NOISE AND VIBRATION IMPACT ASSESEMENT: FINLEY BESS

Project ID: 15837

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Prepared For:

BESS Pacific Pty Ltd C/o
Gransolar Development Australia

Assured Environmental

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Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	22/01/2025	D. Balkin	Initial Draft Release
R1	07/04/2025	D. Balkin	Client Comments
R2	06/05/2025	J. Evans	Client Comments

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GLOSSARY

A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar, to that perceived by the human ear.
ABL	Assessment Background Level is derived from the measured noise levels and calculated to be the tenth percentile of the background L_{A90} noise levels (i.e. sort the recorded hourly L_{A90} into ascending order and select the lowest ten percentile level). The ABL is a single-figure background level representing each assessment period (day / evening / night).
Background Noise	Noise level at a given location and time measured in the absence of any alleged noise nuisance sources. Typically, represented by the L_{A90} noise statistic.
Calibrator	An instrument used to carry out 'field calibrations' before and after monitoring to ensure the sound level meter does not drift.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (0.00002 N/m2).
dB(A) or dBA	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast Time Weighting	Sound level meters apply a time-smoothing function to the measured sound. Fast time weighting has an exponential smoothing time constant of 125 milliseconds.
Free field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally, as measured outside and away from buildings.
L_{Aeq}	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. Noise levels often fluctuate over a wide range with time. Therefore, when a noise varies over time, the L_{Aeq} is the equivalent continuous sound which would contain the same sound energy as the time varying sound. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.
L_{A10}, L_{A90}, L_{An}	Noise level exceeded for n% of the measurement period with A-weighted, calculated by statistical analysis - where n is between 0.01% and 99.99%. For example, L_{A10} is the noise level just exceeded for 10% of the measurement period, calculated by statistical analysis and used to determine traffic noise and L_{A90} is the noise level exceeded for 90% of the measurement period, A-weighted and calculated by statistical analysis and used to determine background noise levels.
L_{AFmax}	A-weighted, fast response, maximum, sound level.
L_{AFmin}	A-weighted, fast response, minimum, sound level.
PPV	Peak Particle Velocity is a term to measure ground vibration and refers to the movement within the ground of molecular particles rather than surface movement. It is commonly measured with units mm/s or mm/s-1.
RBL	Rating background noise level is the overall single-figure background level representing each assessment period (day / evening / night) over the whole monitoring period.
SPL	Sound pressure level is a measure of the loudness of sound, determined by the pressure of sound waves in the air, measured in decibels (dB).
SWL	Sound power level in decibels is ten times the logarithm of the ratio of the sound power to the sound power reference level of 1 picowatt.

ABBREVIATIONS

AGL	Above Ground Level
AHD	Australian Height Datum
BESS	Battery Energy Storage System
CRTN	Calculation of Road Traffic Noise
DCNG	Draft Construction Noise Guideline
DEC	Department of Environment and Conservation (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
DT	Department of Transportation (US)
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority (NSW)
FTA	Federal Transit Administration (US)
LGA	Local Government Area
LIDAR	Light Direction and Ranging
MVPS	Medium Voltage Power Station
NPfI	Noise Policy for Industry
NSW	New South Wales
PPV	Peak Particle Velocity
RMS	Root Mean Square
RNP	Road Noise Policy
RTA	Roads and Traffic Authority
SSD	State Significant Development
TIA	Traffic Impact Assessment
US	United States
VDV	Vibration Dose Value

1 INTRODUCTION

1.1 Background

BESS Pacific Pty Ltd (hereafter 'BESS Pacific') C/o Gransolar Development Australia is proposing to establish a Battery Energy Storage System (BESS).at Riverina Highway, Finley NSW (herein referred to as the 'Subject Site'). The proposal is covered by State Significant Development (SSD) application SSD-72430958.The BESS is proposed to have a total capacity of approximately 100 MW with a total storage capacity of 200 MWh.

1.2 Scope of Assessment

Assured Environmental (AE) was appointed by BESS Pacific to undertake a noise and vibration impact assessment for the proposed Finley BESS.

This noise and vibration study has been undertaken to assess the potential impacts of the construction and operation of the Subject Site, on nearby sensitive receptors in accordance with the following NSW policies and guidelines:

- Draft Construction Noise Guideline (EPA, 2020);
- Road Noise Policy (DECCW, 2011);
- Assessing Vibration: A Technical Guideline, (DEC, 2006); and
- Noise Policy for Industry (EPA, 2017).

In accordance with the requirements of the above guidelines, computational modelling and first-principle calculations have been undertaken to support the assessment of the potential for adverse amenity impacts as a result of the Subject Site development.

1.3 This Report

This report summarises the methodology, results and conclusions of the Noise and Vibration Impact Assessment.

2 THE SUBJECT SITE

2.1 Overview

The proposed development comprises of a BESS facility that would store electricity from the grid and release electricity during periods of high demand. Key features of the Subject Site would include but not be limited to:

- Construction and operation of a BESS with a 100 MW maximum power output capacity and a two-hour duration;
- Connection of the BESS to the Finely Substation infrastructure via a 132 kV underground cabling and transmission lines; and
- Other ancillary infrastructure and services required such as internal access roads, laydown areas, control, and operational buildings.

Further details relevant to this noise and vibration assessment are discussed in the following sub-sections.

2.2 Construction

The construction of the BESS is expected to take approximately 11 months with a peak construction period of approximately 3 months. A number of different activities will be undertaken over that time.

The key construction phases identified for construction of the Subject Site are;

- Site establishment;
- Footing installation;
- Installation of cabling;
- Equipment installation;
- Control room construction; and
- Decommissioning (at the termination of the project).

Construction would be restricted to 'recommended standard hours for construction work', as per the DCNG and described in Table 2.

Table 2: Standard Construction Hours

Work type	Weekday	Saturday	Sunday or Public Holiday
Normal Construction	7 am to 6 pm	8 am to 1 pm	No work

Minor construction activities such as electrical commissioning and fit out may occur outside of standard hours if required, and these works are expected to produce a negligible amount of noise.

The assessment will also consider vehicle movements involved with the construction of the Subject Site.

2.2.1 Equipment and Usage

Construction works are expected to progress across the site such that plant and equipment would only be in a single area for a short period of time. Given this, the potential for adverse impacts at any one receptor is expected to only occur for a short period of time.

A summary of the plant and equipment likely to be required to complete the on-site construction works is presented in Table 3. The Sound Power Level (SWL) of each plant item has been sourced from published noise emission datasets and the library of source noise levels maintained by AE.

Table 3: Construction Noise Sources

Construction Phase a)	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % b)
Site establishment, construction of fencing, drainage & roads.	Truck & dog	2	113	40
	Compactor	2	106	20
	Bulldozer	1	109	40
	Water cart	1	103	40
	Backhoe	1	110	20
	Excavator	1	110	40
	Road truck	4	113	40
	Vibratory roller	2	112	40
Concrete footing installation	Concrete truck	5	106	40
	Excavator	2	110	40
	Concrete truck discharge	2	96	100
Delivery and installation of cabling	Fanna crane	2	101	16
	Excavator	1	110	40
	Hand tools	3	100	40
BESS and inverter container installation including electrical	Piling rig	1	112	20
	Fanna crane	2	101	16
	Loader	2	110	40
	Trucks	3	113	40
	Hand tools	1	100	40
	Generator	1	102	50
Control room building and demobilisation	Excavator	1	110	40
	Fanna crane	2	101	16
	Front-end loader	1	112	40
	Truck and dog	1	113	40
	Generator	2	102	50
Decommissioning (inc. remediation)	Fanna crane	2	101	16
	Trucks	3	113	40
	Excavator	1	110	40
	Bulldozer	1	109	40

a) Based on conservative estimates of equipment used in construction phases.
b) The 'Acoustical Usage Factor' represents the percentage of time that a particular item of equipment is assumed to be running at full power while working on site.

2.2.2 Road Volumes

The Traffic Impact Assessment (TIA)prepared by Premise[a] identifies daily traffic volumes of up to 82 movements (164 trips) during the peak construction period, which is expected to last 3 months. The peak hour would include up to 33 vehicle trips, with up to 20 of those being for heavy vehicles required for the delivery of construction equipment, removal of spoil and delivery of project components. This would fluctuate depending on construction phase. Traffic volumes (during peak construction) are based on client recommendations and are presented in Table 4.

Table 4: Traffic Generation During Peak Construction

Road Segment	Vehicle Speed, km/hr	Vehicle Type	Number of Vehicle Trips	
			Day, 7 am to 10 pm	Night, 10 pm to 7 am a)
Riverina Highway (Arterial Road)	100	Light	56	28
		Heavy	108	54
		Total	**164**	**82**
Canalla Road (Local Road)	50	Light	56	28
		Heavy	108	54
		Total	**164**	**82**

a) Assumed that the arrival trips during the morning may occur before 7 am such that they would be associated with the night period.

The cumulative peak hour trips are presented in Table 5, reproduced from the TIA.

Table 5: Cumulative Peak Hour Trip Generation

	Total	Light Vehicles	Buses	Heavy Vehicles
Peak (Veh/hr)	33	19	4	10

The distribution of peak traffic is presented in Table 6, derived from Table 15 in the TIA.

Table 6: Traffic Trip Distribution

Period	Riverina Highway Eastbound		Riverina Highway Westbound		Broockmanns Road Eastbound	
	LV	HV (inc. buses)	LV	HV (inc. buses)	LV	HV (inc. buses)
AM Peak	9	12	3	2	7	0
PM Peak	3	6	9	8	7	0

[a] *Finley BESS Traffic Impact Assessment Report*, prepared by Premise Australia Pty Ltd, Report No. P001993/TIA, revision 001A, dated 02/04/2025

2.2.3 Potential Vibration Sources

Plant and equipment associated with construction of the Subject Site has the potential for vibration impacts. The vibration source levels for the equipment likely to be used for construction are detailed in Table 7 (vibration level is expressed as peak particle velocity (PPV)).

Table 7: Vibration Source levels – Peak Particle Velocity (PPV)

Equipment Item	PPV at 10 metres, mm/s	Data Source
Roller	5 – 6	RTA [a)]
7 tonne compactors	5 – 7	RTA [a)]
Loaded trucks (rough surface)	5	US DT FTA [b)]
Loaded trucks (smooth surface)	1 – 2	US DT FTA [b)]
Excavator	2.5 – 4	RTA [a)]

a) Roads and Traffic Authority (RTA) Environmental Noise Management Manual; December, 2001.
b) United States (US) Department of Transportation (DT) Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment; September, 2018 – data converted from inches/second.

2.3 Operation

The Subject Site will include BESS equipment comprising of 80 20-foot modular containers comprising of Lithium-Ion batteries with the appropriate cooling and protection system. In addition, 40 Medium Voltage Power Stations (MVPS) (i.e. one per every two batteries) will be located externally to the battery containers.

An internal road will run through the site to access the BESS and inverter equipment. Other physical features of the Subject Site layout include a control room/switchgear and auxiliary transmission, car parking, landscaping, security fencing/lighting, and a single storage structure. Once complete, the Subject Site would operate 24/7 and only require periodic visitation by an authorised person.

The layout of the proposed Subject Site is detailed in Figure 1.

Figure 1: Layout of the Subject Site (source: Premise EIS)

2.3.1 Noise sources

A summary of the noise source information for the operation of the Subject Site is detailed in Table 8.

Table 8: Operational Noise Sources

Noise Source	Qty	Height, m	Usage Period D/E/N, %	SWL, L_{Aeq} dB(A)	Noise Characteristics [a)]
MVPS Inverter (Top façade)	40	2.3	100	63	+4.3 (tonal)
MVPS Inverter (Front façade)	40	2.3	100	72	+4.3 (tonal)
MVPS Inverter (Back façade)	40	2.3	100	74	+4.3 (tonal)
MVPS Inverter (AC Side)	40	2.3	100	79	+4.3 (tonal)
MVPS Inverter (DC Side)	40	2.3	100	74	+4.3 (tonal)
BESS (Front façade)	80	2.9	100	76	-
BESS (Back façade)	80	2.9	100	77	-
BESS (Left façade)	80	2.9	100	75	+0.6 (tonal)
BESS (Right façade)	80	2.9	100	87	+3.3 (tonal)
HV Transformer	1	2.0	100	86	-

a) Inclusive of annoying noise characteristic corrections
b) As provided in MVPS datasheet from the manufacturer
c) Datasheet for BESS equipment provides sound pressure levels at 10 m distance from each façade. The model was calibrated so each façade produced a sound pressure level at 10 m as described in the manufacturers data sheet. No top source is included on the basis that the equipment is containerised with no inlets or outlets on its top face.

All noise sources associated with BESS are considered continuous in nature and are associated with fixed plant items operating in the charging and distribution process. Where annoying noise characteristics have been identified the adjustment has been included in the L_{Aeq} column. The sound power levels have been taken from the following sources.

- BESS noise data taken from manufacturers noise testing data-sheet [b]
- BESS equipment oriented such that loudest façade (i.e., chiller façade) is directed towards the west.
- 1/3 octave spectral data for batteries provided by manufacturers technical datasheet.
- MVPS equipment oriented such that loudest façade (i.e., AC outlet) is directed west.
- 1/3 octave spectral data for inverters were obtained from manufacturers technical datasheet [c].

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b Hithium LX501501 BESS Test Report, Report No. CN24AGU2 002, Condition 3 (compressor at 7000 rpm and 60% fan speed), distributed to Assured Environmental on 26/11/2024

c SCS3950UP-XT Inverter Test Report, Report No. TR_EMC_SCS3950UP-XT_Acoustic_1.0 E 5023, Measurement No. 26 (3679 kVA with Silencer Kit) distributed to Assured Environmental on 26/11/2024

- Transformer (large-scale connection asset) sound power level as advised by the client.
- 1/3 octave spectral data for transformers were taken from the Australian Acoustical Society [d].
- Site specific topography for post development levels applied in computational modelling.

2.3.2 Noise Mitigation

The initial assessment of the Subject Site identified that noise mitigation was not warranted. More details are provided in Section 6.3.

2.3.3 Potential Vibration Sources

Vibration impacts associated with the operational phase of the project are expected to be minimal due to the negligible vibration generated from the on-site equipment and the hardstand the equipment will be placed on. Operational vibration impacts have therefore not been assessed.

d Paper Number 23, Proceedings of ACOUSTICS 2011: *Low-frequency and Tonal Characteristics of Transformer Noise*: Prepared by Michael Gange, dated November 2011

3 DESCRIPTION OF ENVIRONMENTAL VALUE

3.1 Project Location and Surrounding Land Use

The proposed Subject Site is located approximately 5 km west of Finley in southern New South Wales. The proposed Finley BESS is to be located at Riverina Highway, Finley on the corner of Canalla Road and Broockmanns Road, formally identified as Lot 3 on DP740920. The Subject Site is zoned RU1 –Primary Production, as are the majority of surrounding lots.

The BESS footprint will occupy an area of approximately 3 ha across part of Lot 3 on DP740920. The area surrounding the proposed Subject Site includes land in use for agricultural purposes with associated rural dwellings.

The location of the Subject Site and surrounding land uses is shown in Figure 2.

3.2 Topography

Figure 3 illustrates the local topography, as obtained from the NSW Six Maps. It can be seen the Subject Site is approximately 100-110 m AHD. The topography is very flat.

3.3 Sensitive Receptors

AE has identified nine single existing dwellings located in the vicinity of the proposed BESS in all directions. The receptors are summarised in Table 9 and are shown in Figure 2. These serve as the relevant receptors for assessment purposes; where compliance is demonstrated at these receptors, compliance would be implied at those located further afield.

Table 9: Nearby Sensitive Receptors

Receptor	Description	Coordinates (EPSG:7855)		Distance to Site Centroid (m)[a)]	Height (m)
		X	Y		
R1	Existing Dwelling	367315	6055763	518	1.5 [b)]
R2	Existing Dwelling	363845	6055195	778	1.5 [b)]
R3	Existing Dwelling	366324	6055512	1,214	1.5 [b)]
R4	Existing Dwelling	366443	6056064	1,597	1.5 [b)]
R5	Existing Dwelling	364851	6056363	1,989	1.5 [b)]
R6	Existing Dwelling	364629	6053906	1,541	1.5 [b)]
R7	Existing Dwelling	365885	6057203	1,627	1.5 [b)]
R8	Existing Dwelling	365347	6053061	2,203	1.5 [b)]
R9	Existing Dwelling	366814	6053541	2,120	1.5 [b)]

a) Distance measured from receptor to noise producing equipment on-site.
b) Residences modelled as single storey receptors ~1.5 m

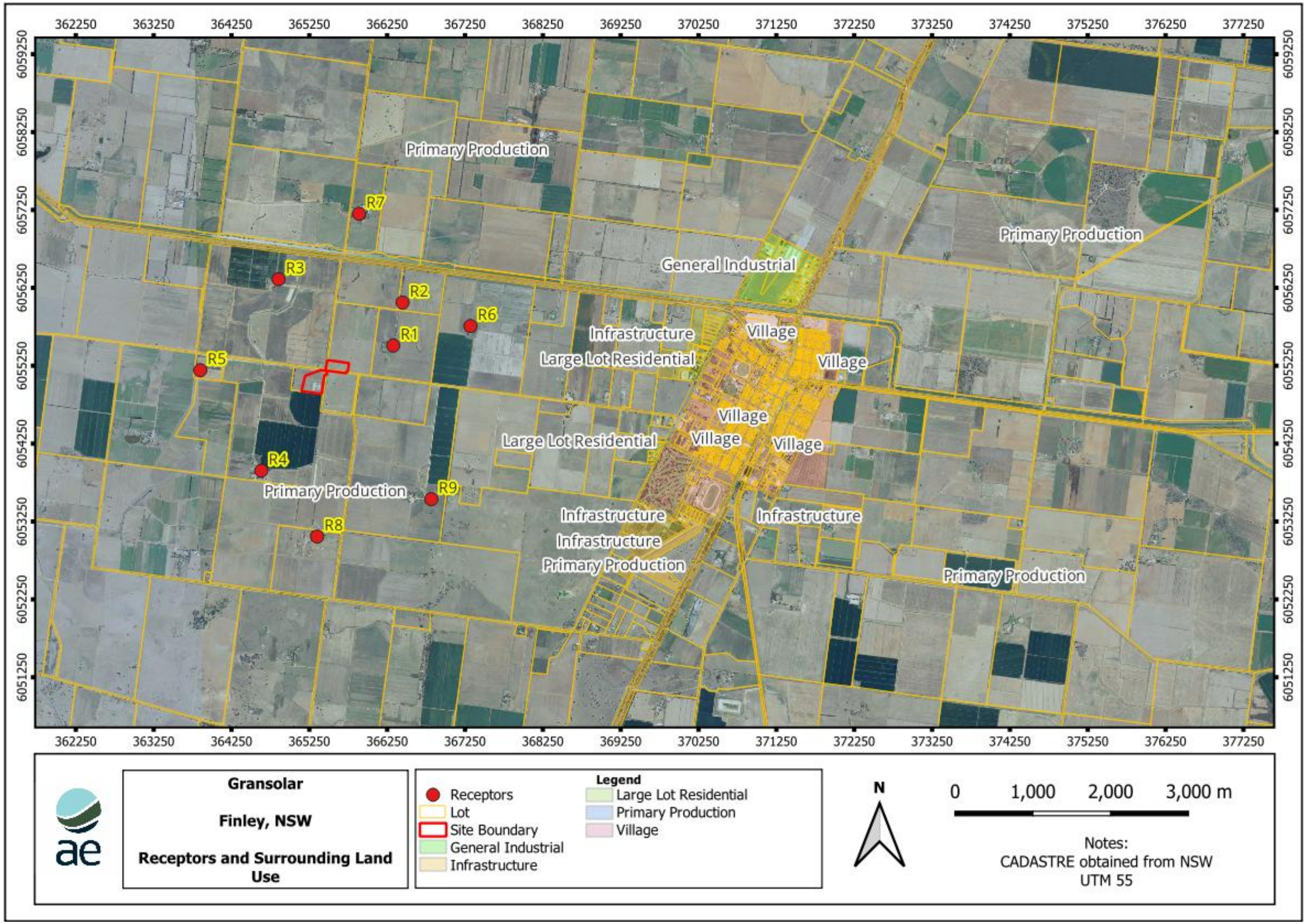

Figure 2: Surrounding Land use & Sensitive Receptors

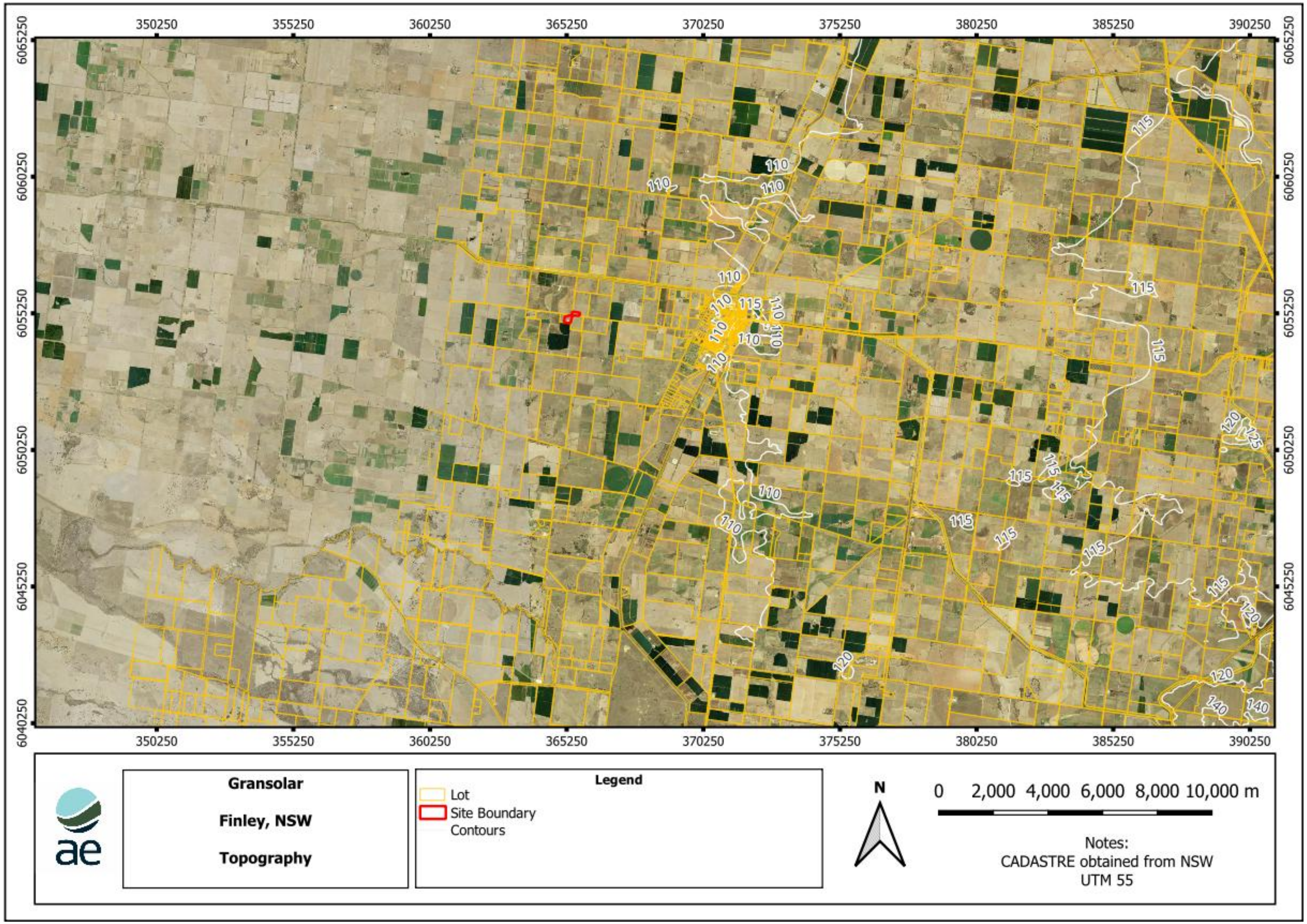

Figure 3: Topography

4 PROJECT CRITERIA

4.1 Overview

The assessment considers the potential impacts from noise and vibration during both the construction and operation of the Subject Site. As such, various criteria are applicable and are discussed in the following sections namely sourced from:

- Draft Construction Noise Guideline (EPA, 2020);
- Road Noise Policy (DECCW, 2011);
- Assessing Vibration: A Technical Guideline, (DEC, 2006); and
- Noise Policy for Industry (NPfI) (EPA, 2017).

4.2 Construction Criteria

4.2.1 Construction Activities

Guidance on the assessment and management of construction noise in NSW is provided in the Draft Construction Noise Guideline (DCNG). The main objectives of the DCNG are to:

- *Minimise the impact of construction noise by:*

  a) *ensuring construction is scheduled during the recommended standard hours to reflect greater sensitivity to noise during the evening and night-time and on weekends and public holidays, except where this is not practical and justified.*

  b) *providing qualitative and quantitative assessment methods to identify construction noise impacts to guide the selection of feasible and reasonable mitigation measures.*

  c) *requiring the proponent to justify their selection of feasible and reasonable work practices based on the likely risk of noise impacts.*

- *Engage with the community, including provide information on the project, the expected noise impacts, what is being done to manage noise, and opportunities to accommodate community preference for respite where this is feasible and reasonable. This is considered a critical component in managing construction noise, particularly from major infrastructure projects that can significantly impact the community over prolonged periods and include extended periods of work outside of the recommended standard hours.*

- *Prepare work methods, plans and strategies to manage noise impacts.*

- *Differentiate between the management of noise from infrastructure construction and noise from routine maintenance and construction work undertaken by public authorities on public infrastructure; and*

- *Explain the regulatory regime underpinning the management of construction noise in NSW and advise on the noise management documentation required at various stages of the approvals process.*

In achieving these objectives, the guideline provides a framework for the qualitative and quantitative assessment of potential construction noise impacts noting that, for major projects, a quantitative assessment is the preferred approach.

4.2.2 Overall Construction Noise Criteria

Table 10 presents the construction noise criteria for sensitive receptors, as outlined in the DCNG.

Table 10: DCNG Relevant Construction Noise Criteria

Receptor Land Use	Time of Day	Management Level, $L_{Aeq,\ 15\text{-minute}}$	How to Apply
Residential	Recommended standard hours: Monday to Friday, 7 am to 6 pm; Saturday 8 am to 1 pm; and No work on Sundays or public holidays	Noise affected. RBL [a)] + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ 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 dB(A)	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 [a)] + 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 dB(A) above the noise affected level, the proponent should negotiate with the community.

Receptor Land Use	Time of Day	Management Level, $L_{Aeq,\,15\text{-minute}}$	How to Apply
		Highly noise affected. 65 dB(A)	The proponent must justify the selection of feasible and reasonable mitigation, including the supplementary mitigation, with emphasis on consultation with the community and the consent authority or regulator and community views on work scheduling and respite periods.
Classrooms / Hospitals / Places of Worship	When in use [b)]	Internal noise level 45 dB(A) [c)]	The proponent should engage with the occupiers and endeavour to schedule the project's work hours to minimise disruption.
Active Recreation	When in use [b)]	External noise level 65 dB(A)	
Passive Recreation	When in use [b)]	External noise level 60 dB(A)	
Industrial	When in use [b)]	External noise level 75 dB(A)	
Office / Retail	When in use [b)]	External noise level 70 dB(A)	

a) RBL level from baseline measurement data or minimum RBLs per the NPfI.
b) Noise management noise levels only apply when the land use is being utilised, per DCNG.
c) "Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB. However, commercial buildings often have sealed windows and higher standards of noise mitigation than residential properties. Where a higher external to internal mitigation is assumed, this should be justified and supported by sufficient evidence." (Per DCNG).

As construction works for the Subject Site will occur within 'recommended standard hours', the criteria for 'outside recommended standard hours' will not be applicable to this assessment. The applicable receptor land uses to the Subject Site are all residential.

The construction noise levels for residential land uses apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

According to the DCNG, where nearby sensitive uses are predicted to be noise affected, the proponent of the project is required to apply reasonable and feasible noise mitigation measures. Noting that a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic, and environmental effects.

Mitigation measures will be discussed, where required, as part of this assessment.

4.2.3 Consolidated Criteria

The construction noise assessment criteria at sensitive receptors to the Subject Site have been determined using the Management Levels in Table 10, and where required, are based on the daytime RBL measured during background monitoring (representative of standard operating hours). In this case, no background monitoring was conducted as it is expected that the background levels will be at or below the minimum RBLs detailed in the NPfI, thus the minimum daytime RBL of 35 dB(A) is applied.

The construction noise criteria for the Subject Site are summarised in Table 11.

Table 11: Project Construction Noise Management Levels

<table>
<tr><th>Land Use</th><th>Time of Day</th><th>Criteria Type</th><th>Management Level, $L_{Aeq,\ 15\text{-}minute}$ dB(A)</th></tr>
<tr><td rowspan="2">Residential</td><td rowspan="2">Recommended Standard Hours (Daytime)</td><td>Noise Affected Criteria</td><td>35 + 10 = 45</td></tr>
<tr><td>Highly Noise Affected Criteria</td><td>75</td></tr>
</table>

It is noted that consultation with potentially impacted residences and / or premises is required in accordance with DCNG.

4.2.4 Construction Road Traffic Noise

The DCNG does not provide criteria for the assessment of construction road traffic. Given this, reference is made to the noise criteria provided in the Road Noise Policy (RNP). Table 12 presents the road traffic noise criteria, per the RNP.

Table 12: Applicable Road Traffic Noise Criteria

<table>
<tr><th rowspan="2">Road Category</th><th rowspan="2">Type of Project & Land Use</th><th colspan="2">Assessment Criteria, dB(A)</th></tr>
<tr><th>Day
(7 am to 10 pm)</th><th>Night
(10 pm to 7 am)</th></tr>
<tr><td rowspan="3">Freeway / arterial / sub-arterial road</td><td>Existing residences affected by new freeway/arterial/sub-arterial road corridors</td><td>$L_{Aeq,15\text{-}hour}$ 55</td><td>$L_{Aeq,9\text{-}hour}$ 50</td></tr>
<tr><td>Existing residences affected by redevelopment of existing freeway/ arterial/sub-arterial roads</td><td rowspan="2">$L_{Aeq,15\text{-}hour}$ 60</td><td rowspan="2">$L_{Aeq,9\text{-}hour}$ 55</td></tr>
<tr><td>Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments</td></tr>
<tr><td rowspan="3">Local road</td><td>Existing residences affected by new local road corridors</td><td rowspan="3">$L_{Aeq,1\text{-}hour}$ 55</td><td rowspan="3">$L_{Aeq,1\text{-}hour}$ 50</td></tr>
<tr><td>Existing residences affected by redevelopment of existing local roads</td></tr>
<tr><td>Existing residences affected by additional traffic on existing local roads generated by land use developments</td></tr>
<tr><td rowspan="6">Proposed and traffic generating developments</td><td>School classroom</td><td colspan="2">$L_{Aeq,1\text{-}hour}$ 40 (internal), when in use</td></tr>
<tr><td>Hospital wards</td><td colspan="2">$L_{Aeq,1\text{-}hour}$ 35 (internal)</td></tr>
<tr><td>Places of worship</td><td colspan="2">$L_{Aeq,1\text{-}hour}$ 40 (internal)</td></tr>
<tr><td>Open space (active use)</td><td colspan="2">$L_{Aeq,15\text{-}hour}$ 60, when in use</td></tr>
<tr><td>Open space (passive use)</td><td colspan="2">$L_{Aeq,15\text{-}hour}$ 55, when in use</td></tr>
<tr><td>Isolated residences in commercial or industrial zones</td><td colspan="2">Proponent should determine suitable internal noise level targets, taking</td></tr>
</table>

Road Category	Type of Project & Land Use	Assessment Criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
		guidance from Australian Standard 2107:2000	
	Mixed use development	Each component of mixed use development should be considered separately	
	Childcare facilities	Sleeping rooms $L_{Aeq,1\text{-}hour}$ 35 (internal) Indoor play areas $L_{Aeq,1\text{-}hour}$ 40 (internal) Outdoor play areas $L_{Aeq,1\text{-}hour}$ 35 (internal)	-
	Aged care facilities	Residential land use criteria apply	

a) Assessment location is external unless otherwise stated.

The noise criteria are external (unless otherwise stated) and are assessed at 1 m from the facade and at a height of 1.5 m from the ground.

The applicable criteria for the Subject Site are for existing residences affected by additional traffic on existing roadways generated by land use developments and are highlighted in Table 12.

The RNP also states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person. Furthermore, the RNP makes the provision for existing residences or sensitive land uses affected by additional traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB(A) above the corresponding "no build option".

4.2.5 Construction Vibration

4.2.5.1 Human Comfort

The vibration criteria presented in Assessing Vibration: A Technical Guideline have been adopted for the assessment. Assessing Vibration: A Technical Guideline provides vibration criteria associated with amenity impacts (human annoyance and comfort) for the three categories of vibration:

- Continuous vibration – continues uninterrupted for a defined period (e.g. road traffic, continuous construction activity);
- Impulsive vibration – includes less than 3 distinct vibration events in an assessment period (e.g. occasional dropping of heavy equipment); and
- Intermittent vibration – includes interrupted periods of continuous vibration (e.g. drilling), repeated periods of impulsive vibration (e.g. pile driving) or continuous vibration that varies significantly in amplitude.

Continuous and impulsive vibration sources are measured in terms of PPV, and intermittent vibration is measured in terms of vibration dose value (VDV).

Table 13 presents the criteria for vibration, per Assessing Vibration: A Technical Guideline.

Table 13: Vibration Criteria for Workshops

Receptor Use	Vibration Type	Assessment Period	Preferred Limit	Maximum Limit
Critical Areas [a)]	Continuous (PPV)	Day or Night	0.14 mm/s	0.28 mm/s
	Impulsive (PPV)	Day or Night	0.14 mm/s	0.28 mm/s
	Intermittent (VDV)	Day or Night	0.1 $m/s^{1.75}$	0.2 $m/s^{1.75}$
Residences	Continuous (PPV)	Day	0.28 mm/s	0.56 mm/s
		Night	0.2 mm/s	0.4 mm/s
	Impulsive (PPV)	Day	8.6 mm/s	17. mm/s
		Night	2.8 mm/s	5.6 mm/s
	Intermittent (VDV)	Day	0.2 $m/s^{1.75}$	0.4 $m/s^{1.75}$
		Night	0.13 $m/s^{1.75}$	0.26 $m/s^{1.75}$
Offices	Continuous (PPV)	Day or Night	0.56 mm/s	1.1 mm/s
	Impulsive (PPV)	Day or Night	18 mm/s	36 mm/s
Offices, schools, educational and places of worship	Intermittent (VDV)	Day or Night	0.4 $m/s^{1.75}$	0.8 $m/s^{1.75}$
Workshop	Continuous (PPV)	Day or Night	1.1 mm/s	2.2 mm/s
	Impulsive (PPV)	Day or Night	18 mm/s	36 mm/s
	Intermittent (VDV)	Day or Night	0.8 $m/s^{1.75}$	1.6 $m/s^{1.75}$

a) E.g. hospital operating theatres and precision laboratories

The applicable criteria for the Subject Site are highlighted in Table 13.

4.2.5.2 Structural Damage

To assess potential damage to buildings, reference has been made to British Standard BS 7385-2: 1993 *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (BS 7385-2).

Table 14 presents vibration criteria for assessing the potential for building damage (cosmetic damage), respective of PPV and frequency (Hz).

Table 14: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	PPV, mm/s	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 at 4 Hz and above	
Unreinforced or light-framed structures Residential or light commercial type buildings	15 at 4 Hz increasing to 20 at 15 Hz	20 at 15 Hz increasing to 50 at 40 Hz and above

Residential building types are applicable to this assessment and are highlighted in Table 14.

4.3 Operational Criteria

4.3.1 Overview

The noise assessment has been completed in accordance with the procedure identified in the Noise Policy for Industry (NPfI). The NPfI recognises that scientific literature has identified that both the increase in noise level above background levels (that is, intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources.

In response to this, the NPfI establishes two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. These two criteria are then used to determine 'project trigger levels' against which the proposed development will be assessed. The lower and most stringent of the two is used to determine the 'project trigger level' which, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response.

The NPfI also considers the potential for sleep disturbance from maximum noise level events from premises during the night-time period.

The derivation of NPfI criteria, relevant to the operation of the Subject Site is discussed in the sub-sections below.

The noise criteria are assessed at the reasonably most-affected point (i.e. highest noise level) on or within the property boundary. For residential dwellings, where the property boundary is more than 30 m from the house, then the criteria apply at the reasonably most-affected point within 30 m of the residence, but not closer than 3 m to a reflective surface and at a height of between 1.2 m – 1.5 m above the ground level.

4.3.2 Intrusiveness Noise Criteria

The Project Intrusiveness Noise Level is intended to protect against significant changes in noise levels as a result of industrial development. To achieve this, the NPfI describes intrusive noise as noise that exceeds background noise levels (as defined by the RBL) by more than 5 dB(A).

AE expects the background noise levels at surrounding receptors to be at or below the minimum RBLs detailed in the NPfI, and thus these minimum levels have been applied in this assessment.

The derived Project Intrusiveness Noise Levels are detailed in Table 15.

Table 15: Derived Project Intrusiveness Noise Levels

Location	Period	RBL, dB(A) [a]	Intrusiveness Noise Level, $L_{Aeq,15minute}$ dB(A)
Nearby residential receptors	Day (7 am to 6 pm)	35	RBL + 5 = 40
	Evening (6 pm to 10 pm)	30	RBL + 5 = 35
	Night (10 pm to 7 am)	30	RBL + 5 = 35

a) The minimum Project Intrusiveness Noise Level was applied per the NPfI.

4.3.3 Amenity Criteria

The Project Amenity Noise Level seeks to protect against cumulative noise impacts from industry and maintain amenity for land uses. Amenity noise levels are not used directly as regulatory limits. They are used in combination with the intrusiveness noise level to assess the potential impact of noise, assess reasonable and feasible mitigation options, and subsequently determine achievable noise requirements.

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 and is calculated as the Recommended Amenity Noise Level (per the receiver category in the NPfI) minus 5 dB(A). Additionally, a correction of +3 dB(A) is used to convert from $L_{Aeq,period}$ to a $L_{Aeq,15\text{-}minute}$ metric.

Receiver categories relevant to this assessment are rural residential. This is based on the LGA zoning, typical background levels, and descriptions of the surrounding environment.

The Recommended Amenity Noise Levels are detailed in Table 16. The derived Project Amenity Noise Levels, relevant to the Subject Site (i.e. rural residential) are also detailed and highlighted in Table 16.

Table 16: Project Amenity Noise Levels

Receptor Type	Period	Recommended Amenity Noise Level, $L_{Aeq,period}$ dB(A)	Project Amenity Noise Level [a)], $L_{Aeq,15\text{-}minute}$ dB(A)
Rural residential	Day (7 am to 6 pm)	50	50 – 5 + 3 = 48
	Evening (6 pm to 10 pm)	45	45 – 5 + 3 = 43
	Night (10 pm to 7 am)	40	40 – 5 + 3 = 38
Suburban residential	Day (7 am to 6 pm)	55	-
	Evening (6 pm to 10 pm)	45	-
	Night (10 pm to 7 am)	40	-
Urban	Day (7 am to 6 pm)	60	-
	Evening (6 pm to 10 pm)	50	-
	Night (10 pm to 7 am)	45	-
Hotels, motels, caravan parks		5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area	-

Receptor Type	Period	Recommended Amenity Noise Level, $L_{Aeq,period}$ dB(A)	Project Amenity Noise Level [a)], $L_{Aeq,15\text{-}minute}$ dB(A)
School classroom - internal	Noisiest 1 hour, when in use	35	-
Hospital ward:			
internal	Noisiest 1 hour	35	-
external	Noisiest 1 hour	50	-
Place of worship	When in use	40	-
Passive recreation	When in use	50	-
Active recreation	When in use	55	-
Commercial premises	When in use	65	-
Industrial	When in use	70	-
Industrial interface (applicable only to residential noise amenity areas)	All	Add 5 dB(A) to recommended noise amenity area	-

a) The project amenity noise level is set at 5 dB below the recommended amenity noise level and a correction of +3 dB used to convert to a $L_{Aeq,15minute}$ metric.

4.3.4 Project Noise Trigger Levels

The Project Noise Trigger Level (i.e. the noise criteria considered by the assessment) is the lower value of the Project Intrusiveness Noise Level and the Project Amenity Noise Level, after the conversion to $L_{Aeq,15\ minute}$ dB(A) equivalent level (conversion included in Table 16 results). The applicable Project Noise Trigger Levels, determined from the lower of the Project Intrusiveness Noise Level and Project Amenity Noise Level are detailed in Table 17.

Table 17: Determining Project Noise Trigger Level

Receptor Type	Period	Standardised $L_{Aeq,15\text{-}minute}$ Noise Level, dB(A)		
		Intrusiveness Noise Level [a]	Amenity Noise Level	Noise Trigger Level
Rural residential	Day (7 am to 6 pm)	40	48	40
	Evening (6 pm to 10 pm)	35	43	35
	Night (10 pm to 7 am)	35	38	35

4.3.5 Sleep Disturbance

NPfI have identified a screening assessment for sleep disturbance based on the night-time noise levels at a residential location. The Night-time Screening Level applicable to the Subject Site is detailed in Table 18.

Table 18: Sleep Disturbance Night-time Screening Level

Receptor Type	Night-time RBL, dB(A)	Greater of 40 or RBL+ 5, $L_{Aeq,15\text{-}minute}$ dB(A)	Greater of 52 or RBL+ 15, L_{Amax} dB(A)
Residential	30	40	52

It is noted that the $L_{Aeq,15minute}$ 40 dB(A) sleep disturbance screening level is less stringent than the night-time Project Trigger Noise Level of $L_{Aeq,15minute}$ 35 dB(A), thus compliance with the Project Trigger Noise Level will imply compliance with this sleep disturbance screening level.

Furthermore, AE notes that the noise sources associated with the operation of the BESS are all continuous. As such, consideration of compliance against the L_{AFmax} sleep disturbance criteria is unwarranted.

4.3.6 Summary of Operational Criteria

The noise criteria (for each time period; day, evening and night) at sensitive receptors around the Subject Site have been determined using the criteria in Table 15, Table 16, Table 17 and Table 18.

For this assessment, the limiting operational criteria in Table 19 has been adopted and is listed according to the receptor type and ID number.

Table 19: Limiting Operational Criteria

Receptor Type and ID	Period	Noise Parameter
		$L_{Aeq,15\text{-}minute}$ dB(A)
Rural residential (R1 – R9)	Day (7 am to 6 pm)	40
	Evening (6 pm to 10 pm)	35
	Night (10 pm to 7 am)	35

5 ASSESSMENT METHODOLOGY

5.1 Construction Activities

For the purposes of predicting impacts associated with noise emissions from construction activities related to the Subject Site on nearby sensitive receptors, noise levels have been predicted using first-principle calculations. These calculations account for the distance between the receptor and the Subject Site infrastructure, as well as the noise level of each source.

Construction activities are expected to vary in both location and duration across the site, with mobile equipment moving throughout the construction phase. The construction noise levels at nearby sensitive receptors have been predicted taking into consideration the following assumptions:

- All equipment and plant are in the same area simultaneously – at the centroid of the BESS footprint;
- The equipment quantities are currently estimates; and
- Propagation is assumed to occur over hard ground and no screening objects between the source and the receiver.

5.2 Road Traffic Noise

For the purposes of predicting impacts associated with road traffic noise emissions, the proprietary software CadnaA (2024 MR2 build 203.5403) developed by DataKustik was used. The model incorporates the influence of topography, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with Calculation of Road Traffic Noise (CRTN) methodology developed by the UK Department of Transport. In accordance with the requirements of the Road Noise Policy (RNP), the predictive noise modelling incorporated the following assumptions:

- L_{Aeq} values were calculated from the L_{A10} values predicted by the CRTN methodology using the approximation $L_{Aeq,1\ hour} = L_{A10,1\ hour} - 3$.
- Noise source heights were set at 0.5 m above road level for cars, 1.5 m for heavy vehicle engines and 3.6 m for heavily vehicle exhausts.
- Noise from heavy vehicle exhausts is 8 dB lower than the steady continuous engine noise; and
- Corrections established for Australian conditions applied through a negative correction to the CRTN predations of -1.7 dB for façade-corrected levels (Samuels and Saunders, 1982).

The traffic assessment was conducted to determine the maximum noise road traffic noise generated by vehicles during peak construction phase.

5.3 Vibration

Vibration impacts associated with the construction phase of the Subject Site have been assessed. In particular, the assessment has considered the potential for impacts on both human comfort and structural damage for the nearest receptors to the construction works.

Based on the vibration source levels (presented in Table 7), PPVs have been predicted at various separation distances. Assessing Vibration: A Technical Guideline indicates that in predicting vibration levels, it can be assumed that the vibration level is inversely proportional to distance.

The US DT FTA Transit Noise and Vibration Impact Assessment Manual (2018)[e] presents the following construction vibration propagation formula assuming an inverse relationship:

$$PPV@d_2 = PPV@d_1 \times (d_1/d_2)^{1.5}$$

where: d_1 = distance 1 (reference distance for source data) (m)

d_2 = distance 2 (separation distance for predicted PPV) (m)

PPV = peak particle velocity (mm/s)

The above formula has been considered for predicted PPVs at various distances from construction equipment.

5.4 Operation

5.4.1 Software

Operational noise emissions from the Subject Site were also modelled using CadnaA. The model is utilised to assess the potential noise emissions from the Subject Site in relevant operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted.

5.4.2 Meteorology

The NPfI presents guidelines for the consideration of meteorological effects on noise propagation, specifically, temperature inversions and/or gradient winds. NPfI provides two options for assessing meteorological effects, 'standard conditions' and 'noise enhancing conditions'. The selected meteorological conditions are summarised in Table 20.

Table 20: Noise Enhancing Meteorological Conditions

Time Period	Meteorological Parameters a)		
	Stability Class b)	Wind Speed, m/s c)	Wind Direction d)
Day (7 am to 6 pm)	D	3	Neutral
Evening (6 pm to 10 pm)	D	3	Neutral
Night (10 pm to 7 am)	F	2	Source to Receptor

a) Meteorological conditions based on 'noise enhancing conditions', per NPfI.
b) Pasquill Gifford Atmospheric Stability Class.
c) At 10 m, above ground level (AGL).

5.4.3 Model Configuration

Table 21 summarises the model configuration used for the modelling.

e US DT FTA (2018). Transit Noise and Vibration Impact Assessment Manual..

Table 21: Model Configuration

Parameter	Approach
Standards	CONCAWE
Time Periods	Day (7 am to 6 pm) Evening (6 pm to 10 pm) Night (10 pm to 7 am)
Digital Terrain	LIDAR data at 10 m intervals.
Ground Absorption	Ground absorption set for soft ground (G = 1.0)

6 ASSESSMENT RESULTS

6.1 Overview

This section presents the findings for the assessments of construction noise and vibration (including construction traffic), as well as operational noise emissions.

6.2 Construction Noise Assessment

6.2.1 Assessment Results

The predicted construction noise levels from construction activities at nearby sensitive receptors to the Subject Site are presented in Table 22.

The results indicate that construction works may be above the Noise Affected criteria of 45 dB(A) but are expected to comply with the Highly Noise Affected criterion of 75 dB(A) at all times. No specific consideration is given for overlapping construction stages, as the exact details of any overlapping periods are not known at this stage. However, based on the predicted results it is evident that any two stages overlapping would not change the result to an extent that the Highly Noise Affected criterion would be exceeded.

It is recommended that reasonable and feasible mitigation measures such as those presented in Section 3.5 and 3.6 of this report are implemented to reduce the noise impact at all receptors.

It is noted that noise level estimates were calculated using worst-case scenario with no ground absorption and minimum distances between plant equipment and sensitive receptors. In practice, construction activities will take place at variable distances, as such the construction assessment is conservative and actual construction noise levels would be lower than those predicted.

Table 22: Predicted Construction Noise Levels at Sensitive Receptors

Receptor	Standard Hours Criteria		Construction Phase					
	Noise Affected	Highly Noise Affected	Site establishment, construction of fencing, drainage & roads	Concrete footing installation	Delivery and installation of cabling	BESS and inverter container installation	Control room building and Demobilisation.	Decommissioning (inc. remediation)
R1	45	75	64	58	53	61	58	60
R2	45	75	61	54	50	58	54	57
R3	45	75	57	51	46	54	50	53
R4	45	75	55	48	43	52	48	51
R5	45	75	53	46	42	50	46	49
R6	45	75	55	48	44	52	48	51
R7	45	75	54	48	43	51	48	50
R8	45	75	52	45	41	49	45	48
R9	45	75	52	46	41	49	45	48

6.2.2 Mitigation of Construction Noise Levels

Given the variable and mobile nature of the construction works, the use of permanent or temporary acoustic barriers at source is not considered feasible. Potential controls available to the construction contractor to minimise potential impacts for construction works could include:

- Implement community consultation or notification measures;
- Ensure workers and contractors are aware of noise management requirements in approvals consents or licenses, site inductions and "toolbox talks" providing a summary of relevant project requirements for reference;
- Inform truck drivers of designated vehicle routes, parking locations and acceptable delivery hours or other relevant practices, such as minimising use of engine brakes and avoiding engine idling;
- Using broad band reversing alarms on all mobile plant and equipment where possible;
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine;
- Operating plant in a quiet and efficient manner;
- Reduce throttle setting and turn off equipment when not being used;
- Regularly inspect and maintain equipment to ensure it is in good working order including checking the condition of mufflers;
- Avoid unnecessary dropping of materials from a height and metal to metal contact on equipment; and
- It is recommended that during any work generating high noise levels that have impulsive, intermittent, low frequency or tonal characteristics, consultation with sensitive receptors occurs regularly.

During works, following best practice mitigation detailed above and staff training regarding excessive noise from machinery use is recommended.

It should be noted that the construction assessment is conservative in nature and that the likelihood of exceeding these noise levels is low. As the highest predicted noise levels do not exceed the highly affected noise criteria of 75 dB(A) at any receptor, the implementation of additional noise controls (except those listed above) is not considered necessary.

6.2.3 Road Traffic Noise Levels

The road traffic noise levels predicted during construction, per the methodology discussed in Section 5.2, are presented in Table 23.

Table 23: Predicted Road Traffic Noise Contribution Levels

Sensitive Receptor	Setback from Road	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Arterial Road						
Nearest to Riverina Highway	175 m	Day	$L_{Aeq,15\text{-}hour}$	60	53.1	Y
		Night	$L_{Aeq,9\text{-}hour}$	55	48.3	Y
Local Road						
Nearest to Canalla Road	755 m	Day	$L_{Aeq,1\text{-}hour}$	55	31.6	Y
		Night	$L_{Aeq,1\text{-}hour}$	50	31.6	Y
Nearest to Broockmanns Road	26 m	Day	$L_{Aeq,1\text{-}hour}$	55	40.5	Y
		Night	$L_{Aeq,1\text{-}hour}$	50	40.5	Y

Compliance with the road traffic criteria is predicted for the peak construction scenario, and thus compliance is implied for all other scenarios such as less intense construction stages and the operational stage.

6.2.4 Vibration Impacts

The predicted vibration impacts during the construction of the Subject Site (expressed as PPV, mm/s), per the methodology discussed in Section 5.3, are presented in Table 24.

Table 24: Predicted PPV at Distances

Distance from Source, m	Predicted PPV, mm/s				
	Roller	7 tonne compactor	Excavator	Loaded trucks (rough surfaces)	Loaded trucks (smooth surfaces)
10	6.00	7.00	4.00	5.00	1.00 – 2.00
20	2.12	2.47	1.41	1.77	0.35 – 0.71
30	1.15	1.35	0.77	0.96	0.19 – 0.38
40	0.75	0.88	0.50	0.63	0.13 – 0.25
50	0.54	0.63	0.36	0.45	0.09 – 0.18
60	0.41	0.48	0.27	0.34	0.07 – 0.14
70	0.32	0.38	0.22	0.27	0.06 – 0.11
80	0.27	0.31	0.18	0.22	0.05 – 0.09
90	0.22	0.26	0.15	0.19	0.04 – 0.07
100	0.19	0.22	0.13	0.16	0.03 – 0.06
150	0.1	0.12	0.07	0.09	0.02 – 0.03
Type	Continuous			Intermittent	
Nuisance Criteria	Residential 0.28 (preferred) / 0.56 (max)			Residential 0.20 (preferred) / 0.40 (max) [a)]	
Building Criteria	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above				

Note: All results are PPV, mm/s unless otherwise indicated.
a) VDV, $m/s^{1.75}$.

The predicted vibration levels presented in Table 24 indicate compliance with the continuous maximum vibration nuisance criteria for locations at a separation distance of 50-60 metres. Compliance with the building damage criteria is predicted at 10 metres from construction for each source. Therefore, as the closest receptor is approximately 500 m from the nearest vibration source, there will be no adverse impact.

For intermittent vibration associated with haul vehicles, it is difficult to provide an appropriate comparison with the relevant criteria (which is presented as a Vibration Dose Value (VDV) in $m/s^{1.75}$). The calculation of a VDV requires both the overall weighted RMS (root mean square) acceleration (m/s^2) typically obtained from on-site measurements and the estimated time period for vibration events.

It is noted, however, that the compactor PPV at distances of 500 m (the approximate distance to the nearest sensitive receptor from potential piling) is predicted to be within the maximum continuous criteria of 0.56 mm/s. This comparison with the continuous criteria (as a conservative approach) indicates that vibration levels associated with compactor are not considered to be significant (which is expected given the significant separation distances).

The vibration assessment demonstrates that there are no adverse amenity effects as a result of the peak construction activities or operational phase at the nearby sensitive receptors.

6.3 Operational Noise Levels

The predicted receptor noise levels during the operational phase of the Subject Site are based on the SWLs listed in Table 8, the source locations identified in Figure 1, and the running details and the methodology described in Section 5.4, are presented in Table 25.

Table 25: Predicted Receptor Noise Levels

Receptor	Predicted Operational Noise Levels, $L_{Aeq,15min}$ dB(A)			Project Noise Trigger Level $L_{Aeq,15min}$ dB(A)			Comply (Y/N)
	Day	Eve	Night	Day	Eve	Night	
R1	32	32	35	40	35	35	Y | Y | Y
R2	17	17	24	40	35	35	Y | Y | Y
R3	20	20	26	40	35	35	Y | Y | Y
R4	24	24	25	40	35	35	Y | Y | Y
R5	18	18	23	40	35	35	Y | Y | Y
R6	11	11	18	40	35	35	Y | Y | Y
R7	18	18	24	40	35	35	Y | Y | Y
R8	< 10	< 10	< 10	40	35	35	Y | Y | Y
R9	< 10	< 10	< 10	40	35	35	Y | Y | Y

The results show a maximum predicted noise level of 35 dB(A) during each of the day, evening, and night periods at the receptor located closest to the BESS footprint, being receptor R1. This suggests that full compliance is achieved during the operational scenario. As such, no additional noise mitigation is warranted.

Noise contour plots of the operational predicted operational noise levels from the Subject Site are presented in Appendix A.

7 CUMULATIVE IMPACT ASSESSMENT

7.1 Assessment of Cumulative Construction Impacts

7.1.1 Finley Solar Farm - 198 Canalla Road, Finley - 170 MW Solar Farm

The Finley Solar Farm proposed by ESCO Pacific Pty Ltd in SSD 8540 is located immediately southeast of the Subject Site and has completed its construction, thus there is no potential for cumulative construction noise impacts.

A modification application (SSD-8540-MOD-1) was determined in 2018 for upgrades to the substation. It is expected that any construction works associated with this modification would already be complete. In the event that they are not, the corresponding Environmental Assessment made no mention of construction noise, hence there is insufficient information to comment on the potential for construction noise impacts.

7.1.2 Berrigan BESS – 16891 Riverina Highway, Finley – 400 MW BESS

The Berrigan BESS proposed by Syncline Energy Pty Ltd in SSD-78106206 is to be constructed immediately (approximately 40 metres) to the west of the Subject Site beyond Canalla Road.

The SSD is currently in the 'Prepare EIS' stage, meaning that at the time of this assessment an EIS and noise impact assessment is not yet available to understand the timeline of its construction and any predicted construction impacts from that site. Without that information, it is not yet possible to comment on the potential for any cumulative noise impacts.

AE notes that given its current stage, the Berrigan BESS would not be considered a relevant future project for cumulative impact assessment per the definitions in Table 2 of the Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE, 2022).

A further evaluation of cumulative construction noise impacts may be warranted at a later stage should more information become available.

7.1.3 South Coree BESS – 384 Broockmanns Road, Finley – 100 MW BESS

The South Coree BESS proposed by Samsung C&T Renewable Energies Australia in SSD-77238990 is to be constructed approximately 300 metres to the east of the Subject Site.

As for the above discussed Berrigan BESS, the South Coree BESS is currently in 'Prepare EIS' stage, meaning that there is currently no information available to complete a cumulative construction noise assessment, nor would it be considered a relevant future project for cumulative impact assessments per the DPIE definitions.

A further evaluation of cumulative construction noise impacts may be warranted at a later stage should more information become available.

7.2 Assessment of Cumulative Operational Impacts

Figure 4 shows the Subject Site and identified receptors as well as the other surrounding SSDs identified for consideration of cumulative impacts.

As identified in the discussions in Section 7.1, both the Berrigan BESS and South Coree BESS are in early stages as proposals such that there is not sufficient information to assess the potential for cumulative impacts in any comprehensive manner. However, AE has made initial comments regarding the potential for cumulative impacts in the following paragraphs.

7.2.1 Finley Solar Farm - 198 Canalla Road, Finley - 170 MW Solar Farm

The Finley Solar Farm is completed and thus its operational impacts can be assessed cumulatively with the proposed Finley BESS on the Subject Site. A Noise Impact Assessment[f] was prepared for the Finley Solar Farm during its original application. AE has identified receptors that are common to the Finley Solar Farm assessment and the assessment of the Subject Site, and has prepared an assessment of cumulative impacts as presented in Table 26. The receptor locations and predicted noise levels for the Finley Solar Farm are reproduced in Appendix B. The cumulative impact is calculated using a simple logarithmic addition based on the set of results considering worst-case meteorological conditions.

As demonstrated, compliance with the operational assessment criteria is achieved at all common receptor locations except R1 when considering the cumulative impacts of the Subject Site and the Finley Solar Farm.

As shown in Table 26, at R1 a minor exceedance of 1 dB is predicted, with noise from the Subject Site being the primary contributor to the calculated cumulative noise level. AE makes the following notes regarding this exceedance:

- An exceedance of 1-2 dB is generally considered to be negligible and imperceptible to the average listener;
- The exceedance is primarily caused by noise emitting from the Subject Site, with only a minor contribution from the Finley Solar Farm. These predictions make the conservative assumption whereby all equipment is operating simultaneously and noise-enhancing weather conditions are occurring;
- To reduce the noise from the Subject Site to a level that would comply within a cumulative assessment would require a noise barrier to be constructed to interrupt the propagation path between the Subject Site and R1. Noise modelling confirmed a 3.5 m high barrier approximately 90 m long would be required to achieve this result. A review of the considerations for implementing feasible and reasonable mitigation measures, Guided by the NPfI Fact Sheet F, suggests that the economic costs of such a barrier may not be completely reasonable when considering the marginal benefit it provides, particularly when this benefit is only observed at a single receptor.

On this basis, AE concludes that the predicted cumulative impact at R1 is acceptable and further mitigation to achieve compliance would not be reasonable.

[f] *Finley Solar Farm Noise Impact Assessment*, prepared by Global Acoustics, their reference 17261_R01, dated 16/08/2017

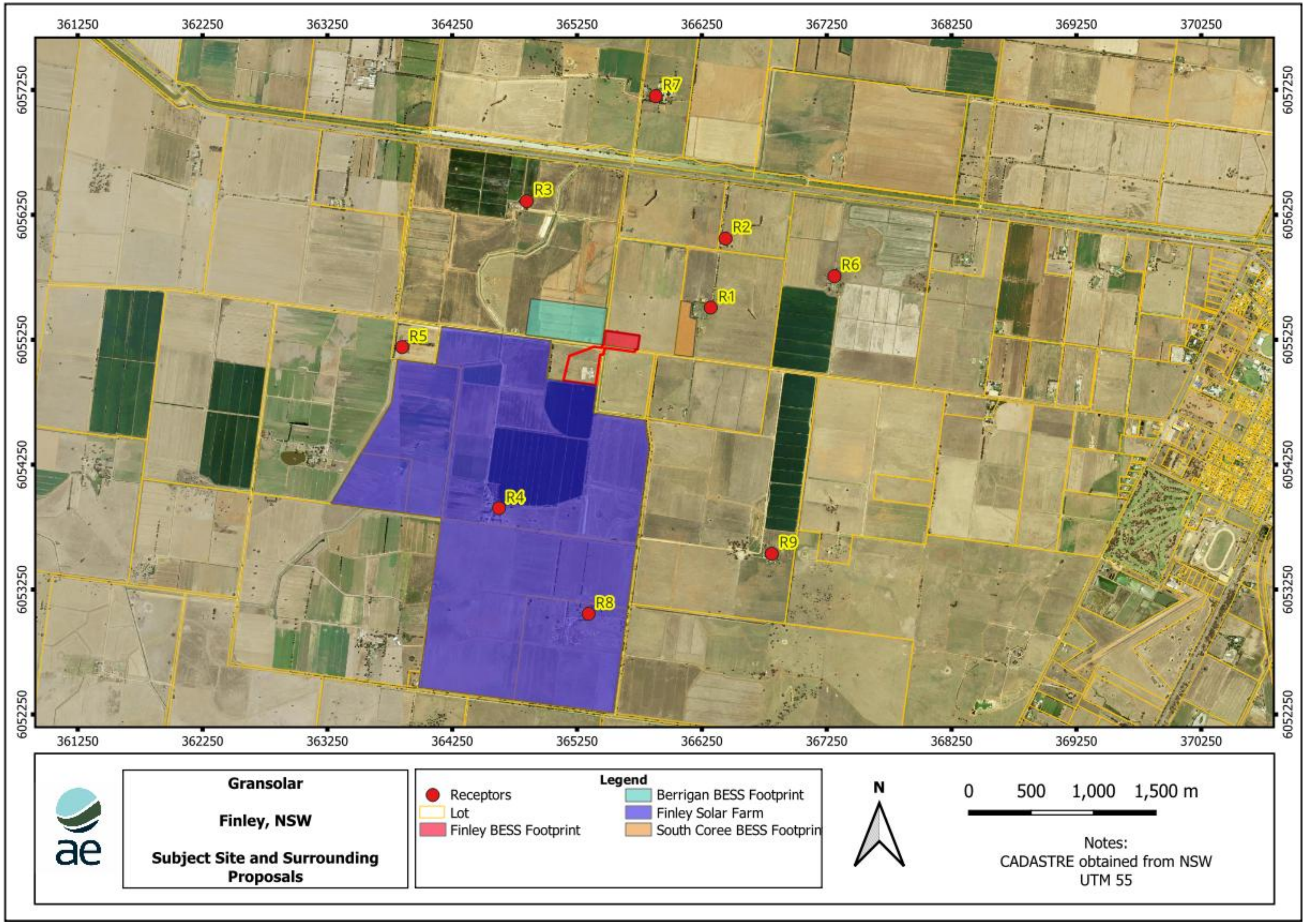

Figure 4: Surrounding Proposals for Cumulative Assessment

Table 26: Predicted Noise Levels at Sensitive Receptors for Cumulative Operational Assessment – Finley Solar Farm

Receptor as defined by AE receptor locations	Receptor as defined in Finley Solar Farm assessment	Intrusive Noise Criteria			Operational Noise levels			Comply (Y/N)
		Day	Eve	Night	Subject Site Assessment	Finley Solar Farm Assessment	Cumulative Impact	
R1	R4	40	35	35	35	27	36	Y
R2	R5	40	35	35	24	20	25	Y
R3	R3	40	35	35	26	27	30	Y
R4	Associated [a)]	40	35	35	25	Unknown [b)]	-	Y
R5	R1	40	35	35	23	35	35	Y
R6	R6	40	35	35	18	< 20 [c)]	22	Y
R7	R9	40	35	35	24	29	30	Y
R8	Associated [a)]	40	35	35	< 10	Unknown [b)]	-	Y

a) Not marked as a specific receptor in the Finley Solar Farm assessment, and is shown to be owned by the project landowners.

b) No predicted noise levels or noise contours are presented, thus the receptor noise levels are not known. However, given the predicted noise from the Subject Site is at least 10 dB below the criteria, the contribution from the Subject Site is effectively negligible during a cumulative impact assessment.

c) Taken as a conservative value of 20 dB(A) for cumulative calculations, actual levels are predicted to be lower by NGH NIA but are not specified.

7.2.2 Berrigan BESS – 16891 Riverina Highway, Finley – 400 MW BESS

The proposed Berrigan BESS footprint is located to the west of the Subject Site, thus is closer to receptors R3, R4, and R5. R3 is an associated receptor, being located within the project area for the Berrigan BESS, and thus is not expected to be included in the assessment of noise impacts for that project. Regardless, the predicted noise levels from the Subject Site are 26 dB(A), and given the Berrigan BESS is closer and is proposing a 400 MW capacity[g] (four times the capacity of the Subject Site), it is expected that the noise levels from the Berrigan BESS equipment will likely dominate the acoustic environment at R3 to an extent that the impact from the Subject Site is minor to negligible.

For receptors R4 and R5, the predicted noise levels from the Subject Site are 25 dB(A) and 23 dB(A) respectively. Given this is at least 10 dB below the assessment criteria of 35 dB(A), the contribution from the Subject Site is effectively negligible during a cumulative impact assessment, and thus the results at these receptors are acceptable.

A more precise understanding would require the noise impact predictions from the Berrigan BESS noise impact assessment, which is not yet available.

7.2.3 South Coree BESS – 384 Broockmanns Road, Finley – 100 MW BESS

It is noted that the South Coree BESS is proposed to be located on the same land as receptor R1, approximately 150 m from the edge of the BESS footprint. In contrast, the Finley BESS is located at least 600 m from R1. R1 is identified as being an associated receptor in the South Coree BESS scoping report[h], thus AE expects it not to be included in the assessment of noise impacts for that development. Regardless, its proximity to the South Coree BESS means that noise levels from that equipment will likely dominate the acoustic environment at R1 to an extent that the impact from the Subject Site on its own, as well as cumulatively with the existing Finley Solar Farm, is minor to negligible.

A more precise understanding would require the noise impact predictions from the South Coree BESS noise impact assessment, which is not yet available.

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g *Scoping Report - Berrigan Battery Energy Storage System (BESS)*, prepared by Cogency, Project Number 2318, dated 21/11/2024

h *Scoping Report - South Coree BESS*, prepared by NGH, Project Number 240316, dated 15/10/2024

8 CONCLUSION

AE was appointed by BESS Pacific Pty Ltd C/o Gransolar Development Australia to undertake a noise and vibration impact assessment for the proposed BESS facility at Riverina Highway, Finley NSW. The Subject Site is to comprise of 80 battery containers such that the total capacity of the development is to be 100 MW.

The noise and vibration assessment included both the construction and operational phases of the development and included all noise sources related to the site, including road traffic noise.

The assessment of potential noise impacts has considered the construction phase should occur during standard hours only. The results of first-principle calculations of predicted construction noise levels demonstrate that the Noise Affected criteria of 45 dB(A) is expected to be exceeded during several of the key construction stages. The Highly Noise Affected criteria of 75 dB(A) is not expected to be exceeded at any locations.

As such, for construction during standard hours, adverse amenity impacts during construction are considered unlikely. During works, following best practice mitigation detailed in Section 6.2.2 is recommended to ensure the amenity of the area is preserved.

The assessment of potential impacts from road traffic noise and vibration emissions from the Subject Site during construction were also conducted. Detailed assessment of impacts during the construction phase identified adverse amenity impacts from road traffic and vibration emissions to be unlikely and compliance with applicable criteria is expected to be achieved.

During the operational phase of the Subject Site, vibration and road traffic emissions are considered negligible due to the nature of the BESS equipment and minimal staff vehicle volumes during the operational phase.

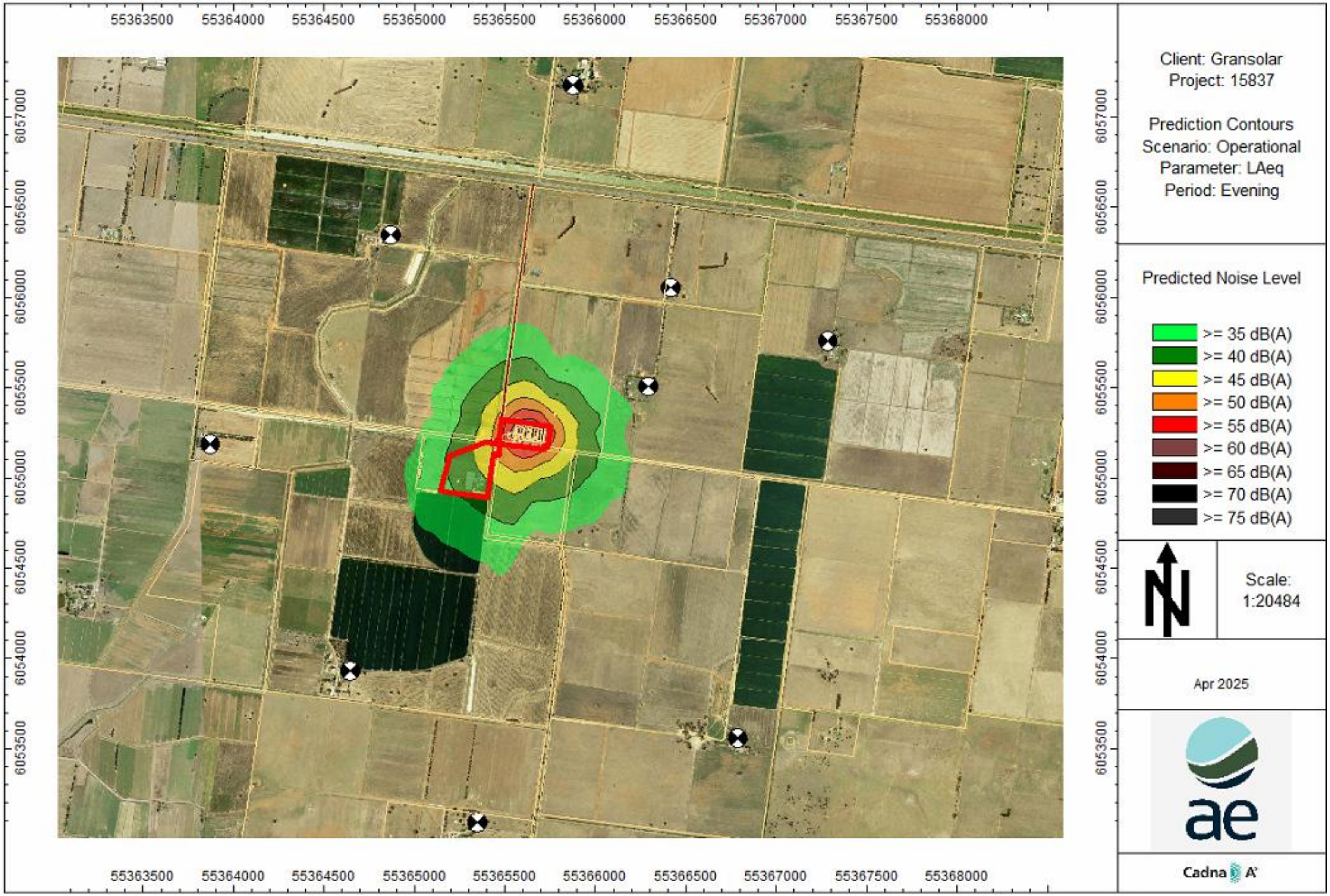
The results of the predictive noise modelling for the operational phase demonstrate that compliance with the derived noise criteria, with the limiting criteria being 35 dB(A) during the night, is expected to be achieved at all sensitive receptors. This compliance indicates that further noise mitigation is not warranted.

Lastly, AE considered cumulative impacts during both construction and operational stages with the existing Finley Solar Farm and proposed Berrigan and South Coree BESS projects. The assessment of cumulative construction noise only requires consideration of the two proposed projects (as an existing project will generate no construction noise), though their early stage meant there was insufficient information

For cumulative operational noise, again there was not sufficient information to conclusively determine the cumulative impacts with the other proposed BESS projects, though AE determined that the contribution from the Subject Site is likely to be negligible at receptors shared with those projects. The cumulative noise levels with the Finley Solar Farm showed a minor 1 dB exceedance at a single receptor, which AE evaluated and concluded that further mitigation would not be considered reasonable.

Overall, based on the results of the assessment, the risk of residual adverse impacts as a result of the proposed Subject Site is considered to be low, with noise and vibration emissions complying with the applicable criteria. Hence, from an acoustic and vibrational perspective, the proposed Subject Site is considered acceptable for the proposed use.

APPENDIX A: NOISE CONTOURS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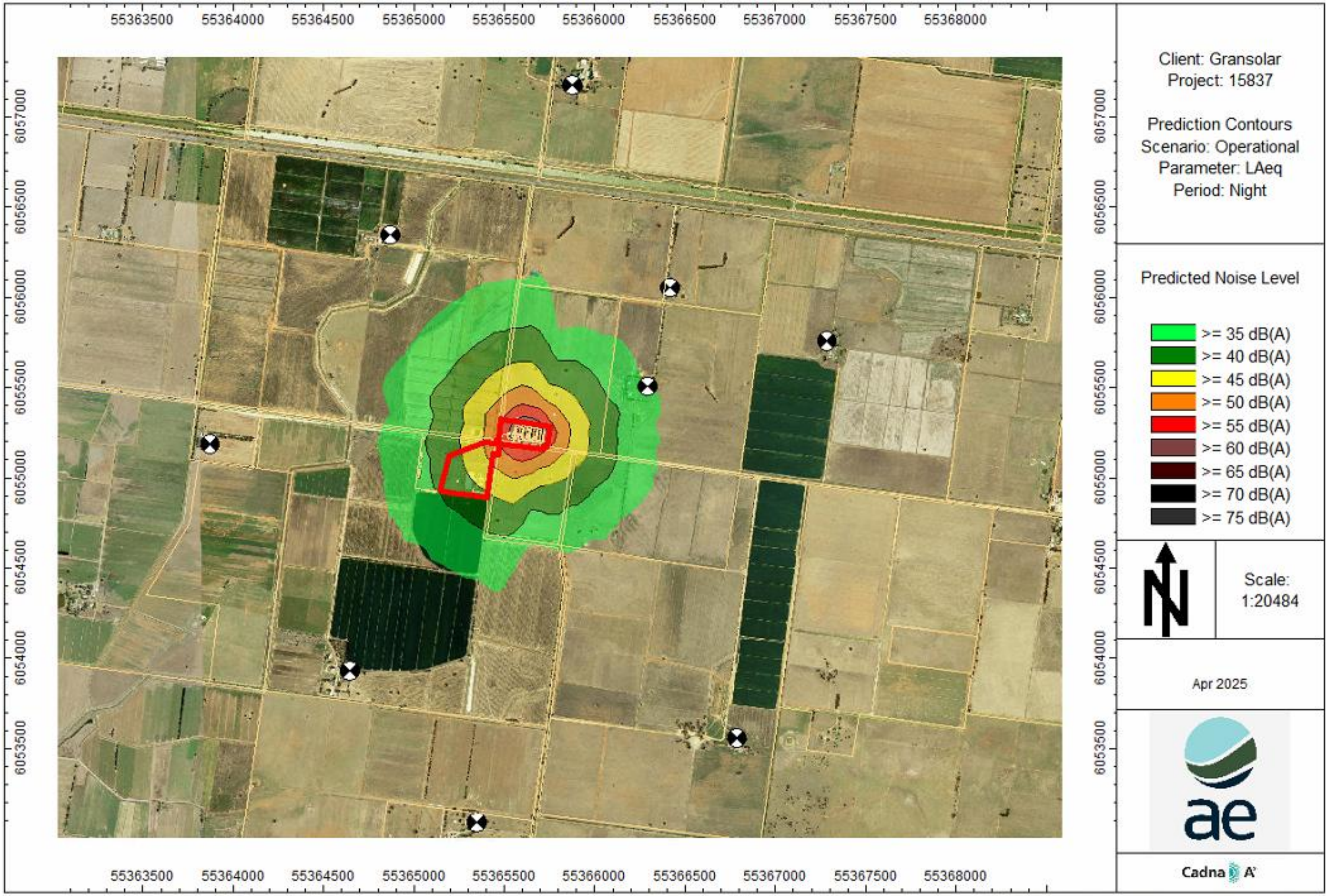
6053500
Client: Gransolar
Project: 15837
Prediction Contours
Scenario: Operational
Parameter: LAeq
Period: Evening
Predicted Noise Level
>= 35 dB(A)
>= 40 dB(A)
>= 45 dB(A)
>= 50 dB(A)
>= 55 dB(A)
>= 60 dB(A)
>= 65 dB(A)
>= 70 dB(A)
>= 75 dB(A)
N
Scale:
1:20484
Apr 2025
Cadna A



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6057000 6056500 6056000 6055500 6055000 6054500 6054000 6053500
Client: Gransolar
Project: 15837
Prediction Contours
Scenario: Operational
Parameter: LAeq
Period: Night
Predicted Noise Level
>= 35 dB(A)
>= 40 dB(A)
>= 45 dB(A)
>= 50 dB(A)
>= 55 dB(A)
>= 60 dB(A)
>= 65 dB(A)
>= 70 dB(A)
>= 75 dB(A)
N
Scale:
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APPENDIX B: FINLEY SOLAR FARM RECEPTORS

4.2 Operational Noise

Operational noise results are shown in Table 4.2.

Table 4.2: OPERATIONAL NOISE, $L_{Aeq,15\ minute}$ dB

Location	PSNL (Day/Evening/Night)	Model Predictions – Neutral Conditions	Model Predictions – Enhancing Conditions	Exceedance Neutral/Enhancing
R1	35	31	35	Nil/Nil
R2	35	<20	<20	Nil/Nil
R3	35	22	27	Nil/Nil
R4	35	22	27	Nil/Nil
R5	35	<20	20	Nil/Nil
R6	35	<20	<20	Nil/Nil
R7	35	20	25	Nil/Nil
R8	35	<20	<20	Nil/Nil
R9	35	24	29	Nil/Nil
R10	35	24	28	Nil/Nil
R11	35	25	30	Nil/Nil
R12	35	30	35	Nil/Nil
R13	35	28	33	Nil/Nil
R14	35	<20	<20	Nil/Nil
R15	35	<20	<20	Nil/Nil
R16	35	<20	<20	Nil/Nil

Notes:

1. *Bold results in red indicate an exceedance (if applicable); and*
2. *Enhancing conditions include 3m/s source to receiver gradient wind.*

No exceedances of adopted PSNL are predicted for operational noise.

4.3 Road Traffic Noise

4.3.1 Riverina Highway

The Riverina Highway is estimated to have an Annual Average Daily Traffic (AADT) of 1,780 with 19% (338) heavy vehicles in 2017. The proposed development is predicted to have an average of 82 movements per day during the peak of the construction period. For the purpose of this assessment all construction movements will be assumed to be heavy vehicles, however the estimated count also includes light vehicles for construction staff.

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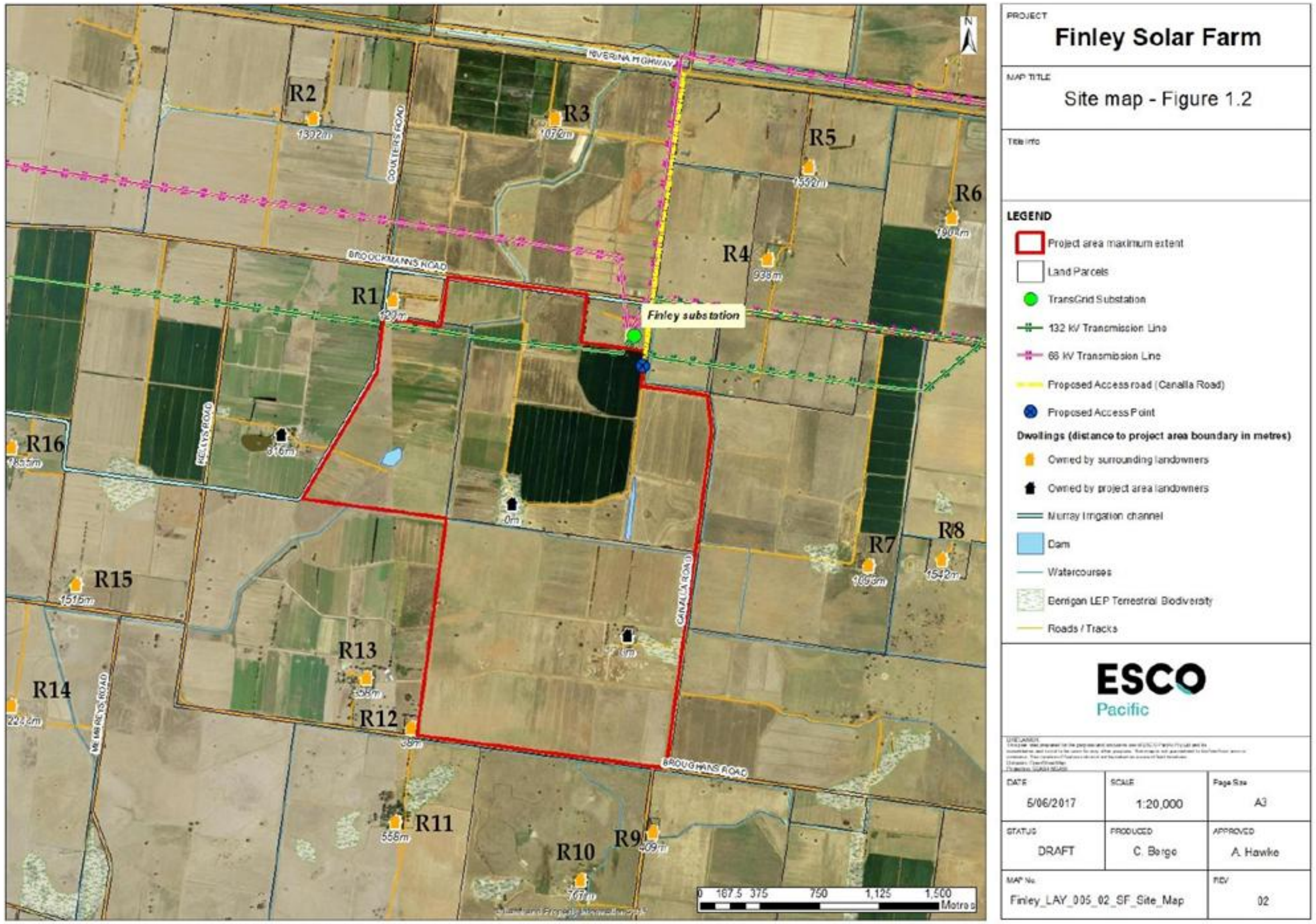

Figure 3: Site Map and Nearby Noise Sensitive Receptors