



Turner River Solar Hub Project - Environmental Noise Assessment



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Executive Summary

This report summarises an environmental noise assessment for the Turner River Solar Hub Generation Project (the Project), which includes the construction and operation of a solar farm, and for the purposes of this assessment, an estimated 600MW generation capacity was used.

The aim of this study is to quantify the potential noise impacts of the Project construction activities and operations on surrounding areas including accommodation camps and Points of Interest.

The major activities undertaken as part of the Project included:

- One month of background (baseline) noise monitoring at three locations in the Project area.
- Noise modelling undertaken to predict noise emissions from construction activities and operations.

The findings from the study are as follows:

Construction activities

- Received noise levels at accommodation camps are lower than the assigned levels (as defined in Regulation 7 of the Noise Regulations) during construction activities and as a result a construction noise management plan for environmental noise impacts is not required.
- Received noise levels at Point of Interest NM1 and NM5 are above the noise target level and measured background noise levels, and therefore are expected to be audible above background noise. All other Points of Interest are below the noise target level.

Operations

- Received noise levels at accommodation camps are lower than the assigned levels during operation of the solar farm.
- Received noise levels at all Points of Interest are below the noise target level and measured background noise levels. This indicates that the operations will likely not affect the current noise environment.

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Definitions, Abbreviations and Acronyms

	Description
Definitions	
Assigned Levels	A noise level determined under regulation 8 (i.e. maximum allowable levels).
Point of Interest	A place / area of potential cultural or other interest that may be impacted by the proposed development.
Decibel (dB)	Unit of measurement for noise.
Decibel A-weighted or dB(A)	Decibel or dB is the unit of measurement for noise, and it is “A” weighted to represent the hearing capability of humans.
Environmental Noise	An accumulation of industrial (as defined in the noise Regulations) noise pollution that occurs outside
Noise	As defined in EP Act s. 3(1): vibration of any frequency, whether transmitted through air or any other physical medium.
Noise sensitive receiver	A receiving premises defined as noise sensitive in the <i>Environmental Protection (Noise) Regulations 1997</i> . These include houses, homesteads and mine accommodation camps.
Noise sensitive area	An area visited where a noise sensitive activity is undertaken.
Noise sensitive activity	An activity which has the potential to be affected by noise. For Native Title Stakeholders, this includes traditional activities such as camping, hunting, and ceremonial.
Acronyms and Abbreviations	
AS	Australian Standard
CONCAWE	Conservation of Clean Air and Water in Europe
dB	Decibel
dB(A)	Decibel A-weighted

	Description
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EPA	The Western Australian Environmental Protection Authority
IF	Influencing Factor
ISO	International Standardisation Organisation
Km	Kilometre
m	metre
PSC	Pasquill Stability Class
SPP5.4	State Planning Policy 5.4
SWL	Sound Power Level
UTM	Universal Transverse Mercator

1 Introduction

This report summarises an environmental noise assessment for the Turner River Solar Hub Generation Project (the Project), which includes the construction and operation of a solar farm, and for the purposes of this assessment, an estimated 600MW generation capacity was used.

1.1 Aim

The aim of this study is to quantify the potential noise levels generated during construction and operation of the solar generation project on surrounding areas including accommodation camps and Points of Interest.

1.2 Operations Overview

Fortescue will construct and operate a solar farm which includes:

- Land clearing.
- Concrete pouring and assembly of solar infrastructure.
- Ongoing operation noise from the solar farm (i.e. inverters and BESS).

1.3 Receivers

Two types of receivers are applicable for this assessment, as follows:

- Noise sensitive receivers including Fortescue's Rapid Junction Camp and Mineral Resources' Wodgina camp.
- Points of interest, defined by Fortescue.

Table 1-1 and Figure 1-1 show the location of receiving locations included in the noise model. Section 2 provides more detailed information on the assessment criteria adopted for the study.

Table 1-1 Coordinates of modelled receiver locations

Receiver	Coordinates (UTM, Zone 50K)	
	Easting	Northing
Noise sensitive receivers		
Mineral Resources' Wodgina Camp	674155	7658462
Fortescue's Rapid Junction Camp	687923	7650217
Point of Interest		
NM1	682230	7654194
NM2	685815	7652388
NM3	682891	7651307

Receiver	Coordinates (UTM, Zone 50K)	
	Easting	Northing
NM4	678396	7655550
NM5	685624	7659508
NM6	687336	7661190
NM7	683219	7662404
NM8	680385	7660068

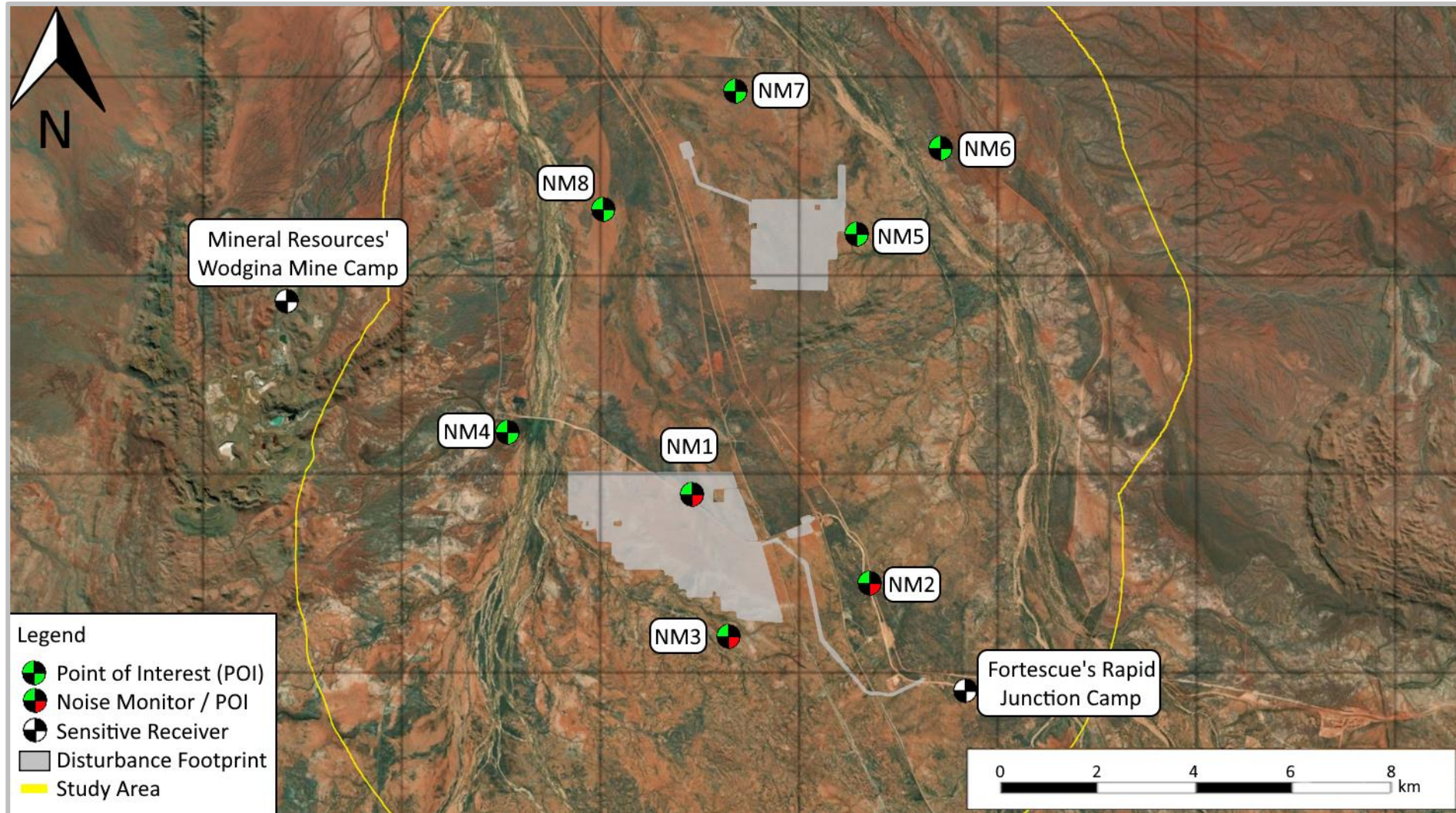


Figure 1-1: Modelled Receiving Locations

1.4 Noise Level Overview

Noise is measured using a decibel (dB) scale which makes it a non-linear number. This means that every 3 dB is a doubling of acoustic energy (for example $10\text{ dB} + 10\text{ dB} = 13\text{ dB}$). The measured levels are quoted as dB(A), which means it is an A-weighted decibel value. A-weighting gives more value to frequencies in the middle of the human hearing spectrum and less value to frequencies at the edges, as compared to a flat audio decibel measurement.

Hearing sound at 70 to 75 dB(A) is equivalent to someone shouting at 1m from your ear, 60 to 65 dB(A) is equivalent to someone speaking at 1m from your ear and 30 to 35 dB(A) is equivalent to someone whispering at 1m from your ear (see Figure 1-2 for some additional examples).

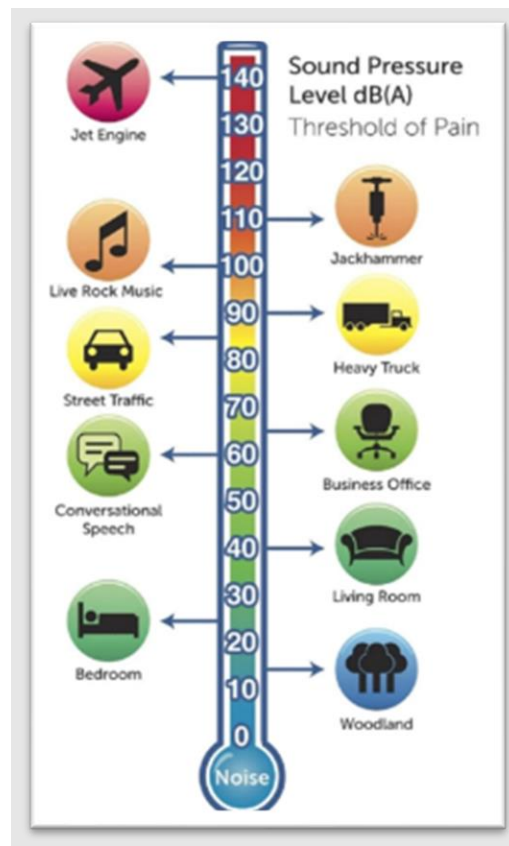


Figure 1-2 Noise Thermometer

2 Assessment Criteria

2.1 Overview of Applicable Regulatory Documents

Table 2-1 provides a list of Regulatory documents that have been considered for determining applicable noise threshold levels for the impact assessment.

Table 2-1 Applicable Documents

Ref	Document Name	Application
[1]	Environmental Protection Act 1986	The Act defines noise as an emission and considered this emission to be unreasonable if it interferes with the health, welfare, convenience, comfort, or amenity of any person. The Act requires the occupier of any prescribed premises who causes an emission or alters the nature or volume of noise from the prescribed premises to ensure that their noise emissions are not unreasonable.
[2]	Environmental Protection (Noise) Regulations 1997	The Regulations defines noise emissions that if found to be in contravention of the standard prescribed in the noise regulations will be considered as unreasonable.
[3]	DWER Draft Guideline “Assessment of environmental noise emissions”, May 2021	The Guideline ensures adequate information is provided to the Department of Water and Environment Regulation for assessing applications with noise emissions, as regulated under the <i>Environmental Protection Act 1986</i> (EP Act).
[4]	Environmental Factor Guideline: Social Surroundings	The Guideline communicates how the factor Social Surroundings is considered by the Environmental Protection Authority (EPA) in the environmental impact assessment (EIA) process.
[5]	State Planning Policy 5.4 Road and Rail Noise	The policy has been used to determine the noise impacts of rail operations on the Homestead, camps and Points of Interest.
[6]	AS2107 Acoustics - Recommended design sound levels and reverberation times for building interiors	AS2107 defines maximum noise levels for internal spaces, including sleeping areas. It has been used, in combination with the noise Regulations, to determine noise impacts on Points of Interest.
[7]	Technical Guidance EIA of Social Surroundings – Aboriginal Cultural Heritage	Outlines the Environmental Protection Authority (EPA) environmental impact assessment (EIA) process for Social Surroundings – Aboriginal cultural heritage (ACH) under the <i>Environmental Protection Act 1986</i> (EP Act).

2.2 Noise Sensitive Receivers Overview

Two receiving locations surrounding the Project are considered as noise sensitive premises, as defined in the *Environmental Protection (Noise) Regulations 1997*. These are the Rapid Junction Camp and Wodgina Camp.

The Points of Interest (i.e. NM1 to NM8), and any potential activities undertaken in these areas, are not included in the definition of noise sensitive receivers in the Environmental Protection (Noise) Regulations, and therefore, suggested noise targets based on activity and use of an area have been used to evaluate if received noise in these areas could be considered as unreasonable.

2.3 Environmental Protection (Noise) Regulations

2.3.1 Regulation 13 Construction Noise Overview

Noise levels associated with construction sites are managed under Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*.

Noise from construction activities falls under Regulation 13, whereby the assigned noise levels set in Regulations 7 and 8 do not apply, provided certain requirements are met. The scope of the Project involves construction activities associated with the development of a solar farm.

Regulation 13 requirements are divided into two-time categories: normal hours and out-of-hours activities. Regulation 13 requires that the site and all the activities within the site, including any equipment, be for the sole or principal purpose of construction work.

2.3.2 Normal Hours Activities

The prescribed standard for noise emissions (i.e. Regulation 7¹) does not apply to construction or demolition work carried out between 7:00 and 19:00 on any day, which is not a Sunday or Public Holiday, provided that:

- The construction work is carried out in accordance with control of environmental noise practices set out in Section 4 of Australian Standard 2436-2010 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”; and
- The equipment used for the construction is the quietest reasonably available.

The Chief Executive Officer (CEO)² of the Department of Water and Environment Regulation (DWER) may request that a noise management plan be submitted before the work is carried out.

- If the occupier³ is required to prepare a noise management plan under sub-regulation (4) in respect of the construction site —
 - the noise management plan is prepared and given in accordance with the requirement, and approved by the CEO; and

¹ Regulation 7 requires noise emitted from any premises when received at other premises must not cause, or significantly contribute to, a level of noise which exceeds the assigned level (as defined in Regulation 8).

² CEO of DWER or CEO of the Shire as delegated in Delegation EV 405 No. 119 Government Gazette 16 May 2014.

³ The person who is causing or permitting that noise to be emitted is to be treated as the occupier of that public place for the purposes of sections 51, 75, 90, 92, 93 and 95 of the Act

- the construction work is carried out in accordance with the noise management plan, excluding any ancillary measure.

2.3.3 Out-of-Hours Activities

The following applies for construction and demolition work undertaken outside normal hours⁴:

- The work must be carried out in accordance with control of noise practices set out in section 4 of Australian Standard 2436-2010 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”; and
- The equipment used for the work must be the quietest reasonably available.

Furthermore, if noise emissions are likely to exceed the assigned noise levels, then the following must be undertaken:

- The occupier must advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7, of the work to be done at least 24 hours before it commences.
- The occupier must show it was reasonably necessary for the work to be done out of hours.
- The occupier must submit a Construction Noise Management Plan to the CEO of DWER at least seven days before the work starts, and the plan must be approved by the CEO. The plan must include details of:
 - details of and reasons for the work to be undertaken out of day-time hours;
 - description of activities which could be noisy;
 - predictions of the noise levels;
 - control measures for noise (including vibration);
 - procedures to be adopted for monitoring noise emissions (including vibration); and
 - complaint response procedures to be adopted.

2.3.4 Regulation 7 and 8

Noise management in Western Australia is implemented via the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the *Environmental Protection Act 1986* (the EP Act).

The Regulations define maximum allowable noise levels which apply to noise received at noise sensitive premises, such as residential areas. These are determined by a combination of a base noise level plus an Influencing Factor (IF). The result is termed the “assigned level”.

The assigned noise levels include L_{A1} , L_{A10} and L_{AMAX} noise parameters, defined as:

- L_{ASMAX} means an assigned level which is not to be exceeded at any time.
- L_{AS1} means an assigned level which is not to be exceeded for more than 1% of time.

⁴ Normal hours are from 07:00 to 19:00 except on Sundays and Public Holidays.

- L_{A510} means an assigned level which is not to be exceeded for more than 10% of time.

The L_{A10} noise level is most representative, as noise emissions will be present for greater than 10% of time.

For noise sensitive premises, the time of day also affects the assigned levels. The following time intervals are defined by the Regulations:

- Day time (0700 to 1900 Monday to Saturday)
- Evening (1900 to 2200 all days)
- Night-time (2200 to 0700 Monday to Saturday, 2200 to 0900 Sundays and Public Holidays)

The assigned noise level is more stringent (10 dB quieter) during night-time hours, because this is when people are more likely to be sleeping or resting. As the construction and operations are likely to occur 24 hours a day, the most stringent night-time assigned levels (2200-0700) are applicable.

Based on the above, the night-time L_{A10} noise level will be assessed. A more detailed overview of the Regulations are presented in Appendix A.

2.3.5 Assigned Noise Levels

Table 2-2 provides an overview of the assigned noise levels defined in the Regulations for noise sensitive premises.

Table 2-2 : Assigned Noise Levels as defined in the Environmental Protection (Noise) Regulations

Sensitive Receiver	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive Premises	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sundays and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor

2.3.6 Influencing Factor

An Influencing Factor (IF) is added to the assigned level based on the surrounding land use adjacent to each of the sensitive receivers, including the amount (%) of industrial and commercial premises, as well as the number and proximity of major roads (i.e. 15,000 vehicles/day) and secondary roads (i.e. 6,000 to 15,000 vehicles/day).

As there are no gazetted roads in the area that have greater than 6,000 vehicles per day, and the surrounding land is not classified as industrial or commercial, the applicable IF is **0**.

2.3.7 Adjustments for intrusive or dominant characteristics

Received noise levels are subject to adjustments (i.e. penalty) if the noise exhibits intrusive or dominant characteristics. These characteristics are defined as impulsive, tonal or modulating. Some examples are listed below:

- Tonality – whistling, bird calls, car horn.
- Impulsiveness – a hammer repeatedly hitting steel.
- Modulation – varying amplitude such as multi drone notes played on a didgeridoo.

These adjustments, shown in Table 2-3 are cumulative up to a maximum of 15 dB. Section 9 of the Regulations sets out objective tests to assess whether received noise is free of these characteristics.

Table 2-3 Adjustments for intrusive or dominant characteristics (cumulative to maximum 15 dB)

Tonality	Modulation	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB

The predicted received noise levels (see section 5) for solar farm operations are lower than the measured background noise levels at night-time (see section 3.3). As a result, no tonality penalty has been applied as any tonal characteristics in the received noise will be masked by background noise. No modulation or impulsiveness is expected based on the equipment being utilised, and therefore no additional penalty adjustments have been applied.

2.4 Social Surroundings

2.4.1 Overview

The EP Act defines Social Surroundings as, *‘the social surroundings of man are his aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings (Subsection 3(2))’*. A more detailed overview of the guidance documentation is provided in Appendix A.

The EPA’s environmental objective for the factor Social Surroundings is *‘To protect social surroundings from significant harm’*. The objective recognises the importance of ensuring that social surroundings are not significantly affected because of implementation of a Project or scheme.

Noise has the potential to unreasonably interfere with the health, welfare, convenience, and comfort of people. As a result, the EPA requires that the following noise considerations be included:

- Emissions of noise are considered in the context of relevant legislation, criteria or standards.
- The level of confidence with which the predicted impacts to social surroundings have been made and the risk should those predictions be incorrect.
- Analysis, modelling, and predictions of impacts from noise, including likely impacts during the worst, best and most likely case scenarios.
- Model predictions could be validated with on-site measurements.
- Characterisation of proximity to sensitive receptors.
- Summary of proposed technologies, emission reduction equipment and management practices.
- Description of proposed management and monitoring arrangements.
- Analysis of cumulative impacts, including existing and reasonably foreseeable emissions.

2.4.2 Details of Points of Interest

No specific areas or places of noise sensitivity were identified during consultation with Kariyarra Traditional Owners. However, concerns were raised about the level of noise during construction and operation phases of the project, and how far these could be heard from the project area. In consultation with Kariyarra, several Points of Interest were identified for use in the noise modelling. Table 1-1 and Figure 1-1 show the locations of the eight Points of Interest included in the noise model as receivers. These are described as NM1 to NM8.

2.4.3 Identified Noise Sensitive Areas

For all Native Title Groups, it is assumed that continued or sporadic access may occur for cultural and recreational purposes including camping, hunting, fishing, and ceremonial use. Therefore, noise target levels based on these activities have been suggested in this report for the impact assessment.

These predicted noise levels were also compared against background noise monitoring undertaken in March 2024, to provide an indication of locations where the Project’s construction activities and operations may be audible.

2.4.4 Proposed Criteria for Noise Sensitive Activities

Activities considered to be noise sensitive (e.g. Hunting, Ceremonial use, and Camping) are not defined in the Regulations. There is also a lack of previous information and proxy data to inform the assessment, and particularly the appropriate noise target criteria.

To determine reasonable noise target levels for the different noise sensitive activities, the following legislative documents, standards, and guidance documentation have been considered:

- The *Environmental Protection Act 1986* requires that noise emissions received at another premises are reasonable. The Regulations consider receiver types and not activities. The assigned noise levels defined in the Regulations are the levels below which the Regulator considers noise to be reasonable. Compliance with the assigned levels does not imply that the noise is inaudible.
- Australian Standard AS2107 considers appropriate internal noise levels for different types of rooms in which various activities are undertaken. The activities have been related back to noise related values.
- Neither the Regulations nor AS2107 consider hunting activity. It has, therefore, been assumed that hunting at night (although unexpected), where the hunter is dependent on auditory senses, will require similar background noise levels to sleeping areas and night-time assigned noise levels defined in the Regulations.

Table 2-5 details the proposed target noise levels for each activity of noise related value which is undertaken in the study area surrounding the Project. In-line with AS2107, both satisfactory and maximum levels have been provided.

Based on the identified noise related values, there are three activities that should be considered when developing appropriate noise levels within these noise sensitive areas. These are as follows:

- **Camping (night-time):** Noise could result in sleep disturbance and annoyance. Threshold levels need to take this into account.
- **Hunting (daytime):** It is expected that hunting will only take place during daylight hours where the hunter uses visual cues. Night-time hunting is not expected, but if undertaken will require low noise levels as the hunter is dependent on auditory cues.
- **Day Use / Ceremonial:** Speech intelligibility and annoyance needs to be considered when considering activities during the day or ceremonial use.

2.5 Applicable Noise Limits for the Project

Table 2-4 gives the night-time assigned levels for nearby sensitive receivers (i.e. camps). Table 2-5 are suggested target noise levels for noise sensitive activities undertaken at Points of Interest.

Table 2-4 Applicable Night-Time Assigned Levels (LA10)

Receiver	Threshold Noise Level (LA10)		
	Night-Time	Evening	Daytime
Wodgina Mine and Rapid Junction Camps	35	40	45

Table 2-5 Activity Based Noise Target Levels for Points of Interest

Activity	Target Noise Level (dB(A))		Comment
	Satisfactory	Maximum	
Camping (night-time)	25	30	The night-time threshold levels are based on avoiding noise-induced sleep disturbance and annoyance. The threshold levels adopted have used the Regulations night-time assigned levels for sensitive receivers and AS2107 noise levels for sleeping areas.
Hunting (daytime)	40	45	The threshold levels are based on avoiding annoyance. It should be noted that these levels are for hunting activities undertaken during the Daytime only.
Daytime use / Ceremonial	30	35/45	The threshold levels are based on avoiding annoyance. It should be noted that these levels are set for activities where speaking to others is involved. The threshold levels adopted are based on AS2107 levels for educational buildings. 45 dB(A) applies to ceremonies if amplification through a microphone speaker system is used.

3 Noise Monitoring – Baseline Noise Environment

3.1 Overview

To develop an understanding of current ambient noise levels in the area, baseline unattended noise monitoring was undertaken. This report presents monitoring undertaken at three locations between the 12 March 2024 and 2 April 2024⁵.

The results from this noise monitoring have been used to estimate the expected increase in noise levels due to the construction and operation of the Project.

The noise monitoring systems were setup to measure overall and statistical noise levels at 15-minute intervals, so that minimum, average and maximum background noise levels during day, evening and night-time periods could be determined.

3.2 Monitoring Locations

Table 3-1 provides names and locations of the baseline noise monitoring and Figure 3-1 shows photos of each noise logger location. Logger locations relative to POI's are shown in Figure 1-1.

Table 3-1 Monitoring Locations (UTM, Zone 50K)

Noise Logger ID	POI	X [m]	Y [m]
Logger 1	NM1	682107	7654314
Logger 2	NM2	685803	7652424
Logger 3	NM3	682846	7651183

⁵ This draft report contains results from 12th of March 2024 to 22nd of April 2024.



Figure 3-1 Logger 1 (left), Logger 2 (centre), Logger 3 (right)

3.3 Monitoring Results

Table 3-2 provides a summary of the noise monitoring results at each location, separated into day (0700 to 1900), evening (1900 to 2200) and night (2200 to 0700). Appendix C contains time plots of the measured noise levels over the monitoring period for Logger 1, 2 and 3.

Definitions of the noise parameters used, are as follows:

- **LAeq**: the average noise level during each time of day.
- **LA10**: the noise level that is present for 10% of time, during each time of day.
- **LA90**: the noise level that is present for 90% of time, during each time of day.

The results indicate that the LA90 background noise levels are below the assigned levels at all locations and are target levels.

Table 3-2 Baseline Noise Monitoring Results Summary (dB(A))

Logger ID	Time of Day	Noise Levels dBA		
		LAeq	LA10	LA90
Logger 1	Day	37.9	43.3	33.7
	Evening	35.3	39.1	32.5
	Night	35.1	38.9	32.4
Logger 2	Day	38.7	44.9	33.9
	Evening	36.6	41.0	33.6
	Night	36.2	41.2	33.1
Logger 3	Day	34.6	41.3	28.9
	Evening	31.9	37.8	27.4
	Night	31.1	36.7	27.1

4 Noise Modelling Overview

4.1 Noise Model Software

A desktop environmental noise model was created to simulate the Project using SoundPlan v8 software program. This software package calculates sound pressure levels at nominated receiver locations and produces noise contours over a defined area of interest. SoundPlan can be used to model different types of noise, such as industrial noise, traffic noise and aircraft noise.

The inputs required by the SoundPlan modelling software are noise sources, ground topographical and absorption data, meteorological data and sensitive receiver point locations. SoundPlan has been setup for this study to utilise ISO9613 “Acoustics - Attenuation of sound during propagation outdoors” for calculating the attenuation of sound during outside propagation and the CONCAWE^{6,7} prediction algorithm. The CONCAWE algorithm is accepted by the Department of Water and Environment Regulation (DWER).

The model has been used to predict received noise levels at noise sensitive receiver locations and to generate noise contour maps for the wider area.

4.2 Noise Model Inputs

4.2.1 Noise Sensitive Receivers

The receiver locations as listed in section 1.3 have been included in the noise model as point receivers, used to undertake the noise assessment.

4.2.2 Topography and Ground Absorption

Topographical data for the area was provided by Fortescue, which was used to create a digital ground map. The acoustic properties of the ground surface influence noise propagation. Flat non-porous surfaces such as concrete, asphalt and water are more reflective, whereas soft, porous surfaces such as foliage and grass are more absorptive. A CONCAWE ground factor of 0.6 was applied to the model, which is indicative of hard ground and considered representative of the area.

4.2.3 Meteorological Conditions

SoundPlan calculates noise levels for defined meteorological conditions. Temperature, relative humidity, wind speed and direction data are required as inputs to the model. Table 4-1 presents the worst-case meteorological conditions applied to the model, which are defined in the DWER “*Draft Guideline on Environmental Noise for Prescribed Premises*”. The worst-case meteorological conditions

1.⁶ CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

2.⁷ The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981.

are based on extensive research undertaken by DWER to understand what meteorological conditions, from a noise perspective, provide favourable propagation from the source to the receiver.

Table 4-1 : Worst-Case Meteorological Conditions applied to the model

Time of day	Temperature	Relative Humidity	Wind Speed	Wind Direction	Pasquill Stability Category (PSC)
Night (19:00 - 07:00)	15° Celsius	50%	3 m/s	worst case	F

4.2.4 Noise Sources

The Project will require construction activities to clear and level the area and to develop concrete plinths for the solar infrastructure. A transmission line will connect the solar inverters to the existing power station.

Table 4-2 presents a summary of the construction activities, equipment quantities and noise source Sound Power Levels (SWLs) attributed to each item which have been used to develop the model. A detailed list of SWLs and octave band data for each item can be found in Appendix B.

Table 4-2 Construction Activities and Operations Noise Sources

Activities	Equipment	Sound Power Level (dBA) per item	Quantity
Clearing	Scraper	111.8	1
	Dozer	113.4	1
	Loader	112.6	1
	Moxy Truck	112.6	2
Concrete	Concrete vibrator	112.2	1
	Compressor	102.4	1
	Concrete Truck	109.0	1
	Concrete Pump	108.6	1
Trenching	Trenching machine	109.1	1
Operations	Inverters and BESS ⁸	96.6	4

⁸ Noise from Inverters and BESS are cooling fans, and their source level has been assumed to be similar to fin fan cooling systems.

4.3 Noise Model Layout

The location of the Project, and locations of the receivers were provided in drawings and spatial files by Fortescue and were imported to the noise model.

4.4 Noise Model Scenarios

The following model scenarios have been developed:

- **Construction Activities** – Three scenarios of construction activities (listed in Table 4-2), clearing, concrete works and trenching activities, have been placed in the centre of the two areas.
- **Operations** - An operational scenario that represents the solar inverters and BESS, located in their proposed positions. The expected location of the Inverters and BESS has been modelled based on information provided by Fortescue.

5 Noise Modelling Results

5.1 Construction Activities

Table 5-1 shows the model results for construction activities. All model scenarios were run under worst-case night-time weather conditions as defined in Table 4-1. Bolded text in the table indicates predicted levels that are higher than the noise target levels.

Table 5-1 Noise Model Results (LA10) – Construction Activities

Receiver	Target Level (dBA)	Construction Activities (dBA)		
		Clearing	Concrete	Trenching
Fortescue's Rapid Junction Camp	35	9.9	3.5	13.2
Mineral Resources' Wodgina Mine Camp		9	2.4	12.4
Point of Interest NM1	30 (Camping, night-time) 45 (Hunting, daytime) 35 (Day Use / Ceremonial)	49.5	41.8	29.6
Point of Interest NM2		27.8	24.2	17.7
Point of Interest NM3		36.2	33.8	39.6
Point of Interest NM4		25.4	19.4	17.7
Point of Interest NM5		44.2	39.8	43.8
Point of Interest NM6		29.5	24.8	29.4
Point of Interest NM7		30.6	26.0	30.5
Point of Interest NM8		26.6	21.8	26.9

Noise levels at both accommodation camps are below assigned limits, so a construction noise management plan is not needed (in accordance with Regulation 13).

However, noise levels at POIs NM1 and NM5 exceed target and background levels, meaning they will likely be audible. If these areas are used by Traditional Owners during construction, it's recommended to plan activities away from them. All other POIs remain below the noise target level.

5.2 Operations

Table 5-2 presents the model results for operations (i.e. solar inverters and BESS).

Table 5-2 - Noise Model Results (LA10) – Operations

Receiver	Target Level (dBA)	Operations (inverters and BESS) (dBA)
Fortescue's Rapid Junction Camp	35	-8.4
Mineral Resources' Wodgina Mine Camp		-0.8
Point of Interest NM1	30 (Camping, night-time) 45 (Hunting, daytime) 35 (Day Use / Ceremonial)	28.4
Point of Interest NM2		18.8
Point of Interest NM3		22.1
Point of Interest NM4		7.7
Point of Interest NM5		12.0
Point of Interest NM6		7.0
Point of Interest NM7		24.4
Point of Interest NM8		24.0

Noise levels at both accommodation camps and all POIs are below the assigned and background levels during solar farm operations, indicating no expected impact on activities at the POIs.

5.3 Noise Contour Maps

Noise contour maps are provided as follows:

- Figure 5-1 – Clearing Construction Activity in Northern area.
- Figure 5-2 – Clearing Construction Activity in Southern area.
- Figure 5-3 - Operations (inverters and BESS) in Northern area.
- Figure 5-4 – Operations (inverters and BESS) in Southern area.

All additional construction contour maps are provided in APPENDIX D.

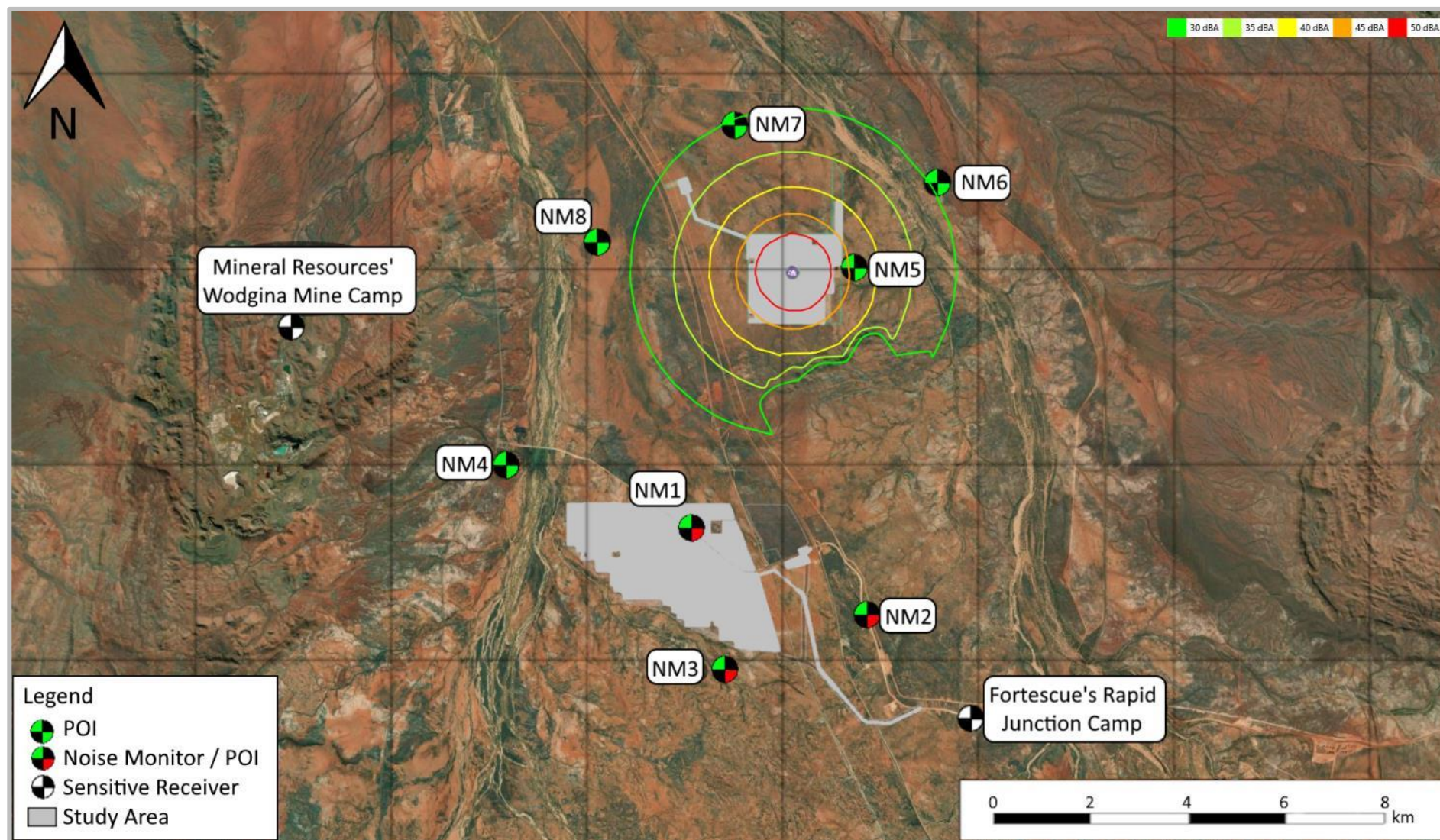


Figure 5-1 Construction (Clearing) Noise Contour Map – Northern Area

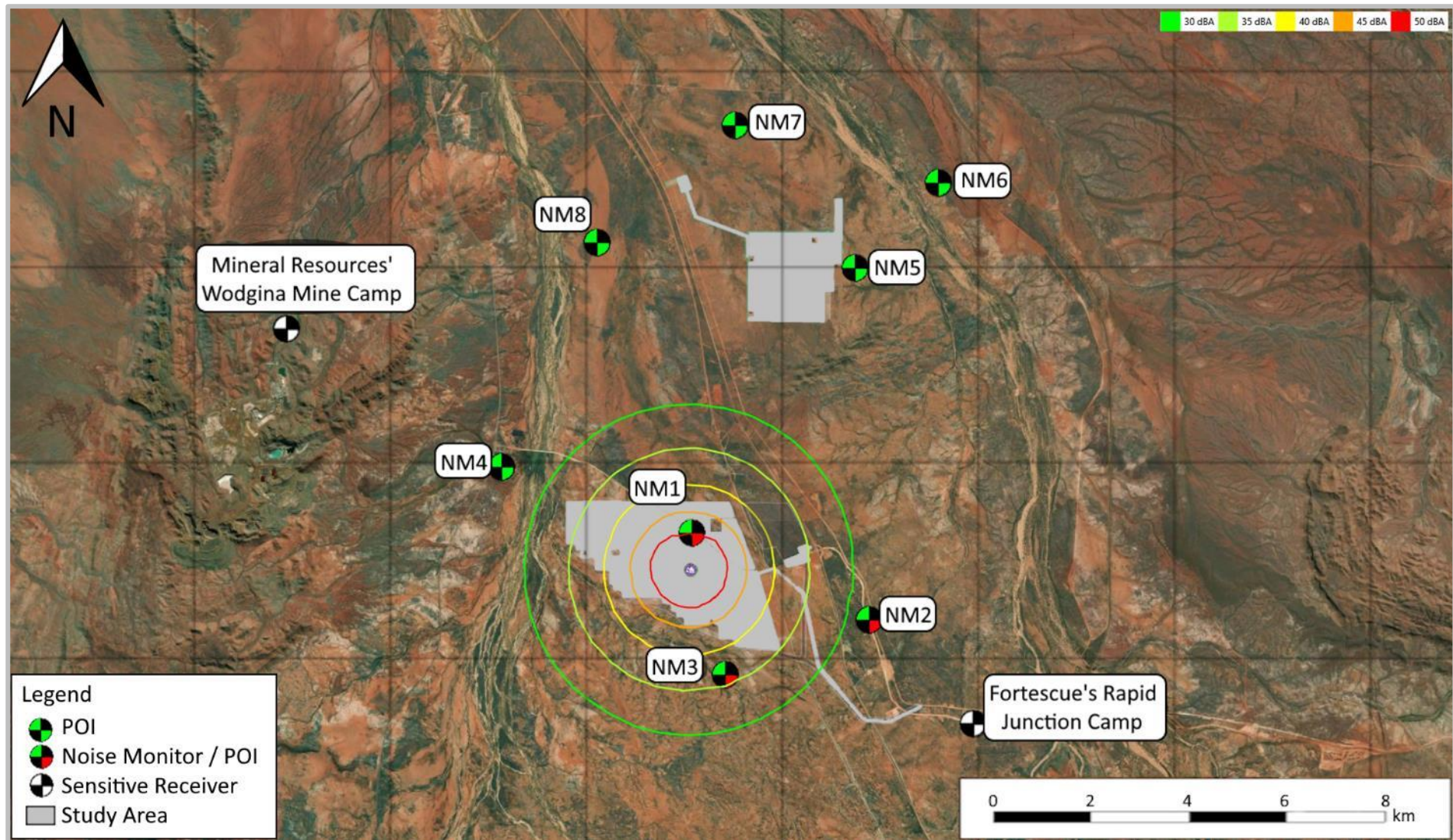


Figure 5-2 Construction (Clearing) Noise Contour Map – Southern Area

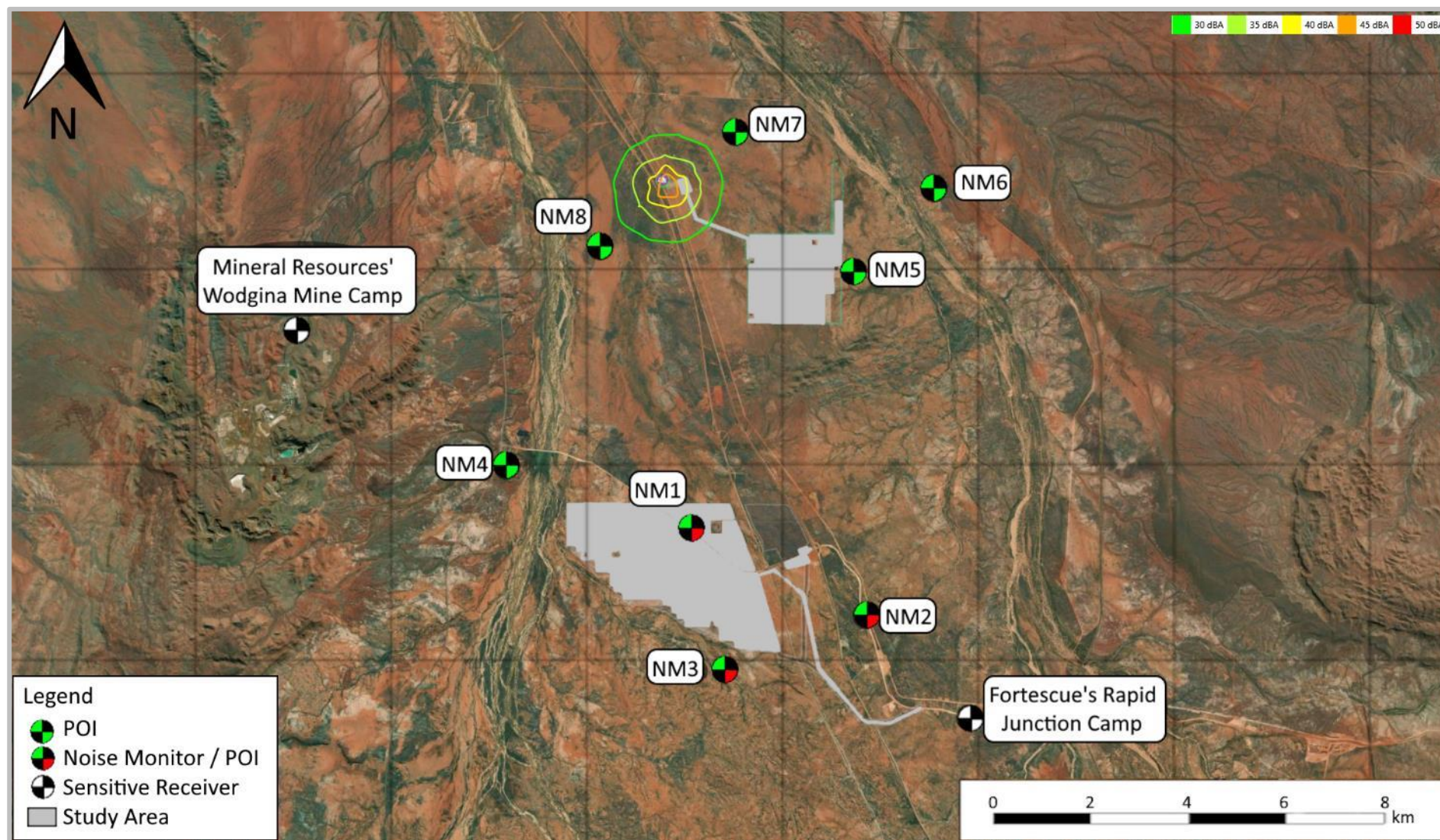


Figure 5-3 Operations Noise Contour Map – Northern Area

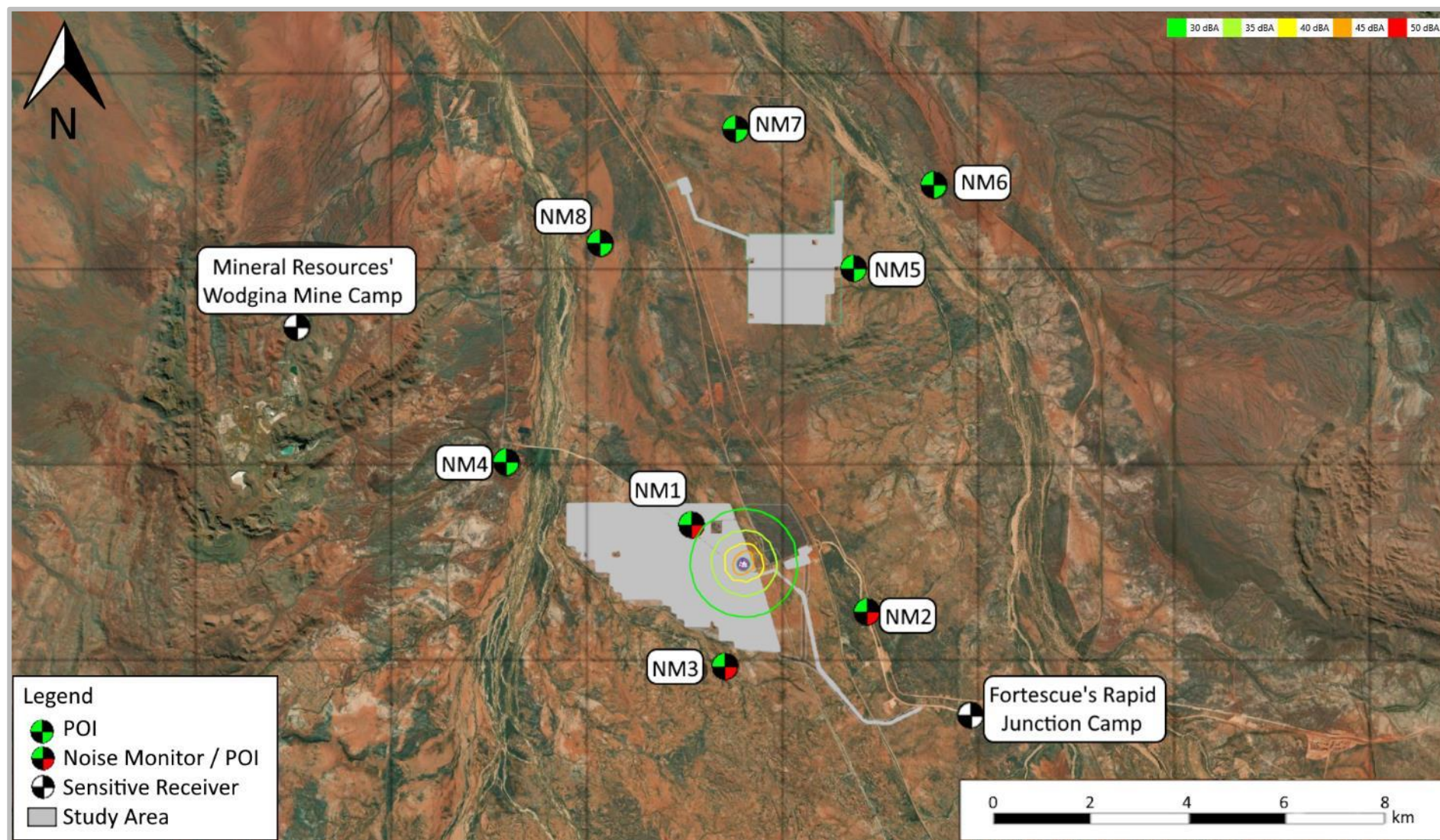


Figure 5-4 Operations Noise Contour Map – Southern Area

6 Conclusions

Based on the modelling and analysis undertaken, the following has been concluded:

Construction activities

- Received noise levels at both accommodation camps are lower than the assigned levels during construction activities and, as a result, a construction noise management plan in accordance with Regulation 13 of the Noise Regulations is not required.
- Received noise levels at POIs NM1 and NM5 are above the noise target level and measured background noise levels. They are therefore expected to be audible above background noise. If NM1 and NM5 are used by Traditional Owners during construction, it is recommended that construction activities be planned to occur as far as possible away from those two areas. All other POIs are below the noise target level.

Operations

- Received noise levels at both accommodation camps are lower than the assigned levels during operation of the solar farm.
- Received noise levels at all POIs are below the noise target level and measured background noise levels. This indicates that the operations are not expected to affect any activities taking place at the POI's.

APPENDIX A

Noise Legislation

A.1 Environmental Protection (Noise) Regulations 1997

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the *Environmental Protection Act 1986*. The Regulations specify maximum noise levels (assigned noise levels) which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises.

Assigned noise levels are defined differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, an Influencing Factor (IF) is included in the assigned noise levels. The IF depends on the presence of major/minor roads and commercial/industrial land use zonings within circles of 100 metres and 450 metres radius from the noise receiver.

For noise sensitive residences, the time of day also affects the assigned levels. The regulations define three types of assigned noise level:

- L_{ASMAX} means an assigned level that is not to be exceeded at any time;
- L_{AS1} means an assigned level that is not to be exceeded for more than 1% of time;
- L_{AS10} means an assigned level that is not to be exceeded for more than 10% of time.

Table A1: Assigned Noise Levels for Noise Sensitive Receivers

Type of premises receiving noise	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor

Type of premises receiving noise	Time of day	Assigned Levels (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

Environmental Protection (Noise) Regulations 1997

Influencing Factors

The Influencing Factor (IF) is based on the surrounding land use adjacent to each of the noise sensitive receivers, including the amount (%) of industrial and commercial premises as well as the number and proximity of major and secondary roads.

The following steps were taken to calculate IF.

1. Two circles of radius 100m and 450m centred on each of the identified receivers were drawn.
2. The circles were used to determine and calculate the area of industrial and commercial premises and the presence major/secondary roads within the circles.

The calculated IF and applicable assigned levels for each receiver are summarised in Table 2-4. The calculated IF is 0.

Adjustments for intrusive or dominant characteristics

Received noise levels are subject to adjustments if the noise exhibits intrusive or dominant characteristics i.e. if the noise is impulsive, tonal or modulating. These adjustments, shown in Table A 1, are cumulative up to a maximum of 15 dB.

Section 9 of the Regulations sets out objective tests to assess whether the received noise is free of these characteristics.

Table A 1 Adjustments for intrusive and dominant characteristics

Tonality	Modulation	Impulsiveness
+ 5dB	+5 dB	+10 dB

A.2 EPA Environmental Factor Guideline: Social Surroundings

The EPA's environmental objective for the factor Social Surroundings is: '*To protect social surroundings from significant harm*'. The objective recognises the importance of ensuring that social surroundings are not significantly affected because of implementation of a Project or scheme.

Considerations for EIA for the factor Social Surroundings include:

- Application of the mitigation hierarchy to avoid or minimise impacts on social surroundings, where possible.
- The aesthetic, cultural, economic and/or social values which may be impacted, and whether those values are significant.
- The contribution implementation of the Project or scheme may make to existing or predicted cumulative impacts to aesthetic, cultural or social values.
- That emissions of noise, odour or dust are considered in the context of relevant legislation, criteria or standards.
- The level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect
- whether proposed management or mitigation of impacts to aesthetic, cultural, economic and/or social surroundings is technically and practically feasible.

Aboriginal heritage and culture

It is an offence to interfere with any Aboriginal site knowingly or where it would be reasonable to know, regardless of whether or not it is registered. In addition to Aboriginal heritage, matters of Aboriginal cultural associations, including traditional Aboriginal customs, directly linked to the physical or biological aspects of the environment, may also be considered significant. This may include, for example, traditional hunting and gathering activities for native fauna and flora as bush tucker.

Amenity

Amenity is a broad term that generally means the qualities, attributes and characteristics of a place that make a positive contribution to quality of life. For the purpose of EIA, amenity values include both visual amenity, and the ability for people to live and recreate within their surroundings without any unreasonable interference with their health, welfare, convenience and comfort. Noise has the potential to unreasonably interfere with the health, welfare, convenience and comfort of people. Amenity values can be highly subjective. What may have amenity value for one person, may not be valued by another. Similarly, people have different levels of perception or tolerance for things that may impact amenity, such as noise, odour and dust.

Predicting the impacts of noise, dust and odour

While modelling the potential impacts of noise and dust may be technically complex, methodologies and practices are generally well understood and accepted. Predictions can also be validated with on-site measurements or proxy data, as noise and dust can be quantitatively measured.

Information required for EIA

Where social surroundings has been identified as an environmental factor the EPA may require the proponent to include information or studies within the following broad topics:

- Analysis, modelling and predictions of impacts from odour, dust and noise, including likely impacts during, worst, best and most likely case scenarios
- Characterisation of proximity to sensitive receptors
- Summary of proposed technologies, emission reduction equipment and management practices
- Description of proposed management and monitoring arrangements
- Analysis of cumulative impacts, including existing and reasonably foreseeable emission sources

The SPP5.4 noise assessment criteria are presented in Table A1. These criteria are applicable to the emission of rail transport noise received at noise sensitive premises.

Table A1 State Planning Policy 5.4 Outdoor Noise Criteria

Time of Day	Noise Target (L_{Aeq})	Noise Limit (L_{Aeq})
Day (0600 – 2200)	55 dB(A)	60 dB(A)
Night (2200 – 0600)	50 dB(A)	55 dB(A)

The 5 dB difference between the noise target and noise limit represents an acceptable margin for compliance. In most situations where either the noise-sensitive land use or major railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. The following actions are required as a result of compliance/non-compliance with the criteria:

- If the noise emissions are compliant with the 'noise target' then no further measures are required.
- If the noise emissions fall between the 'noise target' and 'noise limit' then mitigation measures should be implemented by the developer with the view of compliance with the 'noise target'.
- If the noise emissions exceed the 'noise limit' a detailed noise assessment should be undertaken and noise mitigation measures implemented with the view of compliance with the 'noise target'.

For major and minor redevelopments the noise criteria are **not applicable** but should be used as guidance. The policy recognises that in a number of instances it may not be reasonable and practicable to meet the noise target criteria. Where rail noise is above the target level, measures are expected to be implemented that best balance reasonable and practicable considerations, such as noise cost/benefit, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies. In these cases, the community should also be consulted to assist in identifying best overall solutions.

APPENDIX B

Noise Source Sound Power Levels (SWLs)

Noise source	Octave Band Levels, dB(A)									O/A
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4KHz	8KHz	
Scraper	61.9	77.3	93.4	100.1	104.6	107.2	106.0	101.1	95.7	111.8
Dozer	78.3	84.1	89.8	105.3	108.9	107.8	104.9	98.7	91.9	113.4
Loader	65.9	81.2	99.1	101.2	105.5	107.2	106.5	102.6	98.1	112.5
Moxy Trucks	65.9	81.2	99.1	101.2	105.5	107.2	106.5	102.6	98.1	112.5
Loader	59.8	73.8	93.2	96.4	100.6	102.4	101.7	97.6	93.1	112.6
Concrete Pump	66.6	79.2	89.8	97.3	102.4	103.9	102.2	97.1	91.4	108.6
Compressor	57.9	70.8	81.3	86.1	92.1	92.0	90.4	82.0	73.1	102.4
Concrete Truck	65.3	78.3	89.5	97.2	102.8	104.2	102.5	97.3	90.1	109.0
Concert Vibrator	68.5	84.3	95.7	102.0	101.0	107.2	105.4	100.2	92.8	112.2
Trenching Machine	62.1	78.1	101.0	105.1	105.5	109.5	107.4	100.8	93.1	109.1
Lithium-Ion Storage System	63.1	73.1	83.1	93.1	93.1	83.1	73.1	63.1	53.1	96.6

APPENDIX C

Noise Logging

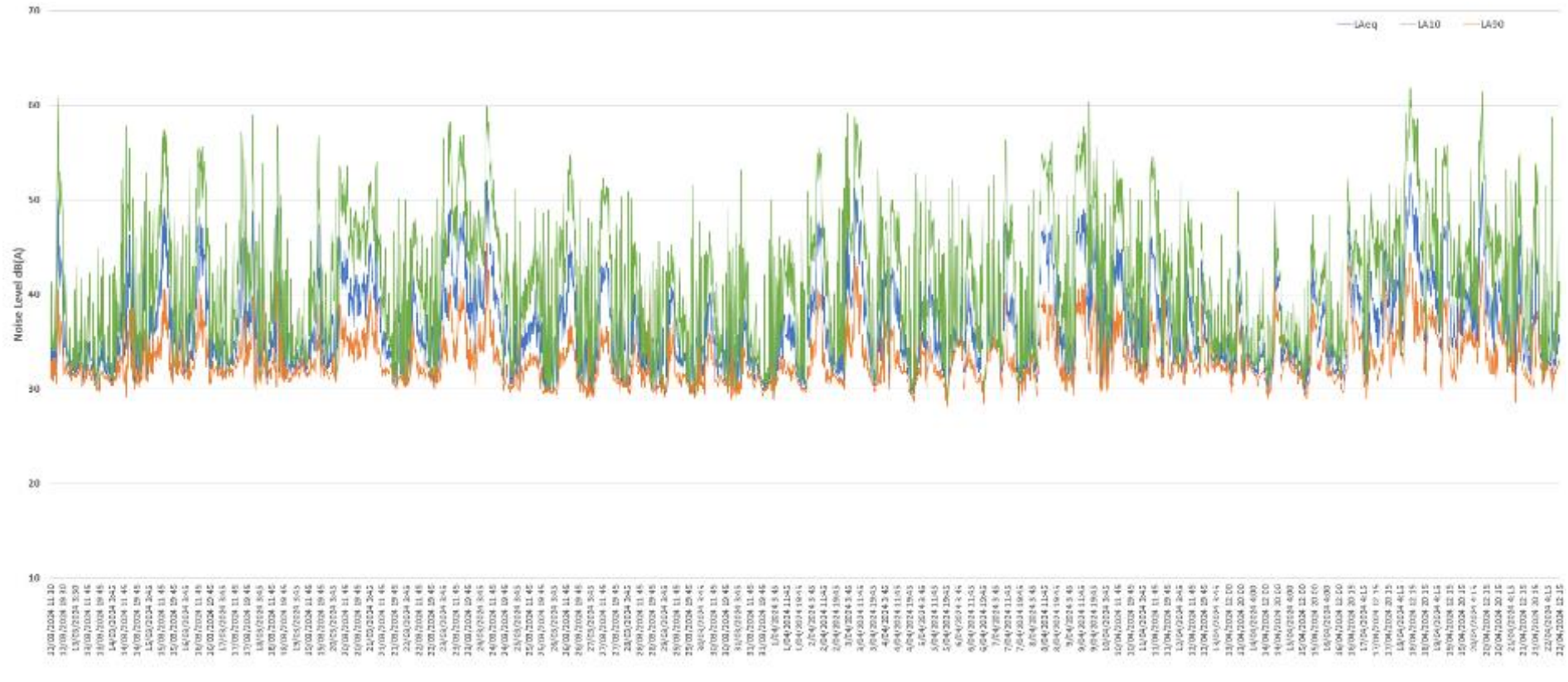


Figure C-1 Measured noise levels over Monitoring period – Logger 1

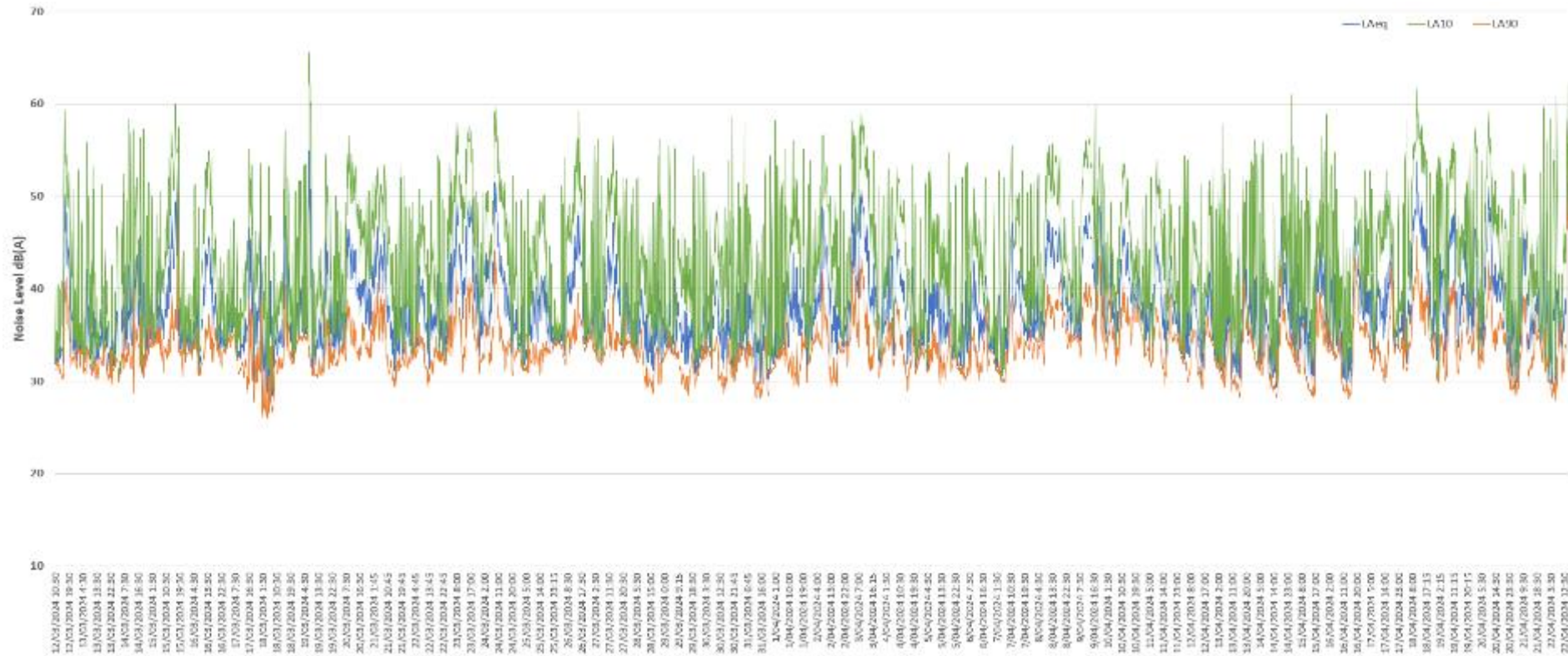


Figure C-2 Measured noise levels over Monitoring period – Logger 2

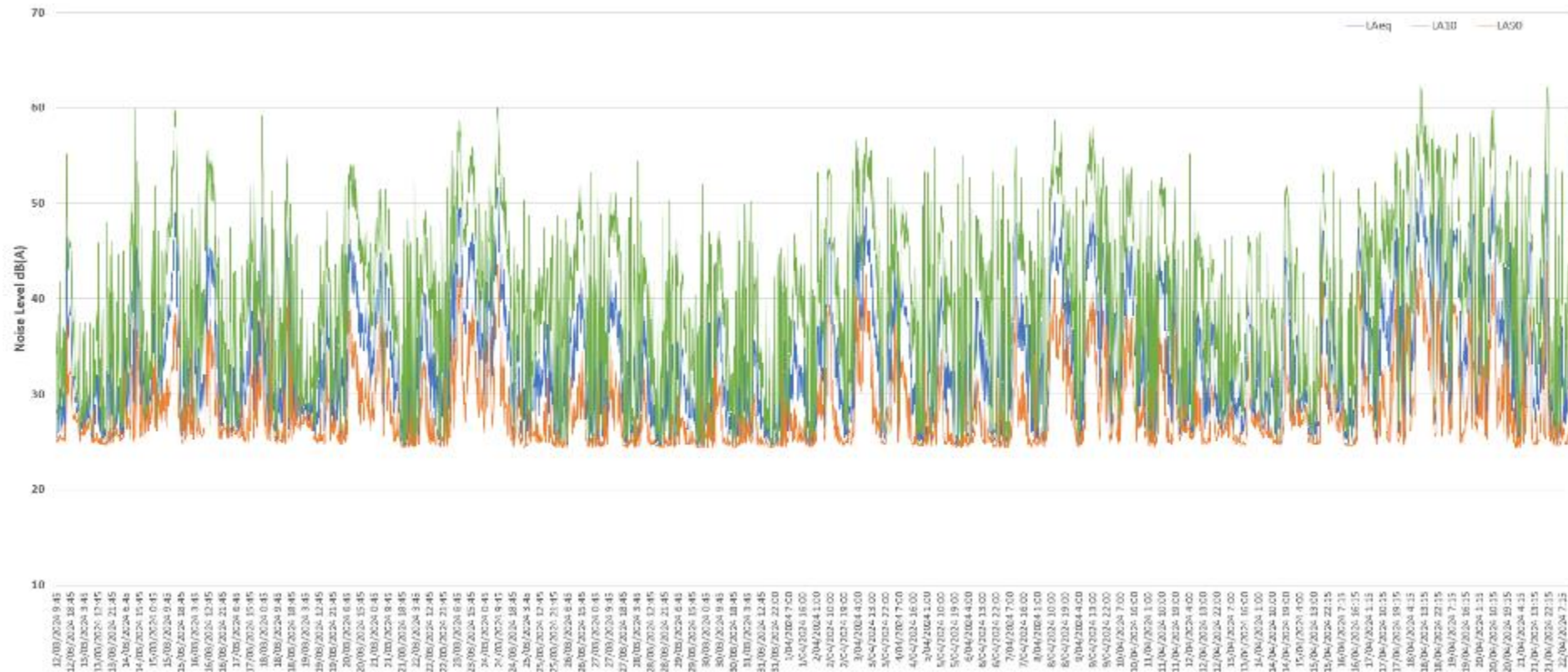


Figure C-3 Measured noise levels over Monitoring period – Logger 3

APPENDIX D

Noise Contour Maps

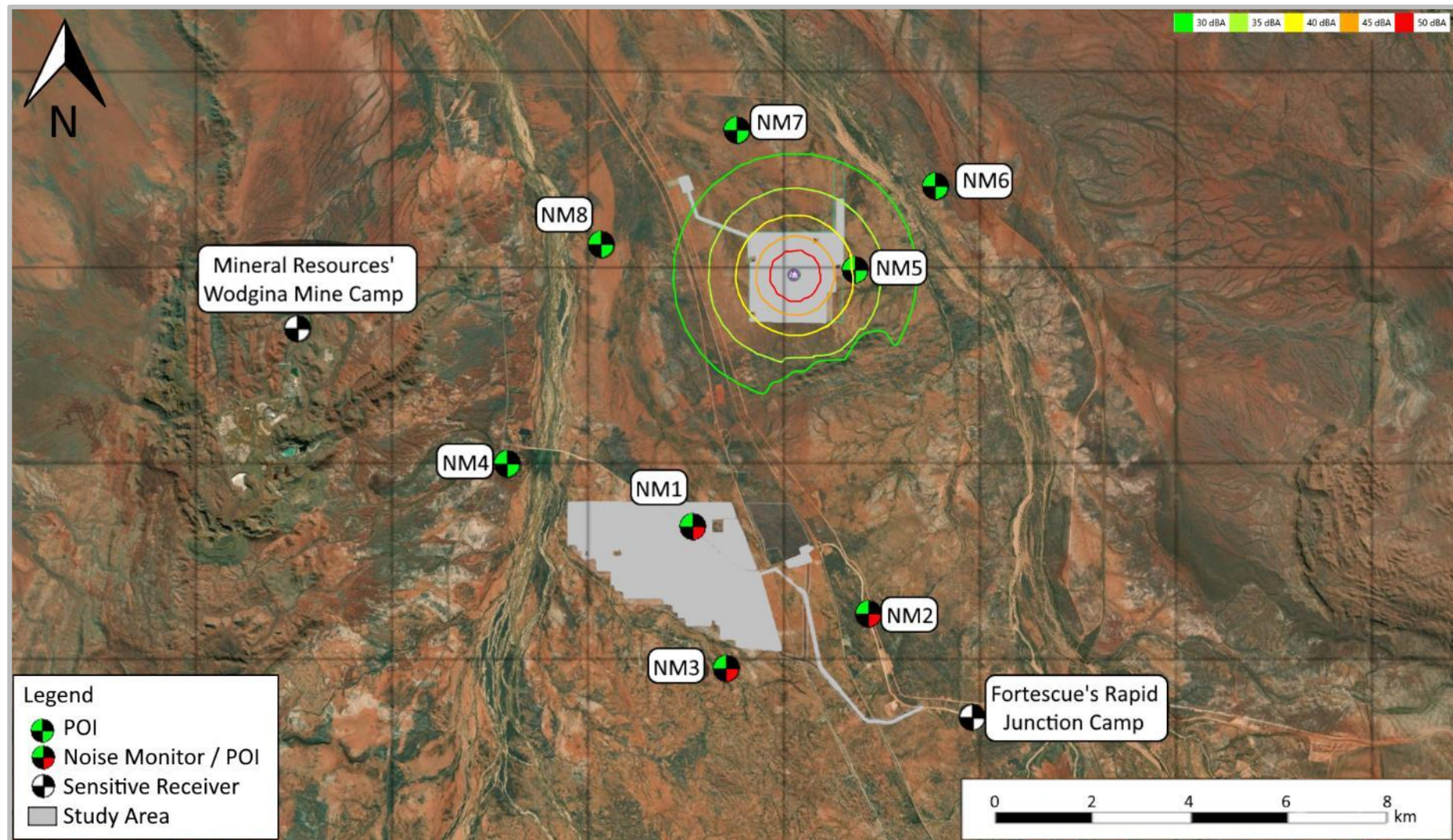
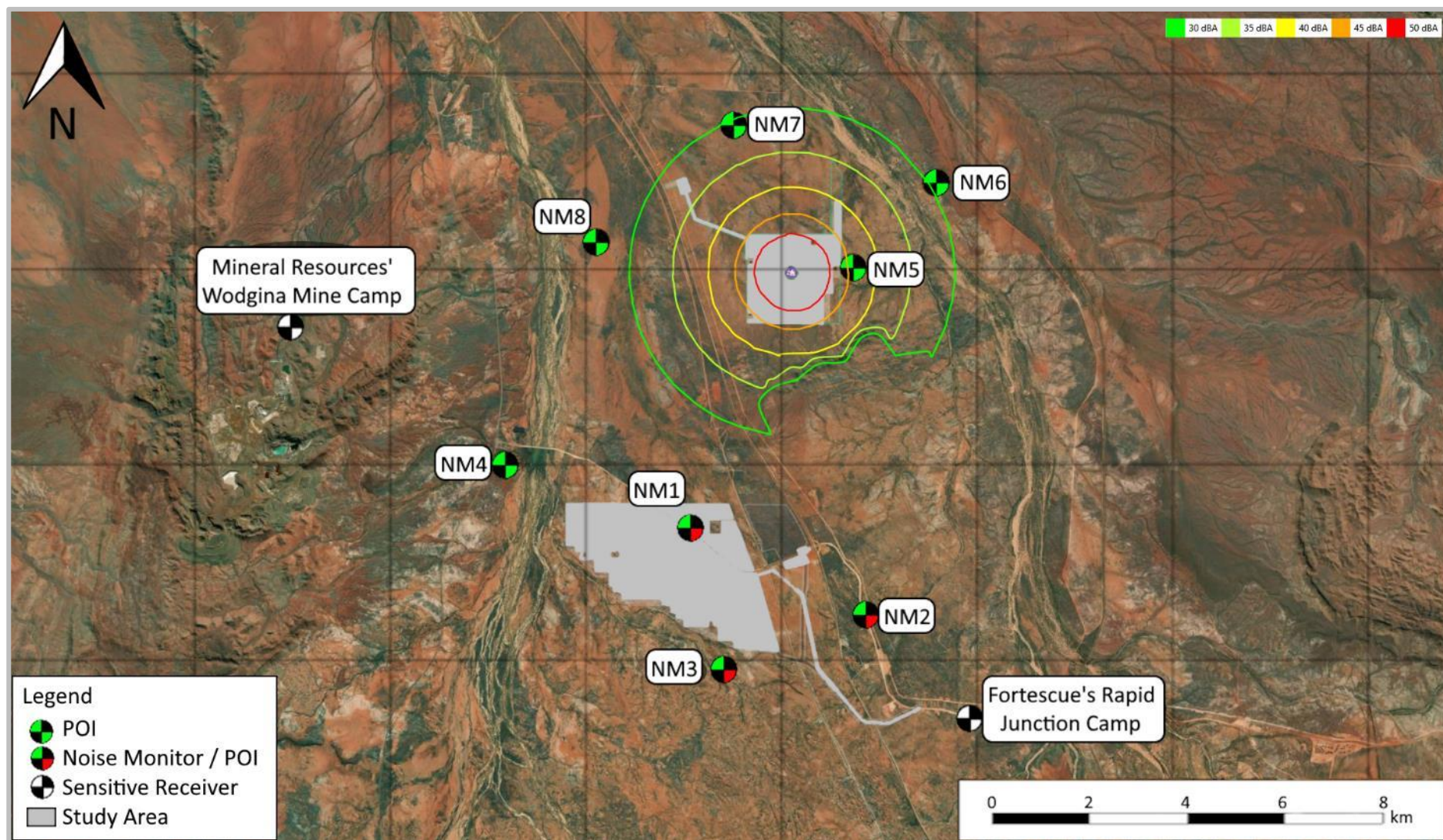


Figure D-1 Concreting Noise Contour Map - Wodgina



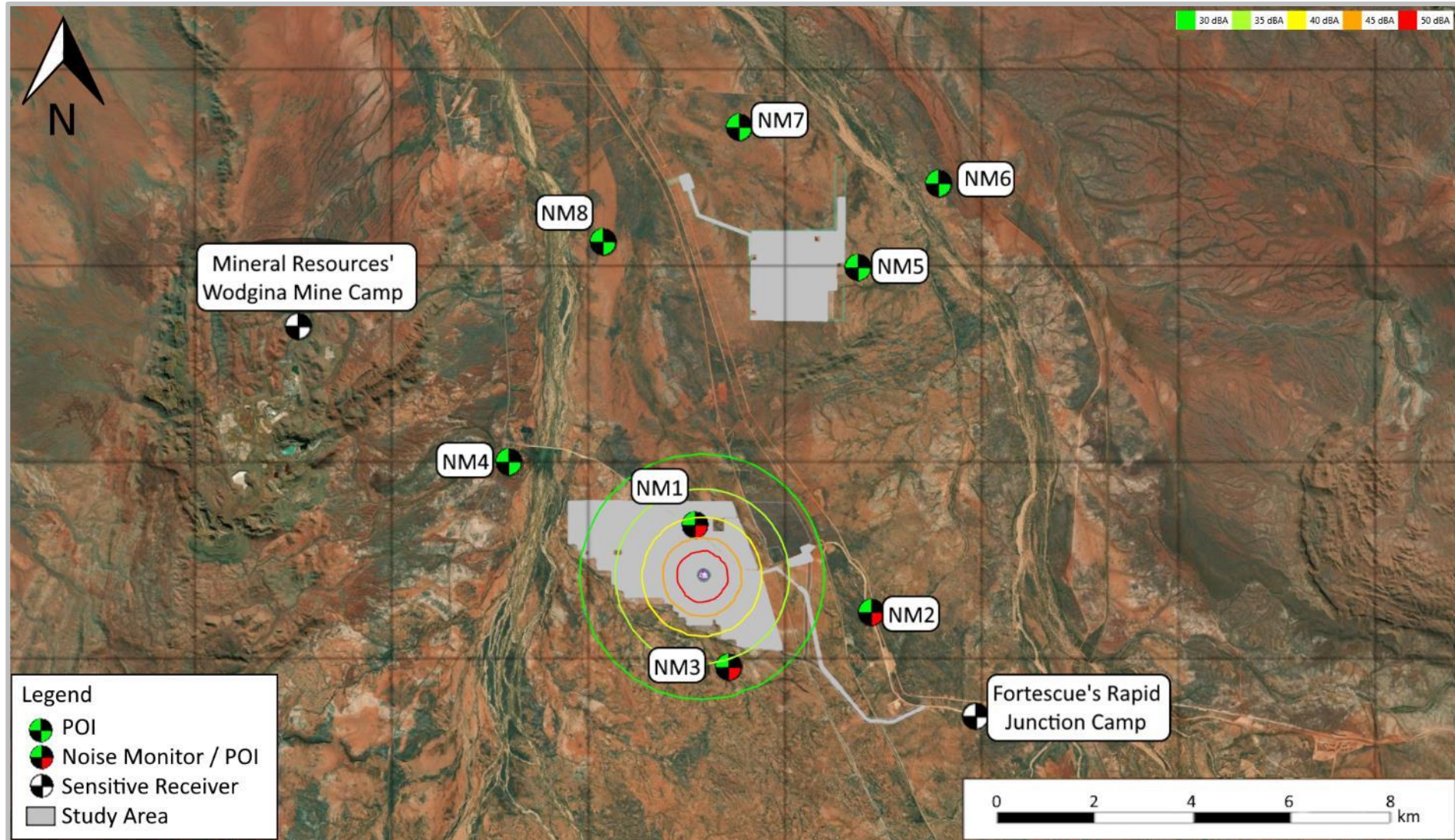


Figure D-3 Concreting Noise Contour Map - TRSH

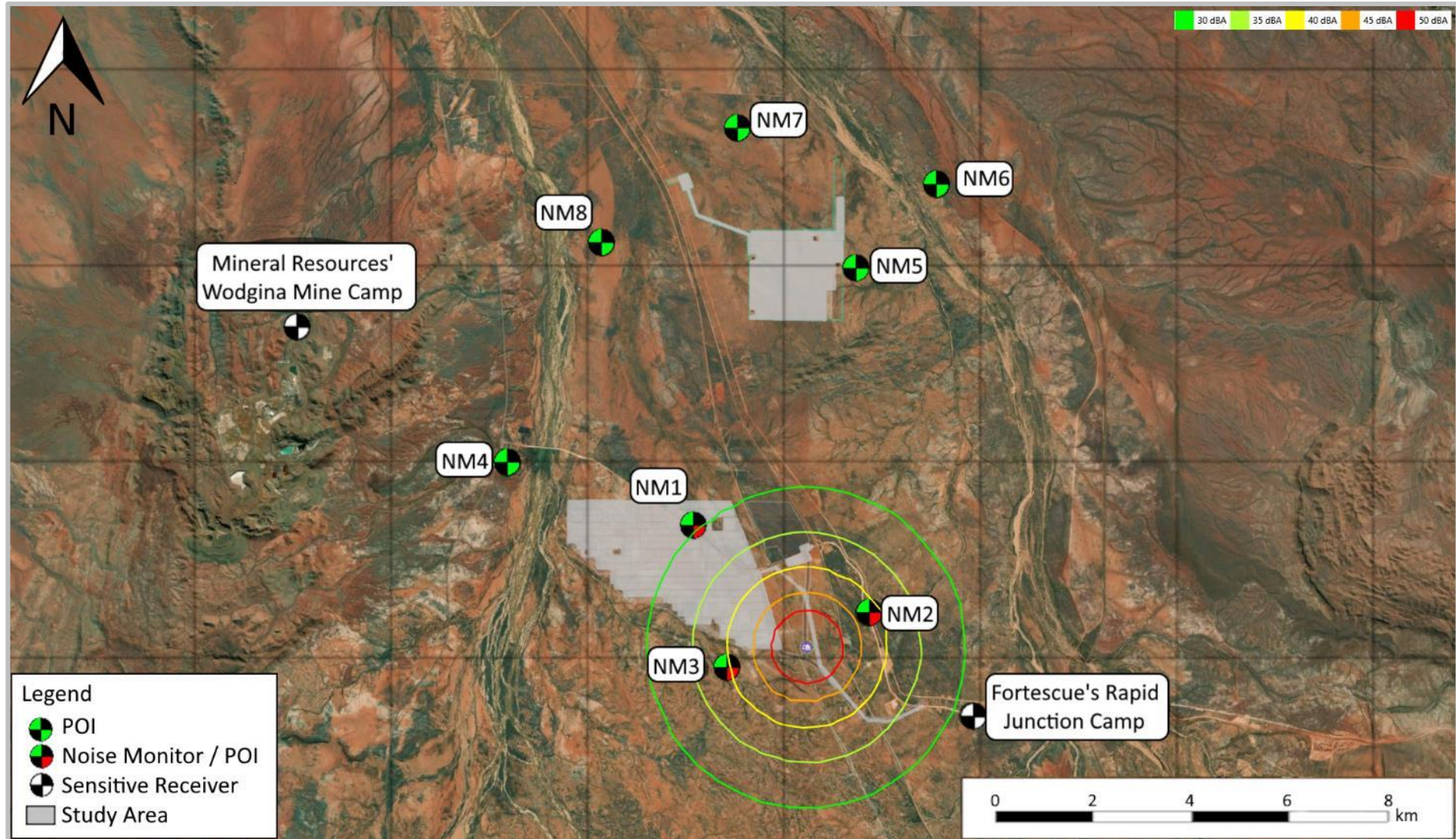


Figure D-4 Trenching Noise Contour Map - TRSH



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