EIS Volume 1 Chapter 15

Noise and Vibration

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15. Noise and Vibration

This chapter describes how the construction and operation of the Project will generate noise within the study area defined for assessment of noise impacts, and provides an assessment of the likely effect on residents and visitors within the noise study area. It is based on the outcomes of the specialist Noise Impact Assessment, attached in Appendix J.

The potential for noise disturbance to fauna is discussed further in Chapter 11 Flora and Fauna.

15.1. Key Findings

- Background noise levels in the Project vicinity are typical of a rural environment. The majority of the proposed transmission alignment is remote from residential receptors and is located well away from town centres such as Morgan, Cadell and Renmark. There are sensitive receptors located predominantly at the eastern end of the alignment in Cooltong, with other receptors being made up of scattered rural homesteads.
- There will be a minor short-term impact on the amenity of up to 21 receptors due to noise disturbance during land clearing and tower installation with the potential for a moderate short-term impact on up to two receptors during the construction phase.
- Helicopters may be used to assist with pre-assembled tower transport during the construction phase. Noise impacts from the use of helicopters during construction would have a very short-term minor impact on the amenity of up to 141 receptors, primarily in the Cooltong area.
- Fauna of conservation significance occur along the alignment, particularly in the eastern section. Noise impacts from construction activities, including the use of helicopters, are unlikely to cause temporary or permanent hearing damage to fauna.
- Laydown areas and construction camps will be established along the route. As these would be established in locations way from receptors (unless otherwise agreed with landholders), noise from activities at these sites is not expected to adversely affect the amenity of residential receptors.
- The noise impact on residents along transport routes from haulage of material to and from construction sites is expected to be minor and short term.
- Noise from the use of helicopters in line inspections during operation is expected to have a negligible transient impact on residential receptors or fauna.
- The operation of the Bundey substation is not expected to affect the amenity of residential receptors.
- Corona discharge events during operation of the transmission line are not expected to create noise impacts that could affect residential receptors or fauna.
- Vibration from the construction process is unlikely to present impacts on sensitive receptors given the separation distance from the proposed transmission line.

15.2. Setting the Context

This section provides information needed to explain the context within which impact assessment is undertaken. It describes:

- the relevant EIS Guidelines
- relevant requirements in legislation and other standards

- views of stakeholders and the environmental and social outcomes they would like the Project to meet
- the assessment methodology used to identify baseline environmental values and to undertake the impact assessment.

15.2.1. EIS Guidelines

The EIS Guidelines require an assessment of the likely impact of noise during construction and maintenance (including from any proposed construction camps) and measures for controlling these impacts as set out in Table 15-1.

Table 15-1: EIS Guidelines addressed in the Noise and Vibration chapter

EIS Guidelines and Assessment Requirements	Assessment level
Land Use and Economic Effects *Assessment Requirement 2*: The proposal will have an impact on the State's economy during construction and operation and may result in immediate and long term effects on land owners and surrounding uses	
• 2.6 Outline any mitigation measures to alleviate or avoid impacts on landowners and land uses and refer to any compensation programmes.	Critical
Effects on communities *Assessment Requirement 9*: The proposed development has the potential to affect that local community during construction and through the establishment of a large linear structure.	
• 9.5: Address any potential effects of electromagnetic fields, corona discharge and electric shocks on public health	Medium
Traffic Effects *Assessment Requirement 14:* The proposal requires access for the transportation of infrastructure and construction material to site and ongoing access for maintenance purposes.	
• 14.4: Identify any potential effects of construction traffic on communities including noise and dust	Standard
Construction, Operation and Maintenance Effects *Assessment Requirement 15:* The construction and operation of the proposal would require a range of impacts to be minimised, mitigated and monitored through an environmental management plan framework	
• 15.3: Describe the likely impact and measures for the control of dust, vibration, noise, emissions, drag out (i.e. onto public roads) and litter during both construction and maintenance	Standard
• 15.9: Outline the approximate size of the construction workforce including any need for any construction workers camps or accommodation. Describe the location and management of accommodation camps including sources of water and power, and the management of waste, wastewater and noise impacts.	Standard
• 15.11: Describe the location(s) where mobile concrete batching plants would be used and the management of wastewater, dust emissions and noise from such plant.	Standard
Specialist Reports and Details A **noise assessment** prepared by a suitably experienced, professional acoustic engineering consultant to moderate external and environmental noise disturbance and amenity impacts for residents and other sensitive uses within the immediate area as a result of the proposed development (primarily during construction).	

Aspects of assessment requirements identified in Table 15-1 above which are not addressed in this chapter are listed in Table 15-2 together with the applicable chapter.

Table 15-2: Aspects of assessment requirements addressed in other chapters

Assessment Requirement	Chapter
2.6 Summary of mitigation measures	Chapter 9 Land Use and Tenure

Assessment Requirement	Chapter
2.6 Mitigation measures for air quality impacts to landowners	Chapter 14 Air Quality
2.6 Mitigation measures for traffic impacts to landowners	Chapter 16 Traffic and Transport
9.5 Potential effects of magnetic fields and electric shocks on public health	Chapter 18 Hazards and Risk Management
14.4 Potential effects of dust from construction traffic	Chapter 14 Air Quality
14.4 Potential effects of construction traffic on communities	Chapter 16 Traffic and Transport
15.3 Likely impacts and measures for control of dust and emissions	Chapter 14 Air Quality
15.3 Impact and measures for control of drag-out	Chapter 16 Traffic and Transport
15.3 Likely impacts and measures for control of litter	Chapter 19 Waste Management
15.9 Construction workforce and location and management of accommodation camps	Chapter 7 Project Description
15.9 Management of soil, waste, wastewater from construction camps	Chapter 10 Physical Environment
15.9 Size of the construction workforce and any need for any construction workers camps and accommodation	Chapter 17 Socio-Economic Environment
15.9 Management of waste and wastewater	Chapter 19 Waste Management
15.11 Location of concrete batching plants	Chapter 7 Project Description
15.11 Management of wastewater from concrete batching plants	Chapter 10 Physical Environment
15.11 Management of dust emissions from concrete batching plants	Chapter 14 Air Quality

15.2.2. Requirements in legislation and other standards

The *Environment Protection Act 1993* (EP Act) creates a general environmental duty to take all reasonable and practical steps to prevent or minimise any resulting environmental harm. This requirement includes noise. Noise is defined as unwanted sound.

As explained in the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* (EPA SA 2009) (Noise EPP Guidelines), noise is commonly defined as unwanted sound. Sound is produced by small fluctuations in air pressure. The loudness of a sound is predominantly related to the size of the fluctuations, but is also related to their frequency i.e. the rate at which they are produced.

The loudness of sounds ranges from those which the human ear can just detect (the threshold of hearing) to those that exceed a threshold of pain. As sound is produced by changes in air pressure, the international standard unit of sound pressure is a pressure measurement, the micropascal (µPa).

The range between the faintest audible sound and the loudest sound the human ear can stand is so large when expressed in these units that measurement of sound pressure is expressed on a logarithmic scale[1], the unit of which is the more commonly known decibel (dB).

The frequency of a sound is the rate at which the fluctuations are produced per second. Practically all sounds contain a mixture of frequencies and the mix of frequencies affects the perceived loudness. A high-frequency sound (e.g. screeching or whistling) at the same acoustic pressure as a low-frequency sound (e.g. thunder) will be perceived to be louder. This is because the human ear is most sensitive to mid-range and high frequencies and is less sensitive to the lower frequencies.

To ensure measured levels approximate the human response, a weighting scale is used. It is known as the 'A' scale and the units are referred to as 'A' weighted decibels and written as dB(A). The dB(A) scale

[1] The logarithmic scale is different to a linear scale – a doubling of the sound pressure, say from 20 µPa to 40 µPa, produces an increase of 6 dB. In subjective terms, a 3 dB increase is often described as a just noticeable difference.

discriminates between sounds in much the same way as people do. References in this chapter are to dB(A) unless noted otherwise.

Some examples of typical sound levels in dB(A) are shown in Figure 15-1.

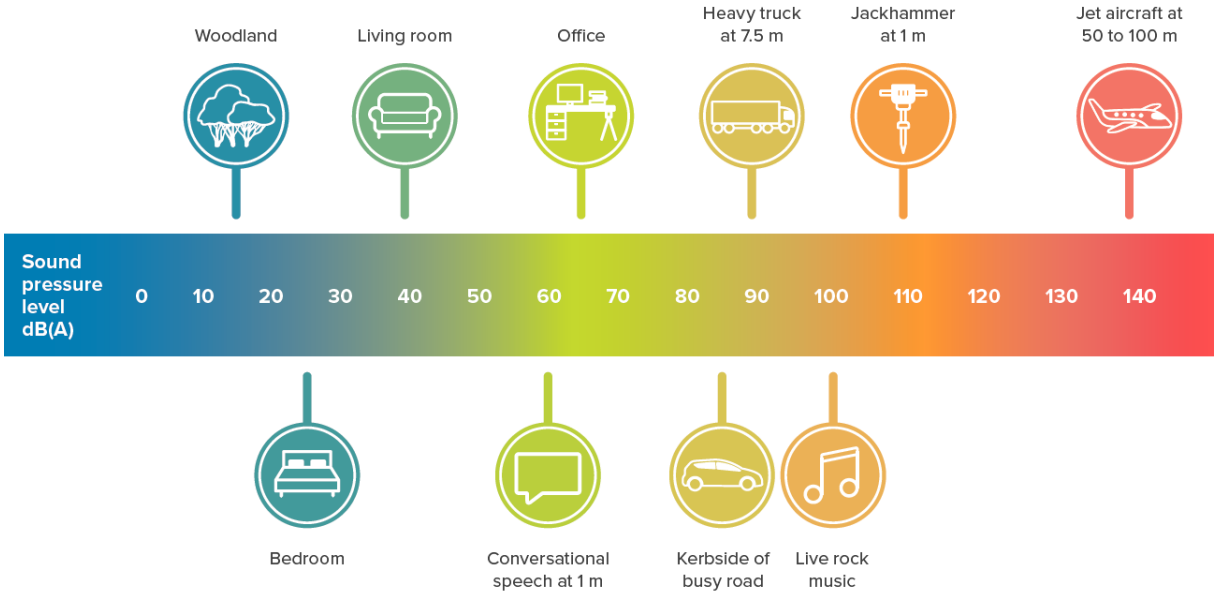


Figure 15-1: Examples of sounds on the dB(A) scale

Construction Noise

The environmental noise impact assessment was completed in general accordance with the *Environment Protection (Noise) Policy 2007* (Noise EPP), which is also the most relevant guideline to address the requirements of the overarching EP Act.

The construction, demolition and related activities noise criteria are outlined in Division 1 of the Noise EPP. This division does not apply to construction activity related to public infrastructure and, consequently, does not apply to the Project. However, it has been used as a guide to establishing appropriate criteria.

Division 1 states that a construction activity resulting in noise with an adverse impact on amenity must not occur on a Sunday or other public holiday and must not occur on any other day except between 7 am and 7 pm. Exceptions are recognised when undertaking activities at a site has the potential to cause unreasonable interruption of vehicle or pedestrian traffic movements, or if other grounds exist that are determined to be sufficient by an authority or administering agency.

Construction noise that has an adverse impact on amenity is defined as that which results in a noise level greater than 45 dB(A) L_{eq} (continuous noise level) or 60 dB(A) L_{max} (maximum noise level) at a noise affected premises such as a residence.

Conversely, in instances where background noise levels exceed 45 dB(A) L_{eq} or 60 dB(A) L_{max}, then construction noise is not considered an adverse impact until the background noise level is exceeded by the construction noise level (either by continuous noise level or maximum noise level or by frequency of occurrence). These guidelines are summarised below in Table 15-3.

These provisions allow for the fact that construction work is inherently noisy and often there is limited recourse for mitigation. However, given the temporary nature of construction works, it is considered acceptable, in certain situations, to exceed the Noise EPP assuming works continue to be undertaken

within reasonable hours of the work day and all reasonable and practical measures are implemented to mitigate noise impacts.

It is also noted that the Noise EPP excludes aircraft noise. For the purposes of this assessment, the potential use of helicopters during construction is considered a construction activity under Part 6, Division 1 of the Noise EPP. This is due to the absence of helicopter noise guidelines in South Australia.

Operational noise

Similar to the construction noise, the Noise EPP is the most relevant guideline to address the requirements under the EP Act for Project operational noise.

The Noise EPP identifies indicative noise levels that are based on zoning of proposed developments and the closest noise impacted premises in the relevant planning instrument. For example, where the land use category is Rural Living, the daytime (7 am – 10 pm) indicative noise level is 47 dB(A) and the night time (10 pm – 7 am) indicative noise level is 40 dB(A). In residential areas, this is marginally increased to 52 dB(A) during the day and 45 dB(A) at night.

As the Project and the sensitive receptors are located in several different land use zones along the alignment the operational noise criteria will vary. The applicable levels are summarised in Table 15-3 below.

Under Part 5, Clause 20(6) of the Noise EPP, exceedance of the recommended criteria does not necessarily mean that the works are non-compliant. Other factors, such as the amount by which the criterion is exceeded or the frequency and duration or exceedance, are to be considered when determining compliance.

Fauna noise

In the absence of current government or other widely accepted guidelines for the specific hearing sensitivity of native fauna native, interim guidelines for potential effects from different noise sources for the average bird have been adopted from Dooling and Popper (2007).

A threshold shift is defined as a shift in the auditory threshold that may occur suddenly after exposure to a high level of noise. A 'permanent threshold shift' persists after a recovery period subsequent to exposure. It results in a permanent loss of hearing in fauna and impairs their ability to detect predators and communicate with other fauna. A 'temporary threshold shift' results in temporary hearing loss.

For the purposes of this assessment, it is considered reasonable that noise due to construction and operations does not cause any form of threshold shift in fauna. Based on Dooling and Popper (2007), the key criterion that should apply to the Project is 93 dB(A) for non-strike continuous noise at the expected location of noise sensitive fauna receivers.

Table 15-3: Summary of adopted noise guidelines

EPA SA Guidelines related to noise during construction		
Continuous noise level observed at a noise affected location, such as a residence	45 dB(A) Leq	
Maximum noise level observed at a noise affected location, such as a residence	60 dB(A) Lmax	
Where background noise levels exceed 45 dB(A) Leq or 60 dB(A) Lmax then construction noise is not considered an adverse impact until the background noise level is exceeded by construction noise (either by continuous noise level or maximum noise level or by frequency of occurrence).		
EPA SA Guidelines related to noise during operations		
Land Use (in the vicinity of the Project)	**Indicative noise factor dB(A)**	
	Day (7 am to 10 pm)	**Night (10 pm to 7 am)**
Rural industry	57	50
Light industry	57	50
Adopted EIS Guidelines related to noise impacting fauna		

EPA SA Guidelines related to noise during construction	
Non-strike continuous noise at the expected location of noise sensitive fauna receivers for temporary threshold shift (TTS)	93 dB(A) L_{eq}

15.2.3. Views of stakeholders

ElectraNet have undertaken a thorough stakeholder engagement program which has included engagement with all affected landholders and known social receptors in close proximity to the transmission line corridor. Noise has not been raised as a specific stakeholder concern to date.

15.2.4. Assessment method

The noise study area for the Project is defined as the zone within which noise might have an impact on the amenity of the environment (Figure 15-2). Collectively, the noise assessment study area includes the following:

- the entirety of the proposed transmission line alignment, comprising a length of approximately 200 km between the existing Robertstown substation, and the SA / NSW border approximately 38 km northeast of Cooltong
- the transmission line corridor is defined as a 500 m buffer around the transmission line, comprising a 1 km corridor
- an extra 2.7 km buffer around the transmission line corridor to assess the extended noise impact
- a 1 km x 1 km clearance around the proposed Bundey substation site.

Baseline noise monitoring was undertaken at locations representative of the ambient noise environment at the nearest sensitive receptors and surrounding area (Figure 15-2). Attended noise measurements were undertaken at the three locations to acquire daytime noise levels. Unattended noise measurements were undertaken over a 10-day period with noise levels averaged over the daytime and night-time periods. Equipment used for monitoring was classified as Class 1 or Class 2 measurement devices in accordance with Australian Standards AS IEC 61672.1-2004 (Plate 15-1). Devices were calibrated in accordance with manufacturer specifications. Details of the monitoring procedure are provided in the Environmental Noise Impact Assessment (Resonate 2021) (refer Appendix J).

Noise monitoring included continuous unattended noise measurements from 3 – 12 April 2019 and attended noise measurements (during daytime) on 3 April 2019.

Plate 15-1: Noise logger installation

Following completion of baseline monitoring, an assessment was undertaken of likely sources of noise and noise receptors during construction and operation.

Noise emissions were modelled in the SoundPLAN Environmental Software v8.0 program using the CONCAWE method. This software is widely used around the world and regarded as the leading software in developing noise propagation models. In accordance with the Noise EPP Guidelines CONCAWE weather category 5 was used for daytime noise emissions.

The noise levels of the relevant construction equipment were obtained from the *Noise database for prediction of noise on construction and open sites* (DEFRA, UK 2005). These are shown in Table 15-4.

Table 15-4: Sound power levels of expected construction equipment for the Project

Stage	Plant, equipment or activity	L_w total, dB(A)
1: Land clearing (substation and towers)	Bulldozer	103
	Grader	114
	Front end loader	104
Total	All	115
2: Tower installation (substation and towers)	Excavator	106
	Concrete truck	108
	Mobile concrete batching plant	110
	Semi-trailer	111
	Mobile crane	104
Total	All	115
3: Line stringing / tower installation[1] (towers only)	Helicopter[2]	127

[1] Helicopters could be used to deliver and erect the towers in some cases, but have been included separately to the land based construction as they are unlikely to occur concurrently.

[2] Different types of helicopters would be used for line stringing (Eurocopter AS350 Squirrel or similar) and tower installation (Kamov Ka-32A11BC or similar). The noise level presented is representative of the helicopter sound power level for both cases and is considered conservative.

The noise generated from Corona discharge was modelled as a line source along the transmission line corridor and was calculated at the western and eastern ends of the Project where the nearest receptors are located. At the nearest inhabited receptor, the predicted noise level is 44 dB(A) which complies with the most stringent night-time criteria.

The impact assessment considers the impacts that are expected to occur as part of the construction and operation of the proposed transmission line and substation. The method of assessment has followed that set out in Chapter 8 Impact Assessment Methodology.

Where there was uncertainty in the assessment of expected impacts, this was evaluated using risk assessment tools, as discussed in Chapter 8 Impact Assessment Methodology. This is discussed under each impact event where relevant. The level of certainty in the assessment of noise impacts was generally high, and consequently uncertainty is only discussed for a small number of impact events (e.g. construction activity noise and traffic noise). A summary of the evaluation of uncertainty for all impact events is contained in Appendix O.

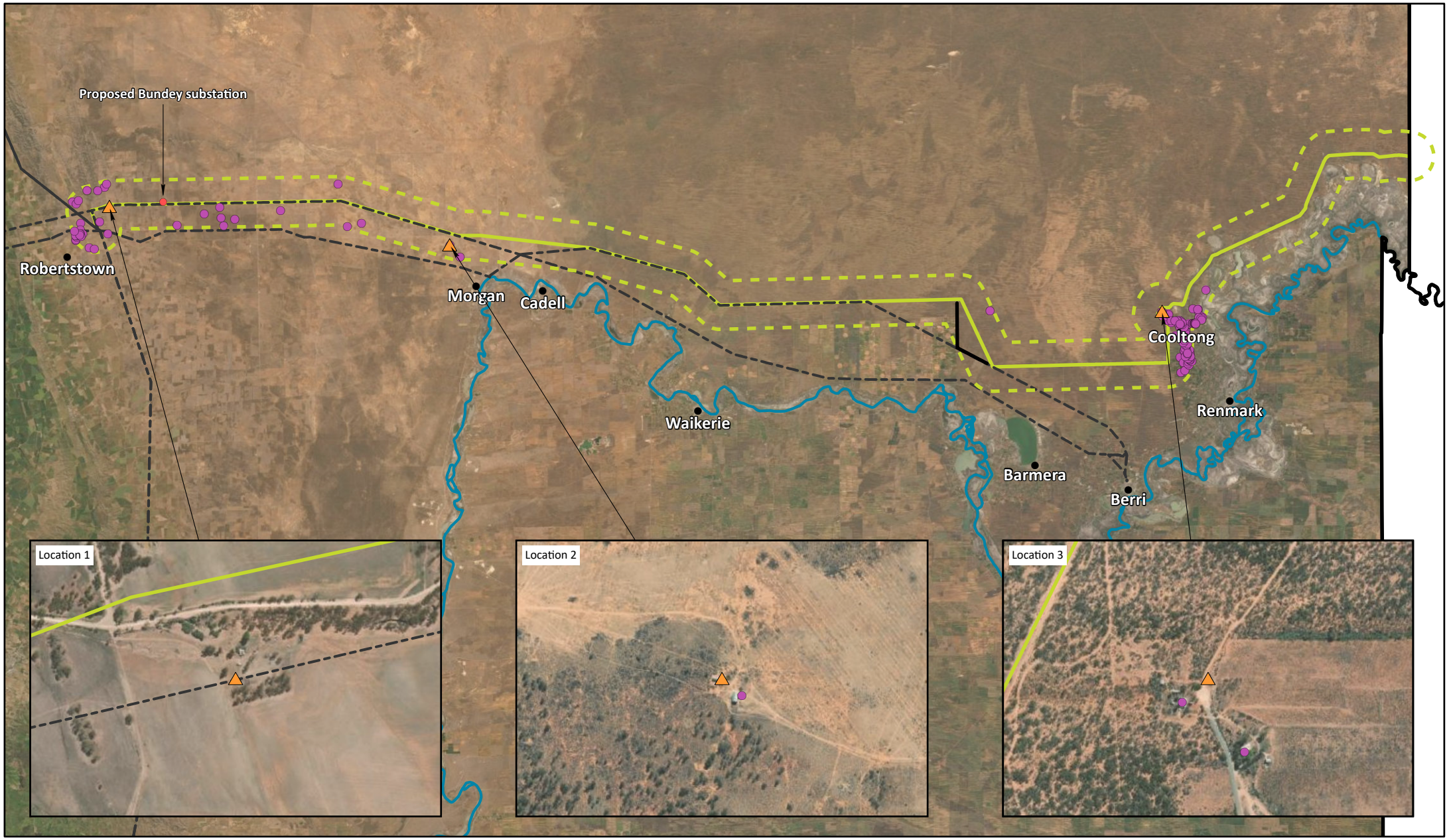


Figure 15-2
Location of background noise loggers

15.3. Description of Existing Environment

15.3.1. Sensitive noise receptors

A total of 141 verified noise sensitive receptors have been identified within the noise study area of which the majority are verified as residences.

To assess the extended noise impacts, the noise study area encompassed the transmission line corridor (500 m buffer around the transmission line) and an additional 2.7 km buffer. This was based on the area that could potentially be noise-affected. The Environmental Noise Impact Assessment (Resonate 2021) considered all properties as noise sensitive as a precautionary measure, unless a field inspection was able to confirm they were uninhabitable buildings. Consequently, it is likely that the assessment over-estimates the number of noise sensitive receptors.

The highest concentrations of receptors are located at the western end of the proposed transmission line alignment between Robertstown and Morgan, and at the eastern end at Cooltong (refer Figure 15-2). The nearest potential noise sensitive receptor is located approximately 330 m from the transmission line alignment. It is noted that the majority of the identified potential receptors are further than 1 km from the transmission line.

Fauna have also been considered as a potential sensitive receptor. The potential impact of noise on fauna has been described as including physiological and behavioural responses, permanent and temporary damage to hearing organs, interference with breeding, and the masking of vital communication. The desktop assessment of nationally threatened species[2] initially highlighted 15 nationally threatened fauna species (11 birds, one frog, one mammal, two reptiles) and one threatened fauna population as potentially occurring in the vicinity of the Project. A likelihood of occurrence assessment for EPBC Act listed species that may actually occur determined that of the 15 species indicated, three are present (Malleefowl, Black-eared Miner, Red-lored Whistler) and one is likely (Regent Parrot). Of the remaining species, seven are considered possible and four are considered unlikely to occur in the vicinity of the Project (refer Chapter 11 Flora and Fauna for further information).

15.3.2. Background noise environment

Baseline noise monitoring was conducted at three locations along the study area, between 3 April 2019 and 12 April 2019. The locations were selected as being representative of the ambient noise environment at the nearest noise sensitive receptor locations and surrounding areas. These locations are identified in Figure 15-2.

Where high wind speeds were determined to have an effect on background noise levels, those levels were excluded.

The results of the attended baseline monitoring are summarised in Table 15-5 below.

Table 15-5: Attended baseline noise measurement results

Location	Date and Time	Measured Noise Level, dB(A)		
		L_{max}	L_{eq}	L_{90}
1	3 April 2019 – 9.40 am	56	32	26
2	3 April 2019 – 11.07 am	57	29	21
3	3 April 2019 – 2.43 pm	52	31	23

[2] Desktop assessment comprised a review of the EPBC Act Protected Matters Search Tool using a 5 km buffer)

Unattended monitoring was also undertaken between the 3 April and 12 April 2019. The average results of this monitoring event are shown in Table 15-6 below.

Table 15-6: Unattended baseline noise monitoring summary

Location	Time	Measured Noise Level, dB(A) – Average		
		L_{max}	L_{eq}	L_{90}
1	Day	76	34	26
	Night	58	28	26
2	Day	69	30	19
	Night	60	22	15
3	Day	75	34	22
	Night	57	20	17

Background noise levels are typical of a rural environment. Noise levels are below the construction and operational criteria for continuous noise levels in the Noise EPP.

15.4. Impact Assessment

The following aspects of the Project have been identified as sources of noise impacts:

- excavation equipment and general construction noise during land clearing and during the installation of the towers and substation
- use of vehicles, generators and other equipment at construction camps and laydown areas
- mobile concrete batching plant
- haulage to and from the transmission line corridor
- construction of the Bundey substation
- potential use of a helicopter during construction of towers (tower transport and stringing)
- potential use of a helicopter during maintenance of the transmission line (operation)
- operation of the substation
- corona discharge during operation of the transmission line.

The potential impact events resulting from these aspects of the Project are discussed below.

15.4.1. Construction noise

Construction noise during land clearing and towers / substation installation

There will be a minor short-term impact on the amenity of up to 17 receptors due to noise disturbance during land clearing and tower installation with the potential for a moderate short-term impact on up to two receptors.

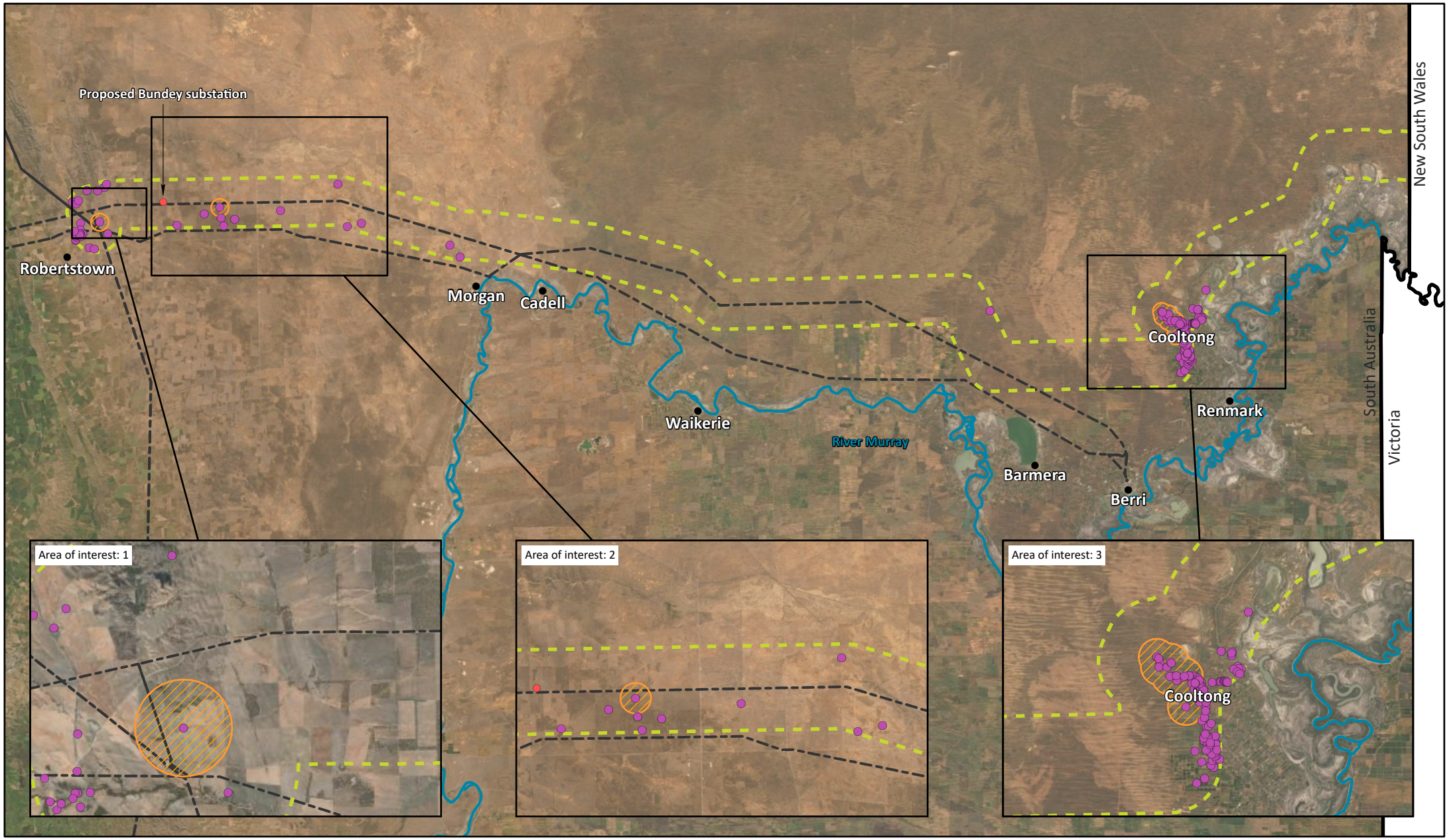
Project activities will generate short term and transient noise emission effects from surface plant and mobile fleet during construction. Construction noise is not considered to have an adverse impact on the amenity of residential receptors unless it exceeds a continuous level of 45 dB(A). Modelling of the noise levels associated with land clearing and construction activities in the Environmental Noise Impact Assessment concludes this level will be achieved at a distance of 1,160 m or greater from the proposed works (refer Appendix J).

Table 15-7 shows a breakdown on the number of receptors within each noise level contour band.

Figure 15-3 shows the area around affected residential receptors within which construction activities would cause an exceedance of 45 dB(A) at that receptor.

Table 15-7: Construction noise levels at nearest receptors

Construction stage	Noise level range (dB(A))	Distance range from proposed alignment (m)	Number of receptors affected
Stages 1 and 2 Land clearing and tower installation	45 – 50	650 – 1,160	9
	50 – 55	330 – 650	7
	55 – 60	160 – 330	1
	60 – 65	90 – 160	0
	> 65	0 – 90	0
		Total noise-affected receptors	**17**



Noise study area (6.4 km)
45 dB(A) exceedance zone - Construction activities
Existing ElectraNet transmission line
River Murray
Social receptor location
Proposed Bundey substation

Figure 15-3
Zones where ground construction activities may affect the amenity of residential receptors

0 20
Kilometres

N

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The noise level of conversational speech can vary from around 50 dB(A) – within a quiet home environment – to 60 dB(A) – within an office or restaurant environment. Noise levels above 60 dB(A) can disrupt day to day life as they can interfere with conversation or listening to the television or radio. Note, however, that an external single event noise will be attenuated by approximately 10 dB(A) by the fabric of a house with open windows (DoTaRS 2000).

Modelling indicates that:

- up to 17 receptors could be adversely affected by noise from ground construction activities
- up to eight receptors could experience noise levels above 50 dB(A) – five of those receptors are in Cooltong
- no receptors will experience noise levels above 65 dB(A).

In summary:

- no receptors will experience noise levels during ground construction activities that will affect conversation or television viewing within a house
- possibly one receptor may experience noise levels that may be regarded as an annoyance for the construction period.

These results represent a worst-case scenario. Modelling used industry-leading software with conservative assumptions. The model assumed weather conditions that were conducive to higher noise exposure at sensitive receptors (e.g. wind blowing from construction site to receptors) and represented 'worst-case' day-time conditions. It also assumed flat topography with no barriers. In reality, such wind conditions are unlikely to occur throughout the whole construction period at each site.

It should be noted that construction would typically occur in a linear manner along the proposed alignment, likely from the SA / NSW border in a westerly direction towards Robertstown, subject to access, weather conditions etc. This means construction activities at each transmission line structure location would be intermittent. It is anticipated that construction activities would progress between 8 to 12 km per month. Potential noise impacts associated with construction may thus be considered as short-term. The modelling assumed the construction period at each tower was one week. This period is unlikely to change significantly (any extension is likely to be a matter of days, rather than weeks).

The implementation of controls will further minimise the impact on affected residential receptors. Control measures to be included in the CEMP are well established and considered standard practice. These include:

- effective stakeholder communication
- planning of noisier construction works taking account of distance to receptor
- locating noisy plant, access roads and site compounds as far as practicable from receptors
- selecting processes and equipment that generate lower noise and vibration levels
- maintaining equipment and installing mufflers and silencers that meet the manufacturer's specifications where relevant
- shutting or throttling down equipment that is used intermittently when it is not in use

A full list of measures is provided in the draft CEMP in Volume 3 Appendix P.

Stakeholder communication with sensitive residential receptors will allow for early notification to those impacted parties and input to be received before works begin. This may allow works to be scheduled in a way that minimises the nuisance to receptors.

Further stakeholder engagement will also ensure that any complaints regarding noise will be quickly brought to ElectraNet's attention so that they can be investigated and noise control measures upgraded if necessary.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Low**.

Vibration as a result of construction of towers / substation

Vibration from construction equipment and activities is not expected to impact on the amenity of nearby receptors.

Potential sources of vibration during construction of the Project will include equipment such as rollers, hydraulic hammers, pilling rigs or jackhammers. The vibration produced by the construction works will be highly dependent on the particular construction processes and equipment that is employed and also on the local geotechnical conditions encountered once construction commences. However, vibration from construction equipment has a limited distance before becoming imperceptible.

Excavations for tower foundations and footings are typically dug using drill rigs. This activity may generate vibrations but these will be infrequent, short term, localised and small-scale. The transient nature of construction activities will also move vibration emissions from drilling, being transient rather than a constant fixed-point location.

The potential for vibration impacts at sensitive receivers will be minimised through refinement of the construction methodology, such as the selection of alternative equipment if works need to occur within close proximity of receivers. As the separation distance between construction works and sensitive receivers is over 100 m and the attenuation of vibration from construction equipment occurs over short distances, it is considered that construction vibration levels will not impact on sensitive receivers.

There are no sources of vibration from the operation of the Project which may result in impacts to sensitive receivers.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Low**.

Use of vehicles, generators and other equipment at construction camps and laydown areas

Noise from temporary construction camps, laydown and staging areas is not expected to adversely affect the amenity of residential receptors.

Temporary worker construction camps, laydown and staging areas will be required along the transmission alignment with final locations determined during the detailed design phase. ElectraNet requires that all temporary worker camps, laydowns and staging areas are sited in areas away from residences and other sensitive social receptors.

These facilities will have multiple noise sources associated with the operation of the temporary camp, workshops, generators, vehicle movements, helicopters landing etc. While the locations have not been finalised, there are sufficient areas available along, or close to the alignment that would be suitable and that are remote from any receptors. Potential noise impacts would be discussed and managed as agreed with the landholder. Consequently, the noise from temporary camps, laydowns and staging areas is not expected to affect the amenity of residential receptors.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Low**.

Haulage and other large vehicle movements

The noise impact associated with haulage and large vehicle movements is expected to be minor and short-term.

The Project will require haulage of material to and from the transmission line corridor. Haulage routes will where practicable, be located as far as possible from residential areas. However, it is possible that some access roads will pass through residential areas on the way to major highways or other large roads better suited to haulage.

Any noise impacts associated with haulage will be short-term given length of the construction period and the transient nature of the construction work as it progresses along the alignment.

Truck movements along uneven surfaces will be restricted to minimum speeds near sensitive receptors. This will be included in the CEMP and will limit the noise impacts associated with travelling at speed on uneven surfaces.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Low**.

Potential use of helicopters during construction of towers and stringing of conductors

Noise from helicopters (if used) during construction would be transient and temporarily impact the amenity of nearby receptors.

The Project may utilise helicopters during construction. A twin engine helicopter (such as a Kamov Ka-32A11BC or similar) may potentially be used to fly pre-assembled towers to tower pads from the laydown / staging areas during the tower assembly process. This technique may be used through ecologically sensitive areas with difficult access, such as Calperum Station, Taylorville Station and Hawks Nest Station.

A single engine helicopter (such as Eurocopter AS350 Squirrel or similar) may be utilised for aerial stringing of conductors along the entire proposed alignment.

The use of helicopters in the vicinity of the nearby residential receptors would be expected to have a localised and temporary impact on the amenity of up to 141 receptors, as shown in Table 15-8. Stringing of the conductor is usually undertaken in sections of 5 – 10 km at a time, allowing approximately 3,000 m a day pulling a draw wire, compared to 500 – 1,000 m a day using a ground stringing method. If used, it is anticipated that helicopters would be working within an area (between each tower) over a 20-day period.

The noise impact on amenity would be temporary and transient however, due to the period the helicopter would be present with an area, the impact is considered as **minor.**

Table 15-8: Noise levels from helicopter at nearest receptors

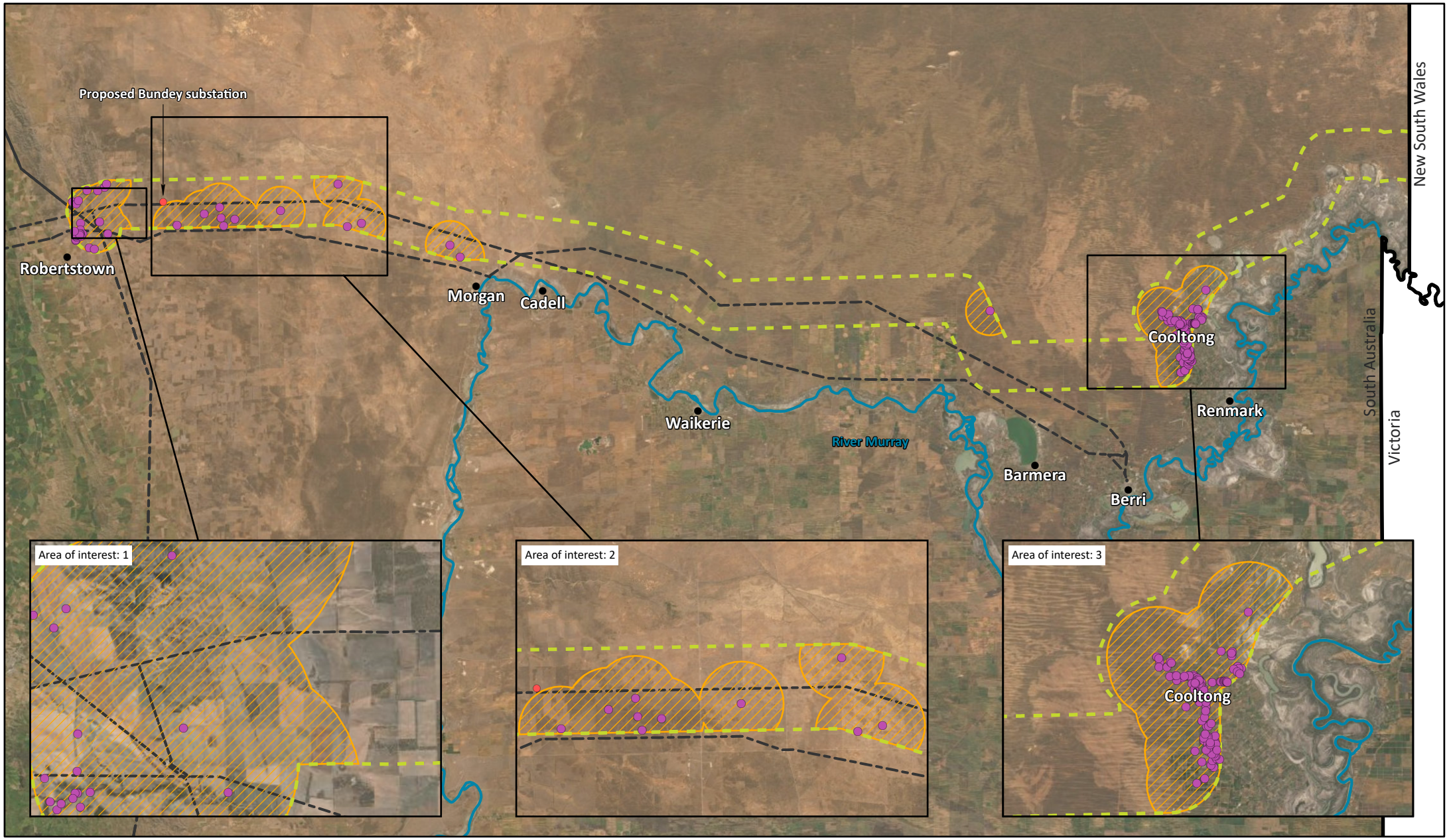
Construction stage	Noise level range (dB(A))	Distance range from proposed alignment (m)	Number of receptors affected
Stage 3 Line stringing / tower installation (towers only)	45 – 50	2,200 – 3,200	77
	50 – 55	1,400 – 2,200	41
	55 – 60	820 – 1,400	11
	60 – 65	450 – 820	9
	> 65	0 – 450	3
		Total noise-affected receptors	**141**

Impacts will be limited to those areas where sensitive receptors are located primarily at Robertstown, between Robertstown and Morgan, and at Cooltong. Tower transport via helicopter would primarily be utilised in Taylorville and Hawks Nest Stations (for access reasons) and will not occur near Cooltong. This represents only a small portion of the entire transmission line alignment. Figure 15-4 shows the area around affected residential receptors within which helicopter activities would cause an exceedance of 45 dB(A) at that receptor.

The implementation of controls will minimise amenity impacts on identified sensitive residential receptors. The following control measures will be included in the CEMP:

- effective stakeholder communication with sensitive residential receptors
- consideration of nearest receptor during planning / timing of construction works
- maintain planned works in daytime hours to minimise disruption to amenity.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Medium**.



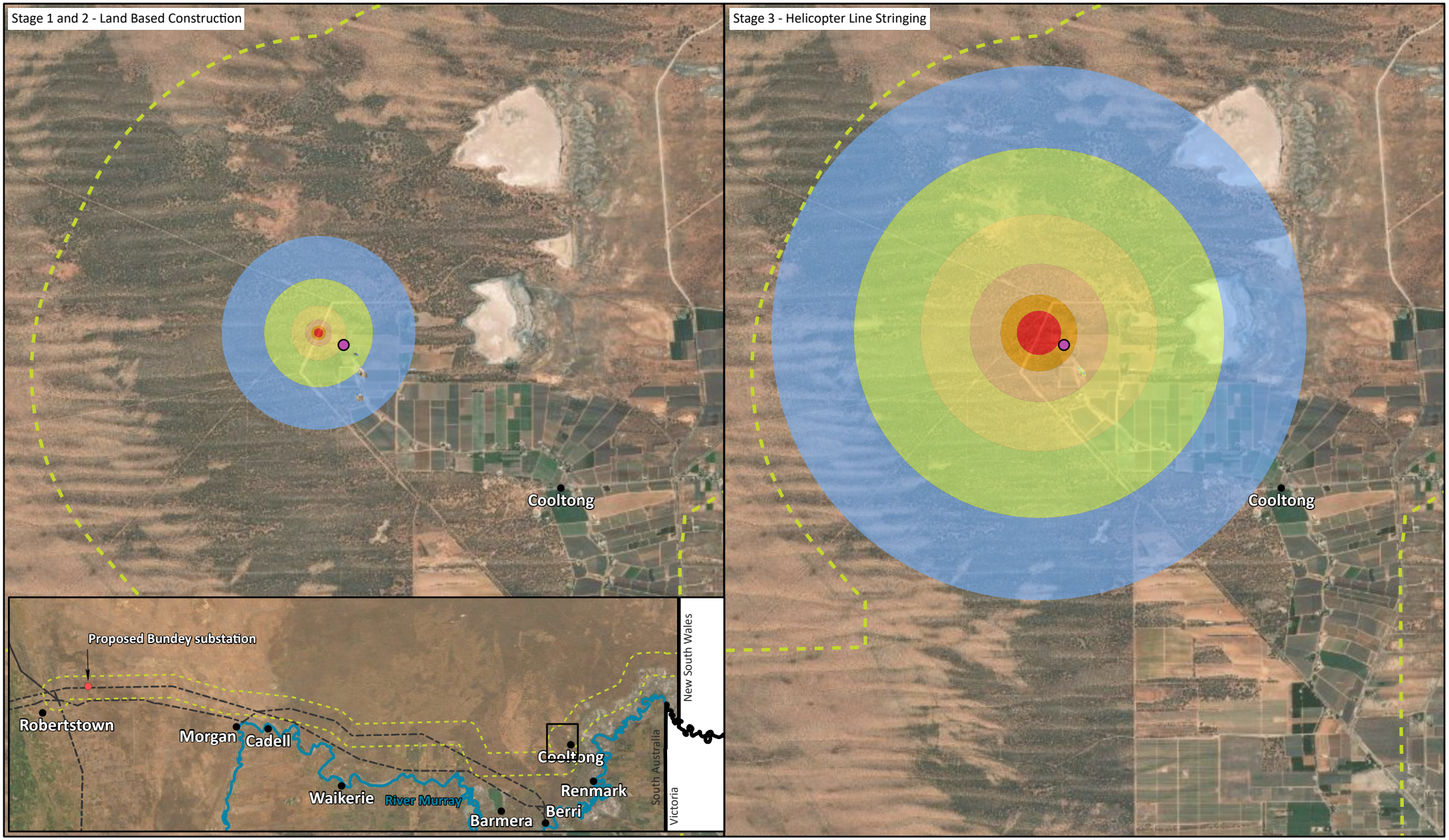
Noise study area (6.4 km)
45 dB(A) exceedance zone - Helicopter activities
Existing ElectraNet transmission line
River Murray
Social receptor location
Proposed Bundey substation

Figure 15-4
Zones where helicopter activities may affect the amenity of residential receptors

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G



Predicted noise levels (CONCAWE Cat 5)

- 45 - 50 dB(A)
- 50 - 55 dB(A)
- 55 - 60 dB(A)
- 60 - 65 dB(A)
- 65 - 70 dB(A)
- > 70 dB(A)

- Noise study area (6.4 km)
- Existing ElectraNet transmission line
- Nearest identified receptor
- Proposed Bundey substation

Figure 15-5
Noise contours for all stages of a single tower installation (includes helicopter stringing)

0 2
Kilometres

N

ElectraNet
energy connect
JBS&G

Local fauna

Noise impacts are unlikely to result in a threshold shift for fauna in the areas surrounding the Project works.

It is expected that for most if not all fauna, noise will be a deterrent and they are unlikely to approach the construction area at a distance that will result in threshold shift. Noise modelling has indicated that during construction, the land clearing and tower installation activities will exceed the fauna criteria at the source of the noise. However, these exceedances only persist at distances up to 5 m from ground construction activities. Most fauna are unlikely to approach within this distance and will avoid the noise source.

Modelling indicates that helicopter operations have the potential to cause temporary threshold shift in some fauna within a 20 m radius of the noise source. However, due to the helicopter operating at heights of approximately 50 m, this is unlikely to have an impact on ground fauna. There is the potential for bird flybys to come within the exceedance distance, however it is expected that the noise will cause avifaunal species to avoid the helicopter as a behavioural response.

The exceedance distances for the criteria for threshold shift in fauna may turn out to be greater than that modelled due to modelling inaccuracies or incorrect assumptions regarding equipment noise levels. However, modelling is conservative and it can be expected that fauna will avoid any loud noise source.

Noise mitigation measures within the CEMP will be implemented to minimise any potential impact experienced by fauna. The implementation of noise mitigation and management controls in the CEMP, as discussed above, will also reduce the potential for impacts on fauna.

The predicted impacts are in the **Minor** category. Uncertainty in the predicted impact (due to uncertainty in the effectiveness of control measures) has been evaluated in Appendix O and the level of risk is **Low**.

15.4.2. Operational noise

Transmission line maintenance using helicopters

Noise associated with the use of helicopters to inspect and maintain the transmission line is expected to have a negligible impact on the amenity of receptors.

The use of helicopters will be infrequent and of short duration. Helicopters will be used during annual maintenance operations to check on the transmission line. The helicopters will fly over the transmission line alignment and will only linger in a specific area (for a matter of minutes) if a problem is noted. Any impacts on the amenity of receptors would be correspondingly brief and negligible.

The predicted impacts are in the **Negligible** category and the level of certainty in this prediction is high.

Helicopter noise impacts are not expected to result in a threshold shift to fauna in the areas surrounding the Project works.

During operational inspections and maintenance, the use of helicopters in the vicinity of fauna has the potential to have some impact on those receptors. However, the minimum distance of the helicopters from the ground surface will be at least 50 m, which is sufficient to reduce the noise level to below criteria for threshold shift.

There is the potential that birds and other fauna could approach within 20 m of the helicopter or transmission line, and therefore experience a threshold shift. However, their innate behavioural response will be to avoid such disturbance.

The predicted impacts are in the **Negligible** category and the level of certainty in this prediction is high.

Operation of the Bundey substation

The operation of the Bundey substation is not expected to affect the amenity of residential receptors.

The noise generated by the substation was modelled based on the following assumptions:

- two 330 kV transformers each with a sound power level of 99 dB(A)
- six reactors each with a sound power level of 85 dB(A)
- the addition of a 5 dB character penalty to account for tonal noise
- conventional construction (i.e. no specific mitigation)

Noise modelling (Resonate 2021) indicates compliance with the most stringent night time criteria at receptor distances greater than 500 m from the location of the transformers within the substation. There are no receptors within 500 m of the substation site and, consequently, the operation of the substation is not expected to affect the amenity of receptors. The substation site measures approximately 80 ha and this will provide an additional buffer.

There are no sources of vibration from the operation of the Project which may result in impacts to sensitive receivers.

The predicted impacts are in the **Negligible** category and the level of certainty in this prediction is high.

Corona discharge events

Corona Discharge events are not expected to create noise impacts that could affect receptors.

Transmission lines can produce spontaneous, pulse-like corona discharges which become apparent as a crackling noise. Corona discharge can be heard during rainy periods as a hissing or cracking sound caused by the implosion of ionised water droplets in the air. Wsozolek (2006) found that the maximum noise that a transmission line will produce due to Corona discharge is 53 dB(A) at a distance of 15 m. Noise modelling (Resonate 2021) indicates the noise level associated with a Corona discharge at the nearest receptor (located in Cooltong in Figure 15-4) is expected to be 44 dB(A), which is below the relevant noise criteria. Given these results, there is no credible risk that a Corona discharge could cause an exceedance of noise criteria at a sensitive receptor.

The predicted impacts are in the **Negligible** category and the level of certainty in this prediction is high.

Noise associated with Corona discharges is not expected to impact on any potential sensitive fauna species.

Modelling indicates that the noise level associated with a Corona discharge within 1 m of the noise source is expected to be 69 dB(A), which is well below the fauna noise criteria of 93 dB. There is no credible risk that Corona discharge could cause an exceedance of fauna criteria.

The predicted impacts are in the **Negligible** category and the level of certainty in this prediction is high.

15.4.3. Summary of key mitigation measures

Potential impacts to amenity due to noise for sensitive receptors have largely been mitigated through the location of the proposed infrastructure and associated work areas. Further mitigation and control measures will be included in the CEMP. Table 15-9 provides a summary of the proposed mitigation measures related to noise.

Table 15-9: Key mitigation measures – noise and vibration

Mitigation measure	Construction	Operation
Complaints register and corrective action program		
Community consultation process, particularly with landholders	✓	✓

Mitigation measure	Construction	Operation
Planning of noisier construction works taking account of distance to receptor	✓	
Consult with landowners if noise generating activities in the vicinity of residences are planned outside normal construction hours.	✓	
Locating noisy plant, access roads and site compounds as far as practicable from receptors	✓	
Selecting processes and equipment that generate lower noise levels	✓	
Regular maintenance of equipment	✓	
Shutting or throttling down equipment that is used intermittently when it is not in use	✓	
Construction of stand-alone accommodation camps away from existing receptors, unless otherwise agreed	✓	
Truck movements limited to designated routes	✓	
Truck movements along uneven surfaces will be restricted to minimum speeds near sensitive receptors and built into the traffic management plan	✓	
Affected receptors along haulage routes to be consulted in advance of works	✓	
Maintain planned works in daytime hours to minimise disruption to amenity	✓	
Restrict maintenance activities to standard working hours where feasible		✓
Maintain minimum distance of the helicopters from the ground surface to at least 50 m, where practical	✓	✓
Register any complaints in ElectraNet's IMS and implement any necessary corrective action program.	✓	✓

15.5. Conclusion

The key finding is that Project construction or operational activities will not lead to significant noise impacts. Most of the proposed alignment is adequately distant from sensitive receivers that no adverse impacts are anticipated during construction or operation of the Project. Where the few receivers are in proximity to the alignment, the impacts will be negligible to minor predominantly due to the transient and temporary nature of construction activities. Relevant landholders will be consulted, and impacts mitigated where practicable.