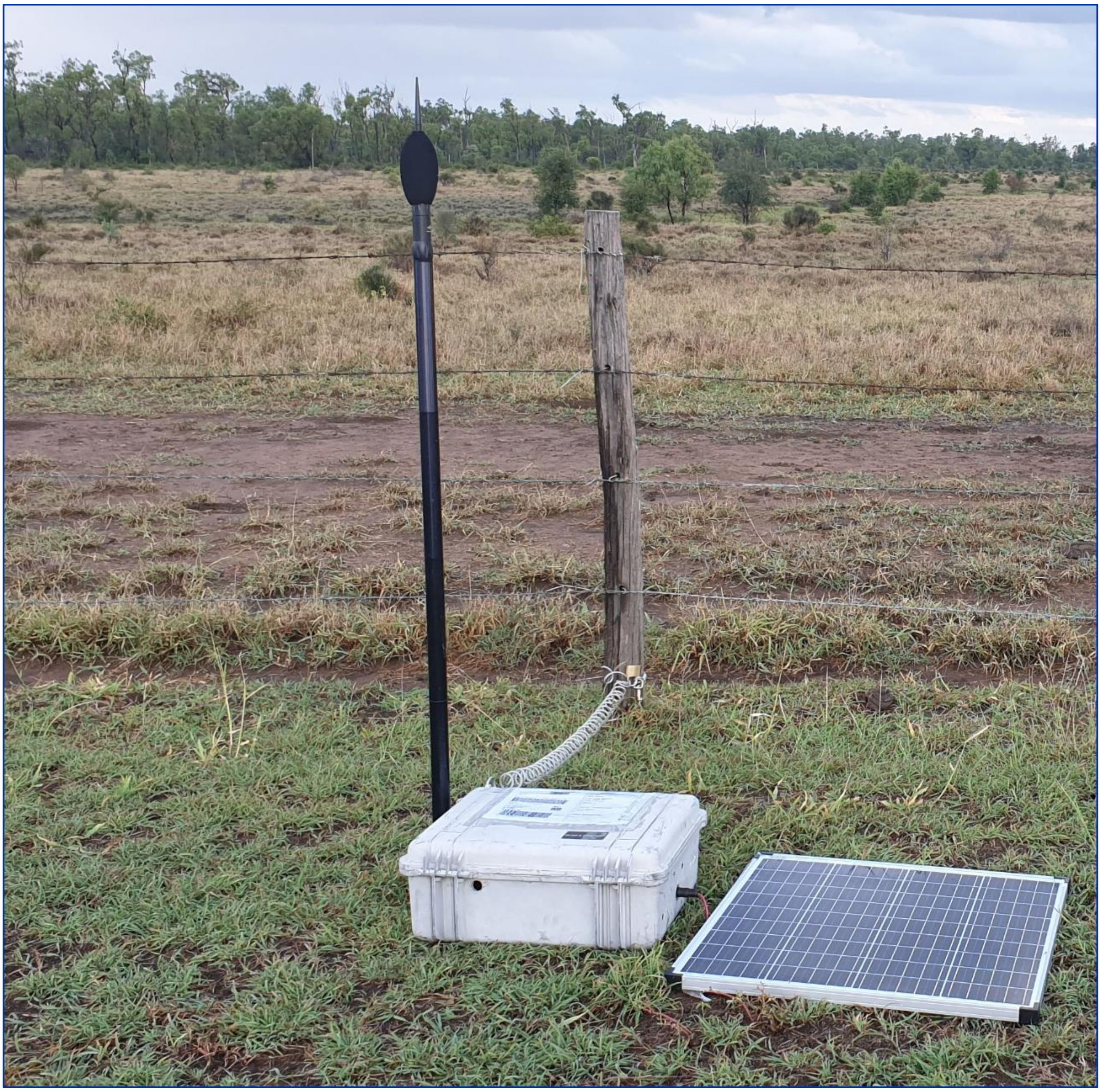


Figure B.3: Noise Monitoring Location C (Old Kyewong)

APPENDIX C NOISE LOGGING DATA

Figure C.1: Graph of Noise Logging Results at Meadowbrook

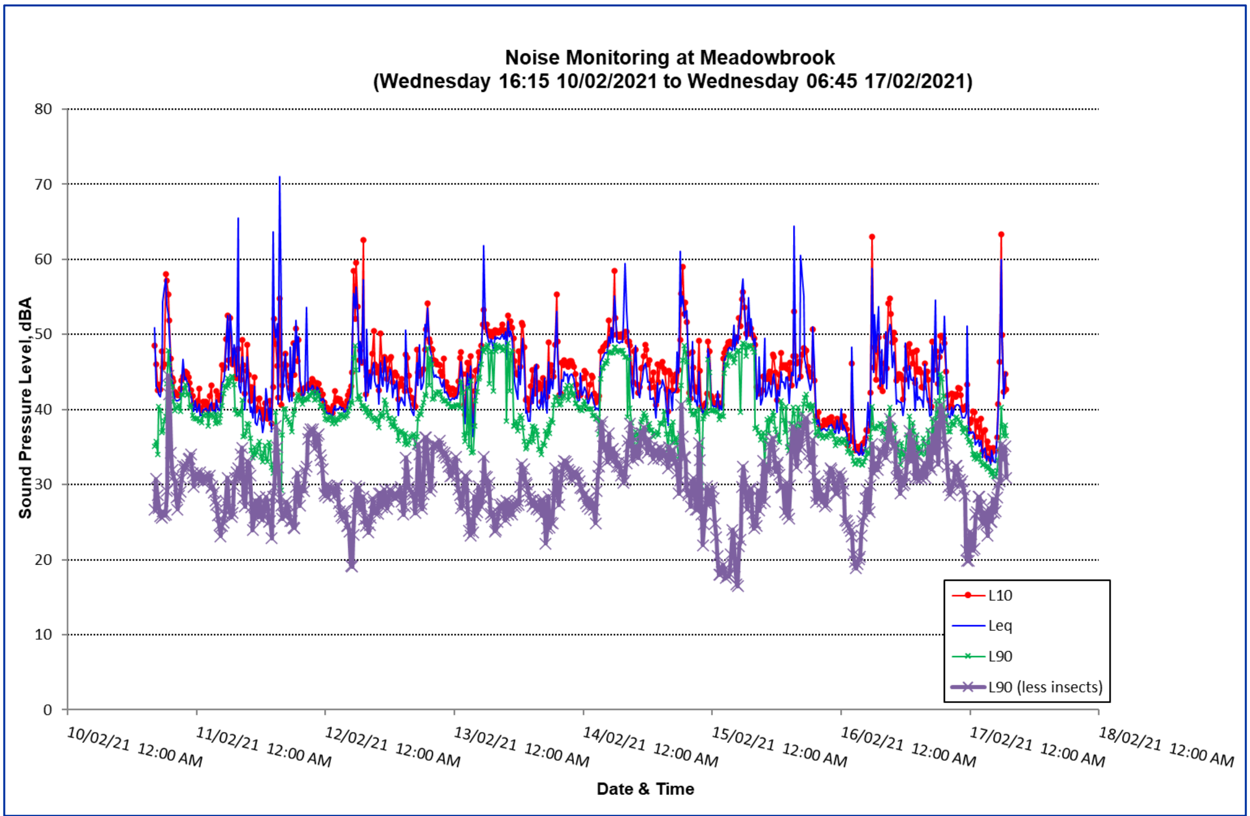


Figure C.2: 24 Hour Noise Monitoring Results at Meadowbrook

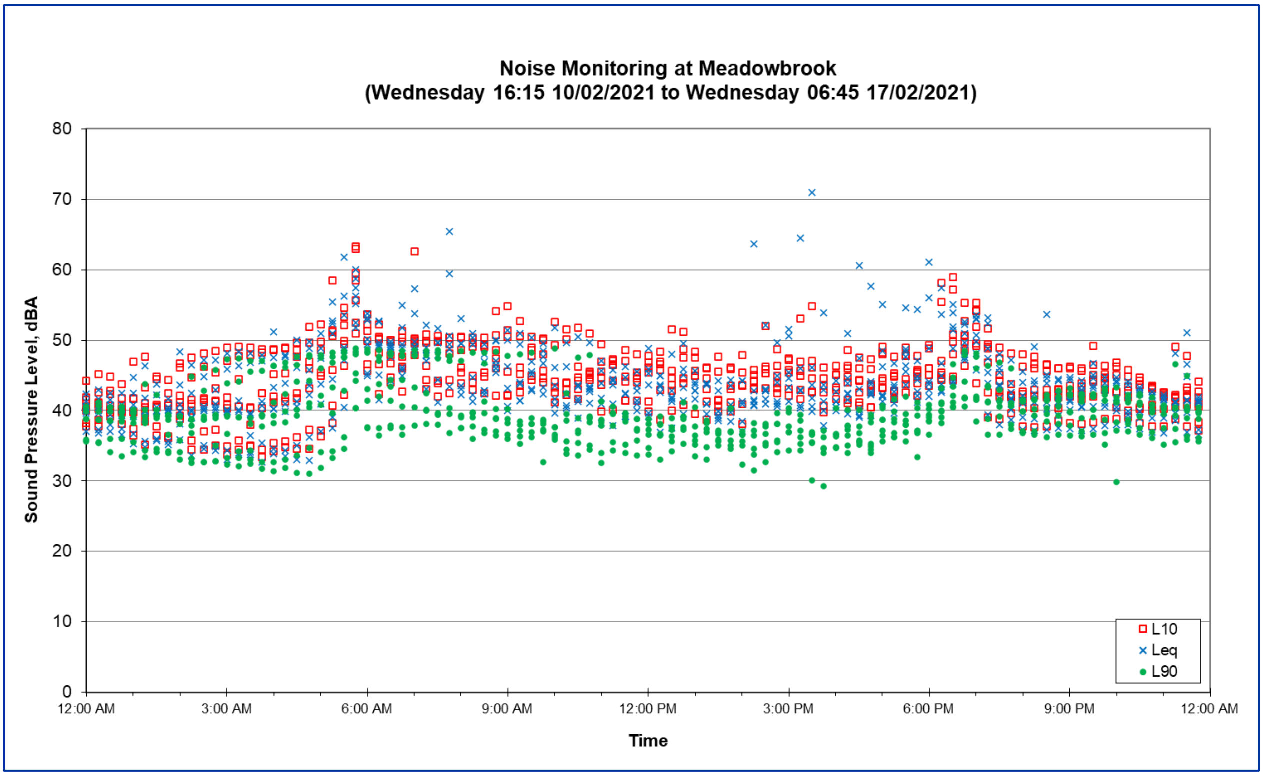


Figure C.3: Graph of Noise Logging Results at Lake Vermont

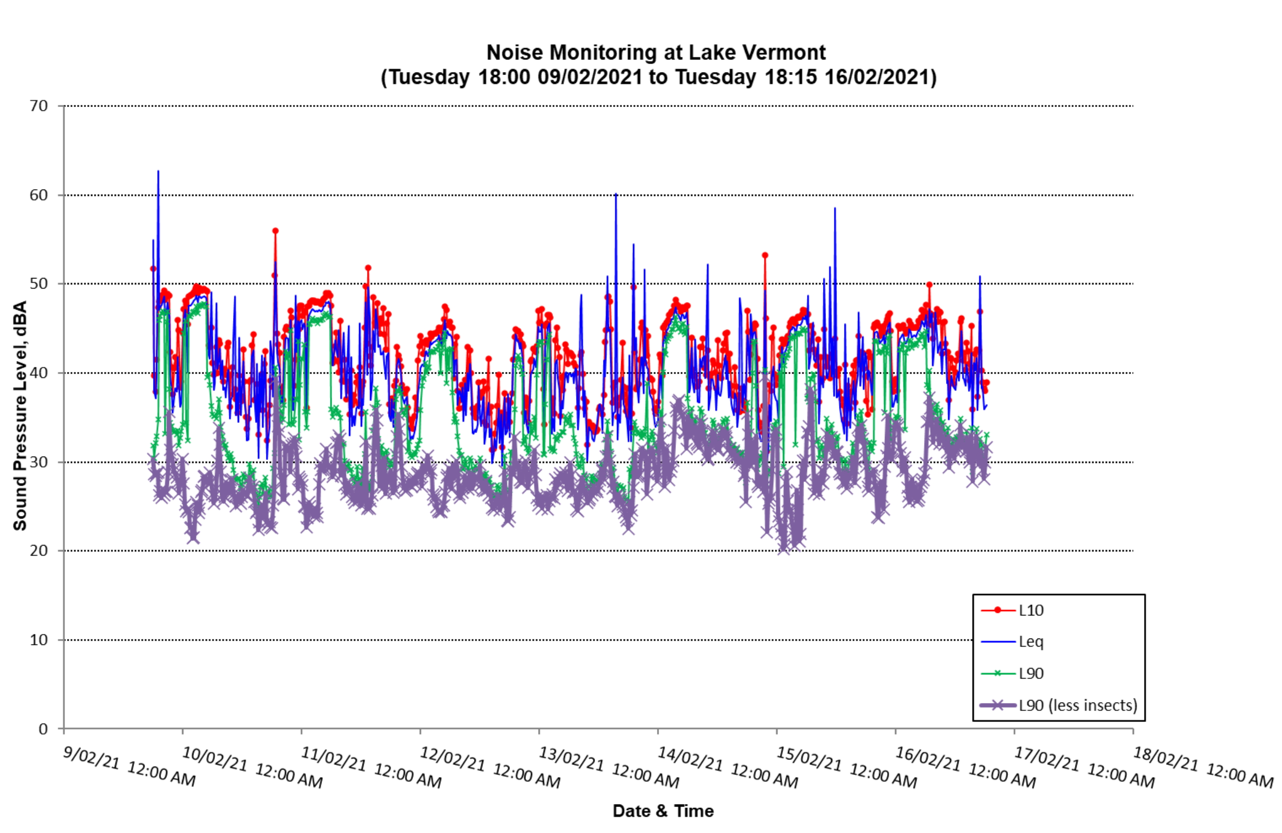


Figure C.4: 24 Hour Noise Monitoring Results at Lake Vermont

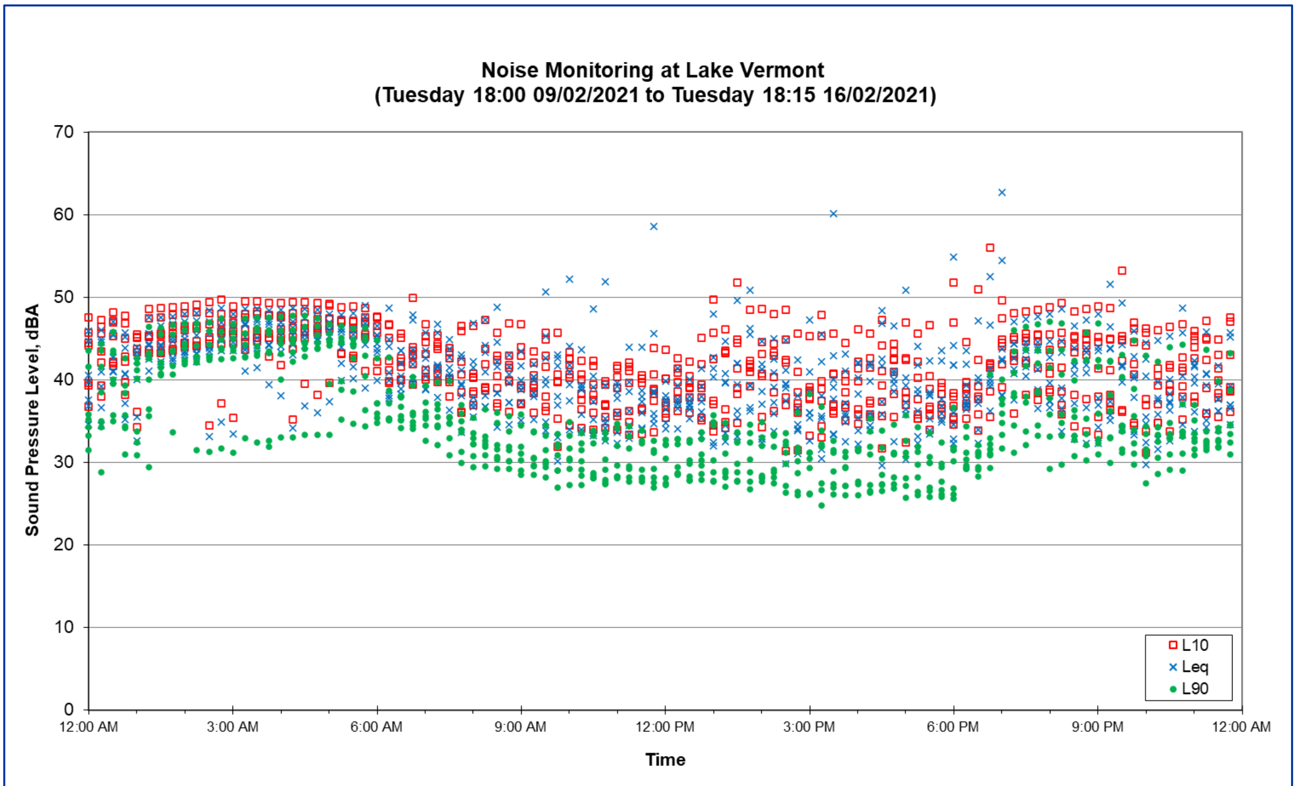


Figure C.5: Graph of Noise Logging Results at Old Kyewong

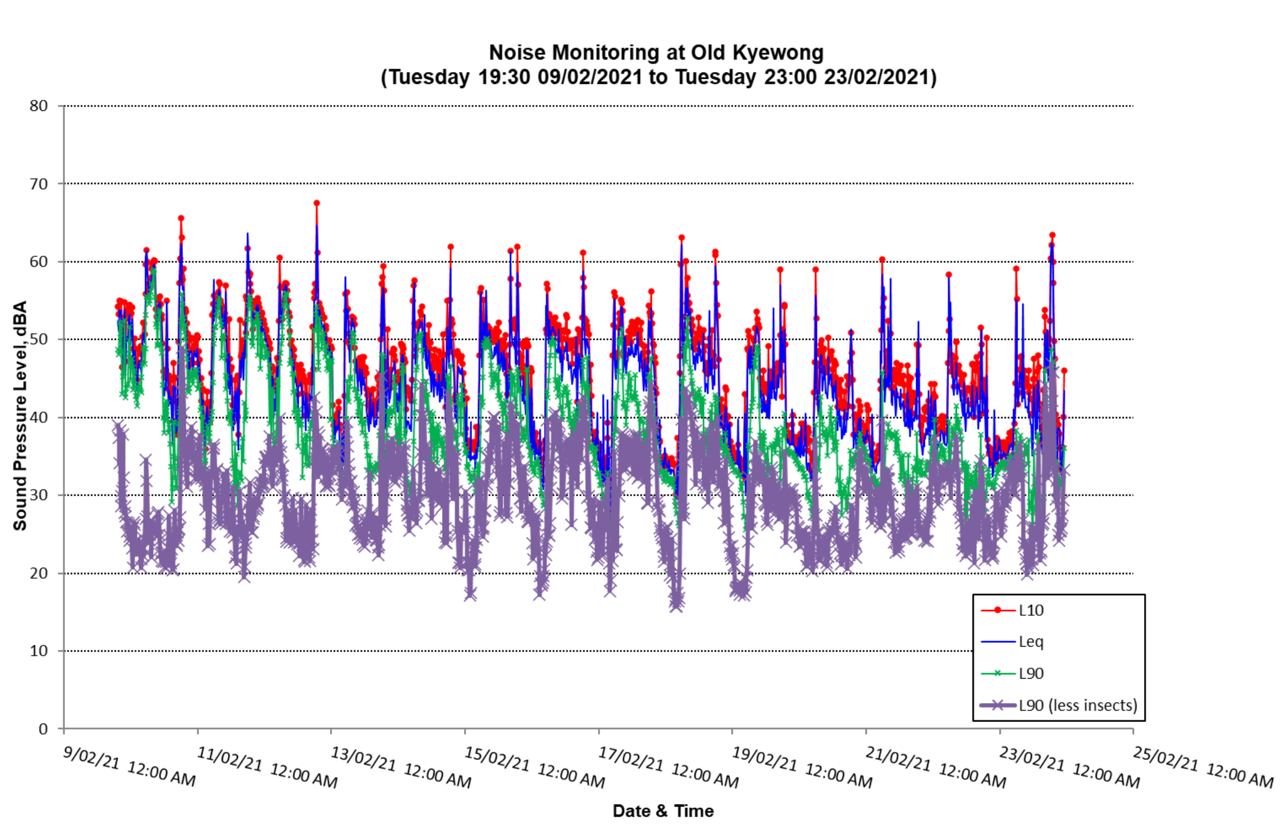


Figure C.6: 24 Hour Noise Monitoring Results at Old Kyewong

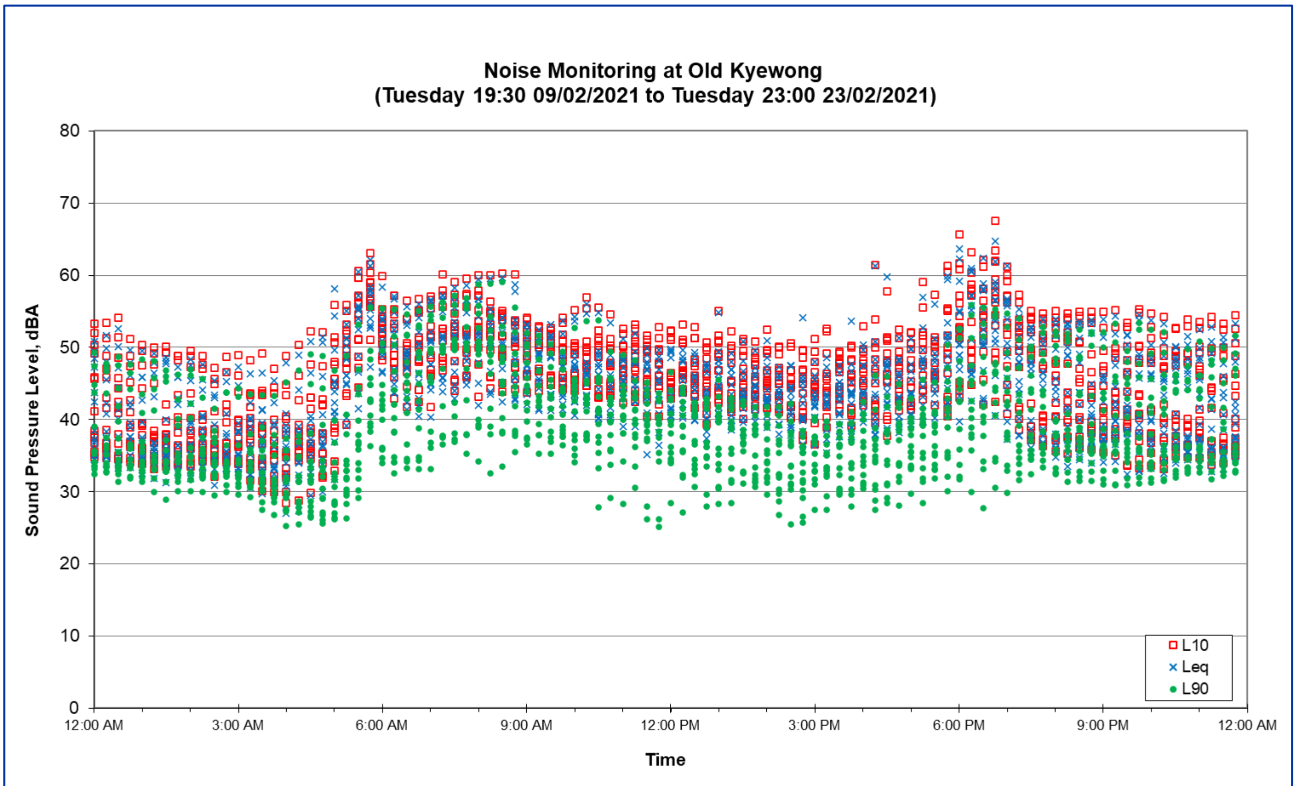


Table C.1: Statical Noise Levels at Location A (Meadowbrook)

Parameter	Noise Levels dBA [Maximum – Top 10% - (Average) – Bottom 10% - Minimum]		
	Day	Evening	Night
L_{max}	89, 72, (62), 53, 48	89, 74, (59), 47, 40	93, 70, (54), 44, 38
L_1	86, 62, (53), 46, 42	71, 64, (51), 43, 40	72, 61, (47), 39, 34
L_{10}	63, 50, (46), 41, 38	59, 51, (45), 40, 38	63, 50, (43), 37, 33
L_{eq}	71, 50, (45), 40, 37	61, 53, (45), 39, 37	62, 50, (43), 36, 33
L_{90}	49, 42, (38), 34, 29	48, 44, (41), 37, 35	49, 47, (40), 34, 30
L_{eq} (less insects)	71, 48, (40), 33, 30	60, 45, (38), 31, 29	55, 44, (34), 28, 20
L_{90} (less insects)	39, 36, (30), 26, 22	45, 36, (32), 27, 24	38, 33, (28), 21, 16

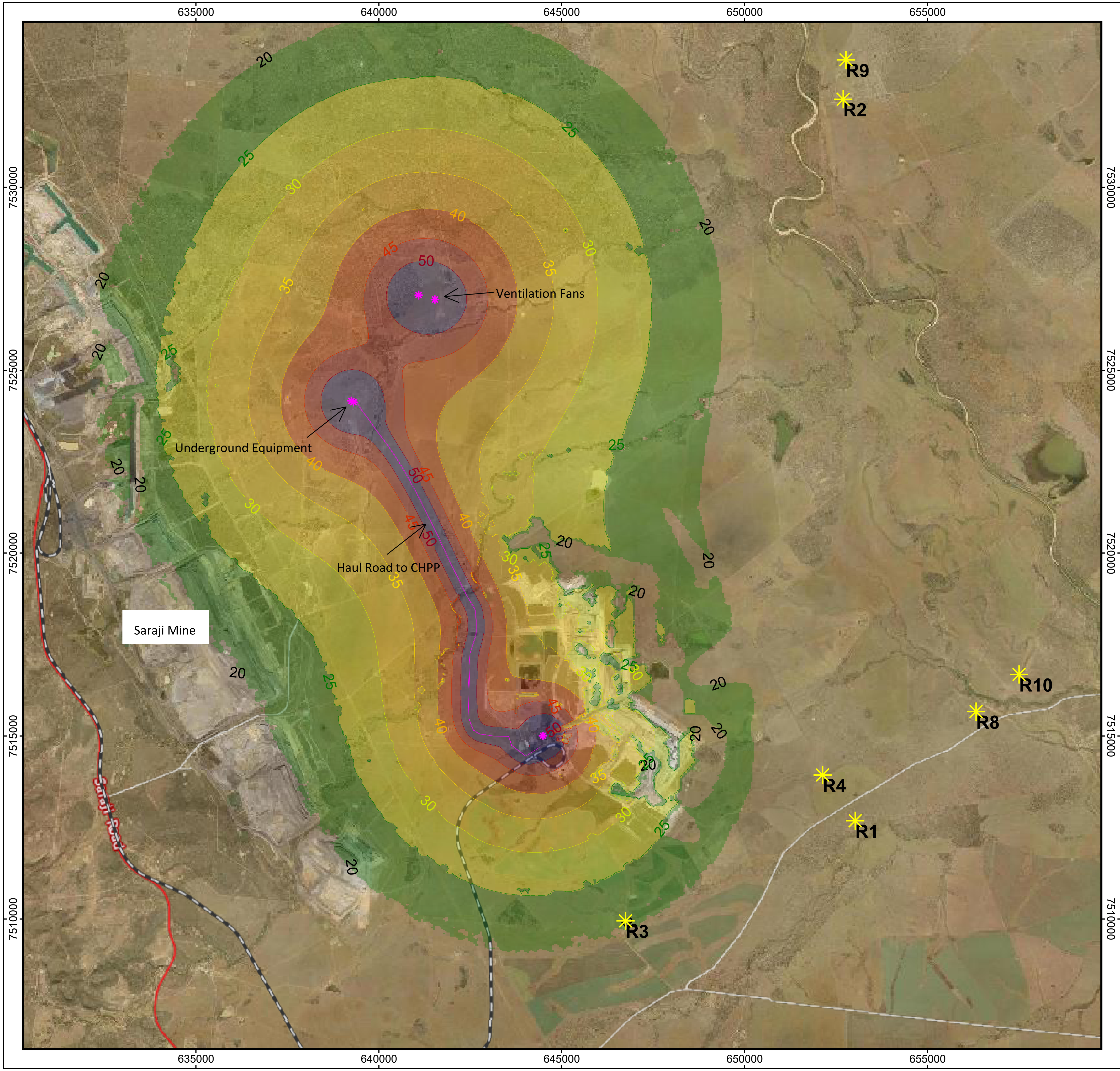
Table C.2: Statical Noise Levels at Location B (Lake Vermont)

Parameter	Noise Levels dBA [Maximum – Top 10% - (Average) – Bottom 10% - Minimum]		
	Day	Evening	Night
L_{max}	88, 71, (61), 52, 46	90, 69, (57), 47, 41	82, 60, (52), 46, 42
L_1	74, 54, (48), 42, 37	68, 54, (47), 41, 36	63, 50, (47), 42, 36
L_{10}	52, 45, (40), 35, 31	56, 48, (42), 36, 33	50, 48, (44), 38, 31
L_{eq}	60, 44, (39), 34, 30	63, 47, (41), 34, 32	49, 47, (43), 36, 30
L_{90}	40, 35, (31), 27, 25	47, 44, (36), 30, 26	48, 46, (39), 32, 28
L_{eq} (less insects)	60, 41, (36), 32, 28	62, 41, (35), 30, 29	48, 38, (33), 28, 23
L_{90} (less insects)	38, 33, (29), 25, 22	40, 33, (29), 26, 22	38, 33, (28), 24, 20

Table C.3: Statical Noise Levels at Location C (Old Kyewong)

Parameter	Noise Levels dBA [Maximum – Top 10% - (Average) – Bottom 10% - Minimum]		
	Day	Evening	Night
L_{max}	90, 71, (63), 55, 46	91, 76, (60), 47, 38	89, 70, (55), 43, 38
L_1	74, 59, (53), 47, 43	76, 64, (52), 41, 35	74, 59, (47), 37, 31
L_{10}	61, 53, (48), 42, 37	68, 57, (48), 38, 33	63, 53, (43), 35, 28
L_{eq}	61, 52, (46), 40, 35	65, 56, (46), 37, 32	62, 52, (41), 33, 27
L_{90}	59, 50, (39), 31, 25	56, 52, (41), 33, 28	56, 47, (37), 30, 25
L_{eq} (less insects)	55, 45, (39), 32, 26	62, 48, (39), 29, 24	58, 45, (35), 26, 17
L_{90} (less insects)	44, 37, (30), 23, 19	49, 39, (32), 25, 21	40, 35, (28), 21, 16

APPENDIX D PREDICTED NOISE CONTOURS



Meadowbrook Lake Vermont Mine
Project Number: 207401.0166

N

Figure
D.1

Year 2032 Noise Contours
Day - Scenario D2

Date: 3/02/2022
Drawn By: PJ
Prepared For: Bowen Basin Coal Ltd

Free Field Noise Levels Leq(15min) dBA

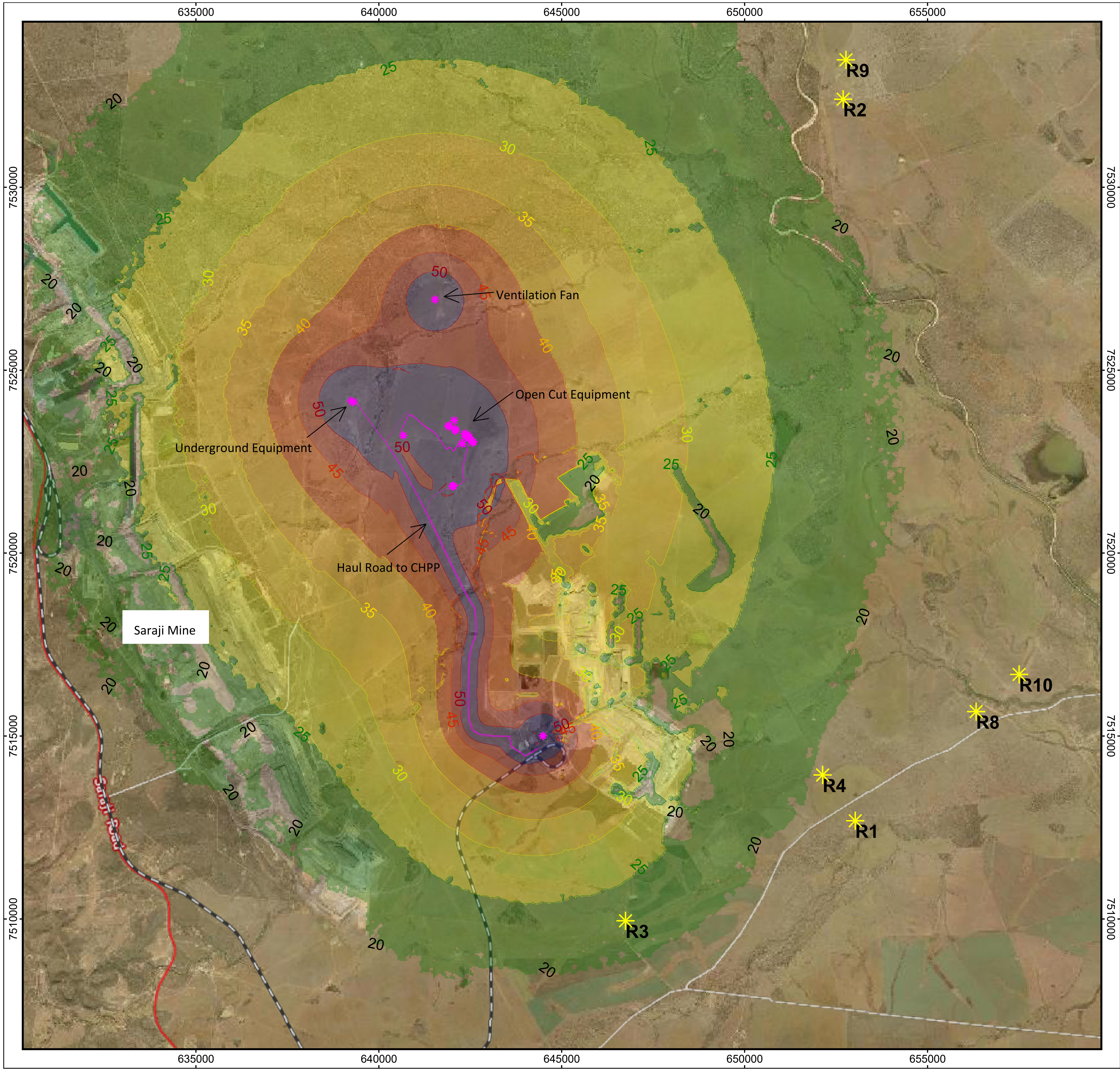
Ground Contour Calculations Height = 2.0m

20 <	<=	25
25 <	<=	30
30 <	<=	35
35 <	<=	40
40 <	<=	45
45 <	<=	50
50 <		

Signs and Symbols

- Point receiver
- Point source
- Line source

Trinity Consultants Australia



Meadowbrook Lake Vermont Mine
Project Number: 207401.0166

N

Figure
D.2

Year 2047 Noise Contours
Day - Scenario D2

Date: 3/02/2022
Drawn By: PJ
Prepared For: Bowen Basin Coal Ltd

Free Field Noise Levels Leq(15min) dBA

Ground Contour Calculations Height = 2.0m

20 <	(green)	<=	25
25 <	(yellow-green)	<=	30
30 <	(yellow)	<=	35
35 <	(orange)	<=	40
40 <	(red)	<=	45
45 <	(dark red)	<=	50
50 <	(dark blue)		

Signs and Symbols

- Point receiver
- Point source
- Line source

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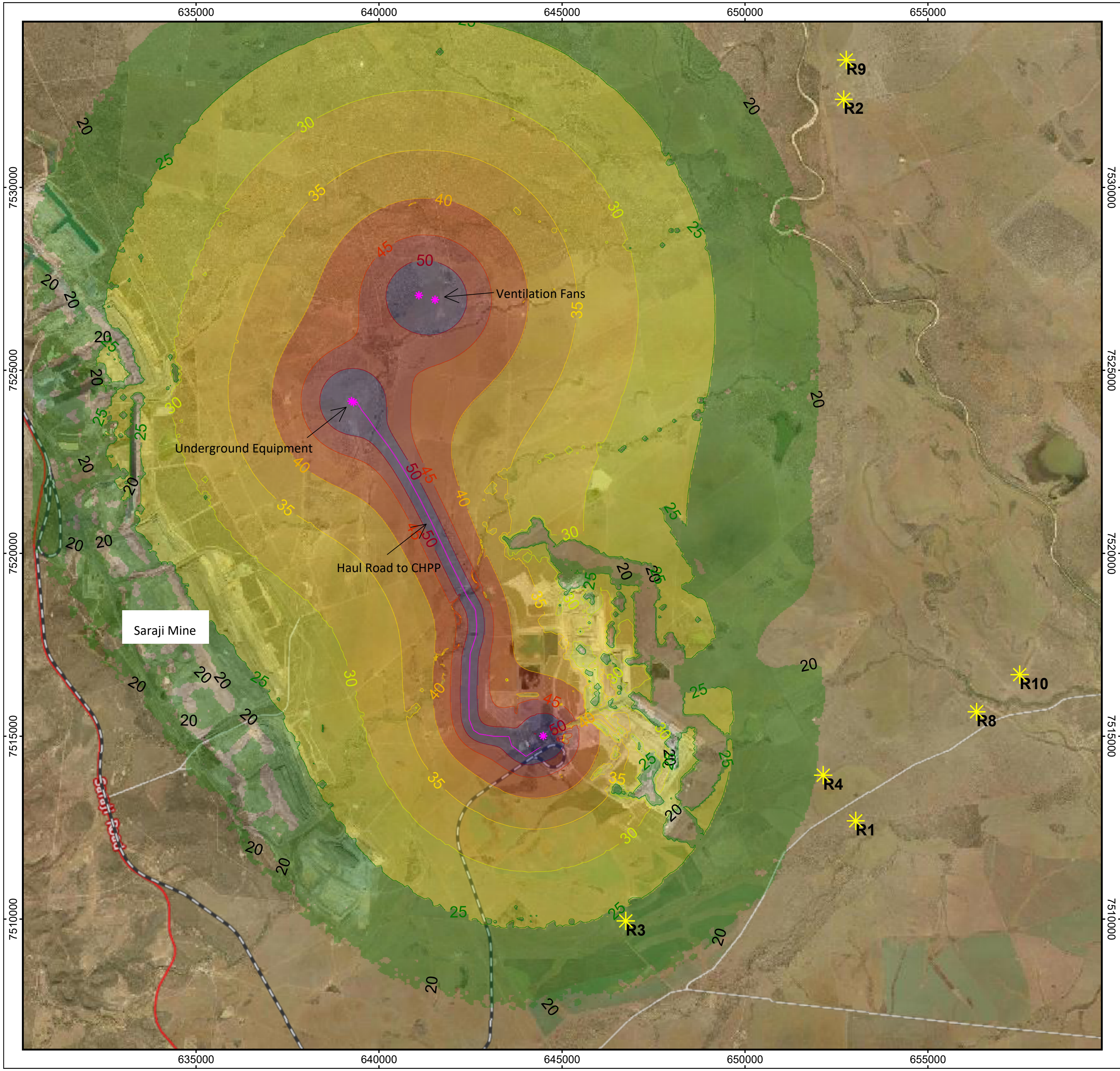

Meadowbrook Lake Vermont Mine
Project Number: 207401.0166

N

Figure
D.3

Year 2032 Noise Contours
Night - Scenario N1

Date: 4/02/2022
Drawn By: PJ
Prepared For: Bowen Basin Coal Ltd

Free Field Noise Levels Leq(15min) dBA

Ground Contour Calculations Height = 2.0m

20 <		<=	25
25 <		<=	30
30 <		<=	35
35 <		<=	40
40 <		<=	45
45 <		<=	50
50 <			

Signs and Symbols

- Point receiver
- Point source
- Line source

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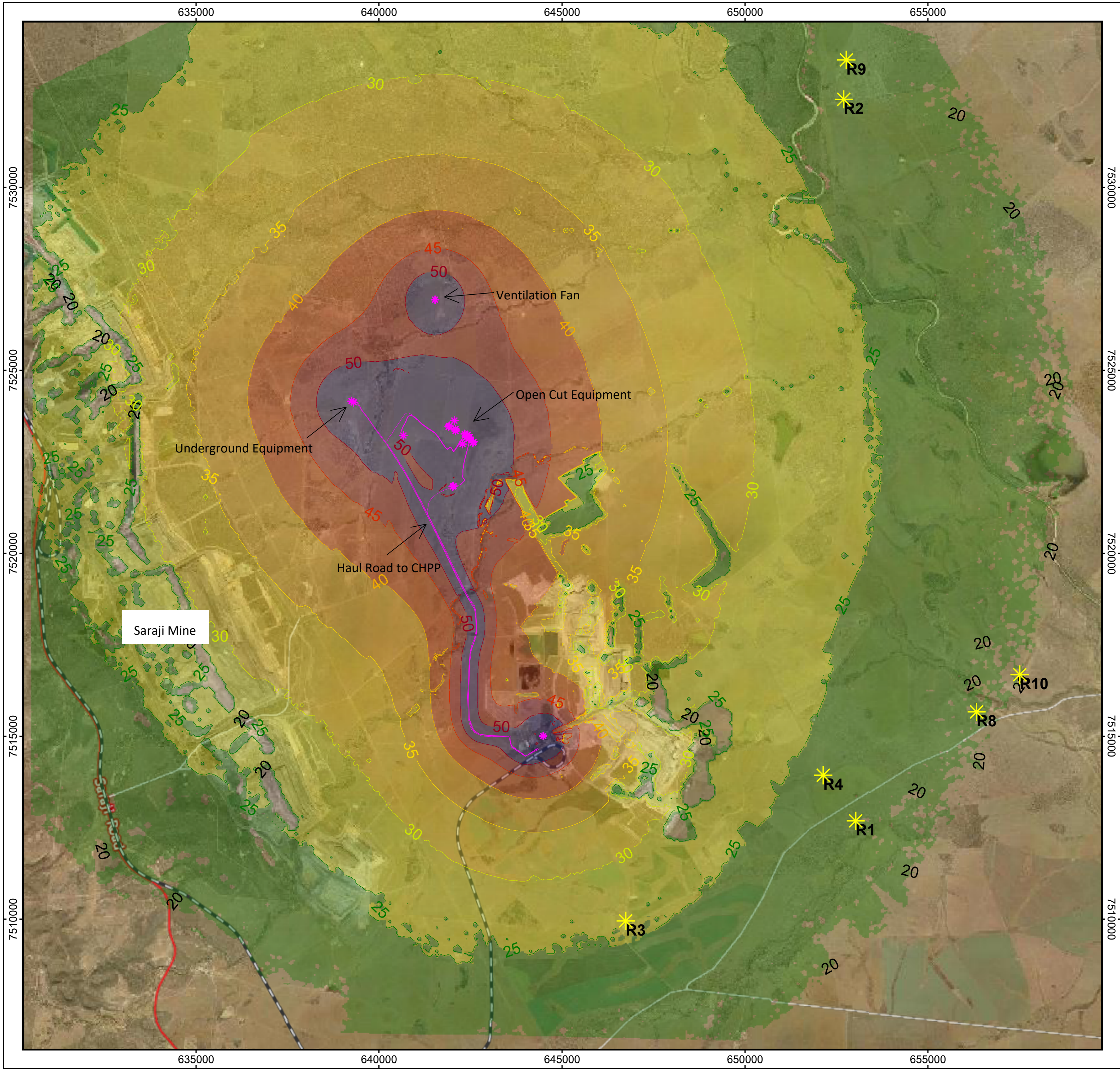

Meadowbrook Lake Vermont Mine
Project Number: 207401.0166

N

Figure
D.4

Year 2047 Noise Contours
Night - Scenario N1

Date: 4/02/2022
Drawn By: PJ
Prepared For: Bowen Basin Coal Ltd

Free Field Noise Levels Leq(15min) dBA

Ground Contour Calculations Height = 2.0m

20 <	<=	25
25 <	<=	30
30 <	<=	35
35 <	<=	40
40 <	<=	45
45 <	<=	50
50 <		

Signs and Symbols

Point receiver
Point source
Line source

Trinity Consultants Australia

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