F.3 Noise impact assessment

Gunlake Quarry Continuation Project (SSD-12469087)

Noise impact assessment report

Prepared for Gunlake Quarries Pty Ltd
September 2021

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Gunlake Quarry Continuation Project (SSD-12469087)

Noise impact assessment

Report Number

J190263 RP9

Client

Gunlake Quarries Pty Ltd

Date

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Version

v1 Final

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9 September 2021

Approved by

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Director
9 September 2021

Executive Summary

ES1 Introduction

Gunlake Quarries Pty Ltd (Gunlake) operates a hard rock quarry (the 'Quarry') located at 715 Brayton Road, Marulan NSW. The Quarry is approximately 7 kilometres (km) north-west of the centre of Marulan in the Goulburn Mulwaree local government area. The land surrounding the Quarry is rural land with a low population density. Gunlake commenced operations in 2009 under project approval 07-0074 granted in September 2008.

Since the Quarry received approval for the Extension Project in 2017 (SSD 7090, NSW Land and Environmental Court Approval 20017/108663), the tonnage of saleable product dispatched by the Quarry has steadily increased and, with an infrastructure boom across the State, Gunlake forecast that demand for products from the Quarry will continue to increase. In response to the increased demand for products from the Quarry, it is proposed to transport more saleable product along the Primary Transport Route. This will require an increase in truck movements than what is currently approved. The additional truck movements will all occur on the recently upgraded Primary Transport Route that has been designed to accommodate comfortably the additional truck movements. The Project is known as the Gunlake Quarry Continuation Project (the 'Continuation Project'). The ignimbrite hard-rock resource will continue to be extracted and processed using the methods currently employed at the Quarry.

The Continuation Project is classified as a State Significant Development (SSD) under Schedule 1, Clause 7 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). This report accompanies a new SSD application and environmental impact statement (EIS) for the Continuation Project.

ES2 Gunlake Quarry Continuation Project

Gunlake seeks a new development approval for the Continuation Project that allows:

- ongoing Quarry operations;
- a maximum of 375 inbound and 375 outbound daily truck movements with up to 4.2 million tonnes per annum (Mtpa) of Quarry products transported from the site in any calendar year;
- 24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday;
- an extraction depth of 546 metres Australian Hight Datum (mAHD); and
- a 30-year Quarry life (from the date of Continuation Project approval).

ES3 Assessment of impacts

ES3.1 Operational noise

An assessment of operational noise for the Continuation Project was undertaken in accordance with the Noise Policy for Industry (NPfI) (EPA 2017). Operational noise limits (project noise trigger levels, PNTLs) were established and included consideration of cumulative industrial noise from other industrial developments in the vicinity. The assessment of Gunlake Quarry noise emissions included consideration of noise characteristics (eg low frequency noise) and a maximum noise event assessment as per the NPfI.

Operational noise levels are predicted to meet relevant noise limits at all assessment locations with the exception of R2. Hence, noise from the Continuation Project is predicted to have negligible impact on the majority of assessment locations.

R2 is an existing dwelling that is currently exposed to quarry noise and qualifies for voluntary acquisition in accordance with Schedule 3 Condition 1 of the Conditions of Consent of the Extension Project Approval. It is recommended that voluntary acquisition rights continue to apply at this residence.

ES3.2 Construction noise

Construction of a new weighbridge and road resurfacing activities will occur within the next few years as part of ongoing quarry operations. These activities will occur during standard construction hours (ie daytime only) and will be relatively short-term duration. Noise emissions from these activities will be consistent with the nature of noise from operational activity and not expected to generate additional noise impact at the nearest noise-sensitive receptors. Given the preceding, a detailed assessment of construction noise impacts has not been included within this report.

ES3.3 Road traffic noise

Existing road traffic noise has been monitored as follows:

- Gunlake Quarry Road Traffic Noise Compliance Assessment (EMM 2020) addressing Schedule 3 Condition 9 of the NSW Land and Environment Court (LEC) Approval 2017/108663, in August 2020; and
- Road traffic noise monitoring undertaken by EMM in November 2020.

This road traffic noise monitoring found that road traffic noise levels generated by Gunlake Quarry and other road users during day and night periods satisfied the relevant noise limits.

As no changes are proposed to Gunlake Quarry traffic volumes on the Secondary Transport Route, noise levels along this route will not change. The road traffic noise on the Primary Transport Route was assessed for the Continuation Project by updating the Extension Project predictions (EMM 2016), by incorporating the measured noise levels of Gunlake Quarry trucks and increased truck numbers. The future total road traffic noise levels, inclusive of Gunlake Quarry trucks associated with the Continuation Project, are predicted to satisfy the relevant road traffic noise criteria at the nearest potentially affected residences on Brayton Road, Ambrose Road and Red Hills Road.

ES3.4 Vibration

The footprint of the Quarry pit and blasting methods and frequency are not proposed to change. Hence, vibration from operational activity is not expected to change as a result of the Continuation Project compared to that currently approved.

Given the separation distance of at least 800 m between the Quarry boundary and the nearest assessment locations, vibration levels are expected to remain below levels that could cause disturbance to residents.

ES4 Evaluation of the project

Gunlake Quarry is ideally located from a noise emission perspective due to distance and natural topographic shielding between the Quarry and the nearest private residences. Gunlake also implement noise mitigation and management measures at the Quarry to minimise off-site noise impacts.

Operational and road traffic noise levels associated with the Continuation Project are predicted to meet relevant noise limits except at assessment location R2. R2 is an existing dwelling that is currently exposed to quarry noise and qualifies for voluntary acquisition in accordance with Schedule 3 Condition 1 of the Conditions of Consent of the Extension Project Approval. These voluntary acquisition rights will continue to apply at this residence.

Existing noise mitigation and management measures will continue to be implemented and maintained. Gunlake will continue to undertake operational noise compliance monitoring on a quarterly basis. If the Continuation Project is approved, Gunlake will be required to review and/or update all management plans applicable to the site.

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Tables

Figures

1 Introduction

1.1 Overview

Gunlake Quarries Pty Ltd (Gunlake) operates a hard rock quarry (the 'Quarry') located at 715 Brayton Road, Marulan NSW. The Quarry is approximately 7 kilometres (km) north-west of the centre of Marulan in the Goulburn Mulwaree local government area (Figure 1.1). The land surrounding the Quarry is rural land with a low population density. Gunlake commenced operations in 2009 under project approval 07-0074 granted in September 2008.

Since the Quarry received approval for the Extension Project in 2017 (SSD 7090, NSW Land and Environmental Court Approval 20017/108663), the tonnage of saleable product dispatched by the Quarry has steadily increased and, with an infrastructure boom across the State, Gunlake forecast that demand for products from the Quarry will continue to increase. In response to the increased demand for products from the Quarry, it is proposed to transport more saleable product along the Primary Transport Route. This will require an increase in truck movements than what is currently approved. The additional truck movements will all occur on the recently upgraded Primary Transport Route that has been designed to accommodate comfortably the additional truck movements. The Project is known as the Gunlake Quarry Continuation Project (the 'Continuation Project'). The ignimbrite hard-rock resource will continue to be extracted and processed using the methods currently employed at the Quarry.

The Continuation Project is classified as a State Significant Development (SSD) under Schedule 1, Clause 7 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). This report accompanies a new SSD application and environmental impact statement (EIS) for the Continuation Project.

1.2 Assessment requirements

This Noise Impact Assessment has been prepared to assess the noise impacts of the Continuation Project on noise-sensitive receptors in the surrounding area. It has been completed with reference to the following guidelines and policies:

- Department of Environment and Climate Change (DECC) NSW 2009, Interim Construction Noise Guideline (ICNG);
- NSW Environment Protection Authority (EPA) 2017, Noise Policy for Industry (NPfI);
- NSW Department of Environment, Climate Change and Water (DECCW) 2011, Road Noise Policy (RNP); and
- NSW Government 2018, Voluntary Land Acquisition and Mitigation Policy (VLAMP).

This report comprises of the following sections:

- a description of the project, local setting and the Quarry surrounds;
- a summary of existing noise limits, noise mitigation and management measures and compliance with current noise-related conditions of consent;
- a description of baseline inputs, specifically:
    - meteorology; and
    - existing ambient noise environment;

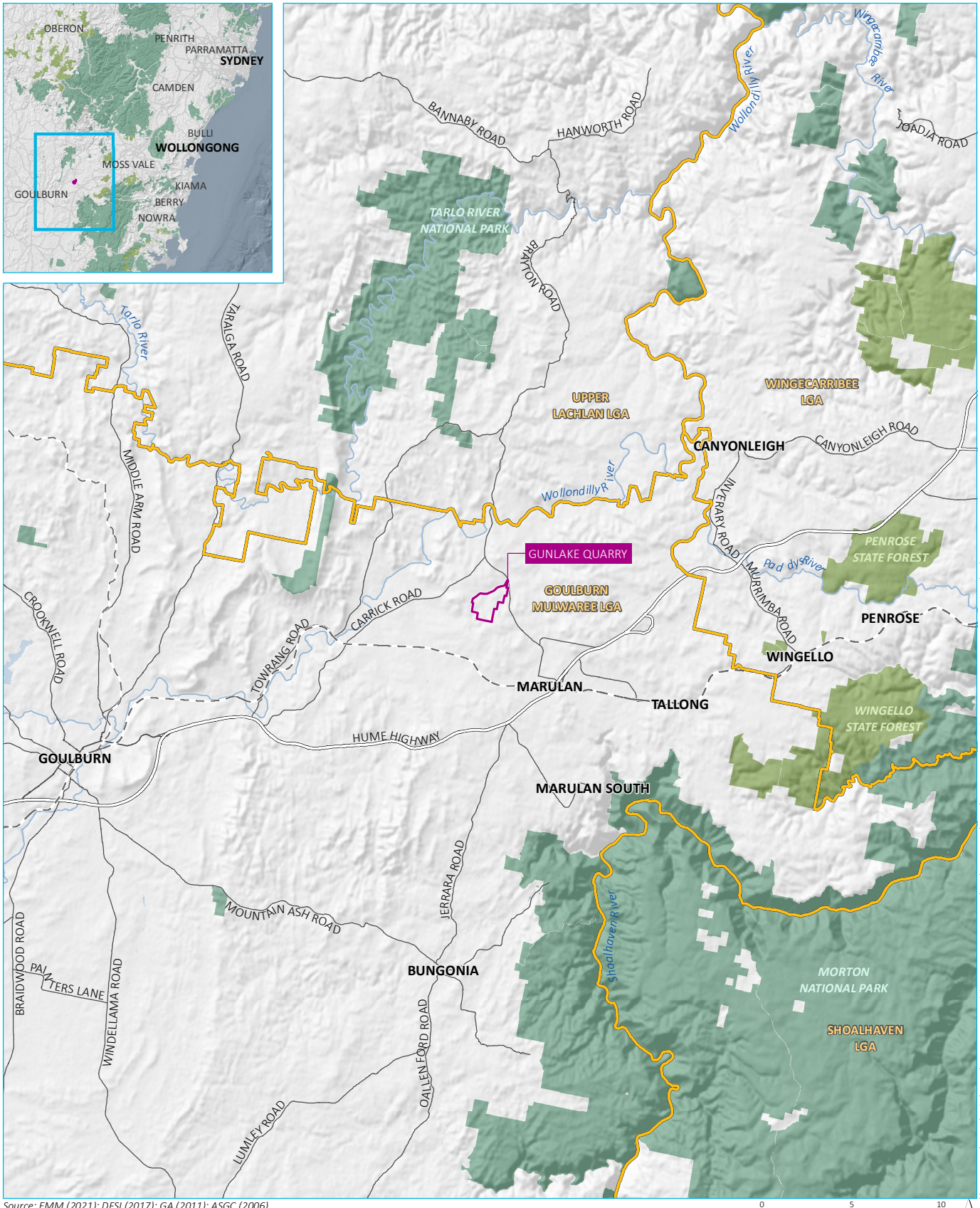
- a summary of the assessment methodology;
- details of noise sources associated with the Continuation Project;
- results and assessment of operational and road traffic noise predictions; and
- overview of mitigation measures and monitoring requirements for the facility.

This assessment was prepared in accordance with the requirements of the NSW Department of Planning, Industry and Environment (DPIE) which were set out in the Planning Secretary's Environmental Assessment Requirements (SEARs) for the Continuation Project, issued on 6 May 2021. The SEARs identify matters which must be addressed in the EIS and essentially form its terms of reference. Table 1.1 lists individual requirements relevant to this Noise Impact Assessment and where they are addressed in this report.

Table 1.1 Noise related SEARs

Requirement	Section addressed
Noise & Blasting – including:	
- a detailed assessment of the likely construction, operational and off- site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy (2018);	This whole report.
- proposed blasting hours, frequency and methods; and	Sections 2.2 and 7
- a detailed assessment of the likely blasting impacts of the development (including ground vibrations, overpressure, fly rock, visual and fumes/odour) on people, animals, buildings/structures, infrastructure and significant natural features, having regard to the relevant ANZEC guidelines (if any changes to blasting are proposed);	Section 7

A number of technical terms have been utilised throughout this report for the discussion of noise and vibration. These are explained in the Glossary.



Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Site boundary
- Local government area
- Rail line
- Highway
- Major road
- River
- Waterbody
- NPWS reserve
- State forest

Regional context

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 1.1

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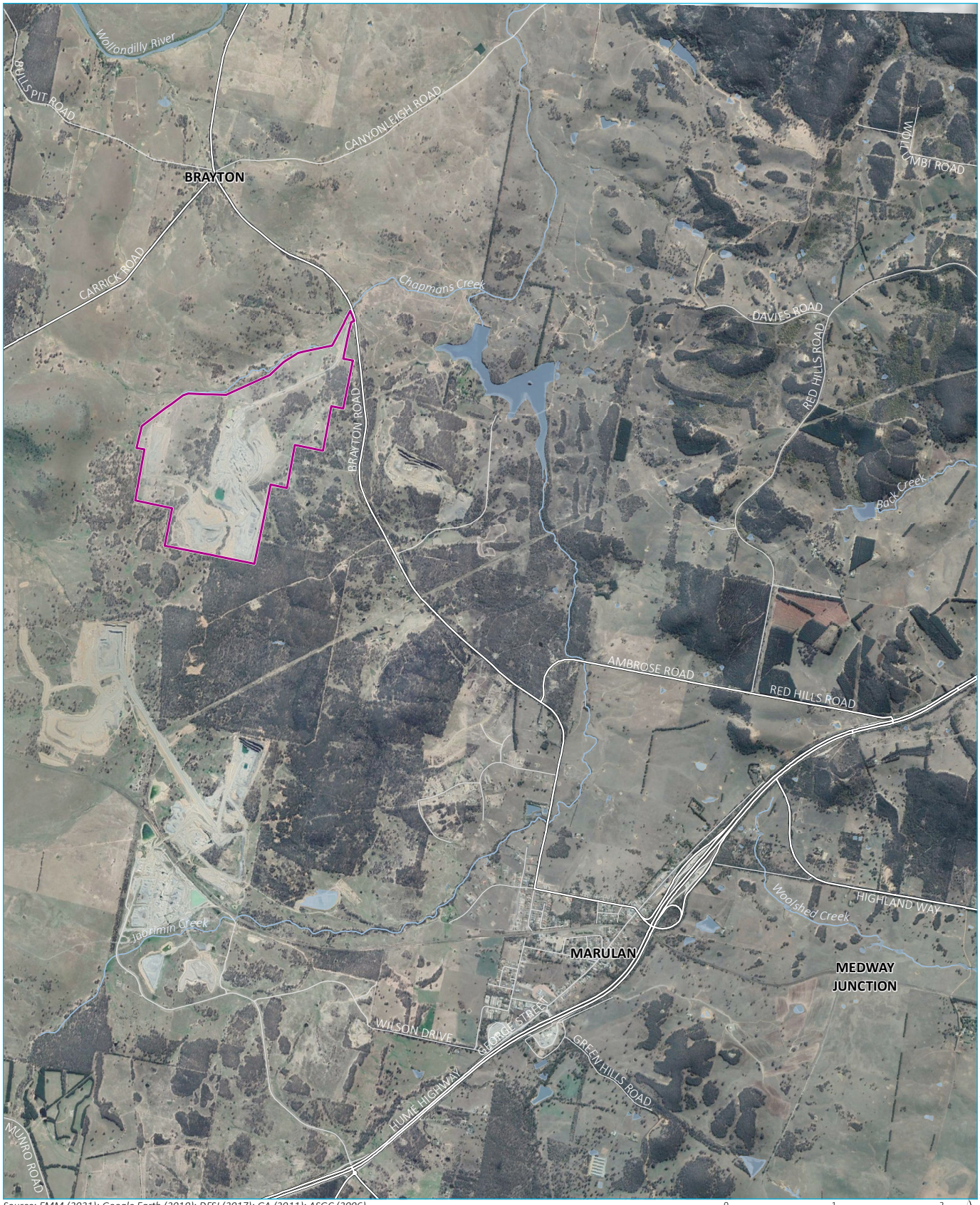
2 Project description and setting

2.1 The site

The Quarry is located wholly on Lot 13 DP 1123374 (the 'Quarry site'). There are biodiversity management areas in Lot 13 DP1123374, Lot 12 DP1123374, Lot 271 DP750053 and Lot 1 DP841147. These lots are owned by Gunlake Quarries Pty Ltd.

The land surrounding the Quarry is rural with low population density, predominately used for agriculture, generally grazing. Built features immediately surrounding the Quarry include dams, access tracks and fences. There are a small number of residences around the Quarry (Figure 2.1). The nearest town is Marulan, about 7 km south-east of the site boundary.

There are four local operational quarries within approximately 15 km of the Quarry site: Lynwood Quarry; Peppertree Quarry; Marulan South Limestone Mine; and Johnniefelds Quarry.



Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011); ASGC (2006)

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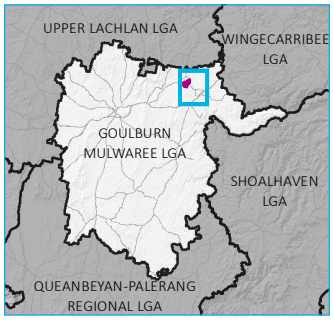

KEY

- Site boundary
- Major road
- Minor road
- Named watercourse
- Waterbody

Local context

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 2.1

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2.2 Continuation Project description

Gunlake seeks a new development approval for the Continuation Project that allows:

- ongoing Quarry operations;
- a maximum of 375 inbound and 375 outbound daily truck movements with up to 4.2 million tonnes per annum (Mtpa) of Quarry products transported from the site in any calendar year;
- 24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday;
- an extraction depth of 546 metres Australian Hight Datum (mAHD); and
- a 30-year Quarry life (from the date of Continuation Project approval).

A summary of the key elements of the approved Extension Project compared to the Continuation Project is provided in Table 2.1.

Table 2.1 Extension Project compared to the Continuation Project

Project element	Approved Extension Project	Proposed Continuation Project
Extraction method	Blasting and excavation.	Blasting and excavation.
Resource	Ignimbrite hard-rock.	Ignimbrite hard-rock.
Extraction	Quarry pit - pit depth of 572 mAHD.	Quarry pit - pit depth of 546 mAHD (ie 26 m deeper than the Extension Project). No change to pit disturbance area.
Operations	Onsite rock processing, including crushing and screening.	Onsite rock processing, including crushing and screening.
Product transport	Transport of up to 2.6 million tonnes per annum (Mtpa) of Quarry products. Truck movements limited to: • a maximum of 295 inbound movements and 295 outbound movements, including no more than 38 outbound truck movements on the Secondary Transport Route, per working day; and • an average of 220 inbound movements and 220 outbound movements, including no more than 25 outbound movements on the Secondary Transport Route, per working day (averaged over the working days in each quarter).	Transport of up to 4.2 Mtpa of quarry products. Total truck movements limited to: • a maximum of 375 inbound movements and 375 outbound movements, including no more than 38 outbound laden movements on the Secondary Transport Route, per working day; and • an average of no more than 25 outbound movements on the Secondary Transport Route, per working day (averaged over the working days in each quarter).
General infrastructure	Offices, amenity buildings, processing plant and other minor infrastructure.	Offices, amenity buildings, processing plant and other minor infrastructure.

Table 2.1 Extension Project compared to the Continuation Project

Project element	Approved Extension Project	Proposed Continuation Project
Management of wastes	Overburden[1] is emplaced in designated emplacement areas.	Overburden is emplaced in designated emplacement areas.
	Receipt of up to 30,000 tonnes of cured concrete per calendar year for beneficial reuse/recycling.	Receipt of up to 50,000 tonnes of cured concrete per calendar year for beneficial reuse/recycling.
	No other classified waste materials to be received on site.	No other classified waste materials to be received on site.
Hours of operation	24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday.	24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday.
Blasting	Up to twice weekly, 9 am to 5 pm Monday to Friday.	Up to twice weekly, 9 am to 5 pm Monday to Friday.
Quarry life	To 30 June 2042.	Extension of the Quarry life to 30 years from the date of approval.

Further information on the project is available in the Continuation Project EIS.

2.3 Product transport

2.3.1 Transport routes

All saleable products are transported from the Quarry to markets by truck. The Continuation Project will continue to use the currently approved Primary and Secondary Transport Routes.

Trucks delivering Quarry products to markets to the north and returning from these destinations use the Primary Transport Route (Figure 2.2). The Primary Transport Route consists of the following roads:

- Brayton Road (classified as a collector road) between Ambrose Road and the Gunlake Quarry access road;
- Ambrose Road between Brayton Road and Red Hills Road; and
- Red Hills Road between Ambrose Road and the Hume Highway.

The Secondary Transport Route is only used by outbound trucks travelling to markets south of the Quarry. The Secondary Transport Route consists of Brayton Road between the Quarry access road and the Hume Highway's southbound access ramp at Marulan. Gunlake currently has approval for a daily average of 25 outbound Quarry product truck movements, and a daily maximum of 38 outbound Quarry product trucks movements on this route. It is not proposed to change the number of trucks that are allowed to use the Secondary Transport Route.

2.3.2 Vehicle movements

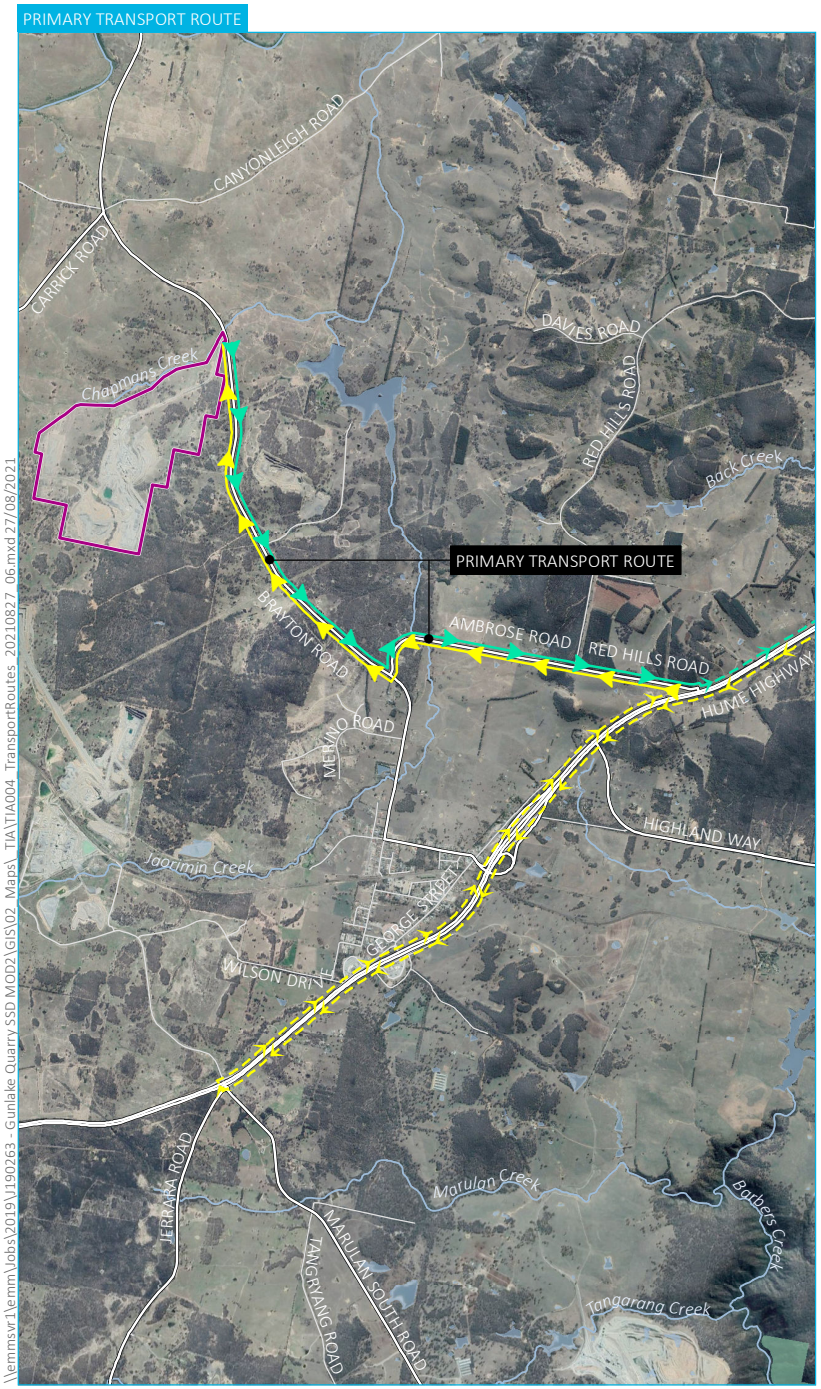
The Continuation Project will transport up to 4.2 Mtpa of Quarry products transported from the site in any calendar year.

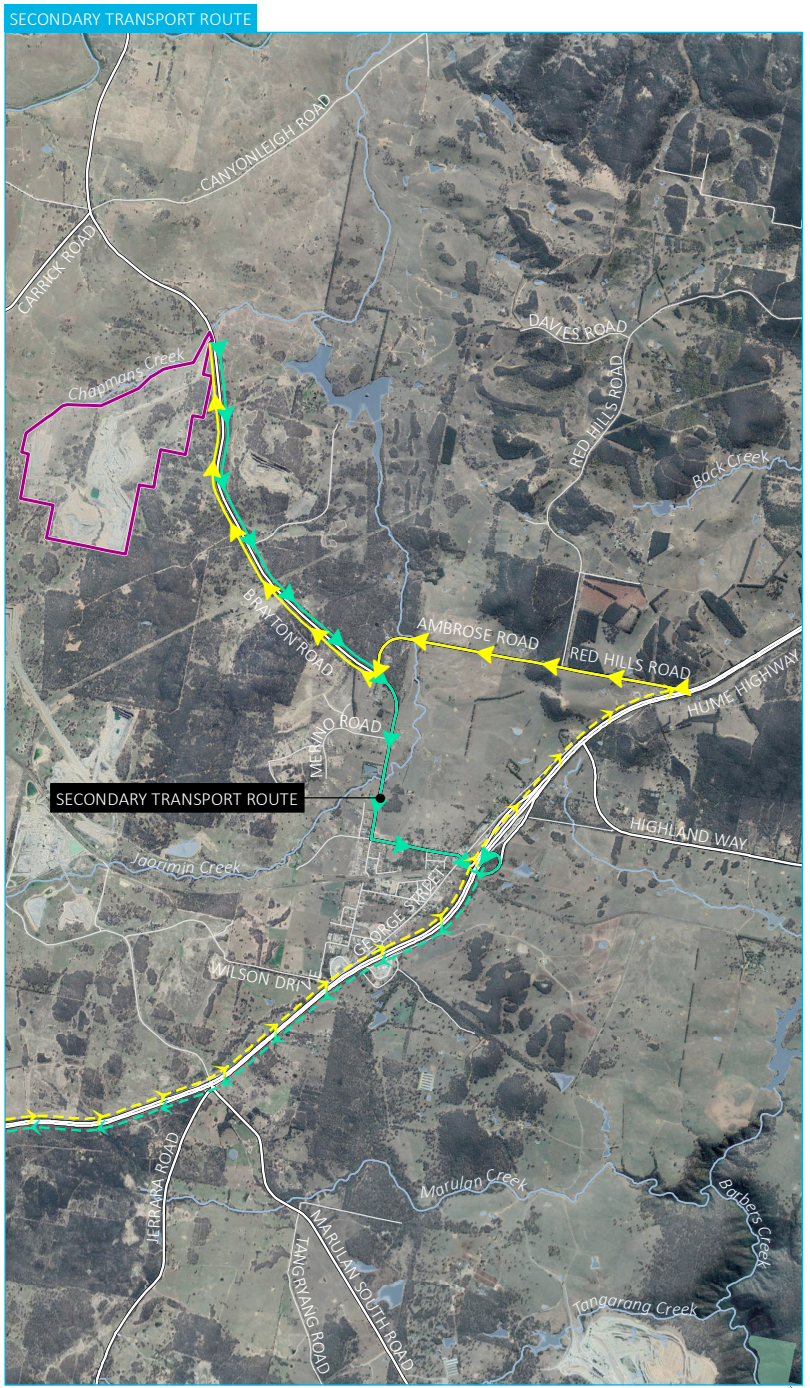
Under the Continuation Project it is proposed to limit daily saleable product truck movements to a maximum of 375 inbound and 375 outbound movements.

[1] 'Overburden': any extracted unsalable material.

Gunlake currently has approval for a daily average of 25 outbound Quarry product truck movements, and a daily maximum of 38 outbound Quarry product trucks movements on the Secondary Transport Route. It is not proposed to change the number of trucks that are allowed to use the Secondary Transport Route.

There are also a small number of transport movements associated with employee travel, fuel deliveries and service vehicles.





KEY

- Site boundary
- Inbound transport route
- Inbound transport route (highway)
- Outbound transport route
- Outbound transport route (highway)
- Major road
- Minor road
- Named watercourse
- Waterbody
- NPWS reserve

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Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011)

Transport routes

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 2.2

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2.4 Assessment locations

Noise emissions from the Quarry have been assessed at the nearest noise sensitive receptors. The nearest noise sensitive receptors (herein referred to as assessment locations) are private residences. Details of the assessment locations and other neighbouring properties are described in Table 2.2 and locations are shown in Figure 2.3.

Table 2.2 Neighbouring properties and noise assessment locations

ID	Description	Assessment location?
R1	Gunlake owned	No
R2*	Private residence, currently qualifies for acquisition upon request as per Schedule 3 Condition 1 of the Conditions of Consent of the NSW Land and Environment Court (LEC) Approval 2017/108663 (the Extension Project Approval)	Yes
R3	Gunlake owned	No
R4	Gunlake owned	No
R5	Private residence	Yes
R6	Private residence	Yes
R7	Private residence, additional mitigation upon request as per Schedule 3 Condition 2 of the Conditions of Consent of the Extension Project Approval	Yes
R8	Private residence	Yes
R9	Private residence	Yes
R10	Private residence	Yes
R12	Private residence	Yes
R13	Private residence	Yes
R14	Private residence	Yes
R15	Private residence	Yes
R16	Private residence	Yes

Note: There is a shed within the R2 property boundary. This was mistakenly assessed as a sensitive receptor in the Extension Project EIS as 'R11'. R11 has been removed as an assessment location in this NIA.

There is a residential subdivision currently under construction located between assessment locations R14 and R15 (off Corriedale Drive and adjacent to Brayton Road). At the time of preparing this report, no residential dwellings had been completed on any of the lots within the subdivision and therefore have not been included as assessment locations. However, potential impacts at the future residences would be comparable to assessment locations R14 and R15.

Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011)

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KEY

- Site boundary
- Noise assessment location
- Other property*
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Waterbody

* R1, R3 and R4 are owned by Gunlake. R11 is a shed linked to R2

Noise assessment locations

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 2.3

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3 Existing environment

3.1 Existing ambient noise levels

Given the rural nature of the locality and based on historical noise data collected in the vicinity, existing ambient noise levels are at or below the minimum levels provided in the NPfI. The minimum rating background level for daytime is 35 dB and for evening and night is 30 dB, as per the NPfI.

3.2 Meteorology

During certain weather conditions, noise emissions from the Quarry at assessment locations may increase or decrease compared with noise during calm conditions. This is due to refraction caused by the varying speed of sound with increasing height above the ground that occurs during winds or where air temperature changes with height.

A conservative approach has been selected for the consideration of potentially noise-enhancing weather conditions with reference to Fact Sheet D of the NPfI. Noise emissions from the Quarry have been predicted for noise-enhancing conditions. This provides a conservative approach since the noise emissions predicted under noise-enhancing conditions are expected to represent the upper range of noise emissions from the Quarry.

3.3 Existing Quarry noise limits

Operational noise limits for the current Quarry operations are provided in Schedule 3 of the Extension Project Approval and are reproduced in Table 3.1.

Table 3.1 Existing operational noise limits

Receiver	Day, $L_{Aeq,15\ min}$ (dB)	Evening, $L_{Aeq,15\ min}$ (dB)	Night	
			$L_{Aeq,15\ min}$ (dB)	$L_{A1,1\ min}$ (dB)
R7	38	38	38	45
R8	37	37	37	45
All other privately-owned residences	35	35	35	45

The Quarry operates under an Environment Protection Licence (EPL 13012) that includes the limits in Table 3.1.

Traffic noise associated with operation of the Quarry is also addressed in Schedule 3 Condition 9 of the Extension Project Approval with a requirement to undertake a traffic noise compliance assessment as follows:

> 9. A noise compliance assessment of the traffic noise impacts of the project must be undertaken within two months of annual dispatches of Quarry products exceeding 1 million, 1.5 million and 1.9 million tonnes. The assessment must be conducted by a suitably qualified and experienced acoustical practitioner and must assess compliance of the traffic noise impacts against the predictions in the EIS and relevant road noise criteria. The traffic noise compliance assessment reports must be provided to the Department within 1 month of each assessment.

3.4 Existing noise mitigation and management

Gunlake Quarry is ideally located from a noise emission perspective given the distance and natural topographic shielding between the Quarry and the nearest private residences. Gunlake also implement the following noise mitigation and management measures at the Quarry with the aim of minimising off-site noise impacts:

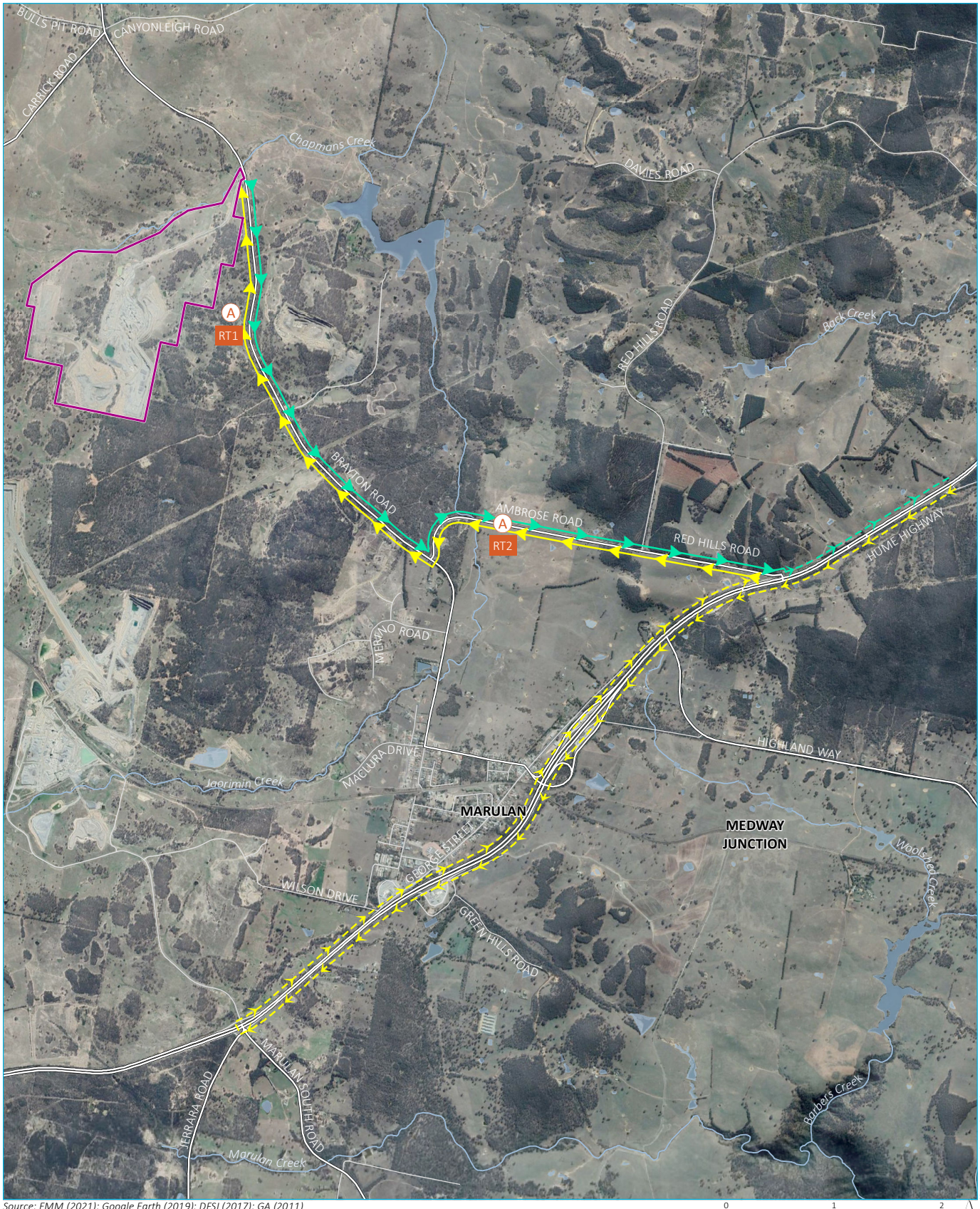
- construction of a noise bund east of the processing area, along with Eastern and Western emplacements;
- primary crusher station enclosures;
- mobile fleet operations reduced during the evening and night periods;
- all mobile plant and fixed noise sources are effectively maintained to ensure that noise emissions do not increase over time;
- inclusion of noise management provisions in relevant on-site work inductions;
- quarterly operator-attended noise compliance surveys; and
- prompt response to any community issues relating to noise.

3.5 Existing Quarry noise emissions

As per the approved Gunlake Quarry Noise and Blast Management Plan (Gunlake Quarries 2020), noise emissions from the Quarry are measured on a quarterly basis. Results of noise compliance monitoring, as summarised in the Gunlake Quarry Project Annual Reviews indicate that the Quarry noise emissions have been compliant with the relevant noise limits.

EMM prepared a road traffic noise compliance assessment addressing Schedule 3 Condition 9 of the Extension Project Approval and the Gunlake Quarry Noise and Blast Management Plan (Gunlake 2020). The Gunlake Quarry Road Traffic Noise Compliance Assessment (EMM 2020) included road noise monitoring in August 2020. Road noise was monitored at two locations (RT1 and RT2) on the Primary Transport Route (Figure 3.1) consisting of a one-hour noise survey at each location. These locations are representative of the nearest, potentially affected receptors to the Primary Transport Route. Average sound exposure levels for Quarry truck passbys were measured and utilised to calculate $L_{Aeq,15hr}$ and $L_{Aeq,9hr}$ noise contributions from Gunlake Quarry trucks and total road traffic noise levels.

The road traffic noise compliance survey demonstrated that road traffic noise levels generated by Gunlake Quarry and other road users during day and night periods satisfied the relevant noise limits under the Extension Project conditions.



Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011)

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KEY

- Site boundary
- Road traffic noise monitoring location
- Inbound transport route
- Inbound transport route (highway)
- Outbound transport route
- Outbound transport route (highway)
- Major road
- Minor road
- Named watercourse
- Waterbody

Road traffic noise monitoring

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 3.1

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4 Assessment methodology

4.1 Applying the NPfI to existing sites

The NPfI provides a methodology for the assessment of operational noise from existing industrial sites. The NPfI acknowledges that some industrial sites were designed for higher allowable noise emissions than those outlined in current NSW noise policy and may have been in existence before neighbouring noise-sensitive developments. The range of mitigation options available for such sites can be limited or costly.

Section 6.1 of the NPfI states that:

> The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where noise emissions from the existing site exceed the project noise trigger levels (PNTLs) as defined in the NPfI, the relevant regulatory authorities and proponent will determine achievable noise limits for the site through negotiation and discussion with relevant stakeholders as required.

The process for applying the NPfI to existing sites is outlined in Section 6.1.1 of the NPfI and is summarised as follows as applicable to the Continuation Project application:

1. Undertake an initial evaluation, including whether approvals/licences include noise limits and whether they are being met (refer Section 3.3).

2. Establish relevant PNTLs, in accordance with the NPfI, to establish a benchmark level to assess the need to consider noise mitigation (refer Section 4).

3. Measure/predict the noise levels produced by the source in question, having regard to meteorological effects such as wind and temperature inversions (refer Section 5).

4. Compare the measured/predicted noise level with the PNTLs (refer Section 5).

5. Where the PNTLs are exceeded, assess feasible and reasonable noise mitigation strategies (not applicable to this assessment since PNTLs are predicted to be achieved).

6. Develop and refine achievable noise limits that will become long-term noise goals for the site. This may involve interaction between the regulator and proponent as well as consultation with the community. Regulators and operators need to consider the technical practicalities and cost of noise reduction measures, and how long it will take to implement these measures, along with the environmental consequences of exceeding the PNTLs.

7. Monitor compliance with the agreed noise limits, and review and amend the noise performance of the site as required.

4.2 Construction noise

Construction noise is generally assessed with reference to the NSW Interim Construction Noise Guideline (ICNG) (EPA 2009). Construction of a new weighbridge and road resurfacing activities will occur within the next few years as part of ongoing quarry operations. These activities will occur during standard construction hours (ie daytime only) and will be relatively short-term duration. Noise emissions from these activities will be consistent with the nature of noise from operational activity and not expected to generate additional noise impact at the nearest noise-sensitive receptors. Given the preceding, a detailed assessment of construction noise impacts has not been included within this report.

4.3 Operational noise limits – NPfI

Noise from industrial sites or processes in NSW is regulated by the local council, NSW Department of Planning, Industry and Environment (DPIE) and/or the EPA and usually have a licence and/or development consent conditions stipulating noise limits. These limits are normally derived from operational noise levels applied at assessment locations. They are based on EPA guidelines (ie NPfI) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation measures.

The reaction to noise is highly subjective. Hence, it is not possible to adopt noise levels that will guarantee that no one will experience an impact. Adherence with the PNTLs should not be interpreted to mean that industrial noise will be inaudible, or that all members of the community will find the noise acceptable. The PNTLs for industry provide a benchmark for assessing a proposed or existing industrial development.

Both the increase in noise level above background levels (ie the intrusiveness of a source) as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources. To ensure both of these factors are considered, the EPA provides two separate noise trigger levels: intrusiveness and amenity. The fundamental difference being intrusiveness noise levels apply over 15 minutes in any period (day, evening or night), whereas the amenity noise levels apply to the entire assessment period (day, evening or night).

4.3.1 Assessing intrusiveness

The intrusive noise trigger levels require that $L_{Aeq,15\ minute}$ noise levels from the site during the relevant operational periods (ie day, evening and night) do not exceed the rating background level (RBL) by more than 5 dB. Intrusive noise trigger levels are applicable at residential assessment locations only.

NPfI minimum RBLs have been adopted for this assessment which indicates a daytime project intrusive noise level of $L_{Aeq,15\ minute}$ 40 dB and an evening/night project intrusive noise level of $L_{Aeq,15\ minute}$ 35 dB.

4.3.2 Assessing amenity

The amenity assessment is based on noise targets specific to land use and associated activities. The targets relate only to industrial-type noise and do not include road, rail and/or community noise. Where the measured existing industrial noise approaches the recommended amenity noise level, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

Where multiple industrial operations are present, to ensure that total industrial noise levels remain within the recommended amenity noise levels for an area, the project amenity noise level for the Continuation Project is the recommended amenity noise level (outlined in Table 2.2 of the NPfI) minus 5 dB.

Residences have been categorised in the NPfI rural amenity categories as per the definitions provided in the NPfI.

An extract from the NPfI that relates to the amenity noise levels relevant to the project is given in Table 4.1.

Table 4.1 Amenity noise levels – Recommended L_{Aeq} noise levels from industrial noise sources

Type of receptor	Noise amenity area	Time of day[1]	Recommended $L_{Aeq(Period)}$ noise level, dB
Residence	Rural	Day	55
		Evening	45
		Night	40

1. Daytime 7 am–6 pm; Evening 6 pm–10 pm; Night-time 10 pm–7 am. On Sundays and Public Holidays, Daytime 8 am–6 pm; Evening 6 pm–10 pm; Night-time 10 pm–8 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

It is commonly acknowledged and accepted amongst regulators and industry that average noise levels are typically 3 dB higher over a 15-minute worst case assessment period when compared to an entire day (11 hour), evening (4 hour) and night (8 hour) assessment period. This assumption is outlined in the NPfI and has been used in this assessment to standardise the time periods for the intrusive and amenity noise levels.

Based on the preceding, the project amenity noise levels (PANL) are summarised in Table 4.2.

Table 4.2 Project amenity noise levels

Type of receptor	Noise amenity area	Time of day[1]	PANL $L_{Aeq(Period)}$, dB	PANL $L_{Aeq,15\ minute}$, dB
Residence	Rural	Day	50	53
		Evening	40	43
		Night	35	38

1. Daytime 7 am–6 pm; Evening 6 pm–10 pm; Night-time 10 pm–7 am. On Sundays and Public Holidays, Daytime 8 am–6 pm; Evening 6 pm–10 pm; Night-time 10 pm–8 am. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

4.3.3 Project noise trigger levels

PNTLs, as per the NPfI, are the more stringent of either the project intrusive or amenity noise levels and are shown in Table 4.3.

Table 4.3 Project noise trigger levels, $L_{Aeq,15min}$

Location	Intrusive noise level, $L_{Aeq,15min}$, dB			Amenity noise level, $L_{Aeq,15\ minute}$, dB			PNTL, $L_{Aeq,15\ minute}$, dB		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
All assessment locations	**40**	**35**	**35**	53	43	38	40	35	35

1. Day: 7 am–6 pm Monday to Saturday; 8 am–6 pm Sundays and public holidays; evening: 6 pm–10 pm; night: all remaining periods.

4.3.4 Maximum noise level event assessment

The difficulty in establishing an absolute noise level criterion that would correlate to an acceptable level of sleep disturbance is acknowledged by relevant governing authorities.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where night-time noise levels at a residential location exceed:

- $L_{Aeq,15\ minute}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater); and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

NPfI minimum RBLs have been adopted for this assessment which indicates maximum noise level assessment trigger levels of $L_{Aeq,15\ minute}$ 40 dB and/or L_{Amax} 52 dB.

The NPfI also references guidance regarding potential for sleep disturbance provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels (L_{Amax}) below 50 to 55 dB are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels (L_{Amax}) of 65 to 70 dB, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60–65 dB calculated at the facade of a residence is unlikely to awaken people according to the RNP.

If noise levels over the NPfI screening levels are identified, then additional analysis would consider factors such as the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development;
- whether there are times of day when there is a clear change in the noise environment; and
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

4.3.5 Low frequency noise

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for annoying noise characteristics; the most applicable to this assessment being low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 4.4 below.

Table 4.4 One-third octave low-frequency noise thresholds ($L_{zeq,15minute}$)

	Frequency (Hz)												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Noise level (dB (Z))	92	89	86	77	69	61	54	50	50	48	48	46	44

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 4.4 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 4.4 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the day period.

4.4 Voluntary Land Acquisition and Mitigation Policy

Consent authorities are required to consider the Voluntary Land Acquisition and Mitigation Policy (VLAMP) (DPE 2018) when assessing and determining development applications and modification applications for SSD mining, petroleum or extractive industry developments. Page 17 of VLAMP states the following regarding the application of voluntary mitigation and voluntary land acquisition:

> A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:
>
> - operational noise impacts of a development on privately-owned land; and
>
> - rail noise impacts of a development on privately-owned land near a non-network rail line (private rail line), that is on, or exclusively servicing an industrial site (see Appendix 3 of the *Rail Infrastructure Noise Guideline* (RING) (EPA 2013));
>
> But not:
>
> - construction noise impacts, as these impacts are shorter term and can be controlled;
>
> - noise impacts on the public road or rail network; or
>
> - modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts[13].
>
> [13]Noise issues for existing premises may be addressed through site-specific pollution reduction programs under the NSW *Protection of the Environment Operations Act 1997*.

The characterisation of the noise impacts (as outlined in the VLAMP and NPfI) are generally based on human perception to changes in noise levels as explained in the glossary of the acoustic terms in this report. For example, a change in noise level of 1–2 dB is typically indiscernible to the human ear. The characterisation of a residual noise impact of 0–2 dB above the PNTL is therefore considered negligible.

This characterisation of residual noise impacts is outlined further in Table 4.5.

Table 4.5 VLAMP characterisation of noise impacts and potential treatments

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts	Potential treatment
All time periods 0–2 dB	Not applicable	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
All time periods 3–5 dB	< recommended amenity noise level > recommended amenity noise level but the increase in total cumulative industrial noise level resulting from development is <1 dB	Impacts are considered to be **marginal**	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
All time periods 3–5 dB	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is >1dB	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	< recommended amenity noise level	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	> recommended amenity noise level	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and refer voluntary land acquisition provisions
Night > 5 dB	Not applicable	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and refer voluntary land acquisition provisions

Source: VLAMP (NSW Government 2018).

4.5 Road traffic noise

The principle guidance to assess the impact of noise from project-related road traffic on public roads is the Road Noise Policy (RNP) (DECCW 2011).

The Quarry is accessed via Brayton Road. The nearest residences potentially affected by an increase in project-related traffic are located on Brayton Road or Ambrose/Red Hills Road which are classified as arterial roads according to the RNP definitions.

The road traffic noise assessment criteria for residential assessment locations, reproduced from Table 3 of the RNP for relevant road categories are provided in Table 4.6.

Table 4.6 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	60 $L_{Aeq,15hr}$	55 $L_{Aeq,9hr}$

Source: RNP (DECCW 2011).

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

In addition to meeting the assessment criteria (Table 4.6), any significant increase in total traffic noise at assessment locations must be considered. Assessment locations experiencing increases in total traffic noise levels above those presented in Table 4.7 should be considered for mitigation.

Table 4.7 Road traffic relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase, dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq(15hr)}$ + 12 dB	Existing traffic $L_{Aeq(9hr)}$ + 12 dB

Source: RNP (DECCW 2011).

4.6 Operational and construction vibration

Vibration from operational activity is not expected to change as a result of the Project compared to that currently approved. The footprint of the Quarry pit is not proposed to change. Given the separation distance of at least 800 m between the Quarry boundary and the nearest assessment locations, vibration levels are expected to be below that which could cause disturbance to residents. Thus, a detailed assessment of vibration impacts has not been included in this report.

5 Operational noise assessment

5.1 Overview

This section presents the methods and base parameters used to model noise emissions from the Quarry, including the effects of noise-enhancing meteorological conditions.

Three-dimensional digitised ground contours of the site, surrounding land and surface infrastructure based on existing terrain data obtained via a drone survey completed in February 2021 was utilised for the purpose of noise monitoring. This data includes the current stage of the Eastern and Western Emplacement/noise bund located east of the processing area. The operational noise model represents a snapshot of typical operations across the site.

Noise predictions were carried out using the iNoise software, created by the same developers of B&K's Predictor software. iNoise calculates total noise levels at assessment locations from concurrent operation of multiple noise sources. The model considers factors such as the lateral and vertical location of plant, source-to-receptor distances, ground effects, atmospheric absorption, topography of the surface facilities area and surrounds and applicable meteorological conditions.

5.2 Plant and equipment

Equipment sound power levels have been based on measurements undertaken at the site for preparation of the Extension Project Noise and Vibration Assessment (EMM 2016) and updated, where required, based on measurements undertaken in February 2021.

A summary of the acoustically significant fixed and mobile equipment items considered in the noise model is provided Table 5.1.

Table 5.1 Acoustically significant plant and equipment for noise modelling

Item	Sound power level per item (dBA)	Operating on-site during this period		
		Day	Evening	Night
Primary crushing stations	113	✓	✓	✓
Secondary crushing stations	114	✓	✓	✓
Tertiary crushing stations	116	✓	✓	✓
Quaternary crushing stations	109	✓	✓	✓
Excavators	104–107	✓	✓	✓
Front end loaders	112–115	✓	✓	✓
Dump trucks	114	✓	✓	✓
Watercarts	102	✓	✓	✓
Grader	104	✓	✓	✓
Dozers	112	✓	✓	✓
Drill	116	✓	×	×
Road trucks – loaded	103	✓	✓	✓
Road trucks – empty	105	✓	✓	✓

Typical maximum noise events include impacts associated with loading and/or unloading material. A typical conservative sound power level of L_{Amax} 125 dB has been used to predict potential sleep disturbance impacts at residential assessment locations for comparison to the maximum noise event trigger levels.

5.3 Low frequency noise modifying factor and noise model validation

Operator-attended noise surveys were undertaken at various locations within and surrounding the Quarry (refer Figure 5.1) to determine whether the low frequency noise (LFN) modifying factor would apply to Quarry noise emissions at the assessment locations and to assist in validating the operational noise model.

The noise spectrums measured at attended monitoring locations 1, 2 and 3 are summarised in Table 5.2 and compared to the LFN thresholds provided in the NPfI. Results indicate that the total (all sources) measured noise spectrum levels are generally below the NPfI LFN thresholds with some minor exceptions; 1–3 dB above the thresholds at 40 Hz, 80 Hz and 100 Hz measured at locations 1 and 2. Based on these measured levels, extrapolation to the nearest assessment locations confirms that the LFN modifying factor is not applicable at any assessment location.

Table 5.2 Low frequency spectrum and NPfI thresholds

	Frequency (Hz)												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
NPfI threshold	92	89	86	77	69	61	54	50	50	48	48	46	44
Location	**Measured spectrum**												
1	48	60	54	47	47	47	**56**	45	45	**51**	**49**	42	44
2	45	61	54	45	48	48	51	49	47	**49**	42	35	33
3	48	55	51	46	48	50	49	48	48	47	42	42	36

Notes: Levels in bold text are above the NPfI threshold values.

Operational noise levels from current operations were calculated and compared to the results of operator-attended noise monitoring (undertaken on-site on 9 February 2021) at the locations provided in Figure 5.1. It was found that calculated noise levels correlated well with measured noise levels (ie within +2 dB). Hence, the computer noise model was deemed appropriate for the purpose of this assessment.

Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011)

0 250 500 m
GDA 1994 MGA Zone 55

N

KEY

- Site boundary
- Operator-attended noise monitoring location
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Waterbody

Operator-attended noise monitoring locations

Gunlake Quarry Continuation Project
Noise impact assessment
Figure 5.1

EMM
creating opportunities

\\emmsvr1\emm\Jobs\2019\J190263 - Gunlake Quarry SSD MOD2\GIS\02_Maps_NIA\NIA004_AttendedNoiseMon_20210827_03.mxd 27/08/2021

5.4 Predicted operational noise levels

Predicted noise levels for each period of operation based on operations summarised in Table 5.1 are provided in Table 5.3. Indicative operational noise contours are provided in Annexure A for night-time operations under noise-enhancing meteorological conditions.

Table 5.3 Operational noise predictions, noise-enhancing meteorological conditions

Location	Period[1]	Predicted noise level (dB)	PNTL (dB)
R2	Day	47 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	46 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	46 $L_{Aeq,15\ minute}$ / 47 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R5	Day	35 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	35 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	34 $L_{Aeq,15\ minute}$ / 40 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R6	Day	36 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	35 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	35 $L_{Aeq,15\ minute}$ / 35 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R7	Day	31 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	31 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	30 $L_{Aeq,15\ minute}$ / 36 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R8	Day	33 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	32 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	31 $L_{Aeq,15\ minute}$ / 37 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R9	Day	36 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	35 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	35 $L_{Aeq,15\ minute}$ / 38 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R10	Day	33 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	32 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	32 $L_{Aeq,15\ minute}$ / 35 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R12	Day	31 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	30 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	30 $L_{Aeq,15\ minute}$ / 34 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R13	Day	32 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	32 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	31 $L_{Aeq,15\ minute}$ / 35 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R14	Day	30 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	30 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	30 $L_{Aeq,15\ minute}$ / 33 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}

Table 5.3 Operational noise predictions, noise-enhancing meteorological conditions

Location	Period[1]	Predicted noise level (dB)	PNTL (dB)
R15	Day	<30 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	<30 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	<30 $L_{Aeq,15\ minute}$ / 30 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}
R16	Day	<30 $L_{Aeq,15\ minute}$	40 $L_{Aeq,15\ minute}$
	Evening	<30 $L_{Aeq,15\ minute}$	35 $L_{Aeq,15\ minute}$
	Night	<30 $L_{Aeq,15\ minute}$ / <30 L_{Amax}	35 $L_{Aeq,15\ minute}$ / 52 L_{Amax}

1. Day: 7 am–6 pm Monday to Saturday; 8 am–6 pm Sundays and public holidays; evening: 6 pm–10 pm; night: all remaining periods.

Operational noise levels from Quarry operations are predicted to be at, or below, (ie, comply with) the relevant PNTLs at all assessment locations with the exception of R2.

5.5 Recommendations

Operational noise levels from Quarry operations are predicted to comply with the relevant noise limits at all assessment locations except R2, hence consideration of additional feasible and reasonable noise mitigation measures was undertaken targeting this location.

In accordance with VLAMP, the predicted quarry noise level at R2 would be considered a significant impact. In assessing the feasibility and reasonableness of additional noise mitigation measures due to this predicted impact, the following factors have been considered in accordance with methodology provided in the NPfI:

- the predicted incremental change in noise levels at R2 compared to current noise emissions is negligible (<2 dB);
- Gunlake have previously implemented (and will continue to implement) the noise mitigation and management measures described in Section 3.4; and
- Operation of the Quarry complies with current noise limits for R2 as per the Extension Project Approval.

R2 is an existing dwelling that is currently exposed to Quarry noise and qualifies for voluntary acquisition in accordance with Schedule 3 Condition 1 of the Conditions of Consent of the Extension Project Approval. These voluntary acquisition rights will continue to apply at this residence.

Gunlake will continue to undertake operational noise compliance monitoring on a quarterly basis until such time as compliance can be proven. If the Continuation Project is approved, Gunlake will be required to review and/or update all management plans applicable to the site.

6 Road traffic noise assessment

6.1 Overview and assumptions

Road traffic noise predictions associated with the Continuation Project have considered a maximum of 375 inbound and 375 outbound movements in any 24-hour period. Based on current daily truck movements to and from the site, it has been assumed that 65% and 35% of all Gunlake Quarry truck volumes would occur during the RNP (DECCW 2011) day (7 am–10 pm) and night (10 pm–7 am) periods, respectively.

The proposed increase to existing, approved Gunlake Quarry traffic volumes on the Primary Transport Route have been considered based on the results of the road traffic noise compliance monitoring (refer Section 3) as well as the results of additional road traffic noise monitoring undertaken by EMM in November 2020. The nearest residential facades potentially affected by the proposed increase in traffic are located on Brayton Road (west of Ambrose/Red Hills Road) and on Ambrose/Red Hills Road.

With regards to the Secondary Transport Route, traffic surveys undertaken in June 2020 at Brayton Road south of Ambrose Road indicate that total average daily traffic volumes were 577 (refer Gunlake Quarry Continuation Project Traffic Impact Assessment (EMM 2021)). Gunlake Quarry heavy vehicle traffic represents a minor component (less than 7%) of total daily traffic volume and occurs during the period from 6am to 7pm Monday to Saturday only. The average and maximum truck movements per day on the Secondary Transport Route would not change as a result of the Continuation Project and therefore road traffic noise levels along this route will not change compared with existing conditions.

6.2 Road traffic noise predictions assessment

The measured sound exposure levels of Gunlake Quarry truck passbys have been used to update the predictions presented in the road traffic noise assessment prepared to accompany the Extension Project EIS (EMM 2016).

Table 6.1 Continuation Project road traffic noise predictions

Road section	Existing (non-Gunlake) road traffic noise levels[1] $L_{Aeq,period}$, dB	Calculated Gunlake Quarry road traffic noise levels[2] $L_{Aeq,period}$, dB	Total road traffic noise levels[3] $L_{Aeq,period}$, dB	RNP Criteria $L_{Aeq,period}$, dB
Day period (7 am to 10 pm)				
Brayton Rd – west of Ambrose/Red Hills Rd	47	48	51	60
Ambrose/Red Hills Rd	33	39	40	60
Night period (10 pm to 7 am)				
Brayton Rd – west of Ambrose/Red Hills Rd	41	47	48	55
Ambrose/Red Hills Rd	30	36	37	55

1. Existing road traffic noise levels have been predicted using the US Federal Highway Administration model and calibrated to measured road traffic noise levels as well as road traffic volumes that were undertaken concurrently with noise monitoring. This excludes Gunlake Quarry traffic.
2. This level considers the maximum of 375 inbound and 375 outbound movements over 24 hours.
3. Logarithmic sum of road traffic noise levels from existing road traffic and Gunlake Quarry truck movements.

The future total road traffic noise levels, inclusive of Gunlake Quarry trucks associated with the Continuation Project, are predicted to satisfy the relevant road traffic noise criteria at the nearest potentially affected residences on Brayton Road, Ambrose Road and Red Hills Road.

7 Blasting

Blasting is currently undertaken up to twice weekly at the Quarry, between 9 am−5 pm, Monday to Friday. Blast design is managed by site personnel and the blasting contractor to control airblast overpressure and ground vibration.

Blast emissions are monitored at R2, which is nearer to the Quarry than any other privately owned residence. There have been 65 blasts at the Quarry between July 2018 and June 2020. During this time, the ground vibration criterion (5 mm/s) has been met on all occasions, whereas the airblast overpressure criterion (115 dB, Lin Peak) has been marginally exceeded on one occasion, in August 2018. Notwithstanding, this exceedance satisfied the allowable exceedance limit of 5% per total number of blasts over a period of 12 months. Furthermore, no blasts exceeded the upper criterion of 120 dB, Lin Peak.

There would be no change to vibration impact as a result of the Continuation Project compared with existing conditions, which are within relevant criteria.

8 Conclusion

This Noise Impact Assessment has been prepared to assess the noise impacts of the Continuation Project on noise-sensitive receptors in the surrounding area. It has been completed with reference to relevant guidelines and policies and in accordance with the SEARs.

Operational noise levels are predicted to meet relevant noise limits at all assessment locations with the exception of R2. Hence, noise from the Continuation Project is predicted to have negligible impact on the majority of assessment locations.

R2 is an existing dwelling that is currently exposed to quarry noise and qualifies for voluntary acquisition in accordance with Schedule 3 Condition 1 of the Conditions of Consent of the Extension Project Approval. It is recommended that voluntary acquisition rights continue to apply at this residence.

The future total road traffic noise levels, inclusive of Gunlake Quarry trucks associated with the Continuation Project, are predicted to satisfy the relevant road traffic noise criteria at the nearest potentially affected residences.

Existing noise mitigation and management measures will continue to be implemented and maintained. Gunlake will continue to undertake operational noise compliance monitoring on a quarterly basis until such time as continuation compliance can be proven. If the Continuation Project is approved, Gunlake will be required to review and/or update all management plans applicable to the site.

References

NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry* (NPfI)

NSW Government 2018, *Voluntary Land Acquisition and Mitigation Policy* (VLAMP)

NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP)

NSW Environmental Protection Authority (EPA) 2009, *Interim Construction Noise Guideline* (ICNG)

Australian Standard AS 1055-1997, *Acoustics - Description and Measurement of Environmental Noise*

Department of Environment and Conservation NSW 2006, *Assessing Vibration: a technical guideline*

Glossary

Technical terms typically utilised in a noise assessment report are explained in Table G.1.

Table G.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{A90} statistical noise levels.
Amenity noise criteria	The amenity noise criteria relate to the overall level of industrial noise. Where existing levels of industrial noise (excluding the subject development) approach the acceptable amenity noise criteria, then noise levels from new industries need to demonstrate that they will not be an additional contributor to existing industrial noise.
A-weighting	There are several different weightings utilised for describing noise, the most common being the 'A-weighting'. This attempts to closely approximate the frequency response of the human ear.
CEMP	Construction environment management plan
C-weighting	There are several different weightings utilised for describing noise, with the 'C-weighted' scale typically used to assess low frequency noise and is also utilised in the assessment of occupational noise.
Day period	Monday–Saturday: 7.00 am to 6.00 pm, on Sundays and public holidays: 8.00 am to 6.00 pm.
dB	Noise is measured in units called decibels (dB).
DECC/DECCW	Department of Environment and Climate Change/Department of Environment, Climate Change and Water
DPIE	Department of Planning, Industry and Environment
EA	Environmental assessment
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Limited
EP&A Act	*Environmental and Planning Assessment Act 1979* (NSW)
EPA	The NSW Environment Protection Authority (formerly the Department of Environment, Climate Change and Water).
Evening period	Monday–Saturday: 6.00 pm to 10.00 pm, on Sundays and public holidays
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
Intrusive noise criteria	The intrusive noise criteria refer to noise that intrudes above the background level by more than 5 dB.
L_{A1}	The A-weighted noise level exceeded for 1% of the time.
L_{A10}	The A-weighted noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L_{A90}	The A-weighted noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L_{Aeq}	The A-weighted energy average noise level. This is the equivalent continuous sound pressure level over a given period. The $L_{Aeq(15\text{-minute})}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
LFN	Low frequency noise

Table G.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	
Linear peak	The peak level of an event is normally measured using a microphone in the same manner as linear noise (i.e. unweighted), at frequencies both in and below the audible range.
L_{Amax}	The maximum A-weighted sound pressure level received during a measurement interval.
Night period	Monday–Saturday: 10.00 pm to 7.00 am, on Sundays and public holidays: 10.00 pm to 8.00 am.
NMP	Noise management plan
NPfI	Noise Policy for Industry
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PNTL	Project noise trigger level
PSNL	The project-specific noise level (PSNL) is criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive noise criteria or amenity noise criteria.
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RNP	Road Noise Policy
SEARs	Secretary's environmental assessment requirements
Sound exposure level	Sound exposure level is the noise level of a particular event (e.g. a truck pass-by) normalised to 1 second. It is the constant sound level that the same amount of energy in one second as the original noise event.
Sound power level (L_w)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.
VLAMP	Voluntary Land Acquisition and Mitigation Policy

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table G.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure G.1.

Table G.2 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

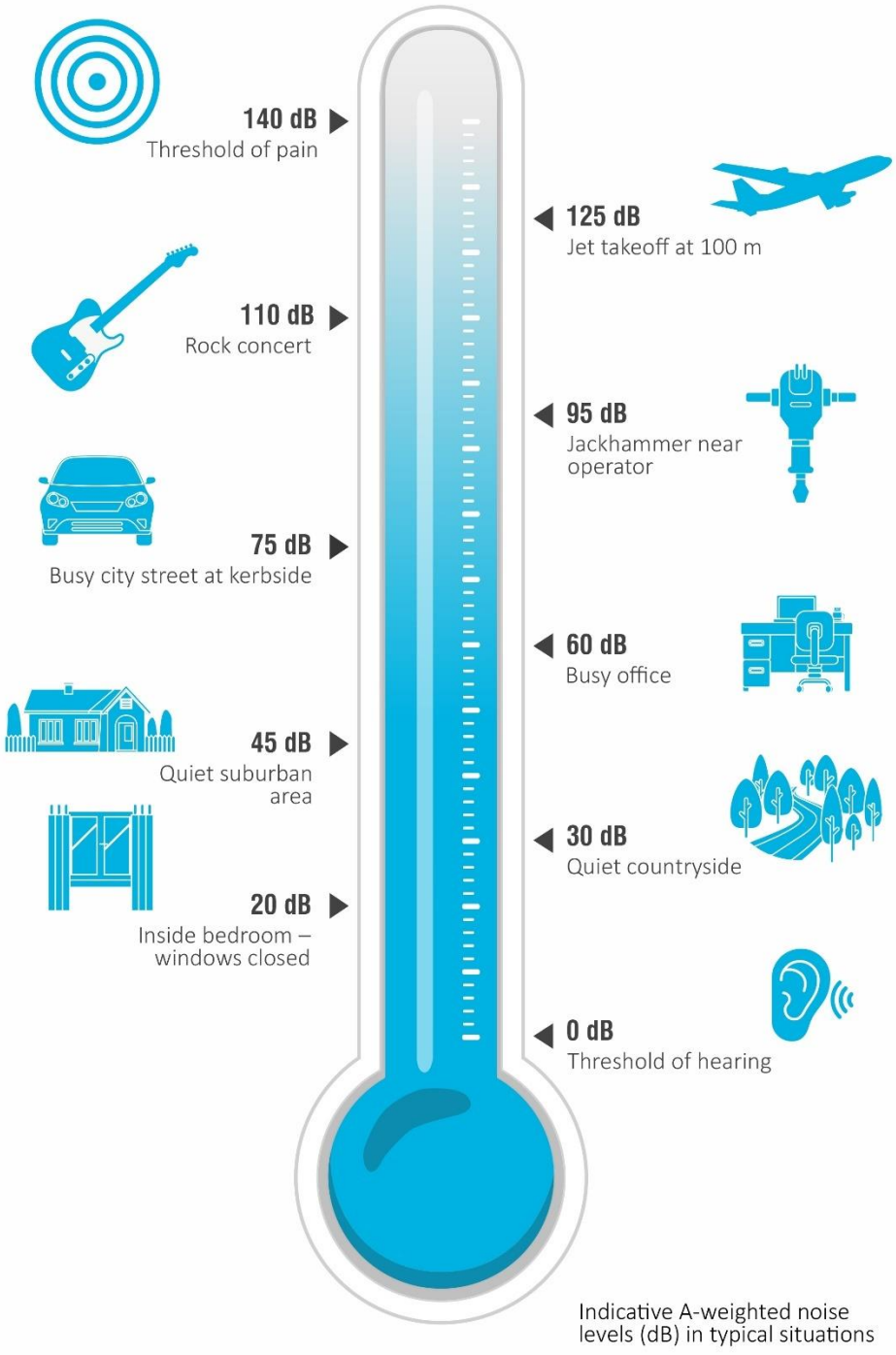
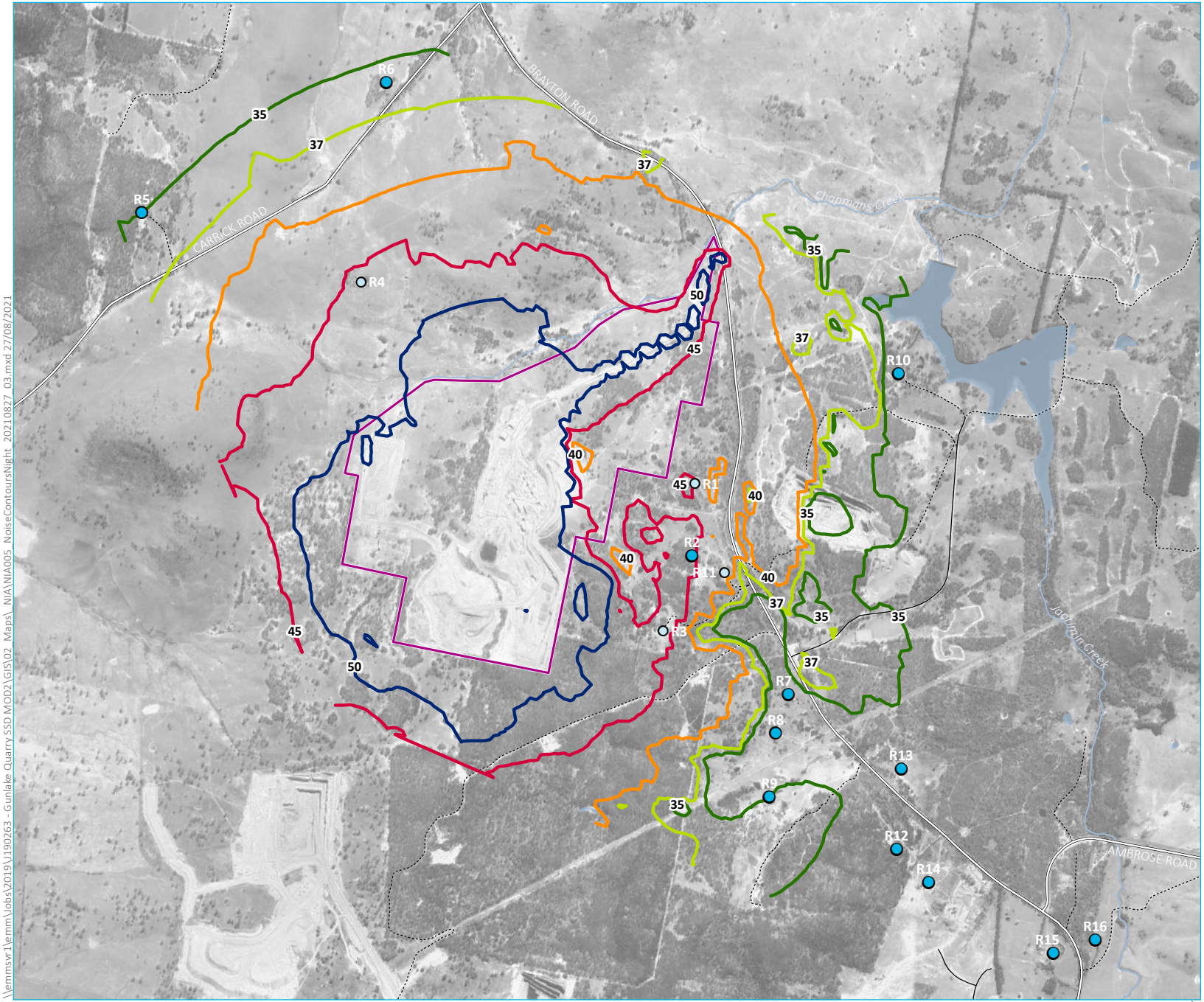


Figure G.1 **Common noise levels**

Annexure A

Indicative noise contours



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Source: EMM (2021); Google Earth (2019); DFSI (2017); GA (2011)

Indicative noise contours - night-time, noise enhancing

Gunlake Quarry Continuation Project
Noise impact assessment
Figure A.1

EMM
creating opportunities