ASPELY BESS: NOISE & VIBRATION IMPACT ASSESSMENT

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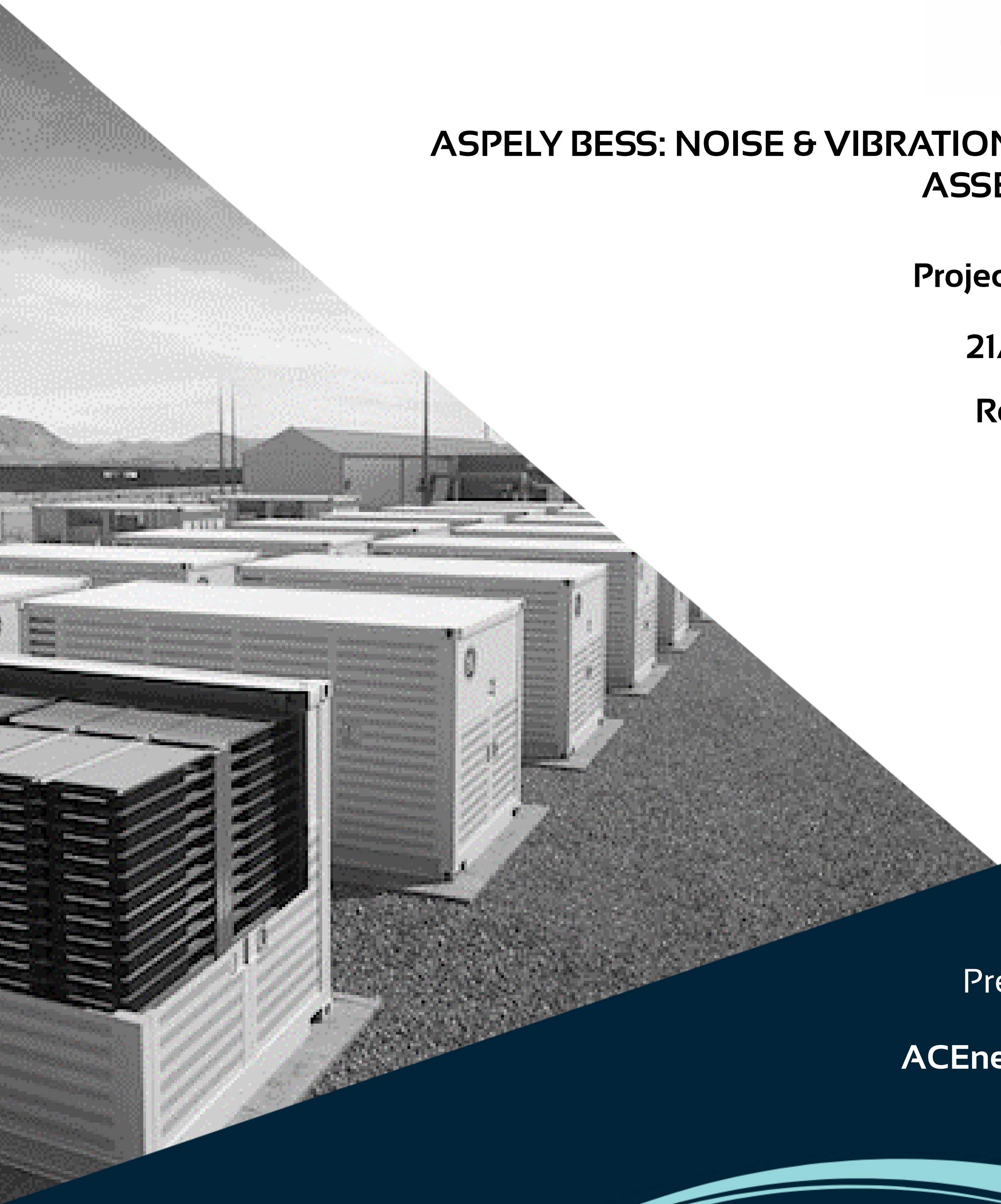

Prepared For:

ACEnergy Pty Ltd

Assured Environmental

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Project Title: ASPELY BESS: NOISE & VIBRATION IMPACT ASSESSMENT

Project Reference ID: 13614

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Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	14/10/2021	D. Walker	Initial Release
R1	3/12/2021	J. Bai	Client Comments
R2	23/12/2021	J. Bai	Change in modelling scenario
R3	13/1/2022	J. Bai	Change in modelling scenario
R4	24/3/2022	J. Bai	Change in modelling scenario
R5	31/3/2022	J. Bai	Change in modelling scenario
R6	4/4/2022	J. Bai	Client comments
R7	28/5/2022	J. Bai	Client comments
R8	10/5/2022	J. Bai	Client comments
R9	12/5/2022	J. Bai	Updated Map
R10	9/6/2022	J. Bai	New Layout
R10	21/6/2022	J. Bai	Updated Boundary

Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations, and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Assured Environmental is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s), unless explicitly stated otherwise.

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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.
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/m^2).
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.
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.
RBL	Rating background noise level – the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
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 pico Watt.

ABBREVIATIONS

EPA	Environmental Protection Authority (NSW)
ICNG	Interim Construction Noise Guidelines
NPfI	Noise Policy for Industry
BESS	Battery Energy Storage System

1 INTRODUCTION

1.1 Scope of Assessment

Assured Environmental (AE) was appointed by Premise Australia on behalf of ACEnergy Pty Ltd to undertake a noise and vibration impact assessment for the proposed Battery Energy Storage System (BESS), located in Aspley, NSW.

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

- NSW Noise Policy for Industry (NPfI) (EPA, 2017)
- NSW Assessing Vibration: a technical guideline (DEC, 2006);
- NSW Road Noise Policy (DECCW, 2011); and
- Interim Construction Noise Guideline (ICNG) (DECC, 2009).

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 development.

1.2 This Report

This report presents the noise and vibration impact assessment in accordance with the agreed scope of work.

2 PROPOSED DEVELOPMENT SITE

2.1 Development Site

The proposed development site is located approximately 9 km south-of Wellington in central New South Wales. Specifically, the proposed BESS is to be constructed on Lot 3 on DP 1012686, shown in Figure 1. The area surrounding the proposed development includes agricultural purposes with associated rural dwellings.

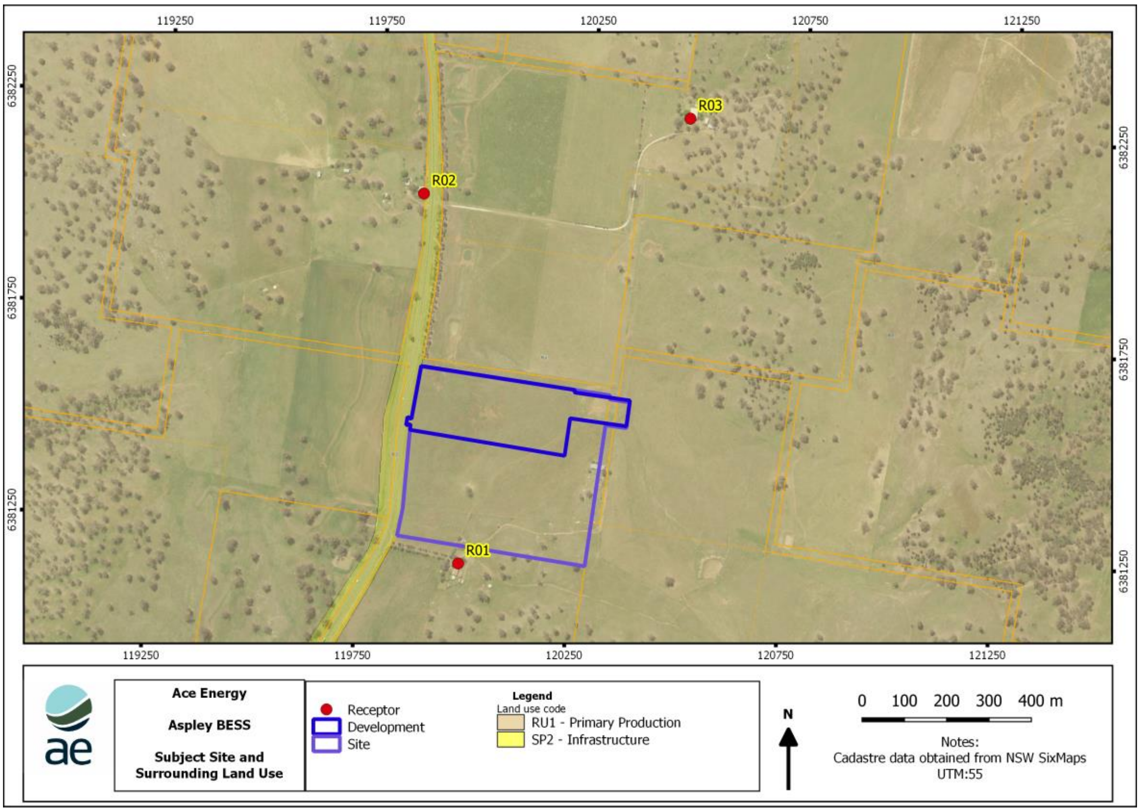


Figure 1: Receptors and Surrounding Land Use

2.2 Nearby Sensitive Receptors

There are three single existing dwellings located in the vicinity of the proposed BESS. Table 2 and Figure 1 provide a summary of selected sensitive receptors to the proposed development and approximate distance to the infrastructure.

Table 2: Nearby Sensitive Receptors

Receptor ID	Description	Coordinates Zone 55 (UTM)		Distance to infrastructure (m)
		Easting	Northing	
R01	Existing Dwelling	682882	6386740	300
R02	Existing Dwelling	6387627	6387627	430
R03	Existing Dwelling	682806	6387627	710

3 CONSTRUCTION NOISE ASSESSMENT

3.1 Duration of Construction Works

The construction of the BESS is expected to take approximately five months, with a number of different activities undertaken over that time.

Construction would be restricted to what the EPA term 'recommended construction hours' (as described in Table 3) which are between 7 am and 6 pm Monday to Friday and 8 am to 1 pm Saturday, with no works on Sundays or Public Holidays.

The assessment has therefore considered the potential for adverse amenity impacts associated with construction during recommended standard hours only.

3.2 Interim Construction Noise Guideline

Guidance on the assessment and management of construction noise in NSW is provided in the Interim Construction Noise Guideline 2009 (ICNG) published by the NSW EPA.

The main objectives of the Guideline are to:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours, unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage;
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts; and
- Provide guidelines for assessing noise generated during the construction phase of developments.

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.

Table 3 presents construction noise criteria outlined in the guideline. Noise levels 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.

Table 3: NSW EPA Construction Noise Criteria – Residential Receivers

Time of Day	Management Level (Free-field)	How to Apply
Recommended standard hours: Monday to Friday, 7 am to 6 pm	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 $L_{Aeq\,(15\,min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.

Time of Day	Management Level (Free-field)	How to Apply
Saturday 8 am to 1 pm No work on Sundays or public holidays		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 + 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.

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.

For construction outside standard hours, the assessment criteria has been determined based on the minimum allowable RBL as provided in the NPfI. That is, for the purposes of the assessment it is assumed that the RBL is 40 dB(A) for daytime periods (standard operating hours) thereby resulting in a noise affected management level of 50 dB(A) and a highly noise affected management level of 75 dB(A).

3.3 Construction Noise Sources

It is noted that 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.

Table 4 below presents a summary of the plant and equipment likely to be required to complete the on-site construction works. The sound power levels presented have been sourced from published noise emission datasets and the library of source noise levels maintained by Assured Environmental.

Table 4: Construction Phases and Expected Equipment

Construction Phase	Timeframe	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % c)
Site preparation and construction of acoustic wall and ancillary infrastructure a)	Weeks 1-8	Truck & Dog b)	2	110	40
		Compactor	2	103	20
		Bulldozer	1	109	40
		Water Cart	1	103	40
		Vibratory Roller	2	103	20
Concrete footing installation and cable installation	Weeks 5-12	Concrete truck	2 per day	99	40
		Excavator	2	105	40
		Concrete truck discharge	2	96	100
BESS and inverter container installation	Weeks 5-16	Trucks	5 per day	110	40
Electrical wiring and testing	Weeks 9-16	Hand tools	5	95	50
commissioning	Weeks 13-20	Hand tools	5	90	50
All	All	Light Vehicle	35/hour		

a) *Construction plant used intermittently as required. Continuous use not expected.*
b) *Truck movements associated with deliveries assumed to move through site at 10 km per hour as a moving point source.*
c) *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.*

3.4 Assessment of Impacts

For the purposes of predicting impacts associated with noise emissions from the Subject Site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (version 2021 MR2 build 181.5161) developed by DataKustik. CadnaA incorporates the influence of meteorology, terrain, 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 CONCAWE.

The model is utilised to assess the potential noise emissions from the subject site under a range of 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.

For this assessment, all the construction phases were assumed to operate concurrently, which is the worst-case scenario. It can be seen from Table 5, that the predicted noise levels at all receptors comply with the noise affected of 50 dB(A) during standard hours. The highest predicted noise level is expected to occur at receptor R01. Although no exceedance is observed, it is recommended that reasonable and feasible mitigation measures such as those presented in Section 3.5 are implemented to reduce the noise impact at this receptor.

Table 5: Predicted Receptor Noise Levels – Daytime, dB(A) (All construction Phases Run Concurrently)

Receptor	Maximum Predicted Noise Level, $L_{Aeq,15min}$ daytime period across all scenarios	Noise Management Level (Standard Hours)		Comply (Y/N)
		Noise Affected	Highly Noise Affected	
R01	43	50	75	Y/Y
R02	41	50	75	Y/Y
R03	36	50	75	Y/Y

3.5 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:

- Limiting the type and scale of concurrent activities undertaken close to sensitive receptors where possible;
- Using broad-band reversing alarms on all mobile plant and equipment;
- 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; and
- Regularly inspect and maintain equipment to ensure it is in good working order including checking the condition of mufflers.

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.

In addition, piling activities which are predicted to exceed 50 dB(A) at any sensitive receiver must only be undertaken:

- between the hours of 7:00am and 6:00pm Monday to Friday; and
- between the hours of 8:00am and 1:00pm Saturday;
- in continuous blocks of no more than three hours, with at least a one-hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers.

4 OPERATIONAL NOISE ASSESSMENT

4.1 Operational Noise Criteria

4.1.1 Overview

The acoustic assessment has been completed in accordance with the procedure identified in the 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 triggers levels against which the proposed development will be assessed. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response.

The derivation of the two sets of criteria are presented below. For residential dwellings, the noise criteria are assessed at the most-affected point (i.e. highest noise level) on or within the property boundary. Where the property boundary is more than 30 metres from the house, then the criteria applies at the most-affected point within 30 m of the house.

4.1.2 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 Rating Background Level or RBL) by more than 5 dB.

Given the rural location of the site, the impact assessment has assumed baseline noise levels equivalent to the minimum background noise levels provided in the NPfI. Therefore, Table 6 presents the derivation of the intrusiveness criteria based on the minimum background noise level established by the NPfI.

Table 6: Derived Intrusiveness Noise Criteria

Receptor	Intrusiveness $L_{Aeq,15\text{-}minute}$ Criteria		
	Day	Evening	Night
All nearby residential receptors [a)]	40 [b)]	35 [b)]	35 [b)]

a) Receptor noise criteria applied at a location 30 m from the dwelling façade.
b) Minimum background noise level established by the NPfI 2017 + 5 dB.

4.1.3 Amenity Criteria

The project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses.

Table 7: NPfI Amenity Noise Levels

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level (dB(A))	
			Total Industrial Noise	Project Specific
Residence	Rural	Day	50	50
		Evening	45	45
		Night	40	40

4.1.4 Project Trigger Levels

The project 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 level, after the conversion to $L_{Aeq,\,15\,min}$ dB(A) equivalent level. Table 8 presents the standardised intrusiveness noise level and the project amenity level as derived by adding 3 dB to each period of the day.

Table 8: Determining Project Trigger Level

Time of Day	Standardised $L_{Aeq,\,15\,min}$ Noise Level (dB)		
	Intrusiveness Criteria	Project Specific ANL	Project Trigger Level
Day	40	50 + 3 = 53	40
Evening	35	45 + 3 = 48	35
Night	35	40 + 3 = 43	35

4.1.5 Sleep Disturbance

NSW EPA have identified a screening assessment for sleep disturbance based on the night-time noise levels at a residential location. Where noise levels at a residential location exceed:

- $L_{Aeq,\,15\,min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is greater; and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 whichever is the greater, a detailed maximum noise level event assessment should be undertaken.

As discussed in Section 4.2.2, the predicted noise levels at residential locations do not exceed 40 dB(A) $L_{Aeq,\,15\,min}$, therefore a detailed sleep disturbance assessment is not required. Further, given 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.

4.2 Predictive Modelling

It is understood that the equipment and associated noise level data used as the basis for this assessment will be comparable with the final selections for the proposed facility. The primary recommendation will be that a suitably qualified acoustic consultant is engaged during detailed design to ensure that compliance with relevant criteria is achieved at nearby noise sensitive receptors. Should equipment with lower sound power level information than adopted, then the nominated noise control strategies may be amended with approval by a suitably qualified acoustic consultant.

The following summaries the assumptions, techniques, and data used to represent the BESS in the noise model.

When considering the sound power levels, the following is noted:

- Battery will be located in containers, which will be enclosed; therefore, each enclosure will provide shielding
- All sources operate continuously within any 15-minute period and therefore no duration or impulsive or intermittent adjustment is required; and
- A frequency spectrum was obtained for the battery façade, which is the façade with the cooling fan. Review of the 1/3 octave frequency confirmed that a +5dB adjustments was applied to this façade
- As per the communication with ACEnergy, a portion of the site is comprised of a switching station. A switching station is a substation that does not contain power transformers but only have power poles, wires and circuit breaker to permit a circuit to be disconnected or change the electric connection between the circuit, and therefore does not produce any noise during the operation.

Table 9: Source Noise Levels

Source	Qty	Supplier	Sound Power Level (dB(A))[e]	Acoustic Usage	Source
ST2752UX liquid cooling BESS Container	138	Sungrow	Three facades have a SPL of 54dB(A) [b] at 5 m. One façade has a SPL of 53 dB(A) at 5m	100%[e]	Manufacturer
SCS-3450-UP Inverter Container with Sound Proofing	46 containers	SMA	90 dB(A) per inverter [b]	100%	Manufacturer
160MVA 132KV Transformer	1	Unknown	90 [b]	100%	Calculated from D. Bies and et. al (2003)
SCS-3450-UP Inverter Container - 4MVA transformer	46	SMA	52 [c]	100%	A. Petrovic et. al (2012)
Light Vehicle [a]	1	N/A	88	Day time	-

a) *No permanent staff onsite, however occasional visitation for maintenance.*
b) *+5 dB adjustment Low frequency*
c) *Not modelled as 10 dB less than surrounding inverters*
d) *Unless otherwise noted*

4.2.1 Noise Modelling Methodology

For the purposes of predicting impacts associated with noise emissions from the Subject Site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (2021 MR2 build 181.5161) developed by DataKustik. CadnaA incorporates the influence of meteorology, terrain, 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 CONCAWE.

The model is utilised to assess the potential noise emissions from the Subject Site under a range of 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.

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 as detailed in Table 10.

Table 10: Standard and Noise Enhancing Meteorological Conditions

Meteorological Conditions	Meteorological Parameters
Standard conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL.
Noise enhancing conditions	Day/evening: stability categories A-D with light winds (up to 3 m/s at 10 m AGL).
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m AGL). And/or stability category F with light winds (up to 2 m/s at 10 m AGL).

The following conditions have been modelled:

- Day Periods – Stability class D at 3 m/s;
- Evening Periods – Stability class D at 3 m/s; and
- Night period - Stability class F at 2 m/s.

4.2.2 Predicted Noise Levels

To achieve compliance the following mitigations are recommended:

- Noise barriers are proposed as shown in Figure 2. In order to be effective, the acoustic barrier would need to be free of gaps and be constructed of material with a mass density greater than or equal to 12 kg/m^2 excluding structural components.

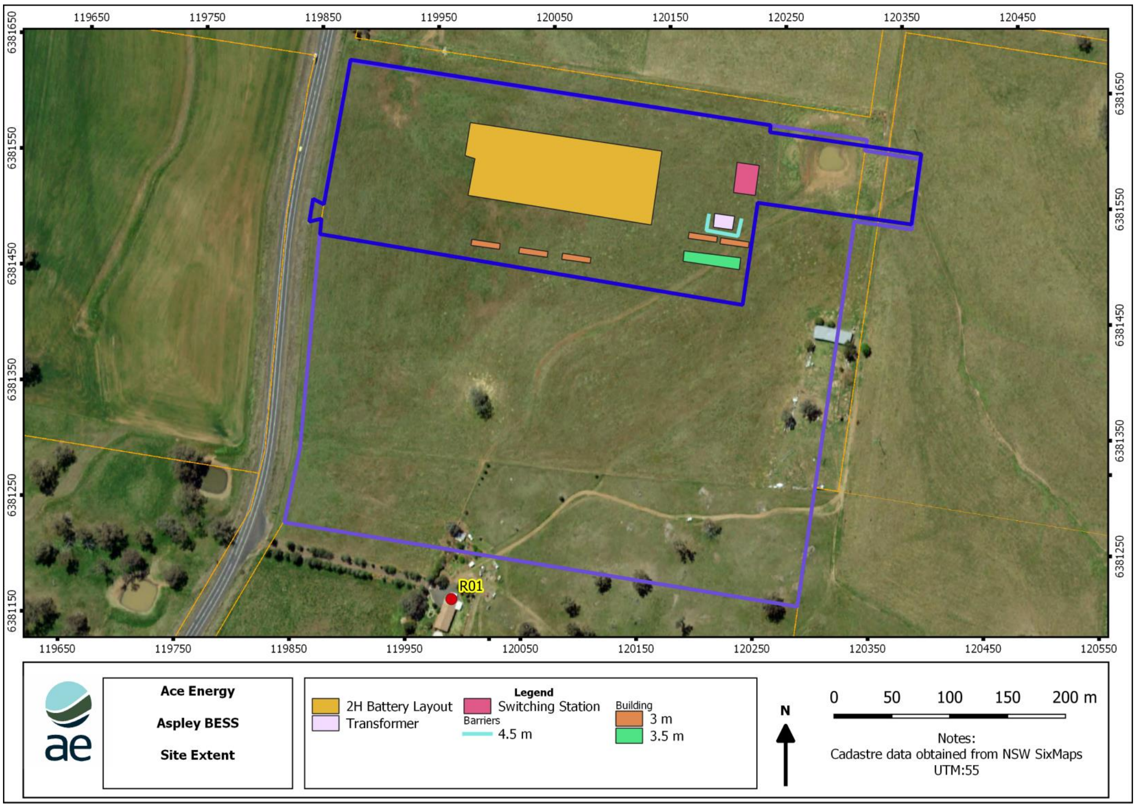


Figure 2: Barrier Location

Table 11 below presents predicted receptor noise levels during the operational phase of the proposed BESS. Review of the predicted noise levels confirms that compliance with the intrusive noise criteria established in accordance with the NPfI can be achieved for all receptors for both day, evening, and night periods under worst-case meteorological conditions.

Table 11: Predicted Receptor Noise Levels - Operational Phase, dB(A)

Receptor	Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Intrusive Noise Criteria			Comply (Y/N)
	Day	Eve	Night	Day	Eve	Night	
R01	34	34	34	40	35	35	Y | Y | Y
R02	30	30	30	40	35	35	Y | Y | Y
R03	35	35	35	40	35	35	Y | Y | Y

5 ROAD TRAFFIC NOISE ASSESSMENT

5.1 Introduction

Noise impacts associated with vehicle movements during the operational phase of the BESS project are expected to be negligible as no staff will be permanently based on-site. Visitation will be limited to periodic maintenance and infrequent plant and equipment replacements. During construction and any future decommissioning of the farm however, traffic movements will be more significant.

Construction is expected to be completed over a five-month period and it's anticipated that up to 50 workers would be on-site daily. For assessment purposes it is assumed that only 30% of the 50 workers would participate in some form of carpooling. Therefore, the modelling has assumed an estimated 35 private light vehicles travelling to and from the site daily.

Given this, the assessment has considered the potential impacts associated with noise emissions from the maximum expected 35 light and 5 heavy vehicle movements from the site entry along two possible routes:

- Route 1: North along Mitchell highway; and
- Route 2: South along Mitchell Highway.

Following additional assumptions have been made with a summary of road traffic data presented in Table 12.

- It has been assumed that 5 trucks per day would arrive spread out across the 11-hour workday. However, for a worst-case assessment, 5 trucks per hour was modelled.
- All movements are expected to occur during standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday).

Table 12: Road Traffic Data

Road Segment	Vehicle Type	Vehicle Speed b)	Number of Movements	
			Day (7 am to 6 pm)	Night (Peak 1-hour)
Mitchell highway	Light	100 km/hr	35	35
	Heavy	100 km/hr	13	13
Mitchell highway	Light	60 km/hr	35	35
	Heavy	60 km/hr	13	13

a) *Assumes all truck deliveries to site occur during standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday)*
b) *Assumed speed based on road type*

5.2 Assessment Criteria

The ICNG does not provide criteria for the assessment of construction road traffic during the project. Given this, reference is made to the noise criteria provided in the NSW Road Noise Policy (RNP). Based on the type of roadway, Table 13 below presents the applicable road traffic noise criteria for existing residences affected by traffic on existing roadways generated by land use developments.

Table 13: Applicable Road Traffic Noise Criteria

Road Category	Type of Project & Land Use	Assessment Criteria
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	Day: $L_{Aeq,1\ hour}$ 55 dB(A) Night: $L_{Aeq,1\ hour}$ 50 dB(A) (external)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	Day: $L_{Aeq,1\ hour}$ 60 dB(A) Night: $L_{Aeq,1\ hour}$ 55 dB(A) (external)

5.3 Noise Modelling Methodology

For the purposes of predicting impacts associated with road traffic noise emissions was completed using the proprietary software CadnaA (2021 MR2 build 181.5161) developed by DataKustik. The model incorporates the influence of terrain, 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 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).

Review of the predicted noise level presented in Table 14 below confirms that compliance with the RNP is achieved at the closest receptors to each potential route.

Table 14: Predicted $L_{Aeq,15\text{-}hour}$ Noise Levels - Road Traffic Noise

Sensitive Receptor	Setback from Roadway	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Mitchell Highway Road	16 m	Day	$L_{Aeq,1\ hour}$	60 dB(A)	53	Y
		Night	$L_{Aeq,1\ hour}$	55 dB(A)	50	Y
Curtis Road	16 m	Day	$L_{Aeq,1\ hour}$	55 dB(A)	50	Y
		Night	$L_{Aeq,1\ hour}$	50 dB(A)	47	Y

6 VIBRATION ASSESSMENT

6.1 Introduction

A review of the proposal indicates there is potential for impacts as a result of vibration generated by plant and equipment during the construction phase. Given this, an assessment of the potential for vibration impacts has been undertaken. In particular, the assessment has considered the potential for impacts on both human comfort and structural damage for the nearest residence to the construction works.

6.2 Assessment Criteria

The vibration criteria presented in the Environmental Noise Management – *Assessing Vibration: A Technical Guideline* (2006) published by the NSW Department of Environment and Conservation (DEC) have been adopted for the assessment. The technical guide provides vibration criteria associated with amenity impacts (human annoyance) for the three categories of vibration:

- Continuous vibration (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.

Table 15 and Table 16 present the criteria for continuous and impulsive vibration and intermittent vibration, respectively.

Table 15: Continuous & Impulsive Vibration Criteria for Residences – Peak Velocity

Location	Vibration Type	Preferred Limit (mm/s)	Maximum Limit (mm/s)
Residences	Continuous	0.28	0.56
Residences	Impulsive	8.6	17

Table 16: Intermittent Vibration Criteria for Residences

Location	Assessment Period	Preferred Value (m/s1.75)	Maximum Value (m/s1.75)
Residences	Day-time	0.20	0.40

The above criteria are suitable for assessing human annoyance in response to vibration levels. In order to assess potential damage to buildings, reference has been made to British Standard *BS 7385-2: 1993 Evaluation and measurement of vibration in buildings – Part 2: Guide to damage levels from ground borne vibration*. Table 17 presents vibration criteria for assessing the potential for building damage.

Table 17: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Particle Velocity (mm/s)	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures – residential or light commercial type buildings	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

6.3 Potential Vibration Sources

Table 18 identifies the vibration source levels for the equipment likely to be used for the construction of the BESS.

Table 18: Vibration Source levels – Peak Particle Velocity

Equipment Item	PPV at 10 metres (mm/s)	Source
Piling (press-in method)	1 – 2	Rockhill, D.J. et. al. [b)]
Roller	5 – 6	DEC
7 tonne compactor	5 – 7	DEC
Loaded trucks (rough surface)	5	USA DT [a)]
Loaded trucks (smooth surface)	1 – 2	USA DT [a)]
Excavator	2.5 – 4	DEC

a) Transit Noise and Vibration Impact Assessment, US Department of Transportation, May 2006
b) Rockhill, D.J., Bolton, M.D. & White, D.J. (2003) 'Ground-borne vibrations due to press-in piling operations'

6.4 Assessment of Potential Impacts

Based on the vibration source levels at 10 metres (presented in Table 18), peak particle velocities have been predicted at various separation distances. The NSW DEC indicates that in predicting vibration levels, it can be assumed that the vibration level is inversely proportional to distance (with the relationship varying between $d^{-0.8}$ to $d^{-1.6}$ based on field data).

The US Department of Transportation's Transit Noise and Vibration Impact Assessment (May 2006) 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. Based on the above information, Table 19 presents PPV predictions for the various construction equipment.

Table 19: Predicted Peak Particle Velocity at Sensitive Receptors (mm/s)

Distance from Source (m)	Predicted Peak Particle Velocity (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 – 2
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)	
Building Criteria	Residential 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				

The predicted vibration levels presented in Table 19 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 300m 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 300 m (the 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).

7 CONCLUSION

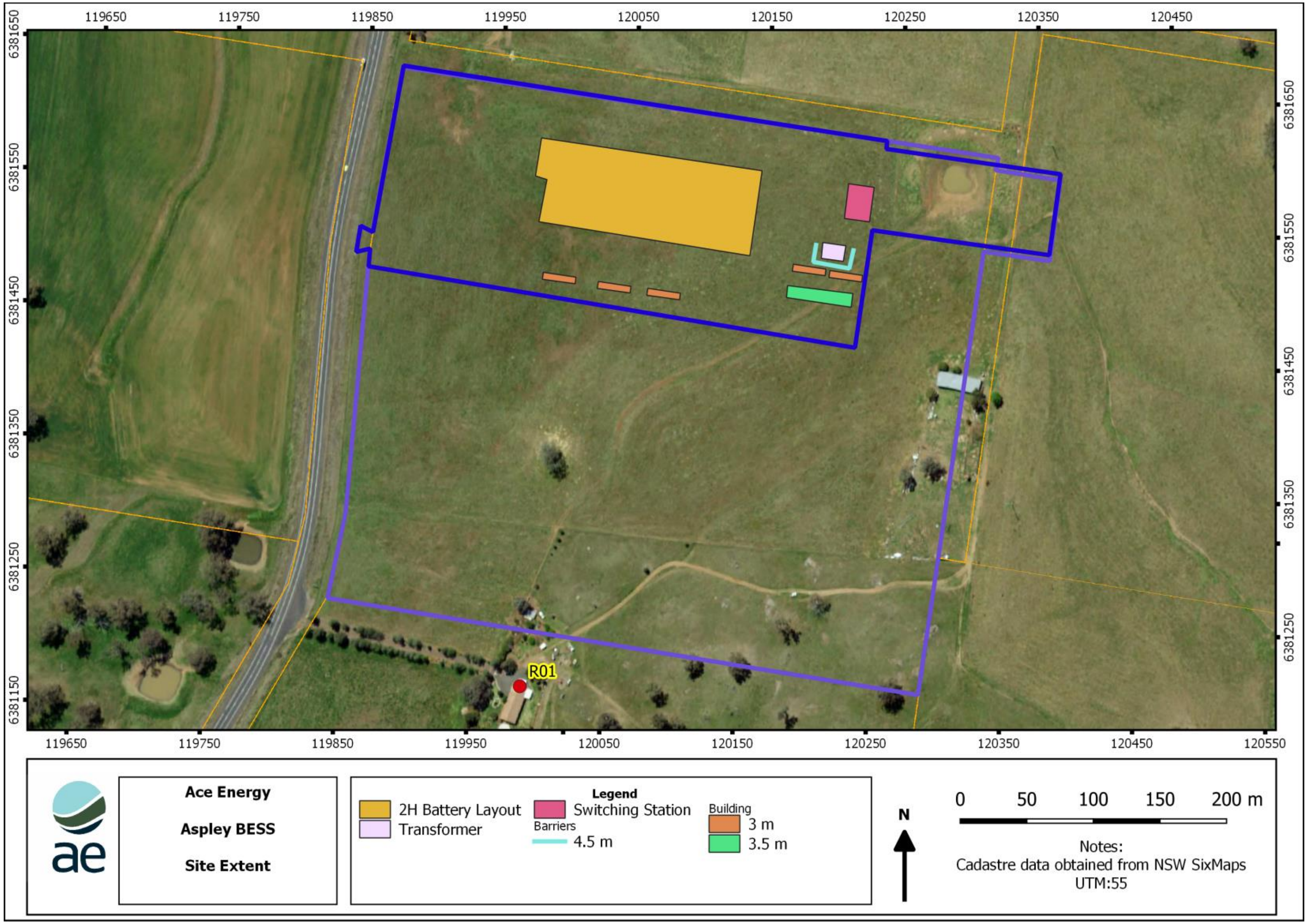
ACEnergy propose to develop a BESS in Aspley, NSW. The impact assessment has considered the potential for adverse impacts resulting from noise (construction, road traffic and operational) and vibration (construction) emissions on nearby residential uses.

The assessment of potential noise impacts has considered the construction phase should occur during standard hours only. For construction during standard hours, adverse amenity impacts during construction are considered unlikely.

For the operational phase of the project, adverse amenity impacts are considered unlikely and compliance with applicable criteria is expected to be achieved.

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

APPENDIX A: PROPOSED PLANS



APPENDIX B: NOISE CONTOURS

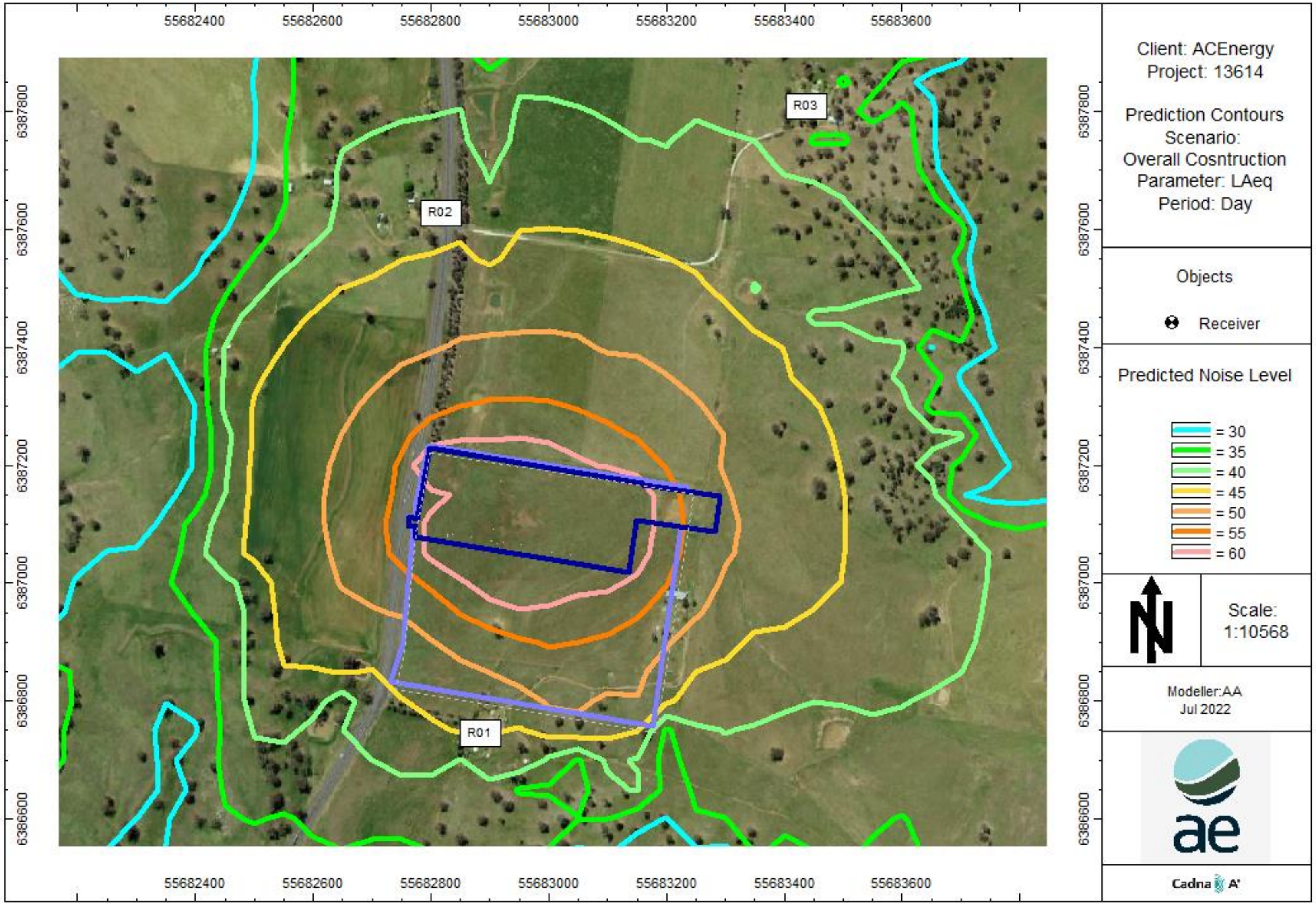


Figure 3: Predicted L_{Aeq} Construction Contours at 1.5m– Day (All Construction Phases Operating at the same time)

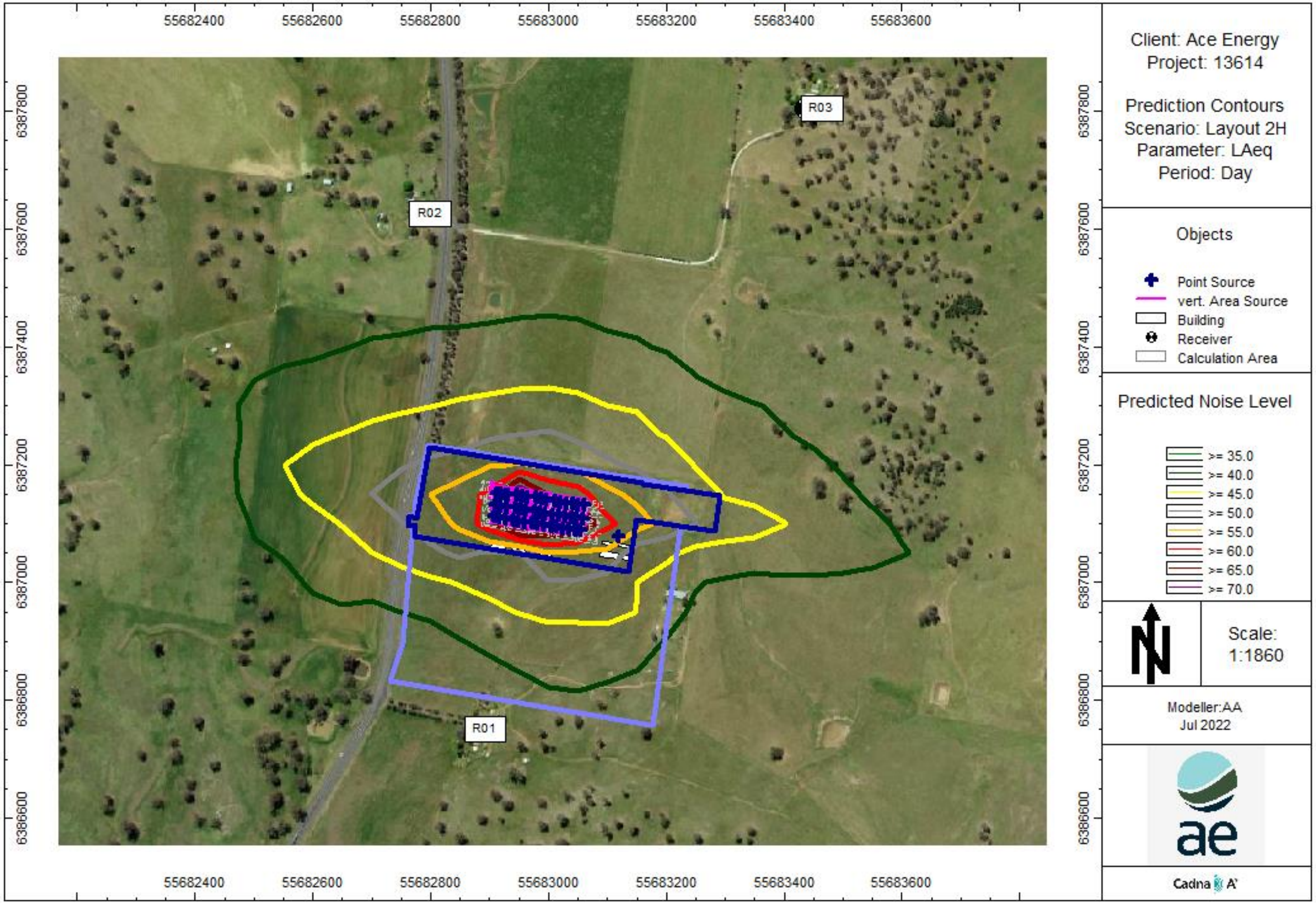


Figure 4:Predicted L_{Aeq} Operation Noise Level Contour at 1.5m– Day

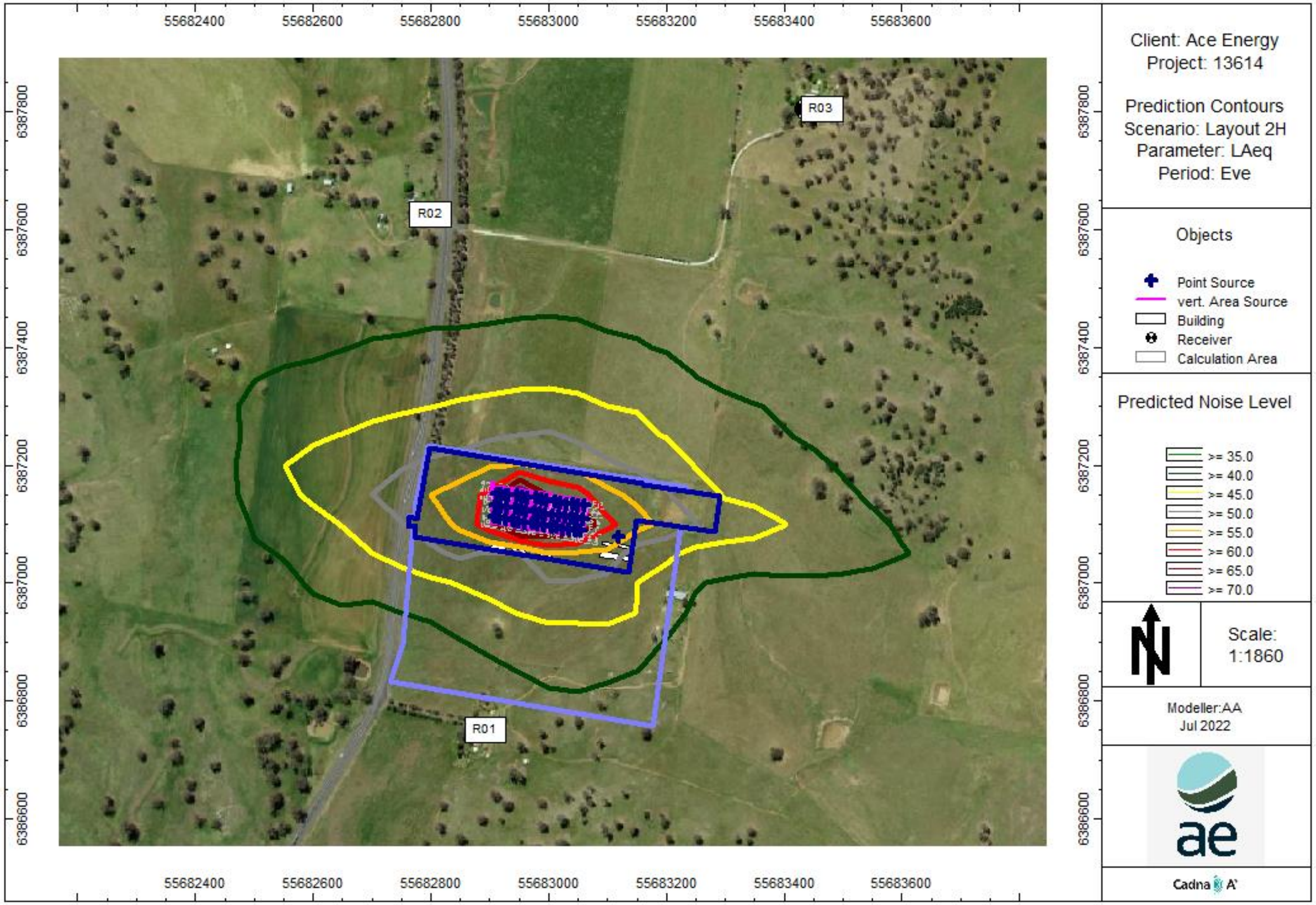


Figure 5:Predicted L_{Aeq} Operation Noise Level Contour at 1.5m– Evening

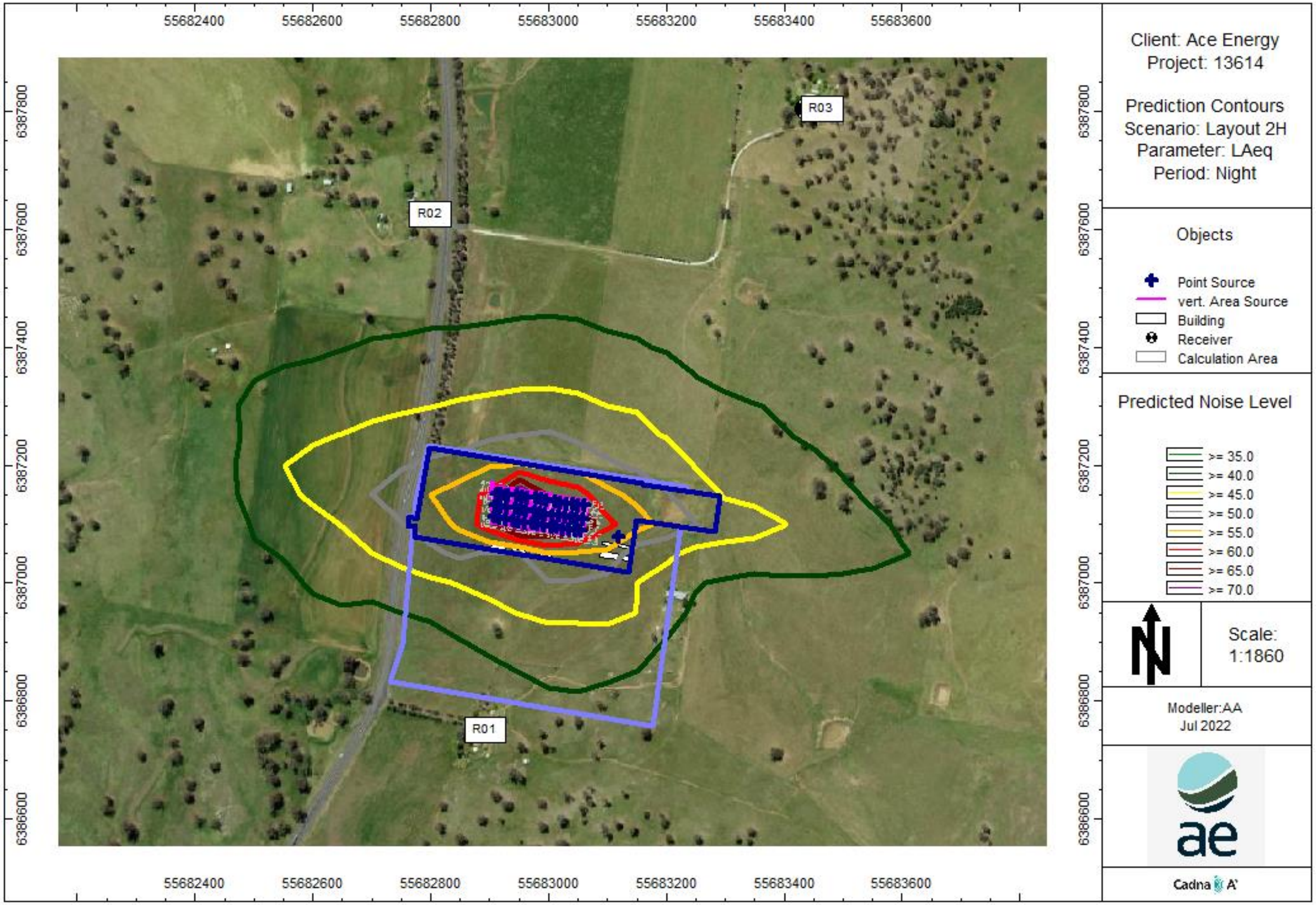


Figure 6: Predicted L_{Aeq} Operation Noise Level Contour at 1.5m– Night