Appendix 11

Noise Impact Assessment

prepared by

Muller Acoustic Consulting Pty Ltd

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Noise Impact Assessment

Copi Mineral Sands Project
Wentworth, NSW

Prepared for: RZ Resources Limited
C/- RW Corkery & Co Pty Limited
March 2024
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Muller Acoustic Consulting

Document Information

Noise Impact Assessment

Copi Mineral Sands Project

Wentworth, NSW

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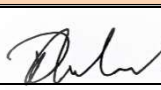
MAC180700-04RP2V5	15 March 2024	Dale Redwood		Oliver Muller	

CONTENTS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by RW Corkery & Co Pty Limited (RWC) on behalf of RZ Resources Limited (the Applicant) to complete a Noise Impact Assessment (NIA) to quantify potential noise emissions associated with the proposed Copi Mineral Sands Project (the Project), located approximately 75km northwest of Wentworth in the Far West Region of NSW. The Project is within the Wentworth Local Government Area (LGA). **Figure 1** provides a Locality Plan.

The NIA was completed to quantify potential acoustic impacts associated with the construction and operation of the Project on the surrounding community and will accompany the Environmental Impact Statement (EIS) that is being prepared to assess the proposed development. The NIA has been prepared in accordance with the following policies and guidelines:

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

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

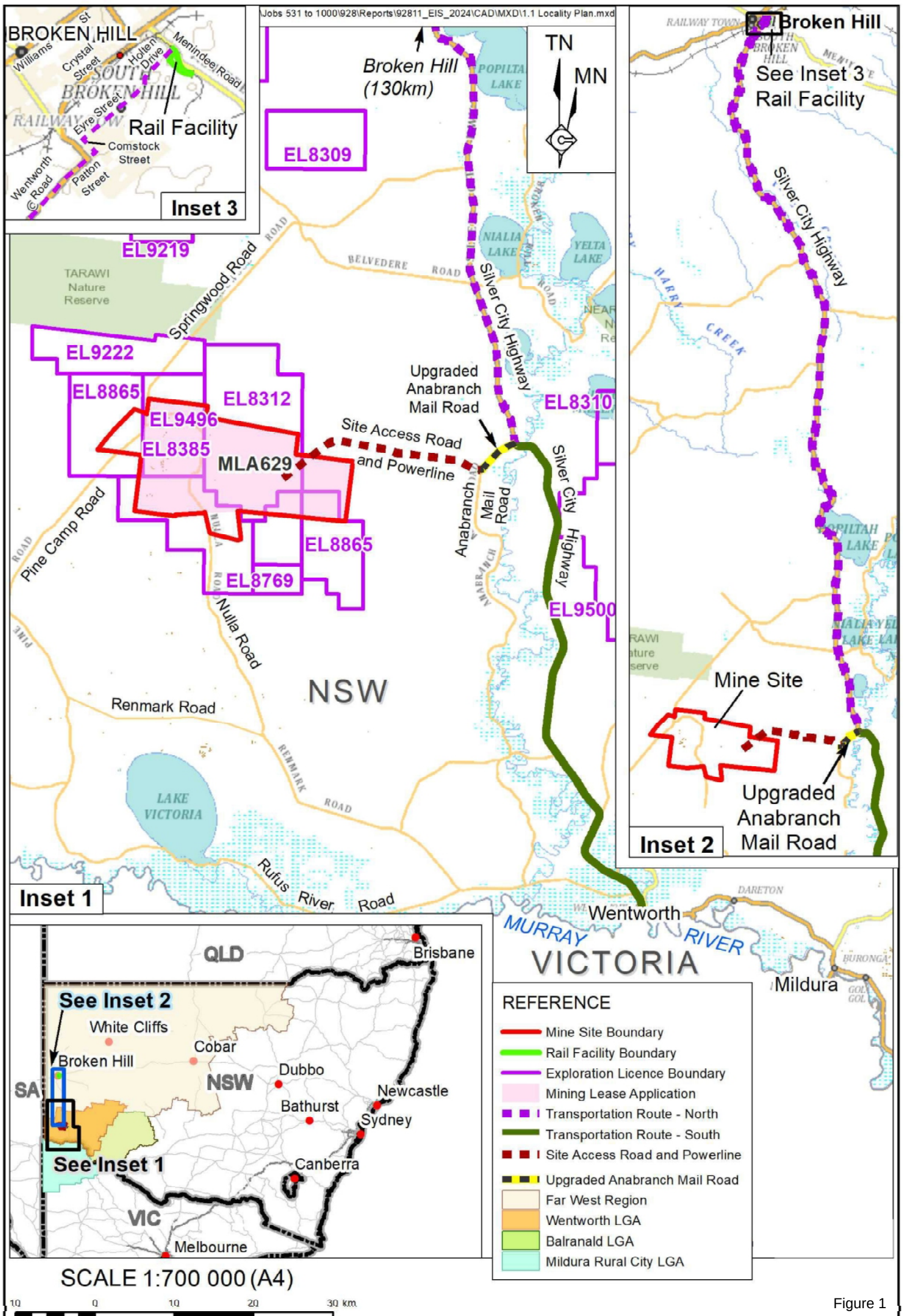


Figure 1
LOCALITY PLAN

1.1 Project Overview

MAC understands that the mineral deposit is a high-grade, strandline type, continuous mineral sand placer deposit with a northwest orientated strike length of approximately 23km, and a deposit width of up to 5km.

The Project would comprise the following (**Figure 2**).

- construction and use of a range of ancillary infrastructure, including the following:
  - an Infrastructure Area including:
    - a Mine Camp;
    - 35MW solar farm;
    - a power station comprising silenced generators with a capacity of up to 30MW for use during construction only;
    - Office and Administration Area;
    - a Laydown Area, Workshop and Stores; and
    - a Rare Earth Concentrate (REC) Plant.
  - A Site Access Road and internal roads;
  - An upgraded Anabranch Mail Road; and
  - A 66kV transmission line.
- Dredge mining from an Extraction Area approximately 17km long and up to approximately 3.3km wide, to extract up to approximately 28 million tonnes per annum (Mtpa) of overburden, up to approximately 48Mtpa of interburden and up to approximately 28Mtpa of ore;
- on-site processing of extracted ore using a floating wet concentrator and land-based REC Plant to produce up to approximately 510,000tpa of heavy mineral concentrate;
- transportation of heavy mineral concentrate in sealed containers from the Mine Site to the Rail Facility via an upgraded Anabranch Mail Road and the existing heavy vehicle transportation route to Broken Hill;
- loading of heavy mineral concentrate containers onto trains or direct transportation to port via road under separate approvals;

- initial placement of overburden, interburden and tailings within the Off Path Storage Facility until sufficient area within the dredge pond has been established. Following this, interburden and tailings would be placed within completed sections of the dredge pond, with overburden used to cap the placed material and for construction of the final landform;
- progressive rehabilitation of completed sections of the Mine Site, including re-establishment of a final landform and revegetation with native species to re-establish ecosystem function within the Mine Site; and
- the life of the Project would be 26 years, comprising an initial 2-year construction period, followed by 17 years of mining operations and a further period of 5 years of rehabilitation.

The mine layout is presented in **Figure 2**.

Site establishment and construction activities would be undertaken over a period of approximately two years, and would involve the following:

- survey and mark out of key boundaries;
- installation of erosion and sediment controls;
- installation of a construction laydown area;
- vegetation clearing of areas for initial infrastructure construction, access roads and the starter open cut pit;
- initial pre-strip and selective handling of topsoil;
- Site Access Road construction and Anabranch Mail Road upgrade, including bulk earthworks;
- installation of mining components and construction of a range of ancillary infrastructure, including:
  - the Mine Camp;
  - Mine Office and Workshop;
  - power generation and transmission facilities;
  - a range of roads, hardstand, vehicle parking and laydown areas suitable for all weather access by light and heavy vehicles;
  - installation of floating concentrator within starter pond; and

- construction and installation of intersection treatments and road upgrades at the junction of:
  - Anabranch Mail Road and Silver City Highway;
  - Comstock and Patton Streets;
  - Comstock and Eyre Streets;
  - Holton Drive and the Rail Facility Access Road; and

The Project would employ up to 480 persons during peak construction periods. During operations, the Project would employ up to 240 persons, and up to 40 persons during rehabilitation.

1.2 Hours of Operation

Table 1 presents the proposed operating hours for the Project. The proposed hours and combination of activities for the Project have formed the basis of the noise modelling scenarios for this assessment.

Table 1 Hours of Operation

Activity	Proposed Days of Operation	Proposed Hours of Operation
Land Preparation	7 days per week	7am to 6pm
Construction Works		7am to 10pm
- Road construction within Broken Hill LGA	7 days per week	
- All other construction		24 hours per day
Mining Operations	7 days per week	24 hours per day
Processing Operations	7 days per week	24 hours per day
Transportation Operations		
- Laden road movements in Broken Hill LGA	7 days per week	7am to 10pm
- All other road movements		24 hours per day
- Rail operations, including loading		24 hours per day
Maintenance Operations	7 days per week	24 hours per day
Rehabilitation Works	7 days per week	7am to 6pm

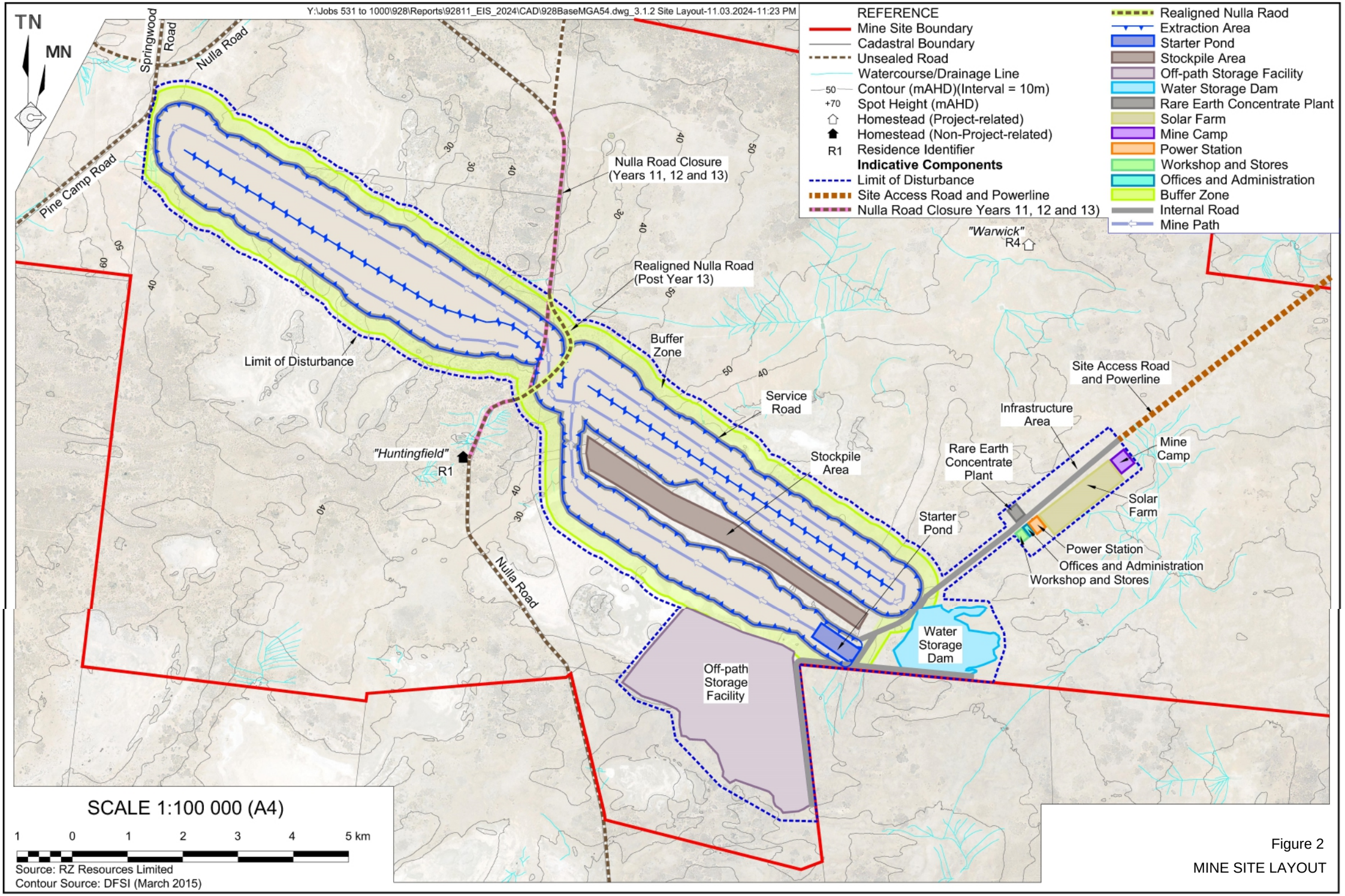


Figure 2

MINE SITE LAYOUT

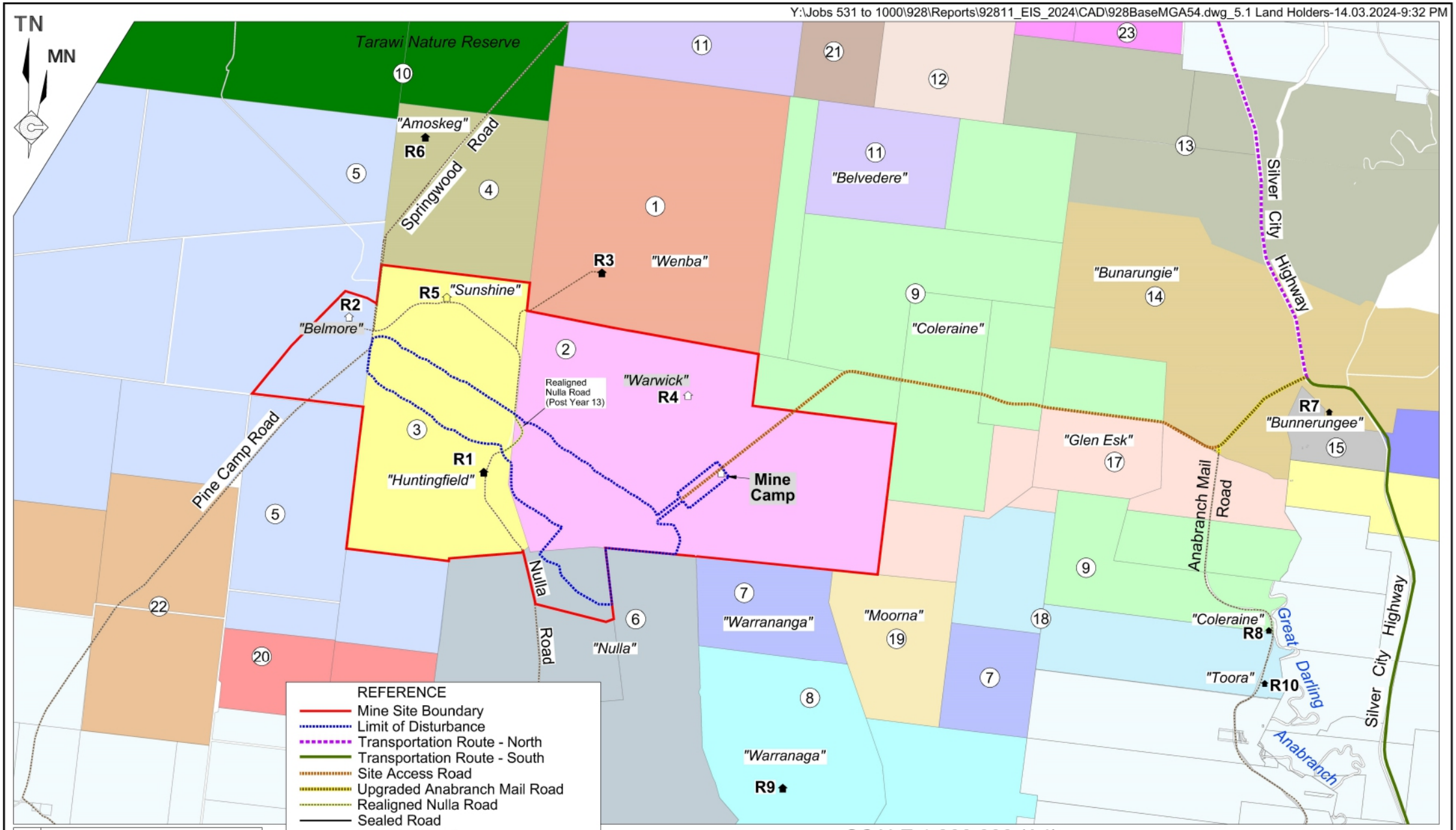
1.3 Sensitive Receivers

The Project is situated approximately 75km northwest of Wentworth in the Murray Basin region of southwestern NSW. Receivers in the locality are categorised as rural residential. The addresses and coordinates MGA(54) for the nearest potentially affected residential receivers to the Project are summarised in **Table 2** and shown on the Surrounding Land Holder Map in **Figure 3**.

Table 2 Residential Receiver Locations

Receiver ID	Receiver Name	Status	MGA 54 Coordinates		Approximate Distance to Limit of Disturbance (km)	Approximate Distance Transport Route (km)[1]
			Easting (m)	Northing (m)		
R1	Huntingfield Homestead	Permanently Occupied	527467	6279758	1.3	>10
R2	Belmore Homestead	Project Related	520721	6287457	1.2	>10
R3	Wenba Homestead	Intermittently Occupied	533434	6289711	7.8	>10
R4	Warwick Homestead	Project Related	537702	6283593	5.1	5.2
R5	Sunshine Homestead	Unoccupiable	525584	6288440	2.4	>10
R6	Amoskeg Homestead	Permanently Occupied	524542	6296515	8.7	>10
R7	Bunnerungee Homestead	Permanently Occupied	569784	6282712	>10	2.1
R8	Coleraine Homestead	Permanently Occupied	566903	6271879	>10	9.4
R9	Warranaga Homestead	Permanently Occupied	542438	6263941	>10	>10
R10	Toora Homestead	Permanently Occupied	566539	6269233	>10	>10
MC	Mine Camp	Project Related	522478	6287752	within boundary	0.5

Note 1: Denotes the offset distance between the receiver location and the Anabranch Mail Road between the Mine Site Boundary and Silver City Highway.



Ref	Western Lands Lease Holder
1	Carpenteri Nominees Pty Ltd
2	Wentworth Pastoral Company
8	Mt Cavern Pastoral Pty Ltd
10	Tarawi Nature Reserve
20	Robertson Chowilla Pty Ltd
◯	All other land is Privately held

Figure 3

SURROUNDING LAND HOLDERS AND RESIDENCES

1.4 Coverage of Secretary's Environmental Assessment Requirements

The key issues to be addressed, as identified in the Secretary's Environmental Assessment Requirements (SEARs) and other government agency requirements are reproduced in **Table 3.**

Table 3 Coverage of SEARs and Other Government Agency Requirements

Noise and Vibration Assessment Requirement	Relevant Section(s)
Coverage of SEARs	
The likely construction, operational and off-site noise impacts of the development, and cumulative noise impacts (considering other mining developments in the locality), in accordance with the Interim Construction Noise Guideline (or as updated subject to transitional arrangements), NSW Noise Policy for Industry, NSW Road Noise Policy and Rail Infrastructure Noise Guideline (as applicable), and the Voluntary Land Acquisition and Mitigation Policy.	**Section 5**
An assessment of the likely noise impacts of the development in accordance with the *Noise Policy for Industry,* and the *Voluntary Land Acquisition and Mitigation Policy (2018);*	**Section 5**
If a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities in accordance with the *Interim Construction Noise Guideline;*	**Section 3.1 & Section 5.1**
An assessment of the likely road noise impacts of the development in accordance with the *NSW Road Noise Policy.*	**Section 5.5**
Coverage of Issues identified by Other Government Agencies	
NSW EPA (4/05/2022) - The Environmental Assessment (EA) should address how the required goals outlined below will be met for each potential impact.	
The EA should describe mitigation and management options that will be used to prevent, control, abate or mitigate identified potential environmental impacts associated with the project and to reduce risks to human health and prevent degradation of the environment.	**Section 4.2 & Section 5.2**
The goals of the Project should include design, construction, operation and maintenance of plant and equipment in accordance with relevant EPA policy, guidelines and criteria, and in order to minimise potential impacts from noise on surrounding receptors.	**Section 4 & Section 5**
Potential noise sources are assessed in accordance with the *Nosie Policy for Industry* (EPA, 2017).	**Section 5.2**
Where required mitigation measures are proposed (e.g. appropriate equipment chosen to minimise noise levels).	**Section 5.2**
All residential or noise sensitive premises likely to be impacts by the development must be identified and included in the assessment. (EPA)	**Section 1.3**
The potential noise impacts associated with any traffic increases need to be assessed in accordance with the *NSW Road Noise Policy* (EPA, 2011). (EPA)	**Section 5.5**

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2 Noise Policy and Guidelines

The following section summarises relevant policy and guidelines pertinent to undertaking a noise impact assessment for this type of project.

2.1 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; or
- qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

Due to the nature of the proposed works, the quantitative method has been applied in this assessment. The quantitative method includes identification of potentially affected receptors, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receptors and, provides management and mitigation recommendations.

2.1.1 Standard Hours for Construction

Table 4 presents the ICNG recommended standard hours for construction works.

Table 4 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

It is anticipated that land preparation activities would occur between 7am and 6pm daily, on a campaign basis. Road construction activities within Broken Hill are anticipated to occur between 7am and 10pm daily, while other construction activities will be undertaken 24 hours per day.

2.1.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case-by-case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours;
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified;
- appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and
- all practicable and reasonable mitigation measures will be put in place.

Given the remote location of the Mine Site and the requirement for personnel and equipment to be transported long distances to site, out of hours construction activities are warranted for the Project. The Applicant has consulted with surrounding residents and no objections to out of hours construction operations have been raised. Finally, practicable and reasonable mitigation measures will be implemented to minimise noise impacts during construction.

2.1.3 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 5** reproduces the ICNG Noise Management Level for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB for Out of Hours (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 5 Noise Management Levels		
Time of Day	Management Level LAeq(15min)[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75dBA (HNA)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

2.1.4 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during out of hours periods, sleep disturbance has been considered in this assessment.

2.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

2.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

2.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period.

2.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

For low noise environments, such as rural environments, minimum assumed RBLs apply within the NPI and can be adopted in lieu of completing background noise measurements. This is considered the most conservative method for establishing noise criteria for a project. These result in minimum intrusiveness noise levels as follows:

- Minimum Day RBL = 35dBA;
- Minimum Evening RBL = 30dBA; and
- Minimum Night RBL = 30dBA.

Due to the rural nature of the locality, the PINLs for the Project have been determined based on the minimum RBL+5dBA.

2.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended Amenity Noise Levels specified in Table 2.2 (of the NPI). The NPI defines two categories of Amenity Noise Levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: "to ensure that industrial noise levels (existing plus new) remain within the recommended Amenity Noise Levels for an area, a Project Amenity Noise Level applies for each new source of industrial noise as follows":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Furthermore, where the PANL is applicable and can be satisfied, the assessment of cumulative industrial noise is not required.

The recommended Amenity Noise Levels as per Table 2.2 of the NPI are reproduced in **Table 6**.

Table 6 Amenity Noise Levels

Receiver Type	Noise Amenity Area	Time of day	Recommended Amenity Noise Level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended Amenity Noise Level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended Amenity Noise Levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

2.2.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a Project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

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

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

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

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

2.3 Voluntary Land Acquisition and Mitigation Policy

The Voluntary Land Acquisition and Mitigation Policy (VLAMP, November 2018) describes the NSW Government's policy for voluntary mitigation and land acquisition actions undertaken to address noise impacts from State significant mining, petroleum and extractive industry developments. It aims to provide a balance between economic development and protecting the health, preserve amenity and control intrusive noise where potential impacts are identified.

The VLAMP outlines methods to determine the significance of potential exceedances of relevant noise assessment criteria and identifies potential treatments for those exceedances (VLAMP Table 1) and has been reproduced in **Table 7**.

Table 7 Characterisation of Noise Impacts and Potential Treatments (VLAMP Table 1)			
If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts:	Potential treatment:
All time periods 0-2dBA	Not applicable	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls
All time periods 3-5dBA	< recommended Amenity Noise Level in Table 2.2 of the NPI; or > recommended Amenity Noise Level in Table 2.2 of the NPI, but the increase in total cumulative industrial noise level resulting from the development is >1dB	Impacts are considered to be **marginal**	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.
All time periods 3-5dBA	> recommended Amenity Noise Level in Table 2.2 of the NPI, and the increase in total cumulative industrial noise level resulting from the development is >1dB	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening >5dBA	< recommended Amenity Noise Levels in Table 2.2 of the NPI	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded facade elements like windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Day and evening >5dBA	> recommended Amenity Noise Levels in Table 2.2 of the NPI	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.
Night >5dBA	Not applicable	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions above.

Voluntary Mitigation Rights

A consent authority should only apply voluntary land mitigation rights where, even with the implementation of best practice management at the mine site:

- the noise generated by the development would meet the requirements of Table 1 (VLAMP) such that the impacts would be characterised marginal, moderate or significant at any residence or privately owned land; or
- the development would increase the total industrial noise level at any residence on privately owned land by more than 1dBA and noise levels at the residence are already above the recommended Amenity Noise Levels in Table 2.2 of the NPI; or
- the development includes a private rail line, and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING by greater than or equal to 3dBA at any residences on privately owned land.

Voluntary Acquisition Rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management at the mine site:

- the noise generated by the development would be characterised as significant, according to Table 1 (VLAMP), at any residence on privately owned land; or
- the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5dB in Table 2.2 of the NPI on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls; or
- the development includes a private rail line, and the use of that private rail line would cause exceedances of the recommended maximum criteria outlined in Table 6 of Appendix 3 of the RING by greater than or equal to 3dBA at any residences on privately owned land.

Impacts would be classified as significant where:

- during the daytime and evening periods, noise levels from the Project are >5dBA above the PNTLs and the total cumulative industrial noise level is greater than the recommended Amenity Noise Levels in Table 2.2 of the NPI; or
- during the night-time period, noise levels from the Project are >5dBA above the PNTLs.

2.4 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria that provide for a degree of amenity appropriate for the land use and road category.

For some industries such as mines and extractive industries, that are not served by arterial roads, a principal haulage route may be identified. The RNP indicates that where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for arterial/sub-arterial roads, recognising that they carry a different level and mix of traffic to local roads. Road noise criteria relevant to this assessment are presented in detail in Section 3.4.

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3 Assessment Criteria

The following sections summarise the relevant noise criteria for the Project.

3.1 Construction Noise Management Levels

The NMLs for construction activities for standard construction hours and out of hours periods are summarised in **Table 8**.

Table 8 Construction Noise Management Levels

Location	Assessment Period	RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
All Residential Receivers	Standard Hours	35	45 (RBL+10dBA)
	Out of Hours Day	35	40 (RBL+5dBA)
	Out of Hours Evening/Night	30	35 (RBL+5dBA)

The RNP provides additional guidance as to the likelihood of sleep disturbance resulting from maximum noise level events. The RNP points out the following:

- triggers for and effects of sleep disturbance have not been conclusively determined. In other words, at the current level of understanding, it is not possible to establish absolute noise level goals that would correlate to levels of sleep disturbance (for all or even a majority of people).
- the RNP suggests that:
  - maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep; and/or
  - one or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.

Therefore, where maximum noise trigger levels are exceeded, an additional assessment has been completed to protect against sleep disturbance adopting an external maximum noise levels of 65dBA (to account for 10dB attenuation for a residential façade with windows open) have been adopted for this assessment.

3.2 Operational Noise

3.2.1 Project Intrusiveness Noise Levels

The PINLs are presented in **Table 9** and have been determined based on the RBL +5dBA.

Table 9 Project Intrusiveness Noise Levels

Receiver	Period[1]	Minimum RBL[2] dB LA_{90}	PINL dB $LA_{eq(15min)}$
All Residential Receivers	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Minimum RBLs adopted.

3.2.2 Project Amenity Noise Levels

The PANL for residential receivers potentially affected by the Project are presented in **Table 10.** It is noted that the Mine Camp is located within the Project boundary and represents a Project-related receiver. Notwithstanding, assessment is undertaken with respect to the Amenity Noise Levels for "temporary accommodation" as per Table 2.2 of the NPI.

Table 10 Amenity Noise Levels and Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	NPI Recommended ANL[2] dB $LA_{eq(period)}$	PANL dB $LA_{eq(15min)}$[3]
Residential	Rural	Day	50	53
		Evening	45	48
		Night	40	43
Mine Camp[4]	Rural	Day	55	58
		Evening	50	53
		Night	45	48

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Recommended Amenity Noise Levels as per Table 2.2 of the NPI.

Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

Note 4: Project Mine Camp.

3.2.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 11** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 11 Project Noise Trigger Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	PINL dB $L_{Aeq(15min)}$	PANL dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$
Residential	Rural	Day	40	53	40
		Evening	35	48	35
		Night	35	43	35
Mine Camp[2]	Rural	Day	n/a	58	58
		Evening	n/a	53	53
		Night	n/a	48	48

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Project Mine Camp.

3.3 Voluntary Land Acquisition and Mitigation Policy Significant Criteria

The VLAMP significance criteria (where impacts would be classified as significant as above) applicable to the Project are presented in **Table 12**. The criteria assume that the total cumulative industrial noise level is attributable to the Project as there is no other significant industrial noise source in the area.

Table 12 VLAMP Project Specific Significance Criteria

Catchment	Period	PNTL dB $L_{Aeq(15min)}$	VLAMP Significant Impact Thresholds		
			Voluntary Acquisition[1]		Vacant Lands Acquisition[2]
			Recommended ANL dB $L_{Aeq(period)}$	PNTL+5dB dB $L_{Aeq(15min)}$	Recommended ANL +5dB dB $L_{Aeq(period)}$
All receivers	Day	40	50	45	55
	Evening	35	45	40	50
	Night	35	40	40	45

Note 1: Voluntary acquisition rights where the Project Noise Level (PNL) exceeds the PNTL by more than 5dB.

Note 2: Project Noise Levels (PNL) exceed the relevant criteria on more than 25% for any privately-owned land parcels.

3.4 Road Traffic Noise Criteria

In accordance with the RNP, this assessment has adopted the 'Freeway/arterial/sub-arterial road' category for the designated inbound and outbound transport routes, consistent with the classification of the Transport Route on Anabranch Mail Road as a 'principal haulage route'. Silver City Highway, Patton Street, Comstock Street, Eyre Street and Holton Drive are all consistent with the classification of 'Freeway/arterial/sub-arterial road' category. **Table 13** reproduces the road traffic noise assessment criteria relevant for this road type.

Table 13 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of Project/development	Assessment Criteria - dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial road	Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments	60dB(A) $LA_{eq(15hr)}$	55dB(A) $LA_{eq(9hr)}$

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

3.4.1 Maximum Noise Trigger Levels

The maximum noise trigger levels shown in **Table 14** are based on night-time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 14 Maximum Noise Trigger Levels

Residential Receivers			
$LA_{eq(15min)}$		LA_{max}	
40dB $LA_{eq(15min)}$ or RBL + 5dB		52dB LA_{max} or RBL + 15dB	
Trigger	40	Trigger	52
RBL +5dB	35	RBL +15dB	45
Highest	**40**	**Highest**	**52**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am

Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

3.4.2 Relative Increase Criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. Receivers located in 'quiet areas', where road traffic noise levels are typically 12dB or more below the relevant criteria, that experience increases in total traffic noise levels above those presented in **Table 15** due to the addition of Project vehicles should be considered for mitigation.

Table 15 Increase Criteria for Residential Land Uses

Road Category	Type of Project/Development	Total Traffic Noise Level Increase, dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $LA_{eq(15hr)}$ +12dB (external)	Existing traffic $LA_{eq(9hr)}$ +12dB (external)

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4 Modelling Methodology

A computer model was developed to quantify Project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2022) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

4.1 Construction Noise Modelling Parameters

4.1.1 Site Establishment and Construction

Project development would occur with the initial construction phase consisting of site access road construction and bulk earthworks, followed by the construction of site buildings and infrastructure including the mine camp, internal roads, water management infrastructure, offices, workshops, laboratory, weighbridge and power supply and distribution.

Construction activities are typically considered to be progressive and will occur at several different locations simultaneously. One combined worst-case scenario was modelled, representative of construction of site access road and bulk earthworks, including formation of laydown areas, and tailings and overburden emplacement areas.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

Noise emission data and assumptions used in this assessment are summarised in **Table 16**. It is noted that the construction phase noise model assumed all plant operating at peak capacity for 100 per cent of the assessment period. It is therefore considered that the predicted noise levels represent worst-case emissions. Equipment sound power levels were generally sourced from manufacturer specifications, with noise levels for the CAT 789 water cart measured by MAC personnel.

Table 16 Single Octave Equipment Sound Power Levels, dB LAeq(15min) *(re10^{-12}W)*

Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dBA[1]
	63	125	250	500	1000	2000	4000	8000	
Site Construction Works									
Bulldozer (CAT D10T) (x2)	90	99	102	104	112	107	103	92	115
Scraper (Case Steiger AFS 550 dual scraper) (x3)	88	97	100	102	110	105	101	90	113
Grader (CAT 18M)	86	85	87	99	105	104	95	85	109
Excavator (CAT 6020) (x2)	91	100	103	105	113	108	104	93	116
Front-end Loader (CAT992)	87	103	107	107	103	108	102	96	113
Haul Truck (CAT 785) (x9)	72	97	104	113	110	107	104	97	116
Water Cart (CAT 789)	83	98	103	109	110	106	100	94	114
Diesel Generators (30MW)[2]	105	110	110	113	107	104	98	91	117

Note 1: Sound Power Level for individual item of plant or equipment.

Note 2: Diesel generators to 30MW total capacity, for example, 15 x 2,500 kva silenced BS Power generators at 102dBA Lw each.

4.1.2 Intersection Upgrade Works

In addition to site establishment works, the Project would involve construction of the Site Access Road (approximately 27km) from Anabranch Mail Road to the Infrastructure Area, realign and upgrade approximately 6.1km of Anabranch Mail Road from the Site Access Road to the Silver City Highway, and installation of intersection treatments at the junctions of:

- Anabranch Mail Road and Silver City Highway;
- Comstock Street and Patton Street;
- Comstock Street and Eyre Street; and
- Holton Drive and the Rail Facility Southern Access Road.

Upgrade works Anabranch Mail Road would involve widening, grading and rolling the existing road. Typical items of equipment would include graders, smooth drum rollers, water carts and delivery trucks. It is noted that there are no sensitive receivers within 3km of the Site Access Road. Hence, it is considered that construction of the Site Access Road would not result in noise levels above the NMLs at any sensitive receiver locations.

The intersection upgrade works would typically involve minor kerb and guttering realignment, reconstruction of pedestrian ramps, modification of drainage pits and minor road widening works with new sealed pavement. Works would typically be undertaken over a period of a few days at each intersection location. Construction equipment may include delivery trucks, small excavator (5.5t), skid steer loaders, grader (Cat140 or similar), generator, concrete saw, asphalt paver, vibratory roller and light vehicles. It is noted that due to the confined nature of the intersection works, not all equipment would operate simultaneously, hence, the noisiest plant (concrete saw – Patton Street / Comstock Street and Eyre Street / Comstock Street; grader – Rail Facility Southern Access) have been considered.

Noise emission data for the upgrade to Anabranch Mail Road and the intersection treatments are provided in **Table 17**.

Table 17 Single Octave Equipment Sound Power Levels, dB LAeq(15min) *(re 10^{-12} W)*

Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dBA[1]
	63	125	250	500	1000	2000	4000	8000	
Anabranch Mail Road									
Construction Fleet	92	100	105	110	114	111	104	96	117
Intersection Upgrade Works									
Concrete Saw	92	91	96	100	105	110	116	109	118
Rail Facility Southern Access									
Grader (CAT 18M)	86	85	87	99	105	104	95	85	109

4.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the fixed plant and surrounding area, as derived from proposed Project plans superimposed onto the surrounding land base topography. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

4.2.1 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source. As the strength of the wind increases, the noise produced by the wind will mask the audibility of most industrial sources.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for potential enhancements, the NPI specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions.

To determine the prevailing conditions for the Project, weather data during the period January 2018 to December 2019 was obtained from the onsite weather station located at coordinates (MGA54) 550020, 6285480. The data was analysed using the EPA's Noise Enhancement Wind Analysis (NEWA) program in order to determine the frequency of occurrence of winds speeds up to 3m/s in each seasonal period.

Table 18 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season for each assessment period. The results of the detailed analysis of meteorological data are presented in Appendix B.

Table 18 Seasonal Frequency of Occurrence Wind Speed Intervals			
Season	Period[1]	Wind Direction ±(45°)	% Wind Speeds (m/s)
			0.5 to 3 m/s
Summer	Day	NE, E, ESE, SE	8
	Evening	ENE	15
	Night	S	13
Autumn	Day	SSW, SW, WSW	10
	Evening	SE	20
	Night	S	24
Winter	Day	SW, WSW, W	11
	Evening	ESE	14
	Night	W	17
Spring	Day	SSW	9
	Evening	S	16
	Night	S	22

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Based on the results of this analysis, prevailing winds are not applicable for the assessment and the relevant meteorological conditions adopted are summarised in **Table 19**.

Table 19 Modelled Site-Specific Meteorological Parameters				
Assessment Condition[1]	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Daytime - Calm	20°C	n/a	60%	n/a
Evening - Calm	10°C	n/a	60%	n/a
Night - Inversion	10°C	n/a	90%	G

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2.2 Operational Noise Modelling Scenarios

Mining operations would commence with a starter pond at the southeastern extent of the deposit. The starter pond would be extracted using conventional free dig, load and haul mining techniques. Extracted overburden, namely materials located above the water table with no heavy mineral, would be used to construct infrastructure within the Mine Site or stockpiled for later use during rehabilitation operations.

Following establishment of the starter pond, the first dredge(s) would be installed, followed by the floating Wet Concentrator Plant and subsequent dredges.

Interburden, namely material located below the water table with no heavy mineral, would be extracted using floating dredges. Interburden would initially be transferred to the Off Path Storage Facility. Once the dredge pond has achieved its minimum operational size, extracted interburden would be used to backfill completed sections of the Extraction Area.

Ore, namely material with sufficient heavy mineral to justify processing, would be extracted using a floating dredge. The ore would be transferred to the floating Wet Concentration Plant for processing.

Tailings and interburden placed within the Extraction Area would be used to progressively backfill completed sections of the Extraction area and would be covered by overburden and soil before being rehabilitated.

Four modelling scenarios were adopted for this assessment (see indicative mining schedule **Figure 4** to **Figure 7**), and included:

- Scenario 1 – Year 5 mining operations;
- Scenario 2 – Year 11 mining operations;
- Scenario 3 – Year 15 mining operations; and
- Scenario 4 – Year 17 mining operations.

These scenarios represent the worst-case operating conditions, with the maximum number of plant and equipment operating simultaneously, at the locations with the highest potential impact on neighbouring receivers, during each of the assessment periods. The operational activities are summarised as follows:

- vegetation removal, soil stripping and site preparation (daylight hours only);
- excavation, transportation and placement of overburden using excavators and haul trucks (dry mining operations);
- mining of the interburden and ore material using dredges and pumping of the ore material to the floating Wet Concentration Plant for conventional gravity separation and then the Rare Earth Concentrate Plant (REC Plant) for further mineral separation;
- transportation of heavy mineral concentrate via road by AB-Triple or AB-Quad road trains;
- maintenance of stockpiled overburden and tailings; and
- operation of the solar farm and BESS for energy supply.

Mobile plant noise emission data used in modelling for this assessment were obtained from manufacture's specifications and the MAC database. The indicative mining fleet for each assessed operational scenario is provided in **Table 20**, and noise emission levels used in the modelling are summarised in **Table 21**.

Table 20 Indicative Mining Fleet

ID	Equipment	Indicative Make / Model	Period of Operation	Number of Equipment			
				Year 5	Year 11	Year 15	Year 17
Concentrate Management							
REC Plant	Excavator	Komatsu PC300 or	All	2	2	2	2
	Bulldozer	CAT D9	All	1	1	1	1
	Haul Truck	CAT 745 or equivalent	All	3	3	3	3
	Loader	CAT 966 or equivalent	All	1	1	1	1
Mining							
1	Excavator	CAT 6020	Day	2	3	2	1
2	Haul Truck	CAT 785	All	7	8	8	4
3	Bulldozer	CAT D10T	Day	3	3	3	3
4	Grader	CAT 16K	All	2	2	2	2
5	Water Cart	CAT 777	All	1	1	1	1
6	Bulldozer	CAT D9	Day	2	2	2	2
7	Scraper	CAT 657	Day	2	2	2	2
8	Excavator	CAT 390	All	1	1	1	1
9	Excavator	CAT 349	All	1	1	1	1
10	Excavator	CAT 336	All	1	1	1	1
11	Wheeled Loader	CAT 992G	All	1	1	1	1
12	Wheeled Loader	CAT 980K	All	1	1	1	1
13	Articulated Truck	Volvo A60H	All	2	2	2	2
14	Articulated Truck	Bell Moxy B50D	All	2	2	2	2
15	Grader	CAT14M	All	1	1	1	1
16	Water Cart	CAT 773	All	1	1	1	1
17	Water Cart	Moxy	All	1	1	1	1
18	Dredge	Jet Suction Dredge	All	3	3	3	3
19	Wet Concentrator Plant	Floating Plant	All	1	1	1	1
20	Road Truck	Road Train	All	2	2	2	2
21	BESS	Modular	All	1	1	1	1

Table 21 Single Octave Equipment Sound Power Levels, dB LAeq(15min) (re10-12W)										
ID	Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dBA[1]
		63	125	250	500	1000	2000	4000	8000	
Concentrate Management										
REC Plant	Excavator (Komatsu PC300)	79	93	94	99	98	93	81	70	103
	Bulldozer (CAT D9)	86	106	103	104	106	108	102	93	113
	Haul Truck (CAT 745)	86	93	95	100	102	101	97	87	107
	Loader (CAT 966)	91	96	98	105	103	101	95	86	109
Mining										
1	Excavator (CAT 6020)	91	100	103	105	113	108	104	93	116
2	Haul Truck (CAT 785)	72	97	104	113	110	107	104	97	116
3	Bulldozer (CAT D10T)	90	99	102	104	112	107	103	92	115
4	Grader (CAT 16K)	86	85	87	99	105	104	95	85	109
5	Water Cart (CAT 777)	71	96	103	112	109	106	103	96	115
6	Bulldozer (CAT D9)	86	106	103	104	106	108	102	93	113
7	Scraper (CAT 657)	88	97	100	102	110	105	101	90	113
8	Excavator (CAT 390)	79	95	95	100	102	102	101	93	108
9	Excavator (CAT 349)	91	94	97	105	100	99	94	84	108
10	Excavator (CAT 336)	91	98	97	96	97	96	93	84	105
11	Loader (CAT 992G)	87	103	107	107	103	108	102	96	113
12	Loader (CAT 980K)	82	98	102	102	98	103	97	91	109
13	Articulated Truck (A60H)	92	99	101	106	108	107	103	93	113
14	Articulated Truck (B50D)	98	90	98	102	106	104	99	92	110
15	Grader (CAT 14M)	84	84	86	98	104	103	93	84	107
16	Water Cart (CAT 773)	83	98	103	109	110	106	100	94	114
17	Water Cart (Moxy)	82	95	91	95	100	98	93	85	104
18	Dredge[2]	85	103	99	103	106	102	95	85	110
19	Wet Concentrator Plant	59	71	88	82	84	89	89	82	95
20	Road Truck	75	90	97	103	102	102	97	93	108
21	BESS	65	79	93	87	83	79	65	45	95
Maximum Noise Level Assessment										
Excavator Bucket Shake		82	98	95	96	104	112	116	107	118

Note 1: Sound Power Level for individual item of plant or equipment.

Note 2: Sound Power Level measured by MAC personnel.

4.2.3 Annoying Characteristics

Fact Sheet C of the NPI provides guidelines for applying 'modifying factors' corrections to account for annoying noise characteristics such as low-frequency, tonality, intermittent noise or noise of short duration. An assessment of annoying characteristics has been undertaken for the Project, and is provided in **Appendix C**. It is noted that due to the nature of the operations, intermittent noise is not considered to be a feature of the site and has not been assessed.

The analysis of low-frequency noise found that modelled noise levels from all sources exceeded the screening test of C-A weighted noise levels greater or equal to 15dB. Therefore, further analysis was undertaken to determine whether noise levels exceeded the threshold in any octave band. The results of the assessment indicated that Z weighted noise levels remained below the relevant thresholds for all octave bands. Hence, no correction for low-frequency noise is applied.

An assessment of tonality was undertaken to identify dominant tones associated with the Project. The tonal noise correction applies when the level of an octave band exceeds the level of the adjacent band on either side by at least 5dB. The results of the tonality assessment demonstrates that the operations are not anticipated to result in dominant tones. Hence, no correction for tonality is applied.

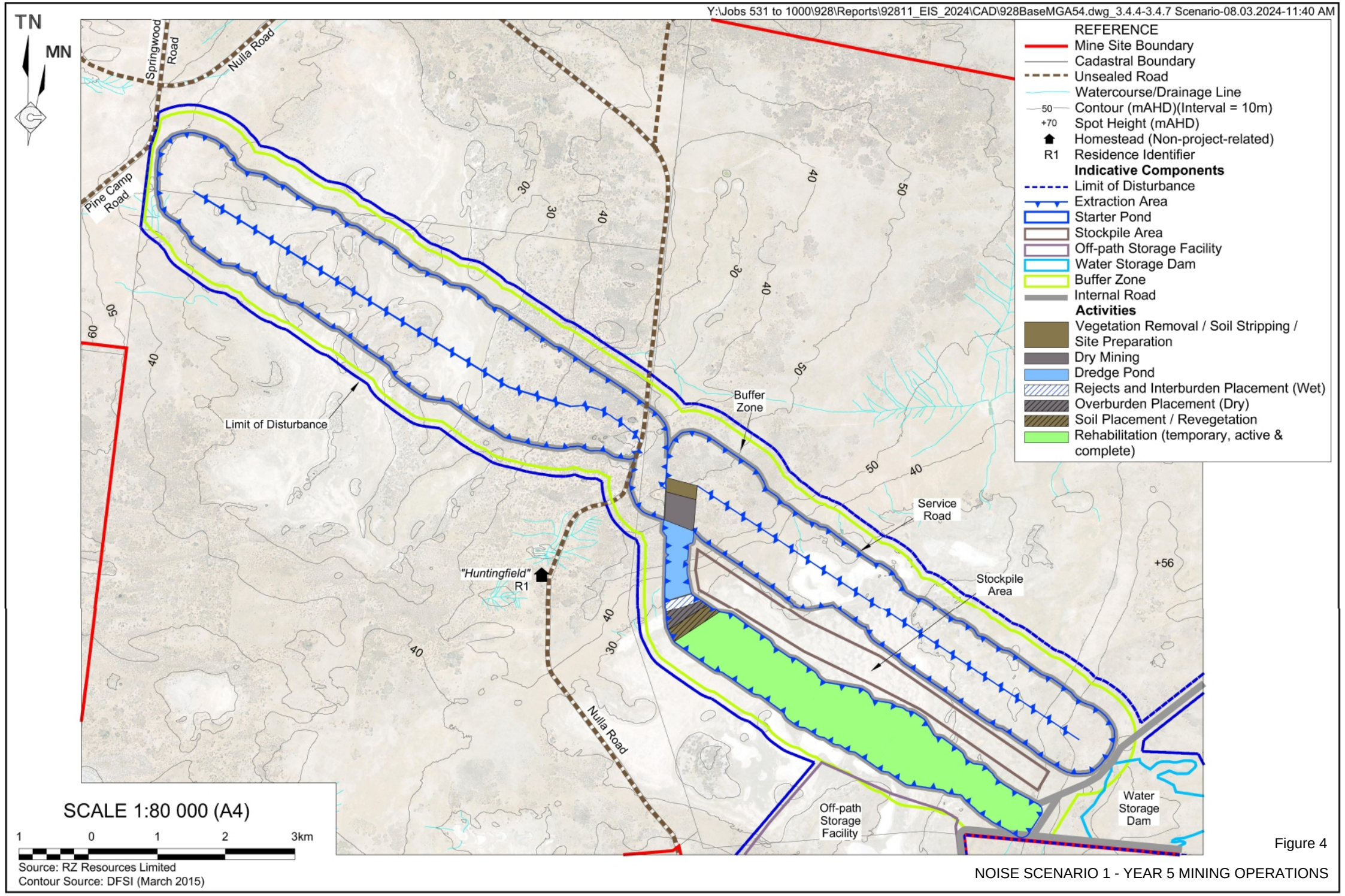


Figure 4

NOISE SCENARIO 1 - YEAR 5 MINING OPERATIONS

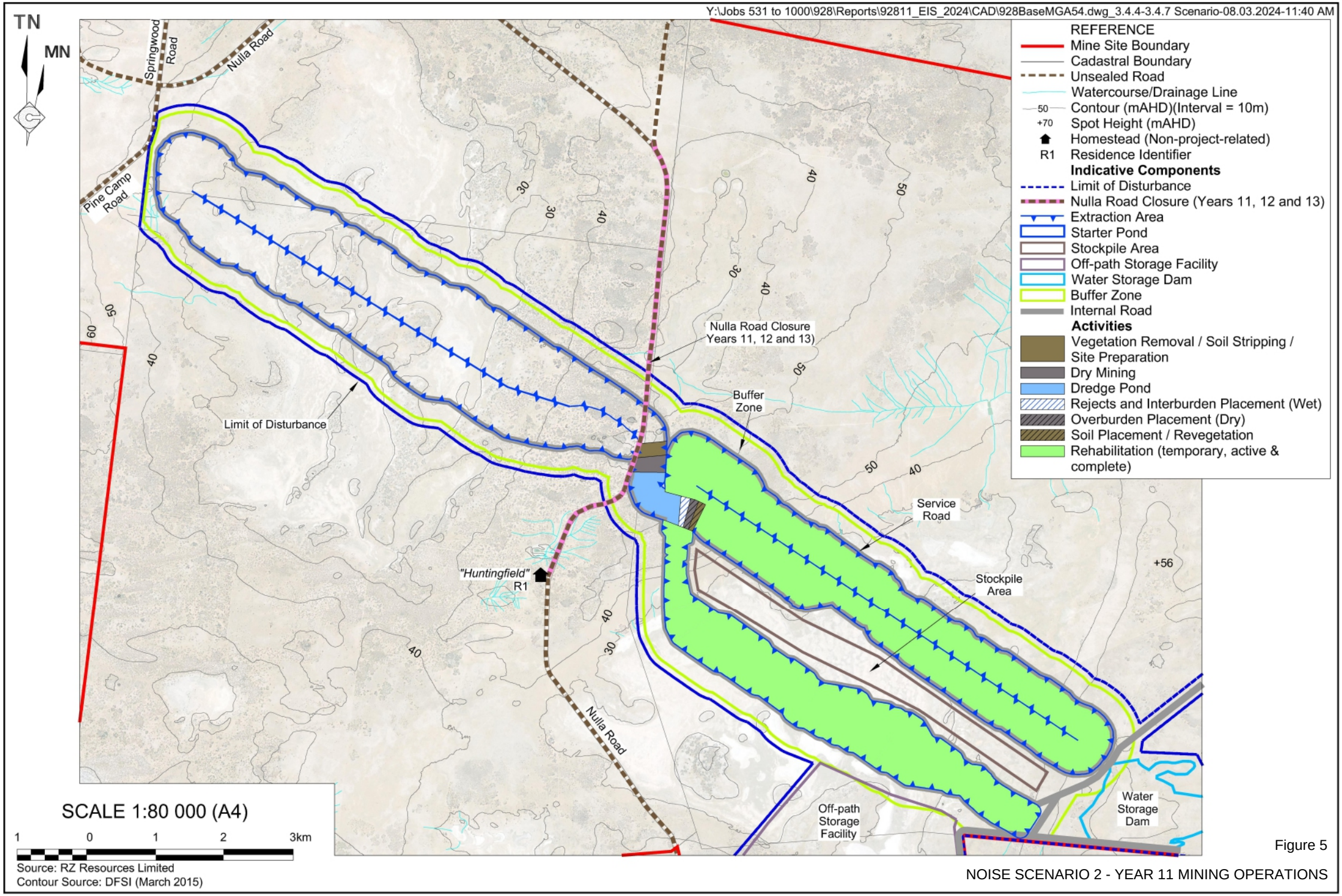


Figure 5

NOISE SCENARIO 2 - YEAR 11 MINING OPERATIONS

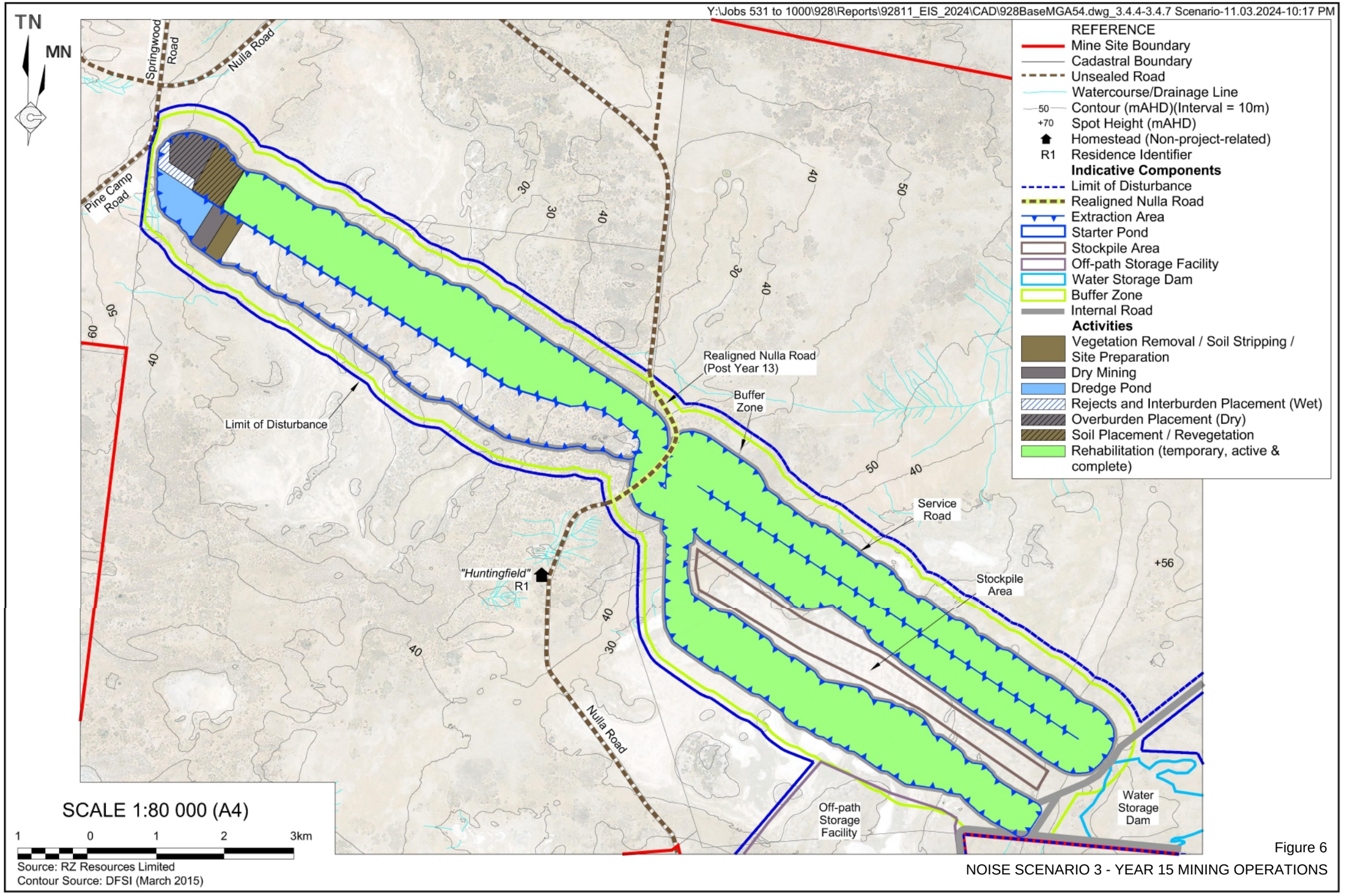


Figure 6

NOISE SCENARIO 3 - YEAR 15 MINING OPERATIONS

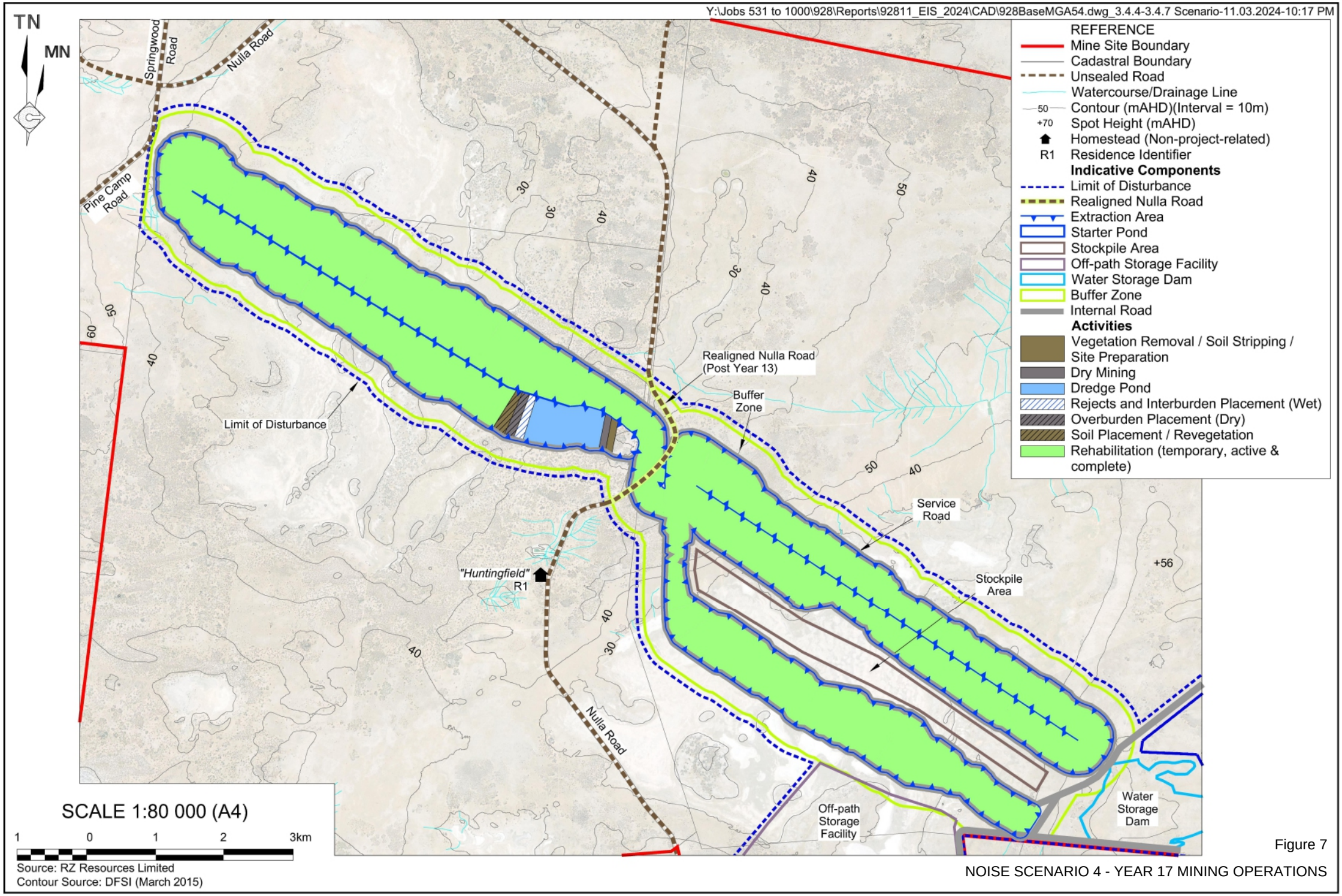


Figure 7

NOISE SCENARIO 4 - YEAR 17 MINING OPERATIONS

4.3 Road Noise Assessment Methodology

The HMC would be transported in sealed containers via road using AB-Triple or AB-Quad road trains to the Rail Facility off Holten Drive, Broken Hill. The travel route from the Project site would be via Anabranch Mail Road, Silver City Highway, Wentworth Road, Patton Street, Comstock Street, Eyre Street and Holten Drive.

Other light and heavy vehicles would typically travel to and from the south, with 90% of vehicles travelling via the Silver City Highway from Wentworth, Victoria and/or South Australia. 10% of light and heavy vehicles would travel from locations and equipment suppliers in Broken Hill via the Silver City Highway and Anabranch Mail Road.

MAC understands that the daily number of vehicle movements associated with the Project include:

- up to 16 laden HMC trucks (32 movements);
- up to seven laden delivery trucks (14 movements);
- an average of two bus trips (four movements); and
- up to 42 light vehicle trips (84 movements).

Haulage of HMC within the Broken Hill LGA would occur between 7am and 10pm daily, with all other vehicle movements occurring 24 hours per day. The travel routes are provided in **Figure 8**.

The closest offset distance to receivers along the haul route are presented in **Table 22**. It is noted that the nearest receiver to Anabranch Mail Road (Residence R7) is setback more than 2km. As this receiver is unlikely to be affected by road traffic noise, it has been excluded from the assessment.

Table 22 Closest Receivers to Haul Route

Street Name	Receiver	MGA 54 Coordinates		Distance to Road
		Easting (m)	Northing (m)	
Silver City Highway	14098 Silver City Highway	558079	6350505	250m
Wentworth Road	101 Wentworth Road	542258	6460472	40m
Patton Street	4 Patton Street	542849	6461122	20m
Comstock Street	43 Comstock Street	543486	6461740	15m
Eyre Street	155 Eyre Street	543394	6462061	20m
	St Annes Aged Care Facility	543562	6462206	20m
Holten Drive[1]	N/A	N/A	N/A	N/A
Adams Street (Wentworth)	181 Adams Street	584381	6226911	25m

Note 1: No sensitive receivers located adjacent to the haul route off Holten Drive

Due to the low traffic volume generated by the Project over a typical day during the construction phase, road traffic noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Whilst each method has a low volume correction, the Project traffic volume is out of the scope of these methods.

Therefore, road traffic noise has been modelled using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as "moving sources" along the transport route using the parameters presented in **Table 23.**

Table 23 Road Traffic Noise Modelling Parameters

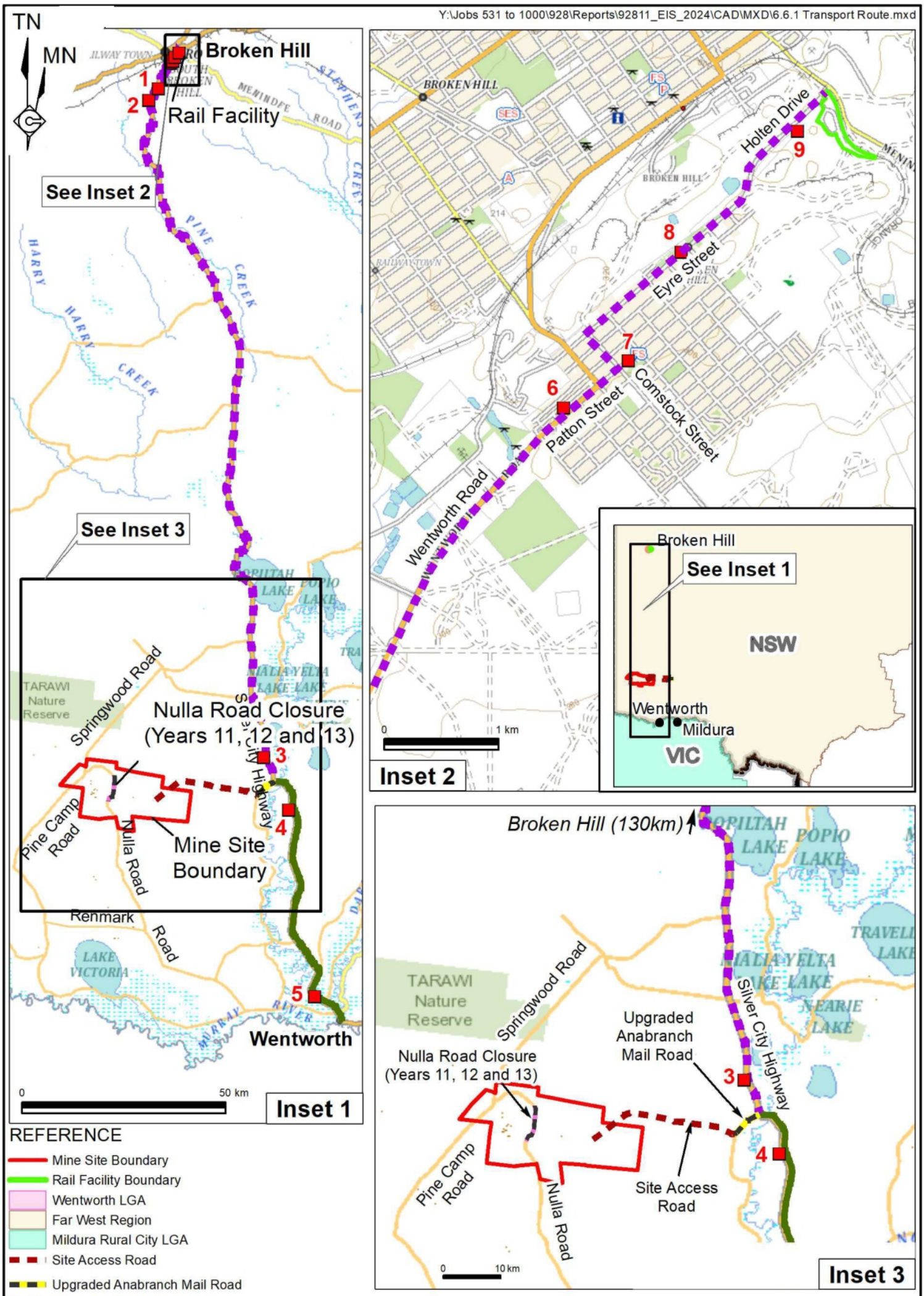
Noise Source/Item	Direction of Travel	Lw dBA re 10^{-12} W	Movements[1]		Speed, km/h[2]	Source Height, m[3]
			Day	Night		
Heavy Vehicle[4] (AB-triple or AB-quad)	North	108	32	n/a	50 / 100	1.5
Other Heavy Vehicle (rigid, semi-trailer or b-double)	North	104	1	1	50 / 100	1.5
	South	104	13	3	50 / 100	1.5
Light Vehicle	North	96	4	4	50 / 110	0.75
	South	96	38	38	50 / 110	0.75

Note 1: Day period 7am to 10pm, night period 10pm to 7am.

Note 2: 50km/h on local roads, 100km/h (truck) / 110km/h (car) on Silver City Highway.

Note 3: Height above ground level.

Note 4: AB-triple and AB-quad vehicle movements during day period only.



Source: NSW Topographic Web Base Map - LPI

Figure 8

PROPOSED TRANSPORTATION ROUTES

5 Noise Assessment Results

5.1 Construction Phase Noise Modelling Results

5.1.1 Site Establishment and Construction

Predicted noise levels for on-site construction activities described in **Section 4.1.1** are provided in **Table 24**. The results of the analysis show that noise emissions from construction activities are predicted to satisfy the relevant noise management levels at all receiver locations during standard or hour of hours construction periods.

Table 24 Combined Noise Predictions – Site Establishment and Construction

Receiver	Receiver Status	Predicted Noise Level dB $LA_{eq(15min)}$	NML dB $LA_{eq(15min)}$		Compliant
			Day	OOH	
R1	Permanently Occupied	<30	45	35	✓
R2	Project Related	<30	45	35	n/a
R3	Intermittently Occupied	<30	45	35	✓
R4	Project Related	<30	45	35	n/a
R5	Unoccupiable	<30	45	35	n/a
R6	Permanently Occupied	<30	45	35	✓
R7	Permanently Occupied	<30	45	35	✓
R8	Permanently Occupied	<30	45	35	✓
R9	Permanently Occupied	<30	45	35	✓
R10	Permanently Occupied	<30	45	35	✓

Note: See **Table 4** for Construction Hours.

5.1.2 Intersection Upgrade Works

Predicted noise levels for road upgrade and intersection treatment activities described in **Section 4.1.2** are provided in **Table 25** for the nearest non project-related residential receivers to each of the construction sites.

The results of the analysis show that construction noise levels are anticipated to remain below the NMLs for the nearest residential receivers for construction of the all-weather access to the Rail Facility Southern Access off Holten Drive, during standard construction hours. Where works are undertaken outside of standard construction hours (ie 6pm to 10pm), noise level are predicted to exceed the relevant NMLs by up to 7dBA.

For intersection upgrade works at Patton Street / Comstock Street and Comstock Street / Eyre Street, construction noise levels are predicted to exceed the standard and out of hours NMLs and the highly noise affected (HNA) noise level of 75dB $LA_{eq(15min)}$ at the nearest residential receivers. It is noted that construction works would be undertaken over a period of a few days at each intersection location.

It is recommended that prior to undertaking intersection upgrade works, the Applicant should contact potentially noise affected neighbours at the earliest possible time, informing them of the nature of the works and duration of activities.

Table 25 Combined Noise Predictions – Road and Intersection Upgrades

Receiver	Distance to Works	Predicted Noise Level dB $LA_{eq(15min)}$	NML dB $LA_{eq(15min)}$			Compliant
			Day	Evening	HNA	
Patton Street / Comstock Street Intersection						
37 Comstock Street	~10m	80	45	35	75	X
Comstock Street / Eyre Street Intersection						
137 Eyre Street	~10m	87	45	35	75	X
Rail Facility Southern Access						
Lot 7313 DP1185108	~530m	42	45	35	75	Day

Note: See **Table 4** for Construction Hours.

5.2 Operational Scenario Noise Modelling Results

Worst-case predicted noise levels for typical activities during Year 5, Year 11, Year 15 and Year 17 operations are provided in Table 26 and noise contour plots are provided in Appendix D. It is noted that receivers R2, R4 and the Mine Camp are Project related and are not considered to be sensitive receivers. R5 is a derelict residence that is unoccupiable.

The results of the model show that noise emissions from Project operations are predicted to satisfy relevant criteria during all assessment periods, including the night period under strong inversion (G Class) conditions, at all non-Project related receiver locations. Notwithstanding, the Applicant the following measures to manage noise emissions from the Project:

- implementation of a predictive forecasting system to provide daily information on meteorological risks associated with noise enhancing conditions;
- implement proactive measures in response to the predictive forecasting system, such as changes to operations, maximise shielding of equipment (ie reduce surface activities), and avoid noisy equipment or processes; and
- development of a Trigger Action Response Plan (TARP) with implementation of reactive management strategies in response to noise alarms triggered from real-time noise monitoring.

Table 26 Combined Noise Predictions – Operational Scenarios[1,2]

Receiver	Predicted Noise Level, dB $LA_{eq(15min)}$																PNTL, dB $LA_{eq(15min)}$			Compliant
	Scenario 1 (Year 5)				Scenario 2 (Year 11)				Scenario 3 (Year 15)				Scenario 4 (Year 17)							
	Day	Evening	Night	Night	Day	Evening	Night	Night	Day	Evening	Night	Night	Day	Evening	Night	Night	Day	Evening	Night	
		Calm		Inversion		Calm		Inversion		Calm		Inversion				Inversion				
R1	35	30	31	33	34	<30	<30	32	<30	<30	<30	<30	34	<30	30	32	40	35	35	✓
R2[2]	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a	n/a
R3	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
R4[2]	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a	n/a
R5[3]	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a	n/a
R6	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
R7	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
R8	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
R9	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
R10	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	40	35	35	✓
MC[4]	37	34	<30	<30	37	34	<30	<30	37	34	<30	<30	37	34	<30	<30	58	53	48	n/a

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Project-related receiver.

Note 3: Unoccupiable residence.

Note 4: Mine Camp assessed against amenity criteria for short term accommodation.

5.3 Maximum Noise Level Assessment

In assessing sleep disturbance, a typical L_{Amax} noise source of 118dB was used to represent transient events such as an excavator shaking the bucket, to the nearest residential receivers.

Predicted noise levels from L_{Amax} events for assessed receivers are presented in **Table 27.** Results identify that Maximum Trigger Levels will be satisfied for all residential receivers. It is noted that predictions are below the EPA screening criteria, hence no further assessment or detailed analysis is required.

Table 27 Maximum Noise Levels Assessment (Night)[1,2]

Receiver	Predicted Noise Level)								Trigger Levels		Compliant
	Scenario 1 (Year 5)		Scenario 2 (Year 11)		Scenario 3 (Year 15)		Scenario 4 (Year 17)		dB LAeq(15min)	dB LAmax	
	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax			
R1	33	<30	32	<30	<30	<30	32	<30	40	52	✓
R2[2]	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a
R3	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
R4[2]	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a
R5[3]	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a
R6	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
R7	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
R8	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
R9	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
R10	<30	<30	<30	<30	<30	<30	<30	<30	40	52	✓
MC[4]	<30	<30	<30	<30	<30	<30	<30	<30	n/a	n/a	n/a

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Project-related receiver.

Note 3: Unoccupiable residence.

Note 4: Mine Camp assessed against amenity criteria for short term accommodation.

5.4 VLAMP Assessment

The results of the operational noise assessment provided in **Section 5.2** demonstrates that noise emissions associated with the operation of the Project would not exceed the PNTLS at any of the assessed receiver locations. Therefore, as per the VLAMP definitions, there are no receivers that fall under voluntary land mitigation rights.

Furthermore, the modelled affection zones, (refer to **Figures D1** to **D16**) are up to approximately 350ha for night period operations during strong temperature inversions, which is <25% of the land area covered by Lot 1907 DP 763791 and Lot 1940 DP 763792 (receiver R1) of 11,000ha. Hence, there are no receivers that fall under the voluntary land acquisitions rights.

5.5 Road Traffic Noise Results

Predicted road traffic noise levels from the Project are presented in **Table 28.** Noise levels were modelled to the nearest residential receivers along each transport route using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods. Predicted noise levels included a +2.5dB façade correction and a -1.7dB ARRB correction.

The results of the road traffic noise calculations indicated that for the closest rural residential receivers to the transport route along the Silver City Highway (14098 Silver City Highway), the Project related road traffic noise levels would be up to 42.7dB $LA_{eq(period)}$ for the day and less than 30dB $LA_{eq(period)}$ during the night period.

For residential receivers located within the townships of Broken Hill and Wentworth, Project related traffic noise levels are predicted at up to 48.9dBA during the day and 36.0dBA during the night. Hence, road traffic noise levels are predicted to remain significantly below the day and night period assessment criteria. It is therefore considered that the road traffic noise criteria would be satisfied at all receiver locations.

Table 28 Operational Road Traffic Noise Levels						
Travel Route	Receiver	Offset from Road	Period	Assessment Criteria dB $L_{Aeq(period)}$	Traffic Noise dB $L_{Aeq(period)}$	Compliant
North (Broken Hill)	14098 Silver City Highway	255m	Day	60 $L_{Aeq(15hr)}$	42.7	✓
			Night	55 $L_{Aeq(9hr)}$	21.5	✓
	43 Comstock Street	15m	Day	60 $L_{Aeq(15hr)}$	48.9	✓
			Night	55 $L_{Aeq(9hr)}$	31.3	✓
	St Annes (Eyre Street)[1]	20m	Day	60 $L_{Aeq(15hr)}$	47.0	✓
			Night	55 $L_{Aeq(9hr)}$	29.2	✓
South (Wentworth)	181 Adams Street	25m	Day	60 $L_{Aeq(15hr)}$	39.9	✓
			Night	55 $L_{Aeq(9hr)}$	36.0	✓

Note 1: Aged care facility assessed against residential land use noise assessment criteria as per Table 4 of the RNP.

6 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Noise Impact Assessment (NIA) of potential emissions from the proposed Copi Mineral Sands Project (the Project), located approximately 75km northwest of Wentworth in the Far West Region of NSW. The assessment has quantified potential noise emissions including Project construction, resource extraction and processing, and dispatch of product via road trucks associated with the Project.

The results of the Noise Impact Assessment (demonstrate that construction phase onsite construction activities) and operational noise levels comply with the relevant ICNG, NPI and VLAMP criteria for all assessment periods at the most affected sensitive receiver locations. It is noted that receivers R2, R4 and the Mine Camp are Project related receivers, while R5 is a derelict residence that is unoccupiable.

During road upgrade works at the intersections of Patton Street / Comstock Street and Comstock Street / Eyre Street, construction noise levels are predicted to exceed the standard and out of hours NMLs, as well as the highly noise affected noise level at the nearest residential receivers, while construction of the all-weather access to the Rail Facility Southern Access off Holten Drive is expected to generate noise levels above the out of hours NML at nearby sensitive receiver locations. Hence, early and ongoing communication with potentially affected receivers should be undertaken prior to the initiation of works. It is noted that construction activities at each of the intersections is anticipated to occur for a few days only.

Results of the maximum noise level assessment are identified to remain below the sleep disturbance trigger levels at all residential receivers. Therefore, sleep disturbance due to noise sources within the Project are unlikely to cause awakening reactions to adjacent receivers.

Additionally, the Noise Impact Assessment (demonstrates that the road noise criteria as specified in the RNP will be satisfied at the nearest potentially affected receivers for worst case operational road traffic.

In summary, the Noise Assessment supports the Environmental Impact Statement for the Project without ameliorative measures being required.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

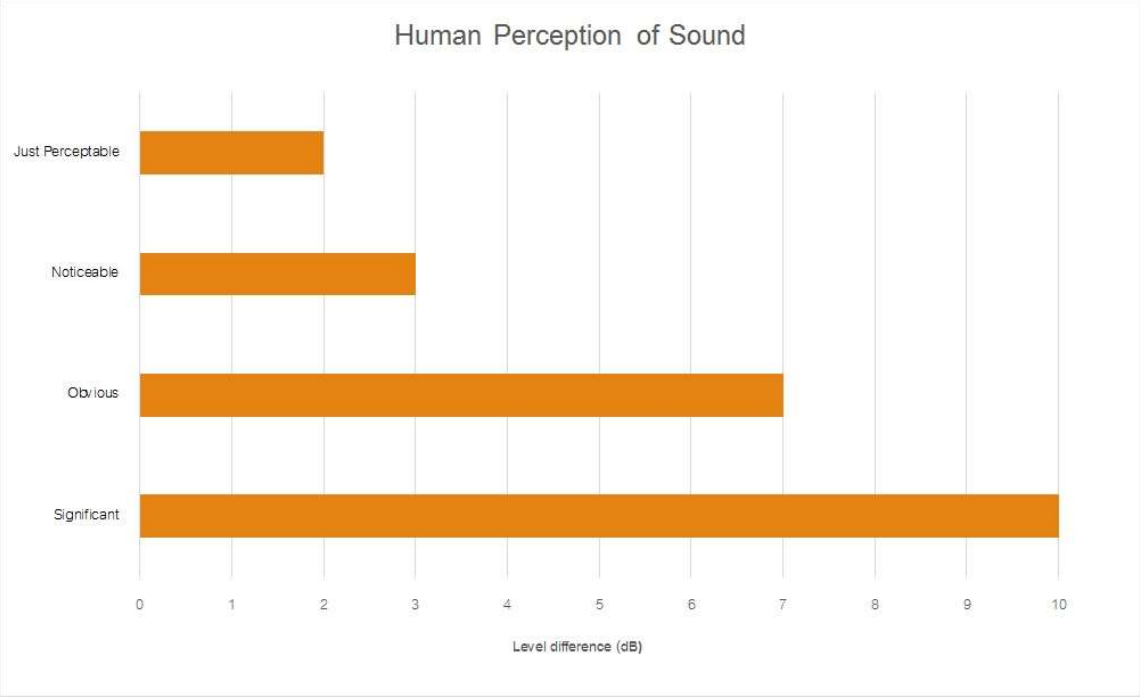
Table A1 Glossary of Acoustical Terms

Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B – NEWA Analysed Meteorology

Table B1 NEWA Analysed Daytime Meteorological Conditions, On-site Weather Station					
Direction ± 45°	Season	Day Percentage Occurrence %	Direction	Season	Day Percentage Occurrence %
0	Summer	6	180	Summer	7
0	Autumn	8	180	Autumn	9
0	Winter	8	180	Winter	8
0	Spring	5	180	Spring	8
22.5	Summer	7	202.5	Summer	6
22.5	Autumn	9	202.5	Autumn	10
22.5	Winter	9	202.5	Winter	9
22.5	Spring	5	202.5	Spring	9
45	Summer	8	225	Summer	7
45	Autumn	9	225	Autumn	10
45	Winter	7	225	Winter	11
45	Spring	5	225	Spring	8
67.5	Summer	8	247.5	Summer	6
67.5	Autumn	9	247.5	Autumn	10
67.5	Winter	5	247.5	Winter	11
67.5	Spring	5	247.5	Spring	8
90	Summer	8	270	Summer	5
90	Autumn	10	270	Autumn	9
90	Winter	7	270	Winter	11
90	Spring	5	270	Spring	6
112.5	Summer	8	292.5	Summer	5
112.5	Autumn	9	292.5	Autumn	8
112.5	Winter	7	292.5	Winter	10
112.5	Spring	6	292.5	Spring	5
135	Summer	8	315	Summer	5
135	Autumn	9	315	Autumn	7
135	Winter	7	315	Winter	9
135	Spring	6	315	Spring	5
157.5	Summer	5	337.5	Summer	5
157.5	Autumn	7	337.5	Autumn	8
157.5	Winter	6	337.5	Winter	9
157.5	Spring	5	337.5	Spring	5

Table B2 NEWA Analysed Evening time Meteorological Conditions, On-site Weather Station					
Direction ± 45°	Season	Day Percentage Occurrence %	Direction	Season	Day Percentage Occurrence %
0	Summer	12	180	Summer	9
0	Autumn	2	180	Autumn	18
0	Winter	5	180	Winter	13
0	Spring	3	180	Spring	16
22.5	Summer	11	202.5	Summer	8
22.5	Autumn	8	202.5	Autumn	15
22.5	Winter	8	202.5	Winter	11
22.5	Spring	7	202.5	Spring	11
45	Summer	14	225	Summer	5
45	Autumn	8	225	Autumn	9
45	Winter	10	225	Winter	11
45	Spring	6	225	Spring	9
67.5	Summer	15	247.5	Summer	2
67.5	Autumn	13	247.5	Autumn	6
67.5	Winter	9	247.5	Winter	10
67.5	Spring	5	247.5	Spring	8
90	Summer	13	270	Summer	2
90	Autumn	14	270	Autumn	4
90	Winter	12	270	Winter	7
90	Spring	10	270	Spring	4
112.5	Summer	10	292.5	Summer	1
112.5	Autumn	16	292.5	Autumn	4
112.5	Winter	14	292.5	Winter	6
112.5	Spring	14	292.5	Spring	3
135	Summer	10	315	Summer	2
135	Autumn	20	315	Autumn	3
135	Winter	12	315	Winter	5
135	Spring	15	315	Spring	3
157.5	Summer	7	337.5	Summer	7
157.5	Autumn	15	337.5	Autumn	4
157.5	Winter	10	337.5	Winter	5
157.5	Spring	13	337.5	Spring	3

Table B3 NEWA Analysed Night-time Meteorological Conditions, On-site Weather Station					
Direction ± 45°	Season	Night Percentage Occurrence %	Direction	Season	Night Percentage Occurrence %
0	Summer	5	180	Summer	13
0	Autumn	6	180	Autumn	24
0	Winter	8	180	Winter	8
0	Spring	4	180	Spring	22
22.5	Summer	10	202.5	Summer	13
22.5	Autumn	8	202.5	Autumn	23
22.5	Winter	9	202.5	Winter	13
22.5	Spring	4	202.5	Spring	20
45	Summer	9	225	Summer	11
45	Autumn	7	225	Autumn	18
45	Winter	7	225	Winter	16
45	Spring	5	225	Spring	18
67.5	Summer	10	247.5	Summer	9
67.5	Autumn	8	247.5	Autumn	12
67.5	Winter	6	247.5	Winter	16
67.5	Spring	5	247.5	Spring	15
90	Summer	10	270	Summer	4
90	Autumn	11	270	Autumn	6
90	Winter	7	270	Winter	17
90	Spring	9	270	Spring	9
112.5	Summer	10	292.5	Summer	2
112.5	Autumn	12	292.5	Autumn	4
112.5	Winter	6	292.5	Winter	15
112.5	Spring	14	292.5	Spring	5
135	Summer	9	315	Summer	2
135	Autumn	17	315	Autumn	4
135	Winter	6	315	Winter	14
135	Spring	16	315	Spring	3
157.5	Summer	6	337.5	Summer	3
157.5	Autumn	13	337.5	Autumn	5
157.5	Winter	5	337.5	Winter	11
157.5	Spring	15	337.5	Spring	3

Appendix C – Annoying Characteristics Assessment

C1 Requirements to Address Annoying Characteristics

Fact Sheet C of the NPI provides guidelines for applying 'modifying factors' adjustments to account for annoying noise characteristics such as low frequency, tonality, intermittent noise, irregular or noise of short duration.

C1.1 Low Frequency Noise

In accordance with Table C1 of the NPI, the low-frequency noise correction applies when the C minus A level is 15dB or more, and:

- Where any of the one-third octave noise levels in Table C2 (reproduced in **Table C-1**) are exceeded by up to and including 5dB and cannot be mitigated, a 2dBA positive adjustment to the measured/predicted A-weighted levels applies for the evening/night period; or
- Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5dB and cannot be mitigated, a 5dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2dBA positive adjustment applies for the daytime period.

Table C-1 One-third octave low-frequency noise thresholds (from Table C2 of NPI)

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

Noise predictions have been completed to determine the applicability of low frequency modifying factors. The modelled C-A noise levels for the nearest residential receivers to the Project (R1, R2, R3, R4 and R5) are provided in **Table C-2.**

It is noted that 1/1 octave data has been adopted for the assessment as 1/3 octave data for the Project is unavailable. Additionally, results should be considered worst case for the site as concurrent operation of all plant and equipment was assessed. It is also noted that the assessment of low frequency noise by calculation is indicative as the inclusion of one third octaves and frequencies below 63Hz are not 100% compliant with the scope of ISO9613.

Table C-2 Modelled C weighted and A Weighted Single Octave Band Levels, dB $LA_{eq(15min)}$									
Receiver ID	Octave Band Centre Frequency, Hz								Total
	Weighting	63	125	250	500	1000	2000	4000	
R1	A	23.5	24.2	23.8	32.9	33.3	19.4	-20.4	36.9
	C	48.9	40.1	32.4	36.1	33.3	18.0	-22.2	49.8
	Difference (C-A), dB								12.9
R2	A	25.3	25.4	24.2	28.3	33.2	18.5	-18.4	35.8
	C	50.7	41.3	32.8	31.5	33.2	17.1	-20.2	51.4
	Difference (C-A), dB								15.6
R3	A	8.1	9.7	4.5	2.9	-6.0	-50.8	--	13.2
	C	33.5	25.6	13.1	6.1	-6.0	-52.2	-1.8	34.2
	Difference (C-A), dB								21.0
R4	A	10.2	10.7	5.6	5.5	0.1	-39.0	-173.6	14.8
	C	35.6	26.6	14.2	8.7	0.1	-40.4	-175.4	36.1
	Difference (C-A), dB								21.3
R5	A	20.4	19.7	17.6	20.2	23.3	1.0	-70.9	27.6
	C	45.8	35.6	26.2	23.4	23.3	-0.5	-72.7	46.3
	Difference (C-A), dB								18.7

Analysis of the noise modelling identifies that with the inclusion of all noise sources, low frequency noise exceeds the screening test difference of C-A=15dB at receiver locations except the nearest residential receiver (R1). Further analysis was therefore undertaken to determine whether any of the 1/3 octave noise levels in Table C2 of the NPI (**Table 1**) are exceeded for Receivers R2 to R5. It is noted that where data was only available as 1/1 octave, levels in each 1/1 band were divided equally into each 1/3 octave band.

The results of the analysis of low-frequency noise thresholds found that received levels do not exceed the thresholds in **Table C-2** by more than 5dB for day period operations at any of the receiver locations. Hence, the low-frequency correction is not applied to received noise levels for this assessment.

C1.2 Tonality

In addition to low frequency noise, a review of modifying factors for tonality have been completed. In accordance with Table C1 of the NPI, a correction for tonal noise applies when the level of 1/3 octave band exceeds the level of the adjacent band on both sides by:

- 5dB or more if the centre frequency of the band containing the tone is in the range 500-10,000Hz;
- 8dB or more if the centre frequency of the band containing the tone is in the range 16-400Hz; or
- 15dB or more if the centre frequency of the band containing the tone is in the range 25-125Hz.

MAC notes that the assessment should be completed with 1/3 octave data, however, only 1/1 octave data was available for the Project. **Table C-3**, presents the results of the 1/1 octave data tonality noise test for the Project.

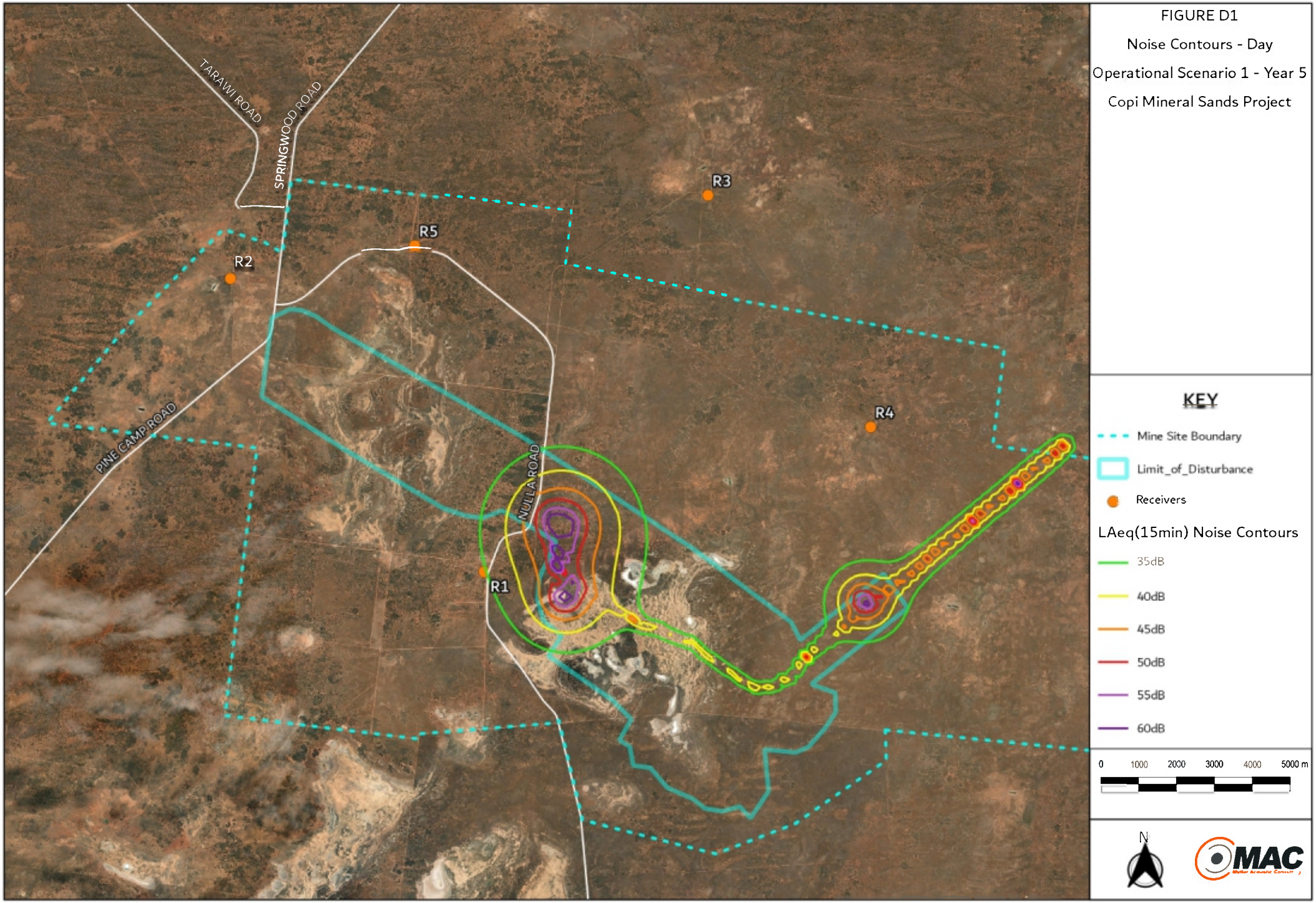
The results of the analysis indicate that there are no dominant tones associated with the Project. Hence, a correction for tonality is not required.

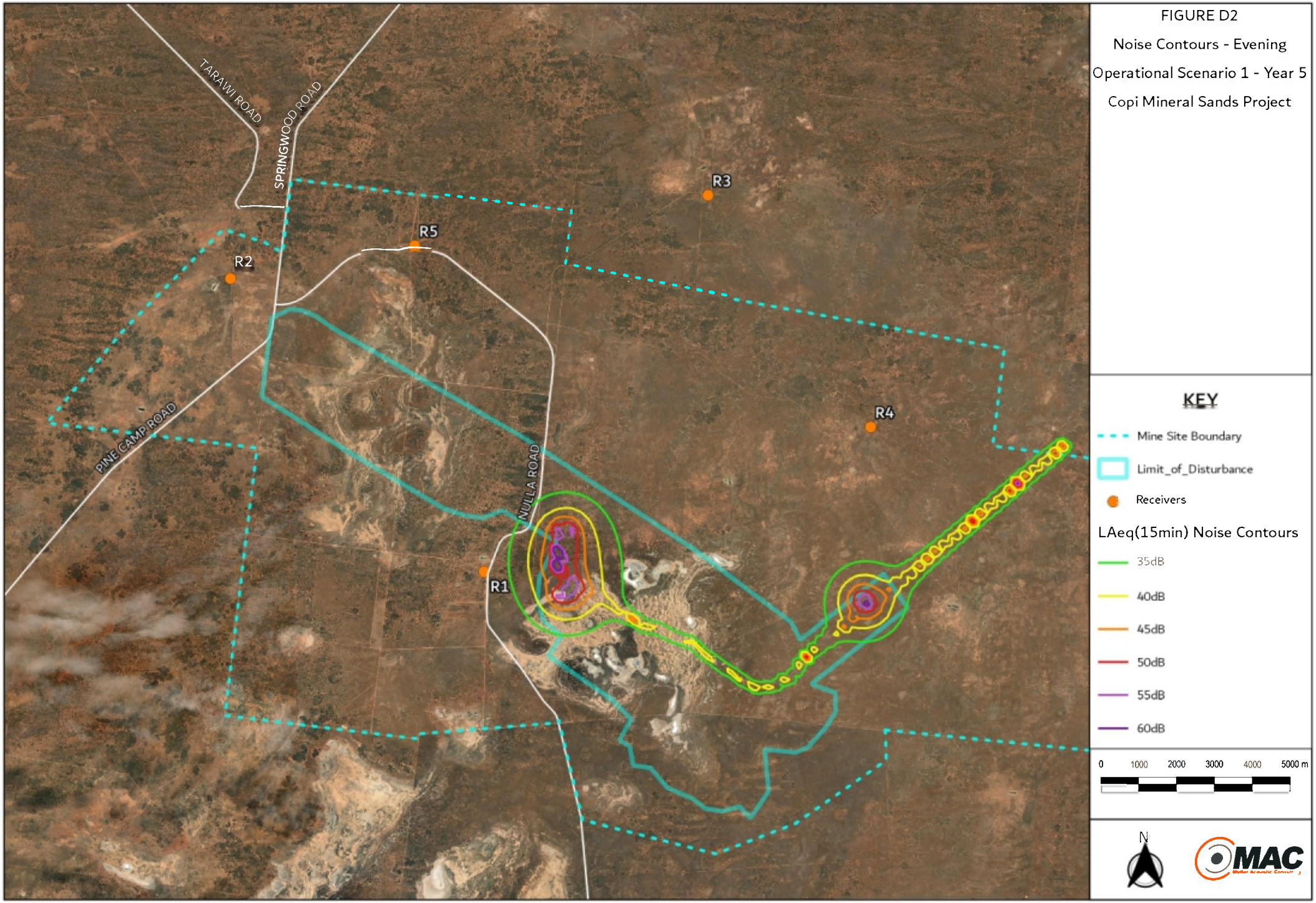
Table C-3 Modelled Z weighted Single Octave Band Levels, dB $LA_{eq(15min)}$

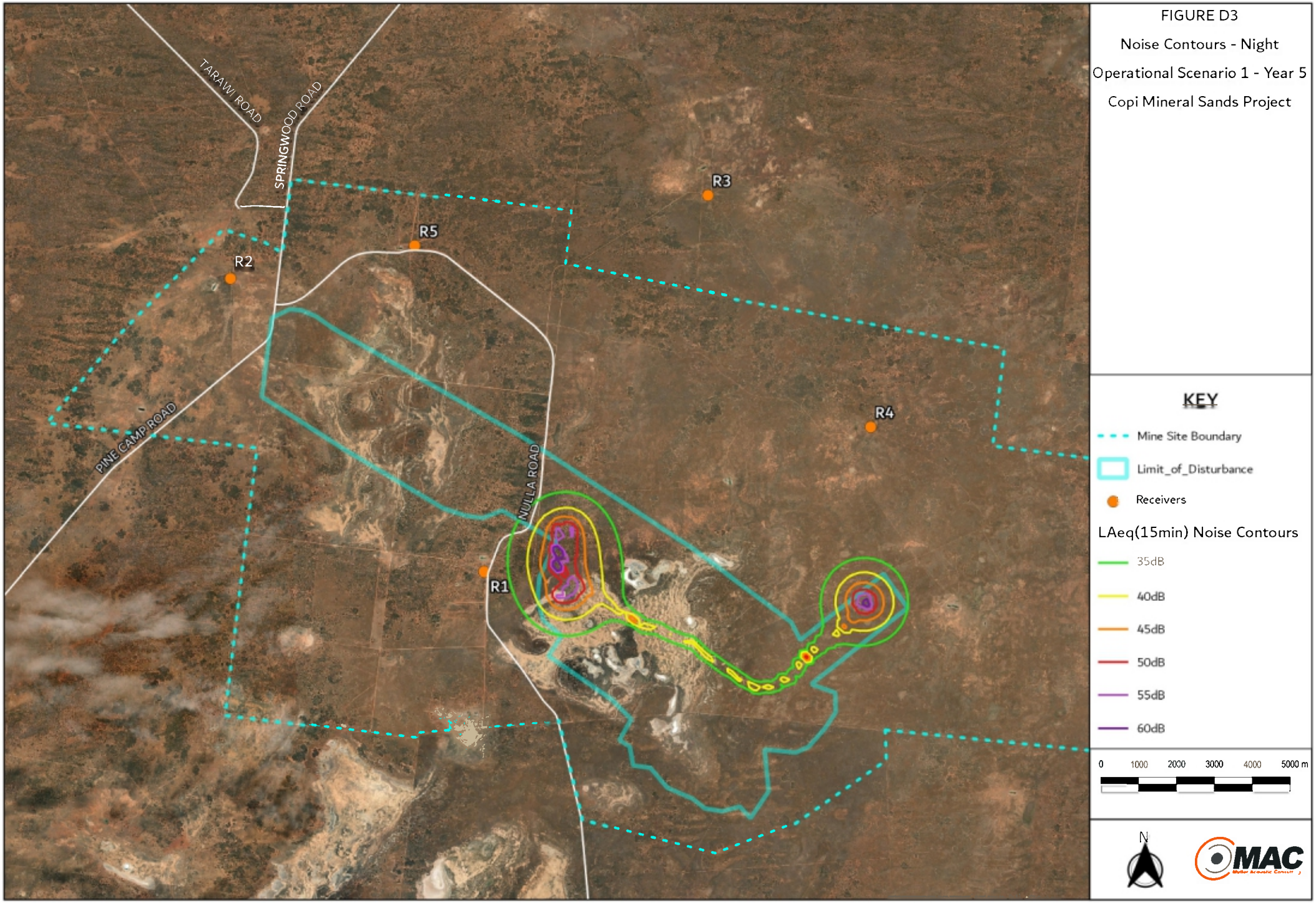
Receiver ID	Octave Band Centre Frequency, Hz								Total
	Weighting	63	125	250	500	1000[1]	2000[1]	4000[1]	
R1	Z	49.7	40.3	32.4	36.1	33.3	18.2	-21.4	50.5
R2	Z	51.5	41.5	32.8	31.5	33.2	17.3	-19.4	52.1
R3	Z	34.3	25.8	13.1	6.1	-6.0	-52.0	-1.0	34.9
R4	Z	36.4	26.8	14.2	8.7	0.1	-40.2	-174.6	36.9
R5	z	46.6	35.8	26.2	23.4	23.3	-0.3	-71.9	47.0

Note 1: For octave data for 1kHz and greater, the key difference between the octave bands is associated with atmospheric attenuation and ground absorption and noise mitigation measures (such as partial enclosures of sources, rather than a dominant tonal component from the source at these frequencies.)

Appendix D – Noise Contour Plots


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D1
Noise Contours - Day
Operational Scenario 1 - Year 5
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0
1000
2000
3000
4000
5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D2
Noise Contours - Evening
Operational Scenario 1 - Year 5
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D3
Noise Contours - Night
Operational Scenario 1 - Year 5
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC

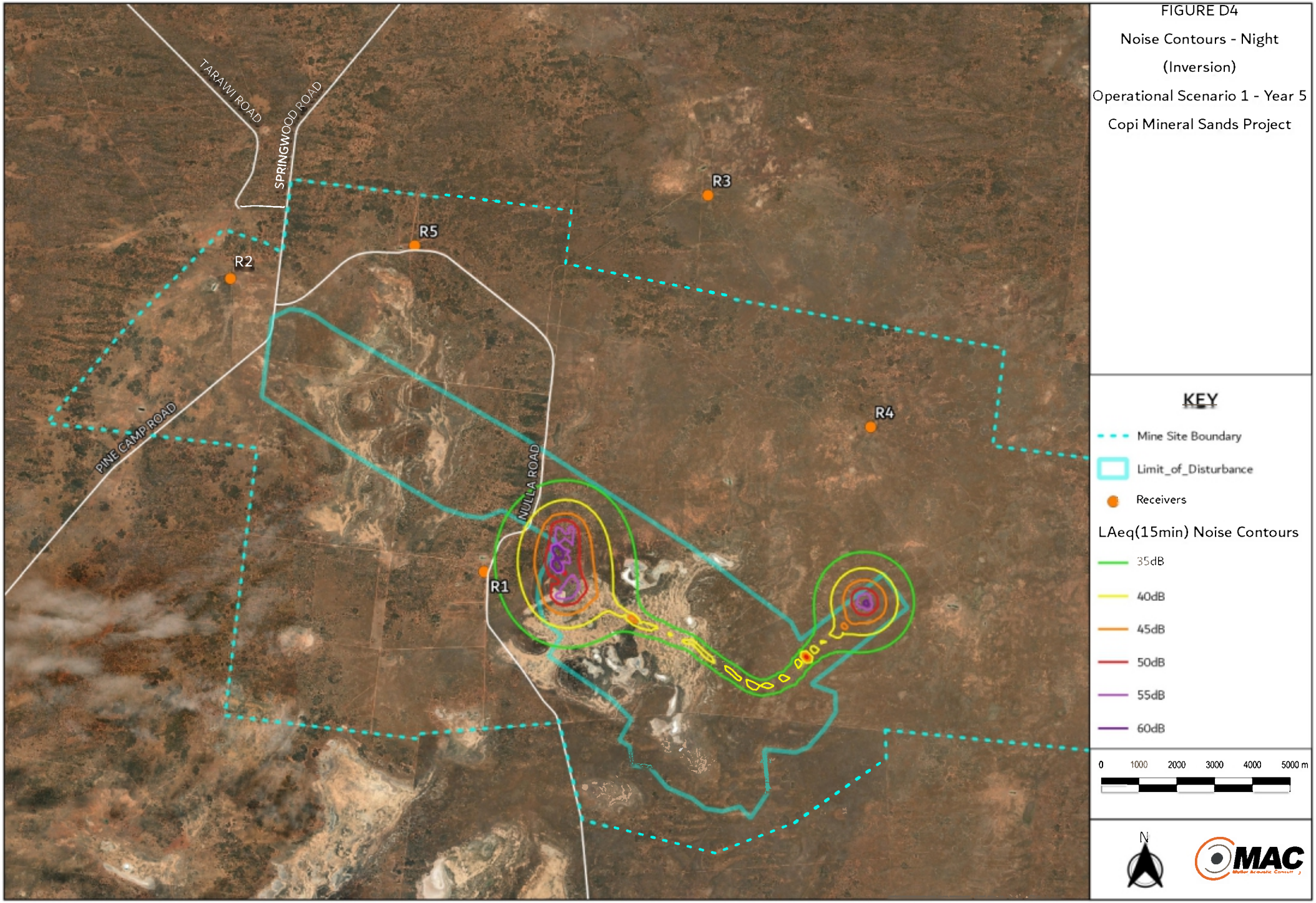


FIGURE D4

Noise Contours - Night (Inversion)

Operational Scenario 1 - Year 5

Copi Mineral Sands Project

KEY

- Mine Site Boundary
- Limit_of_Disturbance
- Receivers

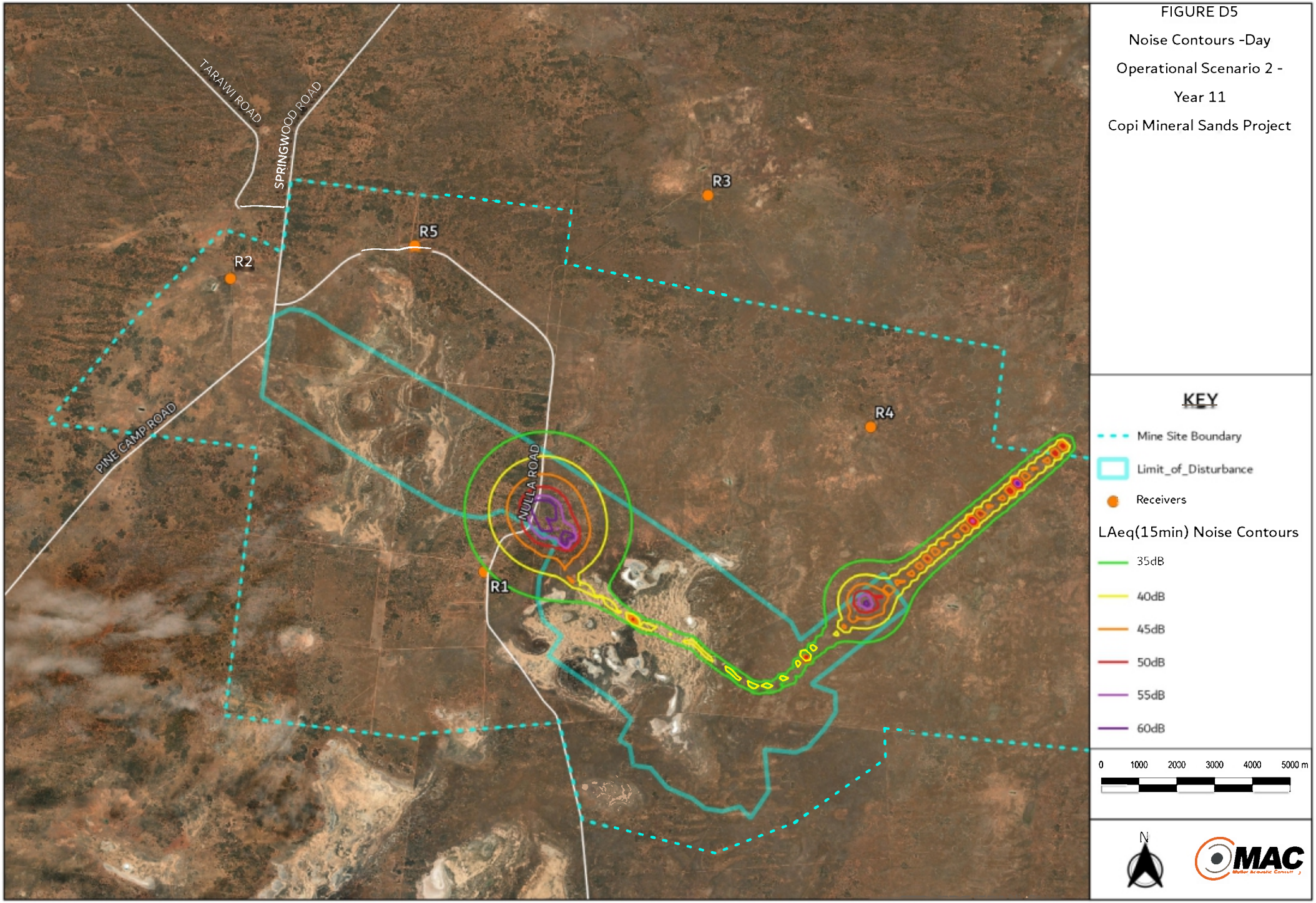
LAeq(15min) Noise Contours

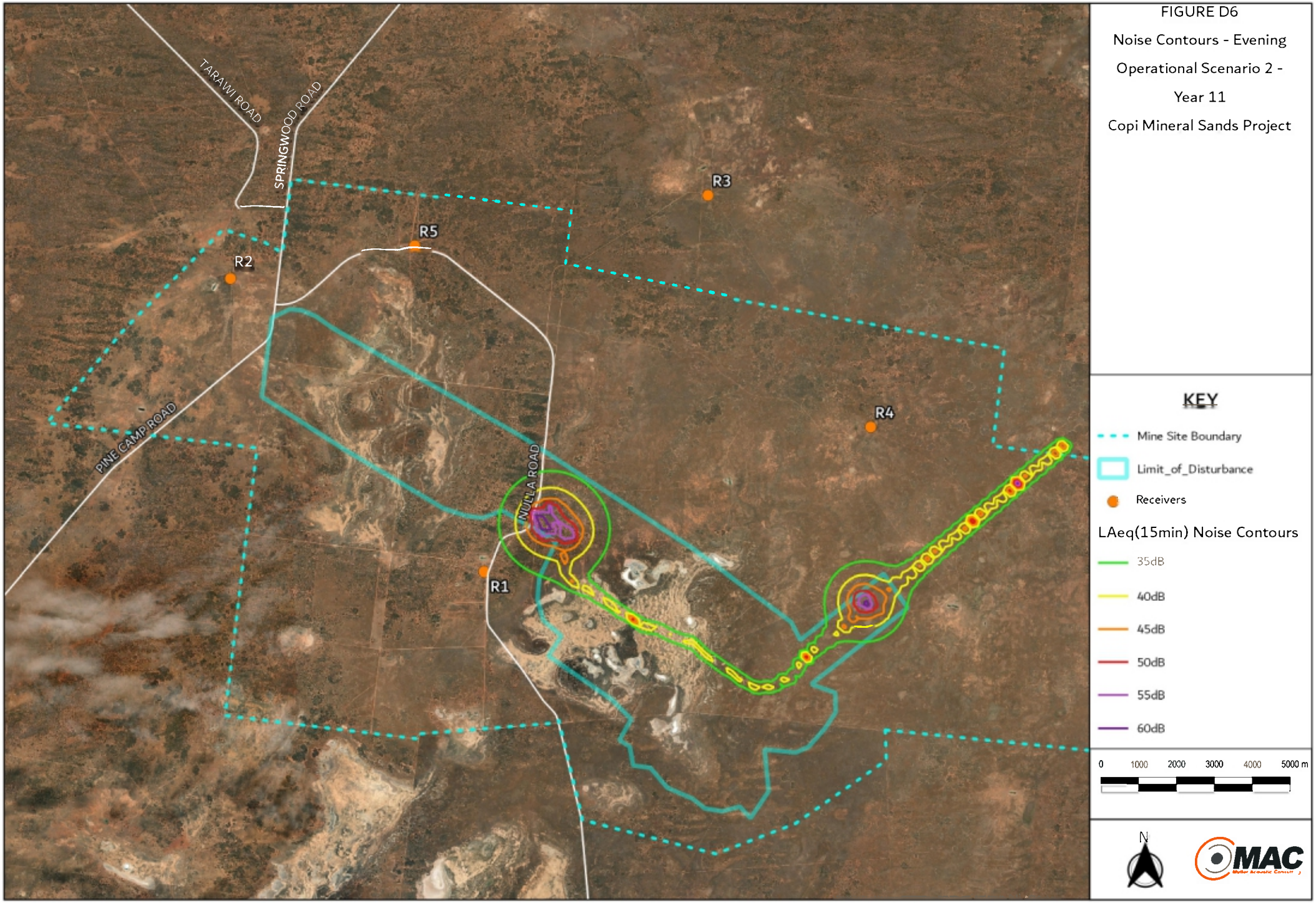
- 35dB
- 40dB
- 45dB
- 50dB
- 55dB
- 60dB

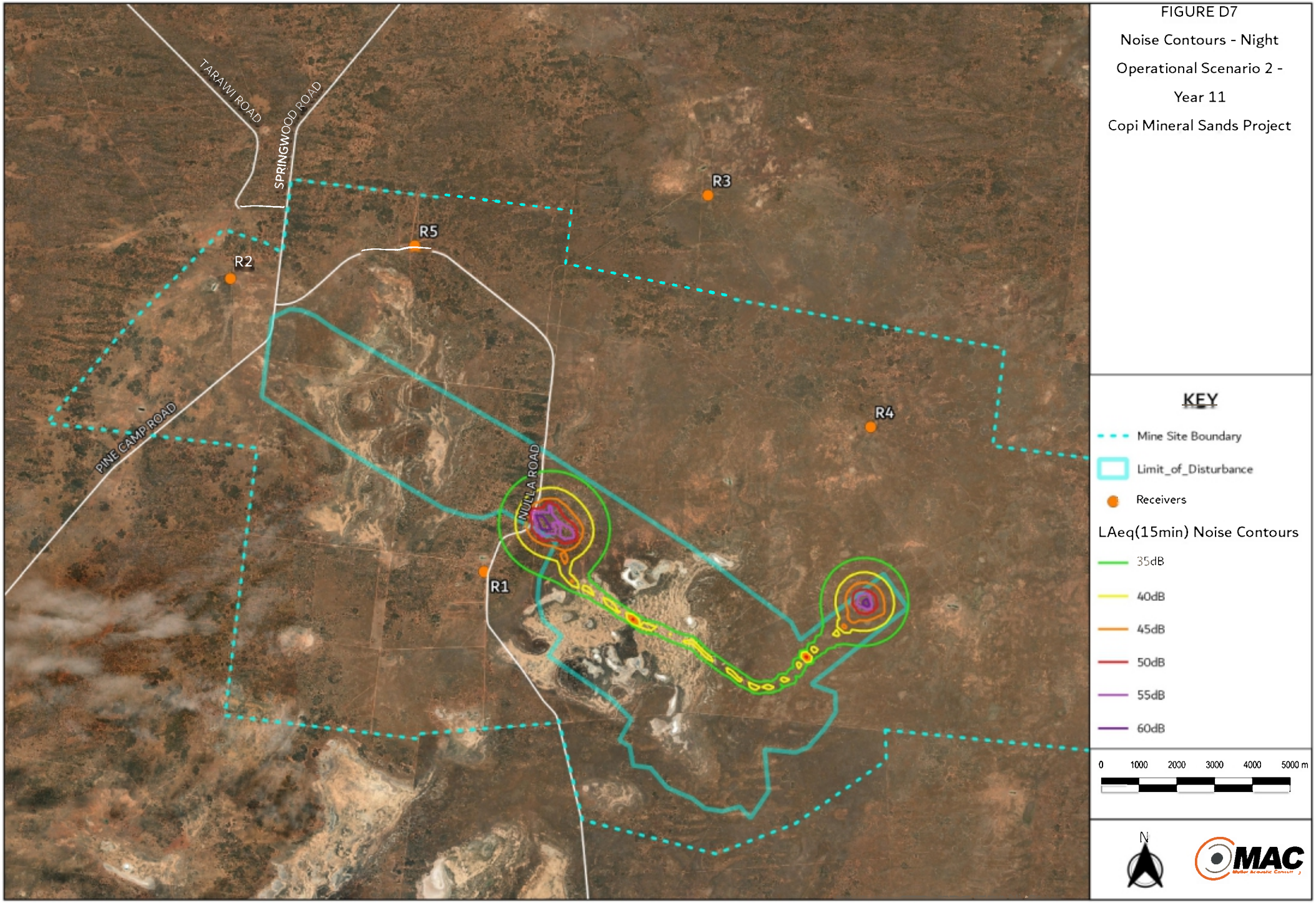
0 1000 2000 3000 4000 5000 m

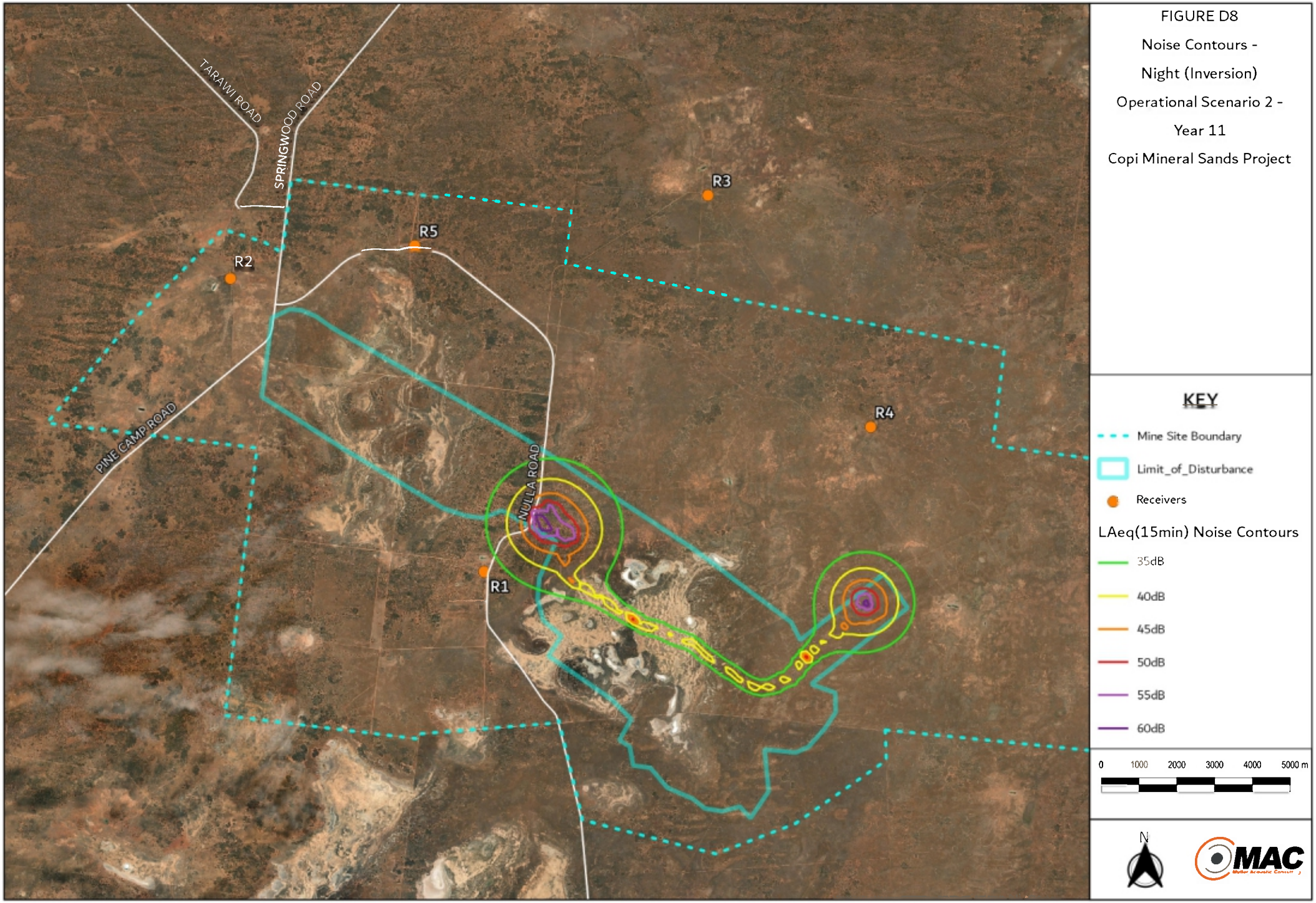
N

MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D5
Noise Contours -Day
Operational Scenario 2 -
Year 11
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D6
Noise Contours - Evening
Operational Scenario 2 -
Year 11
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D7
Noise Contours - Night
Operational Scenario 2 -
Year 11
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D8
Noise Contours -
Night (Inversion)
Operational Scenario 2 -
Year 11
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0
1000
2000
3000
4000
5000 m
N
MAC

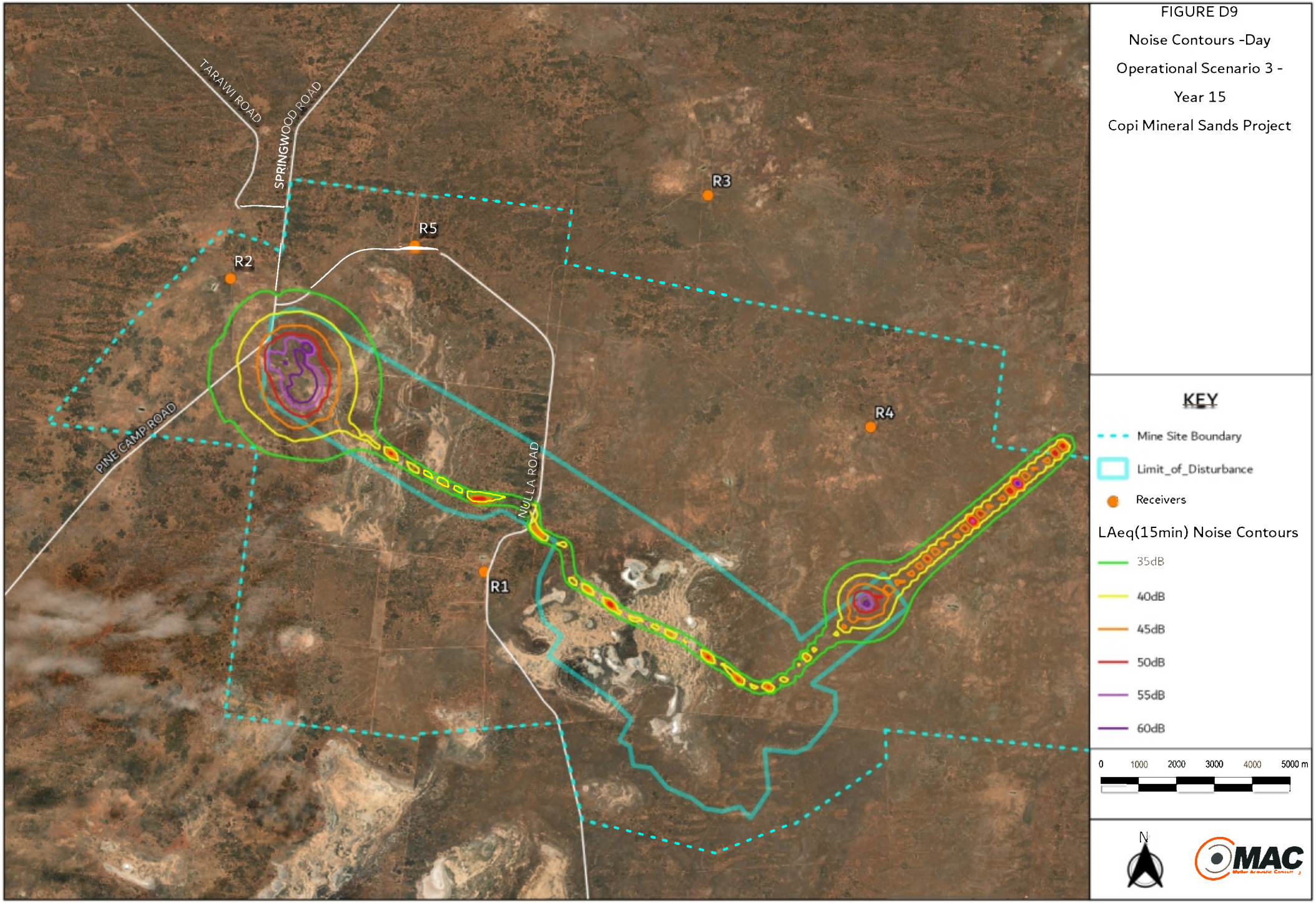


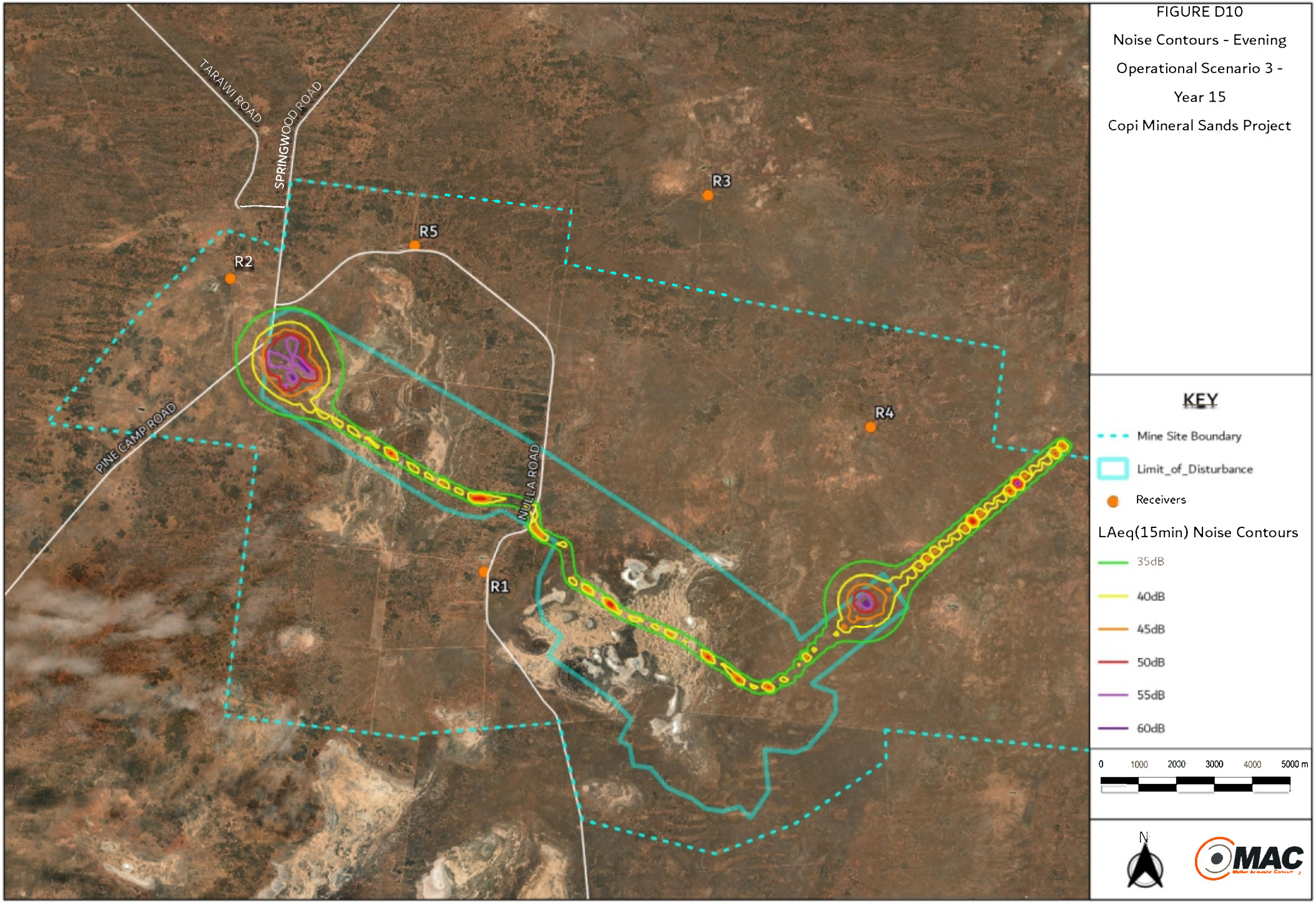
FIGURE D9

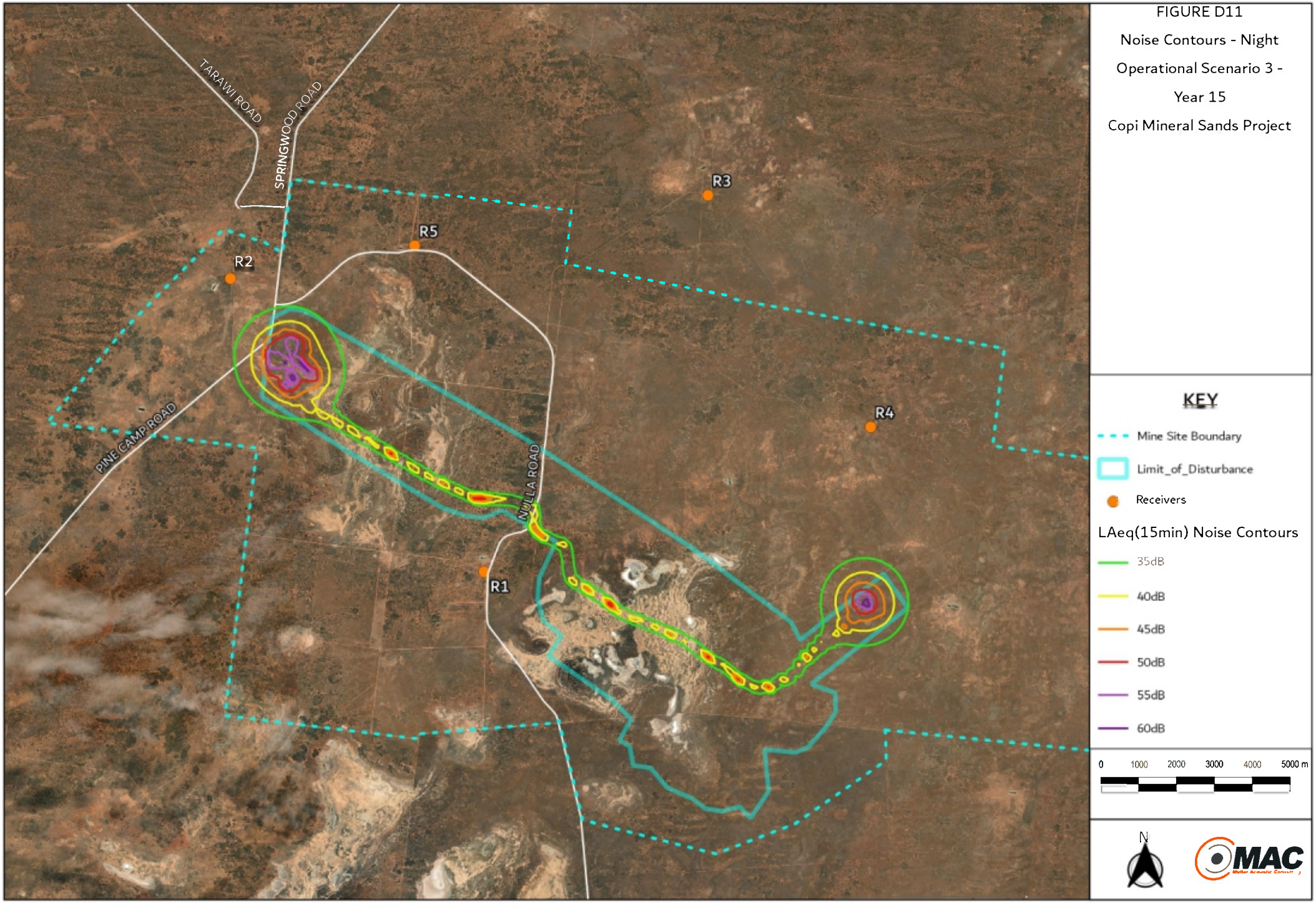
Noise Contours -Day

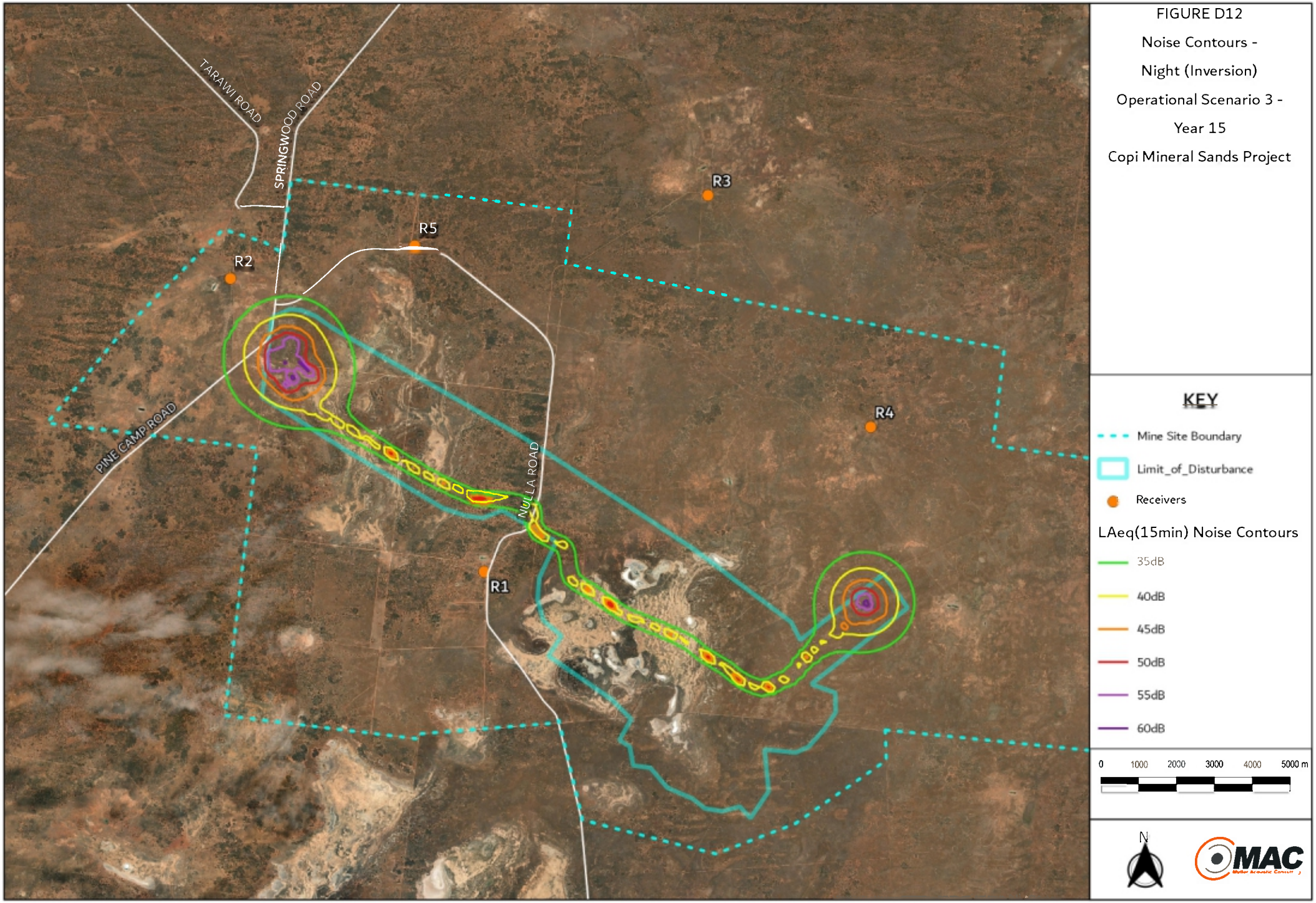
Operational Scenario 3 -

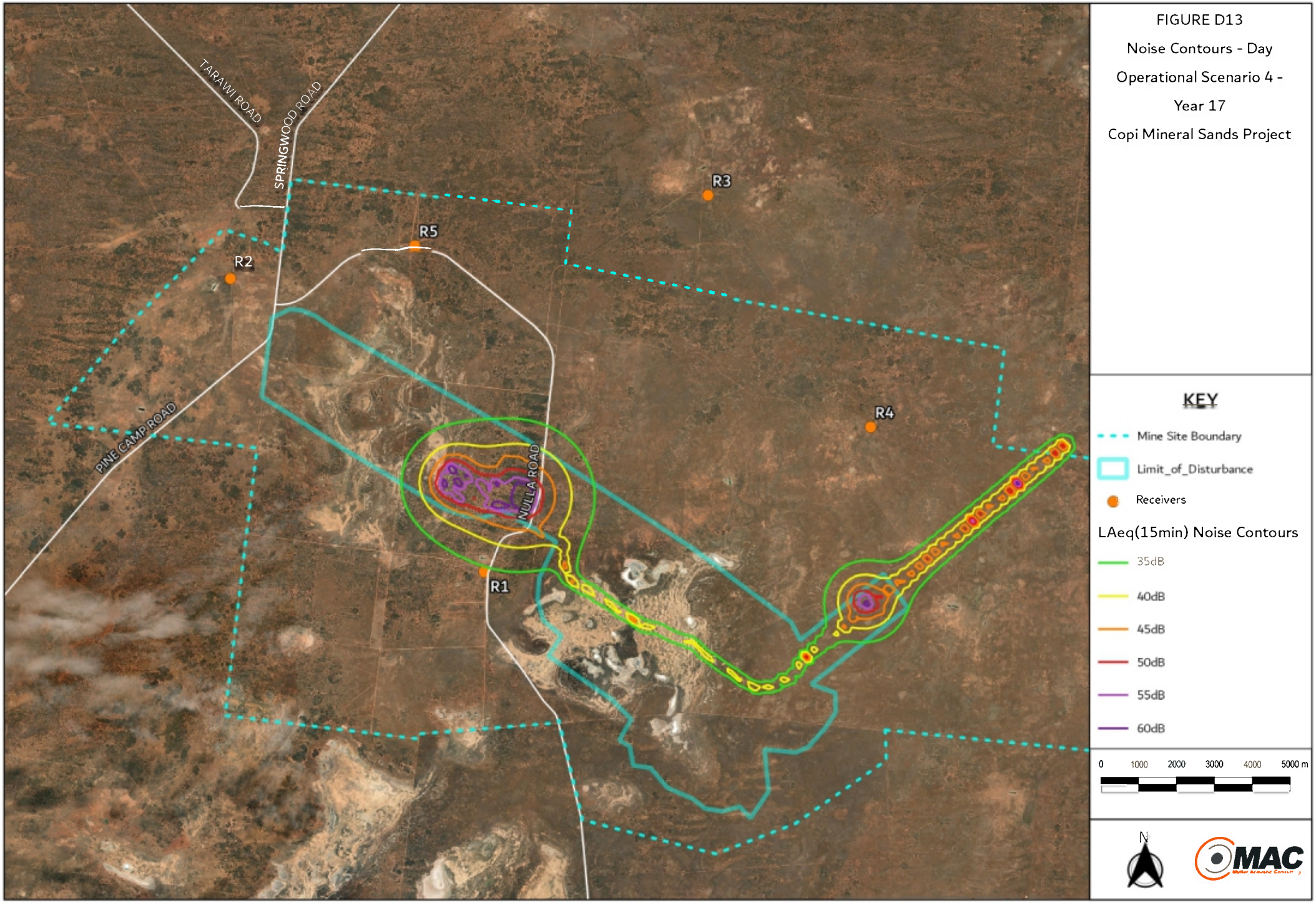
Year 15

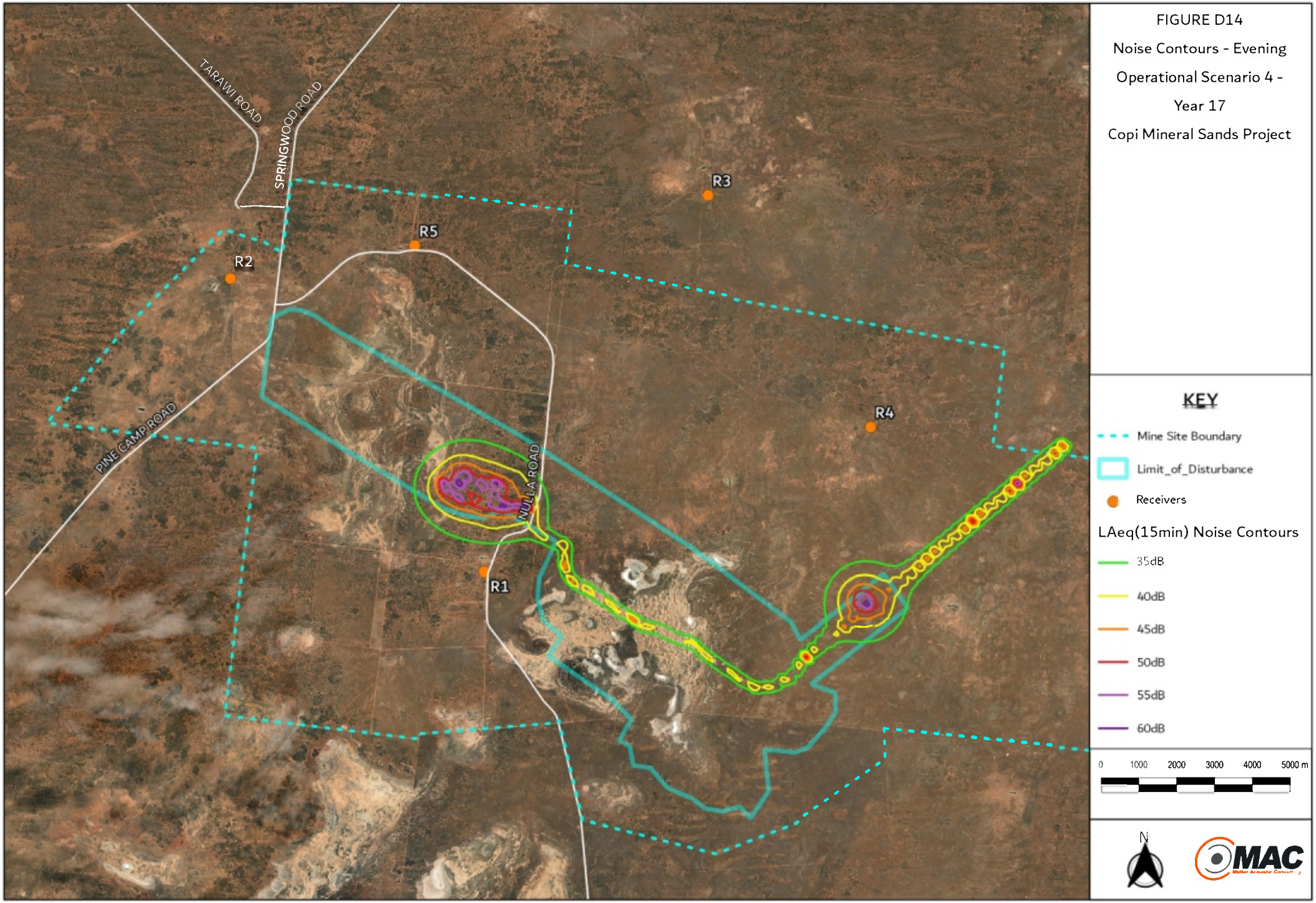
Copi Mineral Sands Project

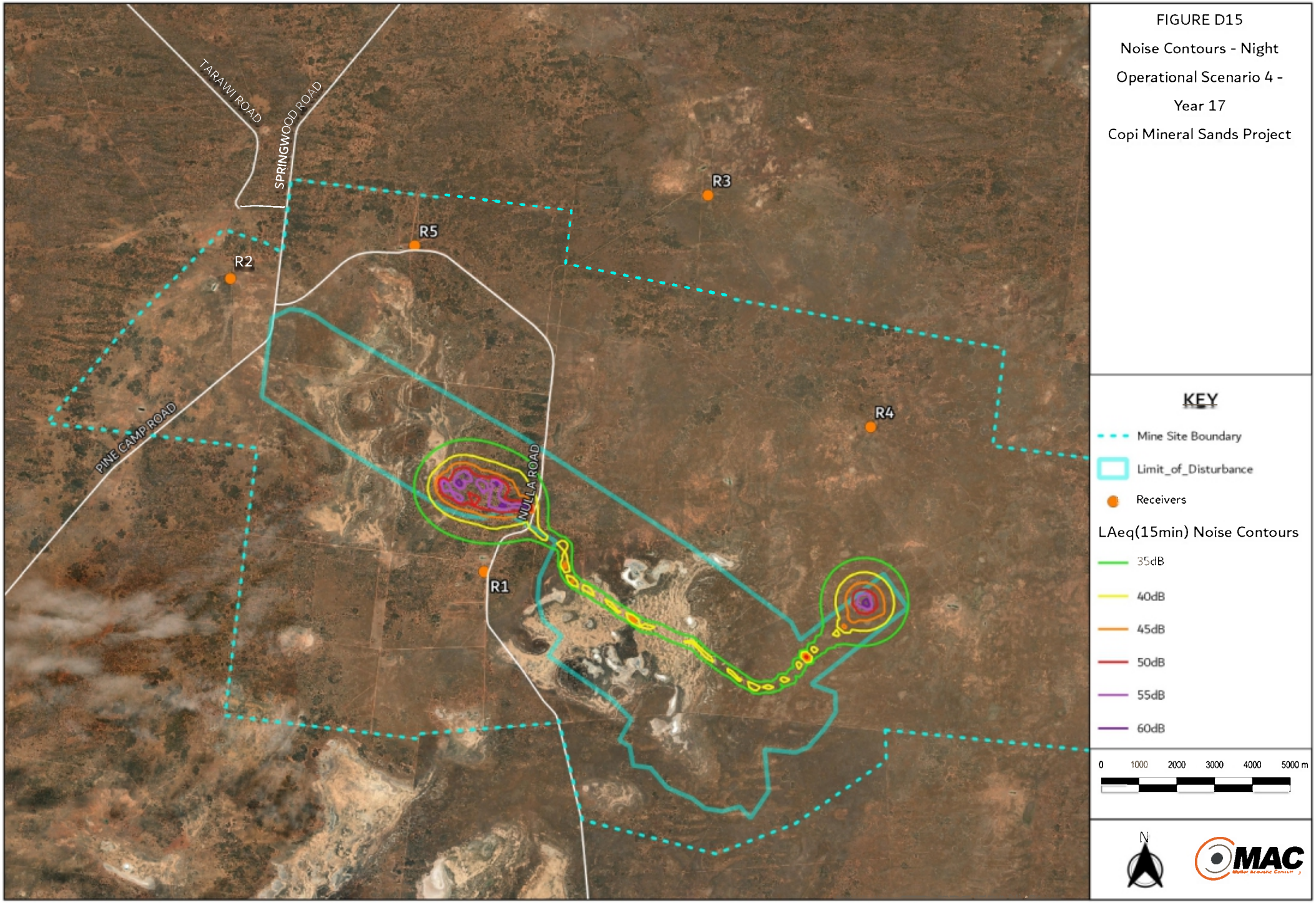

TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D10
Noise Contours - Evening
Operational Scenario 3 -
Year 15
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0
1000
2000
3000
4000
5000 m
N
MAC

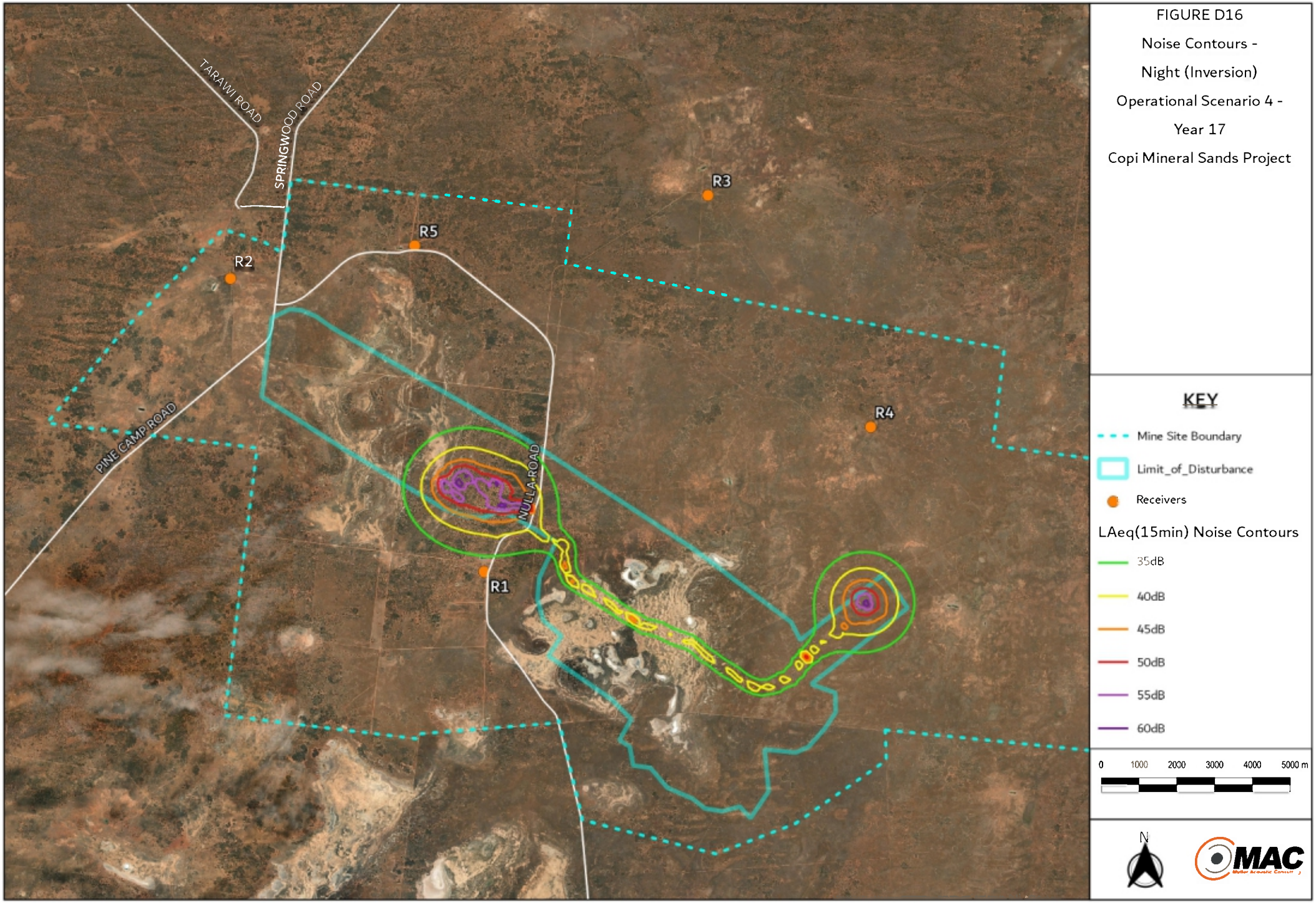

TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D11
Noise Contours - Night
Operational Scenario 3 -
Year 15
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D12
Noise Contours -
Night (Inversion)
Operational Scenario 3 -
Year 15
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0
1000
2000
3000
4000
5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D13
Noise Contours - Day
Operational Scenario 4 -
Year 17
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D14
Noise Contours - Evening
Operational Scenario 4 -
Year 17
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D15
Noise Contours - Night
Operational Scenario 4 -
Year 17
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0 1000 2000 3000 4000 5000 m
N
MAC


TARAWI ROAD
SPRINGWOOD ROAD
PINE CAMP ROAD
NULLA-NULLA ROAD
R1
R2
R3
R4
R5
FIGURE D16
Noise Contours -
Night (Inversion)
Operational Scenario 4 -
Year 17
Copi Mineral Sands Project
KEY
Mine Site Boundary
Limit_of_Disturbance
Receivers
LAeq(15min) Noise Contours
35dB
40dB
45dB
50dB
55dB
60dB
0
1000
2000
3000
4000
5000 m
N
MAC

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