
Appendix I

Noise and vibration assessment

Birriwa Solar and Battery Project Modification

Noise and Vibration Impact Assessment

Prepared for ACEN Australia Pty Ltd

June 2025

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Noise and Vibration Impact Assessment

ACEN Australia Pty Ltd

E240117 Birriwa Solar and Battery Project Modification – NVIA

June 2025

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Executive Summary

ACEN Australia Pty Ltd (ACEN) has approval to develop the Birriwa Solar and Battery Project, a large scale solar photovoltaic (PV) electricity generation facility along with battery storage and associated infrastructure, including the construction of a temporary accommodation facility (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised battery energy storage system (BESS) of up to 600 MW for a 2-hour duration (1,200 MWh). The project (SSD-29508870) was approved on 16 August 2024 by the NSW Independent Planning Commission, with development consent conditions.

ACEN is seeking approval to modify development consent SSD-29508870 to include additional lots, an alternative secondary access route and upgrade to part of the existing Birriwa Bus Route South, an increase in capacity of the approved temporary accommodation facility, and an increase in the storage capacity and duration of the BESS.

A modification report (EMM 2025) has been prepared to support the application to modify SSD-29508870.

This noise and vibration impact assessment (NVIA) has been prepared to address the proposed modifications. This report includes an assessment of:

- construction noise impacts on surrounding sensitive receivers in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC 2009)
- construction vibration impacts on nearby structures and other sensitive uses in accordance with *Assessing Vibration – a technical guideline* (DEC 2006)
- increases in road traffic noise due to construction works in accordance with the *Road Noise Policy* (RNP) (DECCW 2011)
- assessment of operational noise in accordance with the *Noise Policy for Industry* (NPfI) (EPA 2017).

Construction works are proposed to occur in standard hours (i.e. Monday to Friday 7.00 am to 6.00 pm and Saturday 8.00 am to 1.00 pm). Maximum construction noise and vibration impacts are expected to occur during the site establishment phase. Predictions based on proposed construction methodology due to the modification indicate that construction works will comply with noise management levels under the ICNG. Based on setback distances from proposed works, construction vibration impacts are considered negligible.

During peak construction, increases in road traffic noise will occur along Golden Highway, Birriwa Bus Route South and Merotherie Road. Assessed road traffic noise levels indicate increases of approximately 1.1 decibels (dB) along Golden Highway, and predicted levels are predicted to be below the thresholds provided under the RNP.

The assessment of operational noise from the proposed modifications focused on the changes to the BESS, Consideration of tonal characteristics was included within this assessment based on anticipated tonal characteristics being present from several sources. Assessment of operational noise concluded that NPfI (EPA 2017) criteria could be achieved with the implementation of the original mitigation and management measures.

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1 Introduction

1.1 Background

ACEN Australia Pty Ltd (ACEN) has approval to develop the Birriwa Solar and Battery Project, a large scale solar photovoltaic (PV) electricity generation facility along with battery storage and associated infrastructure, including the construction of a temporary accommodation facility (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised battery energy storage system (BESS) of up to 600 MW for a 2-hour duration (1,200 MWh). The project (SSD-29508870) was approved on 16 August 2024 by the NSW Independent Planning Commission, with development consent conditions.

The project site is approximately 15 kilometres (km) south-east of Dunedoo, in the Central-West Orana (CWO) region of New South Wales (NSW), in the localities of Birriwa and Merotherie (refer to Figure 1.1). It is situated within the Mid-Western Regional Local Government Area (LGA). Part of the approved transport access route to the project site via the Castlereagh Highway is situated within the Warrumbungle Shire LGA. The project is within the CWO Renewable Energy Zone (REZ).

ACEN is seeking approval to modify development consent SSD-29508870 to include additional lots, an alternative secondary access route and upgrade to part of the existing Birriwa Bus Route South, an increase in capacity of the approved temporary accommodation facility, and an increase in the storage capacity and duration of the BESS.

A modification report (EMM 2025) has been prepared to support the application to modify SSD-29508870.

1.2 Approved project overview

The approved project comprises the following key components:

- installation of approximately 1 million solar PV panels and associated mounting infrastructure
- a BESS with a capacity of up to 600 MW and a storage duration of up to 2 hours (1,200 MWh)
- an on-site substation with a connection voltage of up to 500 kilovolts (kV)
- electrical collection and conversion systems, including inverter and transformer units, switchyard, control room and staff car park
- underground and aboveground cables
- an operational infrastructure area, including demountable and permanent offices, amenities, and equipment sheds
- internal access roads
- a temporary construction compound (during construction and decommissioning phases)
- an access route upgrade from Castlereagh Highway to the project site via Barneys Reef Road and Birriwa Bus Route South
- a temporary accommodation facility to provide accommodation for up to 500 construction staff during the construction phase of the project
- an emergency access track providing alternative access to the accommodation facility, suitable for emergency vehicles.

1.3 Modification overview

ACEN is seeking to modify SSD-29508870 under to section 4.55(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to:

- Increase the project area and development footprint to include three additional lots (Lot 11/DP 750755, Lot 40/DP 750755, Lot 60/DP 750755) and the remaining part of Lot 34/DP 750755, allowing for additional land to be used for solar generation, BESS, and associated ancillary infrastructure, as needed. Modifying the project area and development footprint across additional neighbouring lots will enable flexibility in design and construction, optimisation of the solar array layout, and will allow sufficient space for maintenance.
- Increase the storage capacity and duration of the BESS from up to 600 MW for a 2-hour duration up to 900 MW for a 4-hour duration. The additional capacity will allow the project to increase its energy storage potential, providing additional firming support and greater network system strength.
- Increase the project area and development footprint to allow for an upgrade to part of the existing Birriwa Bus Routh South Road from the Golden Highway via Merotherie Road as an alternative access route. It also includes a public road crossing along Birriwa Bus Route South to allow construction and operation traffic to access different areas of the project with limited impacts on Birriwa Bus Route South. This upgrade will enable access to the project for the purpose of constructing and operating the approved temporary accommodation facility, as well as the BESS. Oversize over mass vehicles will continue to access the project area via the approved primary access point (i.e. Castlereagh Highway-Barney's Reef Road-Birriwa Bus Route South).
- Increase the approved project's accommodation facility capacity from 500 workers to 650 workers, within the approved accommodation footprint (up to an additional 150 workers will reside at the accommodation facility in peak construction periods).
- Amend the schedule of land to include three additional neighbouring lots.
- Increase the total number of daily vehicle movements to and from the site during pre-construction and construction, from 120 to 156 daily heavy vehicle trips, split between the approved access via Barneys Reef Road and the proposed alternative access via Merotherie Road. Correction of wording errors in the consent conditions from "vehicle movements" to "vehicle trips".

1.4 Report purpose and assessment requirements

This Noise and Vibration Impact Assessment (NVIA) provides an assessment of the potential noise and vibration impacts associated with the proposed modification.

This NVIA has been prepared to accompany the modification report with the specific objectives to:

- model the noise emissions of the proposed operational and construction modifications to the approved development
- assess road traffic noise as a result of construction related vehicles on public roads
- provide an overview of compliance, noise mitigation measures and residual impacts where relevant.

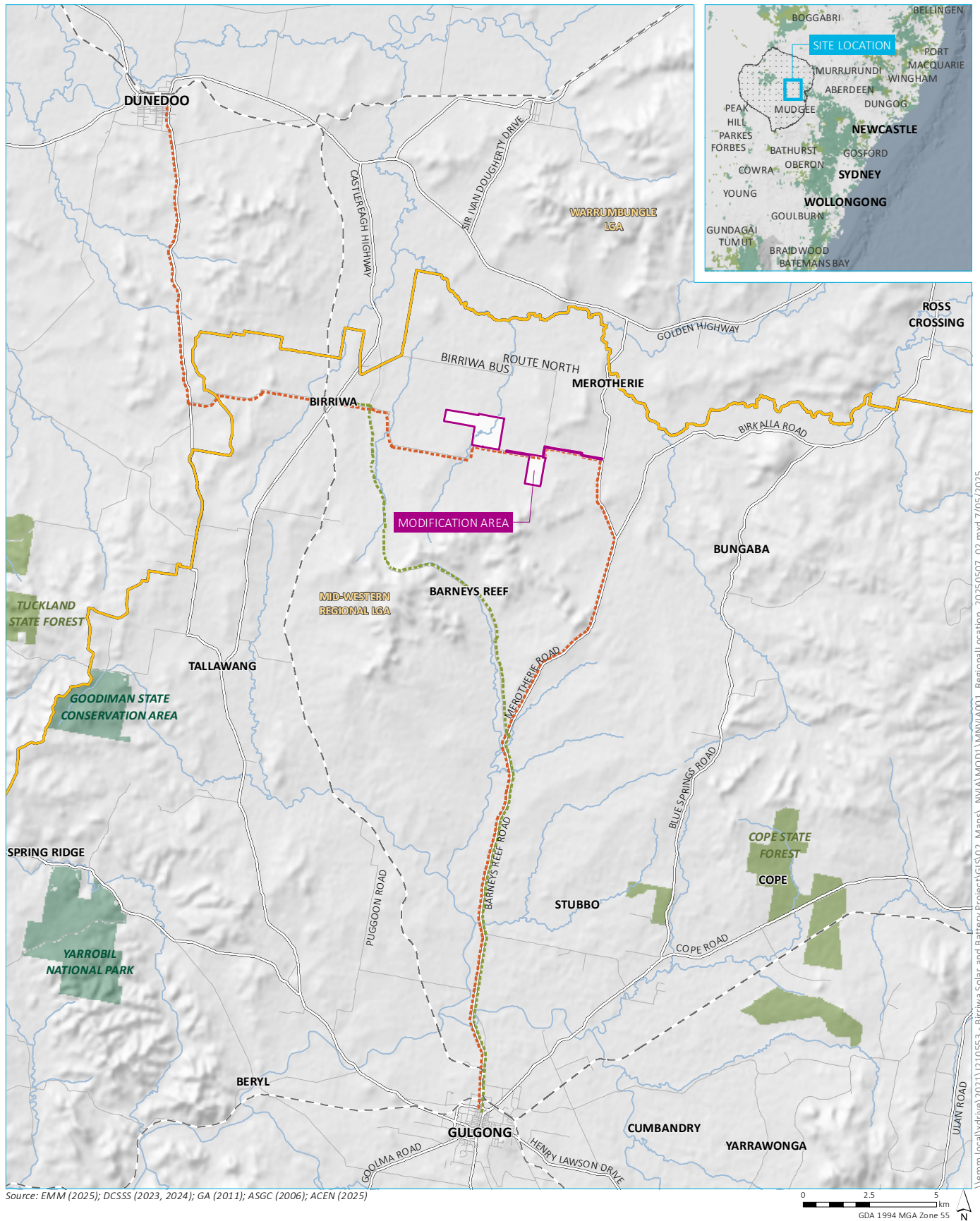
This NVIA has been prepared in general accordance with the guidelines specified in:

- NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry (NPfI)*
- NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy (RNP)*
- NSW Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: a technical guideline*
- NSW Department of Environment Climate Change (DECC) 2009, *Interim Construction Noise Guideline (ICNG)*
- BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2*
- British Standard 6472 – 2008, *Evaluation of human exposure to vibration in buildings (1-80Hz)*
- German Standard DIN 4150 Part 2 1975.

1.5 Key terminology

The following key terms will be used throughout the modification report:

- **The project:** The project as approved by development consent SSD-29508870, comprising the solar and battery project as well as public road upgrades, as assessed in the *Birriwa Solar and Battery Project Environmental Impact Statement (EIS)* (EMM 2022) and the accommodation facility assessed in the *Amendment Report* (EMM 2023).
- **The project area:** The area to which SSD-29508870 applies (approximately 1,535 hectares (ha)). Note, this area is not the development footprint and hence is not the maximum extent of ground disturbing work.
- **The modification area:** The three additional lots to be added to the schedule of lands (Lot 11/DP 750755, Lot 40/DP 750755, Lot 60/DP 750755) and the remaining part of Lot 34/DP 750755, comprising additional areas for infrastructure associated with the solar generation and general operation of the project (approximately 257 ha), and the area of potential impact associated with the upgrade of Birriwa Bus Route South road as an alternative access route to the project area from the Golden Highway via Merotherie Road.
- **The modification development footprint:** This is the impact footprint (approximately 216 ha) associated with the proposed modification, within the modification area. It is the area to be developed within land where ACEN holds landholder agreements. All operational components of the modification will be within the modification development footprint. The modification development footprint is the outcome of the iterative process which led to excluding certain areas of environmental or social constraint.
- **Project development footprint:** The maximum extent of ground disturbing work (impact footprint) associated with construction and operation of the project, comprising approximately 1,413 ha of land, including the development footprint associated with the approved project (approximately 1,197 ha), and the modification development footprint (approximately 216 ha).
- **Associated residence:** A dwelling whose owners have entered into a land agreement with ACEN for the project. Residences identified with an 'A' are associated residences. Note, there are no additional associated residences as a result of the proposed modification.
- **Non-associated residence:** A dwelling whose owners do not have an agreement with ACEN for the project. Residences identified with an 'R' are non-associated.



KEY

- | | |
|--|---|
| Modification area | Central West Orana Renewable Energy Zone (see inset) |
| Existing environment | NPWS reserve |
| — Rail line | State forest |
| — Major road | Central West Cycle (CWC) Trail |
| — Minor road | --- CWC main route - Gulgong to Dunedoo |
| — Watercourse | --- CWC alternate route - Slap Dash Creek side trail |
| Local government area | |

Regional context

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 1.1

2 Existing environment

2.1 Overview

The area around the proposed modification area is consistent with the existing environment assessed within the previous NVIA. Surrounding land uses are predominately rural and agricultural uses. Ambient noise levels would be controlled by natural elements and limited human activity including traffic and agricultural activities. There is one associated receiver located within the proposed modification boundary of Lot 34. This residence has entered into a landholder agreement with ACEN.

Consistent with the previous NVIA, the minimum background noise thresholds of the *Noise Policy for Industry* (NPfI, EPA 2017) have been adopted on the basis that land use is largely rural with limited traffic and industry. The minimum thresholds in the NPfI are:

- day 35 decibels (dB)
- evening 30 dB
- night 30 dB.

2.2 Noise and vibration assessment locations

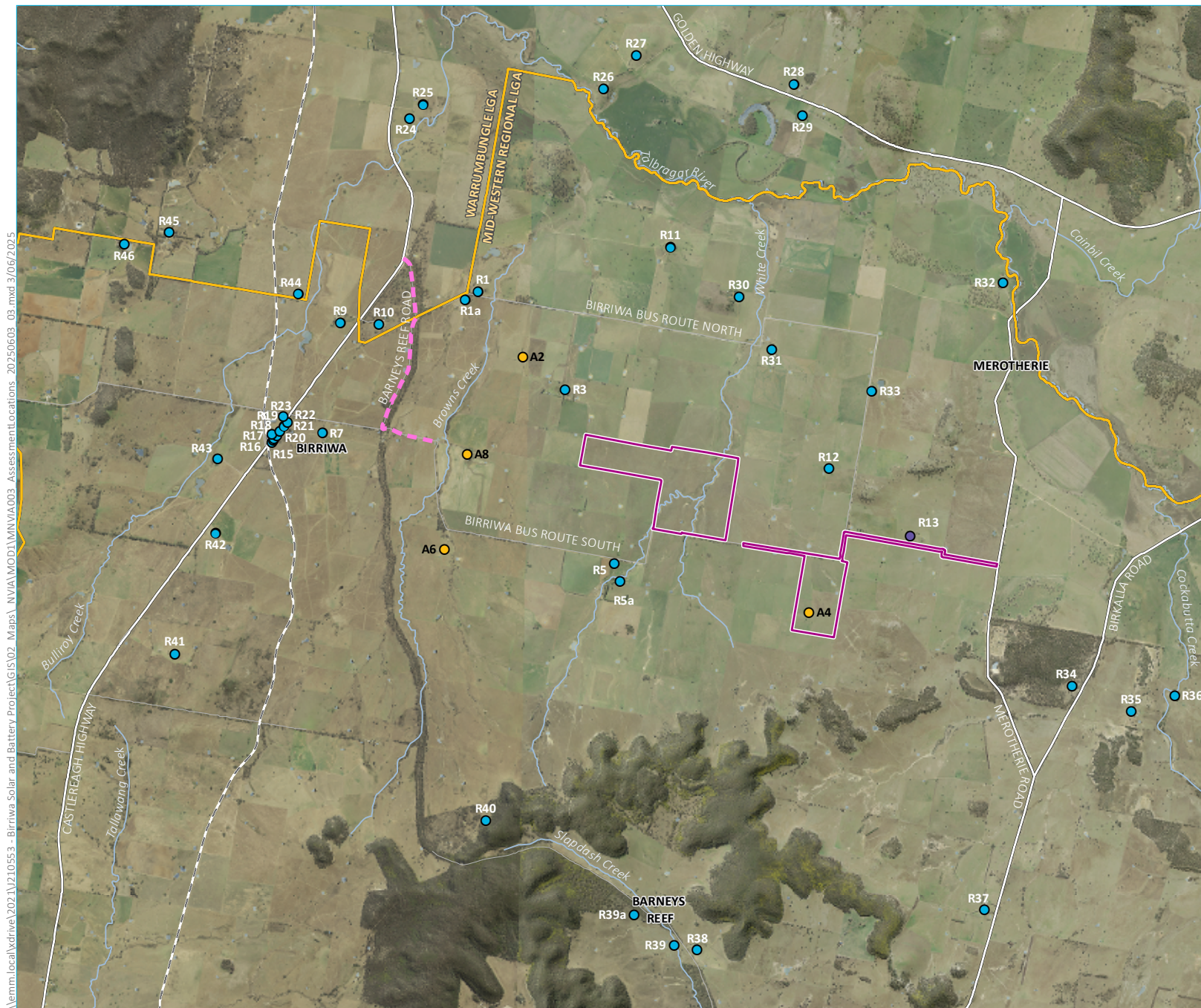
The nearest representative noise sensitive locations to the project have been identified for the purpose of assessing potential noise and vibration impacts. Details are provided in Table 2.1 and their locations are shown in Figure 2.1. They are referred to in this report as assessment locations. Distances shown are the distances to the development footprint.

Table 2.1 Noise assessment locations

ID	Classification	Easting ¹	Northing ¹	Distance to development footprint (m)
R1	Residential	735592	6445545	553
R3	Residential	736829	6444145	464
R5	Residential	737525	6441670	1,804
R7	Residential	733370	6443534	948
R9	Residential	733628	6445094	1,579
R10	Residential	734180	6445077	464
R11	Residential	738332	6446171	1,804
R12	Residential	740589	6443022	948
R13	Residential	741745	6442063	1,579
R15	Residential	732652	6443401	1,558
R16	Residential	732670	6443424	1,538
R17	Residential	732688	6443451	1,567
R18	Residential	732655	6443508	1,504

ID	Classification	Easting ¹	Northing ¹	Distance to development footprint (m)
R19	Residential	732719	6443494	598
R20	Residential	732761	6443551	1,460
R21	Residential	732823	6443618	1,398
R22	Residential	732878	6443685	1,346
R23	Residential	732818	6443761	1,412
R24	Residential	734613	6448010	1,983
R25	Residential	734807	6448202	2,192
R30	Residential	739307	6445466	3,403
R31	Residential	739777	6444720	3,964
R33	Residential	741194	6444116	4,684
R39	Residential	737813	6436663	4446
R40	Residential	735702	6438010	300
R42	Residential	731850	6442099	2,268
R43	Residential	731877	6443162	1,627
R44	Residential	733024	6445509	3,902

Notes: 1. GDA 94 MGA Zone 55



- KEY**
- Modification area
 - Dwelling associated with the project
 - Dwelling not associated with the project
 - Dwelling not associated with the project (EnergyCo building)
 - Road upgrade corridor
 - Existing environment
 - Rail line
 - Major road
 - Minor road
 - Watercourse
 - Waterbody
 - Local government area

Noise assessment locations

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 2.1

3 Assessment criteria

There are no changes to the assessment criteria for non-associated residences from the NVIA prepared for the EIS (EMM 2022).

3.1 Construction Noise

Table 3.1 provides *Interim Construction Noise Guideline* (ICNG) noise management levels (NML) which apply to residential assessment locations. These levels are consistent with the previous NVIA.

Table 3.1 ICNG construction noise management levels for residences

Time of day	NML $L_{Aeq,15min}$	Application
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm, Saturday 8:00 am to 1:00 pm, no work on Sundays or public holidays.	Noise-affected RBL + 10 dB	The noise-affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured $L_{eq}(15-min)$ 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 works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	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 works near schools, or mid-morning or mid-afternoon for works near residences) - 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 + 5 dB	- A strong justification would typically be required for works 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 5 dBA 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.

3.2 Operational noise

Assessment criteria for operational noise are consistent with the previous NVIA prepared for the EIS, and are in accordance with the NPfI. Table 3.2 outlines the project noise trigger levels, and Table 3.3 outlines the sleep disturbance screening criteria, which apply to residential assessment locations.

Table 3.2 Project noise trigger levels

Assessment location	Assessment period ¹	Intrusiveness noise level, $L_{Aeq,15min}$, dB	Amenity noise level ² , $L_{Aeq,15min}$, dB	PNTL ³ , $L_{Aeq,15min}$, dB
All non-associated residences	Day	40	53	40
	Evening	35	43	35
	Night	35	38	35

Notes: 1. Day: 7.00 am to 6.00 pm Monday to Saturday; 8.00 am to 6.00 pm Sundays and public holidays; evening: 6.00 pm to 10.00 pm; night: remaining periods.

2. Project amenity $L_{Aeq,15min}$ noise level is the recommended amenity noise level $L_{Aeq,period} + 3$ dB as per the NPfI.

3. PNTL is the lower of the calculated intrusiveness or amenity noise levels.

Table 3.3 Sleep disturbance screening criteria at residences

Assessment location	Adopted night RBL, dB	Night-time maximum noise level event screening criteria, dB	
		$L_{Aeq,15\text{ minute}}$	L_{Amax}
Non-associated residences	30	40	52

3.2.1 Mitigating noise

Where noise levels above the PNTLs are predicted, all feasible and reasonable mitigation are to be considered for the project to reduce noise levels towards the PNTLs, before any residual impacts are determined and addressed.

The significance of the residual noise impacts is generally based around the human perception to changes in noise levels as explained in the glossary of acoustic terms. For example, a change in level of 1 to 2 dB is typically indiscernible to the human ear. The characterisation of a residual noise impact of 0 to 2 dB above the PNTL is therefore considered negligible. The NPfI characterisation of residual noise impact is outlined further in Table 3.4.

Table 3.4 Significance of residual noise impacts

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of the residual noise level is:
≤ 2 dB	Not applicable.	Negligible
≥ 3 but ≤ 5 dB	- less than recommended amenity noise level; or - greater than recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from development is ≤ 1 dB.	Marginal
≥ 3 but ≤ 5 dB	Greater than recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is > 1 dB.	Moderate
> 5 dB	Less than or equal to recommended amenity noise level.	Moderate
> 5 dB	Greater than recommended amenity noise level.	Significant

Source: NPfI (EPA 2017).

3.3 Road traffic noise

Construction and operational traffic require consideration for potential noise impacts. Consistent with the original NVIA, the principal guidance to assess the impact of road traffic noise on assessment locations is in the RNP (EPA 2011). Table 3.5 presents the road noise assessment criteria for residential land uses (i.e. assessment locations), reproduced from Table 3 of the RNP for road categories relevant to construction and use of the project. Under the definitions of the RNP, Castlereagh Highway would be an arterial road, with Birriwa Bus Route South, Merotherie Road and Barney's Reef Road being local roads.

Table 3.5 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria – dBA	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{eq,15hr}$ 60 (external)	$L_{eq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional traffic on local roads generated by land use developments.	$L_{eq,15hr}$ 55 (external)	$L_{eq,9hr}$ 50 (external)

Additionally, the RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to an increase of up to 2 dB.

In addition to meeting the assessment criteria in Table 3.5 any significant increase in total traffic noise at the relevant residential assessment locations must be considered. Residential assessment locations experiencing increases in total traffic noise levels above those presented in Table 3.6 should be considered for mitigation.

Table 3.6 Road traffic relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase – dBA	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/ sub-arterial roads and transit ways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{eq(15-hr)} + 12$ dB (external)	Existing traffic $L_{eq(9-hr)} + 12$ dB (external)

Appendix B of the RNP, states that noise levels shall be rounded to the nearest integer, whilst difference between two noise levels are to be rounded to a single decimal place.

Relative increase criteria are not available for local roads and therefore have been excluded from this assessment.

4 Assessment method

Assessment of the proposed amendments is consistent with the approach taken within the NVIA prepared for the EIS (EMM 2022, J210553_NVIA). Operational and construction noise levels were predicted using a computer-generated model using SoundPlan 8.2 modelling software with the CONCAWE algorithm. The model was based on the topography and surrounding areas as used for the previous NVIA as part of the EIS (EMM 2022, J210553_Birriwa Solar_EIS).

4.1 Construction noise

The construction noise impact assessment has adopted sound power levels from the EMM noise database and the UK Department of Environment, Food and Rural Affairs (DEFRA) for plant and equipment items used for similar works. Plant and equipment items, sound power levels and quantities adopted in the noise modelling are summarised in Table 4.1.

The assumed list of plant and equipment for each construction scenario that is provided in Table 4.1 are representative of a worst-case period of construction in an active works area. However, due to the practicalities of constructing a project of this nature, the plant and equipment quantities may vary from time -to -time to cater for the requirements of the project's construction. If the actual fleet of plant and equipment required varies significantly from that assumed within Table 4.1, a risk assessment of the proposed works will be undertaken to determine the likelihood of noise impacts on surrounding residential assessment locations.

A construction environmental management plan (CEMP) is expected to be developed as part of the project and will include the risk assessment protocol and detail the management and mitigation measures to be implemented during construction consistent with best practice requirements.

Table 4.1 Construction plant and equipment for typical worst-case scenario

Description	Equipment	Quantity	Item $L_{Aeq,15min}$	Overall $L_{Aeq,15min}$
Phase 1 – Site establishment and earthworks	Dozer	2	110	120
	Grader	1	104	
	Excavator	2	107	
	Roller	1	116	
	Bobcat	2	103	
	Front End Loader	1	107	
	Road truck (deliveries)	2	106	
	Concrete truck	2	106	
	Drilling Rig SM 14	1	106	
	Light vehicle	4	76	
Phase 2 – Construction and commissioning works	Road truck (deliveries)	2	106	114
	Light vehicle	4	76	
	Crane	2	106	
	Forklift	2	106	
	Hand tools	2	80	

4.2 Construction vibration

Safe working distances for typical items of vibration intensive plant are listed in Table 4.2 (consistent with those shown in the NVIA). The safe working distances are quoted for both “Cosmetic Damage” (refer British Standard BS 7385) and “Human Comfort” (refer British Standard BS 6472-1).

Table 4.2 Recommended safe working distances for vibration intensive plant

Plant Item	Rating / description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Medium hydraulic hammer	(900 kg – 12 to 18 t excavator)	7 m	23 m
Large hydraulic hammer	(1600 kg – 18 to 34 t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤ 800 mm	2 m (nominal)	N/A
Vibratory Rollers	<50 kN (typically 1–2 tonnes)	5 m	15 to 20 m
	<100 kN (typically 2–4 tonnes)	6 m	20 m
	<200 kN (typically 4–6 tonnes)	12 m	40 m
	<300 kN (typically 7–13 tonnes)	15 m	100 m
	>300 kN (typically 13–18 tonnes)	20 m	100 m
	>300 kN (>18 tonnes)	25 m	100 m

4.3 Operational noise and vibration

During operation, noise emissions from the BESS facility will primarily be related to fixed plant and equipment including tracker motors, battery cubicles, inverters, LV/HV transformers and HV transformers. While each of these sources is likely to be minimal, due to the number of sources, cumulative emissions may be higher.

4.3.1 Plant and Equipment

Noise impact from the operation of the project was considered at assessment locations outlined in Section 2.2.

As part of the detailed design process, the final locations for potential noise-generating infrastructure, in particular the solar arrays, substation and BESS facilities, will consider the distance between this type of infrastructure and non-associated residences, so as to minimise operational noise impacts, where practicable.

Noise sources considered during the operational phase of the project include tracker motors, battery cubicles, power conversion systems (PCS) and high voltage transformers. Previous operational noise sources are expected to be consistent with the previous NVIA. The modifications are expected to increase the capacity of the BESS to 900 MW and will change specific total equipment noise emissions that will be included in this assessment.

Envisaged operational noise sources are presented in Table 4.3. Based on manufacturer data and assuming constant operation of the LV/HV transformers and HV transformers, Table 4.3 also incorporates the reduced total sound power levels under varying utilisation levels and cooling system operation of the battery cubicles and inverters.

Two locations for the BESS were modelled as part of the original NVIA (600 MW BESS at location A and/or B). However, this modification proposes the following scenarios:

- Scenario 1: 600 MW BESS at location A (as approved) and a 300 MW BESS at location B.
- Scenario 2: 900 MW BESS located across location B and into the remainder of Lot 34. Note, there is no BESS at location A.

Scenario 2 has been assessed and modelled within this report. With regards to scenario 1, a 600 MW BESS at location A has been approved. Given the distance between operational infrastructure areas at location A and B, the addition of a 300 MW BESS at location B under scenario 1 is not expected to result in any change in noise levels near location A and therefore has not been modelled within this report.

Table 4.3 Operational noise source sound power levels

Noise source	L _{Aeq} sound power level per unit, dB ¹	Total sound power level, dB
Solar tracker motors (x20,000)	49	92
Solar Inverters (x268)	88	112
50 MVA LV-MV transformers (x24)	90	104
200 MVA MV-HF transformers (6)	98	106
Total (excluding BESS)		114
BESS – Containerised BESS Option		
Battery cubicles/containers (x161)	92	114
PCU Skids (x161)	87	109
BESS Transformers		
290 MVA HV transformer (x4)	98	104
1200 MVA HV Grid transformer	113	113

Notes: 1. The combined noise levels will be subject to final quantity, configuration and layout of equipment as well as any noise attenuating measures.

The predictor, meteorological, and utilisation parameters for this assessment are consistent with the parameters in the previous NVIA (EMM 2022, J210553_NVIA).

4.4 Road traffic noise

Consistent with the previous NVIA, the UK Calculation of Road Traffic Noise (CoRTN) algorithm was used in the assessment of road traffic noise. The CoRTN algorithm has been used across Australia for several decades and has been extensively validated against specific Australian conditions.

As part of this modification, traffic accessing the project through construction and operation is proposed to be via Birriwa Bus Route South and Merotherie Road via the Golden Highway.

The proposed modification would result in the following changes in traffic volumes during construction phases:

- An increase of 180 daily heavy vehicle movements via Golden Highway, Merotherie Road and Birriwa Bus Route South.
- An increase of 130 daily light vehicle movements via Golden Highway, Merotherie Road and Birriwa Bus Route South.

The additional traffic on Golden Highway is assumed to be 50% from the west and 50% from the east.

The original NVIA assessment considered increase in traffic volumes on the Castlereagh Highway; however, this modification proposes moving this traffic increase to the Golden Highway. It is noted that the approval to access the site via the Castlereagh Highway and Barneys Reef Road is maintained; however, as a worst-case scenario this report considers all traffic associated with the modification accessing the site by the proposed secondary access via Merotherie Road. A summary of the road sections and assessment methodology is provided in Table 4.4.

Table 4.4 Road segments considered in noise assessment

ID	Road segment/name	AADT	Assessment methodology
1	Castlereagh Highway	1250	CoRTN
2	Golden Highway	1644-2223	CoRTN

Road traffic noise levels from the project have been assessed by calculating existing and existing plus project traffic at representative residential assessment locations using the CoRTN method. The following assumptions have been adopted:

- Speed limit for Golden Highway 100 kilometres per hour (km/h) (as signposted).
- There are no buildings or other intervening objects that will act like a noise barrier between the road and the noise assessment point (i.e. we are assessing the locations directly exposed to the road).
- 21% heavy vehicles.
- A façade reflection has been added to predicted noise levels as appropriate.

Operational traffic associated with the project will typically be restricted to occasional maintenance vehicles only with expected maximum of 20 light vehicles a day. Accordingly, operational traffic from the project is not a concern or assessed further in this report.

5 Impact assessment

5.1 Construction noise

In accordance with the procedures used in the previous NVIA, prediction of construction noise levels is provided in Table 5.1 for the potential worst impact (i.e. Phase 1 site establishment and earthworks). The construction noise level presented for each assessment location represents the energy-average noise level over a 15-minute period and assumes all plant operating concurrently.

In accordance with the proposed modifications, both Options A and B are still considered for the location of the BESS. The location of the BESS at Option B has been expanded in size and capacity and has been modelled to reflect these changes. The construction of the BESS at location A remains unmodified and has accordingly not been reconsidered within this report.

Construction works will be undertaken during standard hours of 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday.

Table 5.1 Predicted construction noise levels

Assessment location	Classification	Predicted construction noise level, dB L _{Aeq,15min}			Compliant with 45 dB L _{Aeq,15min} daytime standard construction hours?
		Previous approved project assessment	Modification assessment	Predicted change	
R1	Residential	36	34	-2	Yes
R3	Residential	44	43	-1	Yes
R5	Residential	40	39	-1	Yes
R7	Residential	35	34	-1	Yes
R9	Residential	32	32	0	Yes
R10	Residential	32	32	0	Yes
R11	Residential	28	25	-3	Yes
R12	Residential	37	36	-1	Yes
R15	Residential	29	27	-2	Yes
R16	Residential	29	28	-1	Yes
R17	Residential	29	28	-1	Yes
R18	Residential	29	28	-1	Yes
R19	Residential	29	28	-1	Yes
R20	Residential	29	28	-1	Yes
R21	Residential	29	28	-1	Yes
R22	Residential	29	29	0	Yes
R23	Residential	22	28	+6	Yes
R24	Residential	22	22	0	Yes
R25	Residential	22	21	-1	Yes

Assessment location	Classification	Predicted construction noise level, dB L _{Aeq,15min}			Compliant with 45 dB L _{Aeq,15min} daytime standard construction hours?
		Previous approved project assessment	Modification assessment	Predicted change	
R30	Residential	28	27	-1	Yes
R31	Residential	29	29	0	Yes
R33	Residential	28	28	0	Yes
R39	Residential	22	22	0	Yes
R40	Residential	24	22	-2	Yes
R42	Residential	27	25	-2	Yes
R43	Residential	26	24	-2	Yes
R44	Residential	26	26	0	Yes

The results of the modelling demonstrate predictions comply with the construction NML for all assessment locations during daytime standard construction hours. The proposed modifications of construction operations are predicted to have negligible or reduced change to noise impacts at the majority of assessment locations. Noise impacts at assessment location R23 is predicted to be greater than those predicted in the EIS by 6 dB. However, the modified predicted noise level of 28 dB is 12 dB below the PNTL of 40 dB and would be within the assigned limits of the project under the ICNG.

This modification assessment has been developed in response to the proposed changes from the previous EIS. As a result, the modelled construction activities have been more generally localised towards the BESS at Option B to better illustrate the impacts from the proposed project modifications. Accordingly, the density of the construction noise will shift eastward towards Option B and has resulted in reduction of noise across sensitive many sensitive receivers.

5.1.1 Temporary workers accommodation facility

Noise impacts to the temporary workers facility documented in the amendment to the NVIA has not been included as an assessment location in this modification. The predicted noise impacts from the modification proposal show negligible impacts on most receivers. It is expected that this trend will extend to the temporary workers accommodation facility. Noise impacts at the next nearest assessment location, R12, is predicted to reduce by 1 dB and would likely indicate a similar reduction at the temporary workers accommodation facility. Additional shielding by topography between the project area and the facility would further support this assessment.

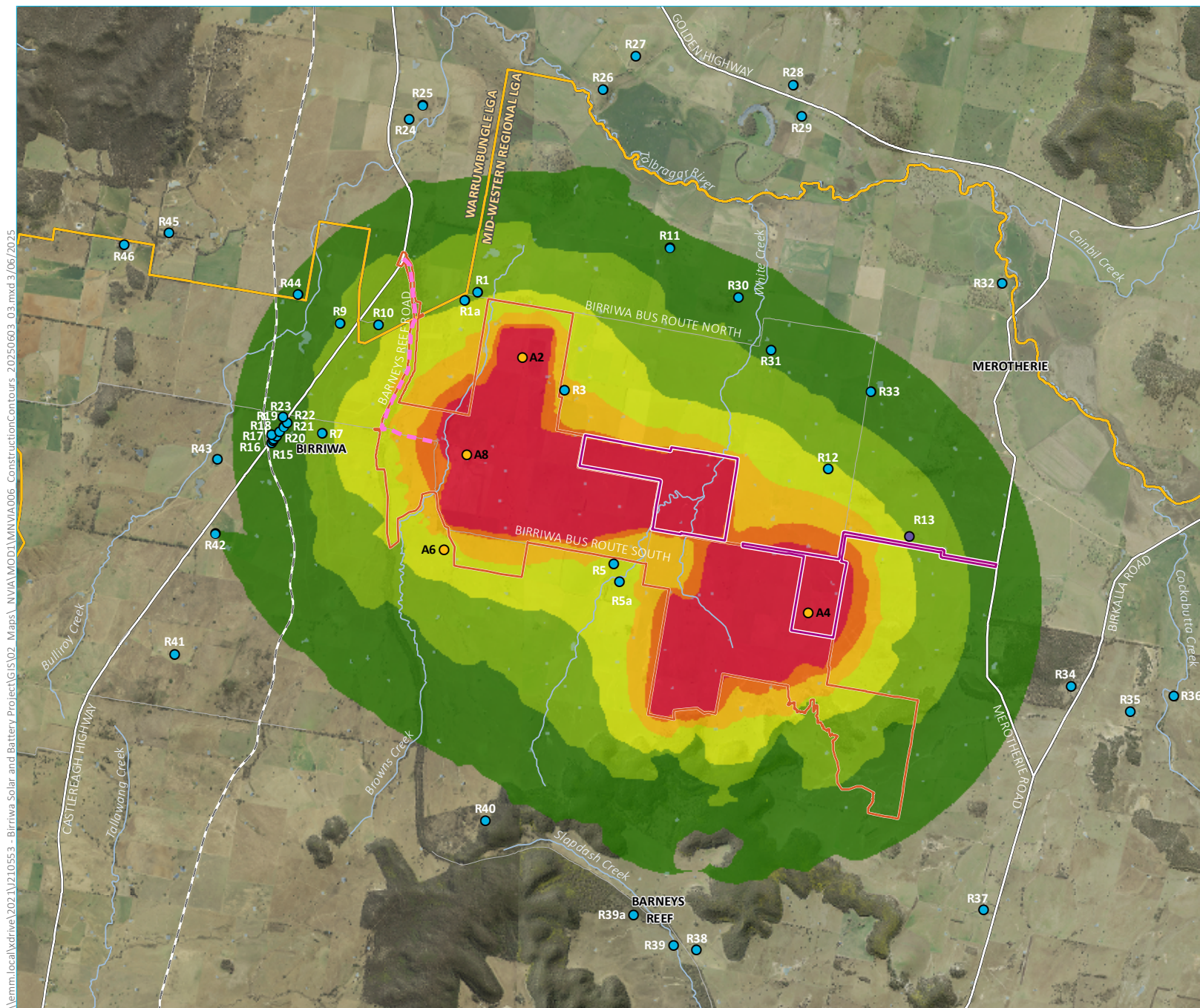
5.1.2 Contours

Predicted L_{Aeq,15min} noise contours representing day construction activities are provided in Figure 5.3 and Figure 5.4 respectively.

The figures represent the predicted construction noise levels during noise enhancing conditions for day under the stated activities.

5.2 Construction vibration

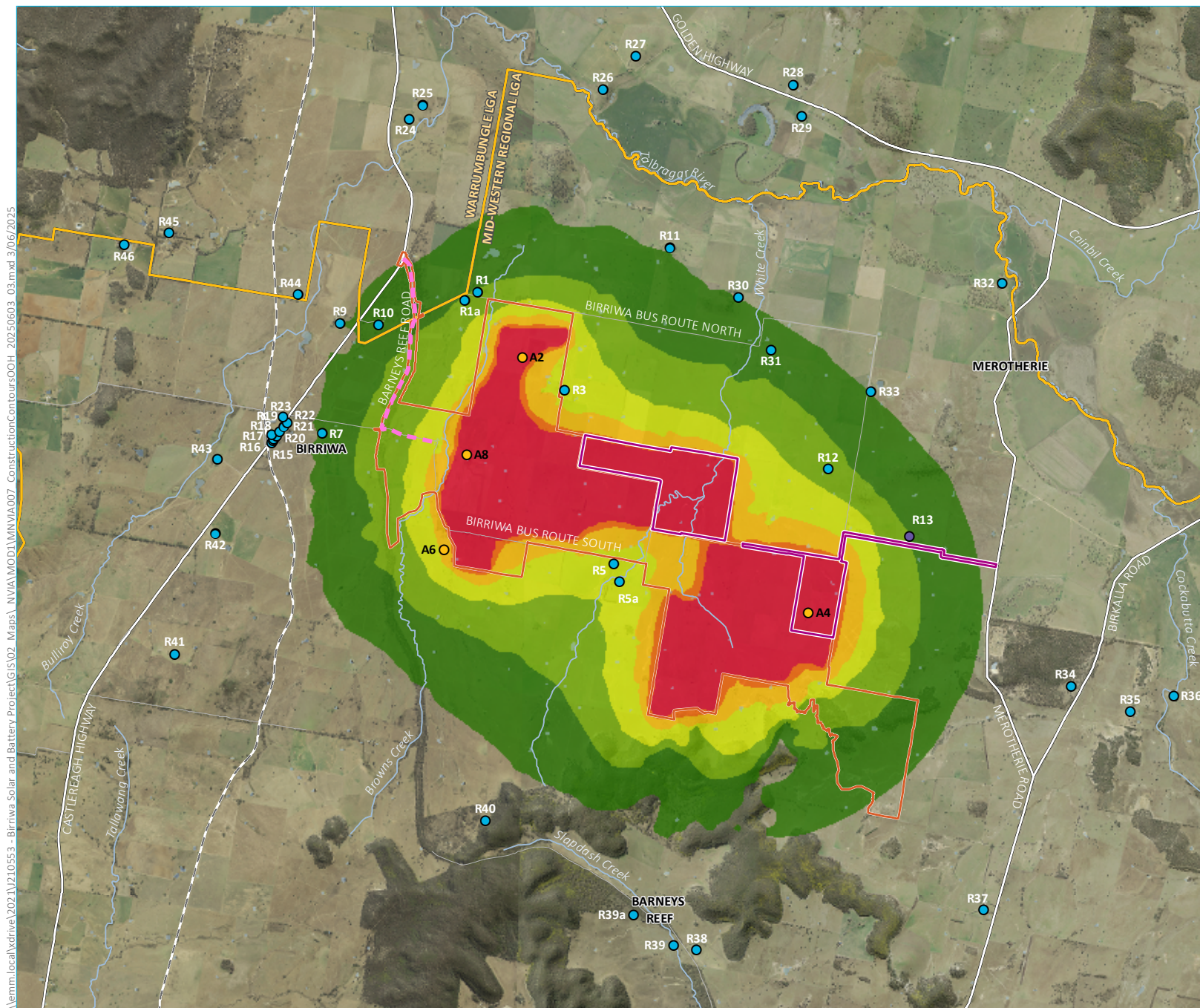
As part of this modification, there are no proposed construction intensive activities within a distance of less than 100 metres (m) from the nearest sensitive receivers. As such, there is not expected to be any change in construction vibration impacts from the NVIA.



- KEY**
- Modification area
 - Approved study area
 - Dwelling associated with the project
 - Dwelling not associated with the project
 - Dwelling not associated with the project (EnergyCo building)
 - Road upgrade corridor
- Noise contour**
- 25 - 30 dB(A)
 - 30 - 35 dB(A)
 - 35 - 40 dB(A)
 - 40 - 45 dB(A)
 - 45 - 50 dB(A)
 - > 50 dB(A)
- Existing environment**
- Rail line
 - Major road
 - Minor road
 - Watercourse
 - Waterbody
 - Local government area

Construction noise contours - day

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 5.1



- KEY**
- Modification area
 - Approved study area
 - Dwelling associated with the project
 - Dwelling not associated with the project
 - Dwelling not associated with the project (EnergyCo)
 - Road upgrade corridor
- Noise contour**
- 25 - 30 dB(A)
 - 30 - 35 dB(A)
 - 35 - 40 dB(A)
 - 40 - 45 dB(A)
 - 45 - 50 dB(A)
 - > 50 dB(A)
- Existing environment**
- Rail line
 - Major road
 - Minor road
 - Watercourse
 - Waterbody
 - Local government area

Construction noise contours
- day OOH

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 5.2

5.3 Operational noise

In accordance with procedures outlined in Section 4.3, prediction of single point operational noise levels was undertaken for day, evening and night periods. The levels presented for each assessment location represents the energy-average noise level over a 15-minute period and assumes all plant operating concurrently under adverse meteorological conditions.

5.3.1 BESS within operational Infrastructure Area B

The proposed design for the BESS consists of racks installed within containers with associated heating ventilation air conditioning (HVAC) for cooling. Noise emissions from these containers are controlled by HVAC and are expected to be relatively broadband in nature.

Table 5.2 Predicted operational noise levels – adverse meteorological conditions – Modified Option B (containerised)

Receiver	Classification	Previous approved project assessment level, dBA			Predicted noise level, dBA			Changes to predicted noise level, dBA			Compliance
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
R1	Residential	31	21	21	27	17	17	-4	-4	-4	Yes
R3	Residential	38	29	30	35	16	16	-3	-13	-14	Yes
R5	Residential	36	32	33	34	27	27	-2	-5	-6	Yes
R7	Residential	25	15	15	22	31	31	-3	+16	+16	Yes
R9	Residential	24	14	14	22	12	12	-2	-2	-2	Yes
R10	Residential	26	16	16	22	12	12	-4	-4	-4	Yes
R11	Residential	23	13	13	22	12	12	-1	-1	-1	Yes
R12	Residential	34	33	34	35	34	34	+1	+1	0	Yes
R15	Residential	22	12	12	19	<10	<10	-3	-2	-2	Yes
R16	Residential	22	12	12	19	<10	<10	-3	-2	-2	Yes
R17	Residential	22	12	12	19	<10	<10	-3	-2	-2	Yes
R18	Residential	22	12	12	18	<10	<10	-4	-2	-2	Yes
R19	Residential	23	13	13	19	<10	<10	-4	-3	-3	Yes
R20	Residential	23	13	13	19	<10	<10	-4	-3	-3	Yes
R21	Residential	23	13	13	19	<10	<10	-4	-3	-3	Yes
R22	Residential	23	13	13	19	<10	<10	-4	-3	-3	Yes
R23	Residential	23	13	13	19	<10	<10	-4	-3	-3	Yes
R24	Residential	17	<10	<10	13	<10	<10	-4	0	0	Yes
R25	Residential	16	<10	<10	13	<10	<10	-3	0	0	Yes

Receiver	Classification	Previous approved project assessment level, dBA			Predicted noise level, dBA			Changes to predicted noise level, dBA			Compliance
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
R30	Residential	25	24	23	26	24	24	+1	0	+1	Yes
R31	Residential	28	26	26	27	26	26	-1	0	0	Yes
R33	Residential	28	27	27	28	24	24	0	-3	-3	Yes
R39	Residential	22	22	21	23	22	22	+1	0	+1	Yes
R40	Residential	17	<10	<10	22	20	20	+5	+10	+10	Yes
R42	Residential	19	<10	<10	18	<10	<10	-1	0	0	Yes
R43	Residential	20	10	<10	16	<10	<10	-4	0	0	Yes

Compliance is predicted at all noise sensitive receivers, consistent with the approved project. Noise predictions generally show an increase in noise impacts at residences towards the east of the project and closer to Option B of the BESS, and accordingly, a general reduction in predicted noise at residences west of the project.

5.3.2 Mitigation

Mitigation measures have been assessed in relation to the previous NVIA where required. No additional mitigation measures beyond the original NVIA have been assessed as being required as part of this Modification. Specifically, these mitigation measures included:

- no electrical infrastructure (i.e. transformers or inverters) installed within 250 m of the property boundary of R3
- the 1,200 MVA grid transformer, which will form part of the BESS, was modelled with a 6.5 m high barrier, positioned to reduce noise impacts on nearby sensitive receivers.

Details on these mitigation measures are provided within the NVIA prepared for the EIS.

Consistent with the NVIA prepared for the EIS, conservative assumptions have been made about emissions due to uncertainty about anticipated electrical and heat loads, and final equipment selection, that may result in noise levels being lower than the predicted values presented in this section. Further detailed designs will be reviewed to ensure noise levels predicted can be achieved through; selection of plant and equipment; site layout and orientation of equipment; provision of acoustic barrier (wall/retaining wall and batter or earth mounds); utilisation and operational procedures consistent with the assumptions in this NVIA; or a combination of the above measures.

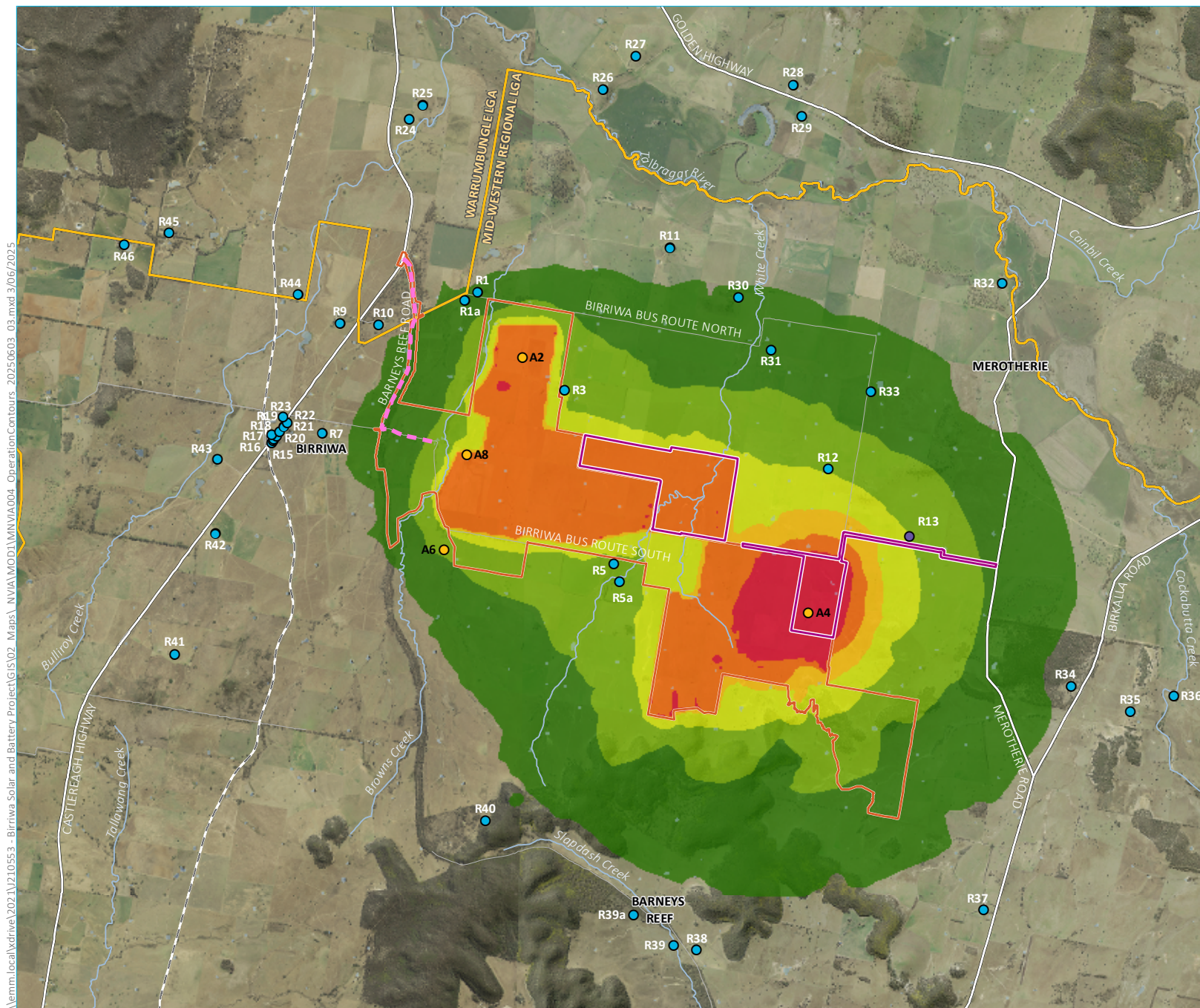
5.3.3 Contours

Predicted $L_{Aeq,15min}$ noise contours representing day and night operations are provided in Figure 5.3 and Figure 5.4 respectively.

The figures represent the predicted operational noise levels during noise enhancing conditions for day, night under the stated BESS utilisations.

5.4 Cumulative operational noise impacts

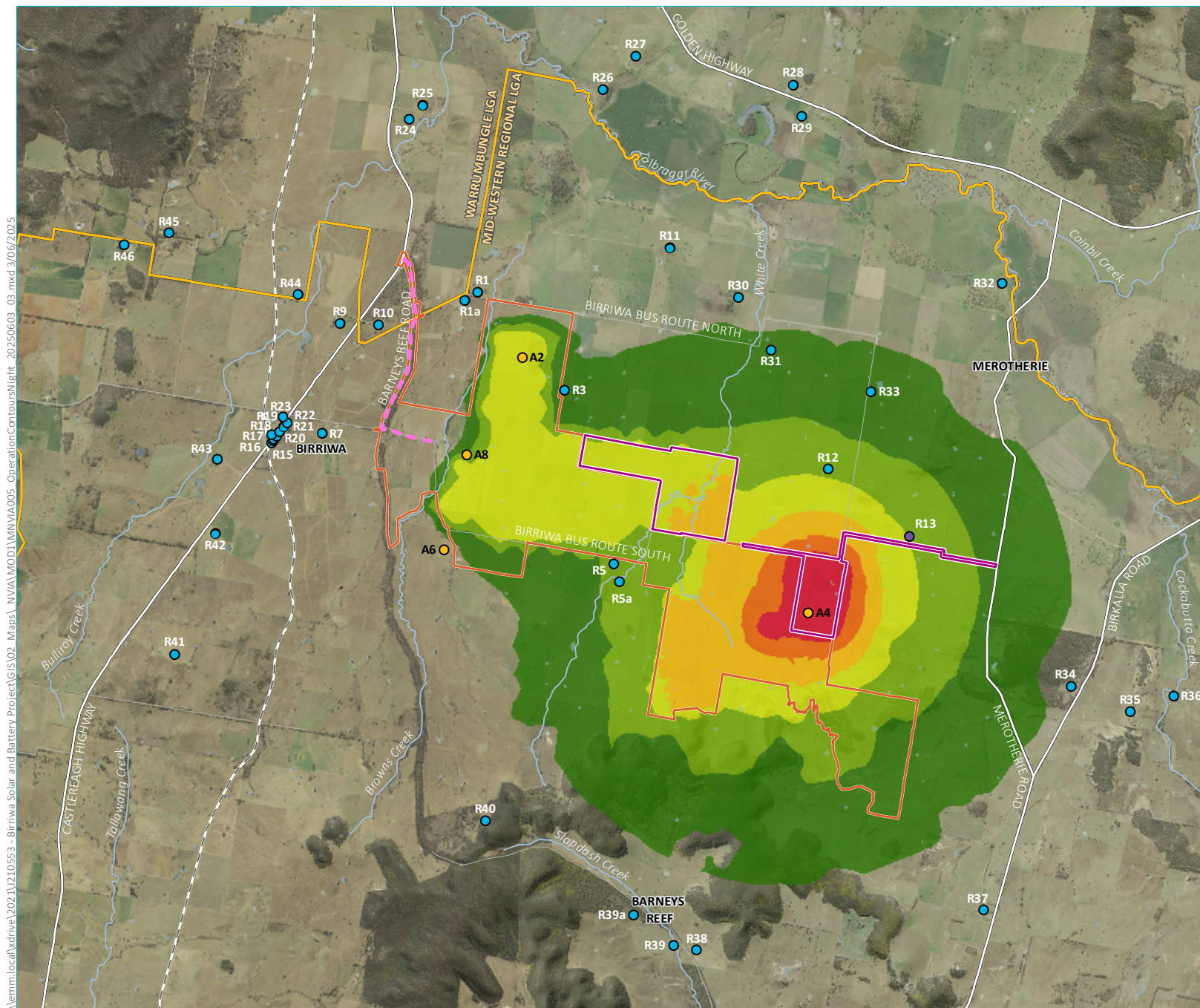
Since approval of the project, the nearest renewable energy project, Barneys Reef Wind Farm has been withdrawn, and an additional project, the Narragamba Solar Farm, is proposed to the south-east of this project. However, given the location of Narragamba and distances to receivers relevant to this modification, it is not anticipated that Narragamba Solar Farm will induce any significant cumulative noise impacts on assessment locations.



- KEY**
- Modification area
 - Approved study area
 - Dwelling associated with the project
 - Dwelling not associated with the project
 - Dwelling not associated with the project (EnergyCo building)
 - Road upgrade corridor
- Noise contour**
- 25 - 30 dB(A)
 - 30 - 35 dB(A)
 - 35 - 40 dB(A)
 - 40 - 45 dB(A)
 - 45 - 50 dB(A)
 - > 50 dB(A)
- Existing environment**
- Rail line
 - Major road
 - Minor road
 - Watercourse
 - Waterbody
 - Local government area

Operational noise contours - day

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 5.3



- KEY**
- Modification area
 - Approved study area
 - Dwelling associated with the project
 - Dwelling not associated with the project
 - Dwelling not associated with the project (EnergyCo building)
 - Road upgrade corridor
- Noise contour**
- 25 - 30 dB(A)
 - 30 - 35 dB(A)
 - 35 - 40 dB(A)
 - 40 - 45 dB(A)
 - 45 - 50 dB(A)
 - > 50 dB(A)
- Existing environment**
- Rail line
 - Major road
 - Minor road
 - Watercourse
 - Waterbody
 - Local government area

Operational noise contours - Night

Birriwa Solar and Battery Project
Noise and Vibration Impact Assessment
Figure 5.4

5.5 Road traffic noise

There is one non-associated residence within 600 m of the segments of Merotherie Road and Birriwa Bus Route South that will be used by project-related vehicles to access the development footprint (R32, off Merotherie Road). Based on proposed traffic volumes on this road, traffic noise levels at this closest non-associated receiver are predicted to be below 50 dBA, and as such further assessment of this road has not been conducted.

It is also noted that relative increase criteria are not applicable to local roads, and therefore further assessment of these two receivers and road traffic noise on these sections of road is not warranted.

Road traffic noise level predictions for peak construction traffic on the Golden Highway were carried out based on the assumptions outlined in Section 4.4. As the area over which Golden Highway traffic volumes is beyond the study area for the modification, consideration was given to noise levels at distances reflective of the nearest residences to the Golden Highway in the vicinity of the turn-off to Merotherie Road (approximately 250 m from the road edge).

At this distance, levels will be substantially below the daytime LAeq,15hr limit of 60 dBA for arterial roads and highways. Additionally, at distances closer to the Golden Highway where levels may already be above 60 dBA, the increase in noise levels is below 2 dB, and therefore construction traffic noise impacts are expected to comply with the RNP.

6 Conclusion

This NVIA has been prepared to support a modification to the Birriwa Solar and Battery Project at Birriwa, NSW. It refers to the previously completed NVIA submitted as part of the EIS (EMM 2022) for the project.

Noise and vibration impacts from construction and operation of the proposed modification are predicted to satisfy all relevant noise and vibration criteria for operation. Impacts from construction noise and vibration are consistent with the previous assessment completed as part of the NVIA. Therefore, there are no proposed additional mitigation measures for the modification.

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