Appendix E

Noise and Vibration Assessment

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AGL Energy Limited
21-May-2021

Broken Hill Battery Energy Storage System Project

Noise and Vibration Assessment

21-May-2021
Prepared for – AGL Energy Limited – ABN: 74 115 061 375

Broken Hill Battery Energy Storage System Project

Noise and Vibration Assessment

Client: AGL Energy Limited

ABN: 74 115 061 375

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Table of Contents

Executive Summary i
1.0 Introduction 1
1.1 Project overview 1
1.2 Secretary's Environmental Assessment Requirements 4
1.3 Purpose and scope of this technical report 4
1.4 Description of the surrounding area 5
1.4.1 Surrounding land uses 5
1.4.2 Assessment receivers 6
1.4.3 Isolated residences within an industrial zone 6
1.5 Estimated rating background levels 8
2.0 Construction Noise and Vibration Criteria 9
2.1 Construction noise 9
2.1.1 Construction noise management levels 9
2.1.2 Construction traffic noise 11
2.2 Vibration criteria 12
2.2.1 Structural damage 12
2.2.2 Human comfort 13
3.0 Operational Noise and Vibration Criteria 14
3.1 Environmental noise emission – *Noise Policy for Industry* 14
3.1.1 Protecting noise amenity 14
3.1.2 Project noise trigger levels 15
3.1.3 Sleep disturbance noise trigger levels 16
3.2 Noise from operational road traffic generation – NSW Road Noise Policy 17
3.3 Operational Vibration 17
4.0 Construction Noise Impact Assessment 18
4.1 Construction noise 18
4.1.1 Construction phases and sources 18
4.1.2 Modelling and conditions 20
4.1.3 Results 20
4.2 Construction Vibration 21
4.3 Construction Traffic 21
5.0 Operational Noise Assessment 22
5.1 Modelled operational scenario 22
5.1.1 Assessment noise source levels 22
5.1.2 Maximum noise levels 22
5.2 Modelling methodology 23
5.2.1 General modelling assumptions 23
5.2.2 Meteorological conditions 23
5.3 Operational noise assessment results 23
5.4 Operational road traffic noise assessment 24
6.0 Construction Noise and Vibration Mitigation 25

Appendix A A
Acoustic Terminology A

List of Figures

Figure 1 Project Area layout 3
Figure 2 The Project Area and assessment receiver locations 7

List of Tables

Table 1	Secretary's environmental assessment requirements	4
Table 2	Assessment receiver locations	6
Table 3	Rating background levels	8
Table 4	Construction noise management levels – Residential receivers	10
Table 5	Construction noise management levels – Residential receivers	11
Table 6	Construction noise management levels – Non-residential receivers	11
Table 7	Standards/guidelines used for assessing construction vibration	12
Table 8	Structural damage safe criteria (DIN 4150) for building vibration (Peak particle velocity)	13
Table 9	Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$)	13
Table 10	*NPfI* recommended $L_{Aeq,15\ minute}$ intrusiveness noise levels from industrial noise sources	14
Table 11	*NPfI* recommended L_{Aeq} amenity noise levels from industrial sources	15
Table 12	*NPfI* project noise trigger levels	16
Table 13	Night-time sleep disturbance trigger levels	16
Table 14	Construction phases and equipment	19
Table 15	Number of residential buildings where noise levels may exceed NMLs - Day	20
Table 16	Number of non-residential buildings where noise levels may exceed NMLs	20
Table 17	Recommended minimum working distances for vibration intensive plant	21
Table 18	Plant items sound power levels	22
Table 19	Predicted operational noise levels	24
Table 20	Recommended noise mitigation measures	25

Executive Summary

AGL Energy Limited (AGL) is seeking development consent to construct, operate and maintain a Battery Energy Storage System (BESS) facility located at Broken Hill, NSW with a capacity of approximately 50 megawatts (MW) and up to 100 megawatt-hour (MWh) (the Project). AECOM Australia Pty Ltd (AECOM) has been engaged to assess the construction and operational noise and vibration impacts of the Project.

The proposed location of the BESS (the Site) is on two lots at 74 to 80 Pinnacles Place, Broken Hill NSW 2880 (Lots 57 and 58 of DP 258288). The Site is located approximately 120 m east of the TransGrid Broken Hill substation located at 76 Pinnacles Road, Broken Hill NSW 2880 (Lot 2 of DP 1102040). The Project would also involve the installation of a transmission connection between the Site and the TransGrid Broken Hill substation, which would traverse Lot 7302 DP1181129, being Commons. The Site and the transmission line corridor constitute the 'Project Area'.

The Project Area is located within an industrial zone and semi-rural landscape. The closest noise sensitive receivers are situated 1.1 km and 1.2 km away.

Construction noise impacts were modelled to determine the potential noise impacts at nearby noise sensitive receivers and compared against the NSW EPA's Interim Construction Moise guideline (ICNG) (DECC 2009), Noise Management Levels for construction scenarios. The modelling showed that no noise sensitive receivers are predicted to exceed the construction noise management levels during the day. In general, the construction of the Project is expected to comply with the noise management levels during the Project's construction during standard construction hours. None of the construction is expected to result in noise levels which exceed the 'highly noise affected' level of 75 dB(A) for noise sensitive receivers.

The noise from traffic generated by the construction activities to and from the Project Area are considered acceptable according to the NSW EPA's Road Noise Policy.

Operational noise from the Site was also modelled and compared against established project noise trigger levels. Results of the noise modelling showed that the operation of the BESS complies with the established project noise trigger levels at all receivers for the day, evening and night periods under standard and noise enhancing meteorological conditions.

The impact of operational traffic noise generated by the Site is considered acceptable according to the NSW EPA's Road Noise Policy.

1.0 Introduction

AGL Energy Ltd (AGL) is seeking development consent to construct, operate and maintain a battery storage facility with a capacity of approximately 50 megawatts (MW) and up to 100 megawatt-hour (MWh) at Broken Hill (the Project). AECOM Australia Pty Ltd (AECOM) was engaged by AGL to prepare the construction and operational noise and vibration impact assessment for the Project.

This technical report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs), issued by the Secretary of the Department of Planning, Industry and Environment (DPIE) on 23 December 2020, in relation to noise and vibration.

1.1 Project overview

The Broken Hill Battery Energy Storage System (BESS) would provide a reliable supply of electricity to Broken Hill in the event of line failure and provide efficient grid support for the region. The Project would provide storage and firming capacity to the National Energy Market (NEM), as well as additional services to assist grid stability including frequency control ancillary services.

The proposed location of the BESS (the Site) is at two lots located at 74 to 80 Pinnacles Place, Broken Hill, New South Wales (NSW) (Lots 57 and 58 of DP 258288). The Site is close to the TransGrid Broken Hill substation located at 76 Pinnacles Road, Broken Hill, NSW (Lot 2 of DP 1102040). The Project will also involve the installation of a transmission connection between the Site and TransGrid Broken Hill substation, which will traverse Lot 7302 DP1181129, being land classified as Commons. The Site and the transmission line easement constitute the 'Project Area'. The Project Area layout is shown in **Figure 1**.

Key features of the Project include:

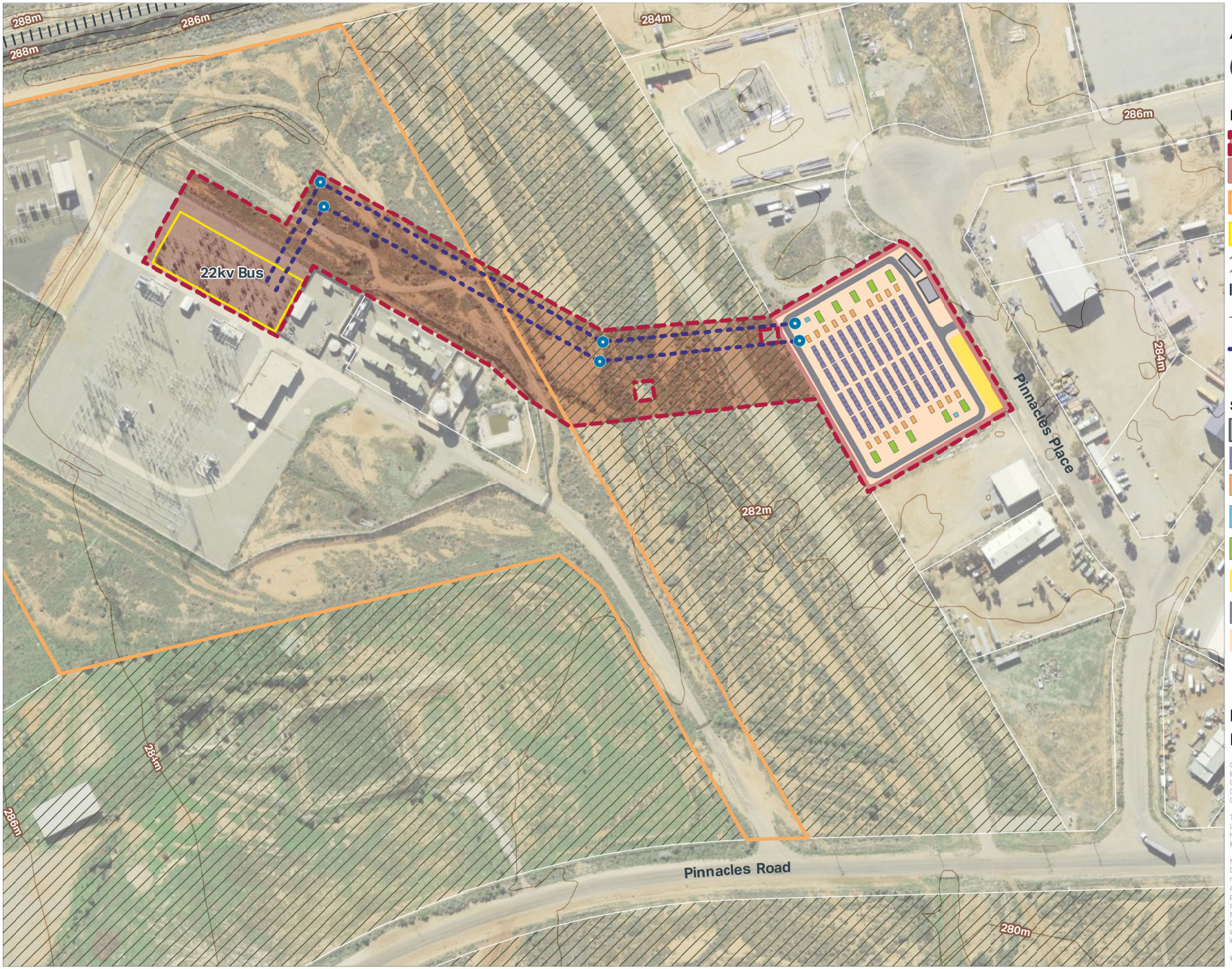
- Construction and operation of a BESS with a capacity of approximately 50 MW and up to 100 MWh; and
- Connection of the BESS facility to the nearby TransGrid substation via a 22 kilovolt (kV) powerline connecting through a 22 kV busbar in the substation.

The Project would be generally comprised of the following components:

- 180 lithium-ion batteries inside battery enclosures
- 11 inverters
- 11 medium voltage transformers up to 22 kV
- Cabling and collector units
- Connection to an existing 22 kV electrical switchyard including minor works to connect the BESS to the TransGrid Broken Hill substation
- Temporary site office and then a permanent control and office building
- Asset Protection Zone (APZ)
- Site access, internal roads and car parking
- Drainage and stormwater management
- Other ancillary infrastructure including security fencing, lighting and CCTV.

The Site is approximately 0.8 ha in size and is located on the western side of Pinnacles Place, which is a bi-directional 13 metres (m) wide local road providing access for an industrial precinct and connection to Pinnacles Road. The two allotments comprising the Site would have approximately100 m frontage to Pinnacles Place. Access to the Project would be established via a new two-way driveway crossing that accommodates entry and exit to the Site for light and heavy vehicles.

Based on the proposed Project layout (refer to **Figure 1**) it is intended that an internal road is provided to enable vehicular access around the Site. Adequate parking will be supplied on site to accommodate the generally low operational staffing needs of the Project.



AECOM

N

0 30 60 m

Legend

- Project Area
- Site
- TransGrid Broken Hill Substation
- 22kV Bus
- Commons
- Railway
- Contour
- Indicative overhead transmission line
- Indicative transmission line pole

Site features

- Office building
- Battery
- Inverter
- Medium voltage auxillary switchboards
- Transformer
- Laydown area/operational parking area
- Access road
- Permeable surface

FIGURE 1:

PROJECT AREA LAYOUT

Source: © Department of Customer Service 2020

1.2 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) relating to construction and operational noise and vibration, and where these requirements are addressed in this technical report, are outlined in **Table 1**.

Table 1 Secretary's environmental assessment requirements

Secretary's Environmental Assessment Requirements	Where addressed
The EIS must address the following specific issues:	-
Noise and Vibration – including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (INCG), operational noise impacts in accordance with the NSW Noise Policy for Industry (2017), cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	Construction noise and vibration impacts are discussed in **Section 4.0**. Operational noise and vibration impacts are discussed in **Section 5.0**. Potential cumulative noise impacts of the Project and other developments within the vicinity are considered in **Section 4.1.3** and **5.3**. The assessment indicates that only marginal exceedances of criteria are anticipated to occur at non-residential receivers during construction. These would be manageable with the implementation of standard mitigation measures (refer to **Section 6.0**). Exceedances are not predicted at residential receivers. As such, a draft noise management plan has not been included in the EIS. A commitment to the preparation of a Construction Noise and Vibration Management Plan has been included in **Section 6.0**.

1.3 Purpose and scope of this technical report

The scope of the noise and vibration impact assessment is to:

- Determine the existing background noise levels at the closest residential receiver location, by applying minimum noise levels provided in the NSW Noise Policy for Industry (NPfI)
- Determine the construction noise and vibration management levels applicable to the identified sensitive receivers in accordance with the NSW Environment Protection Authority's (EPA) Interim Construction Noise Guidelines (ICNG) and Assessing Vibration: A Technical Guideline (AVTG).
- Determine equipment to be used, schedule of construction activities and location of construction activities.
- Provide a construction noise and vibration assessment that assess the likely construction noise and vibration levels in accordance with the ICNG and AVTG and determines the likely noise impacts of additional traffic on identified sensitive receivers in accordance with the EPA's NSW Road Noise Policy (RNP).
- Determine the industrial project noise trigger levels applicable to identified residential sensitive receivers and other nearby receivers in accordance with the EPA's NPfI.
- Establish operational scenarios applicable to the Project.
- Provide an operational noise and vibration assessment that presents the predicted noise emission levels from the operation of the Project and compares them against the established project noise trigger levels.

- Predict any increase in road traffic noise levels due to vehicular movements associated with the operation of the Project. Assessment to be conducted in accordance with the RNP.
- Determine feasible and reasonable noise and vibration mitigation for the construction and operational stages, where required.

1.4 Description of the surrounding area

The Project Area is in the suburb of Broken Hill, which is part of the Broken Hill City Council's Local Government Area (LGA). Broken Hill is an inland mining city in the far west of outback NSW. Broken Hill is located in proximity to the border with South Australia on the crossing of the Barrier Highway (A32) and the Silver City Highway (B79), in the Barrier Range. Located over 1,100 kilometres (km) west of Sydney and surrounded by semi-desert, Broken Hill has prominent park and garden displays.

The Project Area is located approximately 2 km west of the town of Broken Hill in a semi-rural/industrial area. Industrial land uses are located adjacent to and around the Project Area. Several freight storage and handling yards are located immediately to the east, while rural properties are located to the south and east. Approximately 200 m to the north is Adelaide-Broken Hill Railway with the Broken Hill Community Recycling Centre.

The 53 MW Broken Hill Solar Plant operated by AGL was completed in 2016 and is located approximately 1.5 km west of the Project. At the time of construction, the Broken Hill Solar Plant was one of the largest renewable energy facilities in Australia. In addition, AGL has completed construction of the 200 MW Silverton Wind Farm which is located 20 km north-west of the Broken Hill Substation.

1.4.1 Surrounding land uses

A review of the Broken Hill Local Environmental Plan 2013 (Broken Hill LEP) was undertaken to identify the specific land use zones applicable to the Project Area and the surrounding area. According to the Broken Hill LEP, the Project Area is zoned as IN1 General Industrial. This includes the Site and the TransGrid Broken Hill substation and Lot 7302 DP1181129 that connects the Site with the substation. Beyond these adjacent land uses, other land use zones identified within 1 km of the Site have been identified. Other land uses within 1 km of the Project Area include:

- E2 Environmental Conservation
- E4 Environmental Living
- IN1 General Industrial
- RU2 Rural Landscape
- SP1 Infrastructure (Special Activities – Mining)
- SP2 Infrastructure (Rail Infrastructure Facility)
- SP2 Infrastructure (Waste Management Facility)
- SP2 Infrastructure (Water Supply System)

The Site, Project Area, representative sensitive receivers and the surrounding area are presented in **Figure 2**.

1.4.2 Assessment receivers

The assessment receiver locations, along with the land use classification (as defined in the NPfI), of each receiver are presented in **Table 2** and shown on **Figure 2**.

Table 2 Assessment receiver locations

Receiver	Address	Land use classification
R1	101 Wentworth Road Broken Hill	Residential - Suburban
R2	32 Gaffney Street Broken Hill	Residential - Suburban
R3	29 Ryan Street Broken Hill	Residential - Suburban
R4	4 Ryan Street Broken Hill	Residential - Suburban
R5	46 Wills Street Broken Hill	Residential - Suburban
R6	141 Creedon Street Broken Hill	Residential - Suburban
R7	119 Pinnacles Road, Broken Hill	Residential - Rural
R8	121 Pinnacles Road, Broken Hill	Residential - Rural
E1	Rainbow Preschool	Educational
E2	Charles Sturt University	Educational
C1	Broken Hill Bowls Club	Commercial
C2	Service Station, Kanandah Road, Broken Hill	Commercial
I1	82 Pinnacles Road Broken Hill	Industrial
I2	17-19 Pinnacles Road Broken Hill	Industrial
IR1	38 Pinnacles Road Broken Hill	Industrial
A1	Broken Hill Bowls Club	Active recreation area

The receivers in **Table 2** are representative of the potentially worst affected receivers in the vicinity of the Site and wider Project Area. Demonstrating compliance at these receivers will likely result in compliance of the relevant criteria at receivers located further from the Site and Project Area.

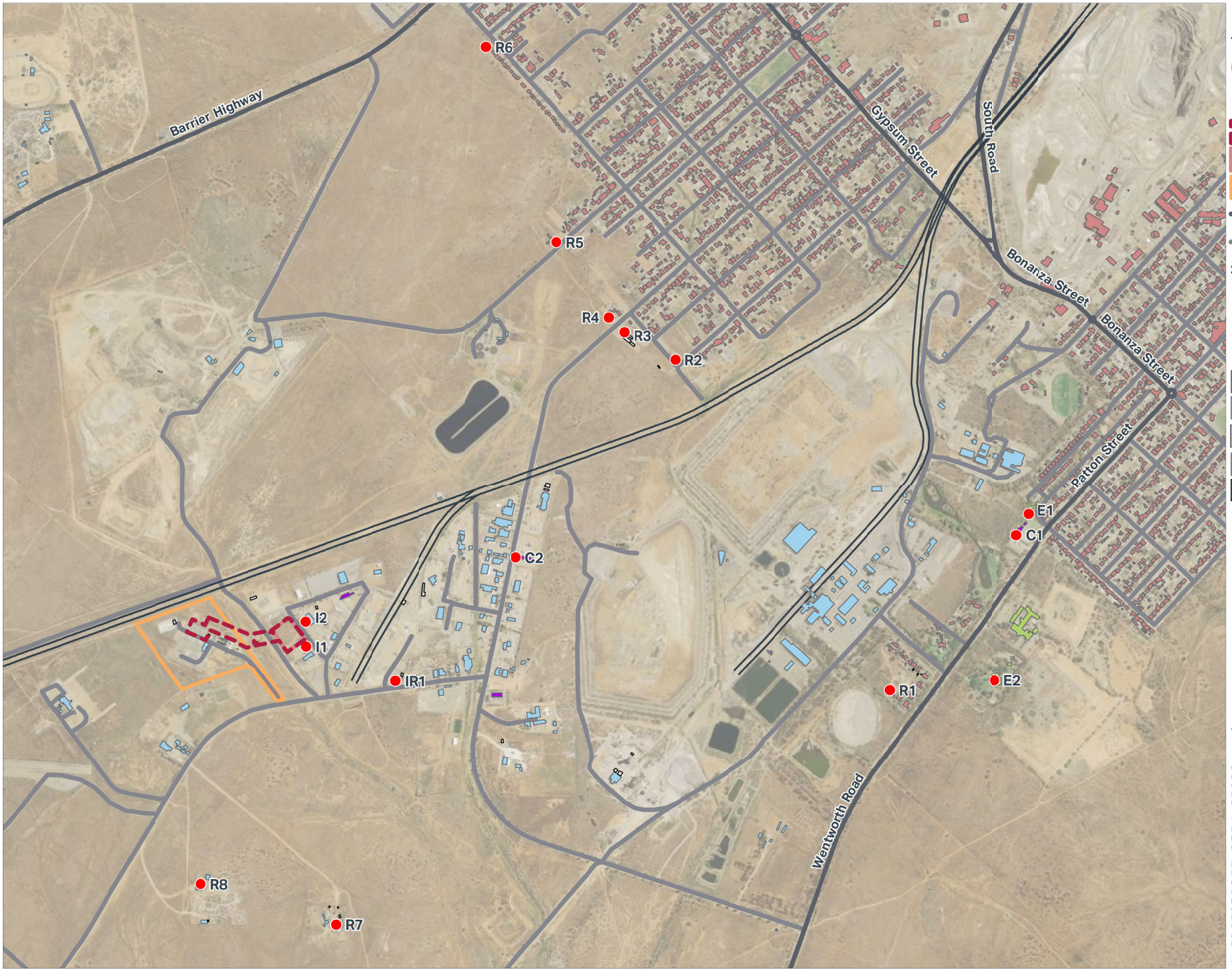
1.4.3 Isolated residences within an industrial zone

A review of satellite imagery of the building located at 38 Pinnacles Road Broken Hill indicates that there is a potential that the site is used or was historically used for residential accommodation.

The property is located on land zoned IN1 General Industrial, which explicitly prohibits residential accommodation. The building is located on Lot 1 of DP556674, which also contains land for industrial use. For these reasons, it is unlikely that the building is a residential dwelling; however, this building has been assessed as an isolated residence within an industrial estate and is, therefore, assessed against the industrial amenity criteria in accordance with the NPfI.

Section 2.4 of the NPfI states that *"isolated residences within an industrial zone the industrial amenity level would usually apply".*

This is considered conservative as demonstrating compliance at this isolated residence within an industrial estate would likely result in compliance of the relevant criteria at any isolated residences within an industrial zone that may be located further from the Site.



AECOM

N

0 250 500 m

Legend

- Project Area
- Site
- TransGrid Broken Hill substation
- Main roads
- Local roads
- Railway
- Operational noise assessment receiver location

Receiver Type

- Commercial
- Education
- Industrial
- Residential
- Shed

FIGURE 2:
ASSESSMENT RECEIVER LOCATIONS

Source: © Department of Customer Service 2020

1.5 Estimated rating background levels

Fact sheet A: *Determining existing noise levels* of the NPfI states the following with regard to minimum rating background noise levels (RBL) for assessment purposes:

> *Where the rating background noise level is found to be less than 30 dB(A) for the evening and night periods, then it is set to 30 dB(A); where it is found to be less than 35 dB(A) for the daytime period, then it is set to 35 dB(A).*

Given that the majority of the residential receivers are located on the edge of the Broken Hill City and are surrounded by vacant land, the minimum noise levels provided in the NPfI are considered appropriate. The RBLs adopted for this Project are summarised in **Table 3**.

Table 3 Rating background levels

Receiver	Minimum assumed rating background noise level (RBL), L_{A90} dB(A)		
	Day 0700 - 1800	Evening 1800 - 2200	Night 2200 - 0700
Residential receivers	35	30	30

The RBLs provided in **Table 3** have been compared to background noise logging levels undertaken by AECOM at other remote rural areas in NSW and are considered to be representative.

This approach is considered conservative, as there is a potential that the existing environment is affected by industrial noise sources and, therefore, the existing RBLs could be higher than what is presented in **Table 3**.

2.0 Construction Noise and Vibration Criteria

Construction of the Project has the potential to temporarily contribute to the existing external noise environment. This section will establish construction noise management levels and vibration criteria to address these potential impacts.

2.1 Construction noise

2.1.1 Construction noise management levels

The ICNG is the principal guideline for the assessment and management of construction noise in NSW. As the proposed works are expected to continue for a period of more than three weeks and are within relatively close proximity to noise sensitive receivers, a quantitative assessment, based on representative construction scenarios, has been carried out for the Project.

Noise levels resulting from construction activities are predicted at nearby noise sensitive receivers using environmental noise modelling software and compared to the noise management levels (NML), derived in accordance with the ICNG.

Where an exceedance of the noise management levels is predicted, the ICNG advises that receivers can be considered ‘noise affected’ and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as provide contact details to facilitate feedback from affected residents during construction.

Where construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be ‘highly noise affected’ and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

2.1.1.1 Residential receivers

Guidance for setting construction noise management levels for residential receivers are summarised in **Table 4**.

Table 4 Construction noise management levels – Residential receivers

Time of day	NML, $L_{Aeq\ (15min)}$, dB(A)[1]	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ 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: 1. 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 2. 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. • For guidance on negotiating agreements see section 7.2.2 (ICNG).

Notes:

1. *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. Noise levels may be higher at upper floors of the noise affected residence.*

The ICNG defines what is considered to be feasible and reasonable as follows:

- Feasible - a work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.
- Reasonable - selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.

Table 5 presents the NMLs applicable to residential receivers nearby to the Site.

Table 5 Construction noise management levels – Residential receivers

Land use	Recommended standard hours RBL, L_{A90} dB(A)	Recommended standard hours noise management levels, $L_{Aeq\ (15\ min)}$ dB(A)	Highly noise affected level, $L_{Aeq\ (15\ min)}$ dB(A)
Residential	35	45	75

2.1.1.2 Non-residential receivers noise management levels

Table 6 presents the NMLs applicable to non-residential receivers.

Table 6 Construction noise management levels – Non-residential receivers

Land use	External noise levels, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Classrooms at schools and other educational Institutions - Internal	45 dB(A)
Classrooms at schools and other educational Institutions - External	65 dB(A)[1]
Active recreation areas	65 dB(A)
Passive recreation areas	60 dB(A)
Industrial premises	75 dB(A)
Commercial premises (including cafes, bars, restaurants, retail stores and hotels)	70 dB(A)

Notes:

1. *This external noise management level is based upon a 45 dB(A) internal noise management level and a 20 dB(A) reduction from outside to inside through a closed window*

2.1.2 Construction traffic noise

Construction traffic noise was assessed with reference to the RNP, which provides the methodology for assessment and the threshold for noise mitigation.

To assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB, in line with the RNP guidelines.

Where the predicted noise increase is 2 dB or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB, and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

2.2 Vibration criteria

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

- continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

The relevant standards and guidelines for the assessment of construction vibration are summarised in **Table 7**.

Table 7 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)
Human comfort (tactile vibration)	Assessing Vibration: A Technical Guideline (AVATG)[1]

Notes:

1. *This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. However the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.*

2.2.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration. The German Standard (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in **Table 8**. DIN 4150 states that buildings exposed to higher levels of vibration than recommended criteria would not necessarily result in damage. In this assessment of DIN 4150 structural damage safe criteria have been adopted for residential and non-residential structures.

Table 8 Structural damage safe criteria (DIN 4150) for building vibration (Peak particle velocity)

Group	Type of structure	At foundation – Less than 10 Hz	At foundation – 10 Hz to 50 Hz	At foundation – 50 Hz to 100 Hz[1]	Vibration at the horizontal plane of the highest floor for all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Notes:

1. *At frequencies above 100 Hz, the values given in this column may be used as minimum values*

2.2.2 Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline A*ssessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in **Table 9**. The VDV criteria are based on the likelihood that a person would comment adversely on the level of vibration over the entire assessment period.

Table 9 Preferred and maximum vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime (7am – 10pm)		Night-time (10pm – 7am)	
	Preferred	Maximum	Preferred	Maximum
Critical areas[1]	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops[2]	0.8	1.6	0.8	1.6

Notes:

1. *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are undertaken require more stringent criteria than the residential criteria specified above*
2. *Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are undertaken but do not require sensitive or delicate tasks.*

3.0 Operational Noise and Vibration Criteria

3.1 Environmental noise emission – *Noise Policy for Industry*

Industrial noise has the potential to affect nearby noise sensitive receivers. The NPfI sets out a procedure to determine project noise trigger levels relevant to a development. If it is predicted that the development is likely to cause the project noise trigger level to be exceeded at existing noise sensitive receivers, then management measures need to be considered to reduce the predicted noise level.

The assessment procedure for industrial noise sources has two components that must be considered:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for residences and other land uses.

Both components are assessed at the boundary of the noise sensitive receiver site. The project noise trigger level applies to environmental noise emissions from the Project, and for residential receivers, represent the lower of the intrusive or amenity noise levels.

The NPfI states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15 minute period, does not exceed the background noise level measured by more than 5 dB. The Rating Background Levels (RBLs) and resultant project intrusiveness noise levels are presented in **Table 10**.

Table 10 *NPfI* recommended $L_{Aeq,15\ minute}$ intrusiveness noise levels from industrial noise sources

Type of receiver	Period[1]	RBL, L_{A90} dB(A)	Intrusiveness noise Level (RBL+5), $L_{Aeq\ 15\ minutes}$ dB(A)
Residential receivers	Day	35	40
	Evening	30	35
	Night	30	35

Notes:

1. *Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.*

   Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays.

   Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Intrusiveness noise levels apply only to residential receivers. For other receivers, only the amenity levels apply.

3.1.1 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from all industrial noise sources in an area should not normally exceed the recommended amenity noise levels specified in Table 2.2 of the NPfI.

Given that the existing acoustic environment to the north east and east of the Site is dominated by road and rail traffic and industrial related sources, the noise amenity area of the residences located to the north east and east (R1-6) is considered to be ‘suburban’. Residences to the south of the Site (R7 and R8) are considered rural as they are not in proximity to other land uses and are located within land classified as R2 low density Residential.

Table 11 ***NPfI*** **recommended L_{Aeq} amenity noise levels from industrial sources**

Type of receiver	Noise amenity area	Time of day	Recommended amenity noise level (L_{Aeq}), dB(A)
Residential	Suburban	Day	55
		Evening	45
		Night	40
	Rural	Day	50
		Evening	45
		Night	40
Hotel, motels, care takers' quarters, holiday accommodation, permanent resident caravan parks.	All	All	Add 5 dB(A) to recommended noise amenity area
School classroom – Internal	Noisiest 1-hour	Noisiest 1-hour	40[1]
School classroom – External	Noisiest 1-hour	Noisiest 1-hour	60[2]
Active recreation area	All	When in use	55
Commercial premises	All	When in use	70
Industrial premises	All	When in use	65
Isolated residence within Industrial zone	All	When in use	65

Notes:

1. *The Noise Policy for Industry states "In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.*
2. *Assumes a 20 dB reduction from external to internal through a closed window.*

According to Section 2.4 of the NPfI, the amenity noise level applicable to the Project is equal to the recommended amenity noise level minus 5 dB. This takes into account the cumulative impacts from other industrial noise sources in the area.

In accordance with the NPfI, the project amenity noise level is converted to a 15-minute period by adding 3 dB.

3.1.2 Project noise trigger levels

Table 12 presents the applicable project noise trigger levels.

Table 12 *NPfI* project noise trigger levels

Type of receiver	Time of day	Intrusiveness noise level (RBL+5) ($L_{Aeq, 15\ minutes}$), dB(A)	Project amenity noise level ($L_{Aeq, 15\ minutes}$), dB(A)	Project noise trigger level ($L_{Aeq\ 15\ minutes}$), dB(A)
Suburban residential receivers	Day	40	53	40
	Evening	35	43	35
	Night	35	38	35
Rural residential receivers	Day	40	48	40
	Evening	35	43	35
	Night	35	38	35
School classroom – Internal	Noisiest 1-hour	-	38	38
School classroom – External	Noisiest 1-hour	-	58	58
Active recreation area	When in use	-	53	53
Commercial premises	When in use	-	63	63
Industrial premises	When in use	-	68	68
Isolated residence within Industrial zone	When in use	-	68	68

Adjustments to the level of noise predicted at the assessment location may be applied in accordance with Fact Sheet C of the NPfI to account for the subjective effects of specific noise characteristics including tonality, low frequency content, intermittency and duration.

3.1.3 Sleep disturbance noise trigger levels

The NPfI requires the potential for sleep disturbance to be assessed by considering maximum noise level events during the night-time period.

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

- $L_{Aeq, 15\ minute}$ 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 dB, whichever is greater.

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

Based on the estimated background noise levels during the night, the sleep disturbance trigger levels for the noise sensitive residential receivers are presented in **Table 13**.

Table 13 Night-time sleep disturbance trigger levels

Type of receiver	Estimated night period RBL, L_{A90} dB(A)	Sleep disturbance screening noise trigger levels	
		$L_{Aeq, 15\ minutes}$, dB(A)	L_{AFmax}, dB(A)
Residential	30	45	52

3.2 Noise from operational road traffic generation – NSW Road Noise Policy

To assess noise impacts from traffic generated by the operation of the Project, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB, in line with the RNP. Where the predicted noise increase is 2 dB or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB, and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

3.3 Operational Vibration

Operational vibration is not expected to be an issue as a result of the Project as the operational activities would not create significant vibration levels at nearby sensitive receivers or adjacent properties. The nearest sensitive receivers are located 1.1 km to the east of the Site. Therefore, an assessment of the operational vibration impacts is not required.

4.0 Construction Noise Impact Assessment

A construction noise and vibration impact assessment has been completed for the Project. As construction works would be undertaken throughout the Project Area, the Project Area is the focus of the construction assessment.

4.1 Construction noise

This construction noise and vibration assessment is based on typical construction scenarios for this type of development.

4.1.1 Construction phases and sources

The construction phases that have been assessed are detailed below:

1. Enabling works
2. Civil, structural, mechanical, electrical works and commissioning
3. Demobilisation
4. Transmission connection

Sound power levels were obtained from published datasets in BS5228: Part 1 2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise* and AECOM's database. All equipment is assumed to be in good working order.

The equipment and associated sound power levels (SWL) for the four construction phases are shown in **Table 14**.

Table 14 Construction phases and equipment

Phase	Equipment / Activity	Percentage time on	'A' Weighted SWL dB(A)
Enabling works	Front end loaders	100	104
	Dump trucks	100	114
	Road trucks	100	108
	Water trucks	100	113
	Excavators	33	94
	Graders	100	114
	Compactors and rollers	33	102
	Overall	**-**	**119**
Civil, structural, mechanical, electrical works and commissioning	Front end loaders	100	104
	Road trucks	100	108
	Graders	100	114
	Concrete trucks and pumps	100	106
	Elevated work platforms	100	95
	Cranes	20	98
	Concrete saws and grinders	33	110
	Dump trucks	100	114
	Excavators	33	94
	Scrapers	100	108
	Compactors and rollers	33	102
	Scrapers	100	108
	Backhoe	100	97
	Generators	100	94
	Overall	**-**	**120**
Demobilisation	Road trucks	100	108
	Water trucks	100	113
	Backhoe	100	97
	Compactors and rollers	100	107
	Overall	**-**	**115**
Transmission connection	Excavators	100	99
	Generators	100	94
	Compactors and rollers	100	107
	Dump trucks	100	114
	Backhoe	100	97
	Cranes	100	105
	Concrete saws and grinders	100	115
	Road trucks	100	108
	Overall	**-**	**119**

Construction is scheduled to be undertaken during recommended standard construction hours, with no night-time works scheduled. Noise generating equipment would not be utilised outside of standard construction hours. As such, the impacts of construction activities on sleep disturbance have not been assessed.

4.1.2 Modelling and conditions

Modelling of the proposed construction scenarios was completed using SoundPLAN version 8.2 (industry standard) noise modelling software. Standard weather conditions were applied.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment. The acoustic shielding calculated in the model due to localised fixed building structures would also vary as the construction equipment moves around the Site.

4.1.3 Results

Table 15 presents the number of residential properties where the NMLs are likely to be exceeded during the day. **Table 16** presents the number of non-residential properties where the NMLs are likely to be exceeded.

Table 15 Number of residential buildings where noise levels may exceed NMLs - Day

Phase	Exceedance of NML			Highly affected >75 dB(A)
	1-10 dB	11-20 dB	>20 dB	
Enabling works	0	0	0	0
Civil, structural, mechanical, electrical works and commissioning	0	0	0	0
Demobilisation	0	0	0	0
Transmission connection	0	0	0	0

Table 15 above shows that all construction phases and activities are expected to comply with the noise management levels at the residential receivers during the Project's construction phases during the day. None of the construction phases are expected to result in noise levels which exceed the 'highly noise affected' level of 75 dB(A) for residential receivers.

Table 16 Number of non-residential buildings where noise levels may exceed NMLs

Phase	Exceedance of NML		
	1-10 dB	11-20 dB	> 20 dB
Enabling works	3	0	0
Structural, civil, mechanical, electrical works and commissioning	3	0	0
Finishes and demobilisation	3	0	0
Transmission connection	2	1	0

The activities associated with the construction phases for the Project are expected to comply with the noise management levels at non-residential receivers during the day, with some minor non-residential receiver exceedances noted (refer to in **Table 16**).

Feasible and reasonable mitigation measures would be detailed in the Construction Noise and Vibration Management Plan (refer to **Section 6.0**).

4.2 Construction Vibration

Vibrations may be generated by the equipment proposed to be utilised. The minimum working distances of these items of equipment from off-site receivers are shown in **Table 17**. This is based on recommendations of the TfNSW *Construction Noise and Vibration Strategy* (CNVS) and AECOM's previous project experience. If these minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver. If vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration would be implemented as outlined in **Section 6.0**.

Table 17 Recommended minimum working distances for vibration intensive plant

Plant	Rating/Description	Minimum working distance	
		Cosmetic damage	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	<300 kN (Typically 7-13 tonnes)	15 m	100 m
Piling Rig	≤800 mm	2 m nominal	4 m
Jackhammer	Handheld	1 m nominal	Avoid contact with structure

4.3 Construction Traffic

The construction work would be undertaken in stages and would require several trucks to deliver materials, including concrete to the Project Area, as well as other light vehicles.

To assess the impact of construction traffic it has been assumed that 20 heavy vehicles and 50 light vehicles would visit the Site during a worst-case day.

The traffic flows used to assess the impact on the existing traffic volumes were provided by a Transport for NSW permanent classifier (ID:T0236) located on the Barrier Highway, approximately, 13 km from the Site. The existing traffic volume of the Barrier Highway is approximately 650 during the day and 70 at night.

Based on the existing traffic volumes on the Barrier Highway, the construction traffic to the Project Area is predicted to increase noise levels by less than 1 dB. Therefore, the potential impact would be very minor and would comply with Project acoustic requirements.

Given that the increase in noise levels would be less than 2 dB, in accordance with the RNP, noise mitigation at residential receivers would not be required to mitigate construction traffic noise impacts.

5.0 Operational Noise Assessment

The noise sources from the Project that have the potential to affect nearby receivers include the batteries, inverters and transformers. As operational noise would only be generated from the Site, the Site is the focus of the operational noise assessment.

5.1 Modelled operational scenario

In order to assess a reasonable worst-case operational scenario, it is assumed that all of the proposed equipment within the Site would operate at full capacity, 24 hours a day, seven days a week. Given that the night-time residential project noise trigger levels is the most stringent, the worst-case operational scenario would be assessed against the night-time residential project noise trigger levels. Compliance with the night-time project noise trigger levels would demonstrate compliance during the day and evening periods for all residential receivers.

Operational noise impacts at non-residential receivers were also based on the night-time operational scenario and compared with the relevant noise trigger levels for non-residential receivers.

The operational equipment is generally categorised as steady-state or quasi steady-state noise sources which typically produce continuous and consistent noise levels.

In order to achieve the capacity, it is expected that the electrical equipment would be required in the following numbers:

- 180 lithium-ion (Li-ion) batteries inside battery enclosures
- 11 inverters
- 11 medium voltage transformers up to 22 kV.

The above equipment numbers have been used in the worst-case operational scenario.

5.1.1 Assessment noise source levels

The sound power levels for the electrical equipment were provided by the manufacturer and have been used to model the noise emission from the Site.

The sound power level inputs presented in **Table 18** were used in the noise modelling, and were assumed to be operating continuously for the entire 15 minute period.

Table 18 Plant items sound power levels

Plant item/Operation	Sound power level, L_{Aeq}, dB(A)
Battery and enclosure	71
Inverter	87
Transformer	79

The noise generating equipment and the equipment sound power levels would be confirmed at the detailed design stage of the Project.

5.1.2 Maximum noise levels

In AECOM's experience, L_{Amax} sound power levels of electrical equipment are typically not greater than 5 dB above L_{Aeq} sound power levels. Given that the sleep disturbance criterion is 10 dB less stringent than the project noise trigger level, compliance with the project noise trigger level would result in compliance with the sleep disturbance criteria. Therefore, no further consideration has been given to the sleep disturbance assessment.

5.2 Modelling methodology

5.2.1 General modelling assumptions

Noise levels due to the operational activities at the Site were predicted to nearby noise sensitive receivers using SoundPLAN version 8.2 (industry standard) noise modelling software. The operational noise levels were predicted using an implementation of CONCAWE[1] algorithms in the SoundPLAN noise propagation software. The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

Noting that the closest residential receptors in the vicinity of the Site are at least 1.1 km away, the CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation.

5.2.2 Meteorological conditions

Both standard and noise enhancing meteorological conditions were considered, with the following parameters:

- Standard meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 0.5 m/s at 10 m.
- Noise enhancing meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 3 m/s at 10 m, and/or stability category F with winds up to 2 m/s at 10 m.

The noise modelling includes:

- Ground topography;
- Buildings and structures;
- All sources behave as point, or moving point sources;
- Ground absorption; and
- Representative operational noise sources as required.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

The noise model considers significant noise sources and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions. The noise model was based on ground topography, and indicative plant equipment sound power levels. All predicted noise levels are free field and 1.5 m above ground level at the most-affected point within a residential property boundary within 30 m of the nearest facade.

5.3 Operational noise assessment results

The predicted noise levels at each of the assessment locations during a reasonable worst-case operational night-time scenarios are presented in **Table 19**.

Standard and noise enhancing meteorological conditions were assessed.

1 CONCAWE – The oil companies' international study group for conservation of clean air and water – Europe (established in 1963) Report 4/81 "The propagation of noise from petroleum and petrochemical complexes to neighbouring communities".

Table 19 Predicted operational noise levels

Receiver	Project noise trigger levels, $L_{Aeq,15minute}$, dB(A)	Predicted noise level, $L_{Aeq,15minute}$, dB(A)			Compliance	
		Standard met conditions	Noise enhancing met conditions[1]	Temperature Inversion	Exceedance	Yes/ No
R1	35	15	18	18	-	Yes
R2	35	21	24	24	-	Yes
R3	35	16	19	19	-	Yes
R4	35	20	23	23	-	Yes
R5	35	19	22	22	-	Yes
R6	35	14	17	17	-	Yes
R7	35	26	29	29	-	Yes
R8	35	28	30	30	-	Yes
E1	58	12	15	15	-	Yes
E2	58	13	16	16	-	Yes
C1	63	13	15	15	-	Yes
C2	63	25	27	27	-	Yes
I1	68	58	59	59	-	Yes
I2	68	54	55	55	-	Yes
IR1	68	38	40	40	-	Yes
A1	53	13	15	15	-	Yes

Notes:

1. Adverse weather considers the worst case of 3 m/s source to receiver wind and temperature inversions.

The predicted operational noise levels in **Table 19** indicate that under standard and noise enhancing meteorological conditions, the operation of the Site, complies with the day, evening and night-time project noise trigger levels at all of the assessment locations.

5.4 Operational road traffic noise assessment

It has been advised that up to three light vehicles would visit the Site during a typical-case day. It is understood that heavy vehicles are not anticipated to regularly access the Site during operation.

The traffic flows used to assess the impact on the existing traffic volumes were provided by a Transport for NSW permanent classifier (ID:T0236) located on the Barrier Highway, approximately, 13 km from the Site.

The existing traffic volume of the Barrier Highway is approximately 650 vehicles during the day and 70 vehicles at night.

Based on the background traffic volumes on the Barrier Highway, the operational traffic to the Site is predicted to increase noise levels by less than 0.1 dB. Therefore, the potential impact would be very minor and would comply with Project acoustic requirements.

6.0 Construction Noise and Vibration Mitigation

The Project is expected to comply with the relevant NMLs for residential receivers during construction and operation.

Although the NMLs are only likely to be marginally exceeded at non-residential receivers, reasonable and feasible noise mitigation measures and work practices would be implemented. Where receivers are predicted to be 'noise affected' the ICNG states that all feasible and reasonable works practices should be applied to meet the NMLs. It is recommended that a Construction Noise and Vibration Management Plan (CNVMP) as part of the Construction Environmental Management Plan be prepared by the contractor prior to commencing construction activities at the Site.

Details of noise and vibration mitigation measures and management practices which would be considered in the CNVMP are detailed below.

The CNVMP should include the following:

- Identification of nearby residences and other sensitive land uses;
- Description of approved construction hours;
- Description and identification of all construction activities, including work areas, equipment and duration;
- Description of what work practices (generic and specific) would be applied to minimise noise and vibration;
- A complaint handling process; and
- Overview of community consultation required for identified high impact works.

Noise and vibration mitigation measures which would be considered in the CNVMP are detailed below in **Table 20**.

Table 20 Recommended noise mitigation measures

Action required	Safeguard details	Timing
Implement community consultation measures	Periodic notification (monthly letterbox drop or equivalent), website, Project Infoline, AGL Community Complaints and Enquiries Hotline, email distribution list and community and stakeholder meetings, as required.	Construction
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction.	Construction
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on Site. No dropping of materials from height, throwing of metal items and slamming of doors.	Construction
Attended vibration measurements	Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed approximately a metre from the building footprint, to warn operators (via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.	Construction
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours.	Construction

Action required	Safeguard details	Timing
Equipment selection and maintenance	Use quieter and less vibration emitting construction methods where feasible and reasonable. Equipment would be regularly inspected and maintained to ensure it is in good working order.	Construction
Maximum noise levels	The noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels.	Construction
Rental plant and equipment	Noise emissions should be considered as part of the selection process.	Construction
Use and siting of plant	• Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. • The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. • Plant used intermittently to be throttled down or shut down. • Plant and vehicles to be turned off when not in use. • Noise-emitting plant to be directed away from sensitive receivers.	Construction
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used within the Project Area and for any out of hours work.	Construction
Minimise disturbance arising from delivery of goods to construction sites	• Loading and unloading of materials/deliveries to occur as far as possible from sensitive receivers. • Select Site access points and roads as far as possible away from sensitive receivers, where possible. • Dedicated loading/unloading areas to be shielded if close to sensitive receivers. • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.	Construction
Construction related traffic	• Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. • Limit the speed of vehicles and avoid the use of engine compression brakes. • Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.	Construction
Alternative methods	All equipment should be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts.	Construction

Action required	Safeguard details	Timing
Site specific minimum working distances	Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed around one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.	Construction

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology that may have been used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period
L_{min}	The minimum sound pressure level measured over the measurement period
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.

L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's Noise Policy for Industry and the EPA's NSW Road Noise Policy.