Appendix 5

Noise Assessment

prepared by

Muller Acoustic Consulting Pty Ltd

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Noise Assessment

Dubbo Project
Toongi, NSW

Prepared for: Australian Strategic Materials (Holdings) Ltd
March 2022
MAC211440-01RP1V1

Muller Acoustic Consulting

Document Information

Noise Assessment

Dubbo Project

Toongi, NSW

Prepared for: Australian Strategic Materials (Holdings) Ltd

C/- R.W. Corkery & Co Pty Limited

62 Hill Street

Orange NSW 2800

Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

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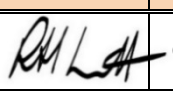
MAC211440-01RP1V1	Final	8 March 2022	Rod Linnett		Oliver Muller	

CONTENTS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by RW Corkery & Co Pty Limited (RWC) on behalf of Australian Strategic Materials (Holdings) Ltd (ASM) to prepare a Noise Assessment (NA) to quantify emissions from the proposed Modification to the approved Dubbo Project (previously known as the Dubbo Zirconia Project). The Dubbo Project (ie the 'project') is situated near the village of Toongi, approximately 25km south of Dubbo, NSW.

This assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECC), NSW Interim Construction Noise Guideline (ICNG), 2009;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011;
- NSW Department of Environment and Conservation (DEC) – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW vibration guideline), 2006;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- International Organisation for Standardisation (ISO) 9613-1:1993 (ISO9613:1) - Acoustics - Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere;
- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation;
- Standards Australia AS/NZS 2107:2016 (AS2107) – Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors; and
- ISO/TR 17534-3 - Acoustics — Software for the calculation of sound outdoors — Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1.

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

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2 Project Description

2.1 Project Background

ASM owns the approved Dubbo Project (previously referred to as the Dubbo Zirconia Project), located within ML1724 (coincident with the approved Dubbo Project Site Boundary). The Dubbo Project, classified as State Significant Development in accordance with State Environmental Planning Policy (State and Regional Development) 2011, was approved under State Significant Development (SSD) Consent SSD-5251 which was granted on 28 May 2015.

The approved activities include the following:

- Mining and extraction of approximately 19.5Mt of ore at a maximum rate of 1 million tonnes per annum (Mtpa) from a shallow open cut developed to a maximum depth of 32m (355m AHD) until 31 December 2037.
- Extraction and placement of approximately 3.5Mt of waste rock within a small Waste Rock Emplacement (WRE) to the southwest of the open cut.
- Haulage of ore to a Run-of-Mine (ROM) Pad for crushing and grinding.
- Processing of the crushed and ground ore using the following methodology.
    - Production of sulphuric acid, sulphation roast of ore and leaching to dissolve sulphated metals.
    - Solvent extraction, precipitation, thickening, washing and drying of the various rare metals and rare earth element (REE) products.
- Construction and operation of a rail siding from the Toongi-Dubbo Rail Line and a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch.
- Transportation by rail, including despatch of up to three (3) trains from the site per week and up to one (1) loaded train per day.
- Transportation by road via the public road network, with Obley Road and Toongi Road to be upgraded (approximately 22km length) to accommodate heavy vehicle traffic.
    - Receive and despatch up to 75 trucks to or from the Project Site per day and up to 16 trucks per hour.
- Mixing and neutralisation of solid residues produced by the processing of the ore with crushed limestone and transportation via a conveyor to a Solid Residue Storage Facility (SRSF).

- Pumping of water used in the processing operations, which cannot be recycled, to a Liquid Residue Storage Facility (LRSF), comprising a series of terraced and lined crystallisation cells.
- Recovery and disposal of an estimated 6.7Mt of salt, which would accumulate within the LRSF, within a series of Salt Encapsulation Cells adjoining the WRE and SRSF.
- Other ancillary activities including equipment maintenance, clearing and stripping of the areas to be disturbed and rehabilitation activities.
- Construction of the Macquarie River Water Pipeline and pumping station.
- Refurbishment of the Toongi-Dubbo Rail Line (approximately 27km length), including upgrade of the Toongi to Dubbo section to a Class 1 track and replacement, upgrade or reinstatement of associated affected infrastructure (e.g. bridges, culverts, level crossings).
- Construction of a natural gas pipeline between the Central West Pipeline at Purvis Lane, Dubbo, and the Project Site.

2.1.1 Approved Activities & Operating Hours

Table 1 presents the approved operating hours for the Dubbo Project.

Table 1 Approved Activities & Operating Hours	
Activity	Operating Hours/ Conditions
Extractive operations	7:00am to 6:00pm, Monday to Friday. 8:00am to 5:00pm, Saturday. No activities on Sundays or Public Holidays.
Ore processing & receipt of processing reagents.	24 hours a day, 7 days a week.
Construction of linear infrastructure	7:00am to 6:00pm, Monday to Friday 8:00am to 1:00pm, Saturday No construction on Sundays or Public Holidays
Other construction activities	7:00am to 6:00pm, Monday to Friday 8:00am to 1:00pm, Saturday[1]
Despatch of refined ore products and receipt of limestone products[2]	6:00am to 10:00pm, Monday to Friday. 8:00am to 5:00pm, Saturday. No activities on Sundays or Public Holidays.
Road transport[3]	Up to 75 trucks dispatched and received per day or up to 16 trucks per hours
Rail transport	Dispatch up to 3 trains per week or 1 train per day

Note 1: No construction to be undertaken on Sundays or Public Holidays unless noise from these activities does not result in any exceedances of 35dB LAeq(15min) at any privately-owned residence.

Note 2: Condition 8 of Schedule 2 of SSD-5251 requires that "*the Applicant shall use all reasonable endeavours to:*

a) restrict train movements to and from the site to between the hours of 9:30am and 2:30pm and 4:30pm and 9:00pm;

b) minimise the unloading and loading of train wagons on the site during the night; and

c) minimise the transport of material by road between the Newell Highway and the site during the night.

Note 3: Does not include receipt or dispatch of heavy vehicles associated with general maintenance or waste collection.

2.2 Proposed Activities & Operating Hours – Modification 1

Following the granting of SSD-5251 on 28 May 2015, a range of further studies and investigations optimising the design and operation of the Project. As a result of the studies several adjustments to the approved site layout and operations which are required to maximise the efficiency of mining, processing and transportation operations on site. **Figure 1** and **Appendix B** presents the proposed Project Site and Processing Plant layouts.

The Proposed Modification seeks consent for the following.

- Construction and operation of:
  - a Chlor-alkali Plant for the production of hydrochloric acid and sodium hydroxide for use in on-site processing operations;
  - a brine concentrator to maximise water recovery; and
  - a conveyor between the Processing Plant and Administration Area and the Salt Encapsulation Cells.

- Reclassification of various approved disturbance areas to permit alternate uses.
- Relocation of:
  - the Salt Encapsulation Cells from the approved location southwest of the Open Cut to the approved location of the Liquid Residue Storage Facility (LRSF) Area 3;
  - the Solid Residue Storage Facility (SRSF) from the approved location west of the Waste Rock Emplacement (WRE) to the approved location of the LRSF Area 5; and
  - the Rail Container Laydown and Storage Area from the approved location to an area immediately to the west of the approved location.
- Realignment of an approximately 1,500m section of the approved Macquarie River Water Pipeline, located entirely within the Project Site, to accommodate proposed changes to the Project Site layout.
- Adjustments to the layout of the approved Processing Plant and Administration Area.
- Realignment of sections the approved Macquarie River Water Pipeline, located entirely within the Project Site.
- A range of adjustments to the approved Project Site layout.
- Extended construction hours for non-linear infrastructure to 24-hours per day, seven days per week.
- Extension of the Project life by eight years from 31 December 2037 to 31 December 2045.

The Proposed Modification would not alter approved linear infrastructure outside of the Project Site. There will be no change in operational road or rail dispatches to that approved in Consent SSD-5251.

2.3 Scope of the Assessment

The NA has quantified potential noise emissions from the following project aspects:

- Operational Activities:
  - Extractive operations.
  - Processing of ore.
  - Chemical plants.
  - Tailings storage.
- Construction activities in the following areas:
  - Processing and chemical plant.

- Rail container laydown and storage area.
- Tailing storage facilities.
- Waste rock emplacement and pit development.
- Establishment of soil stockpiles.
- Mine infrastructure area.

The following aspects are unchanged from the approved project and hence, no further assessment has been completed:

- Construction of linear infrastructure outside the project boundary;
- Dispatch and receival of heavy vehicles to/from site;
- Rail transport; and
- Blasting emissions.

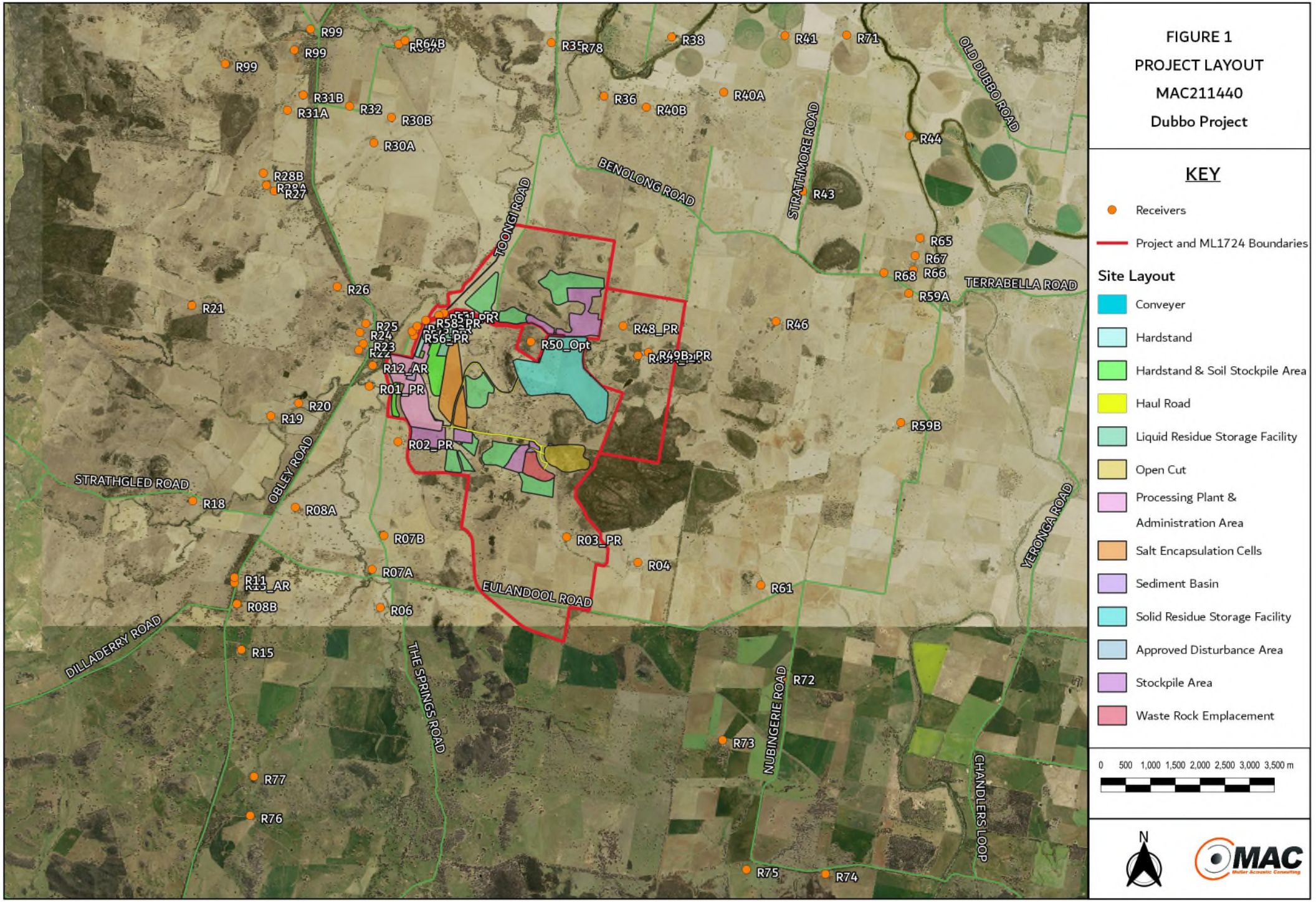
FIGURE 1
PROJECT LAYOUT
MAC211440
Dubbo Project
KEY
Receivers
Project and ML1724 Boundaries
Site Layout
Conveyer
Hardstand
Hardstand & Soil Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Sediment Basin
Solid Residue Storage Facility
Approved Disturbance Area
Stockpile Area
Waste Rock Emplacement
0 500 1,000 1,500 2,000 2,500 3,000 3,500 m
N
MAC
TOONGI ROAD
BENOLONG ROAD
STRATHMORE ROAD
OLD DUBBO ROAD
TERRABELLA ROAD
OBLEY ROAD
STRATHGLED ROAD
EULANDOOL ROAD
YERONGA ROAD
DILLADERRY ROAD
THE SPRINGS ROAD
NUBINGERIE ROAD
CHANDLERS LOOP
R01_PR
R02_PR
R03_PR
R04
R12_AR
R48_PR
R50_Opt
R56_PR
R58_PR

2.4 Receiver Review

A review of residential receivers in proximity to the project has been completed and are summarised in **Table 2. Figure 1** provides a locality plan showing the position of these receivers in relation to the project, whereas **Figure 2** shows those receivers nearest to the project.

Table 2 Receiver Locations

Receiver	Distance to Processing Area, m	Distance to Open Cut, m	Coordinates (GDA94/MGA55)	
			Easting, m	Northing, m
R01_PR[1]	1,215	4,367	648845	6408321
R02_PR[1]	656	3,586	649424	6407205
R03_PR[1]	3,798	1,714	652823	6405282
R04	5,258	2,545	654258	6404772
R06	3,901	5,026	649065	6403864
R07A	3,198	4,729	648902	6404633
R07B	2,480	4,211	649139	6405312
R08A	3,096	5,755	647355	6405883
R08B	5,262	7,477	646176	6403938
R11	4,936	7,323	646126	6404470
R12_AR[1]	1,432	4,449	648915	6408740
R13_AR[1]	5,006	7,360	646127	6404363
R15	5,899	7,820	646267	6403014
R18	4,883	7,778	645286	6406014
R19	3,017	6,187	646860	6407725
R20	2,476	5,672	647419	6407981
R21	5,134	8,280	645271	6409949
R22	1,853	4,836	648630	6409050
R23	1,889	4,808	648722	6409175
R24	2,114	4,976	648655	6409405
R25	2,202	4,965	648773	6409586
R26	3,136	5,853	648198	6410328
R27	5,442	8,039	646932	6412256
R28A	5,627	8,237	646770	6412371
R28B	5,863	8,443	646710	6412614
R30A	5,624	7,446	648938	6413225
R30B	6,086	7,704	649291	6413737
R31A	6,759	9,018	647194	6413883
R31B	6,927	9,058	647513	6414190
R32	6,444	8,332	648449	6413964
R35	8,011	8,271	652515	6415243
R36	7,467	7,202	653577	6414166

Table 2 Receiver Locations				
Receiver	Distance to Processing Area, m	Distance to Open Cut, m	Coordinates (GDA94/MGA55)	
			Easting, m	Northing, m
R38	9,197	8,592	654941	6415357
R40A	8,970	7,848	655990	6414243
R40B	7,743	7,101	654430	6413942
R41	10,647	9,400	657224	6415385
R43	8,959	6,977	657582	6412251
R44	11,380	9,275	659731	6413370
R46	7,426	4,826	657042	6409628
R48_PR[1]	4,490	2,727	653963	6409538
R49A_PR[1]	4,561	2,325	654259	6408943
R49B_PR[1]	4,781	2,494	654471	6409003
R50_Opt[2]	2,706	2,409	652101	6409221
R51_PR	2,101	3,900	650248	6409748
R51_PR	2,168	3,865	650348	6409795
R54_PR	1,754	4,100	649708	6409426
R55_PR	1,851	4,082	649810	6409530
R56_PR	1,671	4,024	649743	6409345
R58_PR	1,973	4,027	649983	6409650
R59A	10,159	7,443	659720	6410193
R59B	9,684	6,585	659560	6407588
R61	7,640	4,590	656736	6404315
R64A	7,545	8,964	649440	6415212
R64B	7,613	8,983	649566	6415286
R65	10,704	8,179	659947	6411308
R66	10,375	7,739	659813	6410665
R67	10,493	7,909	659847	6410950
R68	9,788	7,191	659217	6410606
R71	11,549	10,030	658470	6415396
R72	8,972	6,153	657179	6402467
R73	8,898	6,508	655967	6401193
R74	12,288	9,872	658041	6398496
R75	11,220	9,080	656448	6398585
R76	8,711	9,823	646445	6399673
R77	7,963	9,200	646520	6400459
R78	8,104	8,209	652907	6415195

Note 1: PR indicates Project Related receivers; AR indicates Active Recreation receiver (R12, R13); all other receivers are Rural Residential receivers.

Note 2: Receiver has option to be acquired on request.

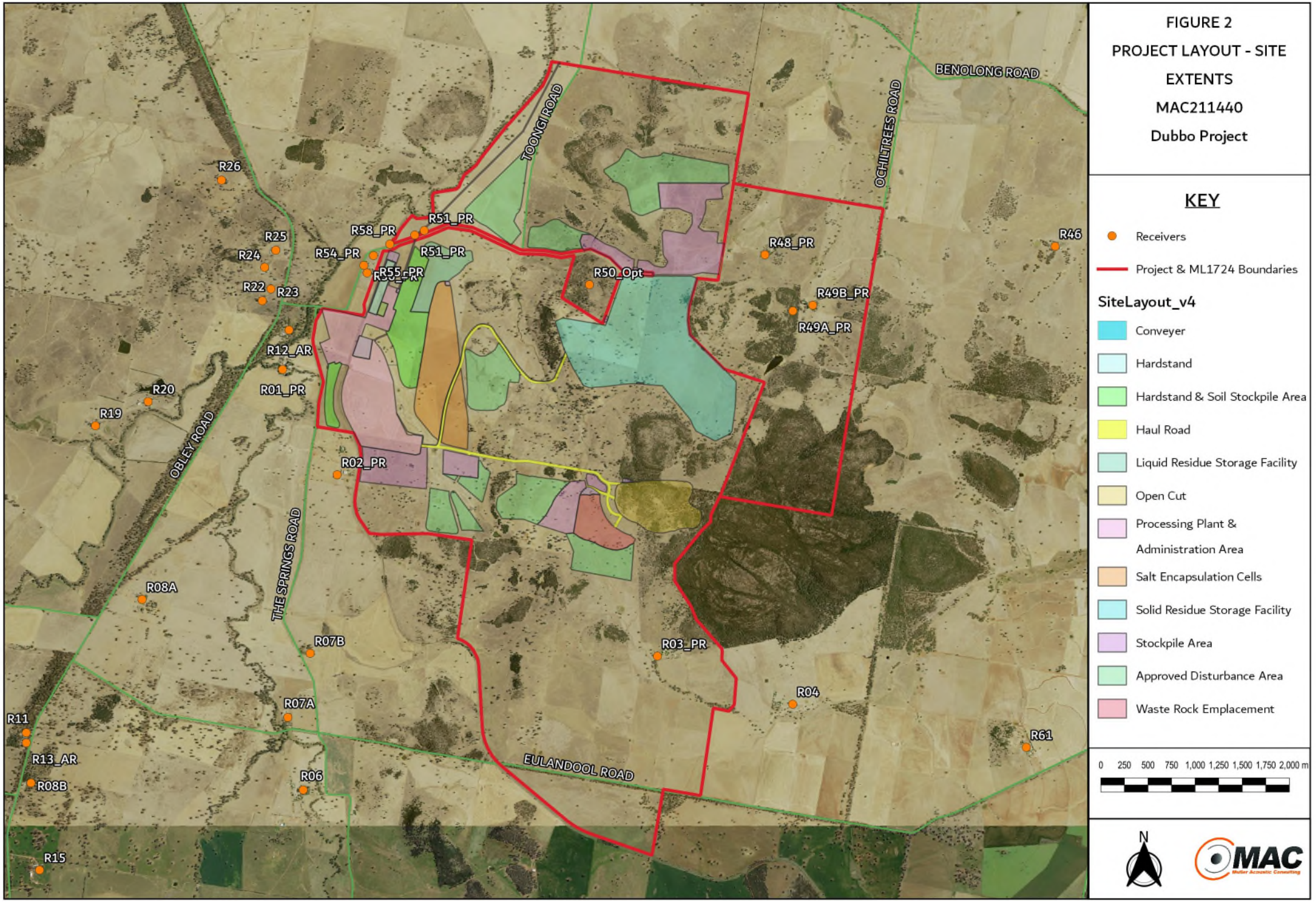
FIGURE 2
PROJECT LAYOUT - SITE EXTENTS
MAC211440
Dubbo Project
KEY
Receivers
Project & ML1724 Boundaries
SiteLayout_v4
Conveyer
Hardstand
Hardstand & Soil Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Approved Disturbance Area
Waste Rock Emplacement
0 250 500 750 1,000 1,250 1,500 1,750 2,000 m
N
MAC
Muller Acoustic Consulting
BENOLONG ROAD
TOONGI ROAD
OCHILTREES ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R22
R23
R12_AR
R01_PR
R20
R19
R58_PR
R51_PR
R54_PR
R55_PR
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R48_PR
R50_Opt
R49B_PR
R49A_PR
R46
R03_PR
R04
R61

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3 Noise Policy and Guidelines

3.1 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.

3.1.1 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.

3.1.2 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.

3.1.3 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.

3.1.4 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.

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 3**.

Table 3 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: 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.

3.1.5 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.

3.2 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; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This NA has adopted a quantitative assessment approach which is summarised in **Figure 3.** The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

3.2.1 Standard Hours for Construction

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

Table 4 Recommended Standard Hours for Construction

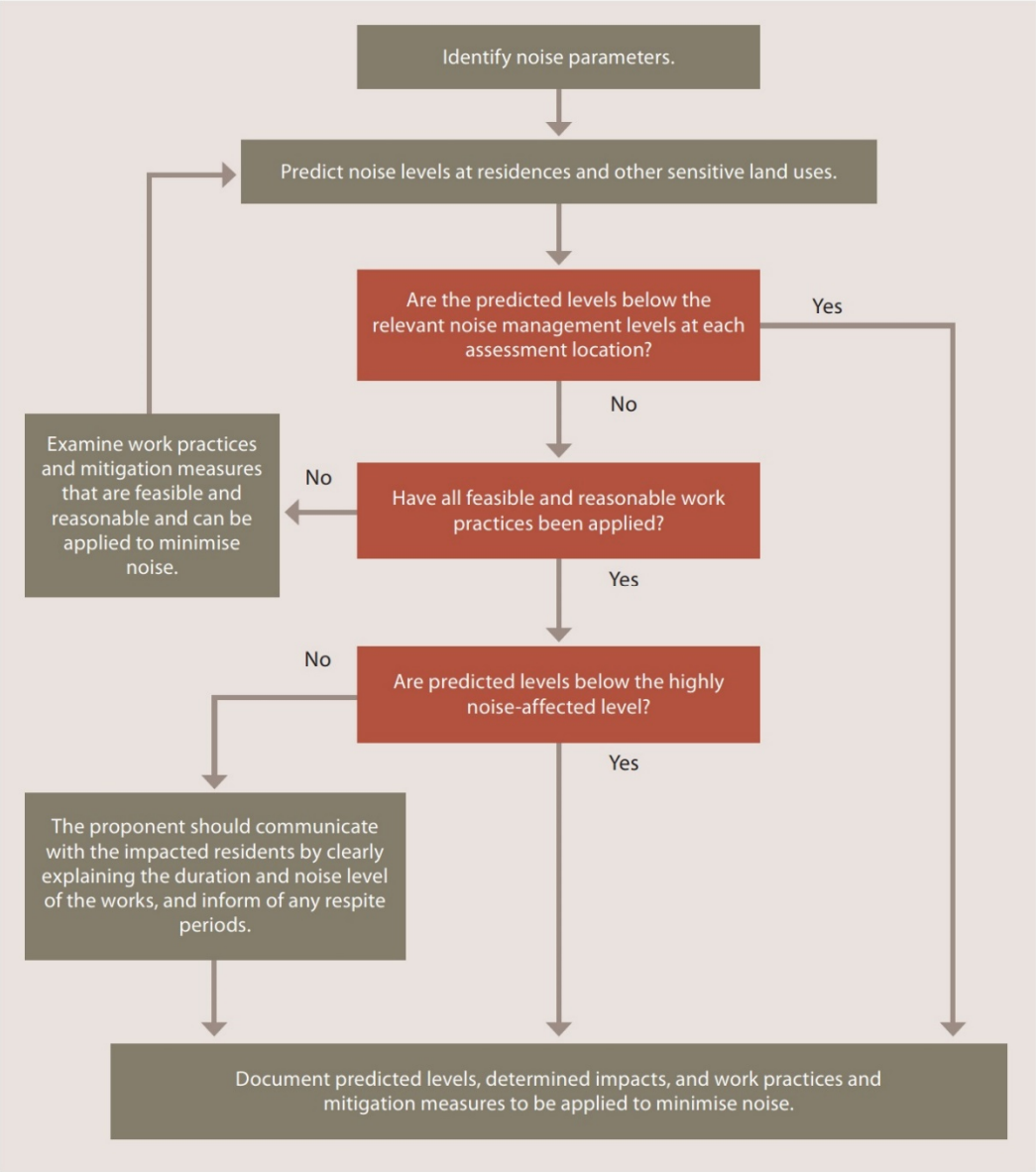
Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

3.2.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). It is proposed that general construction works (concrete pours, steel installation and erection of buildings) will be extended construction hours to 24 hours per day, seven days per week in the following areas:

- Processing Plant and Administration Area;
- Chlor-alkali Plant;
- Rail Container Laydown and Storage Area; and
- Laydown Yards / Growth Medium Stockpile Areas immediately to the east and west of the Processing Plant and Administration Area.

Figure 3 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.2.3 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 (NML) 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.

3.2.4 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.

3.3 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 provides guidance for consent authorities as to when voluntary mitigation or voluntary acquisition rights are to be applied to reduce operational noise impacts from a development on privately owned land. The policy does not apply to construction noise impacts, impacts from the public road or rail network or modifications to existing developments with legacy noise issues.

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 6.

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.

Table 6 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 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.

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4 Assessment Criteria

4.1 Background Noise levels

The assessment has adopted the minimum assumed Rating Background Noise Levels (RBLs) outlined in Section 2.3 of the Noise Policy for Industry (NPI, 2017) and are reproduced in **Table 7**.

Table 7 Default RBLs

Period[1]	Adopted RBL, dB LA_{90}
Day	35
Evening	30
Night	30

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 Operational Noise Criteria

4.2.1 Intrusiveness Noise Levels

The PINL for the project are presented in **Table 8** and have been determined based on the RBL +5dBA and only apply to residential receivers.

Table 8 Project Intrusiveness Noise Levels

Receiver Type	Period[1]	Measured RBL dB LA_{90}	Adopted RBL dB LA_{90}	PINL dB $LA_{eq(15min)}$
Rural Residential	Day	N/A	35	40
	Evening	N/A	30	35
	Night	N/A	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.

4.2.2 Amenity Noise Levels and Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 9**.

Table 9 Amenity Noise Levels and Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	NPI Recommended ANL dB $LA_{eq(period)}$	ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(15min)}$[3]
Residential	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
Active Recreation	All	When in use	55	50	53

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 Amenity Noise Level equals the Amenity Noise Level -5dB as there is other industry in the area.

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.

4.2.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 10** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 10 Project Noise Trigger Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	PINL dB $LA_{eq(15min)}$	PANL dB $LA_{eq(15min)}$	PNTL dB $LA_{eq(15min)}$
Residential	Rural	Day	40	48	40
		Evening	35	43	35
		Night	35	38	35
Active Recreation	All	When in Use	N/A	53	53

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: External level based on 10dB with windows open for adequate ventilation (NPI).

4.2.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 11** 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 11 Maximum Noise Trigger Level

Residential Receivers			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} 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.

4.3 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) are presented in **Table 12**.

Table 12 Construction Noise Management Levels

Receiver Type	Assessment Period[1]	Adopted RBL dB LA_{90}	NML dB $L_{Aeq(15min)}$
Rural Residential	Standard Hours	35	45 (RBL+10dBA)
	OOH	30	35 (RBL +5dBA) 52dB L_{Amax}
Active Recreation	When in use	N/A	65 (external)

Note 1: Refer Table 4 for Standard Recommended Hours for Construction.

Note 2: External level based on 10dB with windows open for adequate ventilation (ICNG).

4.3.1 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. The ICNG does not provide criteria for sleep disturbance and hence the NPI maximum noise trigger levels have been adopted. Given that construction activities are anticipated to occur outside standard construction hours, maximum noise level events from construction would be expected to meet the criteria outlined in **Table 11**.

4.4 Construction Vibration

Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline* (the 'Guideline') provides guidance on determining effects of vibration on buildings occupants. The guideline does not address vibration induced damage to structures, blast induced vibration effects or structure borne noise effects.

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

The Construction Noise & Vibration Strategy (V4.1 Transport for NSW, 2019) sets out safe working distances to achieve the human response criteria for vibration. The key vibration generating source proposed to be used is a vibratory roller used for road construction. For a large vibratory roller, the Construction Noise Strategy sets a safe working distance of 100m to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest receivers to the project are greater than 100m, human exposure to vibration is anticipated to be minimal. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue and have not been considered further in this assessment.

5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2021.1) 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.

5.1 Assessment Scenarios

5.1.1 Construction

Construction would take up to two years and would take place across a number of areas. Noise associated with the construction activities within the Project Site have been assessed as construction noise against the recommended ICNG criteria (i.e. background + 10 dB(A) criteria) and include the site access road, processing plant and administration area, residue storage facilities (liquid and solid residue) haul roads, open cut pit and waste rock emplacement. Construction activities outside the project boundary include water and gas pipelines, the rail upgrade, bridges, and road upgrade are unchanged from the EIS NA and have not been assessed further.

[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

Therefore, the following construction scenarios have been assessed:

- **Scenario 1** – Construction during standard hours – Processing and chemical plant, rail container laydown and storage area; tailings storage facilities, extraction area, haul roads and waste rock emplacement.
- **Scenario 2** – Out of Hours Construction – Processing and chemical plant, rail container laydown and storage area, and Chlor-alkali plant will consist of three (3) teams consisting of the following equipment:
  - Generator;
  - Lighting set;
  - Welder;
  - Forklift/ telehandler;
  - Crane; and
  - Power Tools.

5.1.2 Operations

The results presented assume the maximum number of plant and equipment are operating simultaneously and at their typical operating noise emission level. In practice, such operating scenarios would rarely occur and hence, noise predictions are conservative.

The main activities that have potential to contribute to the total noise emissions from the project Site, processing and extraction. Extraction would occur during day time only and processing is proposed to occur 24 hours every day.

Therefore, the following operations scenarios have been assessed and are considered representative of the various stages of mining, processing, delivery and dispatch operations over the life of the project:

- **Scenario 3** – Extraction, waste rock emplacement, tailings management, ore processing, chemical plant, rail and road dispatch & receival for Project Year 1 to 5.
- **Scenario 4** – Extraction, waste rock emplacement, tailings management, ore processing, chemical plant, rail and road dispatch & receival for Project Year 5 to10.
- **Scenario 5** - Extraction, waste rock emplacement, tailings management, ore processing, chemical plant, rail and road dispatch & receival for Project Year 15 to 20.

5.2 Sound Power Levels

5.2.1 Operations

Table 13 presents the sound power level for each significant operational noise source. Sound power levels were sourced from MAC's database or from in-field measurements for similar projects.

Table 13 Acoustically Significant Sources - Sound Power Levels dBA (re 10^{-12} Watts) Operations

Item and quantity (per 15 minutes)	Sound Power Level (per item) dB LA_{eq}	Total Modelled Sound Power Level dB $LA_{eq(15min)}$	Source Height[1]
Processing Area			
Rare Earth Refinery	75dBA/m^2	99	2.5m
WTP & Brine Concentrator	75dBA/m^2	98	2.5m
DHZ Zolvent	75dBA/m^2	100	2.5m
Cooling Tower	75dBA/m^2	101	2.5m
WTP & Brine Concentrator	75dBA/m^2	98	2.5m
Nb & LRS Circuits	75dBA/m^2	101	2.5m
Jaw Crusher	124	101[2]	2.5m
Medium Cone Crusher	116	94[2]	2.5m
Fine Cone Crusher	114	91[2]	2.5m
CAT986 Front End Loader	108	108	2.5m
Salt Conveyor	68dBA/m	94	3m
Extraction			
40t Artic Haul Truck (x6)	107	115	1.5m
Blast Hole Drill (x2)	114	117	1.5m
Rockbreaker	121	121	1.5m
CAT D8 Bulldozer	111	111	1.5m
CAT349 Excavator (x3)	110	115	1.5m
Waste Rock Emplacement & Road Maintenance			
CAT D8 Bulldozer	111	111	1.5m
30kL Water Cart	109	109	1.5m
CAT14G Grader	107	107	1.5m
Road/Rail Receival & Dispatch			
Standard Road Truck (25 - 40km/h)	104	104	1.5m
Container Forklift	106	106	1.5m
Light Service Vehicle	76	76	1.5m
Train Idling	100	100	2.5m
Train Arrival/Depart <10km/h	105	105	2m

Note 1: Height above the relative ground or building below source.

Note 2: Mitigated Lw.

Table 14 presents the sound power level for the maximum noise level assessment. Sound power levels were sourced from MAC's database or from in-field measurements for similar projects.

Table 14 Maximum Noise Level Assessment (L_{Amax}), Night time periods (10pm to 7am)

Item and quantity	Sound Power Level (per item)	Source Height[1]
Train Shunt at Rail Siding	118	1.5m
Impact Noise – Processing Area	120	1.5m
Impact Noise – ROM	120	1.5m
Impact Noise – Pit	120	1.5m

Note 1: Height above the relative ground or building below source.

5.2.2 Mitigation Included in Design

Noise modelling has included the mitigation proposed in the EIS NA as follows:

- a partial enclosure/screen of the crushing and ore handling circuit; and
- semi enclosed barrier/screen adjacent to the western side of the primary crusher and ore handling circuit.

5.2.3 Construction

Table 15 presents the sound power level for each noise source modelled in for the construction noise assessment. Sound power levels were sourced from MAC's database or from in-field measurements for similar projects.

Table 15 Acoustically Significant Sources - Sound Power Levels dBA (re 10^{-12} Watts) Construction			
Item and quantity (per 15 minutes)	Sound Power Level (per item) dB LA_{eq}	Total Modelled Sound Power Level dB $LA_{eq(15min)}$	Source Height[1]
Construction - Standard Hours			
30kL Water Cart (x2)	109	112	1.5m
CAT14G Grader (x3)	107	112	1.5m
Compactor (x2)	107	110	1.5m
CAT D8 Bulldozer (x6)	111	119	1.5m
Excavator (x6)	107	115	1.5m
40t Artic Haul Truck (x8)	107	115	1.5m
Front End Loader (x6)	116	124	1.5m
Crane 20t (x2)	105	108	1.5m
Forklift/Telehandler (x2)	87	91	1.5m
Power tools (x3)	97	102	1.5m
Diesel Generator (x3)	99	104	1.5m
Vibratory Roller	112	112	1.5m
Welding Truck (x3)	96	101	1.5m
Light Service Vehicle (x4)	76	82	1.5m
Rail Tamping Machine	118	118	1.5m
Trencher	108	108	1.5m
Construction - Out of Hours			
Welding Truck (x3)	96	101	1.5m
Light Service Vehicle (x3)	76	81	1.5m
Forklift/Telehandler (x3)	87	92	1.5m
Power tools (x3)	97	102	1.5m
Diesel Generator (x3)	99	104	1.5m
Crane 20t (x3)	105	110	1.5m
Sleep disturbance assessment (LA_{max}), Out of Hours (10pm to 7am)			
Item	Sound Power Level dB LA_{max}		Source Height[1]
Impact Noise – Processing Area	120		1.5m
Impact Noise – ROM	120		1.5m
Impact Noise – Pit	120		1.5m

5.3 Meteorological Analysis

Noise emissions can be influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver. The noise enhancing conditions identified in the project EIS have been adopted and are summarised in **Table 16.**

Table 16 Modelled Meteorological Parameters

Assessment Condition[1]	Temperature	Wind Speed[2]/ Direction	Relative Humidity	Stability Class[2]
Day - Wind	20°C	3m/s 270° (west)	50%	D
Evening - Wind	10°C	3m/s all directions	50%	D
Night - Wind	10°C	3m/s all directions	50%	D
Night - Inversion	10°C	0.5m/s all directions	50%	F

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

Note 2: Implemented using CONCAWE meteorological corrections.

5.4 Modifying Factors

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.

5.4.1 Tonality

Typically mining noise emissions are relatively steady and continuous and do not exhibit tonal characteristics. Review of the sound power octave data shows the noise sources do not exhibit tonality. Additionally, review of predicted octave levels at receivers do not exhibit tonality.

5.4.2 Low Frequency Noise

Fact Sheet C of the NPI provides guidelines for applying 'modifying factor' adjustments to account for low frequency noise emissions. The NPI states that where there is a difference of 15dB or more between the measured 'C' weighted (dBC) and measured 'A' weighted (dBA) levels indicates the potential for an unbalanced spectrum. Fact Sheet C of the NPI applies a correction factor of +2dB or +5dB depending on the difference between the (measured) Z weighted spectra levels in comparison with those presented in **Table 17**.

Table 17 Low Frequency One Third Octave Threshold Levels

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB $L_{Zeq(15min)}$	92	89	86	77	69	61	54	50	50	48	48	46	44

Technical Note

The guidance provided in Fact Sheet C is primarily aimed at measured levels from industrial noise sources. Also, the criteria is less effective as distance increases (ie greater than 3km[2]) due to atmospheric absorption of higher frequencies. The octave thresholds are derived from the DEFRA (UK) procedure for the assessment of low frequency noise complaints within an occupied room with an adjustment for application to external level. Where levels exceed the thresholds, this indicates the potential for low frequency noise to be subjectively classed as a nuisance.

Additionally, Broner[3] provides absolute level criteria for low frequency noise and recommends a criterion of 60dB $LC_{eq(5min)}$ to a maximum of 65dB $LC_{eq(5min)}$ for sensitive receivers:

The assessment of low frequency noise by calculation is indicative as ISO9613 as inclusion of one third octaves and frequencies below 63Hz are not compliant with the scope of ISO9613.

Therefore, for the purposes of assessment, a review of the difference between the calculated A weighted and C weighted noise levels has been conducted to provide an indication of the potential for low frequency noise effects for receivers within 3km of the major noise sources (pit, waste rock emplacement and processing area) within the project area. Where the difference is greater than 15dB, there is potential for an unbalanced spectrum, however, where differences are below 20dB this potential would be marginal, particularly where the absolute C weighted noise levels are below the 60dB $LC_{eq(5min)}$ to a maximum of 65dB $LC_{eq(5min)}$ as suggested by Broner[3].

5.5 NPI Very Noise Enhancing Conditions

Fact Sheet D of the NPI also states:

'Noise limits derived for consents and licences will apply under the meteorological conditions used in the environmental assessment process, that is, standard or noise-enhancing meteorological conditions. For 'very noise-enhancing meteorological conditions' (see glossary[4]) a limit is set based on the limit derived under standard or noise-enhancing conditions (whichever is adopted in the assessment) plus 5dB. In this way a development is subject to noise limits under all meteorological conditions.'

Essentially, this means a limiting criterion of PNTL +5dB is applicable for meteorological conditions outside that adopted in the assessment. In the context of the project, this means that the operation would need to comply with PNTL +5dB for any meteorological condition.

[2] Low Frequency Noise and Environmental Assessment – Najah Ishac (Acoustics 2015).

[3] Broner, N. "A simple outdoor criterion for assessment of low frequency noise emission", Acoustics Australia, 39(1), 7-14, (2011).

[4] Meteorological conditions outside of the range of either standard or noise-enhancing meteorological conditions as adopted in the noise impact assessment following the procedures in Fact Sheet D.

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6 Noise Assessment Results

6.1 Operational Noise Assessment

Noise predictions from all sources have been quantified at all identified receivers within 5km of the project and are presented as noise contour diagrams in **Figure 4** to **Figure 6** (Scenario 3); **Figure 8** to **Figure 10** (Scenario 4) and **Figure 12** to **Figure 14** (Scenario 5). Predicted noise levels are expected to satisfy the PNTLs at all receivers during all assessment periods for noise enhancing conditions. Predicted noise levels for NPI very noise enhancing conditions are presented in **Figure 7**, **Figure 11** and **Figure 15** and satisfy the PNTL +5dB requirement. Detailed tabulated results are presented in **Appendix C**.

6.1.1 Low Frequency Noise

A summary of the range of calculated A weighted and C weighted noise levels at residential receivers and their difference (C-A) are presented in **Table 18**.

Table 18 Low Frequency Noise Assessment

Scenario	Predicted Noise Level Range dB $LA_{eq(15min)}$	Predicted Noise Level Range dB $LC_{eq(15min)}$	C - A
Scenario 3	-1 – 36	21 - 57	16 -24
Scenario 4	2 - 38	22 - 57	15 -24
Scenario 5	2 -36	21 - 57	15 -24

A review of the range of C – A values indicates that there is potential for low frequency noise in accordance with the NPI (measurement) assessment methodology. Receivers where the C-A value is greater than 15dB are more than 3km from the project, is emphasised as the higher frequencies do not propagate as far as the lower frequencies. Furthermore, considering that the calculated absolute C weighted noise levels are below 60dBC and the calculated absolute A weighted noise levels are below the PNTLs, the C-A parameter becomes less relevant as overall noise levels are very low. Therefore, no penalty has been applied for low frequency.

6.1.2 Maximum Noise Level Assessment

In assessing maximum noise events, typical L_{Amax} noise levels from transient events were assessed at the nearest residential receivers. Predicted noise levels from $L_{Aeq(15min)}$ and L_{Amax} events for the nearest receivers are presented in **Table 19.** Results identify that the maximum noise trigger levels will be satisfied at the nearest receivers, indicating that compliance will also be achieved at more distant receivers.

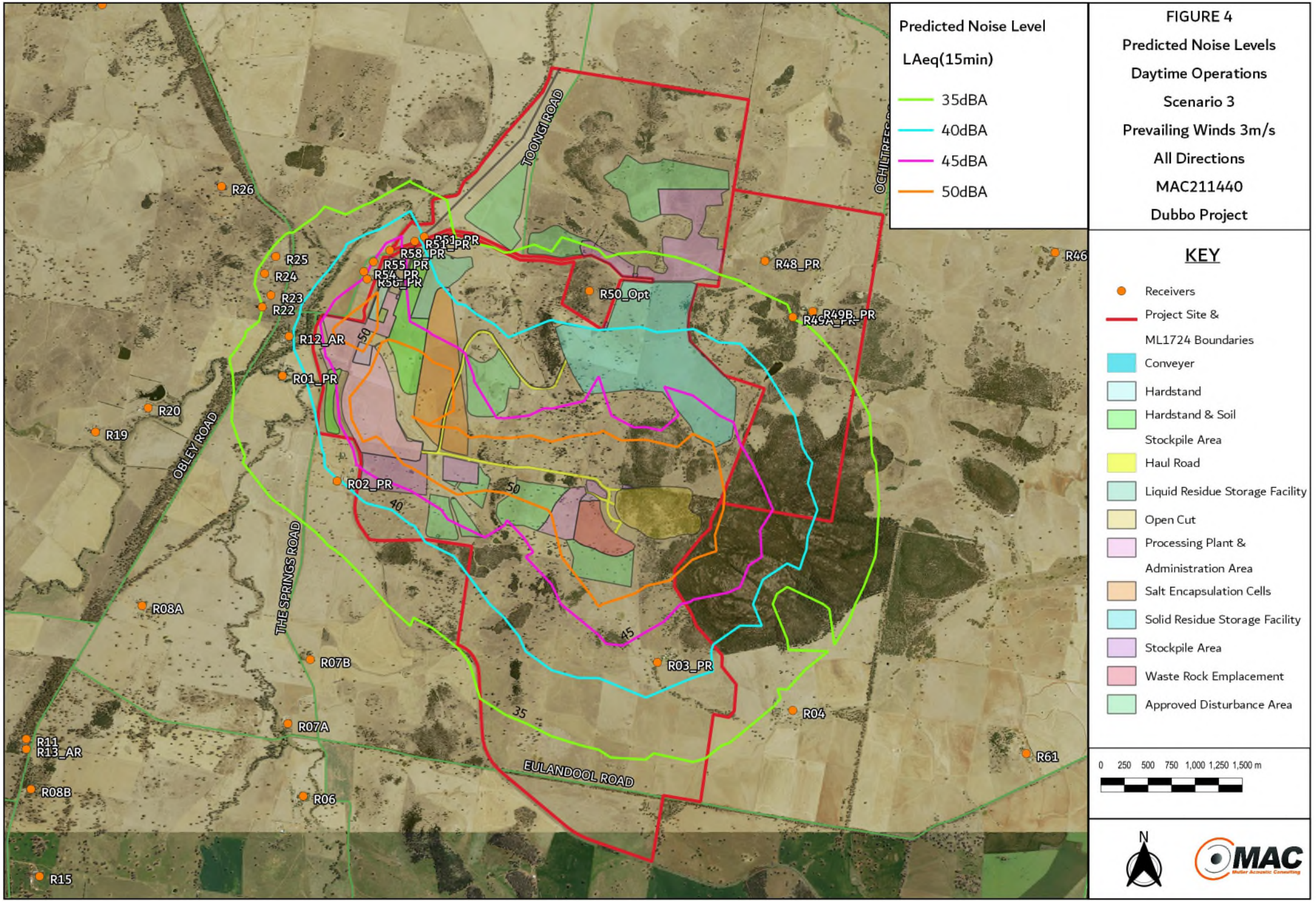
Table 19 Maximum Noise Level Assessment (Night)[1]

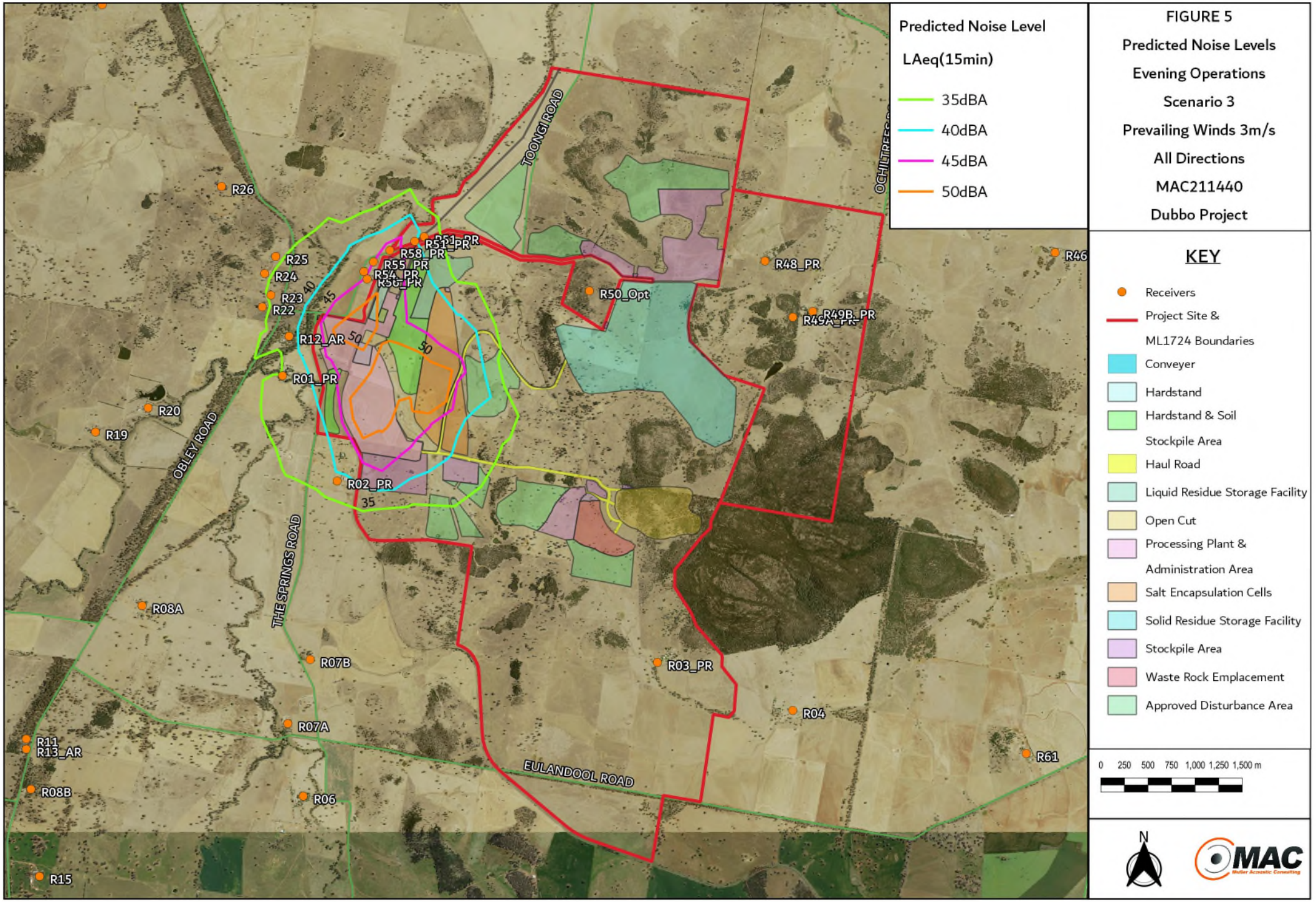
Receiver	Predicted Noise Level		Maximum Trigger Levels		Compliant
	dB $L_{Aeq(15min)}$	dB L_{Amax}	dB $L_{Aeq(15min)}$	dB L_{Amax}	
R07B	<30	<35	40	52	✓
R08A	<30	<35	40	52	✓
R19	<30	<35	40	52	✓
R20	<30	<35	40	52	✓
R23	35	43	40	52	✓
R26	<30	<35	40	52	✓
R27	<30	<35	40	52	✓
R28	<30	<35	40	52	✓

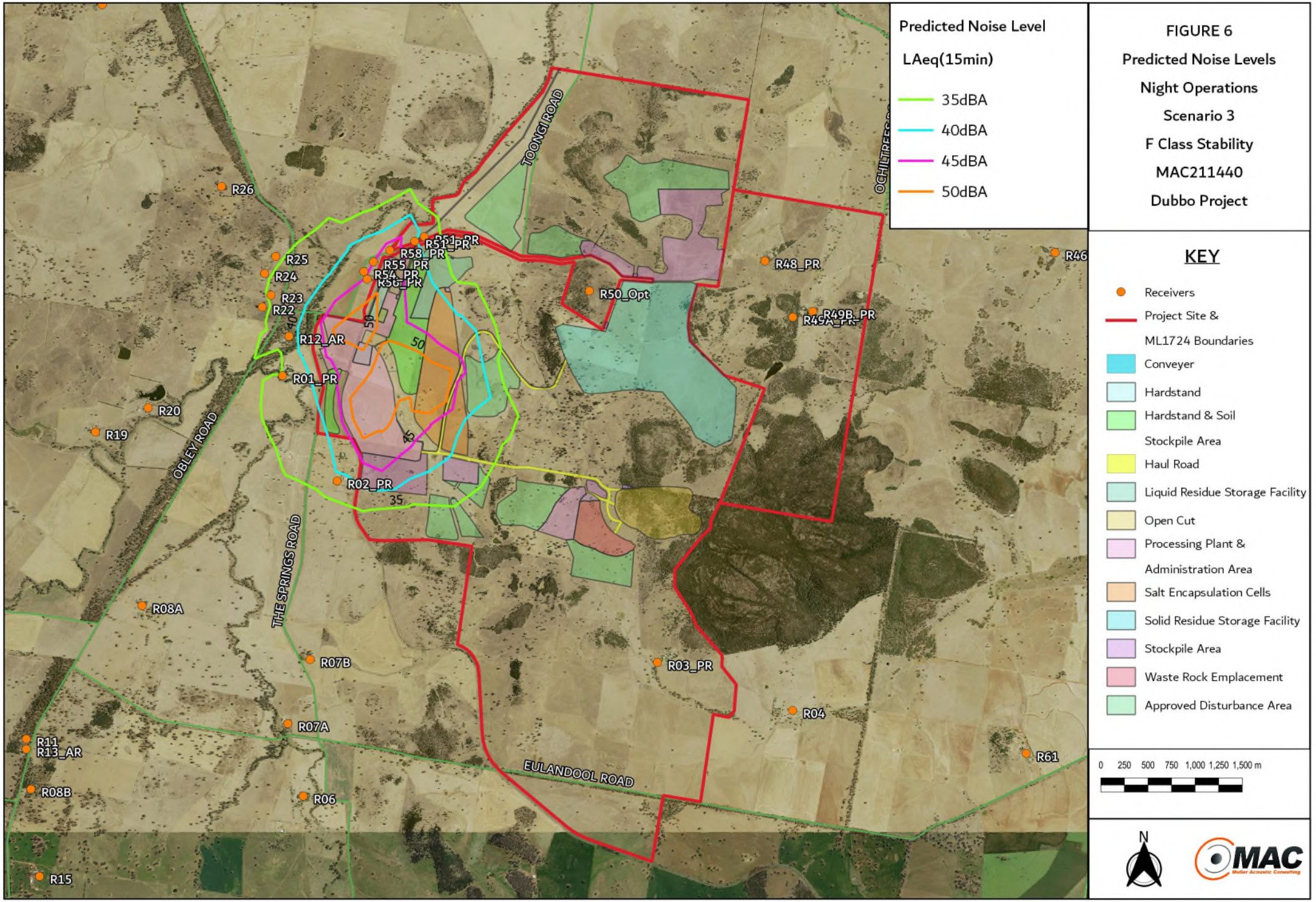
Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

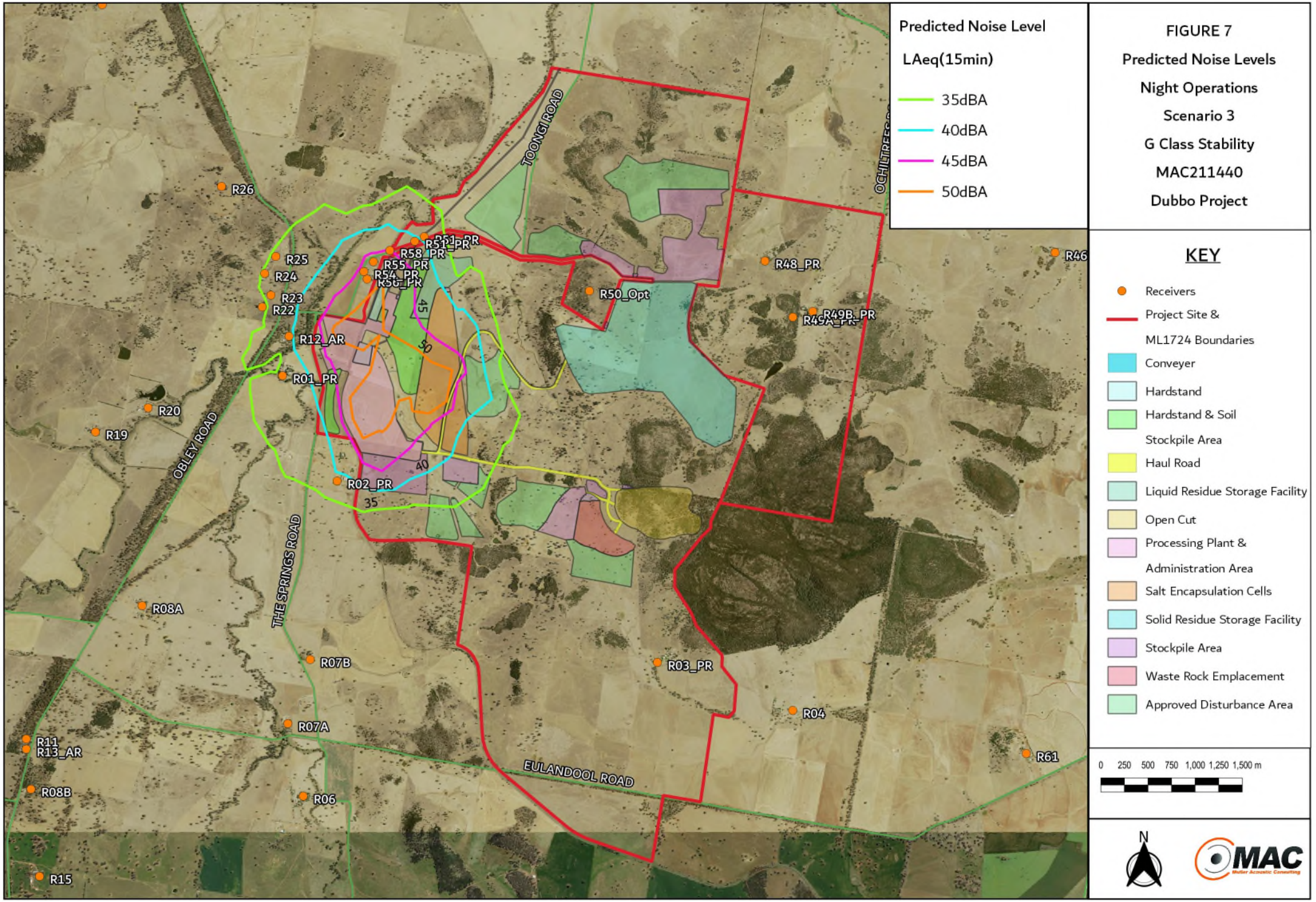
6.1.3 VLAMP

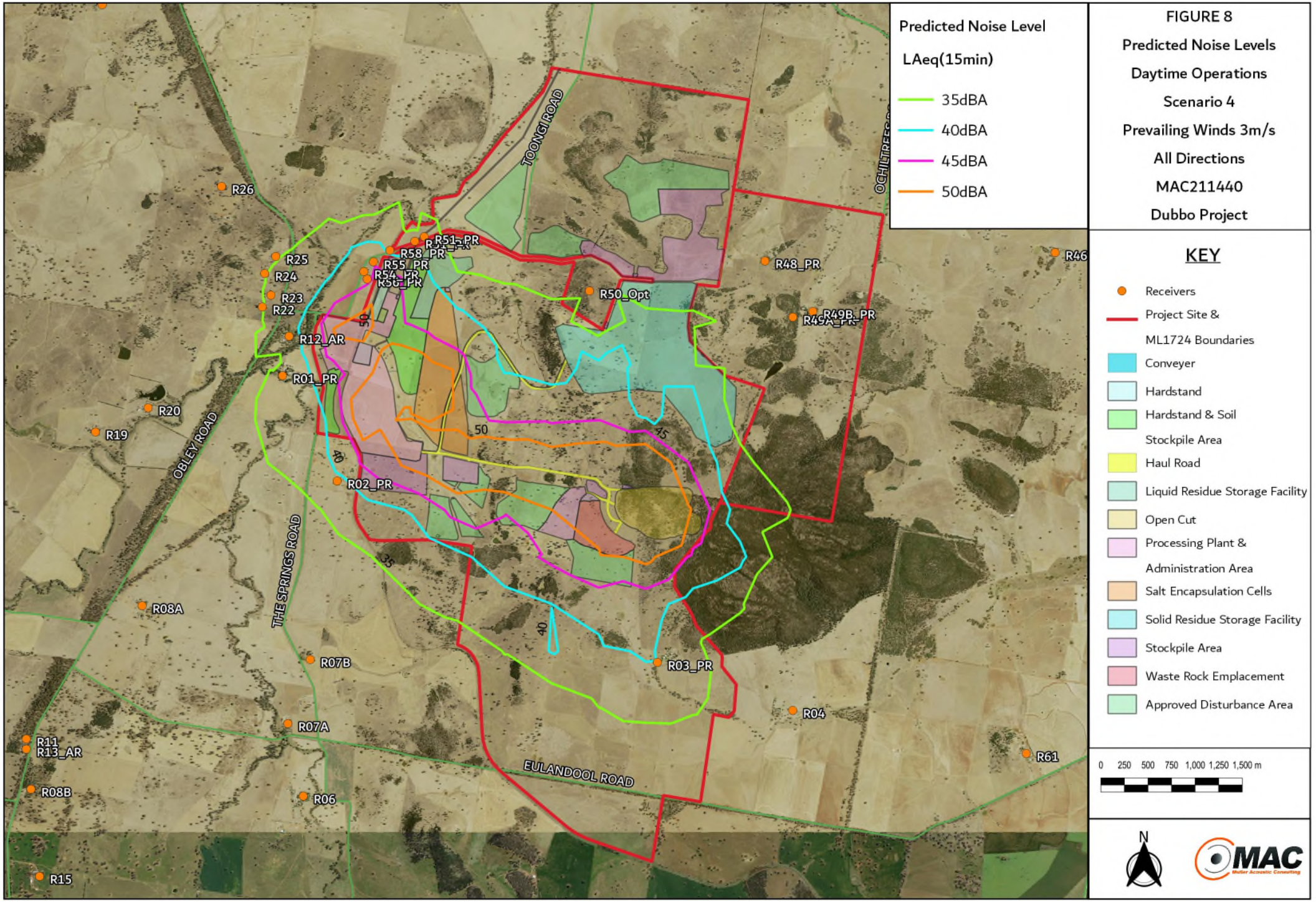
A review of noise contours demonstrates that predicted project noise levels do not exceed the VLAMP criteria (40dB $L_{Aeq(15min)}$ daytime or 35dB $L_{Aeq(15min)}$ night time) at any receiver location. Additionally, predicted project noise levels do not exceed the VLAMP criteria (50dB LAeq(period) daytime and 40dB $L_{Aeq(period)}$ night time) on any privately owned vacant lands. Hence, mitigation and/or acquisition rights are not applicable.

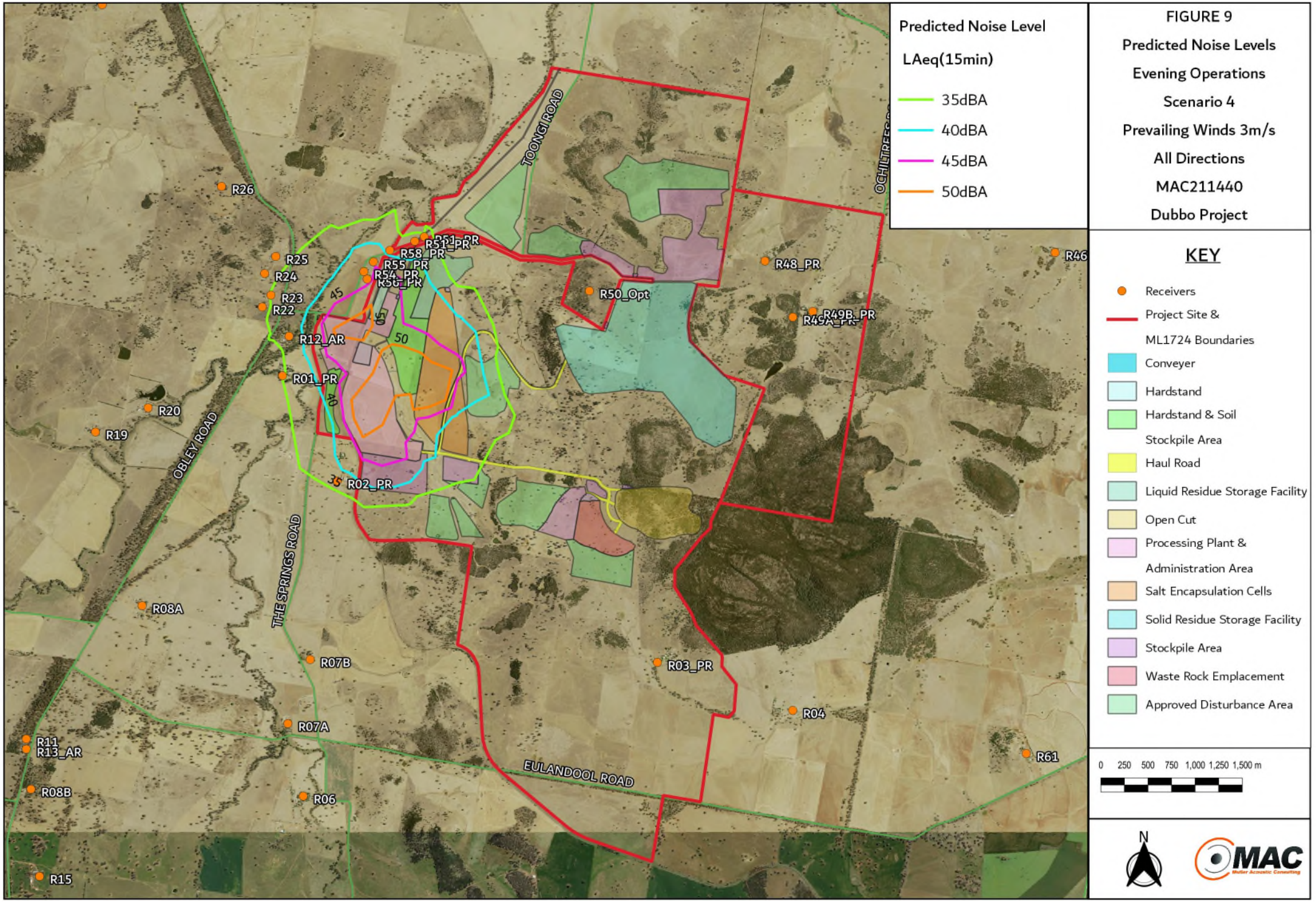

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 4
Predicted Noise Levels
Daytime Operations
Scenario 3
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R58_PR
R55_PR
R54_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61
50
40
45
35

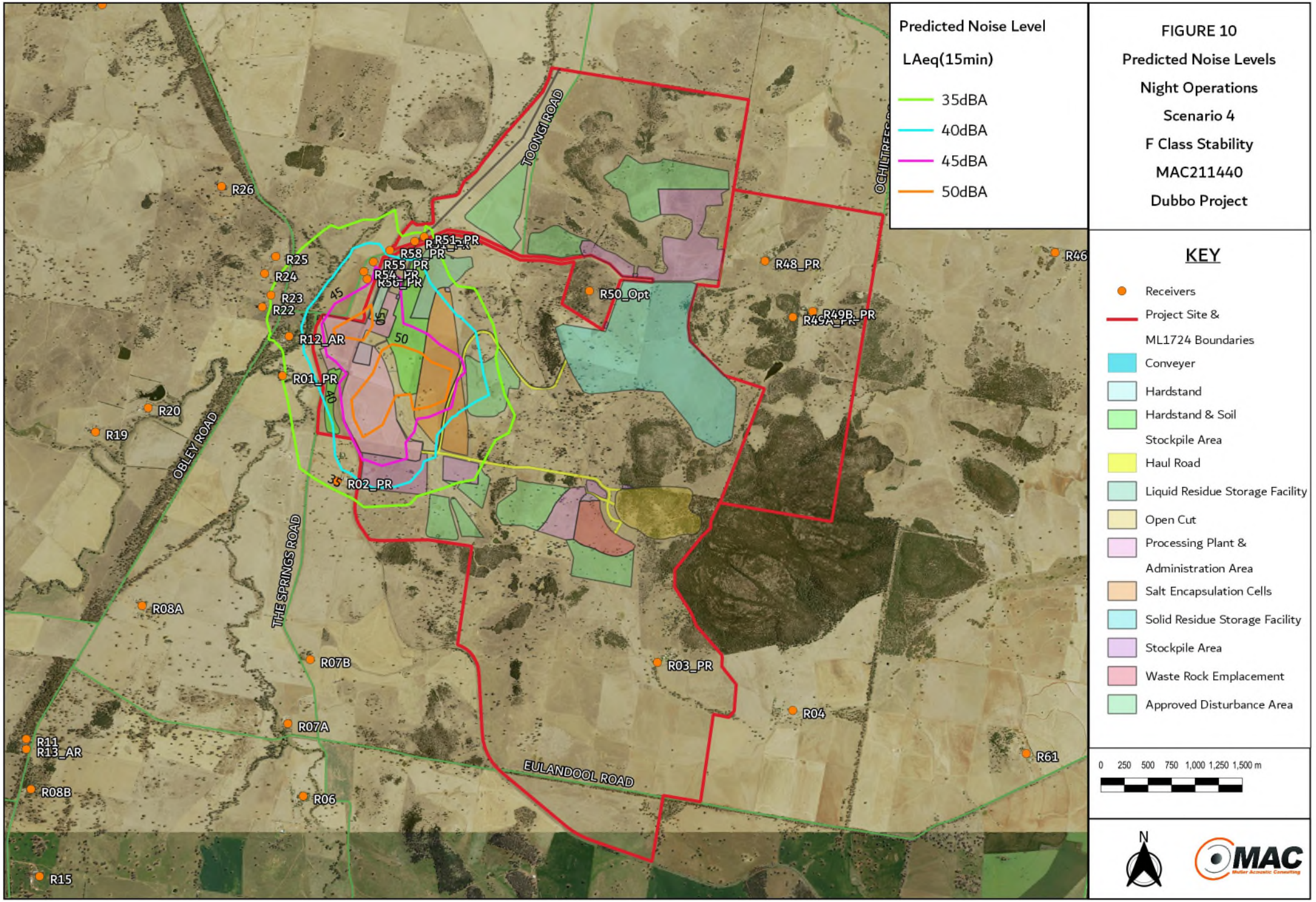

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 5
Predicted Noise Levels
Evening Operations
Scenario 3
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R03_PR
R04
R61
R48_PR
R46
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
40
45
50
50
35

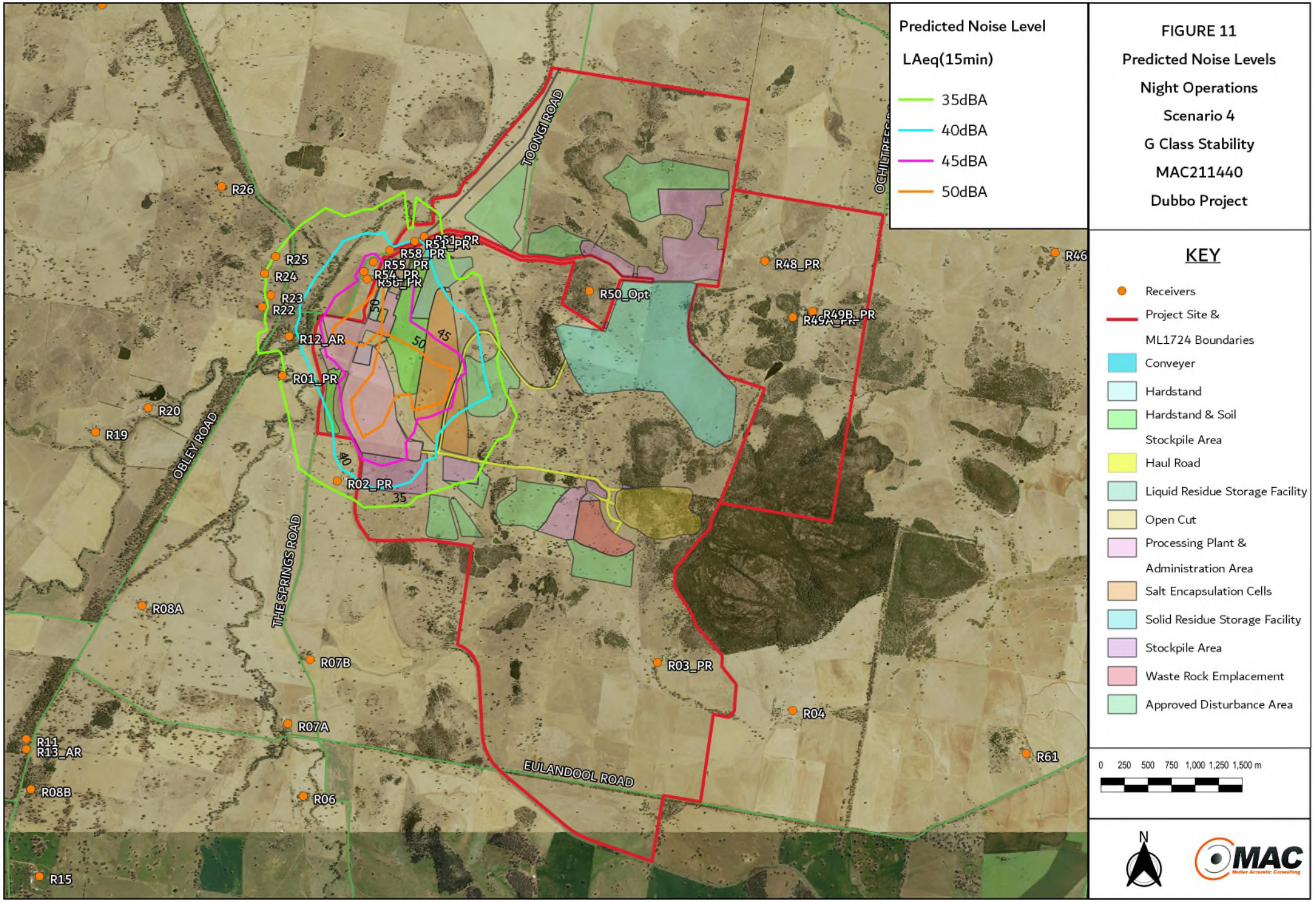

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 6
Predicted Noise Levels
Night Operations
Scenario 3
F Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R58_PR
R55_PR
R54_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61

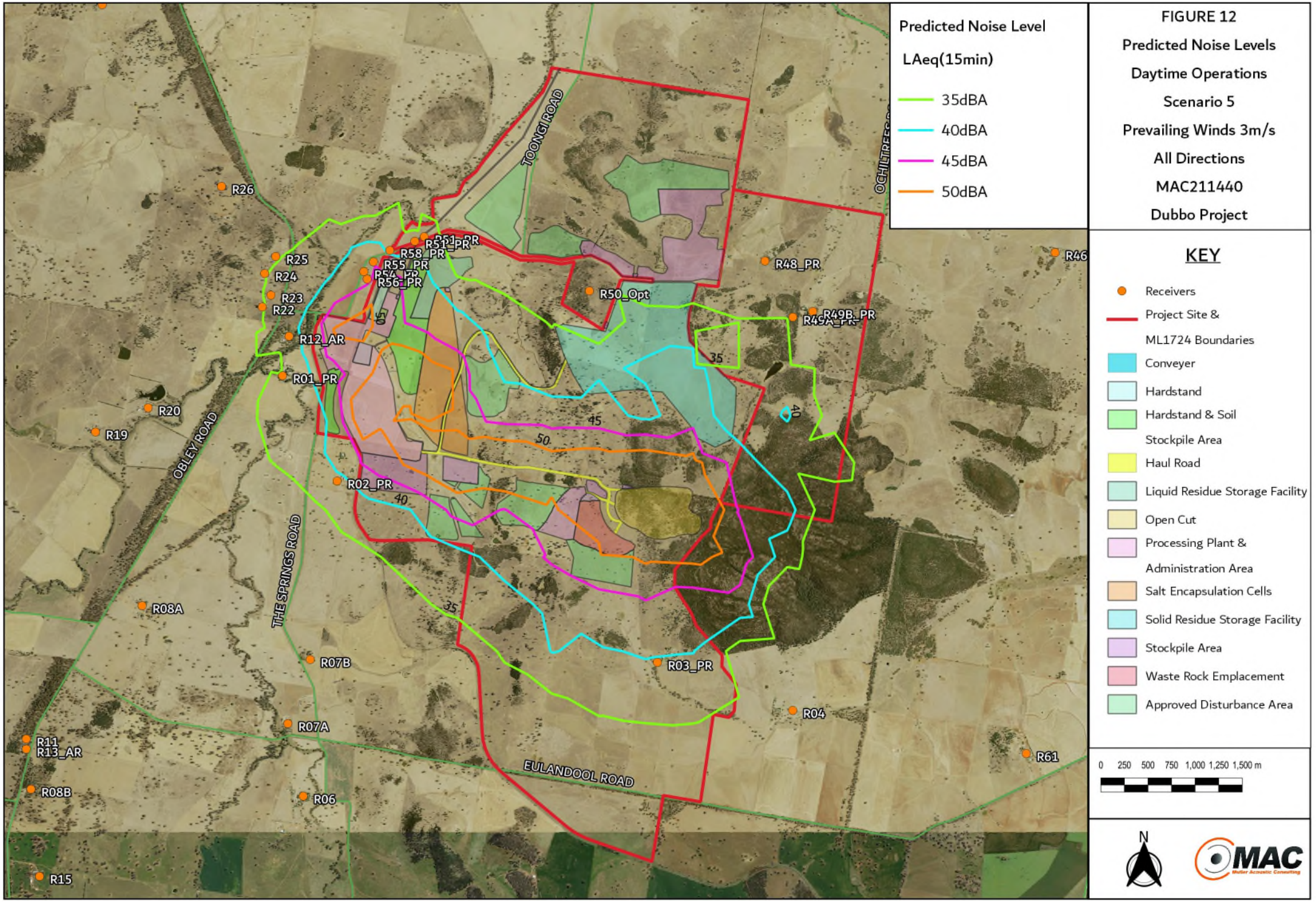

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 7
Predicted Noise Levels
Night Operations
Scenario 3
G Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R03_PR
R04
R61
R48_PR
R46
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
45
50
40
35

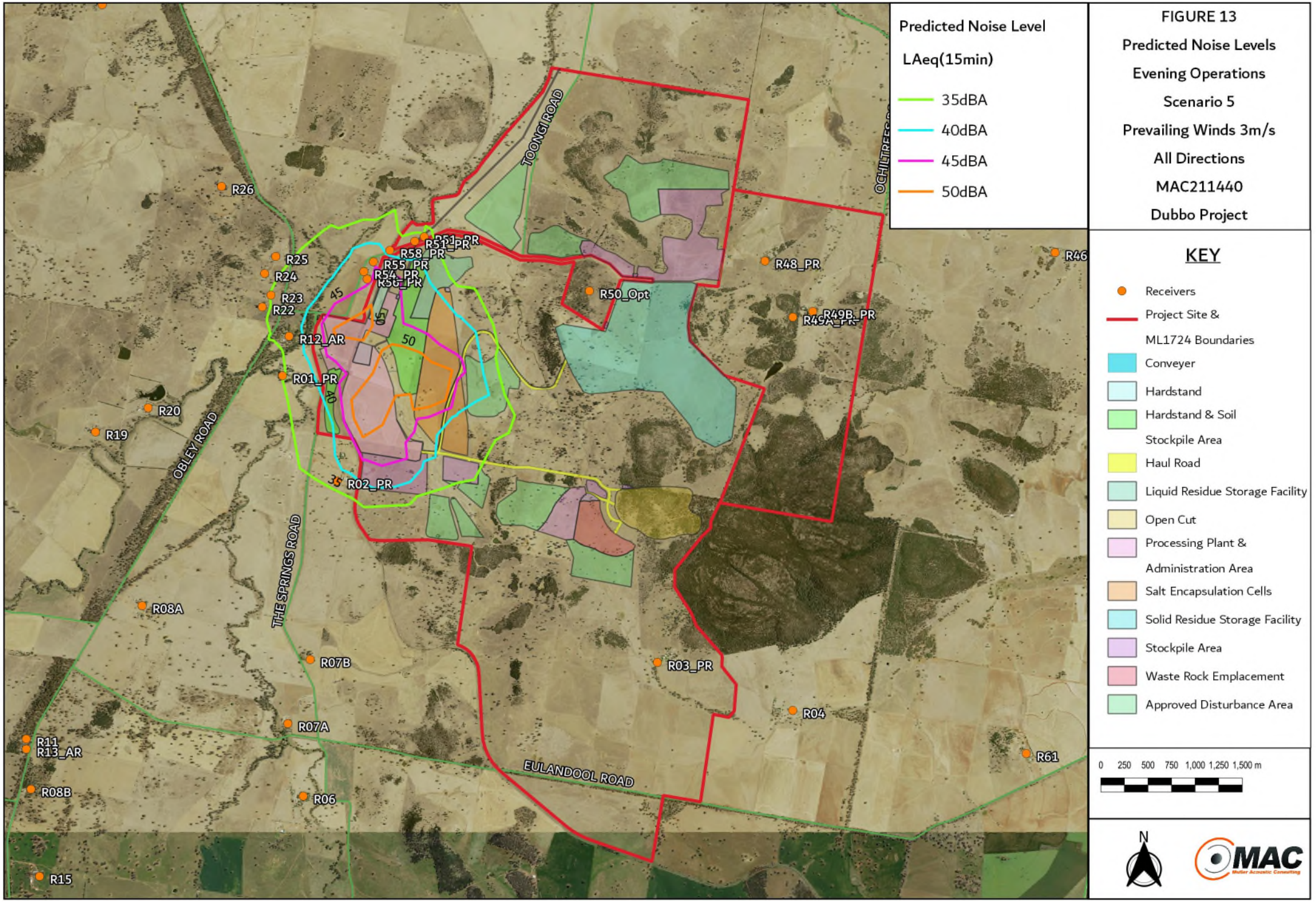

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 8
Predicted Noise Levels
Daytime Operations
Scenario 4
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R51_PR
R58_PR
R55_PR
R54_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61
50
45
40
35

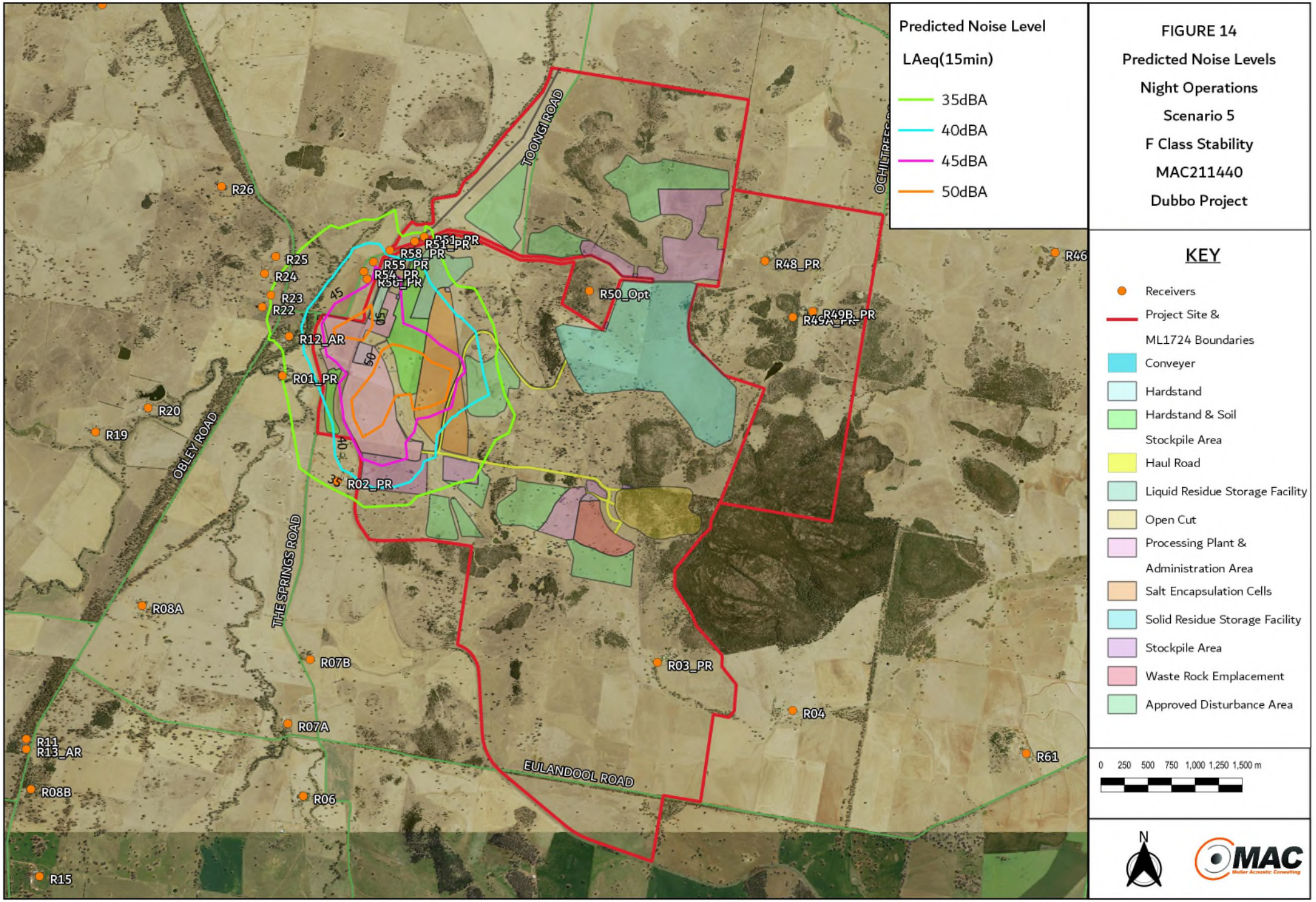

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 9
Predicted Noise Levels
Evening Operations
Scenario 4
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
Muller Acoustic Consulting
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R02_PR
R03_PR
R04
R61
R46
R48_PR
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
45
50
40
35

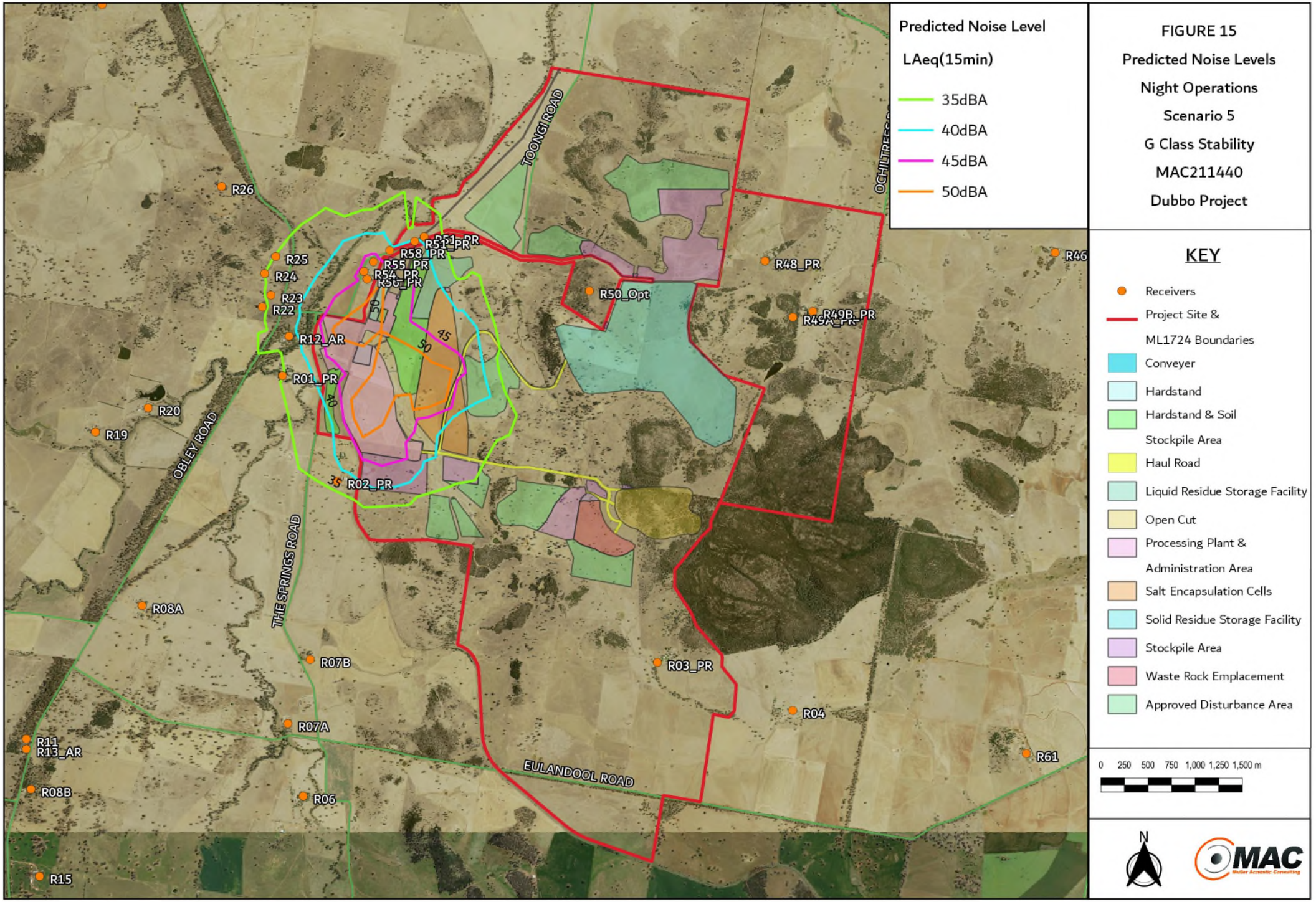

Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 10
Predicted Noise Levels
Night Operations
Scenario 4
F Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R51_PR
R58_PR
R55_PR
R54_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61
R02_PR
45
50
40
35


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 11
Predicted Noise Levels
Night Operations
Scenario 4
G Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R03_PR
R04
R61
R48_PR
R46
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
50
45
40
35


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 12
Predicted Noise Levels
Daytime Operations
Scenario 5
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R58_PR
R55_PR
R56_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61
35
40
45
50


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 13
Predicted Noise Levels
Evening Operations
Scenario 5
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R02_PR
R03_PR
R04
R61
R46
R48_PR
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
45
50
40
35


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 14
Predicted Noise Levels
Night Operations
Scenario 5
F Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R02_PR
R03_PR
R04
R61
R46
R48_PR
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
45
50
40
35


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 15
Predicted Noise Levels
Night Operations
Scenario 5
G Class Stability
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 m
N
MAC
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R03_PR
R04
R61
R48_PR
R46
R50_Opt
R49B_PR
R58_PR
R55_PR
R54_PR
35
40
45
50
55

6.2 Construction Noise Assessment

Noise predictions from construction activities have been quantified at all identified receivers within 3km of the project and are presented as noise contour diagrams in **Figure 16** (Scenario 1) and **Figure 17** (Scenario 2).). Predicted noise levels are expected to satisfy the NMLs at all receivers. Detailed tabulated results are presented in **Appendix C**.

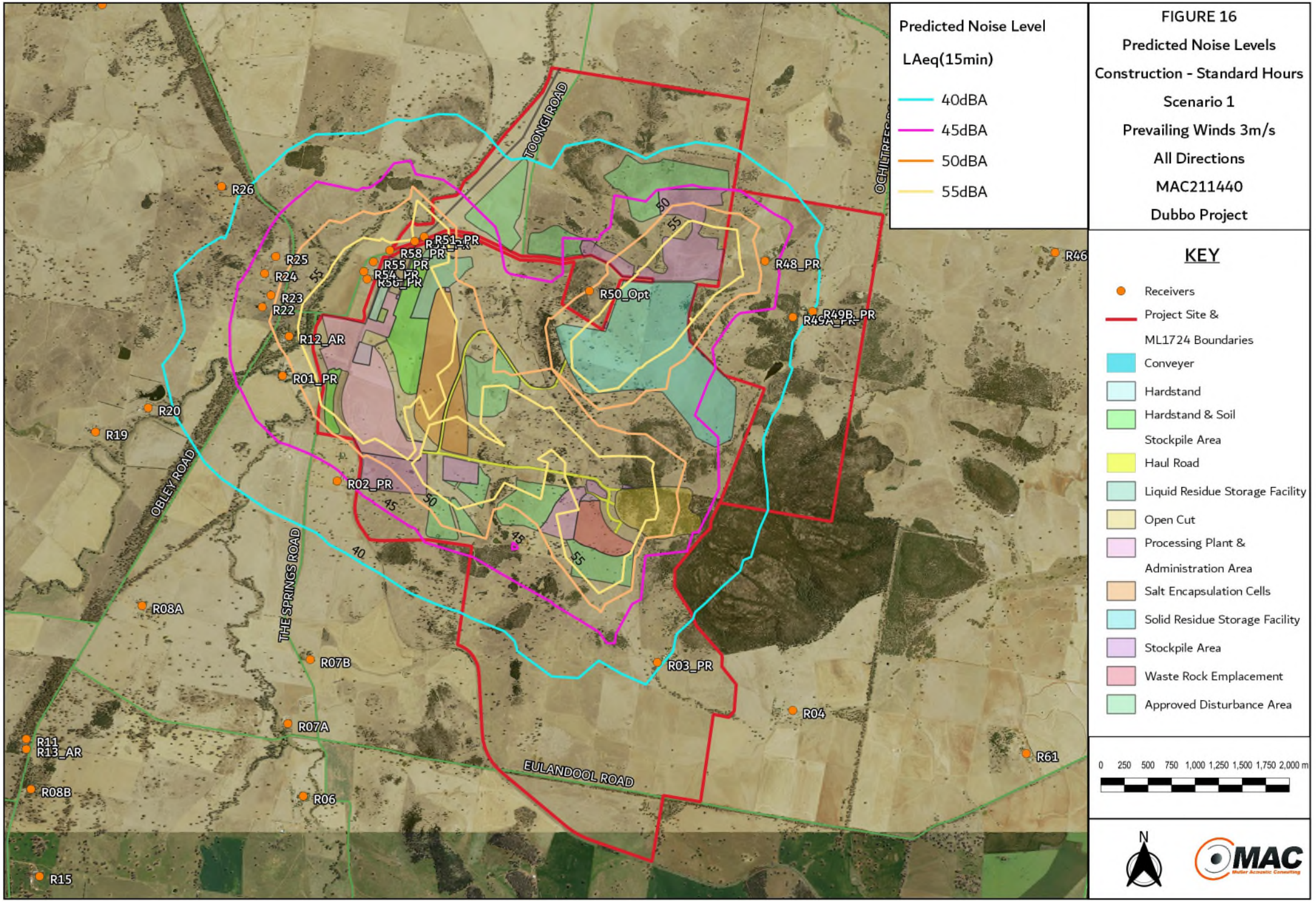
6.2.1 Construction Sleep Disturbance

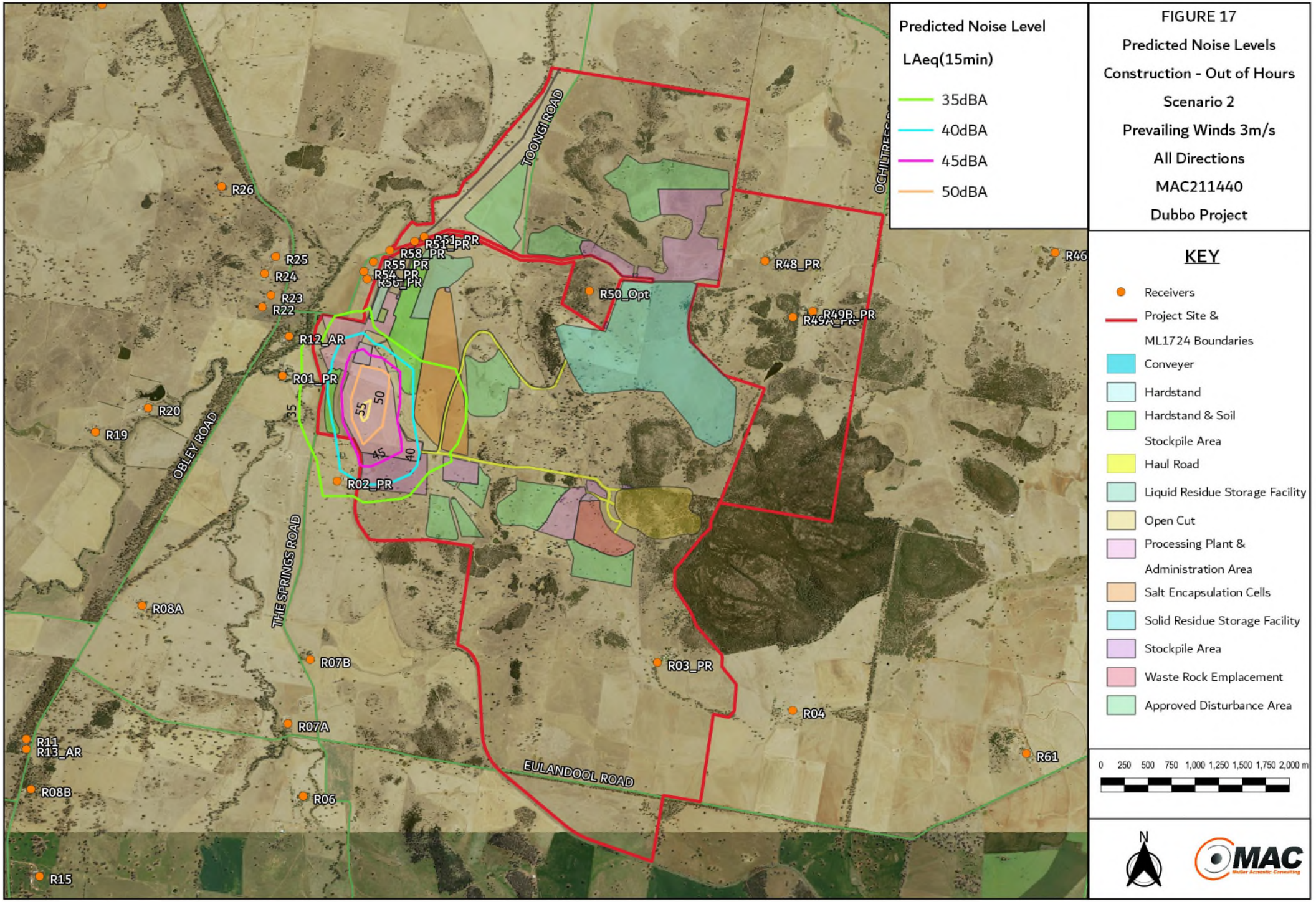
In assessing sleep disturbance from construction activities, typical L_{Amax} noise levels from transient events were assessed at the nearest residential receivers against the NPI maximum noise trigger levels. Predicted noise levels from L_{Amax} events at the nearest receivers are presented in **Table 20.** Results identify that the maximum noise trigger levels will be satisfied at the nearest receivers, indicating that compliance will also be achieved at more distant receivers.

Table 20 Maximum Noise Level Assessment (Night)[1]

Receiver	Predicted Noise Level dB LAmax	Maximum Trigger Levels dB LAmax	Compliant
R19	<35	52	✓
R20	<35	52	✓
R22	<35	52	✓
R23	<35	52	✓
R24	<35	52	✓
R25	<35	52	✓

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


Predicted Noise Level
LAeq(15min)
40dBA
45dBA
50dBA
55dBA
FIGURE 16
Predicted Noise Levels
Construction - Standard Hours
Scenario 1
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 1,750 2,000 m
N
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R51_PR
R58_PR
R55_PR
R54_PR
R50_Opt
R48_PR
R49B_PR
R46
R03_PR
R04
R61
40
45
50
55


Predicted Noise Level
LAeq(15min)
35dBA
40dBA
45dBA
50dBA
FIGURE 17
Predicted Noise Levels
Construction - Out of Hours
Scenario 2
Prevailing Winds 3m/s
All Directions
MAC211440
Dubbo Project
KEY
Receivers
Project Site & ML1724 Boundaries
Conveyer
Hardstand
Hardstand & Soil
Stockpile Area
Haul Road
Liquid Residue Storage Facility
Open Cut
Processing Plant & Administration Area
Salt Encapsulation Cells
Solid Residue Storage Facility
Stockpile Area
Waste Rock Emplacement
Approved Disturbance Area
0 250 500 750 1,000 1,250 1,500 1,750 2,000 m
N
TOONGI ROAD
OBLEY ROAD
THE SPRINGS ROAD
EULANDOOL ROAD
R26
R25
R24
R23
R22
R12_AR
R01_PR
R20
R19
R02_PR
R08A
R07B
R07A
R11
R13_AR
R08B
R06
R15
R03_PR
R04
R61
R48_PR
R50_Opt
R49B_PR
R46
R58_PR
R55_PR
R54_PR
35
50
55
45
40

6.3 Road Traffic

6.3.1 Operations Traffic

Schedule 3, part 2 of the Consent contains a condition relating to noise mitigation at the Western Plains Zoo as follows:

"Prior to undertaking any construction on Obley Road between Camp Road and the Newell Highway, the Applicant shall construct a 3m high and 1km long road noise barrier on land owned by the Zoo and in consultation with the Zoo, to the satisfaction of the Secretary."

The transportation numbers approved under SSD-5251 are consistent with Option C presented in the project EIS which relates to a "road only" scenario.

The proposed barrier must be located on land owned by the Zoo. This is not ideal as a barrier closer to the road would provide more effective attenuation than the proposed barrier design situated midway between the road and receiver. Whilst the road noise barrier proposed in the EIS has been calculated to provide the necessary reduction, other mitigation measures may also be able to effectively reduce noise emissions, such as an alternate road surface. For example, open graded asphalt (refer **Table 21** reproduced from the Roads and Traffic Authority (RTA) Environmental Noise Management Manual (ENMM)) would provide a reduction of up to 5dBA for trucks compared to dense graded asphalt.

Table 21 Road Surface Corrections, Relative to Dense Graded Asphaltic Concrete

Surface Type	Noise Level Variation, dBA		
	Traffic Noise	Car	Trucks
14mm chip seal	+4.0	+4.0	+4.0
Portland cement concrete- tyned and dragged	0 to +3.0	+1.0 to +3.5	-1.0 to +1.0
Cold overlay	+2.0	+2.0	+2.0
Portland cement concrete- exposed aggregate	-0.5 to -3.0	-0.1	-6.7
Stone mastic asphalt	-2.0 to -3.5	-2.2	-4.3
Open graded asphaltic concrete	0 to -4.5	-0.2 to -4.2	-4.9

Source: RTA Environmental Noise Management Manual (ENMM 2001).

Upgrading the road surface along the section passing the Zoo can result in a reduction equivalent to that by the proposed barrier. This would provide additional benefits such as less intrusion to the Zoo's rhinoceros population by not constructing a wall in close proximity and any potential visual impacts of a 1km wall.

As part of this Modification, alteration to Condition 2 Schedule 3 is sought to incorporate mitigation measures other than a road noise barrier, that can achieve a reduction of at least 5dBA.

6.3.2 Construction Traffic

The calculated road traffic noise for the construction phase (daytime period) from the project EIS is reproduced in **Table 22**.

Table 22 Calculated Daytime Road Traffic Noise During Construction - EIS

Road Section	Distance from Road, m	Criteria dB $L_{Aeq(15hr)}$	Existing Traffic Noise dB $L_{Aeq(15hr)}$	Calculated Project Traffic Noise dB $L_{Aeq(15hr)}$	Future Combined Traffic Noise dB $L_{Aeq(15hr)}$	Difference Future - Existing
1	355	60	42.9	33.4	43.4	0.5
2	225	60	43.4	35.8	44.1	0.7
3	65 (Zoo)	60	50.0	42.4	50.7	0.7
4	65	60	42.4	42.4	48.2	1.3

The modification is expected to increase construction traffic during the daytime period from 400 light vehicles movements per day to 625 light vehicles movements per day. There is no change to the number of heavy vehicles due to the modification.

The calculated road traffic noise for the construction phase (daytime period) for the project modification has been calculated and results are presented in **Table 23**.

Table 23 Calculated Daytime Road Traffic Noise During Construction – Modification 1

Road Section	Distance from Road, m	Criteria dB $L_{Aeq(15hr)}$	Existing Traffic Noise dB $L_{Aeq(15hr)}$	Calculated Project Traffic Noise dB $L_{Aeq(15hr)}$	Future Combined Traffic Noise dB $L_{Aeq(15hr)}$	Difference (Future – Existing) dB $L_{Aeq(15hr)}$
1	355	60	42.9	34.6	43.5	0.6
2	225	60	43.4	37.0	44.3	0.9
3	65 (Zoo)	60	50.0	43.7	50.9	0.9
4	65	60	42.4	43.7	46.1	2.4

Predicted combined (daytime) road traffic noise levels associated with construction satisfy the RNP criteria at all receiver s along Obley Road.

The project modification proposes night time construction. It is expected that approximately 50 light vehicles will travel to site via Obley Road. The calculated road traffic noise for the construction phase (night time/ OOH period) for the project modification has been calculated and results are presented in Table 24.

Table 24 Calculated Night time Road Traffic Noise During Construction – Modification 1

Road Section	Distance from Road, m	Criteria dB $LA_{eq(9hr)}$	Existing Traffic Noise dB $LA_{eq(9hr)}$[1]	Calculated Project Traffic Noise dB $LA_{eq(9hr)}$	Future Combined Traffic Noise dB $LA_{eq(9hr)}$	Difference Future - Existing
1	355	55	42.7	27.6	42.8	0.0
2	225	55	42.7	30.6	43.0	0.3
3	65 (Zoo)	55	49.9	36.5	50.1	0.2
4	65	55	46.8	36.5	47.2	0.4

Note 1: Source Project EIS NIA Table 5.11, Option C.

Predicted combined (night time/ OOH) road traffic noise levels associated with construction satisfy the RNP criteria at all receivers along Obley Road.

7 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment (NA) to quantify emissions from the proposed Modification to the approved Dubbo Project (previously known as the Dubbo Zirconia Project). The Dubbo Project (ie the 'project') is situated near the village of Toongi, approximately 25km south of Dubbo, NSW.

Following the approval of SSD-5251 on 28 May 2015, a range of further studies and investigations optimising the design and operation of the Project have been undertaken. As a result of the studies there are several adjustments to the approved site layout and operations which are required to maximise the efficiency of mining, processing and transportation operations on site.

The proposed modification seeks consent to construct and operate additional chemical processing facilities on site and minor relocations of other processing facilities; the rail container laydown area; minor realignments to linear infrastructure; and consolidation of approved disturbance footprints. An increase in transportation (by rail) of reagents is proposed, decreasing the need for road transportation during the initial stages of the project.

The modification proposes 24 hour, 7 day construction for all construction activities within the processing plant and administration area, chlor-alkali plant and rail container laydown / storage area to achieve critical project deadlines. Construction activities outside the project boundary include water and gas pipelines, the rail upgrade, bridges, and road upgrade are unchanged from the EIS and have not been assessed further. There is also no increase in the dispatch and receival of heavy vehicles from site, rail transport and blasting emissions.

Noise emissions have been assessed from construction (standard hours and out of hours) and operational scenarios of the project.

The results of the Noise Assessment demonstrate that emissions from the construction phase of the project would satisfy the relevant NMLs at all assessed receivers. Furthermore, sleep disturbance is not anticipated, as emissions from construction related maximum noise events are predicted to be below the EPA maximum noise trigger levels.

The results of the Noise Assessment demonstrate that emissions from the operational phase of the project would satisfy the relevant PNTLs at all assessed receivers for noise enhancing conditions for all assessment periods. The project will require the implementation of noise mitigation measures to reduce noise emissions from the crushing and screening plant by the means of enclosures. Sleep disturbance is not anticipated, as emissions from operational related maximum noise events are predicted to be below the EPA maximum noise trigger levels.

Additional evaluation of possible mitigation measures has been completed to reduce noise levels from road traffic at the Western Plains Zoo. It is proposed that either the proposed noise barrier required in the consent or other mitigation measures, such as alternate road surfaces may be implemented to achieve the equivalent noise reduction.

Road traffic noise at receivers along Obley Road are expected to satisfy the RNP criteria from the proposed additional road traffic during the construction phase during the daytime and night time periods.

Based on the Noise Assessment results, once noise controls are implemented to the project, there are no noise related issues which would prevent approval of the proposed project.

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

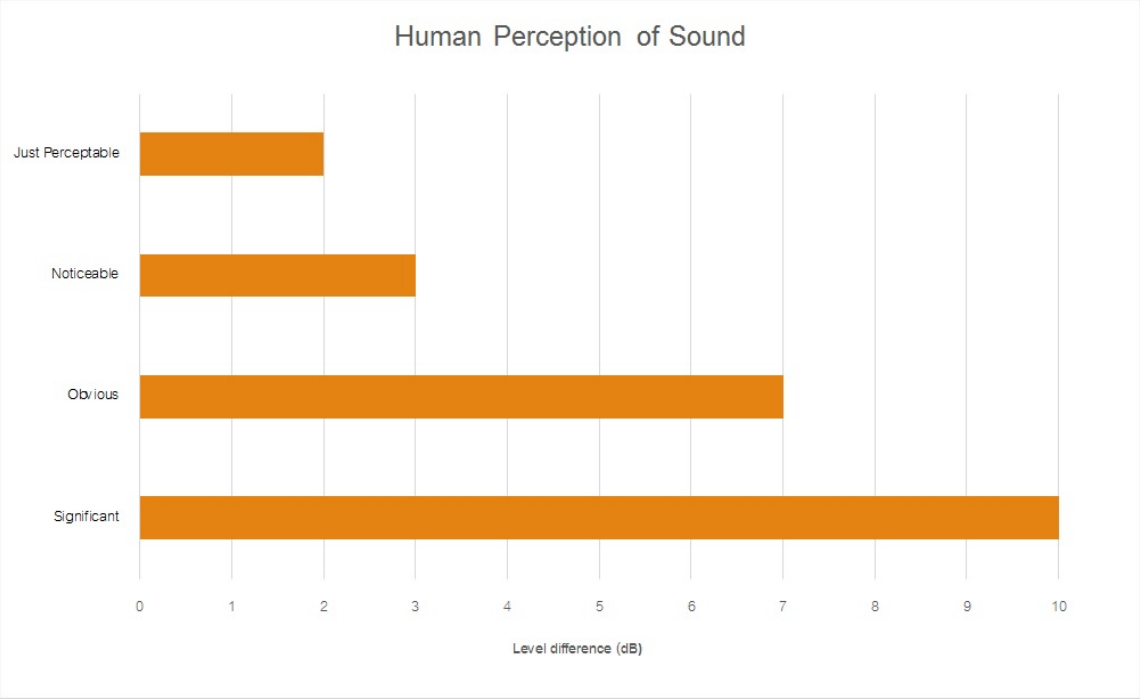
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for 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 – Detailed Project Layouts

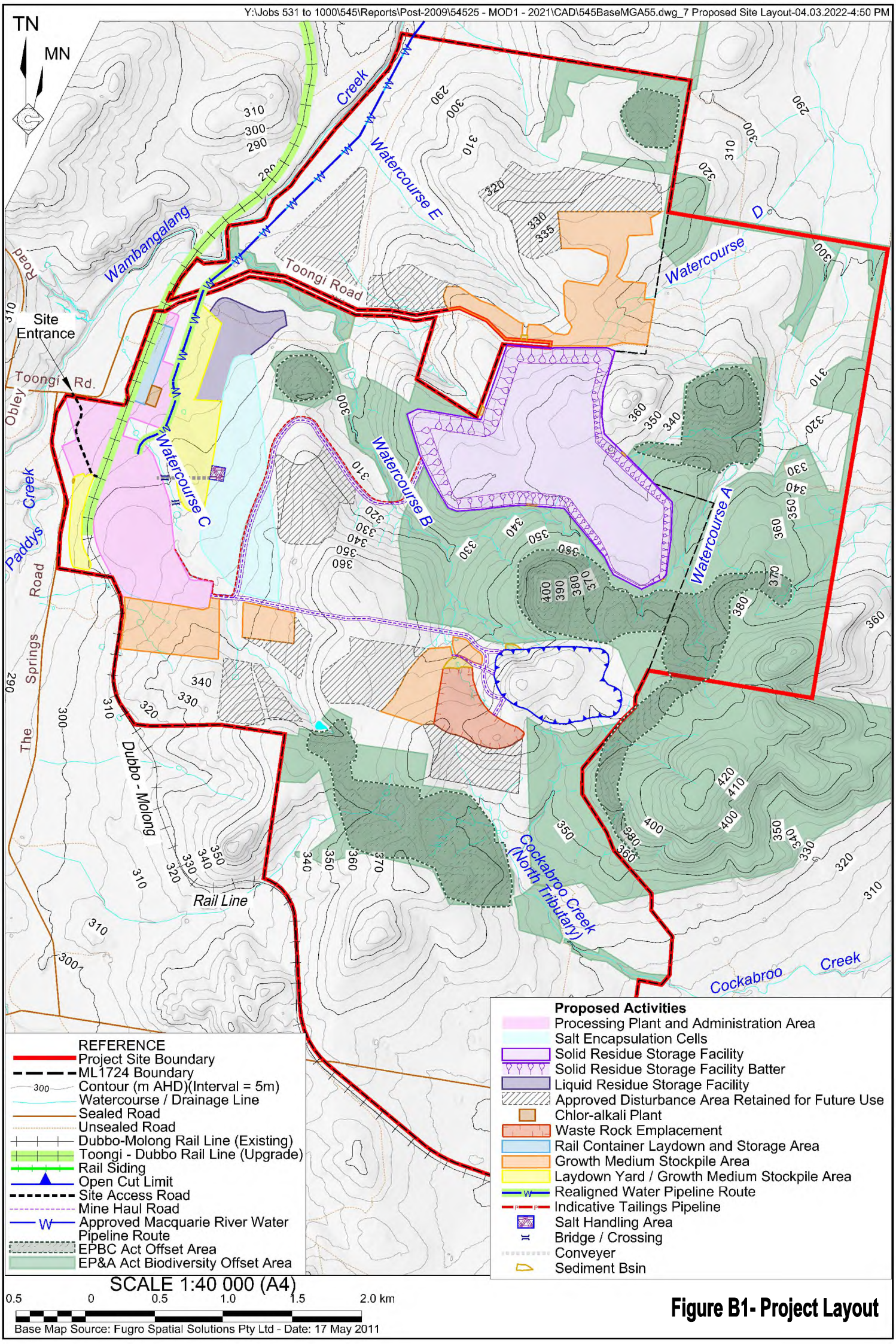

Figure B1- Project Layout

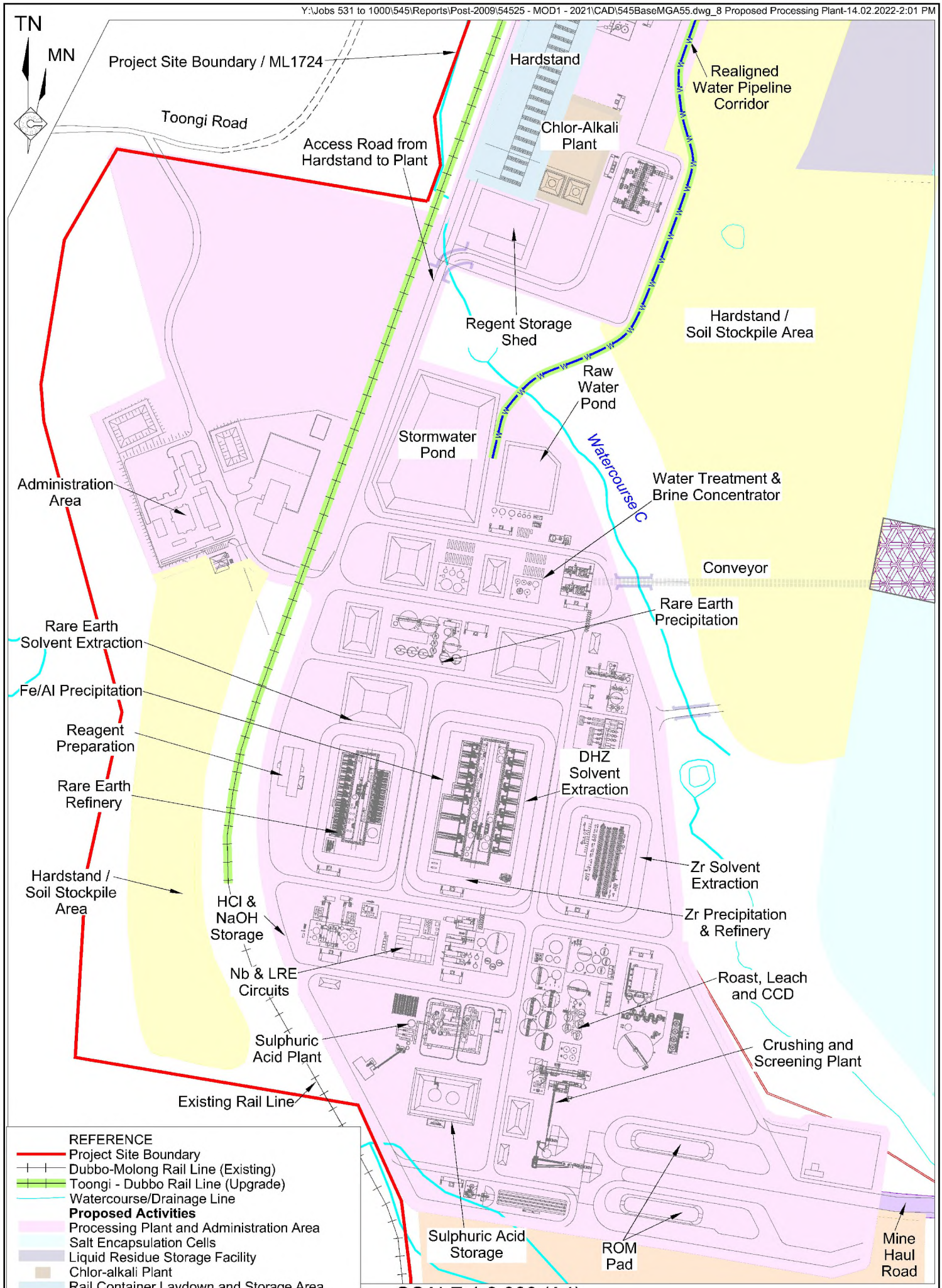

Figure B2 - Processing Plant Layout

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Appendix C – Tabulated Results

	Scenario 1 - Predicted Noise Level	Scenario 2 - Predicted Noise Level	NML	
Name	Standard Hours	Out of Hours	Standard Hours	Out of Hours
R01_PR	47	32	45	35
R02_PR	44	38	45	35
R03_PR	39	15	45	35
R04	32	11	45	35
R06	30	15	45	35
R07A	32	17	45	35
R07B	34	20	45	35
R08A	32	21	45	35
R08B	26	12	45	35
R11	28	15	45	35
R12R	53	31	65	65
R13R	28	15	65	65
R15	25	10	45	35
R18	29	17	45	35
R19	36	23	45	35
R20	39	25	45	35
R21	29	13	45	35
R22	46	31	45	35
R23	50	31	45	35
R24	48	30	45	35
R25	48	29	45	35
R26	38	20	45	35
R27	29	12	45	35
R28A	29	12	45	35
R28B	28	11	45	35
R30A	30	12	45	35
R30B	30	11	45	35
R31A	26	9	45	35
R31B	27	9	45	35
R32	29	10	45	35
R35	27	7	45	35
R36	29	13	45	35
R38	25	5	45	35
R40A	26	5	45	35

	Scenario 1 - Predicted Noise Level	Scenario 2 - Predicted Noise Level	NML	
Name	Standard Hours	Out of Hours	Standard Hours	Out of Hours
R40B	27	7	45	35
R41	23	3	45	35
R43	25	5	45	35
R44	21	2	45	35
R46	29	7	45	35
R48_PR	51	14	45	35
R49A_PR	36	13	45	35
R49B_PR	39	13	45	35
R50_Opt	51	20	45	35
R51_PR	57	28	45	35
R51_PR	65	28	45	35
R54_PR	61	29	45	35
R55_PR	62	30	45	35
R56_PR	63	31	45	35
R58_PR	58	27	45	35
R59A	23	3	45	35
R59B	24	4	45	35
R61	26	7	45	35
R64A	27	8	45	35
R64B	27	8	45	35
R65	22	3	45	35
R66	23	3	45	35
R67	23	3	45	35
R68	24	4	45	35
R71	22	2	45	35
R72	24	5	45	35
R73	24	5	45	35
R74	18	1	45	35
R75	18	2	45	35
R76	21	4	45	35
R77	14	-1	45	35
R78	27	7	45	35

	Scenario 3 - Predicted Noise Level				Scenario 4 - Predicted Noise Level				Scenario 5 - Predicted Noise Level				PNTL			
Name	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**
R01_PR	36	35	35	37	35	34	34	34	35	34	34	35	40	35	35	40
R02_PR	39	37	37	39	38	36	36	36	37	36	36	38	40	35	35	40
R03_PR	42	17	17	42	40	17	17	17	37	24	24	39	40	35	35	40
R04	32	12	12	34	28	12	12	13	30	18	18	32	40	35	35	40
R06	25	16	16	26	24	16	16	16	24	18	18	24	40	35	35	40
R07A	26	18	18	28	26	18	18	19	25	20	20	26	40	35	35	40
R07B	29	22	22	30	29	22	22	22	27	23	23	28	40	35	35	40
R08A	27	22	22	28	27	22	22	22	26	22	22	27	40	35	35	40
R08B	18	12	12	19	18	12	12	12	19	15	15	18	40	35	35	40
R11	22	17	17	23	20	17	17	17	21	18	18	20	40	35	35	40
R12R	39	38	38	41	38	38	38	39	38	38	38	38	53	53	53	58
R13R	22	17	17	23	20	16	16	17	21	18	18	20	53	53	53	58
R15	20	10	10	20	17	10	10	11	20	13	13	19	40	35	35	40
R18	23	17	17	24	22	17	17	17	22	18	18	22	40	35	35	40
R19	28	25	25	29	28	24	24	26	28	25	25	28	40	35	35	40
R20	30	27	27	32	30	27	27	28	30	28	28	30	40	35	35	40
R21	22	14	14	22	21	14	14	14	22	16	16	21	40	35	35	40
R22	34	32	32	35	35	33	33	33	34	33	33	34	40	35	35	40
R23	36	35	35	38	36	35	35	36	36	35	35	37	40	35	35	40
R24	35	34	34	37	35	34	34	35	35	34	34	36	40	35	35	40
R25	35	34	34	37	35	34	34	35	35	34	34	36	40	35	35	40
R26	26	23	23	27	25	23	23	24	25	24	24	26	40	35	35	40
R27	22	14	14	22	22	13	13	14	22	18	18	22	40	35	35	40
R28A	21	13	13	22	21	13	13	14	22	17	17	22	40	35	35	40
R28B	21	12	12	21	21	12	12	13	21	15	15	20	40	35	35	40
R30A	21	13	13	21	19	13	13	14	20	16	16	19	40	35	35	40
R30B	20	12	12	20	18	12	12	13	19	15	15	18	40	35	35	40
R31A	15	10	10	16	15	10	10	11	17	13	13	16	40	35	35	40
R31B	18	10	10	18	16	10	10	11	17	13	13	15	40	35	35	40
R32	19	11	11	19	19	11	11	12	18	14	14	17	40	35	35	40
R35	17	7	7	17	15	7	7	8	17	11	11	16	40	35	35	40
R36	19	13	13	20	18	11	11	13	19	14	14	18	40	35	35	40
R38	14	5	5	15	14	5	5	6	16	10	10	14	40	35	35	40
R40A	15	5	5	16	15	5	5	6	17	10	10	16	40	35	35	40
R40B	17	8	8	18	17	8	8	9	18	12	12	17	40	35	35	40
R41	14	3	3	14	12	3	3	4	14	8	8	13	40	35	35	40
R43	16	5	5	18	15	5	5	6	18	10	10	17	40	35	35	40
R44	12	1	1	12	11	1	1	2	14	7	7	13	40	35	35	40
R46	22	8	8	24	19	8	8	9	22	13	13	23	40	35	35	40

	Scenario 3 - Predicted Noise Level				Scenario 4 - Predicted Noise Level				Scenario 5 - Predicted Noise Level				PNTL			
Name	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**	**Day**	**Evening**	**Night**	**Enh**
R48_PR	32	16	16	33	29	16	16	17	29	19	19	30	40	35	35	40
R49A_PR	33	15	15	35	26	14	14	15	26	18	18	28	40	35	35	40
R49B_PR	33	15	15	34	29	14	14	15	31	19	19	33	40	35	35	40
R50_Opt	37	25	25	38	34	25	25	26	32	26	26	33	40	35	35	40
R51_PR	41	40	40	41	38	38	38	41	39	39	39	41	40	35	35	40
R51_PR	39	38	38	40	37	37	37	39	38	37	37	40	40	35	35	40
R54_PR	44	44	44	46	44	43	43	46	44	44	44	46	40	35	35	40
R55_PR	45	45	45	47	44	44	44	47	46	46	46	47	40	35	35	40
R56_PR	46	46	46	47	44	44	44	46	45	45	45	46	40	35	35	40
R58_PR	49	49	49	45	39	39	39	41	40	39	39	41	40	35	35	40
R59A	15	3	3	16	13	3	3	4	16	9	9	16	40	35	35	40
R59B	17	4	4	18	15	4	4	4	18	10	10	18	40	35	35	40
R61	23	7	7	25	22	7	7	7	23	13	13	24	40	35	35	40
R64A	17	8	8	18	17	8	8	10	17	12	12	15	40	35	35	40
R64B	17	8	8	18	17	8	8	9	17	12	12	15	40	35	35	40
R65	14	2	2	14	13	2	2	3	16	8	8	15	40	35	35	40
R66	14	3	3	15	13	3	3	4	16	8	8	15	40	35	35	40
R67	14	2	2	15	13	2	2	3	16	8	8	15	40	35	35	40
R68	16	4	4	17	14	4	4	4	17	9	9	16	40	35	35	40
R71	12	1	1	12	11	1	1	2	13	7	7	12	40	35	35	40
R72	18	4	4	20	17	4	4	5	18	10	10	18	40	35	35	40
R73	19	4	4	20	18	4	4	5	20	10	10	20	40	35	35	40
R74	11	-1	-1	11	10	-1	-1	0	13	6	6	11	40	35	35	40
R75	10	0	0	10	8	0	0	0	11	5	5	9	40	35	35	40
R76	13	4	4	13	13	4	4	5	14	9	9	13	40	35	35	40
R77	7	1	1	6	3	0	0	0	7	2	2	6	40	35	35	40
R78	17	7	7	18	15	7	7	8	17	11	11	16	40	35	35	40

Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting