Central Queensland Coal Project

Appendix 8 – Noise and Vibration

Central Queensland Coal

CQC SEIS, Version 3

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Central Queensland Coal Pty Ltd

Central Queensland Coal Project SEIS Air and Noise Assessments

Noise Impact Assessment

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EXECUTIVE SUMMARY

Potential noise and vibration impacts from the construction and operation of the Project were assessed against applicable criteria based on the Department of Environment and Heritage Protection's Model Mining Conditions.

Future potential noise levels at the nearest noise sensitive and commercial receptors were predicted using the SoundPlan noise model for Construction (Year 0), Year 3 (Average Year Operation and Rehabilitation) and Year 12 Operation and Rehabilitation) where the potential noise impacts are expected to be the greatest.

Noise levels are predicted to exceed the noise criteria at the nearest receptors and noise mitigation would be required. Noise mitigation measures using quieter haul trucks and management measures have been investigated. As noise levels are predicted to exceed under worst case climatic conditions at Brussels, Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2, ongoing noise monitoring and liaison with property owners will be required. It is recommended that a noise management plan is developed in consultation and engagement with potentially affected receptors to achieve alternative arrangements.

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.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Central Queensland Coal Pty Ltd (CQC) to prepare a Noise Impact assessment for the Central Queensland Coal Project (the Project). The purpose of this assessment is to evaluate the potential impacts of noise generated from the construction and operational stages of the Project and to provide recommendations to mitigate any potential impacts that might have an effect on nearby sensitive receptors.

2 PROJECT DESCRIPTION

Central Queensland Coal Proprietary Limited proposes to develop the Project located 130 km northwest of Rockhampton in the Styx Basin in Central Queensland. The Project will be located within Mining Lease Application (MLA) 80187, MLA 700022 and Exploration Permit for Coal (EPC) 1029. This location is shown in Figure 2-1.

The Project is generally within the Livingstone Shire Regional Council area and is located on gently undulating plains and slopes.

2.1 PROPOSED OPERATIONS

The Project comprises two open cut pit operations that will be mined using a truck and shovel method, with two Mine Infrastructure Areas (MIA) and a new train loadout facility (TLF) that will be developed to connect into the existing North Coast Rail Line. This connection will allow the product coal to be transported to the established coal loading infrastructure at the Dalrymple Bay Coal Terminal (DBCT). The nearest major regional centre is Rockhampton, located approximately 130 km to the southeast of the Project.

The key components of the Project include:

- Two open cut mine pits;
- Two CHPPs;
- Two MIAs;
- Haulage and site access; and
- Rail facilities and TLF.

Strips or blocks will be mined in succession, allowing waste from one strip or block to be dumped into a previously mined out area. Waste from an initial strip or box cut will be dumped into a predetermined out of pit dump. Stripped topsoil and box cut spoil will be stockpiled for later use in mine rehabilitation.

Two open cut pits will be developed – one on the northern side of the Bruce Highway (Open Cut 2) and one on the southern side of the Bruce Highway (Open Cut 1). After topsoil has been removed from a strip, the overburden waste material, where necessary, will be drilled and blasted and subsequently removed by a combination of truck/shovel, truck/excavator or dozer push methods in order to expose the top coal seam. Dozer ripping will be considered if the waste thickness is too thin for blasting.

The mining schedule and site layout is shown in Figure 2-2 and Figure 2-3, showing mining activities progressing north to south.

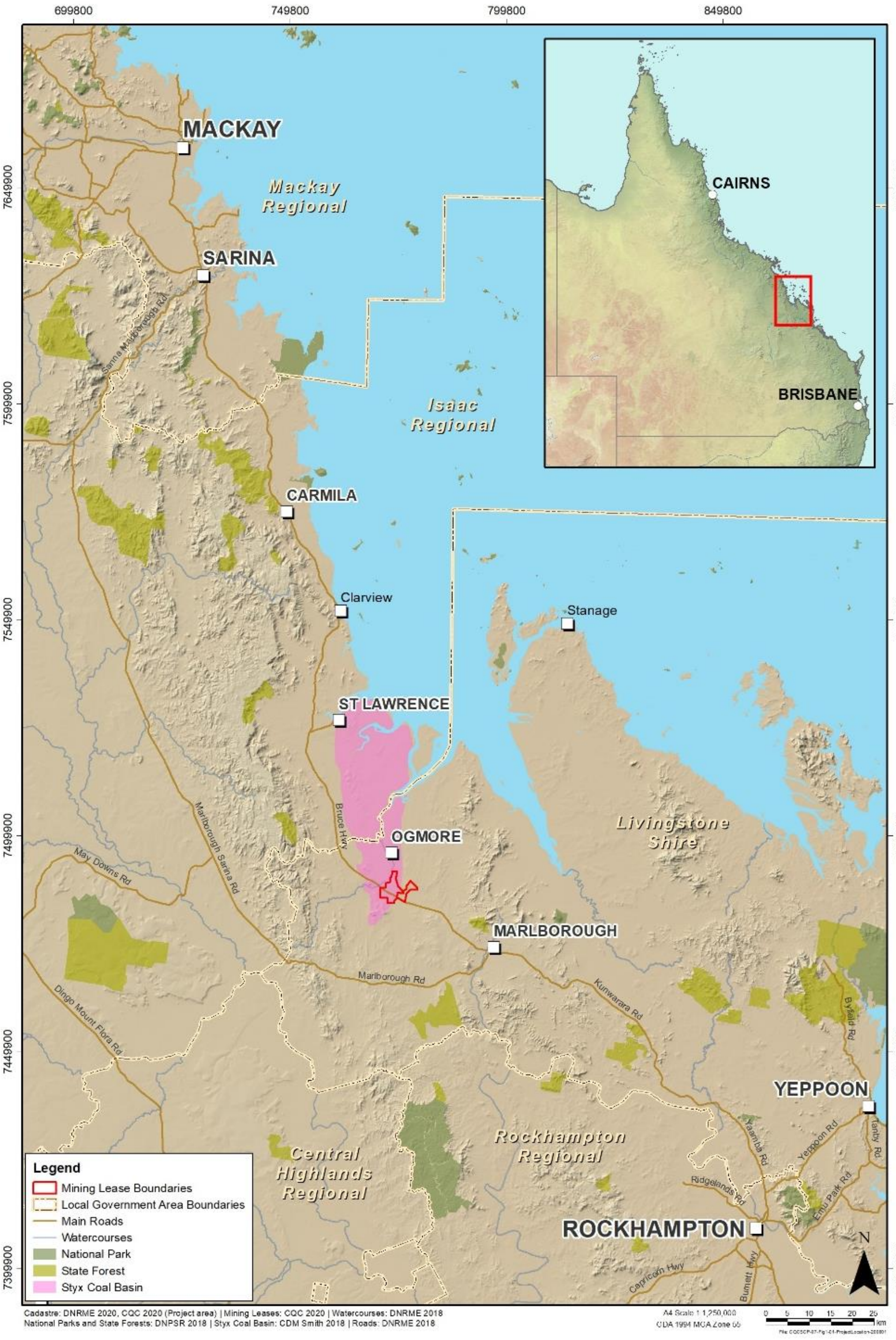


Figure 2-1: Central Queensland Coal Project Location [CQC, August 2020]

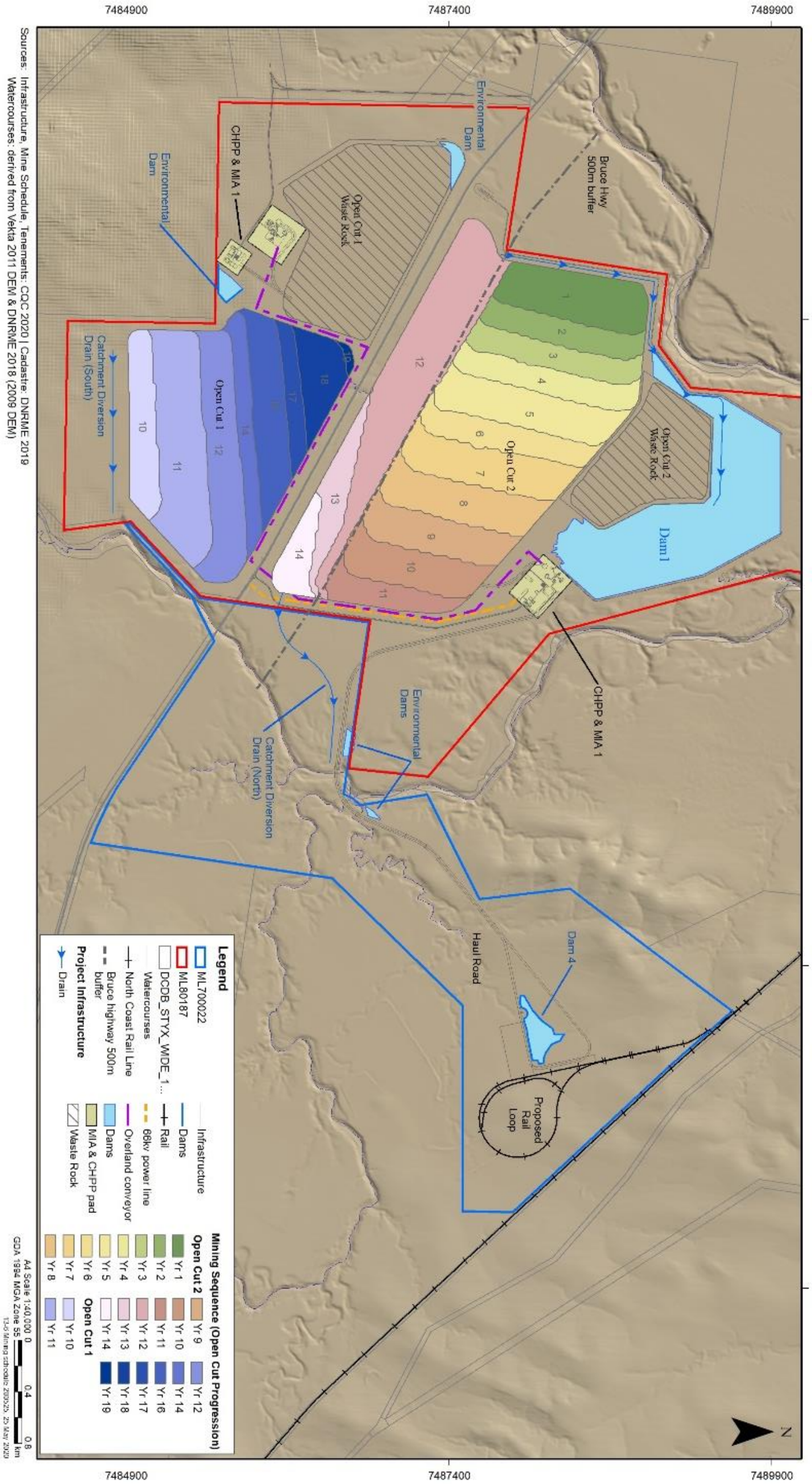


Figure 2-2: Mining Sequence

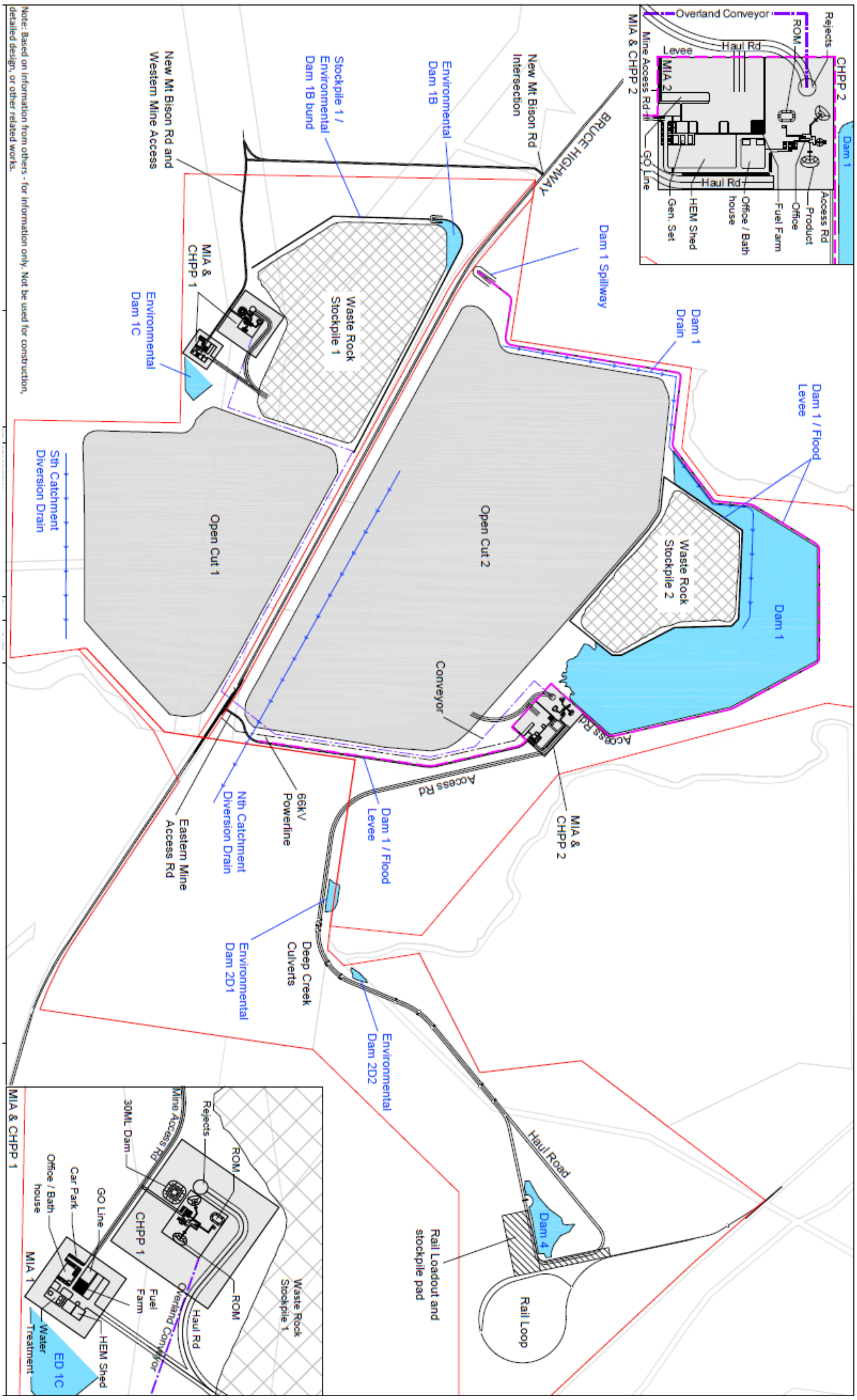


Figure 2-3 - Mine Layout [Central Queensland Coal Pty Ltd, May 2020]

Construction, mining, and rehabilitation activities will generally be occurring concurrently, and this noise assessment has assessed potential cumulative impacts from these three components.

The coal will be mined using front end loaders or small hydraulic excavators or surface miners and placed into rear dump trucks or B Double side tippers for haulage. The haul trucks will transport the coal along the strip or terrace, up a coal ramp out of the pit, then along a haul road to a ROM stockpile area located adjacent to the MIA. The coal will be dumped onto a stockpile or, if certain coal quality requirements are met, may be dumped directly into the ROM hopper where it will be crushed and conveyed to the CHPP feed stockpile ready for processing.

2.2 TOPOGRAPHY

Elevations within the MLA area vary between 4.5 m and 155 m AHD, with the disturbance area located between 11.4 and 43.8 m AHD. Further inland the terrain increases to 584 m west of the MLA.

2.3 SENSITIVE RECEPTORS

The locations of the nearest confirmed noise sensitive and commercial receptors to the Project were provided to Vipac. In total, 11 sensitive receptors are located within the locality of the proposed Project (2 of which are uninhabitable – BAR-H2 and BAR-H3). Excluding the uninhabitable receptors, the sensitive receptor locations are shown in Figure 2-4. Note that the entire township of Ogmore has been counted as one noise sensitive receptor.

It is anticipated that the Project personnel will be accommodated locally, with the use of the Marlborough Caravan Park facility to be used as the mine workers primary accommodation. Under the Model Mining Conditions a camp associated with the Project is not considered a sensitive receptor and has not been assessed in this report. The Marlborough Caravan Park is located approximately 19km south east of the nearest MLA boundary and is not considered a noise sensitive receptor as part of this assessment.

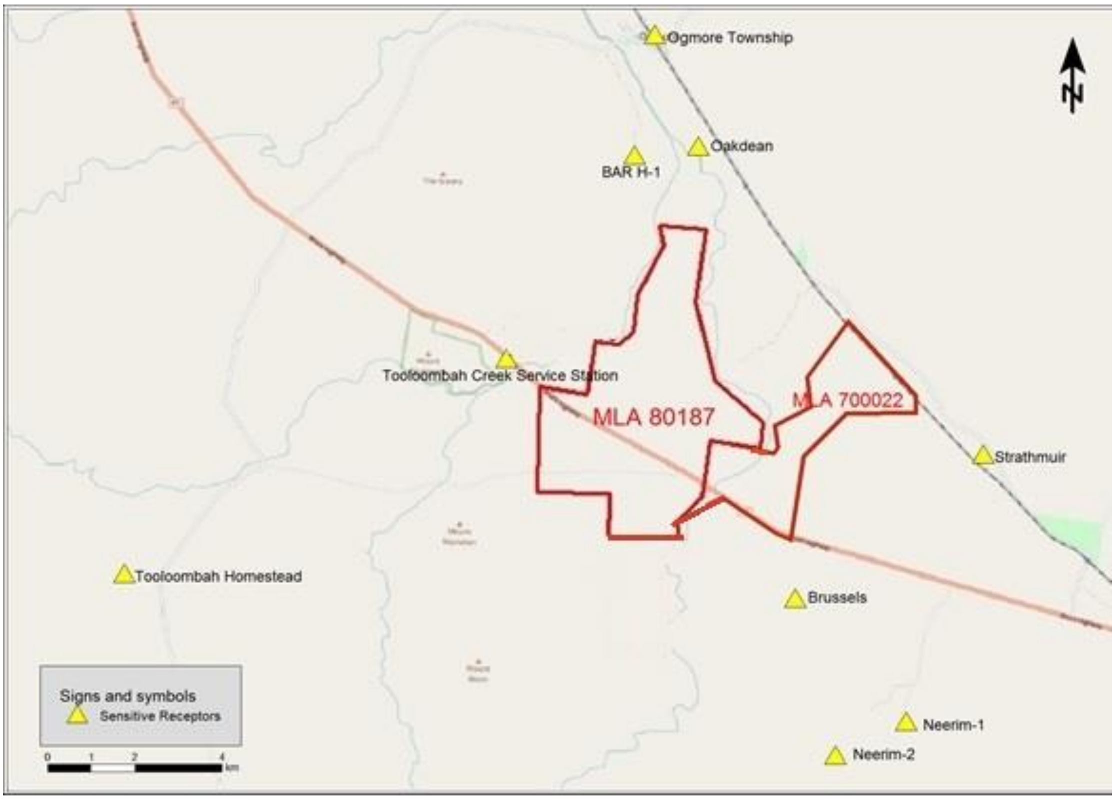


Figure 2-4: Sensitive Receptor Locations Surrounding the MLA

3 REGULATORY FRAMEWORK

This section outlines the regulatory requirements the Project consisting of the Department of Environment and Heritage Protection's Model Mining Conditions and the project specific noise criteria.

3.1 MODEL MINING CONDITIONS

The Queensland *Environmental Protection Act 1994* (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.

In December 2014, the '*Guideline Mining - Model Mining Conditions (MMC)'* were published by the Department of Environment and Heritage Protection. The purpose of this Guideline is to 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. A revised version (version 6.02) was published in March 2017.

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.

3.1.1 NOISE

The methodology to derive the Project specific noise criteria is presented in Table 3-1.

Table 3-1: Noise Limits as Proposed by Model Mining Conditions [DES, 2017]

The holder of this environmental authority must ensure that noise generated by the mining activities does not exceed the criteria in Table D1 – *Noise Limits* of the EHP MMC at a sensitive place or commercial place.

Sensitive Place						
Noise level dB(A) measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7am to 6pm	**6pm to 10pm**	**10pm to 7am**	**9am to 6pm**	**6pm to 10pm**	**10pm to 9am**
$L_{Aeq,Adj,15min}$	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						
Noise level dB(A) measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7am to 6pm	**6pm to 10pm**	**10pm to 7am**	**7am to 6pm**	**6pm to 10pm**	**10pm to 7am**
$L_{Aeq,Adj,15min}$	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 in Table D1:

- 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.

3.1.2 BLASTING NOISE AND VIBRATION

Airblast overpressure and ground vibration limits for blasting are presented in Table 3-2. These limits would be applicable for the project.

Table 3-2: Blasting Noise and Ground Vibration Limits as Proposed by Model Mining Conditions [DES, 2017]

The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in Table D2 – Blasting noise limits to be exceeded at a sensitive place or commercial place.

Blasting noise limits	Sensitive or Commercial Place 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	<insert either no blasting or limits justified by proponent not less stringent than 7am – 6pm>
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	<insert either no blasting or limits justified by proponent not less stringent than 7am – 6pm>

3.1.3 LOW FREQUENCY NOISE

The Department of Environment and Science provides other guidelines including the Ecoaccess Guideline – Assessment of Low Frequency Noise (Queensland Environmental Protection Agency, 2004). This guideline is applicable to low frequency noise (frequencies below 200Hz emitted from commercial premises, industrial premises, mining and extractive operations.

This assessment will assess the likelihood of low frequency noise complaints in accordance with the initial screening criteria as per the Ecoaccess Guideline:

> *'Where a noise immission 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'.*

Where noise emissions show low frequency content is present, the overall sound pressure level inside residences should not exceed 50dBZ to avoid complaints of low frequency noise annoyance.

It is noted that 50dBZ 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 55dBZ when measured in the free field.

3.2 DERIVING PROJECT SPECIFIC NOISE CRITERIA

Based on the measured background noise levels (Section 5.2.2), the applicable noise limits according to the Model Mining Conditions are presented in Table 3-3. Note that the most conservative limits are shown in Table 3-3 and these have been used in this assessment.

Table 3-3: Site Specific Noise Criteria as per Model Mining Conditions Methodology [DES, 2017]

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
$L_{A1,Adj,15\ min}$	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 3-3. CQC have advised that mine construction will only occur 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 3-3. Note that construction and rehabilitation activities will generally occur concurrently with mining activities.

Blasting noise and vibration has been assessed against criteria discussed in Section 3.1.2. For low frequency noise, Ecoaccess Guideline – *Assessment of Low Frequency Noise* has been adopted as discussed in Section 3.1.3.

4 NOISE ASSESSMENT METHODOLOGY

This section outlines the methodologies for the fieldwork, noise monitoring data analysis and noise prediction used for this assessment.

4.1 FIELDWORK

Noise monitoring was carried out by Noise Measurement Services in 2011 as part of a baseline assessment for this Project (report number 1821_R4, 11 July 2011). Noise monitoring was carried out in accordance with Australian Standard AS1055.1-1997 'Acoustics-Description and measurement of environmental noise; Part 1: General procedures' and the results as presented in the Noise Measurement Service report has been referred to for this assessment.

4.2 NOISE PREDICTION METHODOLOGY

4.2.1 MODELLING SOFTWARE

Noise level predictions have been assessed using the SoundPLAN noise modelling software using the CONCAWE (Manning, 1981) noise prediction methodology. The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes in the United Kingdom. It is especially suited to predicting noise propagation over large distances as it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances, as required by the '*EIS Information Guideline – Noise and Vibration*' (Department of Environment and Heritage Protection, No Date).

The prediction of noise in the environment requires the definition of the noise sources and sensitive receptors. A number of environmental parameters affect noise propagation, including:

- Geometric spreading;
- Obstacles such as enclosures, barriers, and buildings;
- Meteorological conditions such as air absorption, wind effects, temperature gradient effects; and
- Ground effects.

The SoundPLAN software and calculation methodology allows the environmental parameters identified above to be modelled.

4.2.2 METEOROLOGICAL CONDITIONS

Noise propagation over long distances can be significantly affected by the weather conditions, mainly source-to-receiver winds and temperature inversions, as both these conditions can increase noise levels at sensitive receptors.

The CONCAWE methodology can predict to one of six meteorological categories (CAT). 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 for the Bureau of Meteorology (BOM) and TAPM data and were found to be very similar.

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 4-1. Temperature inversions are defined as Class F. These conditions only occur with clear and calm conditions during the evening and night time periods. During temperature inversions noise emissions from distant sources can be amplified. During the night time period (22:00-07:00 hours), Class F occurs 34.3% of the hours.

Table 4-1: 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

The wind roses are presented in Figure 4-1 and Figure 4-2 for the Project site. Figure 4-1 shows that the dominant wind direction is from NNE during spring, NNE and SE during the summer months. In autumn, the winds are primarily from the south easterly directions. Southerly and SSE winds are more frequent during the winter season.

A comparison of the wind roses at 09:00 and 15:00 hours was undertaken with the BOM long-term wind roses at St Lawrence. The 09:00 hours wind roses from BOM and TAPM are very similar with slight differences in the percentage of time the wind blows from the SW; the BOM wind rose, based on 18,029 observations, identifies easterly winds accounting for 7% of the time whereas TAPM identifies the south westerlies accounting for 3% of the hours. The 15:00 hours wind roses are similar; the BOM wind rose shows a lower frequency of easterly winds (12%) to TAPM (21%). These slight differences in wind are influenced by the topography surrounding both the BOM monitoring station and the Project site. Overall, the meteorological data generated by TAPM is considered to be representative of the site.

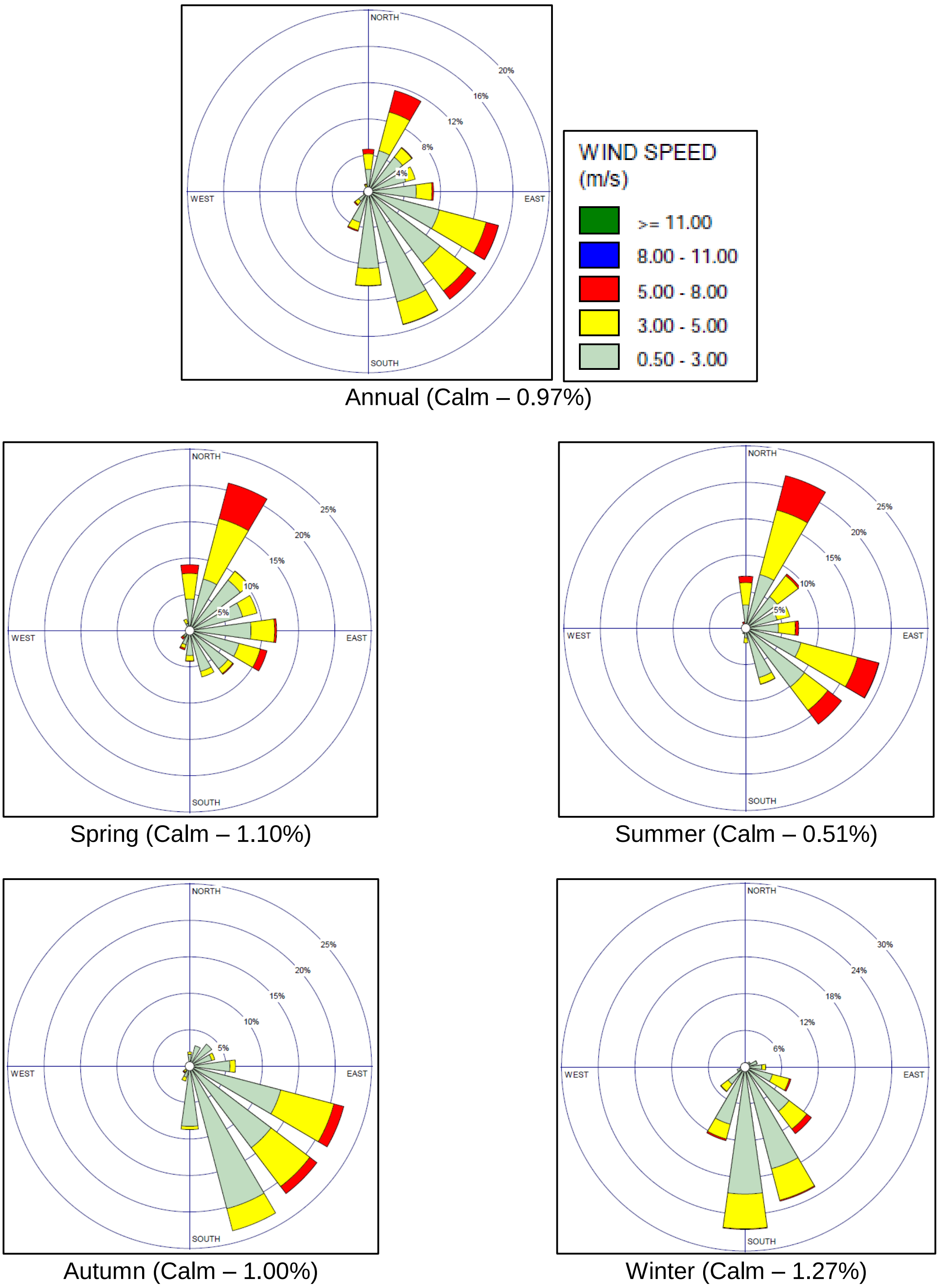
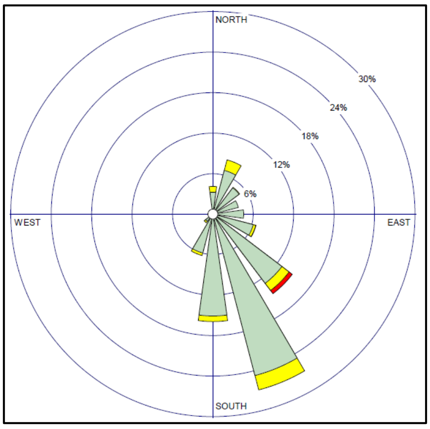
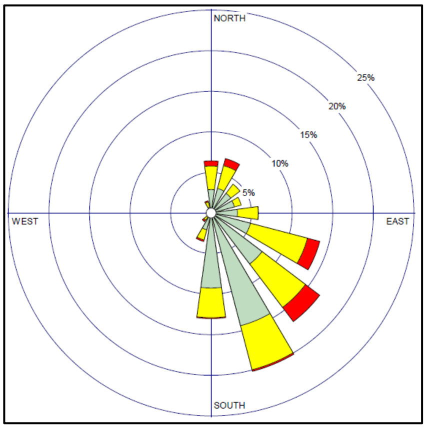


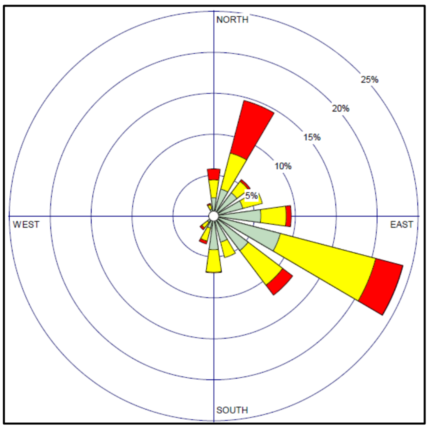
Figure 4-1: Site-Specific Wind Roses by Season for 2014



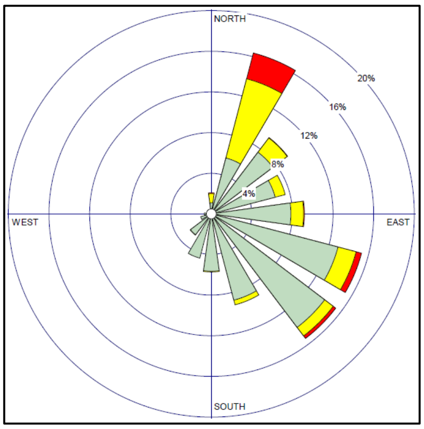
00:00-06:00 (Calm – 1.02%)



06:00-12:00 (Calm – 1.33%)



12:00-18:00 (Calm – 1.14%)



18:00-00:00 (Calm – 0.31%)

Figure 4-2: Site-Specific Wind Roses by Time of Day for 2014

4.2.3 MODELLED WEATHER SCENARIOS

The EIS Information Guideline for Noise & Vibration 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:

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 TLF are likely to experience higher noise levels as sound is carried by south-easterly winds. This would consequently results in lower noise levels at receptors located south-east of the mine and TLF.

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.

5 EXISTING ENVIRONMENT

This section describes the existing environment in terms of the environmental values of the surrounding area, existing noise sources, which may be of concern and the noise monitoring details.

5.1 EXISTING SOURCES OF NOISE

The noise environment in the vicinity of 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 MLA area and the North Coast Rail Line is located approximately 1.5 km from the northern boundary of the proposed MLA 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 (CDM Smith, 2016).

5.2 NOISE MONITORING

Noise monitoring was undertaken by Noise Measurement Services in March 2011. It is likely that the noise data includes contribution from seasonal sources such as insects. However, it could not be determined whether noise measurement data was processed to remove seasonal noises in accordance with EHP guidelines.

5.2.1 MEASUREMENT PARAMETERS AND WEATHER CONDITIONS

Type 2 environmental noise loggers were used to record L_{01}, L_{10}, L_{90} and L_{eq} levels in 15 minute intervals. Noise logging equipment was calibrated before and after measurements. 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 2km 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.

5.2.2 SUMMARY OF NOISE LEVELS

Summary of noise measurement results from the Noise Measurement Services report have been reproduced in Table 5-1 to Table 5-4 for the four monitoring locations.

Table 5-1 Noise Levels Measured at ML1 Mamelon

Description	L1 dB(A)	L10 dB(A)	L90 dB(A)	Leq dB(A)
Day	53.5	40.5	34.3	40.3
Evening	56.3	48.9	44.7*	49.2
Night	53.4	46.3	39.5	45.3

* May be affected by seasonal insect or fauna noise.

Table 5-2 Noise Levels Measured at ML2 Strathmuir

Description	L1 dB(A)	L10 dB(A)	L90 dB(A)	Leq dB(A)
Day	69.6	45.6	35.5	49.8
Evening	53.1	43.5	37.8	46.1
Night	71.3	44.1	38.2	50.9

Table 5-3 Noise Levels Measured at ML3 Neerim Property

Description	L1 dB(A)	L10 dB(A)	L90 dB(A)	Leq dB(A)
Day	56.7	42.2	32.7	41.3
Evening	57.8	47.8	38.1	45.6
Night	50.3	42.2	32.6	39.5

Table 5-4 Noise Levels Measured at ML4 Gravel Road (2km West of ML1)

Description	L1 dB(A)	L10 dB(A)	L90 dB(A)	Leq dB(A)
Day	52.1	39.6	31.7	39.7
Evening	50.4	40.5	32.4	38.1
Night	49.8	40.0	28.1	37.4

6 NOISE MODELLING DETAILS

This section details the noise sources used in the prediction of the noise levels at the sensitive receptors, including the proposed equipment, location of the equipment and the associated sound power levels (SWL).

6.1 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 provided by the Proponent 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.

6.2 EQUIPMENT

The proponent provided the equipment list schedules for the life of the Project for the mobile plant for construction and operation. The equipment schedules for construction and operation (including rehabilitation) are presented in Table 6-1 and Table 6-2 respectively.

Table 6-1: Equipment Schedule for Construction

Equipment	Quantity
CAT 631G Scraper	2
785D Haul Truck/Hitachi EH3500 AC3	4
789D Haul Truck/Hitachi EH3500 AC3	4
793D Haul Truck/Hitachi EH4000 AC3	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
Frannar Crane	1
Service vehicles	
Generator (520kVA)	
Generator (300kVA)	
Generator (1MW)	1
UDR800 Drill	1

Table 6-2: Mining Equipment Schedule for Operation (Including Rehabilitation)

	Quantity	
Equipment	**Year 3**	**Year 12**
CAT 631G Scraper	1	1
785D Haul Truck/Hitachi EH3500 AC3		
789D Haul Truck/Hitachi EH3500 AC3	4	8
793D Haul Truck/Hitachi EH4000 AC3	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
Frannar Crane	1	2
Service vehicles	10	19
Generator (520kVA)	3	3
Generator (300kVA)	3	3
Generator (1MW)		
UDR800 Drill		

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.

6.3 SOUND POWER LEVELS

Equipment noise data used for this assessment are shown in Table 6-3 and Table 6-4. 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.

Table 6-3: Modelled Sound Power Levels for Construction

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 Scraper		77	92	102	103	104	102	96	88	85	109
785D Haul Truck	74	86	97	111	114	106	101	94	86		116
789D Haul Truck	74	86	97	111	114	106	101	94	86		116
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
Frannar 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

*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.

Table 6-4: Modelled Sound Power Levels for Operation

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
CAT789D 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
Frannar 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

*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.

6.4 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 as shown in Figure 2-2 for Year 3 and Year 12. The locations of sources are presented in Figure 6-1 to Figure 6-3 for Construction (Year 0), Year 3 and Year 12 respectively.

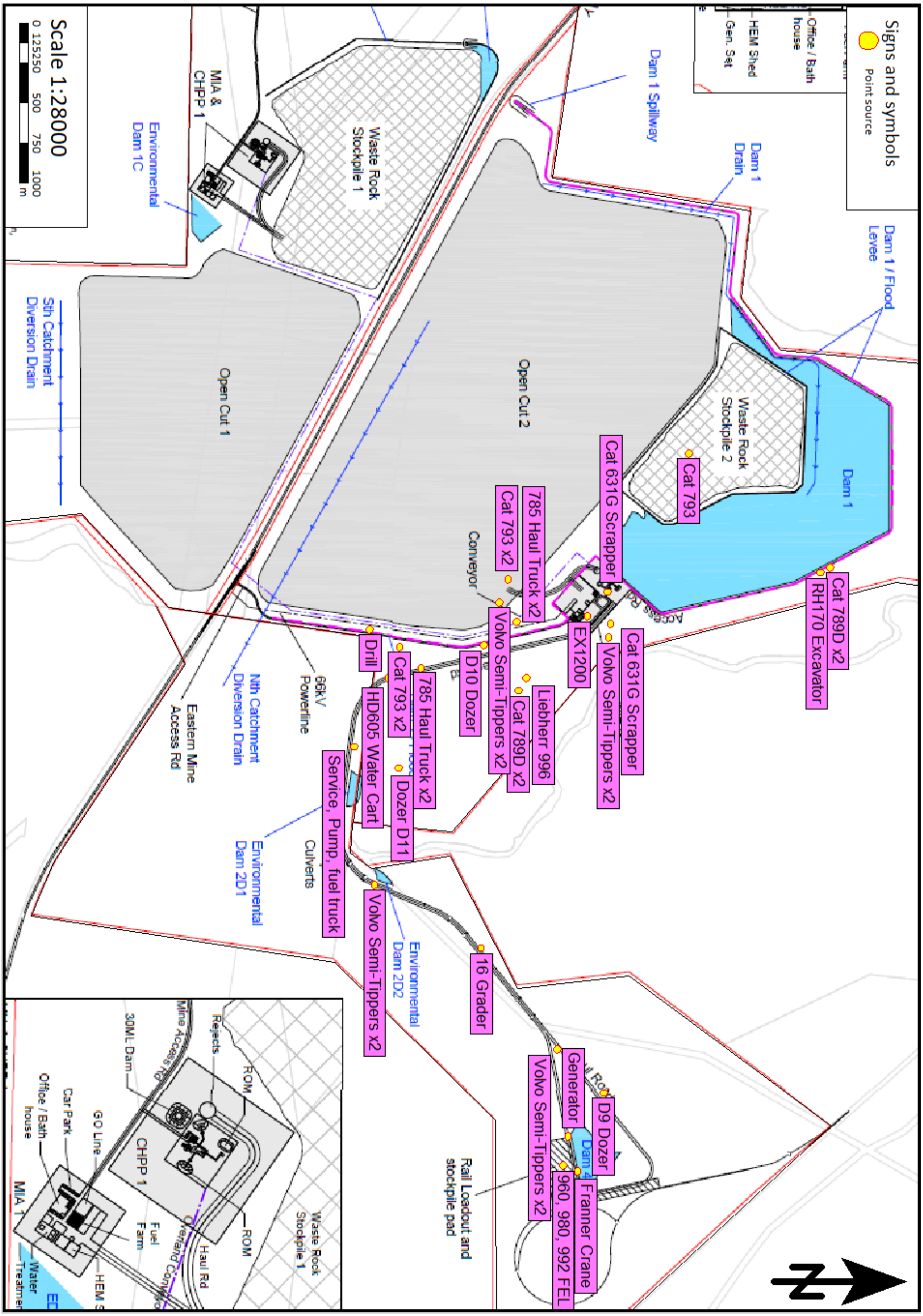


Figure 6-1: Location of Noise Sources as Modelled for Construction (Year 0)

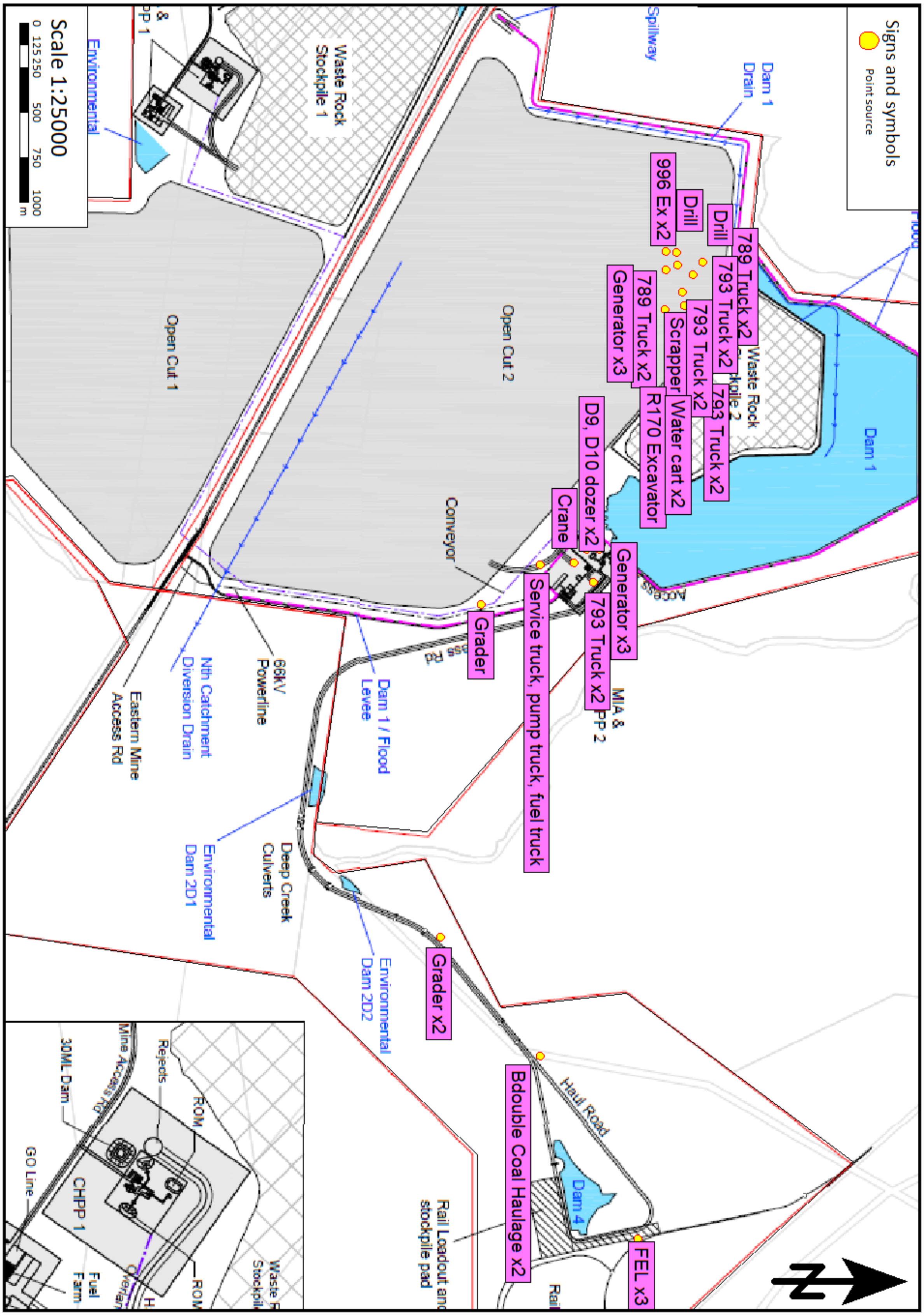


Figure 6-2: Location of Noise Sources as Modelled for Year 3

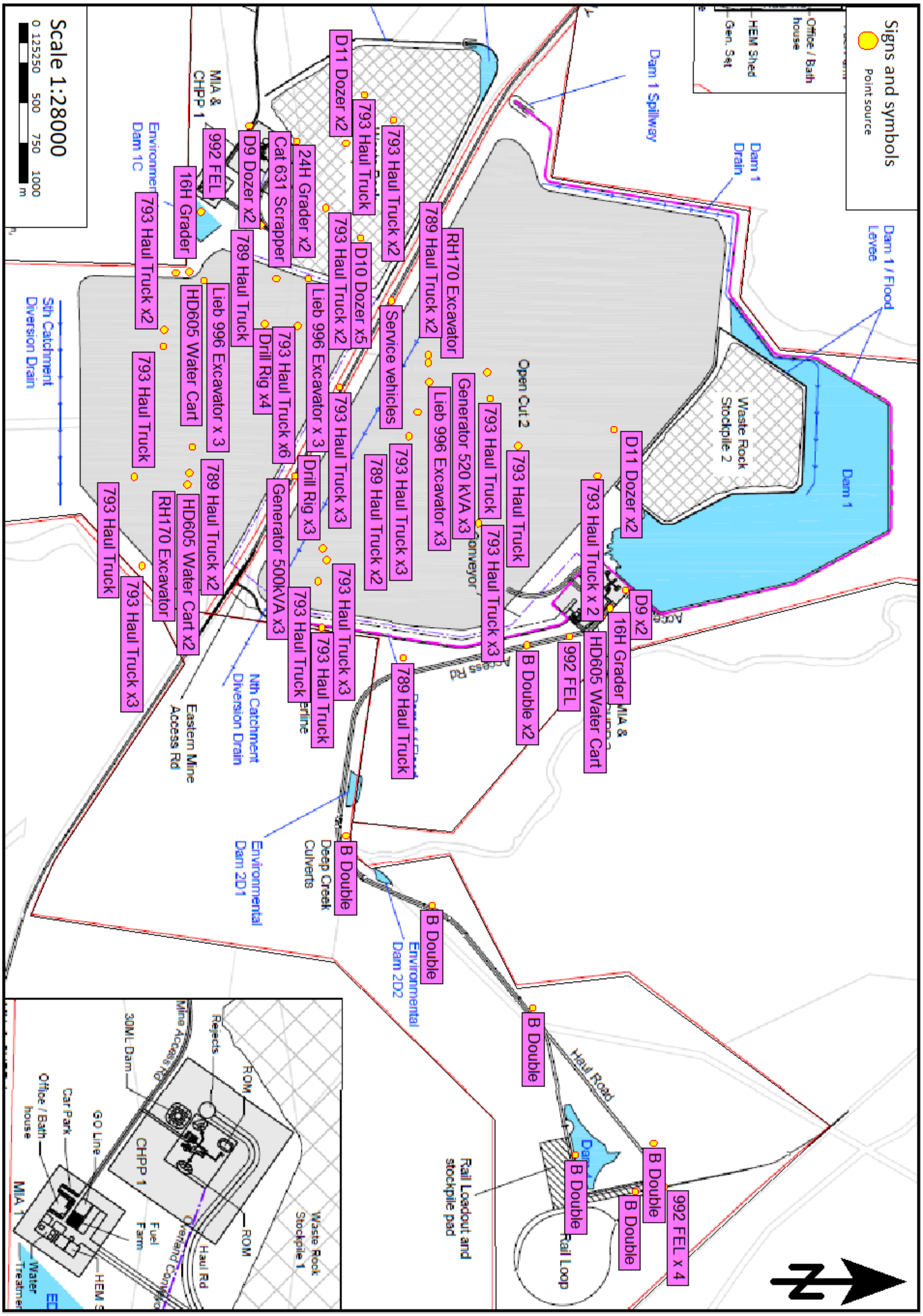


Figure 6-3: Location of Noise Sources as Modelled for Year 12

7 NOISE IMPACT ASSESSMENT

This section details the results of the noise modelling and the impacts at nearby sensitive receptors. For Construction (Year 0), Year 3 and Year 12, the following scenarios have been modelled:

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; and
- 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; and
- 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 may 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 6-1 and Table 6-2 will be in operation simultaneously in their respective stages, whereas this is unlikely to occur in actual operations.

7.1 PREDICTED NOISE LEVELS

Construction prediction results during daytime, and Year 3 and Year 12 operation prediction results during daytime evening and night are tabulated in Table 7-1 to Table 7-7, respectively.

Note that although the Tooloombah Creek Service Station does not operate during the night time period, night time noise levels at Tooloombah Creek Service Station have still been assessed as the service station has a residence located toward the rear of the property.

It should also be noted that BAR H-2 and BAR H-3 are uninhabited. Discussions with the property owner confirmed that there is no intention to restore either property to a habitable condition. For completeness, both properties have been included in the noise modelling; however, given the current and ongoing uninhabitable status of both properties, they have been excluded from the noise impact assessment.

Night time period noise contours for Year 3 and Year 12 under average and worst case climatic conditions are presented in Appendix B. Low frequency noise levels are presented in Section 7.1.1.

Noise levels were predicted for both average and worst case climatic conditions. Predicted exceedances of the noise criteria have been shown in red.

Table 7-1 Predicted Construction Noise Levels for Year 0 - Daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	37	38	42	43
BAR H-3#		40	42	45	47
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
Tooloombah Homestead		14	12	19	17
TSC RES 1		36	37	41	42
TSC RES 2		35	36	40	41

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-2 Predicted Operation Noise Levels for Year 3 - Daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	38	39	43	44
BAR H-3#		42	43	47	48
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
Tooloombah Homestead		14	12	19	17
TSC RES 1		37	38	42	43
TSC RES 2		36	37	41	42

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-3: Predicted Operation Noise Levels for Year 3 - Evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	38	39	43	44
BAR H-3#		42	43	47	48
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
Tooloombah Homestead		14	14	19	19
TSC RES 1		37	38	42	43
TSC RES 2		36	37	41	42

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-4: Predicted Operation Noise Levels for Year 3 - Night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*30/35*	38	39	43	44
BAR H-3#		42	43	47	48
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
Tooloombah Homestead		11	12	16	17
TSC RES 1		36	38	41	43
TSC RES 2		36	37	41	42

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-5: Predicted Operation Noise Levels for Year 12 - Daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	44	45	49	50
BAR H-3#		46	47	51	52
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
Tooloombah Homestead		21	20	26	25
TSC RES 1		45	46	50	51
TSC RES 2		44	45	49	50

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-6: Predicted Operation Noise Levels for Year 12 - Evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	44	45	49	50
BAR H-3#		46	47	51	52
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
Tooloombah Homestead		21	21	26	26
TSC RES 1		45	46	50	51
TSC RES 2		44	45	49	50

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-7: Predicted Operation Noise Levels for Year 12 - Night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*30/35*	44	45	49	50
BAR H-3#		46	47	51	52
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
Tooloombah Homestead		19	20	24	25
TSC RES 1		45	46	50	51
TSC RES 2		44	45	49	50

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Excluding uninhabitable properties, initial construction activities during the daytime are predicted to comply with the noise criteria during both average and worst case climatic conditions.

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 except for Tooloombah Creek Service Station and TSC RES 1 during worst case conditions only. 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, TSC RES 1 and TSC RES 2. Exceedances are also predicted during worst case climatic conditions only for Year 3 at Brussels.

During daytime and evening periods, noise levels in Year 12 are predicted to exceed the noise criteria under average and worst climatic conditions at TSC RES 1, TSC RES 2 and Tooloombah Creek Service Station. Exceedances at Brussels are also predicted under worst case climatic conditions during the day and evening period. 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 and are detailed in Section 9.

7.1.1 LOW FREQUENCY NOISE

A low frequency noise assessment was undertaken for the operations by predicting dB(Lin) at noise sensitive receptors and comparing against a 55 dB(Lin) 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.

As shown in Table 7-8 and Table 7-9, 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 7-8: Low Frequency Noise Assessment - Year 3 Operations, Worst Case Climatic Conditions - Evening

Receptor ID	Criteria	$L_{eq,\ 18:00\text{-}22:00\ hours}$ dB(Lin) Worst Climatic
BAR H-2#	L_{eq} 55 (Lin) outdoors	47
BAR H-3#		51
BAR H-1		45
Brussels		41
Neerim-1		34
Neerim-2		34
Oakdean		43
Ogmore Township		37
Strathmuir		40
Tooloombah Creek Service Station		46
Tooloombah Homestead		29
TSC RES 1		46
TSC RES 2		45

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-9: Low Frequency Noise Assessment - Year 12 Operations, Worst Case Climatic Conditions - Evening

Receptor ID	Criteria	$L_{eq,\ 18:00\text{-}22:00\ hours}$ dB(Lin) Worst Climatic
BAR H-2#	L_{eq} 55 (Lin) outdoors	52
BAR H-3#		54
BAR H-1		42
Brussels		50
Neerim-1		40
Neerim-2		41
Oakdean		43
Ogmore Township		38
Strathmuir		44
Tooloombah Creek Service Station		52
Tooloombah Homestead		34
TSC RES 1		53
TSC RES 2		52

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

7.2 NOISE CONTROL AND MITIGATION OPTIONS

Noise modelling results indicate 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.

Noise modelling results indicate that Caterpillar haul trucks are a major contributor of noise. Minimisation of noise through noise reduction has been investigated by replacing the CAT793D trucks with Hitachi EH4000 AC3 (Level 2 – Exhaust System) haul trucks and replacing CAT785 and CAT789 trucks with Hitachi EH3500 AC3 (Level 2 – Exhaust System) haul trucks. Predicted noise levels with the Hitachi fleet of haul trucks for day, evening and night during Construction (Year 0), Year 3 and Year 12 are shown in Table 7-10 to Table 7-16.

Night time period noise contours for Year 3 and Year 12 under average and worst case climatic conditions are presented in Appendix B. Where exceedances of the noise criteria have been predicted, these levels have been indicated in red.

Table 7-10: Predicted Construction Noise Levels with Noise Attenuated Hitachi Fleet for Year 0 - Daytime

Receptor ID	**Criteria (L_{Aeq}/L_{A1})**	**L_{Aeq} dB(A)**		**L_{A1} dB(A)**	
		Average Climatic	**Worst Climatic**	**Average Climatic**	**Worst Climatic**
BAR H-2#	*37/42*	30	31	35	36
BAR H-3#		34	35	39	40
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
Tooloombah Homestead		8	6	13	11
TSC RES 1		29	30	34	35
TSC RES 2		28	29	33	34

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-11: Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 3 - Daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	31	32	36	37
BAR H-3#		35	36	40	41
BAR H-1		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
Tooloombah Homestead		10	8	15	13
TSC RES 1		29	30	34	35
TSC RES 2		29	30	34	35

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-12 - Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 3 - Evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	31	32	36	37
BAR H-3#		35	36	40	41
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
Tooloombah Homestead		10	10	15	15
TSC RES 1		30	31	35	36
TSC RES 2		29	30	34	35

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-13: Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 3 - Night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*30/35*	31	32	36	37
BAR H-3#		34	36	39	41
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
Tooloombah Homestead		7	8	12	13
TSC RES 1		28	28	33	33
TSC RES 2		28	30	33	35

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-14: Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 12 - Daytime

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	34	35	39	40
BAR H-3#		36	37	41	42
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
Tooloombah Homestead		13	12	18	17
TSC RES 1		35	36	40	41
TSC RES 2		34	35	39	40

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-15: Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 12 - Evening

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*37/42*	34	35	39	40
BAR H-3#		36	37	41	42
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
Tooloombah Homestead		13	13	18	18
TSC RES 1		35	36	40	41
TSC RES 2		34	35	39	40

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

Table 7-16: Predicted Operation Noise Levels with Noise Attenuated Hitachi Fleet for Year 12 - Night

Receptor ID	Criteria (L_{Aeq}/L_{A1})	L_{Aeq} dB(A)		L_{A1} dB(A)	
		Average Climatic	Worst Climatic	Average Climatic	Worst Climatic
BAR H-2#	*30/35*	34	35	39	40
BAR H-3#		36	37	41	42
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
Tooloombah Homestead		11	12	16	17
TSC RES 1		35	36	40	41
TSC RES 2		34	35	39	40

#both properties are uninhabitable and are excluded from the Noise Impact Assessment

With the replacement of CAT793D trucks with the quieter Hitachi fleet, noise levels during construction are predicted to comply at all receivers during the daytime in both average and worst case climatic conditions.

Noise levels are also predicted to comply in Year 3 for the day time and evening periods at all sensitive receptors in both climatic conditions.

Excluding uninhabitable properties, all noise sensitive receptors during the night time period in Year 3 are predicted to comply.

In Year 12, noise levels are again predicted to comply during the day time and evening periods at all sensitive receptors in both climatic conditions.

Excluding uninhabitable properties, all noise sensitive receptors during the night time period in Year 12 are predicted to comply with the exception of:

- Brussels during worst case climatic conditions
- Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2 during both average and worst case climatic conditions.

A noise management strategy is to be developed for the project, which will include consultation and engagement with potentially affected receptors.

7.3 REHABILITATION NOISE

Based on information from the mine schedule, the 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.

8 BLASTING NOISE AND VIBRATION

Blasting will be required for the removal of overburden and extraction of coal from the open cut pits. Table 8-1 shows the separation distances between blast locations and the nearest receptors.

Table 8-1: Separation Distances for Blasting Assessment

Receptor	Distance to Pit Edge
Tooloombah Creek Service Station, BAH H-2, BAH H-3	2 km
Brussels	3 km

The nearest commercial receptor (Tooloombah Creek Service Station) is located approximately 2 km from potential blasting activities. The nearest residential receptor (Brussels) is located approximately 3 km from potential blasting activities. Note that BAR H-2 and BAR H-3 are both vacant due to both properties being uninhabitable. Discussions with the property owner confirmed that there is no intention to restore either property to a habitable condition. For completeness, both properties have been included in the blast and vibration predictions.

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 8-2.

Table 8-2: 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.

At a distance of 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(Lin) and 127 dB(Lin), 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 should be conducted in order to provide feedback on blast control measures.

9 NOISE MITIGATION AND MANAGEMENT MEASURES

The noise modelling results indicate that the noise levels from the Project are likely to exceed the Project criteria at a number of sensitive receptor locations during operational stages of the mine. Specific mitigation measures are proposed to address the impacts associated with operational activities (including progressive rehabilitation) to minimise the number of sensitive receptors impacted by the noise and to reduce the noise level. Mitigation for noise associated with mine closure and final rehabilitation will be achieved by the measures that will be implemented during operational stages with the addition of activities being limited to daytime only which removes potential impacts during the evening and night time periods.

9.1 MITIGATION FOR OPERATIONAL AND PROGRESSIVE REHABILITATION 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 CAT992 FEL's and B-Double Coal Haulage Units.

Leading up to achieving peak production of 10 Mtpa at year 12, Central Queensland Coal will as part of its approach to noise impact mitigation commence the replacement of Caterpillar haul trucks with Hitachi EH3500 AC3 (Level 2 – Exhaust System) and Hitachi EH4000 AC3 (Level 2 – Exhaust System) haul trucks, achieving a reduced Sound Power Level of 113 and 112 dB(A) respectively. Predicted noise levels with the Hitachi fleet are described in Section 7.2. Excluding uninhabitable properties, the use of the Hitachi Fleet of trucks will see noise levels comply during daytime, evening and night time periods for construction Year 3 and Year 12 stages, with the exception of Tooloombah Creek Service Station, TSC Res 1, TSC Res 2 in Year 12 during both average and worst case climatic conditions, and at Brussels during worst case climatic conditions only.

With the replacement of Caterpillar trucks with the quieter Hitachi trucks, noise levels are predicted to comply with the noise criteria at most receptors for both average and worst case climatic conditions. Noise exceedances of 4dB(A) are still predicted at Brussels for the night period and under worst case climatic conditions with the use of Hitachi trucks. Noise exceedances of 4 to 6 dB(A) are predicted to occur at TSC Res 1, TSC Res 2 and Tooloombah Creek Service Station with the use of Hitachi trucks.

Should noise monitoring identify that noise levels exceed the Model Mining Conditions noise limits for daytime, evening, and night time, Central Queensland Coal Project 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 as they arise. Central Queensland Coal Project will also consider shutting down specific operations when climatic conditions dictate.

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

9.2 GENERAL NOISE CONTROL MEASURES

The following 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 low noise idlers are generally between 5 to 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;
- 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 to 20 dB(A) of noise reduction 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; and
- 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.

9.3 GENERAL MITIGATION FOR BLASTING

General mitigation measures for blasting include the following:

- Implement a Blast Management Plan;
- 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.

9.4 COMPLAINT MANAGEMENT

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 noise and vibration. 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.

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 EHP's Noise Measurement Manual.

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 complaint register;
- A written response will be made within seven days;
- 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; and
- Corrective actions will be reported to the affected persons and recorded in the complaints register or as required in the EA conditions.

9.5 VIBRATION FROM RAIL MOVEMENTS

CQC 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 CQC train loading facility 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, CQC understand that QR and Aurizon will operate within the Transport Noise Management Code of Practice, Transport and Main Roads (issued March 2016). CQC 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.

10 IMPACTS ON FAUNA

The DEHP *EIS Information Guideline – Noise and Vibration* 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, (1998), 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.

11 CONCLUSIONS

Potential noise and vibration impacts from the construction and operation of the Project were assessed against applicable criteria based on the Department of Environment and Heritage Protection's Model Mining Conditions.

Future potential noise levels at the nearest noise sensitive and commercial receptors were predicted using the SoundPlan noise model for Construction (Year 0), Year 3 and Year 12 where the potential noise impacts are expected to be the greatest.

Noise levels are predicted to exceed the noise criteria at the nearest receptors and noise mitigation would be required. Noise mitigation measures using quieter haul trucks and management measures have been investigated in Section 9. As noise levels are predicted to exceed under worst case climatic conditions at Brussels, Tooloombah Creek Service Station, TSC Res 1 and TSC Res 2, ongoing noise monitoring and liaison with property owners will be required. It is recommended that a noise management plan is developed in consultation and engagement with potentially affected receptors to achieve alternative arrangements, in particular with the receptor at Brussels.

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.

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Appendix A GLOSSARY

Ambient noise – the totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.

Attenuation – a general term used to indicate the reduction of noise or vibration, by whatever method or for whatever reason, and the amount in decibels, by which it is reduced.

A-weighting – a frequency weighting devised to attempt to take into account the fact human response to sound not equally sensitive to all frequencies.

Background noise level - The INP defines the background noise level as '*the underlying level of noise present in ambient noise when all unusual extraneous noise is removed'*. Additionally, the INP states that *'sound levels contributing to background levels can include sound from nearby traffic, birds, insects, animals, machinery and similar sources if these sounds are a normal feature of the location'*.

dB(A) – the A-weighted sound pressure level.

dB(Z) or dB(Lin) – the Z-weighted (linear) sound pressure level.

Decibel (dB) – the logarithmic-scaled unit used to report the level or magnitude of sound.

Hertz (Hz) - the unit of frequency.

L (Level) – the sound pressure level (SPL); it implies the use of decibels related to the ratio of powers or the power related quantities such as sound intensity or sound pressure.

Loudness – the measure of the subjective impression of the magnitude or strength of a sound.

Noise descriptors – A noise descriptor is a measure of noise used to define a specific characteristic of noise, e.g. average energy, variation (maximum and minimum) and annoyance. Noise descriptors are based on measurements of the sound pressure level. Common noise descriptors are provided below:

$L_{Aeq,T}$	Time–average A-weighted sound pressure level
$L_{A90,T}$	Background A-weighted sound pressure level. Corresponds to the level that is exceeded for 90% of the measured time interval
$L_{Amax,T}$	Maximum A-weighted sound pressure level, obtained by arithmetically averaging of the maximum levels of the noise under investigation
$L_{Amin,T}$	Minimum A-weighted sound pressure level, obtained by arithmetic averaging of the minimum levels of the noise under investigation
$L_{A10,T}$	Level that is exceeded for 10% of the measured time interval. The L_{10} is typically used to measure road traffic noise
$L_{A1,T}$	Level that is equal to or exceeded for 1% of the time interval considered in the absence of the noise under investigation

Noise criteria – a maximum or minimum value imposed on a noise index e.g. a legal purpose.

RBL – Rating Background Level: Statistical noise descriptor used to describe the lowest noise levels (background) on site.

Sound power – the sound energy radiated per unit time by a sound source, measured in watts.

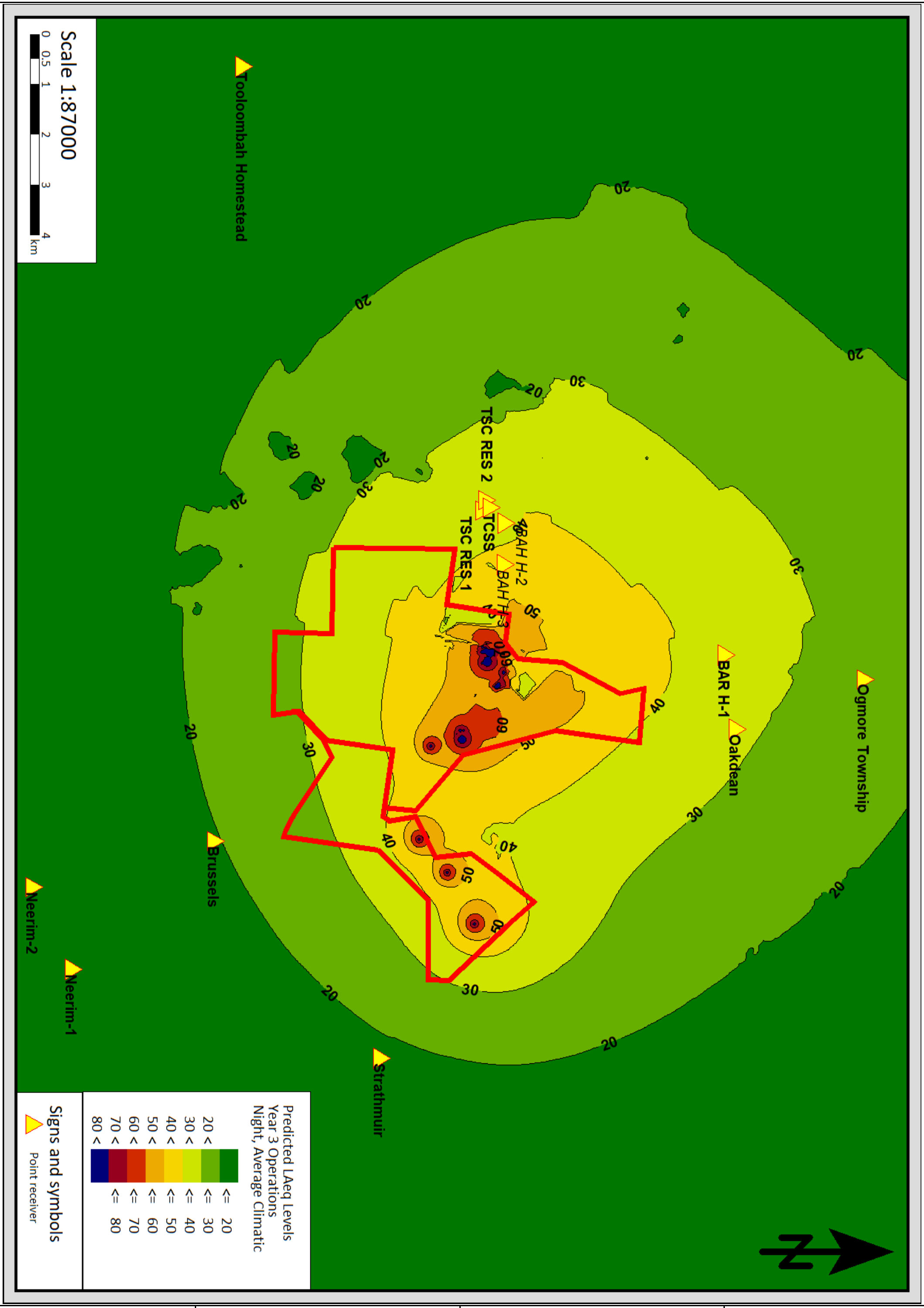
Sound propagation – the transfer of sound from one point to another.

Velocity – a vector quantity that specifies the time derivative of displacement.

Appendix B NOISE PREDICTION CONTOURS

L_{Aeq} noise contour plots have been included for the following scenarios:

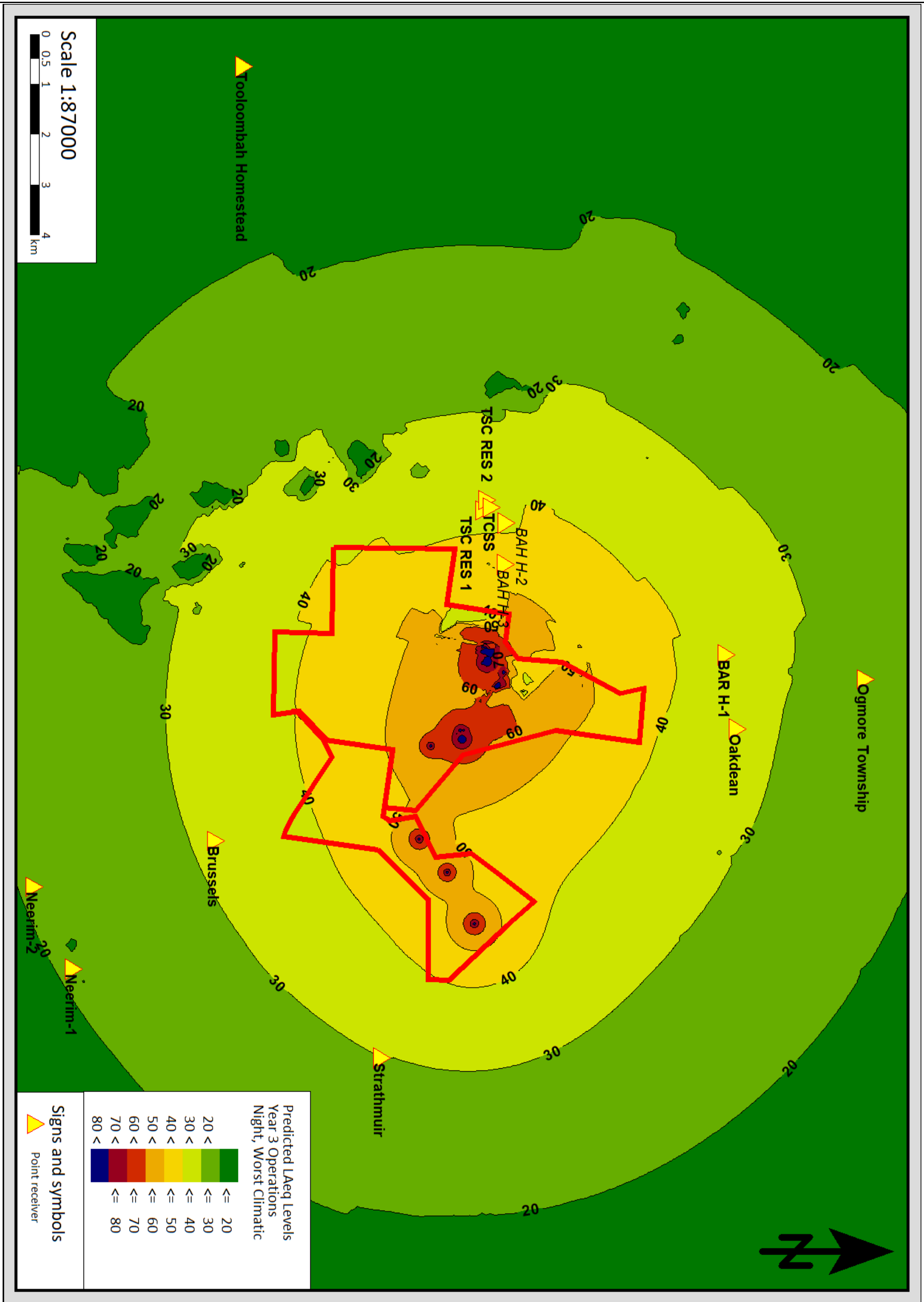
- Year 3 night time with average climatic conditions:
  - With regular Cat 793 trucks; and
  - With Cat 793XQ trucks.
- Year 3 night time with worst case climatic conditions:
  - With regular Cat 793 trucks; and
  - With Cat 793XQ trucks.
- Year 12 night time with average climatic conditions:
  - With regular Cat 793 trucks; and
  - With Cat 793XQ trucks.
- Year 12 night time with worst case climatic conditions:
  - With regular Cat 793 trucks; and
  - With Cat 793XQ trucks.



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Average Climatic	30 dB(A)

Comment:
Year 3 with no noise mitigation

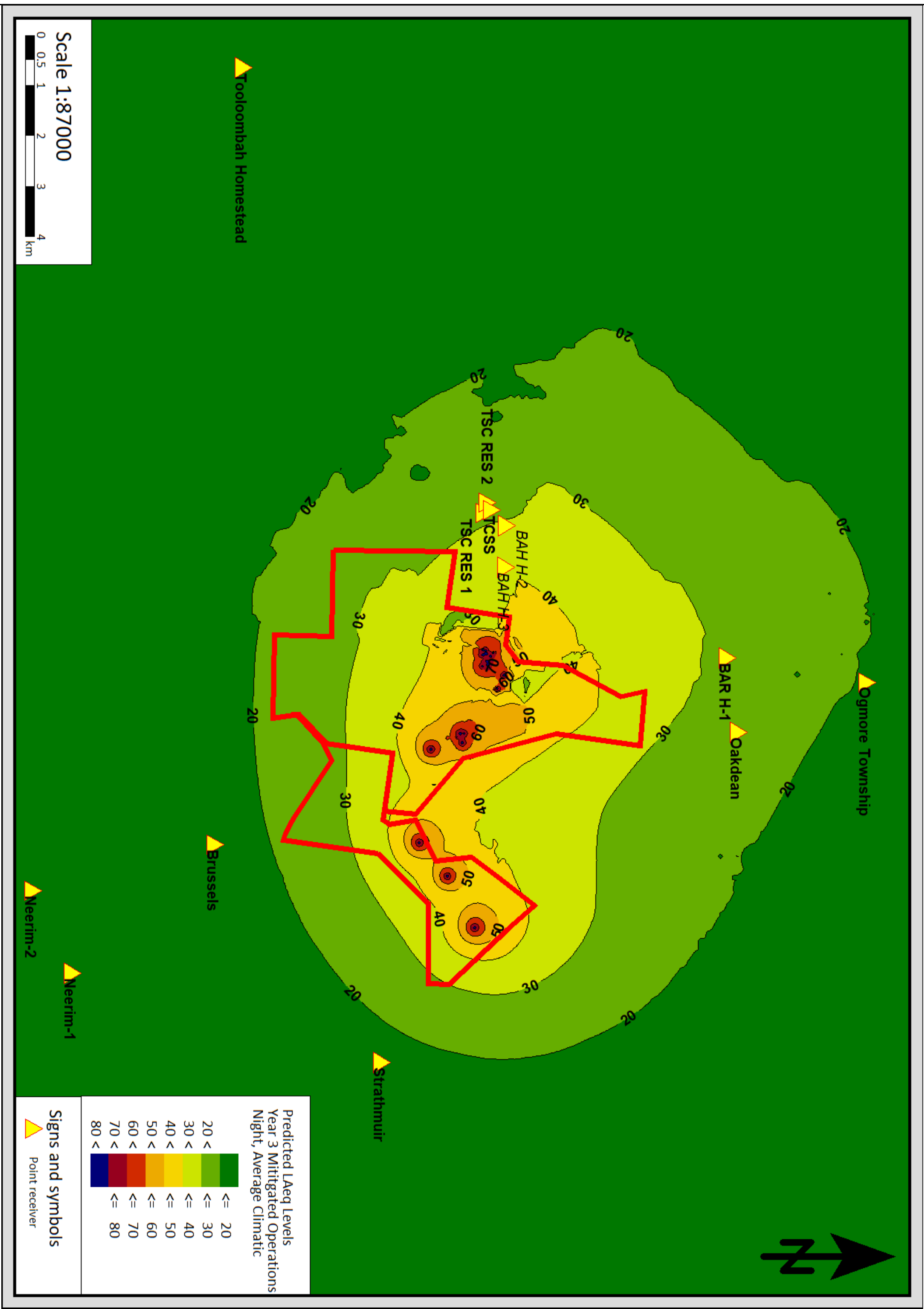
Figure B-1 Year 3 Noise Map, Average Climatic with No Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Worst Climatic	30 dB(A)

Comment:
Year 3 with no noise mitigation

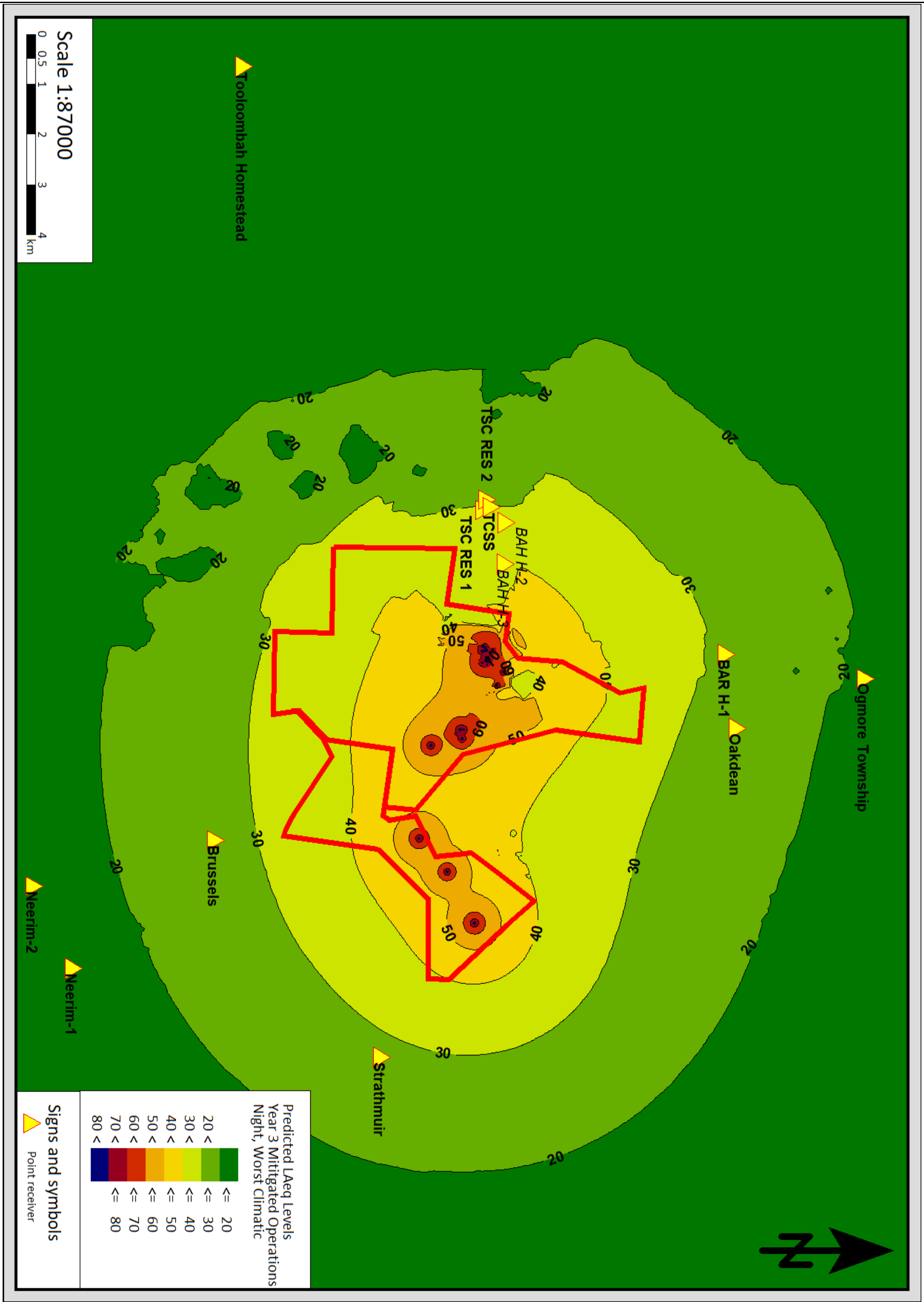
Figure B-2 Year 3 Noise Map, Worst Climatic with No Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Average Climatic	30 dB(A)

Comment:
Year 3 with noise mitigation

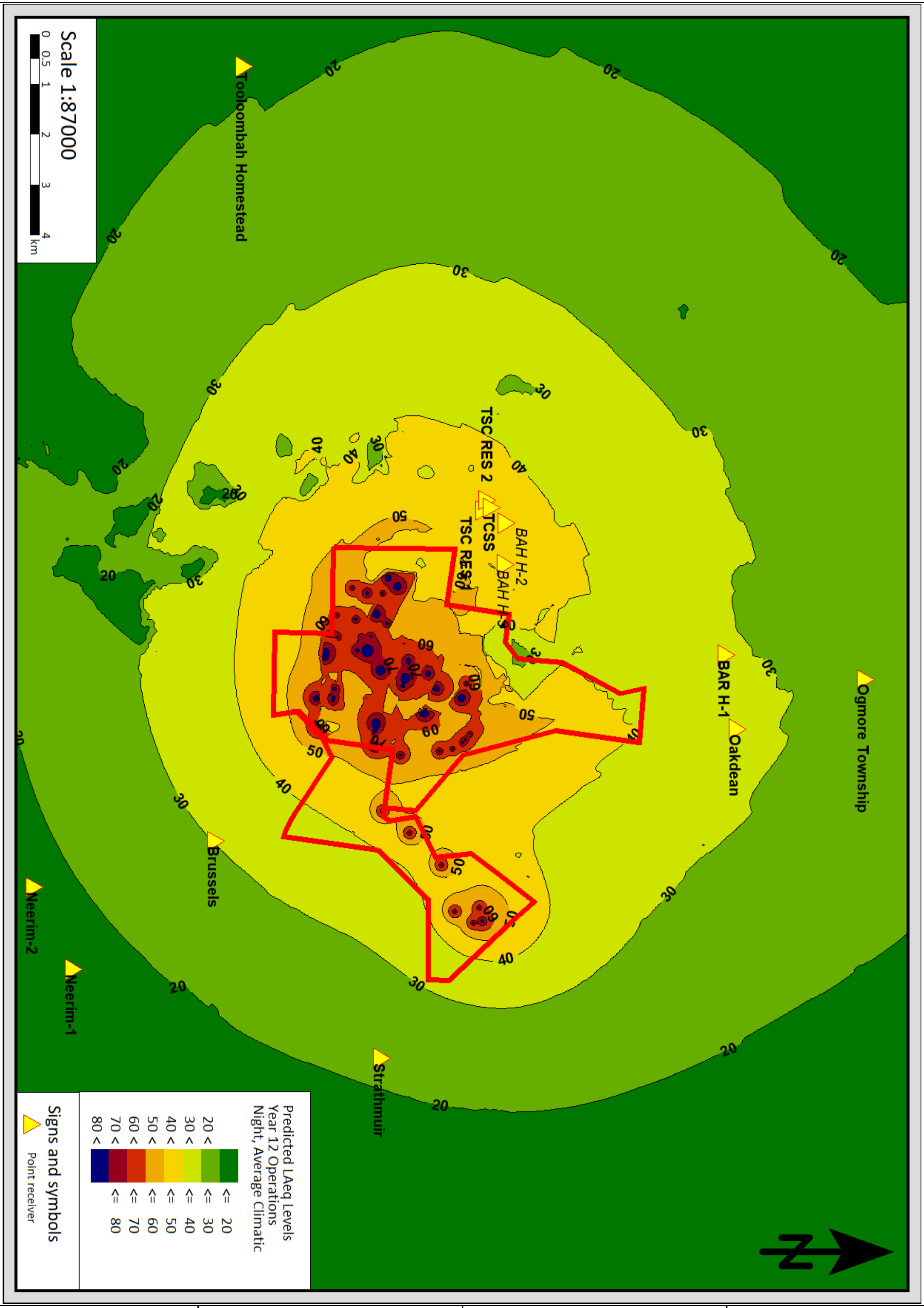
Figure B-3 Year 3 Noise Map, Average Climatic with Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Worst Climatic	30 dB(A)

Comment:
Year 3 with noise mitigation

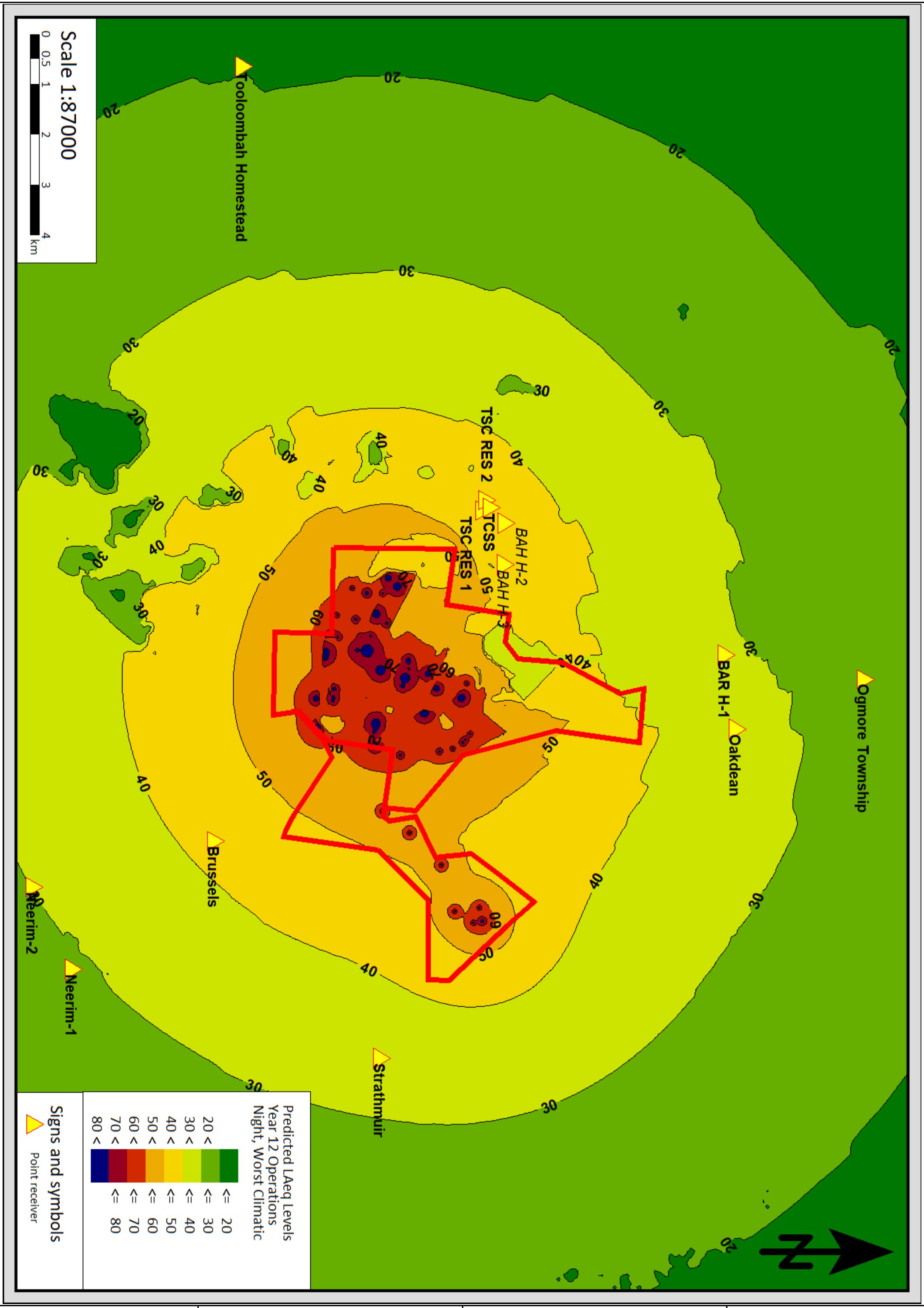
Figure B-4 Year 3 Noise Map, Worst Climatic with Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Average Climatic	30 dB(A)

Comment:
Year 12 with no noise mitigation

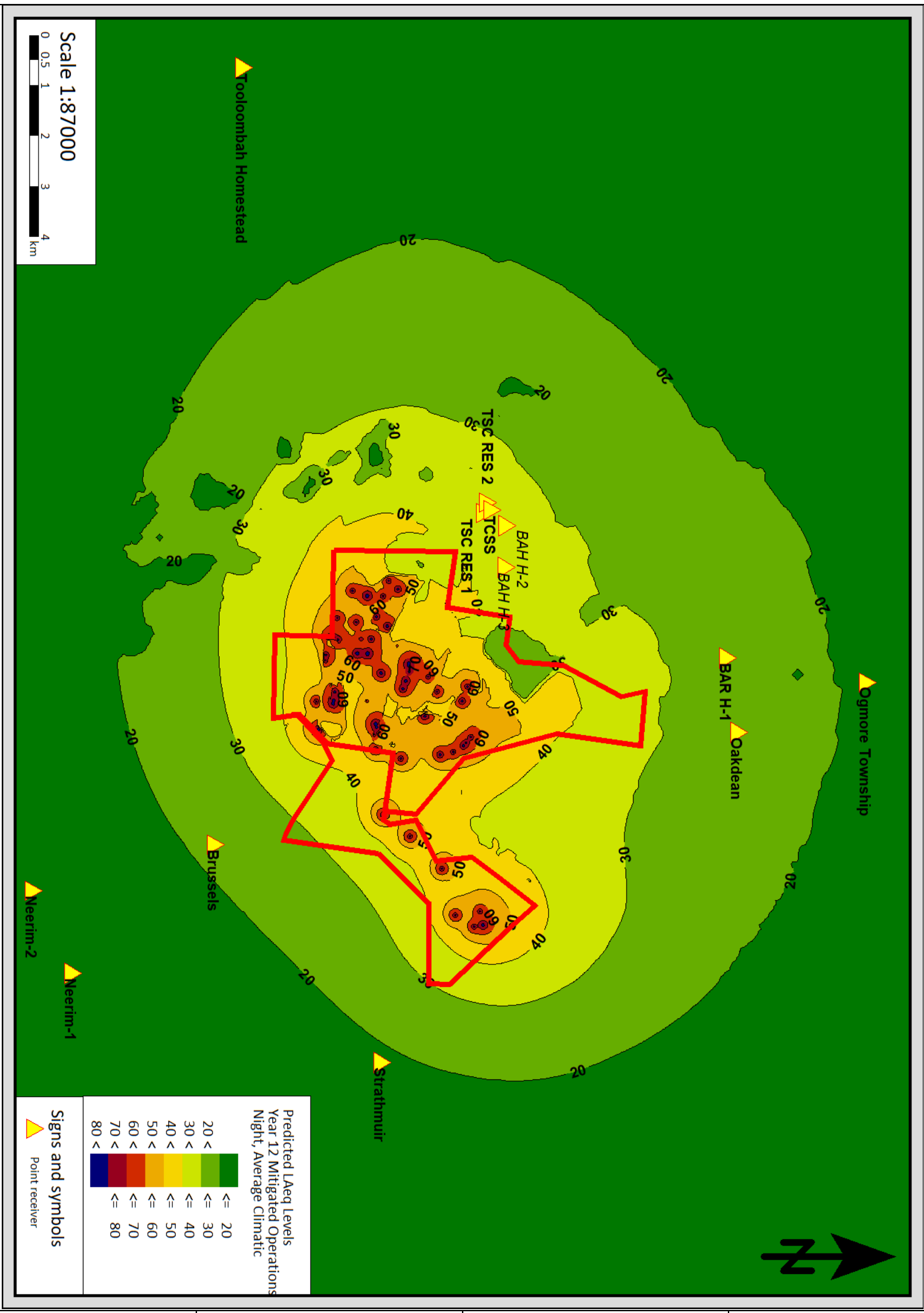
Figure B-5 Year 12 Noise Map, Average Climatic with No Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Worst Climatic	30 dB(A)

Comment:
Year 12 with no noise mitigation

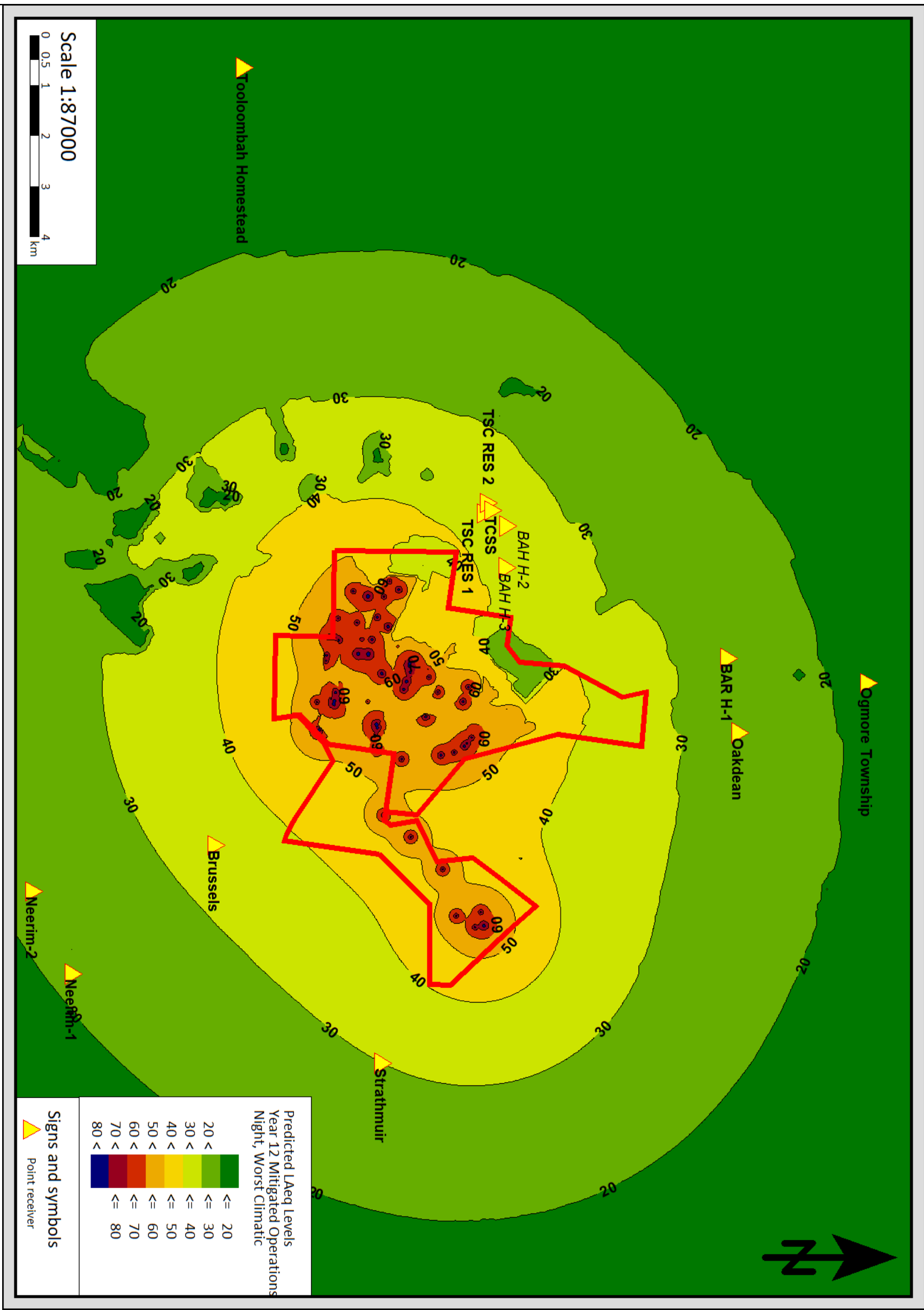
Figure B-6 Year 12 Noise Map, Worst Climatic with No Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Average Climatic	30 dB(A)

Comment:
Year 12 with noise mitigation

Figure B-7 Year 12 Noise Map, Average Climatic with Noise Mitigation



Parameter	Assessment Period:	Assessment Type:	Criteria:
L_{Aeq}	Night	Worst Climatic	30 dB(A)

Comment:
Year 12 with noise mitigation

Figure B-8 Year 12 Noise Map, Worst Climatic with Noise Mitigation