Central Queensland Coal Project

Chapter 13 - Noise and Vibration

Central Queensland Coal

CQC SEIS, Version 3

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Contents

Figures

Tables

Terms and Abbreviations

ACARP	Australian Coal Association Research Program
ANFO	Ammonium nitrate / fuel oil (used as explosive)
A-weighting	A frequency weighting devised to attempt to take into account the fact human response to sound not equally sensitive to all frequencies
BMP	Blast Management and Monitoring Plan
BOM	Bureau of Meteorology
CAT	Caterpillar brand equipment
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	Decibels - the logarithmic-scaled unit used to report the level or magnitude of sound
dB (A)	the A-weighted sound pressure level
dB (Linear)	the Z-weighted (linear) sound pressure level
DBCT	Dalrymple Bay Coal Terminal
DES	Department of Environment and Science
DTMR	Department of Transport and Main Roads
EA	Environmental Authority
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP Act	Queensland *Environmental Protection Act 1994*
EP Regulation	Queensland Environmental Protection Regulation 2019
EPP Noise	Environmental Protection (Noise) Policy 2019
EPP	Environmental Protection Policy
ESA	Environmentally Sensitive Area
EV	Environmental Values
Hz	Hertz - unit of frequency
km	Kilometres
L	Level - the sound pressure level; it implies the use of decibels related to the ratio of powers or the power related quantities such as sound intensity or sound pressure
L_{01}	The sound pressure level exceeded for 1% of the time under consideration
$L_{01, adj, 15 mins}$	The sound pressure level, adjusted for tonal character that is equal to or exceeded for 1% of any 15 minutes sample period
L_{10}	The sound pressure level exceeded for 10% of the time under consideration

$L_{10, adj, 15 mins}$	The sound pressure level, adjusted for tonal character that is equal to or exceeded for 10% of any 15 minutes sample period
L_{90}	The sound pressure level exceeded for 90% of the time under consideration
$L_{90, adj, 15 mins}$	The sound pressure level, adjusted for tonal character that is equal to or exceeded for 90% of any 15 minutes sample period
L_{A01}	The A-weighted sound pressure level exceeded for 1% of the time under consideration
$L_{A01, adj,15 min}$	The A-weighted, equivalent continuous sound pressure level that is equal to or exceeded for 1% of any 15 minutes sample period
L_{A10}	The A-weighted, sound pressure level exceeded for 10% of the time under consideration
L_{A90}	The A-weighted, sound pressure level for any 15 minutes sample period exceeded for 90% of the time under consideration
L_{Aeq}	the A-weighted, equivalent continuous sound pressure level
$L_{Aeq, adj,15 min}$	The A-weighted, equivalent continuous sound pressure level for any 15 minutes sample period
L_{eq}	The equivalent continuous sound pressure level
$L_{eq, adj, 15 mins}$	The equivalent continuous sound pressure level for any 15 minutes sample period
m	Metres
MIA	Mine Infrastructure Area
MIC	Mass Instantaneous Charge
ML	Mining Lease
MMC	Guideline Mining - Model Mining Conditions
NVMP	Noise and Vibration Management Plan
PPV	Peak Particle Velocity
QR	Queensland Rail
SEIS	Supplementary Environmental Impact Assessment
SWL	Sound Power Level (measured in watts)
TAPM	The Air Pollution Model
TLF	Train Loadout Facility
ToR	Terms of Reference

13 Noise and Vibration

13.1 Introduction

Noise and vibration emissions attributable to activities undertaken during the construction and operation of the Central Queensland Coal Project (the Project) have the potential to impact the surrounding environment, particularly sensitive locations within the area. This chapter addresses the relevant legislation and policies, the assessment method, the existing noise environment and identifies potential impacts and proposes mitigation measures for the construction and operation of the Project.

Matters raised in submission to the Environmental Impact Statement (EIS) relating to Chapter 13 – Noise and Vibration were predominately focused on:

- it was requested the cumulative noise impact of construction and operation of the mine to be predicted and the impact assessed against Model Mining Conditions
- noise impacts generated during rehabilitation should be considered
- the noise impacts on BAR H-2 and BAR H-3, TSC Res 1 and TSC Res 2 should be assessed
- noise from the construction of dams and the haul routes during the construction phase should be modelled and
- a revised noise impact assessment should be prepared suggesting mitigation measures to be implemented where the modelling predicts exceedances of the Model Mining Condition criteria rather than Environmental Protection Policy (Noise).

These matters were addressed in the last version (i.e. version 2) of the Supplementary Environmental Impact Assessment (SEIS). Since then, however, the technical report (see Appendix A8 - Noise and Vibration Technical Report) has again been updated to ensure that it considered changes to the Project layout that have occurred since Version 2 of the SEIS. See Chapter 3 – Project Changes and Responses to Regulator Comments for the full description of changes to Project Layout. The main change to the Project layout that necessitated the revision of the noise and vibration assessment, is the movement of Mine Infrastructure Area (MIA) 1 to the north-west of its former location (see Chapter 3).

13.1.1 Environmental Objectives and Outcomes

The environmental objective and performance outcomes relevant to noise are provided in Schedule 8, Part 3, Division 1 of the Environmental Protection (EP) Regulation 2018. Objectives and outcomes for noise that are specific to the Project are given in Table 1 of the Project Terms of Reference (ToR). The overarching objective is to operate the Project in a way that protects the environmental values of the acoustic environment.

13.1.1.1 EP Regulation Environmental Objectives and Performance Outcomes

The environmental objective and performance outcomes relating to noise outlined in the EP Regulation are:

13.1.1.1.1 Environmental Objective

The activity will be operated in a way that protects the environmental values of the acoustic environment.

13.1.1.1.2 Performance Outcomes

1. Sound from the activity is not audible at a sensitive receptor.
2. The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

13.1.1.2 ToR Environmental Objectives and Outcomes relevant to the project

The Environmental Objectives and Outcomes for noise given in the Project ToR are that:

- The activity will be operated in a way that protects the environmental values of the acoustic environment.

13.1.2 ToR Cross-reference Table

Table 13-1 summarises the requirements from the ToR for the Project relevant to this chapter, and where they are addressed.

Table 13-1: ToR cross reference

Terms of reference	Section of the SEIS
8.11 Noise and Vibration	
Describe and illustrate the locations of any sensitive receptors that are listed in Schedule 1 of the Environmental Protection (Noise) Policy 2008.	Section 13.4.3
Also describe any other environmental values that could be impacted by emissions from the proposed project.	Section 13.4
Fully describe the sources and characteristics of noise and vibration that would be emitted during the construction, commissioning, operation, upset conditions, and closure of the project.	Section 13.6 and 13.7
Conduct noise and vibration impact assessment in accordance with the EHP's EIS information guideline—Noise and vibration. The assessment must address low-frequency (<200Hz) noise emissions and potential cumulative impact of the project with other emissions of noise from any existing developments and known possible future development in the area.	Sections 13.5
Describe how the proposed activity would be managed to be consistent with best practice environmental management.	Sections 13.8 and 13.9
The EIS must address the compatibility of the project's noise emissions with existing or potential land uses in surrounding areas. Potential land uses might be gauged from the zonings of local planning schemes, or State Development Areas, etc.	Chapter 5 - Land
Describe how the achievement of the environmental management objectives would be monitored, audited and reported, and how corrective actions would be managed.	Sections 13.8 and 13.9; Appendix 12 - draft EMP

13.1.3 Relevant Legislation and Policy Instruments

The following legislation, policy, guidelines and standards relate to the assessment of noise and vibration for the Project and are relevant for identifying values and mitigating and managing impacts. The policies and guidelines consider the existing acoustic environment and inform the

proposed noise and vibration criteria for the Project. Refer to Chapter 2 – Introduction, for further details on the Project's legislative framework.

13.1.3.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) provides the key legislative framework for environmental management and protection in Queensland. The EP Act utilises several mechanisms to achieve its objectives including: Environmental Protection Policies (EPPs) for water use, noise and air.

13.1.3.2 Environmental Protection (Noise) Policy 2019 (EPP Noise)

The purpose of this policy is to achieve the objective of the EP Act in relation to the acoustic environment by:

- identifying environmental values to be enhanced or protected
- stating acoustic quality objectives for enhancing or protecting the environmental values and
- providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

13.1.3.3 Model Mining Conditions

The EP Act provides for the granting of environmental authorities for resource activities – mining activities. In giving approval under the EP Act, the administering authority must address the regulatory requirements set out in the Environmental Protection Regulation 2019 and the standard criteria contained in the EP Act.

The 'Guideline Mining - Model Mining Conditions (MMC)' (version 6.02, DES 2017) provide a set of model conditions to form general environmental protection commitments for the mining activities and the environmental authority conditions pursuant to the EP Act.

The Guideline states that the 'model conditions should be applied to all new mining project applications lodged after the guideline is approved', therefore this Project is subject to the noise criteria outlined in the guidelines. Noise and blasting criteria have been discussed below.

13.1.3.3.1 Noise

The acoustic criteria outlined in the MMC, as presented in Table 13-2.

Table 13-2: Model mining conditions noise criteria

Noise level dB(A) measured as:	Monday to Saturday			Sunday and Public Holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
Sensitive place						
$L_{Aeq,Adj,15min}$	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 0
$L_{A1,Adj,15min}$	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Commercial place						
$L_{Aeq,Adj,15min}$	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5

CV = Critical Value, AV = Adjustment Value
To calculate noise limits:

- If background ≤ (CV – AV), then the noise limit = background + AV
- If (CV – AV) < background ≤ CV, then the noise limit = CV

- If background > CV, then the noise limit = background + 0
- In the event that measured background $L_{A90,adj,15min}$ is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level
- 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.

13.1.3.3.2 Blasting

The MMC also provides criteria for blasting activities. The MMC criteria for airblast overpressure and ground vibration are described in Table 13-3.

Table 13-3: Airblast overpressure and ground vibration criteria

Blasting noise limits	7am to 6pm	6pm to 7am*
Airblast overpressure	115 dB (Linear) peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) peak at any time	No blasting
Ground vibration peak particle velocity	5 mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	No blasting

* Should blasting during these hours be required, approval will be sought from the appropriate Authorities, and will be covered by a specific Blast Management Plan.

Blasting will occur on Monday to Sunday between 7 am and 6 pm. Should blasting outside these hours be required, approval will be sought from the appropriate Authorities, and will be covered by a specific Blast Management Plan developed for each individual occurrence and will incorporate a notification procedure informing all related and impacted parties. Typically, vibration impacts are localised (within a 20 m radius) and only have the potential to affect sensitive receptors where these are very close to the source of vibration.

13.1.3.4 Eco access Guideline – Assessment of Low Frequency Noise

The Ecoaccess Guideline - Assessment of Low Frequency Noise (Roberts 2004) is applicable to low frequency noise frequencies below 200 Hertz emitted from commercial premises, industrial premises, mining and extractive operations.

The guideline provides for the assessment of the likelihood of low frequency noise complaints in accordance with the initial screening criteria as per the Ecoaccess Guideline:

> *'Where a noise occurs exhibiting an unbalanced frequency spectra, the overall sound pressure level inside residences should not exceed 50 dB(Linear) to avoid complaints of low frequency noise annoyance. If the dB(Linear) measurement exceeds the dB(A) measurement by more than 15 dB, a one-third octave band measurement in the frequency range 10 to 200 Hz should be carried out'.*

When noise emissions show low frequency content is present, the overall sound pressure level inside residences should not exceed 50 dBZ to avoid complaints of low frequency noise annoyance. It is noted that 50 dBZ is an internal noise limit. For low frequency noise to be measured external to the residence, a correction of 5 dBZ is assumed for external noise passing through a window into the residence. As a result, the external low frequency noise limit should be 55 dBZ when measured in free field.

13.1.3.5 Application Requirements for Activities with Noise Impacts (ESR/2015/1838)

The Application Requirements for Activities with Noise Impacts (ESR/2015/1838) outlines the information required to support an EA application for activities with noise impacts. The guidelines require three key areas to be addressed:

- identify the environmental values (EVs) of the receiving acoustic environment including the identification of any nearby sensitive places (see Section 13.4)
- identify the possible impacts due to the proposed activity and all associated risks to the EVs (see Section 13.5 and Section 13.6) and
- identify the strategies to mitigate and manage the identified risks to the EVs (see Section 13.8 and 13.8).

The EVs associated with noise include human health and wellbeing such as sleep quality, relaxation and recreation activities, community amenity and the health and biodiversity of ecosystems.

13.1.3.6 EIS Information Guideline – Noise and Vibration

The EIS Information Guideline – Noise and Vibration (DES 2020a) provides guidance material for the preparation of an EIS Noise and Vibration chapter. The guideline supports the ToR by including comprehensive steps to address the noise and vibration impacts and management measures for the Project.

13.1.3.7 Guideline – Noise and Vibration from Blasting

The DES Guideline – Noise and vibration from blasting (ESR/2016/2169) provides criteria for Environmental Authorities issued under the EP Act.

The guideline specifies human comfort criteria for:

- Airblast overpressure level
- Ground vibration peak particle velocity and
- Times of blasting.

The vibration and blasting criteria as per this guideline is described in Section 13.5.6.

13.2 Deriving Project Specific Noise Criteria

Based on the measured background noise levels, the applicable noise limits according to the MMC are presented in Table 13-4. Note that the most conservative limits are shown in Table 13-4 and these have been used in this assessment.

Table 13-4: Site specific noise criteria for sensitive places as per the MMC methodology

Sensitive Receptor						
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
$L_{Aeq,\ adj,15\ min}$	37	37	30	37	37	30
$L_{A01,\ adj,15\ min}$	42	42	35	42	42	35
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
$L_{Aeq,adj,15\ min}$	42	42	35	42	42	35

The operation of the Project will be 24 hours per day; therefore, the Project will be subject to the daytime, evening and night time criteria presented in Table 13-4. Mine construction will only occur in the daytime - between 7am to 5pm. In this assessment, construction during Year 0 and operation in Years 3 and 12 have been predicted and assessed using the criteria in Table 13-4.

After year 0, construction and rehabilitation activities will generally occur concurrently with mining activities. The same vehicles will be used for construction and operation, so construction noise does not occur in addition to operational noise. This is because, during periods when construction and operation occur concurrently, the operation fleet is pared back to allow use of the fleet in construction.

Blasting noise and vibration has been assessed against criteria given in Table 13-3. For low frequency noise, Ecoaccess Guideline for the Assessment of Low Frequency Noise (Roberts 2004) has been adopted as discussed in Section 13.1.3.4.

13.3 Methods

13.3.1 Fieldwork

Noise monitoring was undertaken at four locations by Noise Measurement Services in 2011 as part of the baseline assessment for the Project. The assessment was carried out in accordance with Australian Standard AS1055.1-1997 'Acoustics-Description and measurement of environmental noise; Part 1: General procedures' (Standards Australia 1997) and the results as presented in the Noise Measurement Service report have been referred to in this chapter and Appendix A8 – Noise and Vibration Technical Report. Further details of the noise monitoring assessment method by Noise Measurement Services is provided in Appendix A8 – Noise and Vibration Technical Report. The noise monitoring locations are shown on Figure 13-1.

13.3.2 Noise Prediction Modelling

Noise level predictions have been assessed using the SoundPLAN noise modelling software using the CONCAWE noise prediction methodology. The CONCAWE methodology is suited for predicting noise propagation over large distances as it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise. This method is supported by the EIS Information Guideline – Noise and Vibration (DES 2020a). The SoundPLAN software and calculation methodology allows environmental parameters to be modelled. Further details on the noise modelling software is presented in Appendix A8 – Noise and Vibration Technical Report. The details of the modelling are discussed below in Section 13.5.

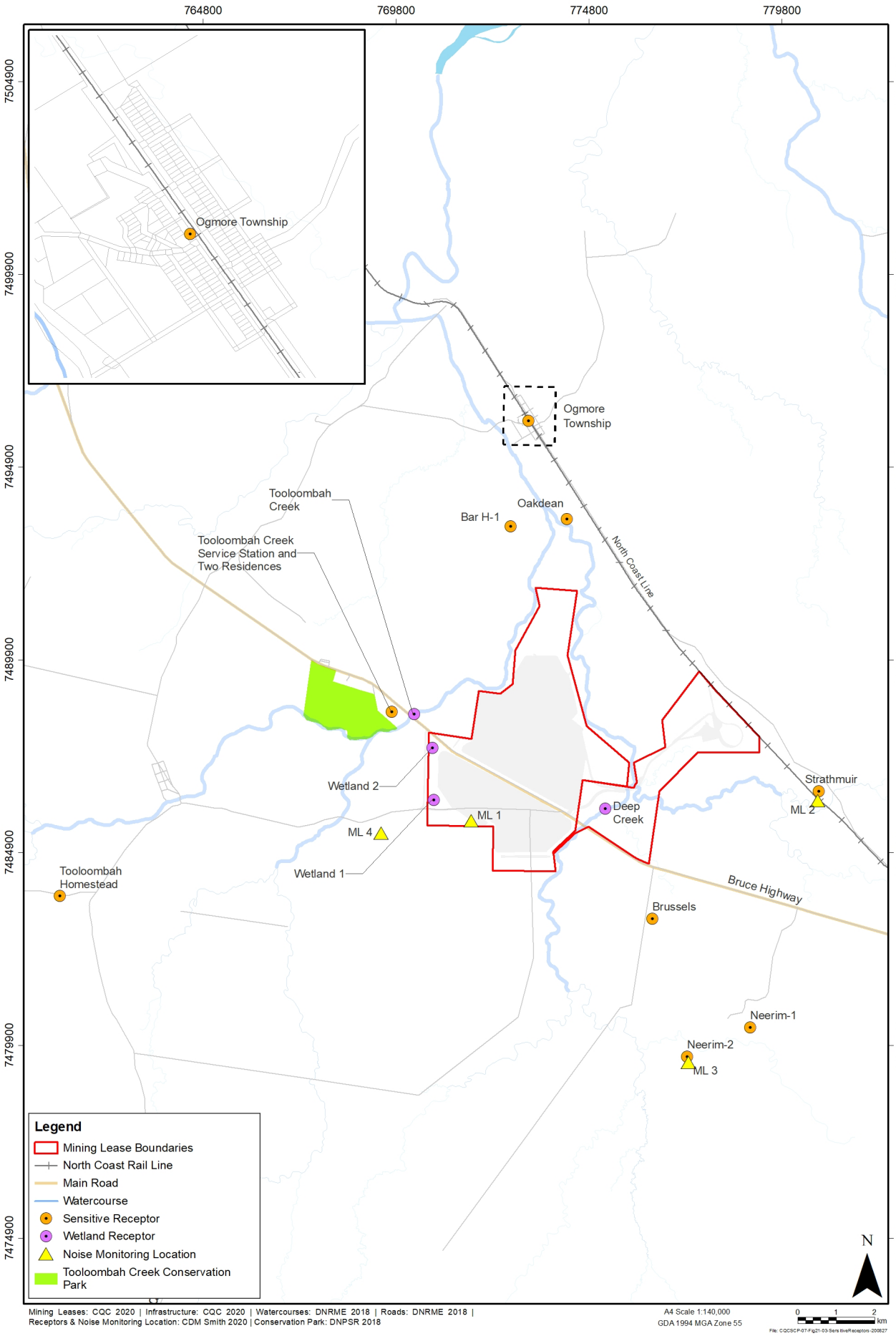

Figure 13-1: Monitoring sites and sensitive receptors

13.4 Description of Environmental Values

The following sections outline the existing environment relevant to the Project area and the noise and vibration impact assessment.

13.4.1 Terrain

Elevations across the Styx catchment range from 0 – 540 m above sea level. The area predominantly comprises flat or undulating lands, draining via several smaller creeks and tributaries to the Styx River and estuary, and into the Coral Sea. The land within the Project area can be described as gently undulating. The topography of the Project area is discussed in more detail in Chapter 5 - Land.

13.4.2 Surrounding Land Uses

The dominant land use within and adjoining the Project area is beef cattle grazing. The mine component of the Project is located entirely within Mamelon cattle property. The haul road is located on Mamelon, Brussels and Strathmuir and the TLF is located on Strathmuir. These properties are used for beef cattle grazing. Land uses within the Project area are discussed in Chapter 5 - Land.

13.4.3 Sensitive Receptors

Consistent with the EPP Noise a sensitive receptor is a place where noise can result in adverse impacts. As listed in Schedule 1 of the EPP Noise sensitive receptors include dwellings, libraries and educational institutions, childcare centres, medical institutions, commercial and retail activity centres, protected areas identified under the *Nature Conservation Act 1992* as a critical habitat or area of major interest, and public parks or gardens.

Using aerial imagery and on ground assessments, nine sensitive receptors are located in proximity to the Project.

It is anticipated that the Project personnel will be accommodated locally; however, if this is not practicable overflow accommodation will be provided via the expansion of existing Marlborough Caravan Park. As such no accommodation camp will be required for the Project.

Overall, there a very few sensitive receptors surrounding the Project given the particularly rural nature of the area. The receptor name and the location of each receptor is described in Table 13-5. Except for the nearest sensitive receptor, Tooloombah Creek Service Station, which includes two residential receptors, all identified receptors are isolated homesteads. The entire township of Ogmore has been counted as one sensitive receptor.

Sensitive receptor locations and monitoring locations in relation to the Project boundary are given in Table 13-5 and shown in Figure 13-1.

Table 13-5: Sensitive receptor locations within wider Project area

Receptor name	Location		Distance and direction
	Latitude	Longitude	
BAR H-1	149.654152	-22.644752	4.1 km (N)
Brussels	149.69164	-22.736011	3.2 km (SE)
Neerim-1	149.716823	-22.761051	6.9 km (SE)
Neerim-2	149.701064	-22.768169	3.4 km (SE)
Oakdean	149.668225	-22.642817	4.5 km (NE)
Ogmore Township	149.658111	-22.619961	6.8 km (N)
Strathmuir	149.732975	-22.705505	6.3 km (E)
Tooloombah Service Station (including two residences)	149.625007	-22.688686	2.2 km (W)
• TSC RES 1	149.626891	-22.688964	1.9 km (NW)
• TC RES 2	149.626348	22.687752	2.1 km (NW)
Tooloombah Homestead	149.541997	-22.733402	10.2 km (W)

Environmentally Sensitive Area (ESA) mapping identified a category B ESA within the mining lease. This category B ESA is associated with remnant vegetation listed as Endangered under the *Vegetation Management Act 1999* (VM Act). The assessment of noise impacts on ecological receptors are addressed in Chapter 14 – Terrestrial Ecology.

Two additional sensitive receptors BAR H-2 and BAR H-3 were identified in the original EIS. These two receptors have been discarded from the assessment as: BAR H-2 is an unoccupied and dilapidated house that has been confirmed as uninhabitable and BAR H-3 is a pump hut, hence not suitable to be an inhabited dwelling. Should the BAR H-2 house be returned to a liveable standard at some time in the future Central Queensland Coal will implement noise monitoring to ascertain any potential exceedances from operations.

13.4.4 Meterological Conditions

Noise propagation over long distances can be significantly affected by the weather conditions, in particular winds and temperature inversions, as both these conditions can increase noise levels at sensitive receptors. They may also reduce noise levels in certain situations.

The EIS Information Guideline - Noise and Vibration (DES 2020a), requires the prediction of noise for "*different times of under both average and worst-case climatic conditions*". Adverse climatic conditions with respect to noise modelling relates to those atmospheric conditions that enhance the motion of noise, that is calm and clear conditions during the evening and night time periods.

The CONCAWE methodology can predict to one of six meteorological categories. To determine which category is modelled, the Pasquill Stability Classes need to be determined for the Project. For this assessment the weather conditions, including stability class frequencies at the proposed Project have been obtained from The Air Pollution Model (TAPM). TAPM is a three-dimensional prognostic model developed and verified by Commonwealth Scientific and Industrial Research Organisation (CSIRO). TAPM data was generated for the air quality assessment has been used for uniformity. The wind parameters were compared to the Bureau of Meteorology (BOM) data, the TAPM data and were found to be very similar and overall, the meteorological data generated by TAPM is considered to be representative of the site.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance the motion of noise. The Pasquill-Gifford Stability Classes define the amount of turbulence in the air, of which the most widely used categories are Classes A-F. The TAPM generated meteorology determined the stability class for each hour of the year. The frequency of each stability class occurrence is shown in Table 13-6. Temperature inversions are defined as Class F. These conditions only occur with clear and calm conditions during the evening and night time periods. During the night time period (22:00-07:00 hours), Class F occurs 34.3% of the hours.

Table 13-6: Annual stability class distribution predicted [TAPM 2014]

Stability Class	Description	Frequency of Occurrence (%) and Average Wind Speed (m/s)					
		Daytime Period		Evening Period		Night Time Period	
		Freq.	Wind Speed	Freq.	Wind Speed	Freq.	Wind Speed
A	Very unstable low wind, clear skies, hot daytime conditions	1.3%	2.1	-	-	-	-
B	Unstable clear skies, daytime conditions	10.8%	3.0	-	-	-	-
C	Moderately unstable moderate wind, slightly overcast conditions	36.1%	3.4	43.9%	4.2	-	-
D	Neutral high winds or cloudy days and nights	51.8%	3.0	20.1%	2.7	33.5%	1.4
E	Stable moderate wind, slightly overcast night-time conditions	-	-	34.7%	2.4	32.2%	2.0
F	Very stable low winds, clear skies, cold night-time conditions	-	-	-	-	34.3%	2.1

In summary the average climatic conditions are:

- Day: Stability Class D 3m/s south-easterly wind, 20 degrees Celsius (that is, wind blowing away from receptors southeast of the mine).
- Evening: Stability Class D 2.7m/s south-easterly wind, 20 degrees Celsius.
- Night: Stability Class D 1.4m/s south-easterly wind, 20 degrees Celsius.

The worst climatic conditions are:

- Day: Stability Class D 3m/s source to receiver wind, 10 degrees Celsius.
- Evening: Stability Class E 2.4m/s source to receiver wind, 10 degrees Celsius.
- Night: Stability Class F 2.1m/s source to receiver wind, 10 degrees Celsius.

13.4.5 Background Noise

The noise environment near the Project can be characterised as ‘very rural’, with only mild sources of activity noise, mostly local activity at dwellings and plant and machinery used for agriculture and livestock. The Bruce Highway cuts through the proposed Mining Lease (ML) area and the North Coast Rail Line is located approximately 1.5 km from the northern boundary of the proposed ML area. These are likely to have an influence on the acoustic environment; however, traffic is intermittent on both road and rail. Environmental noise (wildlife, flora, wind) is the predominant noise.

Noise emitted from natural sources such as wind and fauna activity varies throughout the seasons. During the summer months, background noise is dominated by insect noise. Noise monitoring was

undertaken in March 2011. Measurement results for this assessment were supplemented by estimated background noise levels from Australian Standard AS1055.2 for a noise category R1 which is expected to be representative of a rural area with negligible transportation noise.

Type 2 environmental noise loggers were used to record L_{01}, L_{10}, L_{90} and L_{eq} levels in 15 minute intervals. Noise monitoring was conducted at the following four locations:

- ML1 - Lease office Mamelon
- ML2 - Strathmuir property
- ML3 - Neerim property and
- ML4 - Gravel track adjacent to energy easement (approximately 2 km west of ML1).

A weather station was set up at ML1. Weather conditions during monitoring included periods of rain and wind. Intervals that included rainfall events or an average wind speed above 5.5 m/s were removed from the datasets

A summary of the noise monitoring results is presented in Table 13-7.

Table 13-7: Summary of noise monitoring results March 2011

Noise descriptor	Time period for all days	Overall noise levels dB(A) during monitoring period			
		ML1	ML2	ML3	ML4
$L_{eq, adj, 15 mins}$	Day (7am to 6pm)	40.3	49.8	41.3	39.7
	Evening (6pm to 10pm)	49.2	46.1	45.6	38.1
	Night (10pm to 7am)	45.3	50.9	39.5	37.4
$L_{01, adj, 15 mins}$	Day (7am to 6pm)	53.5	69.6	56.7	52.1
	Evening (6pm to 10pm)	56.3	53.1	57.8	50.4
	Night (10pm to 7am)	53.4	71.3	50.3	49.8
$L_{10, adj, 15 mins}$	Day (7am to 6pm)	40.5	45.6	42.2	39.6
	Evening (6pm to 10pm)	48.9	43.5	47.8	40.5
	Night (10pm to 7am)	46.3	44.1	42.2	40.0
$L_{90, adj, 15 mins}$	Day (7am to 6pm)	34.3	35.5	32.7	31.7
	Evening (6pm to 10pm)	44.7*	37.8	38.1	32.4
	Night (10pm to 7am)	39.5	38.2	32.6	28.1

* May be affected by seasonal insect or fauna noise

Estimated background levels for different areas containing residences are provided in Australian Standard AS1055.2-1997 'Acoustics-Description and measurement of environmental noise; Part 2: Application to specific situations'. For a noise area category R1, average $L_{A90,T}$ for day, evening and night are 40 dB(A), 35 dB(A), and 30 dB(A) respectively.

In comparison to AS1055.2 estimated levels, measured noise levels at all measurement locations were lower during the day. Measured noise levels at all locations were higher at evening and night, except for ML4.

13.5 Noise Modelling

13.5.1 Scenarios Modelled

Noise modelling has been conducted for three stages of the proposed project as follows:

- Construction Stage
- Stage 1, Year 3 of operations and
- Stage 2, 12 years following commencement of operation.

Noise modelling includes terrain data for Year 3 and Year 12 mining sequence contours. The construction stage has been modelled on existing natural ground level terrain data prior to any works commencing.

The scenario assessed for Stage 2 of operations represents near maximum capacity with maximum equipment usage. This scenario is considered representative of worst case conditions.

13.5.1.1 Climatic scenarios

The EIS Information Guideline - Noise and Vibration (DES 2020a) requires the prediction of noise for "*different times of under both average and worst-case climatic conditions*"

After reviewing the site specific wind speeds, wind direction and stability classes, it has been determined that the sensitive receptors will be generally upwind of mining noise sources. This has been applied for the assessment under average climatic conditions. For the worst case assessment; source to receptor winds have been applied.

Stability classes A, B, and C are associated with an unstable atmosphere and are generally unfavourable for noise propagation. Condition D is a neutral condition for noise propagation while conditions E and F are unfavourable as stable conditions further facilitate noise propagation.

Taking into consideration the time of day the Project will be operating the following weather scenarios have been assessed:

13.5.1.1.1 Average Climatic Conditions:

Class D (neutral) conditions occur for more than 50%, 20%, and 33% of the time during the day, evening and night. Class D has been modelled for the average climatic condition scenarios for day, evening, and night, with south-easterly winds at speeds as applicable for the time of day. It should be noted that under average conditions, noise levels at receptors located north-west of the mine and Train Loadout Facility (TLF) are likely to experience higher noise levels as sound is carried by south-easterly winds. This would consequently result in lower noise levels at receptors located south-east of the mine and TLF.

13.5.1.1.2 Worst Case Climatic Conditions:

Class E and F (stable) conditions are worst case climatic conditions that occur in the Project area in the evening and night periods respectively. Class E has been assessed for the worst case evening noise, while Class F has been used to assess worst case night time noise levels. Class D is applicable for the day time. Worst case source to receptor winds have been assessed, with wind speeds as applicable for the time of day.

13.5.1.1.3 Climatic scenarios modelled

The average and worst case climatic conditions were assessed using the following modelling scenarios:

Average Climatic Conditions

- Day: Stability Class D 3m/s south-easterly wind, 20 degrees Celsius (that is, wind blowing away from receptors southeast of the mine).
- Evening: Stability Class D 2.7m/s south-easterly wind, 20 degrees Celsius.
- Night: Stability Class D 1.4m/s south-easterly wind, 20 degrees Celsius.

Worst Climatic Conditions

- Day: Stability Class D 3m/s source to receiver wind, 10 degrees Celsius.
- Evening: Stability Class E 2.4m/s source to receiver wind, 10 degrees Celsius.
- Night: Stability Class F 2.1m/s source to receiver wind, 10 degrees Celsius.

Construction is proposed to only occur during the day period, therefore evening and night time levels for construction have not been assessed.

It should also be noted that actual noise levels are expected to be lower than the predicted noise levels that are presented in the following sections. This is due to:

- the conservative modelling assumption that all equipment listed in Table 13-8 and Table 13-9 will be in operation simultaneously in their respective stages, whereas this is unlikely to occur in actual operations
- a fleet management system (such as Wenco) will be in place to restrict night time operations to below surface (in pit) and
- the actual haul truck equipment used will likely have lower dB(A) lower noise emissions (SWL basis) than those modelled.

13.5.1.2 Equipment scenarios

Two equipment scenarios were modelled for each of the three stages and climatic conditions described above. The first equipment scenario involved the use of the CAT 785D, 789D and 793D Haul Trucks - discussed in Section 13.6. A second equipment scenario investigated the minimisation of noise through replacing the aforementioned CAT trucks with CAT 793D XQ noise attenuated trucks. However, these were used for the purposes of assessment only (as spectral data was unable to be provided by Hitachi), and it is intended that the Hitachi EH3500 AC3 (Level 2 – Exhaust System) haul trucks will replace CAT 785D and CAT 789D trucks, and the Hitachi EH4000 AC3 (Level 2 – Exhaust System) will replace the CAT 793D haul trucks. With the Level 2 attenuation package, the Hitachi equipment intended to be used are able to achieve same or lower noise level (SWL dB(A)) than the CAT 793D XQ.

Predicted noise levels associated with the Hitachi trucks are discussed in Section 13.7.

13.5.1.2.1 Construction Phase

The construction equipment modelled and the location of this equipment, for modelling purposes, is provided in Table 13-8 and Figure 13-2.

Table 13-8: Construction equipment schedule

Equipment	Quantity
CAT 631G Scraper	2
785D Haul Truck (Hitachi EH3500 AC3 as alternative[1])	4
789D Haul Truck (Hitachi EH3500 AC3 as alternative[1])	4
793D Haul Truck (Hitachi EH4000 AC3 as alternative[1])	5
RH170 Excavator	1
Liebherr 996 Excavator	1
EX1200 Excavator	1
SKS 270mm Drill	
MD5150C Track Drill	
D9 Dozer	1
D10 Dozer	1
D11 Dozer	1
HD605 Water Cart	1
16M Grader	
24H Grader	
16 Grader	1
B-Double Coal Haulage Units	
992 Front End Loader	1
960 Front End Loader	1
980 Front End Loader	1
Volvo Semi-Tippers	8
Service Truck	1
Pump Truck	1
Fuel Truck	1
Franna Crane	1
Service vehicles	
Generator (520kVA)	
Generator (300kVA)	
Generator (1MW)	1
UDR800 Drill	1

[1] Spectral data was unable to be provided by Hitachi for the EH3500 AC3 and EH4000 AC3 Haul Trucks. For the purposes of providing a conservative assessment, spectral data for these models have been based off CAT793D XQ noise attenuated haul trucks. With a Level 2 attenuation package the Hitachi EH4000 AC3 and EH3500 AC3 are able to achieve same or lower noise level (SWL dB(A)) than the CAT 793D XQ.

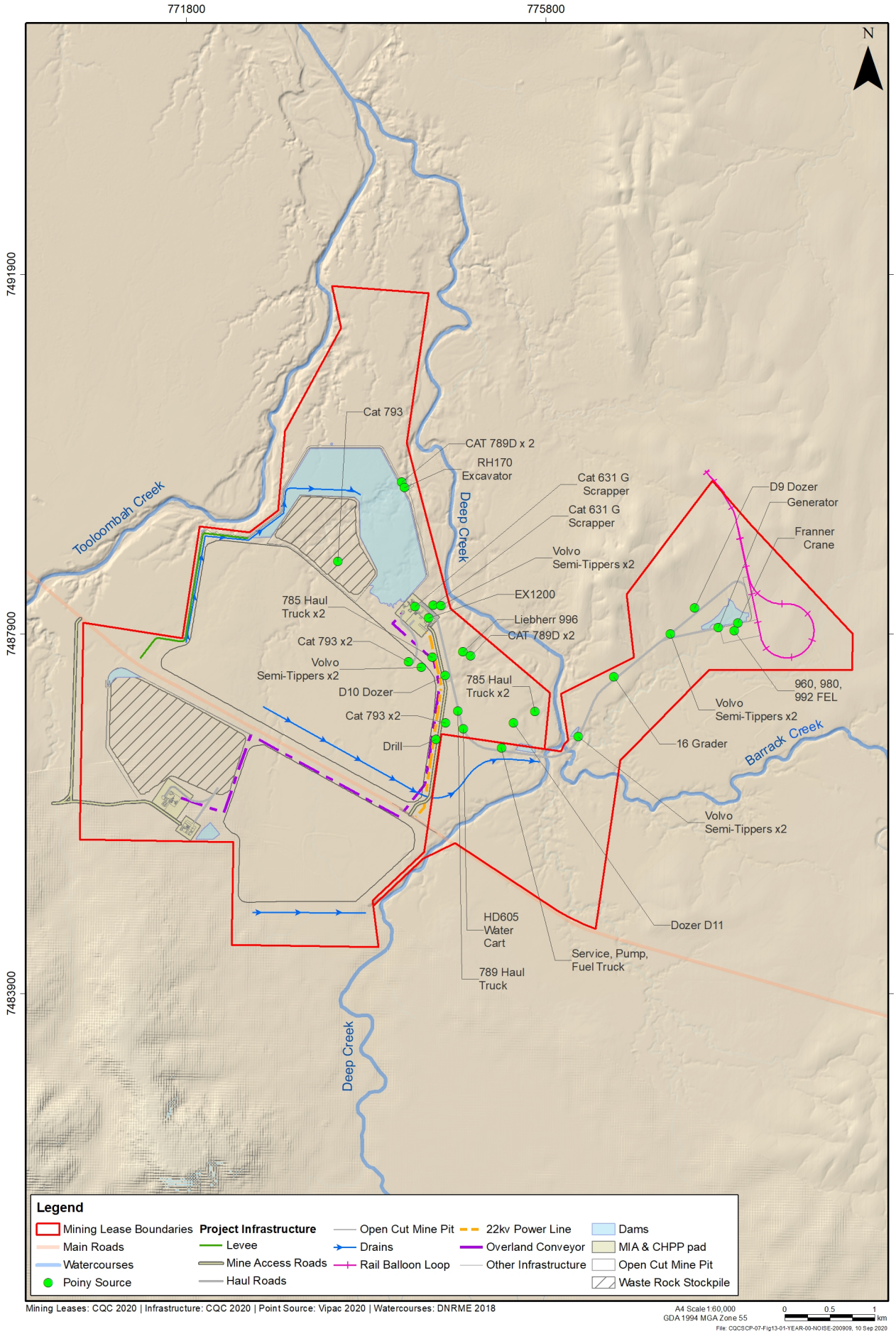

Figure 13-2: Construction noise sources as modelled

13.5.1.2.2 Operational Phase

The mining equipment sequence for the Project operations is presented Table 13-9 and the location of stationary equipment is presented in Figure 13-3 for Year 3, and Figure 13-4 for Year 12.

Table 13-9: Operational equipment schedule

Equipment	Quantity	
	Year 3 (Stage 1)	Year 12 (Stage 2)
CAT 631G Scraper	1	1
785D Haul Truck (Hitachi EH3500 AC3 as alternative[1])		
789D Haul Truck (Hitachi EH3500 AC3 as alternative[1])	4	8
793D Haul Truck (Hitachi EH4000 AC3 as alternative[1])	8	36
RH170 Excavator	1	2
Liebherr 996 Excavator	2	9
EX1200 Excavator		
SKS 270mm Drill	1	4
MD5150C Track Drill	1	3
D9 Dozer	1	4
D10 Dozer	2	5
D11 Dozer	2	4
HD605 Water Cart	2	4
16M Grader	2	2
24H Grader	1	2
16 Grader		
B-Double Coal Haulage Units	2	8
992 Front End Loader	3	6
960 Front End Loader		
980 Front End Loader		
Volvo Semi-Tippers		
Service Truck	1	2
Pump Truck	1	2
Fuel Truck	1	3
Franna Crane	1	2
Service vehicles	10	19
Generator (520kVA)	3	3
Generator (300kVA)	3	3
Generator (1MW)		
UDR800 Drill		

[1] Spectral data was unable to be provided by Hitachi for the EH3500 AC3 and EH4000 AC3 Haul Trucks. For the purposes of providing a conservative assessment, spectral data for these models have been based off CAT 793D XQ noise attenuated haul trucks. With a Level 2 attenuation package the Hitachi EH4000 AC3 and EH3500 AC3 are able to achieve same or lower noise level (SWL dB(A)) than the CAT 793D XQ.

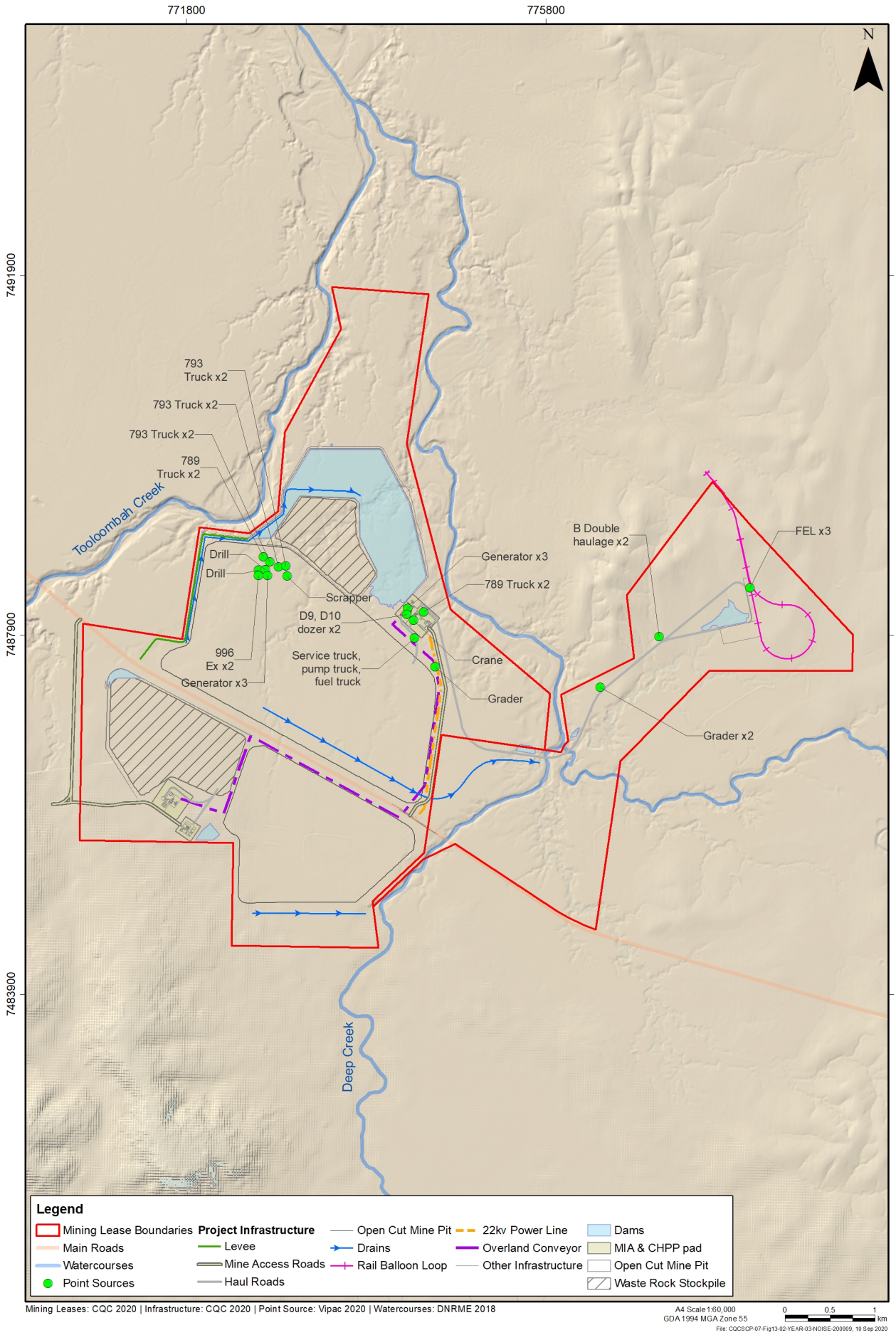

Figure 13-3: Year 3 operation noise sources as modelled

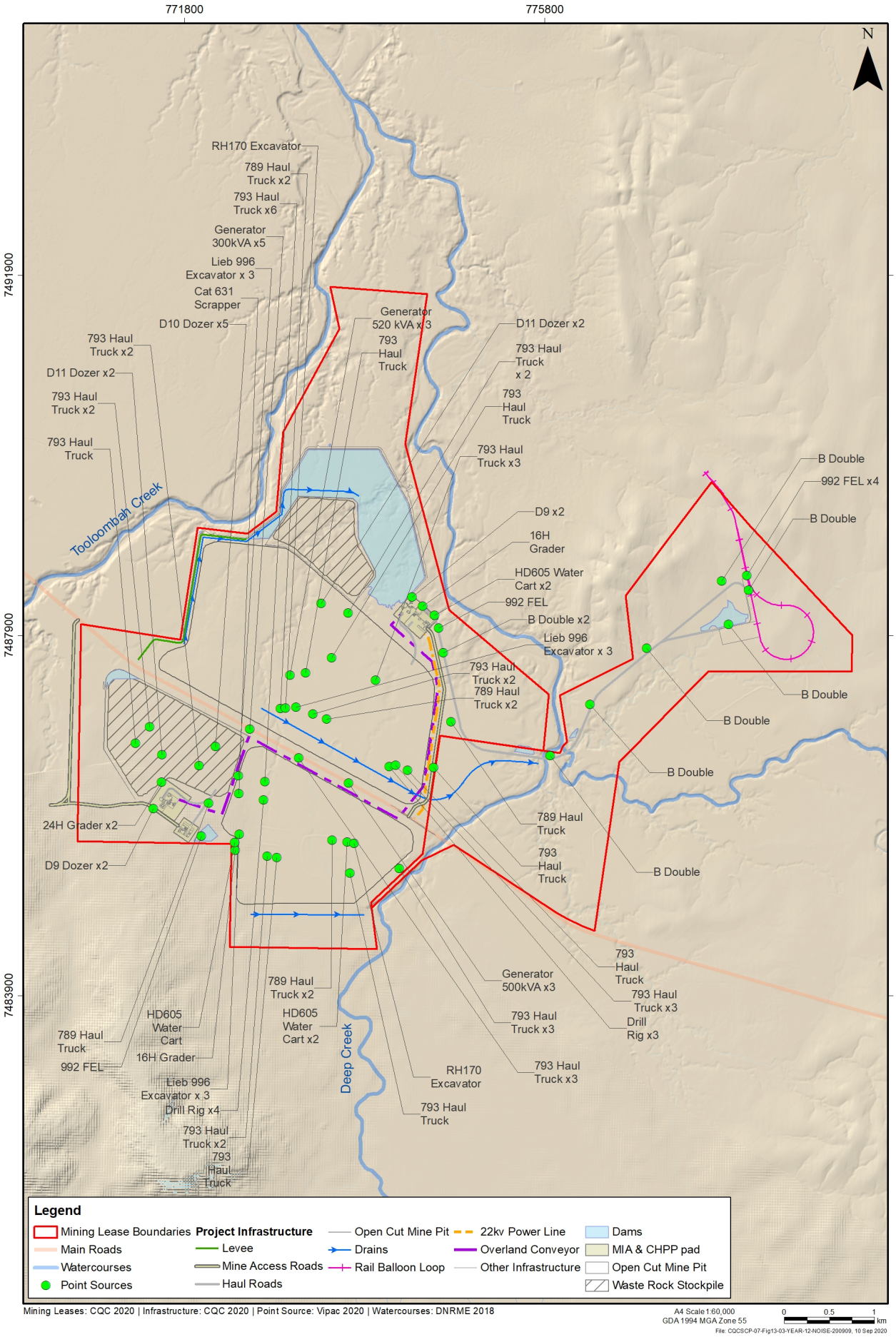

Figure 13-4: Year 12 operation noise sources as modelled

13.5.2 Sound Power Levels

Equipment noise data used for this assessment are shown in Table 13-10 and Table 13-11. The following sources have been referred to in establishing associated sound power levels (SWL) noise sources:

- Vipac's database, which includes noise measurements of plant measured at other mine sites
- Overall Sound Power Level data provided by Hitachi for the Hitachi haul truck fleet and
- noise data from previous similar projects.

L_{A01} noise levels were estimated to be 5dB above the L_{Aeq} levels shown below, based on similar assessments.

The indicative equipment to be used and their corresponding sound power levels (noise) during the construction phase are outlined in Table 13-10 and operations in Table 13-11.

Table 13-10: Sound power levels for significant noise sources - construction phase

Plant	Frequency (dB(A))										SWL dB(A)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	L_{eq}
Generator (1MW)					108						108
CAT 631G Scrapper		77	92	102	103	104	102	96	88	85	109
CAT 785D Haul Truck	74	86	97	111	114	106	101	94	86		116
CAT 789D Haul Truck	74	86	97	111	114	106	101	94	86		116
CAT 793D Haul Truck	81	93	104	118	121	113	108	101	93		123
RH170 Excavator		86	95	103	111	112	113	107	100		118
Liebherr 996 Excavator		91	95	98	104	106	103	93	81		110
EX1200 Excavator		93	97	100	106	108	105	95	83		112
960, 980, 992 Front End Loader		81	101	95	106	107	107	101	94		112
Volvo Semi-Tippers	64	81	96	102	107	108	104	98	92		112
UDR800 Drill		80	89	97	100	105	107	109	107		114
D9, D10, D11 Dozer	72	88	97	96	105	104	103	98	90		110
HD605 Water Cart	67	84	99	105	110	111	107	101	95		115
16 Grader	64	78	94	100	106	110	106	103	98		113
Franna Crane	79	87	94	103	115	118	119	119	114		125
Hitachi EH3500 AC3 (Level 2 – Exhaust System) Haul Truck*	72	84	95	109	112	104	99	92	84		113
Hitachi EH4000 AC3 (Level 2 – Exhaust System) Haul Truck*	72	84	95	109	112	104	99	92	84		112

*Indicative figures only for these trucks. Spectral data was unable to be provided by Hitachi for the EH3500 AC3 and EH4000 AC3 Haul Trucks. For the purposes of providing a conservative assessment, spectral data for these models have been based off CAT 793D XQ noise attenuated haul trucks. With a Level 2 attenuation package the Hitachi EH4000 AC3 and EH3500 AC3 are able to achieve same or lower noise level (SWL dB(A)) than the CAT 793D XQ .

Table 13-11: Sound power levels for significant noise sources - operational phase

Plant	Frequency (dB(A))										SWL dB(A)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	L_{eq}
CAT 613G Scraper		77	92	102	103	104	102	96	88	85	109
CAT 793D Haul Truck	81	93	104	118	121	113	108	101	93		123
CAT 789D Haul Truck	74	86	97	111	114	106	101	94	86		116
RH170 Excavator		86	95	103	111	112	113	107	100		118
Liebherr 996 Excavator		91	95	98	104	106	103	93	81		110
SKS 270mm Drill		80	89	97	100	105	107	109	107		114
MD5150C Track Drill		80	89	97	100	105	107	109	107		114
D9, D10, D11 Dozer	72	88	97	96	105	104	103	98	90		110
HD605 Water Cart	67	84	99	105	110	111	107	101	95		115
16M Grader	64	78	94	100	106	110	106	103	98		113
24H Grader	67	81	96	103	108	113	109	105	101		116
B-Double Coal Haulage Units	64	81	96	102	107	108	104	98	92		112
992 FEL		81	101	95	106	107	107	101	94		112
Service, Pump, Fuel Truck					85						85
Franna Crane	79	87	94	103	115	118	119	119	114		125
Service Vehicles					88						88
Generator 520kVA					108						109
Generator 300kVA					108						108
Conveyors (per meter)		65	69	76	73	76	76	81	81		86
Conveyor Drives		73	81	87	96	103	96	92	84		105
CHPP - total	89	94	98	105	112	114	112	109	98	79	119
Truck Unloading and Primary Crusher	61	79	91	98	107	111	114	113	103	88	118
Secondary Crusher	53	74	91	98	104	104	100	89	80	62	108
Hitachi EH3500 AC3 (Level 2 – Exhaust System) Haul Truck*	72	84	95	109	112	104	99	92	84		113
Hitachi EH4000 AC3 (Level 2 – Exhaust System) Haul Truck*	72	84	95	109	112	104	99	92	84		112

*Indicative figures only for these trucks. Spectral data was unable to be provided by Hitachi for the EH3500 AC3 and EH4000 AC3 Haul Trucks. For the purposes of providing a conservative assessment, spectral data for these models have been based off CAT 793D XQ noise attenuated haul trucks. With a Level 2 attenuation package the Hitachi EH4000 AC3 and EH3500 AC3 are able to achieve same or lower noise level (SWL dB(A)) than the CAT 793D XQ .

13.5.3 Location of Sources

Noise source locations for the construction stage are based on the assumption that construction of the dams, CHPP 1, haul roads and the rail siding will occur during Year 0. The operational noise sources have been modelled to reflect the mining schedule (see Chapter 1 – Introduction and Project Description) for Year 3 and Year 12. The locations of sources are presented in Figure 13-2 to Figure 13-4 for Construction (Year 0), Year 3 and Year 12 respectively.

13.5.4 Rehabilitation Noise

Based on information from the mine schedule, the construction, operation and rehabilitation stages will occur simultaneously between Years 3 to 19. From Year 19 through to Year 24 the only activities at site will be related to final rehabilitation and mine closure activities (apart from a small period of mining at the start of Year 19). A separate assessment of rehabilitation is not necessary for years 19 to 24, as the Year 12 scenario modelled is representative of the worst case scenario for noise related to rehabilitation due to maximum mining operations occurring.

13.5.5 Low Frequency Noise Assessment

A low frequency noise assessment was undertaken for the operations by predicting dB(Linear) at noise sensitive receptors and comparing against a 55 dB(Linear) criteria. Low frequency noise has been predicted for the evening time only, as noise during this period is expected to be the highest due to meteorological conditions. Compliance with the noise criteria during this period would also result in compliance for day and night.

13.5.6 Blasting Noise and Vibration Assessment

The vibration assessment incorporated blasting (removal of overburden and extraction of coal from open cut pits) and mobile plant equipment. Blasting will be required to break and fragment the overburden and interburden horizons. The separation distances between the nearest pit edge and sensitive receptors is provided in Table 13-12.

Table 13-12: Separation distances for blasting assessment

Receptor	Distance to pit edge
Tooloombah Creek Service Station (including TSC Res 1 and TSC Res 2)	2 km
Brussels	3 km

Control of ground vibration is highly dependent on the charge mass per delay (or Mass Instantaneous Charge, MIC), blasting control measures, and local ground properties. Blasting parameters for the Project are shown in Table 13-13.

Table 13-13: Blasting parameters

Blast Parameter	Value
Blast hole diameter	165 mm to 275 mm
Blast hole depth	15 to 50 m
Explosive	ANFO, Heavy ANFO and Emulsion
MIC	1000 kg / 250 kg

Estimations of potential blasting vibration and airblast overpressure levels have been made using equations outlined in Australian Standard AS2187.2-2006 - Explosives – Storage and use of explosives (Standards Australia 2006).

13.5.6.1 Bruce Highway

Central Queensland Coal has committed to an interim 500 m buffer area off the Bruce Highway where no blasting will occur until a specific Blast Management and Monitoring Plan (BMP) for the buffer area has been approved by DES and DTMR. The current mine plan has no mining proposed within the interim buffer area until 12 years from the commencement of construction. The commitment to no blasting within the interim buffer area will enable Central Queensland Coal to

undertake blasting outside of the buffer area in accordance with the current mine planning, whilst using the blast data to inform the preparation of the specific BMP for the interim buffer area.

The data will also be used to further model potential for vibration impacts to the Bruce Highway prior to mining activities occurring within the buffer area. Further discussion in respect of the geotechnical assessment which considers potential for impacts to the Bruce Highway and the approach to implementing and managing blasting activities are included in Chapter 6 – Traffic and Transport.

13.6 Potential Impacts

This section assesses the impacts of the revised noise and vibration modelling assessment results on the sensitive receptors shown in Figure 13-1. It should be noted that actual noise levels may be lower than the predicted noise levels that are presented. This is due to the conservative modelling assumption that all equipment listed in Table 13-8 and Table 13-9 will be in operation simultaneously in their respective stages, whereas this is unlikely to occur in actual operations.

A further consideration in respect of modelling noise generated by the Project is that further geotechnical assessment of the mining pit at the 500 m buffer zone is proposed to be undertaken with six months of project activities commencing. Depending on the outcome of this analysis, the mine plan may be updated which may require updated noise modelling to assess for impacts to sensitive receptors.

Notwithstanding, Central Queensland Coal commits to undertaking routine noise monitoring from the commencement of construction at potentially impacted sensitive receptors to monitor for noise impacts. The mitigation measures that will be implemented are described at Sections 13.7 and 13.8.

13.6.1 Construction – Year 0

Noise generation from the preparation of the open cut mining area and surface infrastructure areas will be the primary potential impact to the existing acoustic environment. This includes activities such as truck movements, blasting, constructing the TLF and power generation. Construction activities will only occur during the daytime.

As can be seen from Table 13-14, initial construction activities during year 0 are predicted to comply with the noise criteria during both average and worst case climatic conditions.

Table 13-14: Predicted construction noise levels for Year 0 - daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	34	35	39	40
Brussels		22	36	27	41
Neerim-1		10	24	15	29
Neerim-2		10	24	15	29
Oakdean		33	34	38	39
Ogmore Township		24	25	29	30
Strathmuir		18	31	23	36
Tooloombah Creek Service Station		36	37	41	42
• TSC RES 1		36	37	41	42
• TSC RES 2		35	36	40	41
Tooloombah Homestead		14	12	19	17

13.6.2 Stage 1 - Year 3 Operations

As can be seen from Table 13-15 and Table 13-16, during daytime and evening periods, noise levels in Year 3 are predicted to comply with the noise criteria at the majority of receptors under average and worst climatic conditions. The exception is the Tooloombah Creek Service Station and one of the residences on that propoerty, TSC RES 1, during worst case conditions only. Predicted exceedances of the noise criteria have been shown in red.

As shown in Table 13-17, exceedances during average and worst case climatic conditions for the Year 3 night time period are predicted to occur at Bar H-1, Oakdean, Tooloombah Creek Service Station and the two residences on that site, TSC RES 1 and TSC RES 2. Exceedances are also predicted during worst case climatic conditions only for Year 3 at Brussels.

Table 13-15: Predicted operation noise levels for Year 3, stage 1- daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	34	36	39	41
Brussels		18	32	23	37
Neerim-1		9	20	14	25
Neerim-2		9	21	14	26
Oakdean		33	34	38	39
Ogmore Township		24	25	29	30
Strathmuir		17	30	22	35
Tooloombah Creek Service Station		37	38	42	43
• TSC RES 1		37	38	42	43
• TSC RES 2		36	37	41	42
Tooloombah Homestead		14	12	19	17

Table 13-16: Predicted operation noise levels for Year 3, stage 1- evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	35	36	40	41
Brussels		18	32	23	37
Neerim-1		9	21	14	26
Neerim-2		9	22	14	27
Oakdean		33	34	38	39
Ogmore Township		25	26	30	31
Strathmuir		17	30	22	35
Tooloombah Creek Service Station		37	38	42	43
• TSC RES 1		37	38	42	43
• TSC RES 2		36	37	41	42
Tooloombah Homestead		14	14	19	19

Table 13-17: Predicted operation noise levels for Year 3, stage 1- night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	30/35	36	36	41	41
Brussels		19	32	24	37
Neerim-1		9	20	14	25
Neerim-2		9	21	14	26
Oakdean		32	34	37	39
Ogmore Township		26	25	31	30
Strathmuir		18	30	23	35
Tooloombah Creek Service Station*		36	38	41	43
• TSC RES 1		36	38	41	43
• TSC RES 2		36	37	41	42
Tooloombah Homestead		11	12	16	17

*Currently non-operational; unlikely to operate at night if it becomes operational again

13.6.3 Stage 2 – Year 12 Operations

As can be seen from Table 13-18 and Table 13-19, during daytime and evening periods, noise levels in Year 12 are predicted to exceed the noise criteria under average and worst climatic conditions at Tooloombah Creek Service Station, including the residences on that site, TSC RES 1, TSC RES 2 and. Exceedances at Brussels are also predicted under worst case climatic conditions during the day and evening period. As shown in Table 13-20, exceedances during average and worst case climatic conditions for the Year 12 night time period are predicted to occur at Bar H-1, Oakdean, TSC RES 1, TSC RES 2 and Tooloombah Creek Service Station. Exceedances are also predicted during worst case climatic conditions only for Year 12 at Brussels and Strathmuir.

Noise reduction has been investigated by replacing the Caterpillar haul trucks with Hitachi haul trucks as detailed below in Section 13.7.

Table 13-18: Predicted operation noise levels for Year 12, stage 2- daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	31	32	36	37
Brussels		28	42	33	47
Neerim-1		15	29	20	34
Neerim-2		16	30	21	35
Oakdean		33	33	38	38
Ogmore Township		25	26	30	31
Strathmuir		20	34	25	39
Tooloombah Creek Service Station		44	45	49	50
• TSC RES 1		45	46	50	51
• TSC RES 2		44	45	49	50
Tooloombah Homestead		21	20	26	25

Table 13-19: Predicted operation noise levels for Year 12, stage 2- evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	31	33	36	38
Brussels		28	43	33	48
Neerim-1		15	30	20	35
Neerim-2		17	31	22	36
Oakdean		33	34	38	39
Ogmore Township		26	27	31	32
Strathmuir		21	35	26	40
Tooloombah Creek Service Station		44	45	49	50
• TSC RES 1		45	46	50	51
• TSC RES 2		44	45	49	50
Tooloombah Homestead		21	21	26	26

Table 13-20: Predicted operation noise levels for Year 12, stage 2- night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	30/35	32	32	37	37
Brussels		30	42	35	47
Neerim-1		16	29	21	34
Neerim-2		18	30	23	35
Oakdean		32	33	37	38
Ogmore Township		26	26	31	31
Strathmuir		22	34	27	39
Tooloombah Creek Service Station*		44	45	49	50
• TSC RES 1		45	46	50	51
• TSC RES 2		44	45	49	50
Tooloombah Homestead		19	20	24	25

*Currently non-operational; unlikely to operate at night if it becomes operational again

13.6.4 Low Frequency Noise

No low frequency noise impacts will occur during construction because the type of equipment and plant to be used does not cause low frequency emissions at a level that could affect sensitive receptors. Accordingly, as shown in Table 13-21 and Table 13-22, low frequency noise from mining activities is predicted to comply with the Low Frequency Noise criteria and low frequency noise impacts are not predicted.

Table 13-21: Low frequency noise assessment – Year 3 (stage 1) operations, worst case climatic conditions – evening

Receptor ID	Criteria	$L_{eq,\ 18:00\text{-}22:00\ hours}$ dB(Lin) Worst Climatic
BAR H-1	L_{eq} 55 (Lin) outdoors	45
Brussels		41
Neerim-1		34
Neerim-2		34
Oakdean		43
Ogmore Township		37
Strathmuir		40
Tooloombah Creek Service Station		46
TSC RES 1		46
TSC RES 2		45
Tooloombah Homestead		29

Table 13-22: Low frequency noise assessment – Year 12 (stage 2) operations, worst case climatic conditions – evening

Receptor ID	Criteria	$L_{eq,\ 18:00\text{-}22:00\ hours}$ dB(Lin) Worst Climatic
BAR H-1	L_{eq} 55 (Lin) outdoors	42
Brussels		50
Neerim-1		40
Neerim-2		41
Oakdean		43
Ogmore Township		38
Strathmuir		44
Tooloombah Creek Service Station		52
TSC RES 1		34
TSC RES 2		53
Tooloombah Homestead		52

13.6.5 Impacts on Fauna

The DES EIS Information Guideline – Noise and Vibration (DES 2020a) requires that a fauna assessment "*should assess the potential environmental impacts of noise and vibration on terrestrial and marine animals and birds, including migratory species and on any nearby protected areas – also addressing amenity*". There are no current government policies or other accepted guidelines that provide recommended noise level thresholds or limits in relation to noise impact on terrestrial fauna. In Australia, there are no noise studies presently available that deal with noise impacts on native species for long-term exposure, therefore a general literature review has been carried out for potential fauna impacts.

There is limited knowledge or understanding of the effects of noise on fauna given that the research and studies on animals to date has been limited to small, disconnected, anecdotal or correlational studies as opposed to coherent programs of controlled experiments (Manci et al. 1988), (Larkin 1996), (Radle 2007), (Wyle 2003), (Warren et al. 2006), (Dooling and Popper 2007) and (Dooling, Fay, and Popper 2000). Noise may adversely affect wildlife by interfering with communication, masking the sounds of predators and prey and causing stress or avoidance reactions, and in some cases may lead to changes in reproductive or nesting behaviour. At sufficiently high levels, noise could cause temporary or permanent hearing damage.

In general, Radle (2007) states the consensus that terrestrial animals will avoid any industrial or plant or construction area where noise or vibration presents an annoyance to them. Additionally, Radle (2007) observed many animals react to new noise initially as a potential threat (potentially followed by startle / fright and avoidance), but quickly 'learn' that the noise is not associated with a threat. Most wildlife is generally mobile and will act to avoid noise and vibration if it is perceived to be annoying.

The response to noise by animals can depend on a wide variety of factors including noise level, noise spectrum (frequency distribution), noise characteristics (such as impulsiveness, rate of onset, tonality, modulation etc.), duration, temporal variation, number and type of events, level of ambient noise, time of day / season / year, and the animal's age, sex, type of activity at the time, breeding situation and past experience, and the type of animal species / genera, hearing thresholds, individual differences etc.

Studies have shown the reaction to noise can vary from species to species, including those that are known to have adapted to human activity. Environment Australia (1998) suggests that unusual noise, in combination with close proximity visual stimulation, is enough to disturb any animal, including humans. In addition, any sudden and unexpected intrusion, whether acoustic or of another nature, may also produce a startle or panic reaction.

Studies of the impact of the sonic boom on domestic and wild animals show that these species are unaffected by repeated booms and farmers have reported birds actually perching on scare guns after only a couple of days operation (Environment Australia 1998). From a literature review, it has been considered that noise levels up to 60 dB(A) do not result in negative or adverse response to impacted animals or livestock. Noise levels up to 80 dB(A) can generate startle responses in birds and animals, and noise levels in excess of 90 dB(A) may cause negative impact such as behavioural responses.

The predicted noise levels from the Project operations are approximately 60 dB(A) at the MLA boundary and these noise levels are not expected to cause adverse response to animals or livestock. Typically, animals will avoid high noise areas and it is expected that animals will relocate away from such areas. In addition, the relatively low level of impulsive or low frequency noise at distance from mine operations is not likely to cause effects on domestic or wild animals. The noise and vibration from haul truck movements could potentially produce the most likely occurrence of impact on animals (that are located near the haul road at the time of such truck passby events).

To summarise, the impacts of noise on animals is generally inconclusive. In general, there is no or little evidence of cause and effect regarding behavioural or physiological effects on domestic animals, and possibly slight evidence of some effects on some types of wild animals (especially for high or impulsive levels of noise). Finally, it is noted that animals tend to habituate to disturbances over time, particularly when it is steady and associated with non-threatening activity.

13.6.6 Blasting Noise and Vibration

Estimations of potential blasting vibration and airblast overpressure levels have been made using equations outlined in Australian Standard AS2187.2-2006 Explosives – Storage, Transport and Use. At 2 km, blasting 1,000 kg ANFO MIC is estimated to result in the following vibration and airblast overpressure:

- PPV of 1.5 mm/s and
- airblast overpressure of between 107 dB(Linear) and 127 dB(Linear), dependent on stemming.

Blasting is expected to comply with the blasting vibration and airblast overpressure criteria for the proposed blasting parameters with appropriate stemming. Blast control measured is to be refined for local conditions by the blasting contractor. Blast monitoring will be conducted in order to provide feedback on blast control measures.

As mentioned above, it is envisaged that an explosives contractor will provide the explosives for the site. The preferred option for storage and supply of bulk explosives is for the blasting contractor to store the chemicals in a remote location offsite, and then transport the shots to site in specially designed trucks for loading into the blast holes. The blasting contractor, through a specifically designed initiation system, connects each primed blast hole together with detonating cord. The speed at which each blast progresses is determined by the site Blast Engineer to minimise noise and vibration. Ground vibration and airblast overpressure from blasting will be managed to acceptable levels at the identified receptor locations in accordance with Australian Standard AS2187.2-2006 Explosives – Storage, Transport and Use.

Vibration from activities other than blasting are not expected to affect any sensitive receptors. Vibration from traffic on roads, for example, only affects areas within 20 m of the road. No receptors are located this close to the Project. Consequently, mobile plant equipment will not cause any disturbance to the sensitive receptors.

13.6.7 Vibration from Rail Movements

Central Queensland Coal has been in discussions with Queensland Rail (QR) for access capacity to its network (below rail) for the 148 km section of railway between the Central Queensland Coal TLF and Yukan and with Aurizon for access capacity for the 30 km section between Yukan to DBCT on the Aurizon network. Both QR and Aurizon have confirmed through the Indicative Access Proposal process that capacity is available for initial haulage tonnages.

As the initial haulage tonnages are within existing service capacities it is expected that vibration allowances will be within existing design tolerances and operational approvals. Notwithstanding, Central Queensland Coal understand that QR and Aurizon will operate within the Transport Noise Management Code of Practice, Transport and Main Roads (issued March 2016). Central Queensland Coal understands that as future haulage tonnages increase, and additional rail capacity is required QR and Aurizon will undertake appropriate assessment with respect to managing potential vibration related impacts.

13.6.8 Rehabilitation Noise

The operation and rehabilitation stages will occur simultaneously between Years 3 to 19. A separate assessment of rehabilitation is not necessary as the Year 12 scenario modelled is

representative of the worst case scenario for noise related to rehabilitation due to maximum mining operations occurring.

13.7 Avoidance and Minimisation of Noise

Noise modelling results indicate that noise levels from the Project are likely to exceed the noise criteria at a number of receptor locations, and noise mitigation measures would be required.

Section 9 of the Environmental Protection (Noise) Policy 2019 outlines the hierarchy preference in which noise should be addressed. In the first instance, the Policy recommends that:

1. noise be avoided, however if this is not possible
2. the minimisation of noise through either:
    a. re-orientation of an activity or
    b. use of Best Available Technology (BAT) and
3. management of noise.

It is not feasible to avoid noise altogether, but one element of avoidance has been implemented by the elimination of evening and night-time construction activities.

Noise modelling results indicate that Caterpillar haul trucks are the major contributor of noise during operations. For receptors near the TLF, other major noise sources include CAT 992 FEL's and B-Double Coal Haulage Units.

Minimisation of noise through noise attenuation has been investigated by re-running the noise model and replacing the CAT 793D trucks with CAT 793 XQ trucks. The CAT 793 XQ have been used to simulate expected noise levels from the intended replacements of: Hitachi EH3500 AC3 (Level 2 – Exhaust System) replacing CAT 785 and Hitachi EH3500 AC3 (Level 2 – Exhaust System) replacing the CAT 789 haul trucks. This was undertaken because spectral data was unable to be provided by Hitachi for the EH3500 AC3 and EH4000 AC3 Haul Trucks. However, with the Level 2 noise attenuation package (which at a minimum will be fitted - higher level attenuation packages provide for even lower noise attenuation), both the Hitachi EH 4000AC3 and Hitachi EH 3500AC3 are able to achieve same, or lower, noise level (SWL dB(A)) than the CAT 793D XQ. As such, it should be noted that the noise produced using the Hitachi fleet is likely to be less than the noise levels discussed herein. Predicted noise levels associated with the Hitachi trucks are discussed below.

As can be seen from Section 13.7.1 and Section 13.7.2 below, replacement of the Caterpillar vehicles with the Hitachi vehicles investigated is effective in minimising noise. As such, Central Queensland Coal will, as part of its approach to noise impact mitigation, in lieu of Caterpillar haul trucks, use Hitachi EH3500 AC3 (Level 2 – Exhaust System) and Hitachi EH4000 AC3 (Level 2 – Exhaust System) haul trucks, achieving a reduced maximum Sound Power Level of 113 and 112 dB(A) respectively. In addition, Central Queensland Coal will use an industry proven state-of-the-art fleet management system (such as Wenco) to monitor and control the movement of mining (and construction) equipment. These systems can be used to eliminate the surface movement of equipment during sensitive noise periods (such as night time) and restrict the movement of equipment to 'in pit', which will further reduce the impact of noise.

13.7.1 Minimisation for Construction

Although no exceedances are predicted using Caterpillar equipment during the construction period, CQC have investigated the use of Hitachi equipment to minimise noise levels that will become problematic in later stages of the mine life.

CQC commit to only undertaking construction activities during the day, therefore there will be no noise generated from construction activities in the evening or at night. Minimisation of daytime noise through noise reduction has been investigated by replacing the CAT 793D trucks with Hitachi EH4000 AC3 (Level 2 – Exhaust System) haul trucks and replacing CAT 785 and CAT 789 trucks with Hitachi EH3500 AC3 (Level 2 – Exhaust System) haul trucks. Predicted noise levels with the Hitachi fleet of haul trucks for the daytime construction period, year 0 are shown in Table 13-23. As can be seen in Table 13-23, with the use of the Hitachi trucks, no exceedances are predicted at any sensitive receptor, and noise levels are lower than those detailed in Table 13-14, which gives the noise levels predicted using the Caterpillar fleet for construction activities.

Table 13-23: Predicted construction noise levels with noise attenuated Hitachi fleet for Year 0

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	28	29	33	34
Brussels		17	31	22	36
Neerim-1		7	18	12	23
Neerim-2		6	18	11	23
Oakdean		27	28	32	33
Ogmore Township		18	19	23	24
Strathmuir		15	29	20	34
Tooloombah Creek Service Station		29	30	34	35
• **TSC RES 1**		29	30	34	35
• **TSC RES 2**		28	29	33	34
Tooloombah Homestead		8	6	13	11

13.7.2 Minimisation for Operation

13.7.2.1 Year 3 – Stage 1

Predicted noise levels with the Hitachi fleet of haul trucks for day, evening and night during Year 3 are shown in Table 13-24 to Table 13-26. As can be seen in these tables, with the use of the Hitachi trucks, no exceedances are predicted at any sensitive receptor.

Table 13-24: Predicted operational noise levels with noise attenuated Hitachi fleet for Year 3 - daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	27	28	32	33
Brussels		14	26	19	31
Neerim-1		6	16	11	21
Neerim-2		7	16	12	21
Oakdean		25	26	30	31
Ogmore Township		18	19	23	24
Strathmuir		15	28	20	33
Tooloombah Creek Service Station		29	30	34	35
• TSC RES 1		29	30	34	35
• TSC RES 2		29	30	34	35
Tooloombah Homestead		10	8	15	13

Table 13-25: Predicted operational noise levels with noise attenuated Hitachi fleet for Year 3 – evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	27	29	32	34
Brussels		14	27	19	32
Neerim-1		6	17	11	22
Neerim-2		7	17	12	22
Oakdean		25	26	30	31
Ogmore Township		19	20	24	25
Strathmuir		15	28	20	33
Tooloombah Creek Service Station		29	30	34	35
• TSC RES 1		30	31	35	36
• TSC RES 2		29	30	34	35
Tooloombah Homestead		10	10	15	15

Table 13-26: Predicted operational noise levels with noise attenuated Hitachi fleet for Year 3 – night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	30/35	28	28	33	33
Brussels		15	26	20	31
Neerim-1		6	16	11	21
Neerim-2		6	16	11	21
Oakdean		25	26	30	31
Ogmore Township		20	19	25	24
Strathmuir		16	28	21	33
Tooloombah Creek Service Station		29	30	34	35
• TSC RES 1		28	28	33	33
• TSC RES 2		28	30	33	35
Tooloombah Homestead		7	8	12	13

13.7.2.2 Year 12 – Stage 2

Predicted noise levels with the Hitachi fleet of haul trucks for day, evening and night during year 12 are shown in Table 13-27 to Table 13-29. As can be seen in these tables, with the use of the Hitachi equipment, no exceedances are predicted at any sensitive receptor during day or evening. However, at night, under worst-case climatic conditions only, noise exceedances of 4dB(A) are predicted at Brussels. Exceedances of between 4dB(A) and 6dB(A)are predicted at the Tooloombah Creek service station and the two associated residential receptors under both average, and worst-case, climatic conditions.

However, despite these predicted exceedances, noise criteria are expected to be able to be met at the four affected receptors for the following reasons:

- The Tooloombah Creek Service Station is unlikely to be a receptor. The Service Station is currently not operational. In the event that it does become operational once again during the Project life, it is noted that in the past when it was operational, it did not operate at night, so it is considered unlikely to do so in future if it were to open again.
- In addition to using the Hitachi trucks in lieu of the CAT trucks, as a further mitigation measure, Central Queensland Coal will also use an industry proven state-of-the-art fleet management system (such as Wenco) to monitor and control the movement of mining (and construction) equipment. These systems can be used to eliminate the surface movement of equipment during sensitive noise periods (such as night time) and restrict the movement of equipment to 'in pit', which will further reduce the impact of noise.
- With reference to the predicted exceedances under worst-case climatic conditions at Brussels and the Tooloomba Creek Service Station complex it is noted that these conditions (stability Class F) would typically occur on cold nights when windows are likely to be closed. With closed windows, noise levels inside residential dwellings are expected to achieve the criteria, particularly with no surface movement of mining equipment.
- It should also be noted that the noise produced using the Hitachi fleet is likely to be less than that modelled as noise mitigation modelling was based on CAT 793D XQ noise attenuated haul trucks, and the Hitachi models proposed to be used are able to achieve lower noise levels.

Therefore, with the replacement of Caterpillar trucks with the quieter Hitachi trucks and the use of a fleet management system, noise levels are predicted to comply with the noise criteria at all four affected receptors under worst case climatic conditions (when windows would typically be shut due to the cold weather conditions). It is also likely that compliance at the three receptors predicted to be affected under average case weather conditions will be achieved with the use of the fleet management system to restrict movement of the fleet to within the pit, and noting that the estimates for noise mitigated fleet provided are likely to be greater than that generated by the Hitachi equipment.

It should also be noted that while year 12 represents the worst case noise scenario, this level of noise emission will be short lived, and will only occur for the maximum period of one year. Noise levels similar to those presented for year 3 are expected for the majority of the life of the Project.

If exceedances do occur during year 12 activities, CQC are confident that compliance will be able to achieved using the range of mitigation measures discussed in Section 13.8, below.

Table 13-27: Predicted operation noise levels with noise attenuated Hitachi fleet for Year 12 - daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	25	26	30	31
Brussels		20	34	25	39
Neerim-1		9	21	14	26
Neerim-2		10	22	15	27
Oakdean		25	26	30	31
Ogmore Township		18	18	23	23
Strathmuir		17	30	22	35
Tooloombah Creek Service Station		34	35	39	40
• TSC RES 1		35	36	40	41
• TSC RES 2		34	35	39	40
Tooloombah Homestead		13	12	18	17

Table 13-28: Predicted operation noise levels with noise attenuated Hitachi fleet for Year 12 - evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	37/42	25	27	30	32
Brussels		20	34	25	39
Neerim-1		9	22	14	27
Neerim-2		10	23	15	28
Oakdean		25	26	30	31
Ogmore Township		18	19	23	24
Strathmuir		17	30	22	35
Tooloombah Creek Service Station		34	35	39	40
• TSC RES 1		35	36	40	41
• TSC RES 2		34	35	39	40
Tooloombah Homestead		13	13	18	18

Table 13-29: Predicted operation noise levels with noise attenuated Hitachi fleet for Year 12 - night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A) Average Climatic	L_{Aeq} dB(A) Worst Climatic	L_{A1} dB(A) Average Climatic	L_{A1} dB(A) Worst Climatic
BAR H-1	30/35	26	26	31	31
Brussels		22	34	27	39
Neerim-1		9	21	14	26
Neerim-2		10	22	15	27
Oakdean		25	26	30	31
Ogmore Township		19	18	24	23
Strathmuir		18	30	23	35
Tooloombah Creek Service Station*		34	35	39	40
• TSC RES 1		35	36	40	41
• TSC RES 2		34	35	39	40
Tooloombah Homestead		11	12	16	17

*Currently non-operational; unlikely to operate at night if it becomes operational again

13.8 Mitigation and Management Measures

The use of the Hitachi trucks will see noise levels comply during daytime, evening and night time periods for construction and Year 3, and during day and evening in Year 12. However, for Year 12 night activities, noise exceedances of 4dB(A) are still predicted at Brussels under worst case climatic conditions, and exceedances of 4 to 6 dB(A) are predicted to occur at TSC Res 1, TSC Res 2 and Tooloombah Creek Service Station under both worst case and average climatic conditions.

As a further mitigation measure, Central Queensland Coal will also use an industry proven state-of-the-art fleet management system (such as Wenco) to monitor and control the movement of mining (and construction) equipment. These systems can be used to eliminate the surface movement of equipment during sensitive noise periods (such as night time) and restrict the movement of equipment to 'in pit', which will further reduce the impact of noise.

It should also be noted that the noise produced using the Hitachi fleet is likely to be less than that modelled as noise mitigation modelling was based on CAT 793D XQ noise attenuated haul trucks, and the Hitachi models proposed to be used are able to achieve lower noise levels.

With the replacement of Caterpillar trucks with the quieter Hitachi trucks and the use of a fleet management system, noise levels are predicted to comply with the noise criteria at all four affected receptors under worst case climatic conditions (when windows would typically be shut due to the cold weather conditions). It is also likely that compliance at the three receptors predicted to be affected under average case weather conditions will be achieved with the use of the fleet management system to restrict movement of the fleet to within the pit, and noting that the estimates for noise mitigated fleet provided are likely to be greater than that generated by the Hitatchi equipment.

Year 12 represents the worst case noise scenario, this level of noise emission will be short lived, and will only occur for the maximum period of one year. Noise levels similar to those presented for year 3 are expected for the majority of the life of the Project.

Noise monitoring will be undertaken at the Brussels and the Tooloombah Creek Service Station complex sensitive receptors. Should noise monitoring identify that the actual noise levels noise levels do exceed the Model Mining Conditions noise limits for daytime, evening, or night time, Central Queensland Coal will establish screens (i.e. vegetative, earthen mounds) between operational areas and the Brussels, Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2, sensitive receptors.

Should ongoing noise monitoring identify exceedances despite the implementation of the above screening measures at the Brussels, Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2 sensitive receptors, internal and external noise mitigation such as double glazing on windows and wall insulation will be provided.

In implementing noise mitigation measures, Central Queensland Coal Project will continue to liaise with the owners of Brussels, Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2, and any other property to validate noise issues if they arise.

Central Queensland Coal will also consider shutting down specific operations when climatic conditions dictate if exceedances do occur, and the operational procedure of restricting mining equipment to 'in pit' does not totally produce conformance to the required noise levels.

If no suitable or acceptable noise amelioration solutions are available, negotiations will be undertaken with the affected property owners for property purchase.

13.8.1 General Noise Control Measures

In addition to the measures discussed above, the following general noise control measures will be considered for minimising noise generated from mining activities:

- Providing appropriate training for staff to operate the equipment in order to minimise unnecessary noise emissions. This could be achieved during site inductions and regular training programs.
- Avoiding unnecessary revving of engines and switch off equipment when not required.
- Keeping internal roads well maintained.
- Using rubber linings in or constrained layer damping on, for example, chutes and dumpers to reduce impact noise.
- Minimising the drop heights of materials, in particular at the TLF.
- Use ultra-low noise idlers on the conveyors; the noise reduction associated with these are generally 5 - 10 dB(A).
- Positioning of overburden and top soil piles in between haul roads and receptors, where practicable, to provide noise shielding.
- The movement of plant onto and around the site should have regard to the normal operating hours of the site and the location of any sensitive receptors as far as is reasonably practicable.
- Installation of an industry state-of-the-art fleet management system (such as Wenco) on the mining (and construction) equipment to limit the surface movement of equipment during the more sensitive noise times (such as night).
- Employing audible reversing warning systems on mobile plant and vehicles that are of a type that have minimal noise impact on persons outside sites. This may include alarms that automatically adjust volumes based on the surrounding noise environment or alarms that are non-tonal in nature (such as broadband or 'quack' alarms).
- As far as reasonably practicable, enclosing sources of significant noise. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements. A typical enclosure may provide 10 - 20 dB(A) depending on the material.
- Operating plant in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading should also be carried out away from such areas.
- Shutting down machines such as cranes that might have intermittent use. Such machines should be shut down between work periods or should be throttled down to a minimum.

13.8.2 Mitigation for Blasting

Mitigation measures to minimise the impacts of blasting include:

- Prepare a Blast Management and Monitoring Plan and submit for approval to DES a minimum of three months prior to blasting. Procedures will be developed in conjunction with the Queensland Department of Transport and Main Roads (DTMR) to ensure that there will be no

operational impacts to vehicles on the Bruce Highway due to blasting activities associated with the Project. The BMP will also be submitted to DTMR for their review at least three months prior to any blasting that may affect the Bruce Highway.

- Blasting programs will be planned and safely executed to comply with the vibration standards.
- Blasting, overpressure and flyrock will be controlled to an acceptable level with the following control measures:
  - Blasting will occur on Monday to Sunday between 7am and 6pm only. No blasting will occur outside of these hours unless approval has been obtained from the relevant authorities and a specific Blast Management Plan has been prepared
  - Blasting activities will be carried out in accordance with the Project's EA so that ground vibration and airblast overpressure (the wave explosive energy released into the atmosphere) are within approved blasting limits and in accordance with AS 2187
  - Blasting activities will account for the direction the wind is blowing to reduce the risk of potential airblast overpressure impacts at noise sensitive receptors
  - Real time noise monitoring will be undertaken as outlined in the ACARP Live Noise Prediction Method for Australian Conditions (Sanderson 2013).
- Consultation with surrounding landholders will be undertaken to develop protocols for notification of blasts including:
  - Residents and all workers will be notified prior to blasting activities.
- An exclusion zone for people and livestock will be established around each blast site prior to firing a blast.

13.8.3 Environmental Management Framework

CQC have prepared a draft Environmental Management Plan (EMP) for construction and operation of the Project. The draft EMP is contained in Appendix 12 and has been developed to manage and mitigate potential environmental impacts, and to assist Central Queensland Coal to comply with relevant environmental approvals and permit conditions. The draft EMP has been prepared in general accordance with the Commonwealth Environmental Management Plan Guidelines (Commonwealth of Australia 2014) and is modelled on the AS/NZS ISO 14001 (Standards Australia 2016) Plan-Do-Check-Act (PDCA) continual improvement model.

Appendix C of the draft EMP provides specific sub-plans for managing environmental impacts. The Noise and Vibration Management Plan (NVMP) is relevant to this chapter.

The management plans in Appendix C of the draft EMP are high-level at this stage and will be updated following project approval to reflect the Environmental Authority Conditions.

13.8.4 Complaint Protocol

Central Queensland Coal will develop a complaints procedure within its Standard Operating Procedures that will address issues raised by community members or stakeholders in regard to air quality. Complaints will be further investigated, recorded and corrective actions will be implemented if required and where reasonable and actions taken will be communicated back to the complainant. The approach to managing complaints is detailed in Appendix C of Appendix A14c - Social Impact Assessment.

Where appropriate, further monitoring will be undertaken at the affected location. Monitoring will be conducted to provide feedback into the success of mitigation measures, to confirm modelling and determine if further corrective actions are required to protect sensitive receptors. Monitoring will be undertaken in accordance with the requirements of the EA conditions, the MMC and the DES Noise Measurement Manual (2020b).

Vibration and blasting monitoring will be undertaken as needed during each blast event to provide feedback to control environmental impacts. Mitigation measures and blast design parameters may need to be revised if complaints or exceedances are recorded.

The complaints procedure will include:

- A site contact phone number will be established to allow a timely response to noise related complaints.
- A complaints register.
- Additional monitoring (if appropriate) following a complaint, provided it is not vexatious or frivolous. If additional noise monitoring is required, it will be conducted at the affected location.
- If the applicable criteria or the EA conditions are exceeded corrective actions will be implemented.
- Corrective actions will be reported to the affected persons and recorded in the complaints register or as required in the EA conditions.

A site contact number will be provided to neighbours to facilitate lodgement of complaints about noise and vibration.

13.9 Qualitative Risk Assessment

The risk of impacts arising from the Project is largely avoided by the very low number of sensitive receptors near the proposed mining activities. The nearest dwellings are TSC Res 1 and TSC Res 2 located within 100 m from the Tooloombah Creek Service Station, approximately 2 km to the northwest of Open Cut 1.

Potential impacts and risks to environment values within and surrounding the Project area have been assessed utilising the risk assessment framework.

For the purposes of risk associated with noise and vibration, risk levels are defined as follows:

- Extreme – Works must not proceed until suitable mitigation measures have been adopted to minimise the risk
- High – Works should not proceed until suitable mitigation measures have been adopted to minimise the risk
- Medium – Acceptable with formal review. Documented action plan to manage risk is required and
- Low - Acceptable with review.

A qualitative risk assessment that outlines the potential impacts, the initial risk, mitigation measures and the residual risk following the implementation of the mitigation measures is shown at Table 13-30.

Table 13-30: Qualitative risk assessment

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
Vibration and over blast pressure (construction and operation)	Blasting activities that occur during construction will generate ground vibration, overpressure and potentially flyrock. The vibration during blasts will be within a range of human comfort at sensitive receptor locations given the separation distances. Blasting procedures will keep flyrock to a minimum and contained within the pit. Unplanned blast events or accidents in the blasting processes can cause unanticipated noise and vibrational impacts. Such an event may occur in a year through human error or equipment failure.	Low	Blasting programs will be planned and safely executed to comply with the vibration standards. Blasting, overpressure and flyrock will be controlled to an acceptable level with the following control measures: • Blasting will occur on Monday to Sunday between 7 am and 6 pm only. No blasting will occur outside of these hours • Blasting activities will be carried out in accordance with the Project's EA so that ground vibration and airblast overpressure (the wave explosive energy released into the atmosphere) are within approved blasting limits. • Blasting activities will account for the direction the wind is blowing to reduce the risk of potential airblast overpressure impacts at noise sensitive receptors. • Real time noise monitoring will be undertaken as outlined in the ACARP Live Noise Prediction Method for Australian Conditions (Sanderson 2013) Consultation with surrounding landholders will be undertaken to develop protocols for notification of blasts including: • Residents and all workers will be notified prior to blasting activities. • Onsite monitoring of noise and vibration will be undertaken.	Low

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
			• An exclusion zone for people and livestock will be established around each blast site prior to firing a blast. • The above blasting protocols will also be in place during for any operational blasting activities which are required.	
Noise disturbance to residents (construction)	Noise from the Project's construction has the potential to cause a nuisance to residential receptors.	Low	Noise sources from construction activities will be attenuated, where practicable and will involve: • Scheduling mobile equipment so that it does not congregate and is restricted to 'in pit' operations during the night time period. • Training staff to operate the equipment to minimise unnecessary noise emissions. • Machines and plant will be switched off when not in use and not left running unnecessarily. • Plant will be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading will also be carried out away from such areas.	Low
Disturbance to wildlife (construction and operation)	Refer to Chapter 14 – Terrestrial Ecology and Chapter 16 – Matters of National Environmental Significance for noise related impacts.	Low	Refer to Chapter 14 – Terrestrial Ecology and Chapter 16 – Matters of National Environmental Significance for noise related mitigation measures.	Low
Noise disturbance to residents (operation)	Low frequency noise from mining activities are predicted to comply with low frequency noise criteria and low frequency noise impacts are not predicted.	Low	Apply general noise attenuating measures and monitor noise at sensitive receptors to confirm noise modelling results and manage complaints. General noise attenuating measures include:	Low

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
			• Training for staff to operate the equipment to minimise unnecessary noise emissions. • Internal roads will be kept well maintained. • Machines and plant will be switched off when not in use and not left running unnecessarily. • Scheduling mobile equipment so that it does not congregate and is restricted to 'in pit' operations during the night time period. • Rubber linings will be used where practicable in, for example, chutes and dumpers to reduce impact noise. • The drop heights of materials will be minimised, where practicable. • As far as reasonably practicable, sources of significant noise will be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements. • Plant will be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading will also be carried out away from such areas. • When purchasing new equipment or machinery, noise emissions will be considered as part of the procurement process.	
Low frequency noise (operation)	As the mid to high frequency components dissipate over distance low frequency noise becomes more dominant and can result in human discomfort resulting in annoyance. The continuous use of	**Medium**	Upon receiving a complaint noise monitoring will be undertaken, corrective actions will be implemented where required and general noise attenuating	**Low**

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
	machinery can contribute to low frequency noise. Low frequency noise from mining activities are predicted to comply with low frequency noise criteria and low frequency noise impacts are not predicted.		measures will be applied. General noise attenuating measures include: • Training staff to operate the equipment to minimise unnecessary noise emissions. • Internal roads will be kept well maintained. • Machines and plant will be switched off when not in use and not left running unnecessarily. • Rubber linings will be used where practicable in, for example, chutes and dumpers to reduce impact noise. • As far as reasonably practicable, sources of significant noise will be enclosed. The extent to which this can be done depends on the nature of the machine or process to be enclosed and their ventilation requirements. • Plant will be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading will also be carried out away from such areas. • When purchasing new equipment or machinery, noise emissions, particularly at the low frequency will be considered as part of the procurement process.	

13.10 Conclusion

The noise environment near the Project can be characterised as 'very rural', with only mild sources of activity noise. This consists of mostly local activity at dwellings, and plant and machinery used for agriculture and livestock. The Bruce Highway cuts through the proposed ML area and the North Coast Rail Line is located approximately 1.5 km from the northern boundary of the proposed ML area. These are likely to have an influence on the acoustic environment; however, traffic is intermittent on both road and rail. Environmental noise (wildlife, flora, wind) is the predominant noise.

Noise emissions assessed by this SEIS include:

- construction works
- operational activities during Year 3 - Stage 1
- operational activities during Year 12 – Stage 2 and
- blasting.

Potential noise and vibration impacts from the construction and operation of the Project were assessed against applicable criteria based on the Guideline Mining - Model Mining Conditions and the Queensland Environmental Protection Policy (Noise) 2019.

Future potential noise levels at the nearest noise sensitive and commercial receptors were predicted using the SoundPlan noise model for the construction (year 0), year 3 and year 12 operational scenarios. For the operational scenarios, mining activities during the peak production year (Year 12) have greatest potential for noise impacts and are representative of the worst case scenario.

Noise levels for operation were predicted to exceed the noise criteria at the nearest receptors and thus noise mitigation was investigated. Noise minimisation using quieter haul trucks were investigated and shown to be effective, hence will be adopted. However, for the worst case scenario (year 12), even with the use of quieter equipment, noise levels are predicted be exceeded under worst case climatic conditions at Brussels, and under both worst case and average climatic conditions at the Tooloombah Creek Service Station complex, which consists of the Service Station and two residential receptors - TSC Res 1 and TSC Res 2. However, with the installation of an industry state-of-the-art fleet management system (such as Wenco) on the mining (and construction) equipment to restrict the movement of equipment at night, and closed windows at the affected residences/buildings, it is expected that noise emissions will be below the required levels.

Due to the potential for exceedances, ongoing noise monitoring and liaison with property owners will be required. It should be noted however, that the worst case scenario represented by year 12 will only occur for the maximum period of one year, and noise levels similar to those for presented for year 3 (which meet all of the noise criteria) are expected for the majority of the life of the Project.

Noise impacts will be managed through a Noise Management Plan and, for blasting outside of MMC stipulations, a Blast Management Plan. A complaints procedure will allow for all complaints regarding the Project's noise to be documented, investigated and reported, with corrective actions provided as appropriate.

The Noise Management Plan will be developed in consultation and engagement with potentially affected receptors to achieve alternative arrangements, in particular at Brussels and the Tooloombah Creek Service Station complex.

Potential ground vibration and airblast overpressure levels were predicted based on AS2187.2-2006. Blasting impacts are expected to comply with blasting criteria with appropriate stemming.

13.11 Commitments

In relation to managing potential noise impacts, Central Queensland Coal's commitments are provided in Table 13-31.

Table 13-31: Commitments – Noise and Vibration

Commitment
Continue to liaise with the owners of Oakdean, BAR H-1, Brussels, Strathmuir, TSC Res 1 and TSC Res 2 and any other properties to validate noise issues if they arise.
Replace CAT 793D trucks with Hitachi EH4000 AC3 (Level 2 – Exhaust System) and the CAT 785 and CAT 789 trucks with the Hitachi EH3500 AC3 (Level 2 – Exhaust System) haul trucks (Year 12) and fit a fleet management system.
Develop a complaints procedure within the Standard Operating Procedures that will address issues raised by community members or stakeholders regarding noise and vibration.
Develop and implement a Noise Management Plan prior to commencement of construction as part of the Project Environmental Management Plan.
Prepare a Blast Management and Monitoring Plan and submit for approval to DES a minimum of three months prior to blasting. Procedures will be developed in conjunction with the Queensland Department of Transport and Main Roads (DTMR) to ensure that there will be no operational impacts to vehicles on the Bruce Highway due to blasting activities associated with the Project. Geotechnical and noise monitoring measures will also be detailed. The BMP will also be submitted to DTMR for their review at least three months prior to any blasting that may affect the Bruce Highway.
Should noise monitoring identify that noise level exceedances occur outside acoustic amenity levels recommended in the EPP (Noise) for daytime, evening, and night time, Central Queensland Coal will establish screens (i.e. vegetative, earthen mounds) between operational areas and the affected sensitive receptors.