

Appendix

E

E.2 | Noise Impact Assessment



Dinawan Wind Farm

Noise Impact Assessment

28 May 2024

Reference ID: 54-13



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Abbreviations

| | |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| AC | Alternating Current |
| Bulletin | <i>New South Wales Department of Planning and Environment Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development, 2016</i> |
| CIA Guideline | <i>New South Wales Government Cumulative Impact Assessment Guidelines for State Significant Projects, 2022</i> |

| | |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONCAWE | Noise prediction algorithm as provided in the document: <i>The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, 1981</i> |
| dB(A) | Noise level in A-weighted decibels |
| dB(C) | Noise level in C-weighted decibels |
| DCCEEW | Commonwealth Department of Climate Change, Energy, the Environment and Water |
| DECC | New South Wales Department of Environment & Climate Change |
| DECCW | New South Wales Department of Environment, Climate Change and Water |
| DPE | New South Wales Department of Planning and Environment |
| DPHI | New South Wales Department of Planning, Housing and Infrastructure |
| DPIE | New South Wales Department of Planning, Infrastructure and Environment |
| EIS | Environmental Impact Statement |
| EPA | New South Wales Environment Protection Authority |
| GHG | Greenhouse gases |
| GW | Gigawatts |
| ha | Hectares |
| ICNG | <i>New South Wales Department of Environment & Climate Change Interim Construction Noise Guideline, 2009</i> |
| Km/hr | Kilometres per hour (for vehicle speeds in this NIA) |
| L _{Aeq} | A-weighted equivalent time-averaged noise level |
| L _{Aeq, 1 hour} | A-weighted equivalent time-averaged noise level over a period of 1 hour |
| L _{Aeq, 10 minute} | A-weighted equivalent time-averaged noise level over a period of 10 minutes |
| L _{Aeq, 15 hours} | A-weighted equivalent time-averaged noise level over a period of 15 hours |
| L _{A90} | A-weighted background noise level exceeded for 90 percent of a period |
| L _{A90, 10 minute} | A-weighted background noise level exceeded for 90 percent of a 10 minute period |
| LGA | Local government area |
| International Standard | <i>International Standard ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation</i> |
| Institute of Acoustics Guide | <i>Institute of Acoustics (UK) "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise"</i> |
| m/s | Meters per second (for hub height wind speeds in this NIA) |
| MW | Megawatts |
| MVA | Megavolt amperes |
| NIA | Noise Impact Assessment in response to the SEARs |
| NPI | <i>New South Wales Environment Protection Authority Noise Policy for Industry, 2017</i> |
| NSW | New South Wales |
| O&M | Operations and maintenance |
| OEM | Original equipment manufacturer |
| OSOM | Oversize and over mass |
| Planning Systems SEPP | <i>State Environmental Planning Policy (Planning Systems) 2021</i> |

| | |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project | <i>The Dinawan Wind Farm</i> |
| RBL | Rated Background Level (a calculated quantity using the background noise levels) |
| REZ | Renewable Energy Zone |
| RNP | <i>NSW DECCW Road Noise Policy, 2011</i> |
| SEARs | <i>Secretary's Environmental Assessment Requirements</i> for Application Number SSD-50725959 issued on 14 December 2022 and reissued on 22 August 2023 |
| Spark Renewables | Spark Renewables Pty Limited |
| SSD | State significant development |
| Vibration Guideline | <i>NSW DECC Assessing Vibration: A Technical Guideline</i> |
| Wind Farm Guidelines | <i>South Australian Environment Protection Authority Wind Farms – Environmental Noise Guidelines 2009</i> |
| WTG | Wind turbine generator |

Glossary

| | |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A-weighting | A mathematical adjustment to the measured noise levels to represent the human response to sound. An <i>A-weighted noise level</i> is presented as dB(A) |
| Agreement | Legal contract between Spark Renewables and a landowner, including, amongst other things, the noise levels that apply at the landowner's dwellings |
| Ambient noise level | The noise level in the environment in the absence of the project (also referred to as the <i>ambient environment</i> in this NIA) |
| Assessment locations | A dwelling within 8km of the project's WTGs |
| Background noise level | Minimum ambient noise level, evaluated as the level exceeded for 90 per cent of a period ($L_{A90, period}$) |
| C-weighting | A mathematical adjustment to the measured noise levels to emphasise low frequency content. A <i>C-weighted noise level</i> is presented as dB(C) |
| Candidate WTG | <i>Candidate WTG</i> is used in the NIA to indicate the ability of the project to comply with the SEARs. The candidate WTG is a contemporary make and model which might be procured to serve the project at a future stage |
| Decibels | The logarithmic unit of measurement to define the magnitude of a fluctuating air pressure wave. Used as the unit for <i>sound</i> or <i>noise level</i> |
| Development corridor | The land within the project area where project components may be placed, providing the necessary flexibility for component placement during detailed design (i.e. micro-siting). The development corridor is wholly within the project area |
| Development footprint | The indicative extent of the project's ground disturbance area, including earthworks, associated with permanent infrastructure and temporary construction facilities. The development footprint will be within the development corridor; however, its exact location will be confirmed following detailed design |
| Dinawan Energy Hub | Proposed hybrid wind farm, solar farm and battery energy storage system within the South West Renewable Energy Zone (REZ) of NSW |

| | |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dinawan Wind Farm | The wind farm component of the Dinawan Energy Hub |
| Equivalent noise level | The A-weighted noise level which is equivalent to a noise level which varies over time |
| Frequency | Represents the number of fluctuating air pressure waves in one second. High frequency sound (high pitch or squeal) will generate many waves and low frequency sound (bass or rumble) will generate a small number of waves. The unit of frequency is Hz |
| Intermittent noise | Noise where the level suddenly drops / rapidly increases in a cycle over several times during the period of assessment |
| Low frequency noise | Noise containing dominant audible components within the low-frequency range (10–160 Hertz) of the frequency spectrum |
| Noise | An interchangeable term with sound but which is most often described as <i>unwanted sound</i> |
| Octave Band | The segregation of sound into discrete frequency components. For example, the 63 Hz <i>octave band</i> is a low frequency component of sound/noise, and the 2000 Hz <i>octave band</i> is a high frequency component of sound/noise. The one-third (or 1/3) octave is more finite segregation (1/3 rd) of each octave band |
| Project area | The land required for the project. The project area contains the entirety of all 349 landholdings that overlap with the development corridor and is approximately 39,061 ha. The project area is the maximum area considered for the project based on the extent of land where Spark Renewables holds landholder agreements. The project area includes parts of Goolgumbula Road, Wilson Road, Fernbank Road, McLennons Bore Road and Kidman Way (including the road easement) and Coleambally Outfall Drain, where site access and/or electrical cabling may be required |
| Site access point | The proposed locations where all construction and operation traffic will access the development footprint. Access across the development footprint will be possible via internal tracks |
| Sound | An activity or operation which generates a fluctuating air pressure wave. The ear drum can perceive both the frequency (pitch) and the magnitude (loudness) of the fluctuations to convert those waves to sound |
| Sound pressure level | The magnitude of sound (or noise) at a position. The sound pressure level can vary according to location relative to the noise source, and operational, meteorological and topographical influences |
| Sound power level | The amount of sound energy an activity produces for a given operation. The sound power level is a constant value for a given activity. The sound power level is analogous to the power rating on a light globe (which remains constant), whereas the lighting level in a space (sound pressure level in this analogy) will be influenced by the distance from the globe, shielding and different locations within the space |
| Special noise characteristics | Excessive levels of tonality or low frequency WTG noise |
| Tonal noise | Noise containing a perceptible and objectively identified (using a recognised test) pitch component |

Executive Summary

Spark Renewables Pty Limited proposes to develop the Dinawan Wind Farm (the **project**) with up to approximately 200 wind turbine generators (**WTGs**) and ancillary infrastructure.

The project is on the traditional lands of the Wiradjuri people and several smaller nations of the Murrumbidgee plains, about halfway between the towns of Coleambally and Jerilderie in New South Wales.

This Noise Impact Assessment (**NIA**) forms part of the environmental impact statement for the project and has been prepared to objectively consider the specific and targeted *Secretary's Environmental Assessment Requirements (SEARs)*, triggering an assessment of the following:

- noise associated with operation of WTGs and ancillary infrastructure
- noise associated with construction
- noise associated with traffic
- vibration
- cumulative impacts with other renewable energy projects.

The NIA confirms the operation of the WTGs and ancillary infrastructure can comply with the relevant objective assessment criteria from the *NSW Department of Planning and Environment's (2016) Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development* and the *NSW Environment Protection Authority's (2017) Noise Policy for Industry*.

The NIA also confirms construction activity and traffic noise will not have adverse impacts on residences in the vicinity of the development footprint with the implementation of *feasible and reasonable* work practices, and the vibration criteria will be readily achieved.

Consideration is also given to cumulative impacts, and it is confirmed that the project will not constrain the development, operation, or construction of neighbouring renewable energy projects.

Based on the above, the NIA concludes that noise and vibration generated by the project will achieve the SEARs requirements and as such will not adversely impact on the acoustic amenity of the residences within the vicinity of the project.

Introduction

Overview

Spark Renewables Pty Limited (**Spark Renewables**) proposes to develop the Dinawan Wind Farm (the **project**). The project includes the installation, operation, maintenance and decommissioning of up to approximately 200 wind turbine generators (**WTGs**) and ancillary infrastructure. The project is on the traditional lands of the Wiradjuri people and several smaller nations of the Murrumbidgee plains, about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edward River local government areas (**LGAs**) in New South Wales (**NSW**). The regional and local context of the project is shown in Figure 1 and Figure 2, respectively.

The project is within the South West Renewable Energy Zone (**REZ**), a region selected by the NSW Government for its significant potential for renewable energy generation and regional development.

The project will connect to the Dinawan Substation, currently under construction as part of the Project EnergyConnect interconnector that will run between Robertstown in South Australia and Wagga Wagga in NSW. The substation and interconnector are separate approved projects being built by Transgrid.

The main objective of the project is to generate renewable energy, consistent with NSW Government policy for development of infrastructure for renewable energy generation, and will significantly contribute to the target of 3.98 gigawatts (**GW**) of generation planned in the South West REZ. The project will have a generation capacity of up to approximately 1,200 megawatts (**MW**) (**AC**), equivalent to the needs of 600,000 NSW households per year. It will assist in meeting NSW and Australian Government emissions reduction targets and will abate approximately 3.2 million tonnes of greenhouse gases (**GHG**) annually.

The project is State significant development (**SSD**) pursuant to schedule 1 of *State Environmental Planning Policy (Planning Systems) 2021* (**Planning Systems SEPP**). Accordingly, approval for the project is required under *Part 4, Division 4.7* of the *NSW Environmental Planning and Assessment Act 1979* (**EP&A Act**).

Figure 1 Regional Context

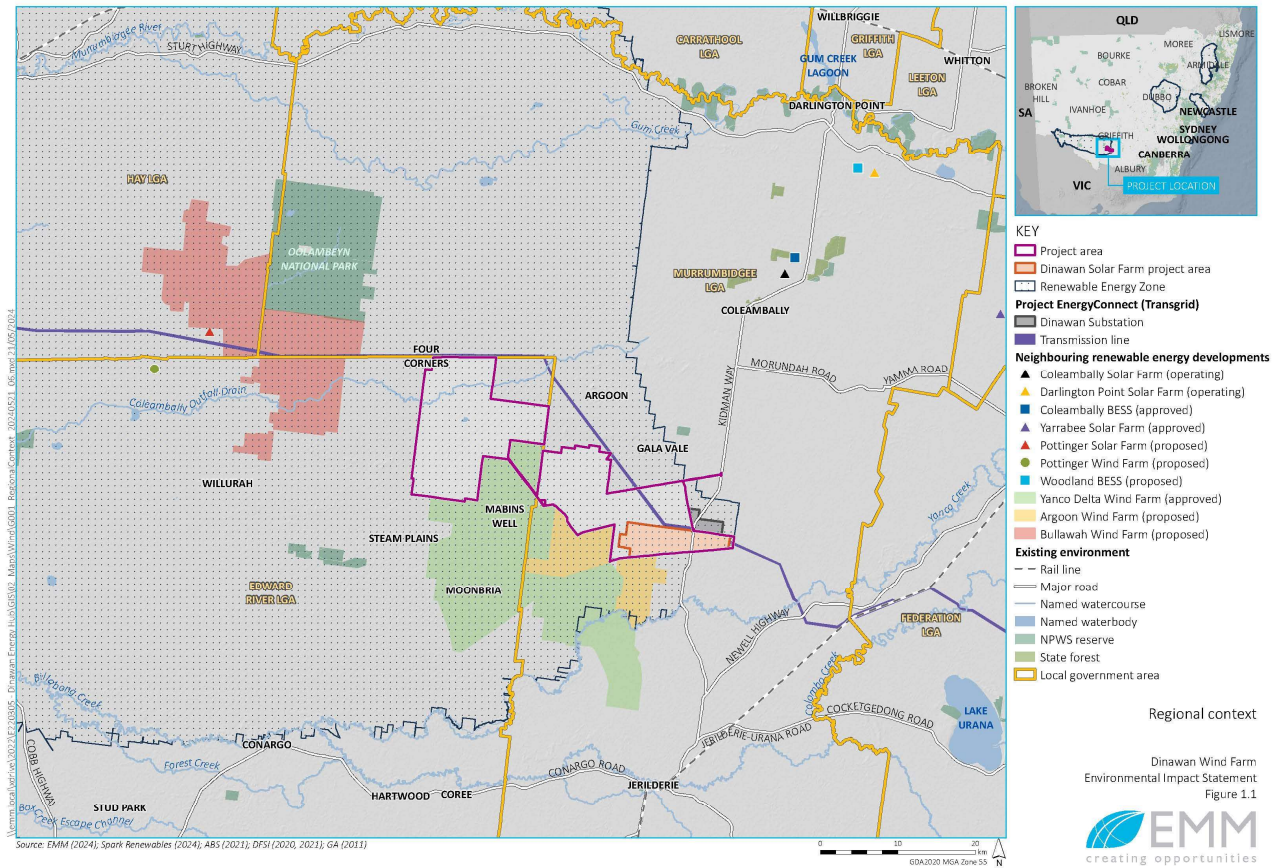
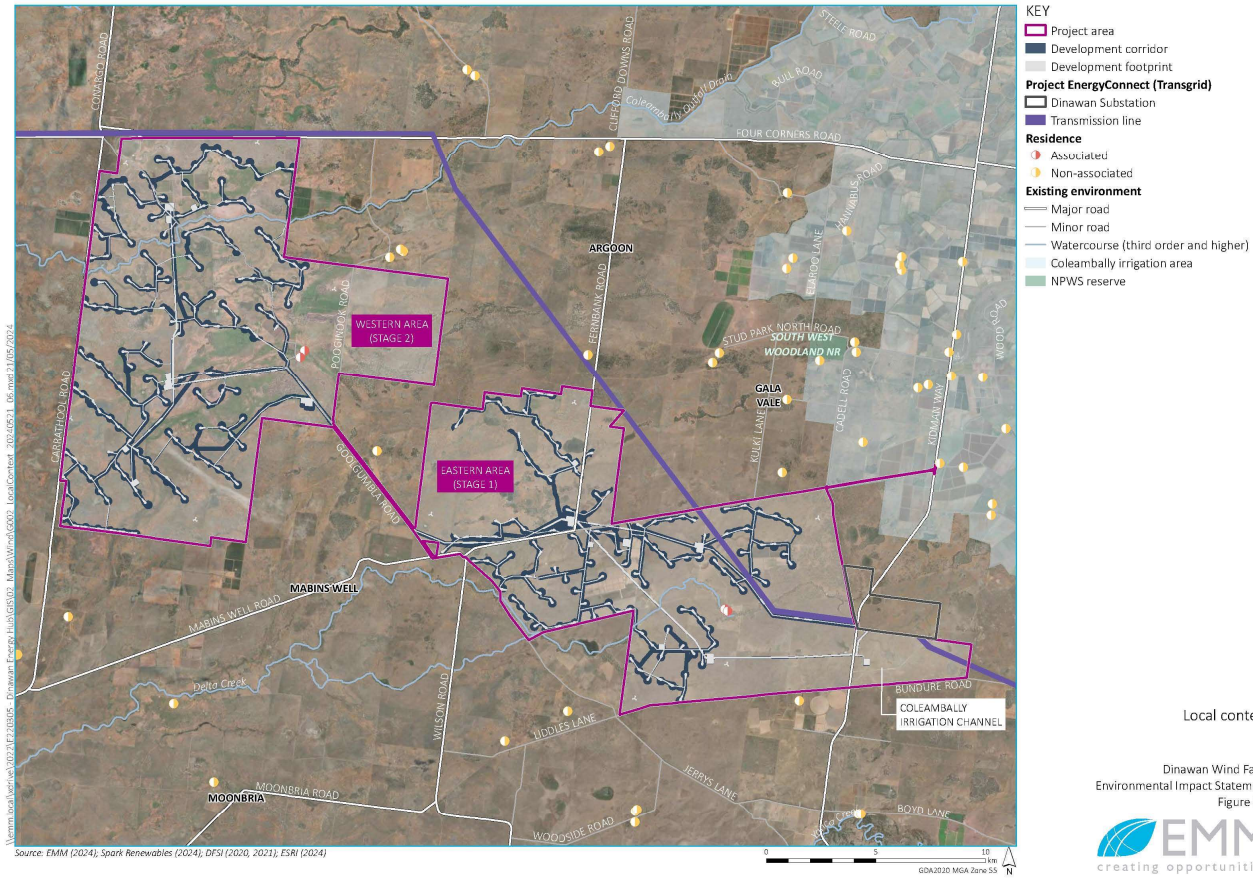


Figure 2 Local Context



Assessment Approach and Requirements

This Noise Impact Assessment (**NIA**) forms part of the environmental impact statement (**EIS**) for the project.

The NIA has been prepared in accordance with requirements of the NSW Department of Planning, Housing and Infrastructure (**DPHI**) (formally the NSW Department of Planning and Environment (**DPE**)) which were set out in the Planning Secretary's Environmental Assessment Requirements (**SEARs**) for the project, issued on 14 December 2022 and reissued on 22 August 2023 with additional requirements from the Commonwealth Department of Climate Change, Energy, the Environment and Water (**DCCEEW**). The SEARs identify matters which must be addressed in the EIS. Table 1 lists individual requirements relevant to this NIA and where they have been addressed.

Table 1 Requirements of the SEARs and Relevant Section of the NIA

| Noise Assessment | Relevant Bulletin/Policy/Guideline/Standard | Relevant Pages of the NIA |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| WTGs | NSW DPE <i>Wind Energy: Noise Assessment Bulletin for State Significant WindEnergy Development, 2016</i> | Page 25 to 29 |
| Ancillary infrastructure | NSW Environment Protection Authority (EPA) <i>Noise Policy for Industry, 2017</i> | Page 30 to 31 |
| Construction | NSW Department of Environment & Climate Change (DECC) <i>Interim Construction Noise Guideline, 2009</i> | Page 32 to 38 |
| Traffic | NSW Department of Environment, Climate Change and Water (DECCW) <i>Road Noise Policy, 2011</i> | Page 39 to 40 |
| Vibration | NSW DECC <i>Assessing Vibration: A Technical Guideline, 2006</i> | Page 41 |
| Cumulative Impacts | NSW Department of Planning, Infrastructure and Environment (DPIE) <i>Cumulative Impact Assessment Guideline for State Significant Projects, October 2022</i> | Page 41 to 43 |

A number of technical terms have been utilised throughout this NIA for the discussion of noise and vibration. These are explained in the *abbreviations and glossary* section.

Project Description and Setting

Project Overview

A full project description is provided in Chapter 3 of the EIS and an indicative project layout separated into its eastern and western stages is shown in Figure 3 and Figure 4 of this NIA respectively. The project will comprise the following key components:

- a network of approximately 200 (3 blade) WTGs across two stages
- electrical collection system, substations and control rooms
- electricity transmission line infrastructure connecting the project substations to the Dinawan Substation
- operations and maintenance (**O&M**) infrastructure, including site offices and amenities, buildings, equipment and maintenance sheds and laydown, storage and parking areas
- temporary construction facilities, including worker accommodation facility, construction compounds, site offices and amenities, concrete batching plants, construction materials storage (including stockpiles), laydown areas, temporary meteorological masts, borrow pits, water tanks and storage and parking areas
- other permanent infrastructure, including hardstands, water tanks, permanent meteorological masts, new access tracks and upgrades to existing access tracks
- site access points from the public road network and public road upgrades to facilitate the delivery of WTG components.

Figure 3 Indicative Project Layout – Stage 1 East

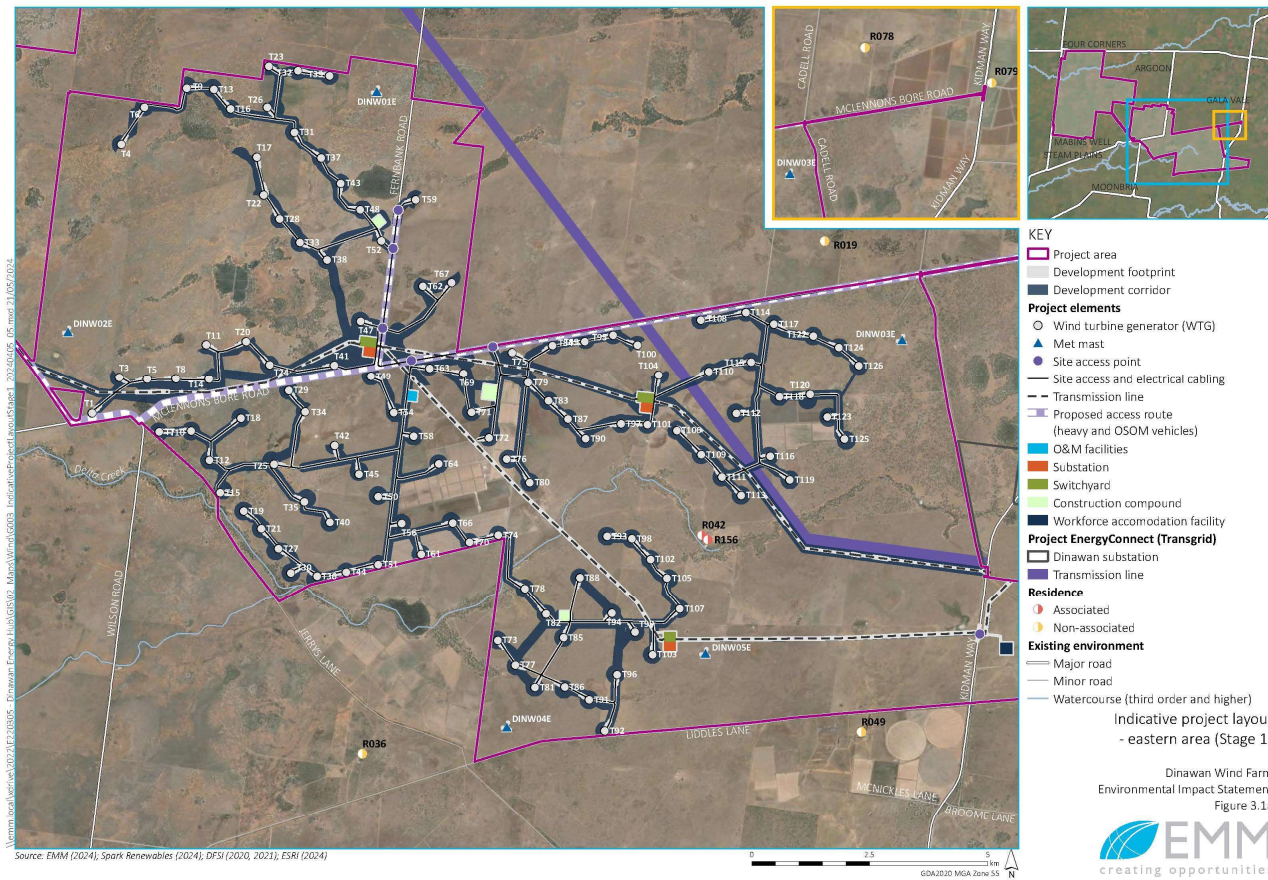
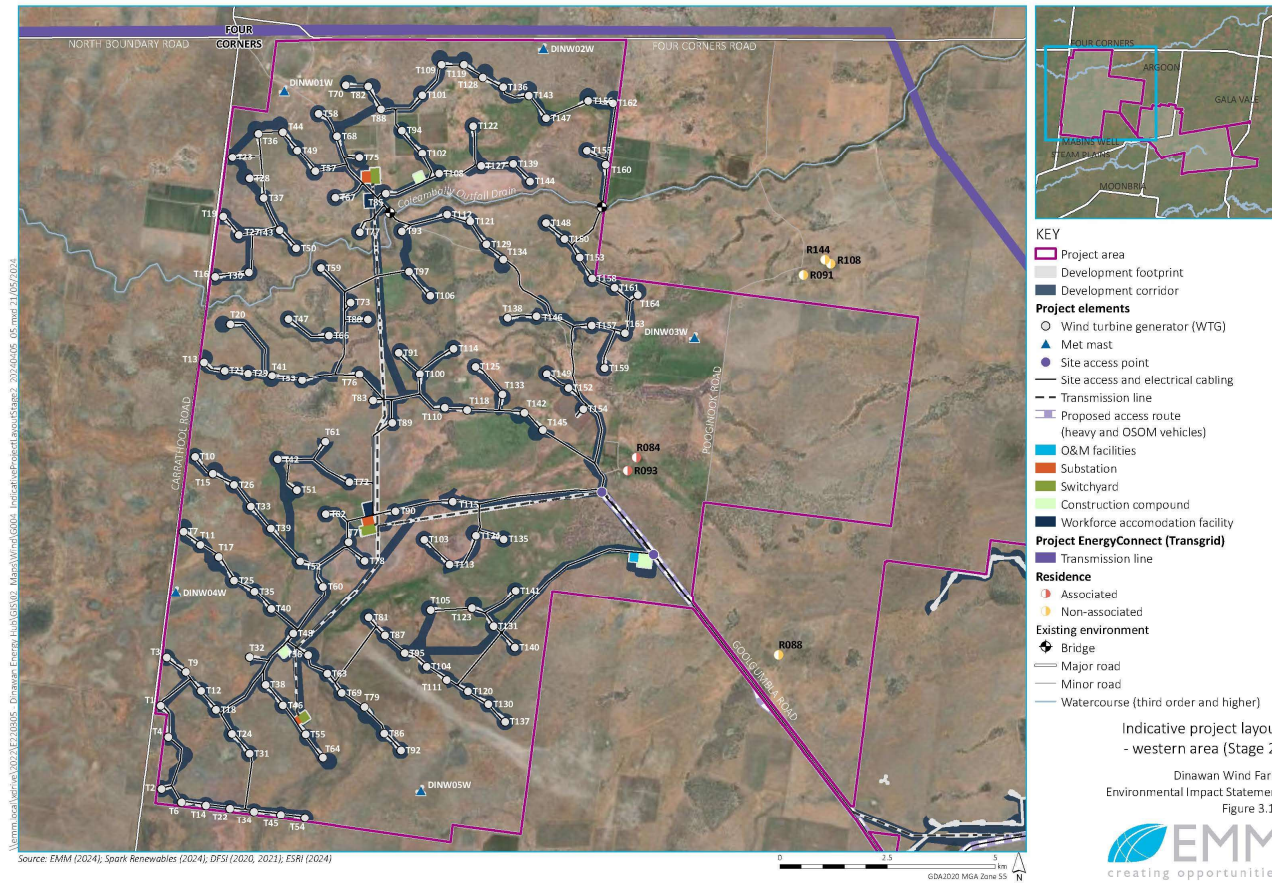


Figure 4 Indicative Project Layout – Stage 2 West



Project Area

The majority of the land within the project area is privately owned, and can be considered as two distinct areas, the eastern wind area and the western wind area. The land within the project area is predominantly used for sheep and cattle grazing and some irrigated cropping.

The development corridor is the land within the project area where project components may be placed, providing the necessary flexibility for component placement during detailed design (i.e. micro-siting). A development footprint has also been provided within the development corridor for the construction works ground disturbance area.

Direct impacts for public road upgrade works are required on Kidman Way, McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road and will facilitate access to the development corridor. From the site access points, private internal roads will be used to traverse the development corridor.

The preferred point of connection to Transgrid's network is via the Dinawan Substation, which forms part of Project EnergyConnect and will be constructed on land adjacent to the project area. An overhead transmission line will connect the project's collector substations (**substations**) to the Dinawan Substation.

Project Staging

It is anticipated that the project will be constructed in two stages:

- Stage 1 will be the construction of the eastern wind area, including associated public road upgrades, grid connection infrastructure and workforce accommodation facility. Stage 1 is within the Murrumbidgee LGA
- Stage 2 will be the construction of the western wind area, including associated public road upgrades, grid connection infrastructure and workforce accommodation facility. Stage 2 is predominantly within the Edward River LGA, with the exception of additional public road upgrades and grid connection infrastructure within Murrumbidgee LGA.

The project's generation capacity and connection to the electricity grid is dependent on the outcomes of the South West REZ Access Scheme and the construction of electricity grid infrastructure (including Dinawan Substation). For the purposes of this assessment, it has been assumed that the project will connect to Dinawan Substation and project infrastructure will be housed within the full extent of the development footprint (i.e. this NIA has assessed impacts associated with the construction and operation of both stages 1 and 2).

Assessment Locations

There are 27 residences within 8 km of the proposed WTGs. Noise impacts from the project have been assessed at these residences referred to as **assessment locations**. The coordinates of the assessment locations are summarised in Table 2.

It is understood that agreements have been made between Spark Renewables and the landowners of four of the assessment locations (shown as associated residences on Figure 3 and Figure 4).

Table 2 Assessment Locations (within 8km of a WTG) and Agreement Status

| Assessment Location ID | Agreement | Co-ordinates (MGA Zone 55) | |
|------------------------|-----------|----------------------------|----------|
| | | Easting | Northing |
| R008 | No | 379621 | 6111127 |
| R019 | No | 386328 | 6126615 |
| R036 | No | 376514 | 6115707 |
| R038 | No | 373635 | 6114344 |
| R042 | Yes | 383717 | 6120369 |
| R049 | No | 387096 | 6116160 |
| R050 | No | 383448 | 6132094 |
| R056 | No | 388044 | 6131752 |
| R078 | No | 390024 | 6127989 |
| R079 | No | 393521 | 6127021 |
| R082 | No | 379598 | 6110614 |
| R084 | Yes | 364488 | 6132202 |
| R087 | No | 358496 | 6116044 |
| R088 | No | 367795 | 6127593 |
| R090 | No | 353668 | 6120017 |
| R091 | No | 368376 | 6136446 |
| R092 | No | 351325 | 6118277 |
| R093 | Yes | 364286 | 6131895 |
| R107 | No | 383154 | 6131653 |
| R108 | No | 369007 | 6136713 |
| R111 | No | 379690 | 6111191 |
| R140 | No | 351239 | 6118289 |
| R141 | No | 351366 | 6118291 |
| R143 | No | 377446 | 6132006 |
| R144 | No | 368878 | 6136800 |
| R156 | Yes | 383844 | 6120276 |
| R157 | No | 386544 | 6129920 |

Assessment Criteria

SEARs

The SEARs issued by the NSW DPHI for the project under Application Number SSD-50725708 issued on 14 December 2022 and reissued on 22 August 2023 states that:

The EIS must address the following specific issues for the wind farm and associated infrastructure:

...

- *an assessment of the wind turbine noise in accordance with the NSW Wind Energy: Noise Assessment Bulletin (EPA/DPE, 2016);*
- *an assessment of the noise generated by ancillary infrastructure in accordance with the NSW Noise Policy for Industry (EPA, 2017);*
- *assessment of the construction noise under the Interim Construction Noise Guideline (DECC, 2009) and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;*
- *assessment of the traffic noise under the NSW Road Noise Policy (DECCW, 2011);*
- *an assessment of vibration under the Assessing Vibration: A Technical Guideline (DECC, 2006); and*
- *assessment of the cumulative noise impacts (considering other developments in the area).*

WTG Noise

The SEARs require the operation of *wind turbine noise* to be assessed against the *NSW DPE Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development* (the **Bulletin**).

Noise Limits

The Bulletin provides a *base equivalent noise level* ($L_{Aeq,10 \text{ minute}}$) of 35 dB(A) at the assessment locations without an agreement.

Background noise level ($L_{A90,10 \text{ minute}}$) monitoring may also be conducted prior to construction, which can justify an increase in the noise assessment criteria above the *base equivalent noise level* of 35 dB(A) in the circumstance where the measured background noise levels are sufficiently high (which can occur at higher hub height wind speeds).

This assessment utilises the *base equivalent noise level* of 35 dB(A) at all hub height wind speeds as a conservative approach, noting that background noise level monitoring is proposed to occur during the design stage of the project for the purpose of determining existing noise levels in the ambient environment.

The Bulletin also enables higher *equivalent noise levels* to apply at assessment locations with an agreement, provided the landowner is appropriately informed and understands the agreed noise levels. The NIA provides predicted noise levels at the assessment locations with agreements, but does not compare the levels against specific criteria as these will be the subject of the separate agreements.

Special Noise Characteristics

The Bulletin requires that the *equivalent noise level* at the assessment locations be adjusted where excessive levels of tonality, low frequency noise (**special noise characteristics**), or a combination of both are identified, to a maximum adjustment of 5 dB(A). Whilst special noise characteristics are not common characteristics of modern WTGs, excessive levels of tonality and low frequency noise are determined as follows:

Tonality

Sounds containing a perceptible and objectively identified (using a recognised test) pitch component (an unusually high level of energy in a relatively narrow band of frequencies) when considered within the ambient environment may be referred to as exhibiting excessive levels of tonality. The presence of excessive tonality is defined objectively by the Bulletin as when the noise level within a one-third octave band exceeds the noise level within the adjacent one-third octave bands on both sides by:

- 5 dB or more if the centre frequency of the one-third octave band containing the tone is in the range 500 Hz to 10,000 Hz;
- 8 dB or more if the centre frequency of the one-third octave band containing the tone is in the range 160 Hz to 400 Hz; and/or
- 15 dB or more if the centre frequency of the one-third octave band containing the tone is in the range 25 Hz to 125 Hz.

If tonality from the WTGs is audible at the assessment locations and found to be a repeated and dominant characteristic, 5 dB(A) should be added to the noise levels.

Absence of tonality measured at an intermediate location (closer to a WTG than the assessment location) is sufficient proof that 5 dB(A) should not be added to the noise levels at an assessment location.

Low Frequency

Sound containing dominant audible components within the low-frequency range when considered within the ambient environment may be referred to as exhibiting excessive levels of **low-frequency**. The presence of excessive low frequency is defined objectively by the Bulletin as when the C-weighted noise level (a noise level with an adjustment to emphasise low frequency content) is greater than 60 dB(C) at an assessment location.

If excessive low frequency noise from the WTGs is found to be a repeated and dominant characteristic at an assessment location, 5 dB(A) should be added to the noise levels.

Ancillary Infrastructure Noise

The SEARs require the *noise generated by ancillary infrastructure* be assessed against the *NSW Noise Policy for Industry 2017* (the **NPI**). The NPI provides *noise trigger levels* for commercial and industrial premises that emit noise.

The *noise trigger levels* are determined by calculating an *intrusiveness noise level* (based on the existing ambient noise levels) and an *amenity noise level* (based on the type of land use and location, such as rural, suburban, or urban). The *noise trigger level* is the lower of the two calculated levels.

The project's *intrusiveness noise level* is calculated as 5 dB(A) more than the rated background level (**RBL**) measured in the ambient environment. In quiet locations, the NPI provides minimum (default) RBL values, which are used in this assessment due to the remote project location and corresponding low background noise levels in the ambient environment. The approach is common for projects in rural areas, where low ambient noise levels exist and the minimum RBL values would be assigned. The NPI establishes the following minimum RBL values:

- 35 dB(A) during the day
- 30 dB(A) during the evening and night periods.

The *project amenity noise level* is calculated from the *recommended amenity noise level* of the NPI, minus 5 dB(A). The NPI establishes the following residential *amenity noise levels* in a rural area:

- 50 dB(A) between 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sunday (day)
- 45 dB(A) between 6.00pm to 10.00pm (evening)
- 40 dB(A) for the remaining periods (night).

A further 3 dB(A) adjustment (addition) is to be applied to standardise the $L_{Aeq,15min}$ to $L_{Aeq,period}$ noise level, *unless robust evidence is provided for an alternate approach*. The 3 dB(A) adjustment is not applied to this project because noise levels from continuous sources, such as transformers, will not alter in noise level if considered at full operation over the full duration of a period (as is done in this NIA).

The calculated *project intrusiveness* and *amenity noise levels* are provided in Table 3, as well as the resulting *noise trigger levels*, that are used to establish the assessment criteria for operation of ancillary infrastructure.

Table 3 Calculation of Project Noise Trigger Levels for Ancillary Infrastructure

| Period | Project Intrusiveness Noise Level dB(A) $L_{Aeq,15min}$ | Project Amenity Noise Level dB(A) $L_{Aeq,15min}$ | Noise Trigger Level dB(A) $L_{Aeq,15min}$ |
|---------|------------------------------------------------------------|------------------------------------------------------|----------------------------------------------|
| Day | 40 (35 + 5) | 45 (50 – 5 + 3) | 40 |
| Evening | 35 (30 + 5) | 40 (45 – 5 + 3) | 35 |
| Night | 35 (30 + 5) | 35 (40 – 5 + 3) | 35 |

When predicting noise levels in accordance with the NPI, a modifying factor correction should also be applied before comparison with the *noise trigger level* where the noise has characteristics of tonality, intermittency, or low-frequency. Whilst the noise from ancillary infrastructure can exhibit tonal noise in proximity, it is not a common characteristic at the typical separation distances between ancillary infrastructure serving wind farms and the assessment locations.

Construction Noise

The SEARs reference the NSW DECC *Interim Construction Noise Guideline (ICNG)* to assess the noise from construction of the project. The ICNG provides *guidance on managing construction works to minimise noise..., with an emphasis on communication and cooperation with all involved in, or affected by, construction noise.*

The methodology of assessing construction noise under the ICNG is to:

1. identify relevant sensitive land uses (assessment locations) that may be affected
2. identify the proposed hours and timeframe of the works
3. determine the potential noise impacts at the assessment locations (through predictions)
4. select/apply best work practices to minimise noise impacts.

Section 2.2 of the ICNG provides *Recommended standard hours* for construction works to occur. The recommended standard hours, as provided in Table 4, are not mandatory, but specific justification needs to be provided to the authority to conduct works outside of these.

Table 4 Recommended Standard Hours for Construction Work

| Work Type | Recommended Standard Hours of Work |
|----------------------------|----------------------------------------------------------------------------------------------------------|
| <i>Normal construction</i> | <i>Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays</i> |
| <i>Blasting</i> | <i>Blasting is not proposed for this project</i> |

Construction works proposed outside the recommended standard hours must fall into one of the categories in Table 5.

Table 5 Acceptable Categories of Work Outside of Standard Hours

| Work Type | Description |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <i>the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads</i> |
| 2 | <i>emergency work to avoid the loss of life or damage to property, or to prevent environmental harm</i> |
| 3 | <i>maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours</i> |
| 4 | <i>public infrastructure works that shorten the length of the project and are supported by the affected community</i> |
| 5 | <i>works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.</i> |

For new infrastructure works, the ICNG requires a quantitative assessment which includes predictions of the noise level at assessment locations, and a comparison against the *management levels*, repeated in Table 6 below. The *management levels* are the triggers to implement *all feasible and reasonable* work practices.

The *management level* and corresponding requirements under the ICNG are repeated in Table 6. The RBL is referenced in determining the *management level*. As noted above, the NPI establishes minimum RBL values of 35 dB(A) during the day period, and 30 dB(A) during the evening and night periods.

Table 6 Noise Management Levels and Requirements

| Time of Day | Management Level L_{Aeq} (15 min) | How to Apply |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm Sundays or Public Holidays No work | Noise Affected RBL + 10 dB [= 45dB(A)] | The noise affected level represents the point above which there may be some community reaction to noise. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside Recommended Standard Hours | Noise Affected RBL + 5 dB [= 35dB(A)] | A strong justification would typically be required for works outside the recommended standard hours. <ul style="list-style-type: none"> 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 (of the ICNG). |

Project construction activities will be undertaken during standard day time construction hours (i.e. 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday). Exceptions to these hours may be required for:

- oversize and overmass (**OSOM**) deliveries outside of peak traffic times
- concrete batching and pouring
- crane movements between WTG sites
- activities that are inaudible outside the project area
- WTG construction when hindered by adverse weather conditions.

The relevant council and surrounding landholders will be notified of any exceptions.

Traffic Noise

The SEARs reference the *NSW DECCW Road Noise Policy (RNP)* for the assessment of traffic noise. The RNP defines criteria to be used in assessing the impact of road noise.

The most appropriate road traffic noise assessment criteria that apply to the project are the noise levels for "existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads" and "existing residences affected by additional traffic on existing local roads generated by land use developments" as detailed in Table 7 below.

Table 7 Road Traffic Noise Assessment Criteria

| Road Category | Type of project/land use | Assessment criteria – dB(A) | |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------|
| | | Day (7.00am – 10.00pm) | Night (10.00pm – 7.00am) |
| Freeway/ arterial/ sub-arterial roads | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | L _{Aeq} , 15 hour 60 (external)) | L _{Aeq} , 9 hour 55 (external) |
| Local roads | Existing residences affected by additional traffic on existing local roads generated by land use developments | L _{Aeq} , 1 hour 55 (external)) | L _{Aeq} , 1 hour 50 (external) |

The noise assessment criteria are targets for determining *all feasible and reasonable* noise reduction measures. Noise levels higher than the criteria may need to be applied where it is demonstrated that the criteria cannot be met by applying *all feasible and reasonable* mitigation measures.

When considering *all feasible and reasonable* mitigation measures, consideration needs to be given to the fact that traffic associated with the project will predominantly occur during construction as opposed to a permanent increase in traffic flows. The assessment criteria of the RNP are based on a permanent increase in traffic flows and so their application to transient construction traffic is a conservative assessment approach.

Vibration

The SEARs reference the *NSW DECC Assessing Vibration: A Technical Guideline (Vibration Guideline)* for the assessment of vibration. The Vibration Guideline establishes acceptable vibration levels for continuous and impulsive vibration, and intermittent vibration from industry, transportation and machinery based on acceptable values of human exposure as detailed in Table 8 and Table 9 below.

Table 8 Continuous and Impulsive Vibration Acceleration (m/s²) 1–80 Hz

| Location | Assessment Period | Preferred Value | | Maximum Value | |
|-----------------------------|-------------------|-----------------|---------------|---------------|---------------|
| | | z-axis | x- and y-axes | z-axis | x- and y-axes |
| Continuous vibration | | | | | |
| Residences | Daytime | 0.010 | 0.0071 | 0.020 | 0.014 |
| | Night-time | 0.007 | 0.005 | 0.014 | 0.010 |
| Impulsive vibration | | | | | |
| Residences | Daytime | 0.30 | 0.21 | 0.60 | 0.42 |
| | Night-time | 0.10 | 0.071 | 0.20 | 0.14 |

Table 9 Acceptable Vibration Dose Values for Intermittent Vibration (m/s^{1.75})

| Location | Assessment Period | Preferred Value | Maximum Value |
|------------|-------------------|-----------------|---------------|
| Residences | Daytime | 0.20 | 0.40 |
| | Night-time | 0.13 | 0.26 |

Cumulative Impacts

The *NSW Government Cumulative Impact Assessment Guideline for State Significant Projects* (the **CIA Guideline**) aims to *set clear expectations and requirements for assessing project level cumulative impacts related to State significant projects*. There are no objective targets to be achieved in the CIA Guideline.

This NIA utilises the Bulletin for the assessment of WTG noise. The Bulletin uses the *South Australian Environment Protection Authority Wind Farms – Environmental Noise Guidelines 2009* (the **Wind Farm Guidelines**) as the basis of the noise criteria and assessment methodology in NSW.

The Wind Farm Guidelines noise criteria *...accounts for the cumulative effect of noise from other similar development and for the increased sensitivity of receivers to a new noise source*. Based on the above no further consideration is required for the cumulative impact of WTG noise where compliance is achieved with the Bulletin's *base equivalent noise levels*.

This NIA utilises the NPI for the assessment of ancillary infrastructure noise. The NPI notes that *where the project amenity noise level applies and it can be met, no additional consideration of cumulative industrial noise is required*.

The NIA assesses the project against the *noise trigger levels* determined under the NPI. The *noise trigger levels* are lower or equivalent to the *project amenity levels* as outlined in Table 3. Based on the above, no further consideration is required for the cumulative impact of ancillary infrastructure noise where compliance is achieved with the NPI *noise trigger levels*.

Notwithstanding the above, further information on cumulative impacts is provided in the NIA to assist in considering the project and its potential to constrain the development, operation, or construction of neighbouring renewable energy projects.

Assessment

WTG Noise

Noise Model

A three-dimensional model for the WTG layout has been developed based on the algorithm provided by *International Standard ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (the **International Standard**).

The International Standard specifies a method for predicting noise levels at a distance from a noise source under meteorological conditions favourable to noise propagation. The algorithm also conservatively assumes that these favourable propagation conditions (which include wind blowing from the WTG to the assessment location) occur simultaneously between all WTGs and all assessment locations.

The model incorporates the following:

- assessment locations identified within 8km of any WTG, as detailed in Table 2
- the cumulative effect of 267¹ WTGs operating concurrently with locations as detailed in Appendix A for the eastern area of WTGs (Stage 1) and Appendix B for the western area of WTGs (Stage 2)
- topographical ground contours
- inputs detailed in accordance with the modelling recommendations of the *Institute of Acoustics (UK) "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise"* (**Institute of Acoustics guide**):
 - Warranted sound power level data for the candidate WTG
 - 10°C temperature
 - 70% relative humidity
 - 50% acoustically hard ground and 50% acoustically soft ground
 - barrier attenuation of no greater than 2 dB(A)
 - 4m receiver height at each assessment location
 - application of a 3 dB(A) correction where a "concave" ground profile exists.

¹ The EIS layout is indicative and conservatively includes 267 WTGs. The detailed design will limit the total number of WTGs to 200.

Candidate WTG

This assessment has been based on the *Vestas V162-6.0* (with serrated trailing edges) with a hub height of up to 180m and a rotor diameter of 162m.

Sound Power Levels

The sound power levels are based on the original equipment manufacturer (**OEM**) noise level data for integer wind speeds (at hub height) from cut-in wind speed to the wind speed of the rated power.

The NIA has been based on the equivalent noise level produced by the *Vestas V162-6.0* (with serrated trailing edges) WTG in Mode *PO6000* in “one-third octave bands” between 6.3 Hz and 10 kHz, which is subject to commercial in confidence provisions imposed by the OEM. The total sound power level data presented in Table 10 provides an indication of the noise generated by the candidate WTG. Where required, the OEM can provide the one-third octave band data to authorities or an independent reviewer (subject to the completion of a non-disclosure agreement).

Table 10 Sound Power Levels

| Candidate WTG | Integer Hub Height Wind Speed (m/s) | Total Sound Power Level (dB(A)) |
|-------------------------------------------------------------------------------|-------------------------------------|---------------------------------|
| <i>Vestas V162-6.0MW (PO6000 operating mode) with serrated trailing edges</i> | 3 | 93.9 |
| | 4 | 94.1 |
| | 5 | 94.3 |
| | 6 | 96.2 |
| | 7 | 99.2 |
| | 8 | 102.0 |
| | 9 | 104.1 |
| | 10 (up to rated power) | 104.3 |

The measurement of noise levels and contractual agreements to arrive at warranted sound power levels can introduce variations to the noise level data. As the contractual agreements will be finalised during the procurement stage of the project, the noise model and NIA incorporates an adjustment (increase) of 1 dB(A) to the *total sound power levels* in Table 10 to align with the inputs of the Institute of Acoustics guide.

Predicted Noise Levels

Noise level predictions have been made using the noise model, inputs and assumptions detailed above.

The predicted noise level for the operation of the *Vestas V162-6.0* (with serrated trailing edges) in Mode *PO6000* are provided in Table 11 for each assessment location from the cut-in wind speed to the wind speed at rated power at integer hub height wind speeds. The distance to the closest WTG from each assessment location is also provided in Table 11.

Table 11 Predicted WTG Noise Levels

| Assessment Location ID | Closest WTG (m) | A-Weighted base equivalent noise level | Predicted WTG Noise level (dB(A)) for each hub height integer wind speed | | | | | | | | Highest predicted WTG C-Weighted Noise Level at any integer wind speed (dB(C)) |
|------------------------|-----------------|----------------------------------------|--------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-----------------------|--------------------------------------------------------------------------------|
| | | | 3 m/s | 4 m/s | 5 m/s | 6 m/s | 7 m/s | 8 m/s | 9 m/s | 10 m/s to rated power | |
| R008 | 5467 | 35 | 13 | 13 | 14 | 16 | 20 | 23 | 25 | 25 | 49 |
| R019 | 2042 | 35 | 23 | 23 | 23 | 26 | 29 | 32 | 34 | 34 | 54 |
| R036 | 3753 | 35 | 19 | 19 | 20 | 22 | 26 | 29 | 31 | 31 | 53 |
| R038 | 5404 | 35 | 15 | 15 | 16 | 18 | 22 | 25 | 27 | 27 | 51 |
| R042 | 1187 | Subject to agreement | 29 | 30 | 30 | 32 | 36 | 38 | 41 | 41 | 58 |
| R049 | 4669 | 35 | 16 | 16 | 17 | 19 | 23 | 26 | 28 | 28 | 51 |
| R050 | 7097 | 35 | 13 | 14 | 14 | 17 | 21 | 23 | 26 | 26 | 50 |
| R056 | 7423 | 35 | 11 | 11 | 12 | 15 | 18 | 21 | 23 | 24 | 49 |
| R078 | 4980 | 35 | 14 | 14 | 14 | 17 | 21 | 23 | 26 | 26 | 49 |
| R079 | 7165 | 35 | 10 | 10 | 11 | 13 | 17 | 20 | 22 | 22 | 48 |
| R082 | 5954 | 35 | 12 | 12 | 13 | 16 | 20 | 22 | 24 | 25 | 49 |
| R084 | 1681 | Subject to agreement | 24 | 24 | 25 | 27 | 30 | 33 | 35 | 36 | 55 |
| R087 | 7952 | 35 | 11 | 11 | 12 | 14 | 18 | 21 | 23 | 23 | 49 |
| R088 | 3754 | 35 | 18 | 18 | 19 | 21 | 25 | 27 | 30 | 30 | 53 |
| R090 | 4172 | 35 | 16 | 16 | 17 | 19 | 23 | 26 | 28 | 28 | 51 |
| R091 | 3892 | 35 | 17 | 17 | 18 | 21 | 24 | 27 | 29 | 29 | 52 |
| R092 | 6446 | 35 | 12 | 12 | 12 | 15 | 19 | 21 | 24 | 24 | 49 |
| R093 | 1776 | Subject to agreement | 24 | 24 | 24 | 27 | 30 | 33 | 35 | 35 | 55 |
| R107 | 6722 | 35 | 14 | 14 | 15 | 17 | 21 | 24 | 26 | 26 | 50 |
| R108 | 4553 | 35 | 16 | 16 | 17 | 20 | 23 | 26 | 28 | 28 | 52 |
| R111 | 5382 | 35 | 13 | 13 | 14 | 17 | 20 | 23 | 25 | 25 | 49 |
| R140 | 6470 | 35 | 12 | 12 | 12 | 15 | 19 | 21 | 24 | 24 | 49 |
| R141 | 6416 | 35 | 12 | 12 | 13 | 15 | 19 | 22 | 24 | 24 | 49 |
| R143 | 2496 | 35 | 19 | 19 | 20 | 22 | 26 | 29 | 31 | 31 | 53 |
| R144 | 4441 | 35 | 16 | 17 | 17 | 20 | 23 | 26 | 28 | 29 | 52 |
| R156 | 1188 | Subject to agreement | 29 | 29 | 30 | 32 | 35 | 38 | 40 | 40 | 58 |
| R157 | 5180 | 35 | 14 | 15 | 15 | 18 | 22 | 24 | 26 | 27 | 50 |

Special Noise Characteristics

The Bulletin requires that the *equivalent noise level* at the assessment locations be adjusted where excessive levels of tonality, low frequency noise, or a combination of both be identified to a maximum adjustment of 5 dB(A).

An assessment of tonality has been made by analysing the 1/3 octave band *sound power level* data for the candidate WTG. This data indicates that the candidate WTG does not have tonal characteristics in close proximity (or an intermediate location as noted above). As such, it can be concluded that the candidate WTGs will not be tonal at the assessment locations.

An assessment of low frequency noise has been made by comparing the predicted C-weighted noise levels provided in Table 11 against the criterion of 60 dB(C). The predicted noise levels indicate the 60 dB(C) criterion will be achieved at all assessment locations.

Based on the above, no adjustment is required to be made to the A-Weighted noise levels provided in Table 11 for special noise characteristics.

Noise Prediction Summary

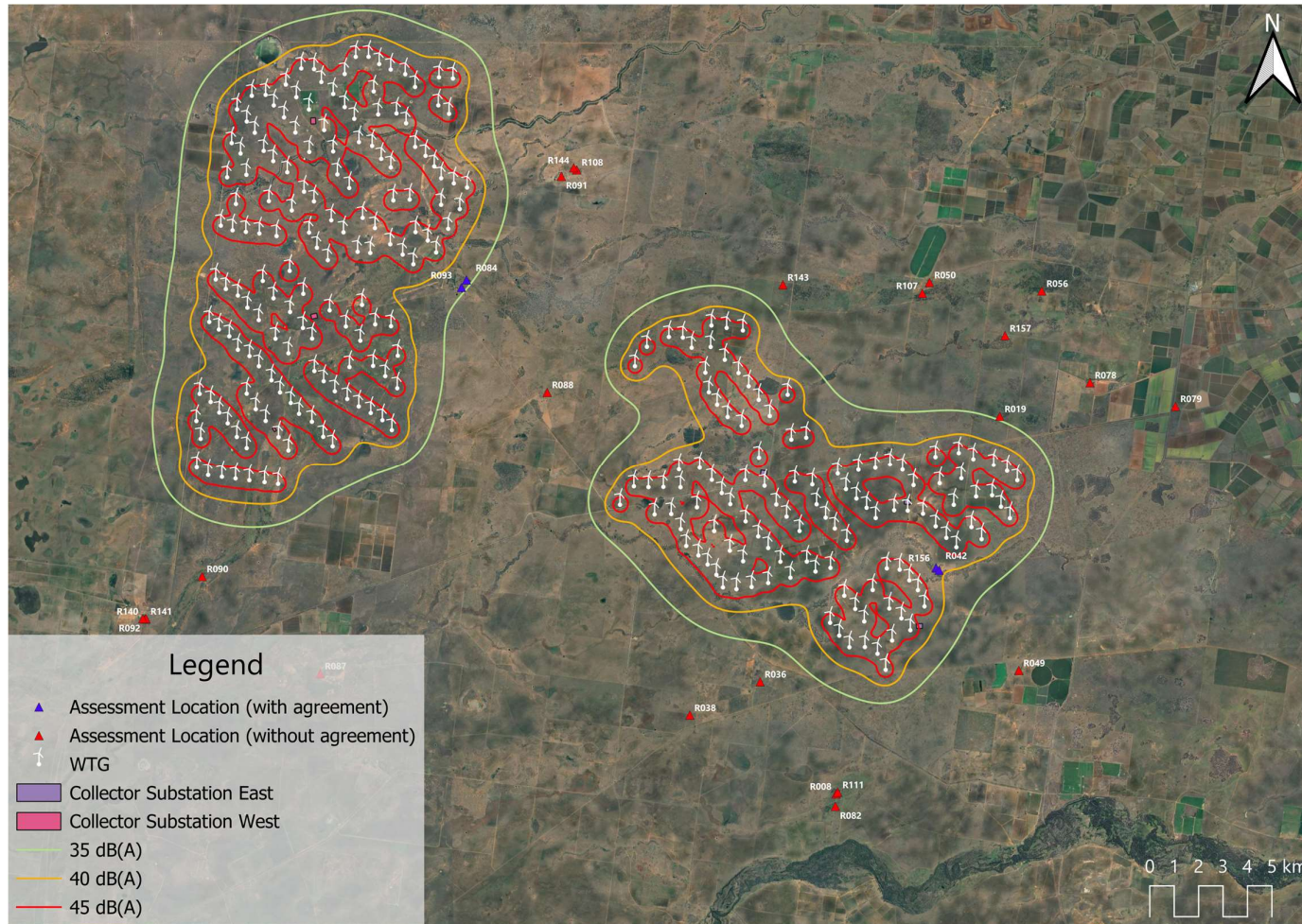
The predicted noise levels are less than the *base equivalent noise level* of 35 dB(A) at all hub height integer wind speeds and at all assessment locations without an agreement.

The noise prediction contours for the operation of the *Vestas V162-6.0* (with serrated trailing edges) in Mode *PO6000* are provided in Figure 5. The noise prediction contours illustrate that all assessment locations without an agreement are outside (or subject to lower noise levels than) the *base equivalent noise level* contour of 35 dB(A).

Final Noise Modelling

Details affecting the predicted noise levels can alter during the design, development, procurement (including OEM selection and agreements to arrive at warranted sound power levels), and/or micro-siting. The NIA should be updated to reflect changes which can arise to ensure ongoing compliance with the project's noise assessment criteria.

Figure 5 WTG Noise Prediction Contours



Ancillary Infrastructure Noise

Noise Model

A three-dimensional noise model for the ancillary infrastructure has been developed based on the algorithm provided by *The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, 1981 (CONCAWE)*.

CONCAWE specifies a method for predicting noise levels at a distance from a noise source under meteorological conditions favourable to noise propagation (*noise-enhancing meteorological conditions* as referenced under the NPI). The algorithm also conservatively assumes that the favourable propagation conditions (which include wind blowing from the noise source to the assessment location) occur simultaneously between all sources and the assessment locations.

The model incorporates the following:

- the assessment locations detailed in Table 2
- topographical ground contours
- Meteorological Category 6 conditions (which correspond to 2m/s wind speed (downwind) and *pasquill stability category F*, as nominated for *noise enhancing weather conditions* under the NPI)
- 10°C temperature
- 80% relative humidity
- soft ground.

Transformers

The noise from the substations have been based on one 300 MVA rated transformer located at each of the six substation locations as detailed in Table 12 below.

Table 12 Substation Locations

| Substation ID | Centrepoint Co-ordinates (MGA Zone 55) | |
|---------------|----------------------------------------|----------|
| | Easting | Northing |
| East 1 | 376672 | 6124269 |
| East 2 | 382547 | 6123070 |
| East 3 | 383036 | 6117992 |
| West 1 | 358215 | 6138723 |
| West 2 | 358253 | 6130718 |
| West 3 | 356626 | 6126079 |

Sound Power Levels

The noise predictions have been based on a sound power level of 101 dB(A) for each of the 300 MVA transformers as derived from *Australian Standard AS 60076.10:2009 Power transformers – Part 10: Determination of sound levels*.

Special Noise Characteristics

The NPI requires a correction to be applied for any annoying noise characteristics that the project's operation exhibits at the assessment locations. The annoying characteristics include:

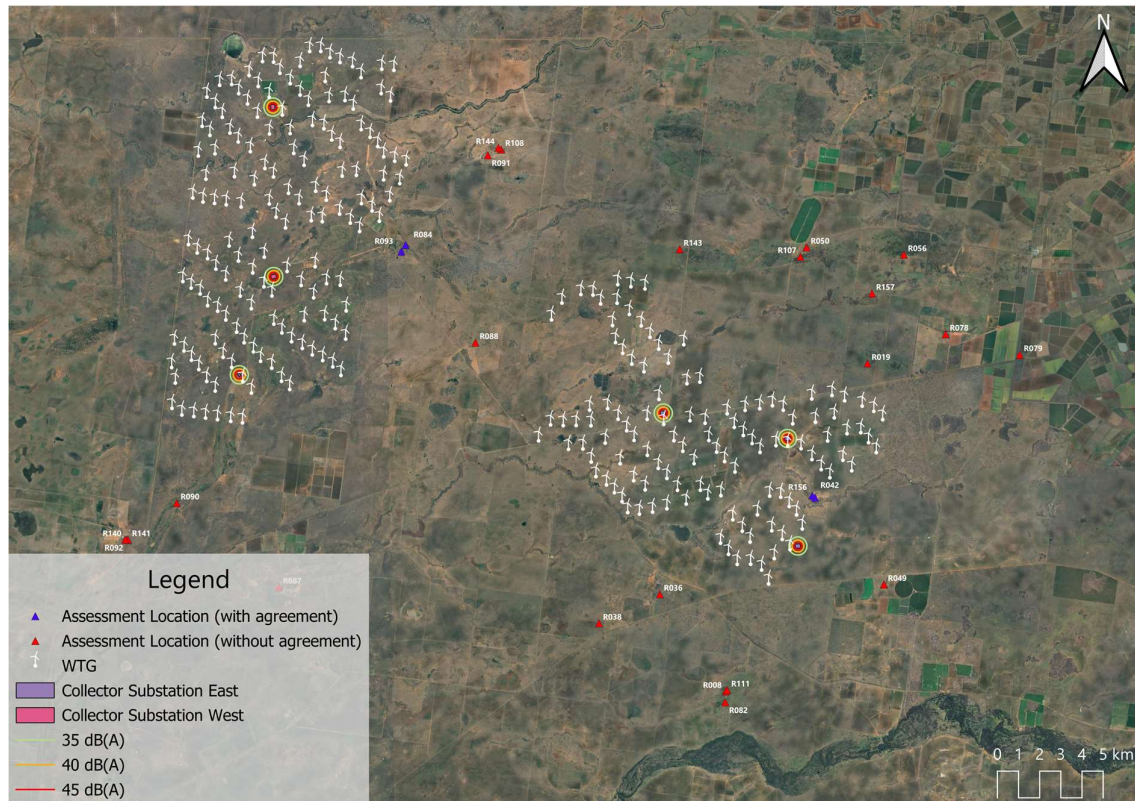
- Tonal noise
- Low frequency noise
- Intermittent noise

Whilst the noise from transformers can exhibit tonal noise characteristics when in close proximity, the assessment has been conducted on the basis that the assumed full capacity continual operation of the transformers will not exhibit dominant tonal or low frequency characteristics due to the separation distances of more than 4km between the substations and the closest assessment locations.

Predicted Noise Levels

Noise level predictions have been conducted using the noise model and inputs detailed above. The noise level from the transformers is predicted to be less than 15 dB(A) at the assessment locations. Noise level contours of the predictions are provided in Figure 6. Figure 6 indicates the localised nature of any noise impacts from the ancillary infrastructure.

Figure 6 Ancillary Infrastructure Noise Prediction Contours



WTGs and Ancillary Infrastructure

The SEARs require the operation of the WTGs to be assessed against the Bulletin and the *ancillary infrastructure* to be separately assessed against the NPI. The different assessment criteria are in recognition of the different noise generating characteristics of the WTGs and the ancillary infrastructure.

The NPI does not require additional consideration of cumulative impacts where the *project amenity noise levels* are achieved. Figure 6 shows that the noise impacts of the project's ancillary infrastructure are extremely localised, and readily achieve the NPI criteria at the assessment locations.

Due to these low predicted noise levels, there will be no cumulative noise impacts (if the NPI required such a consideration to be made) in combination with the WTGs at any assessment location, even if the WTGs were at the limit of the Bulletin criteria.

Construction Noise

The final construction activities and equipment will vary depending on the construction stage and the required processes. The predicted noise from construction activity is presented as a worst-case scenario for each stage of construction.

Construction activity will typically occur during the ICNG scheduled hours (i.e. 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday). Exceptions to these hours may be required for:

- OSOM deliveries outside of peak traffic times
- concrete batching and pouring
- crane movements between WTG sites
- activities that are inaudible outside the project area
- WTG construction when hindered by adverse weather conditions.

These activities will be justified to operate outside the recommended standard hours as required in accordance with Table 5 of this NIA and in particular, on the basis of safety and to *shorten the length of the project's construction*.

Noise Model

The noise from construction activity has been modelled based on the algorithm provided by CONCAWE. CONCAWE specifies a method for predicting noise levels at a distance from a noise source under meteorological conditions favourable to noise propagation. The predictions incorporate the following:

- the assessment locations detailed in Table 2
- sound power level data for the indicative construction activity as detailed in Table 13
- topographical ground contours
- Meteorological Category 6 conditions (which correspond to 2m/s wind speed (downwind) and *pasquill stability category F*, as nominated for *noise enhancing weather conditions* under the NPI
- 10°C temperature
- 80% relative humidity
- soft ground.

Noise Sources and Data

Construction of the project will include the following main stages:

1. Road upgrades
2. Site Mobilisation and Compound Establishment
3. Internal Access Road and Hardstand Construction
4. WTG Foundation Construction
5. Electrical Trenching and Cabling
6. WTG Installation, Commissioning and Testing
7. Substation and Electrical Connection Construction
8. Decommission of Temporary Structures and Demobilisation

These eight stages will include ancillary activities such as concrete batching at construction compounds, concrete pours at WTGs, crane movements within the development footprint and installation of transmission line infrastructure.

Sound Power Levels

Noise predictions for each stage of construction and key ancillary activities have been conducted based on the cumulative sound power levels provided in Table 13, using previous construction noise measurements and data available in *The South Australian Department of Infrastructure and Transport Guideline for the Management of Noise and Vibration: Construction and Maintenance Activities, 2021*. The use of the cumulative noise level for each stage is a conservative approach as it assumes all equipment associated with a construction stage will operate concurrently and continuously at full capacity.

Table 13 Construction Equipment Sound Power Levels

| Construction Stage or ancillary activity (location of construction) | Construction Hours | Equipment | Cumulative Sound Power Level |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Road upgrades (Road upgrades are proposed on Kidman Way, McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road) | Standard hours | Planer Bobcat Truck Front end loader Grader Vibratory roller Water truck | 118 dB(A) |
| Site Mobilisation and Compound Establishment (Accommodation camps, O&M facilities, and construction compounds) | Standard hours | Forklift Bulldozer Bobcat Excavator Truck Front end loader Grader Vibratory roller Water truck | 121 dB(A) |

| Construction Stage or ancillary activity (location of construction) | Construction Hours | Equipment | Cumulative Sound Power Level |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Concrete Batching (Construction compounds) | Standard hours and outside standard hours | Front end loader Concrete truck Batching plant | 117 dB(A) |
| Internal Access Road and Hardstand Construction (Access roads, accommodation camps, O&M facilities, and construction compounds) | Standard hours | Excavator Bobcat Truck Front end loader Grader Vibratory roller Water truck Concrete truck Concrete pump | 119 dB(A) |
| WTG Foundation Construction (WTG sites) | Standard hours | Crane Excavator Truck Front end loader Concrete truck Concrete pump | 118 dB(A) |
| Concrete Pour | Standard hours and outside standard hours | Concrete truck Concrete pump Generators Lights | 114 dB(A) |
| Electrical Trenching and Cabling (Transmission line and between WTG sites) | Standard hours | Trencher Front end loader Truck Low loader Crane | 118 dB(A) |
| Transmission Line Installation | Standard hours | Excavator Truck Crane Concrete truck Concrete pump | 116 dB(A) |
| Crane movements (between WTG sites) | Standard hours and outside standard hours | Crane | 113 dB(A) |
| WTG Installation, Commissioning and Testing (WTG sites) | Standard hours and outside standard hours (when hindered by adverse weather) | Truck Low loader Crane Hand tools | 116 dB(A) |

| Construction Stage or ancillary activity (location of construction) | Construction Hours | Equipment | Cumulative Sound Power Level |
|-------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Substation and Electrical Connection Construction (Substations and switchyards) | Standard hours | Excavator Bobcat Truck Front end Loader Vibratory roller Water truck Crane Concrete truck Concrete pump Hand tools | 120 dB(A) |
| Decommission Temporary Structures and Demobilisation (Accommodation camps and construction compounds) | Standard hours | Forklift Crane Trucks Front end Loader | 117 dB(A) |

Special Noise Characteristics

Under the ICNG, any noise predictions conducted for the purposes of a quantitative assessment shall include a 5 dB increase for the following activities:

- Use of 'beeper' style reversing or movement alarms
- Use of power saws
- Grinding metal, concrete or masonry
- Rock drilling
- Line drilling
- Vibratory rolling
- Bitumen milling or profiling
- Jackhammering, rock hammering or rock breaking
- Impact piling.

The project construction works may include some of these activities and therefore, for the purposes of conservatism all construction noise level predictions in this NIA have a 5 dB(A) adjustment included.

Predicted Noise Levels

Noise level predictions have been conducted for each construction stage using the noise level data and assumptions detailed above, and are summarised in Table 14 below.

The impacts of each stage of construction activity have been considered individually on the basis that whilst multiple construction stages will occur concurrently, they will be in different areas of the development footprint. This is adequately accounted for by considering the cumulative impacts of all equipment associated with a construction stage operating continuously at full capacity.

Table 14 Predicted Construction Noise Levels

| Construction Stage or ancillary activity (location of construction) | Distances to be Highly Noise Affected >75 dB(A) | Distances to be Noise Affected During Standard Hours >45 dB(A) | Distances to be Noise Affected Outside Standard Hours >35 dB(A) | Assessment Locations Predicted to be Noise Affected During Construction | Noise Level at Closest Assessment Location(s) and Corresponding Separation Distance |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Road upgrades (Road upgrades are proposed on Kidman Way, McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road) | Less than 100m | Less than 1300m | NA | R019 (standard hours) | Less than 49 dB(A) 1000m from development footprint |
| | | | | R079 (standard hours) | Less than 69 dB(A) 175m from development footprint |
| | | | | R088 (standard hours) | Less than 51 dB(A) 800m from development footprint |
| Site Mobilisation and Compound Establishment (Accommodation camps, O&M facilities, and construction compounds) | Less than 125m | Less than 1700m | NA | Nil | Less than 35 dB(A) R049 is 3350m from the Stage 1 accommodation camp |
| Concrete Batching (Construction compounds) | Less than 85m | Less than 1200m | Less than 2250m | Nil | Less than 30 dB(A) R088 is 3600m from the eastern construction compound in Stage 2 |
| Internal Access Road and Hardstand Construction (Access roads, accommodation camps, O&M facilities, and construction compounds) | Less than 100m | Less than 1400m | NA | Nil | Less than 41 dB(A) R019 is 1800m from the Stage 1 development footprint |

| Construction Stage or ancillary activity (location of construction) | Distances to be Highly Noise Affected >75 dB(A) | Distances to be Noise Affected During Standard Hours >45 dB(A) | Distances to be Noise Affected Outside Standard Hours >35 dB(A) | Assessment Locations Predicted to be Noise Affected During Construction | Noise Level at Closest Assessment Location(s) and Corresponding Separation Distance |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| WTG Foundation Construction (WTG sites) | Less than 100m | Less than 1300m | NA | Nil | Less than 40 dB(A) R019 is 2000m from Stage 1 WTG T122 |
| Concrete Pour | Less than 60m | Less than 1100m | Less than 2100m | R019 (outside standard hours for concrete pours at WTGs T117 and T122) | Less than 36 dB(A) R019 is less than 2100m from Stage 1 WTGs T117 and T122. All other WTGs are at greater distances than 2100m |
| Electrical Trenching and Cabling (Transmission line and between WTG sites) | Less than 100m | Less than 1300m | NA | Nil | Less than 40 dB(A) R019 is 2000m from Stage 1 WTG T122 |
| Transmission Line Installation | Less than 75m | Less than 1100m | NA | R088 (standard hours) | Less than 49 dB(A) R088 is 800m from the development footprint |
| Crane movements (between WTG sites) | Less than 60m | Less than 900m | Less than 1800m | Nil | Less than 35 dB(A) R019 is 1800m from the development corridor |
| WTG Installation, Commissioning and Testing (WTG sites) | Less than 80m | Less than 1100m | Less than 2250m | R019 (outside standard hours for installation of WTGs T114, T117, T122 and T124) | Less than 38 dB(A) R019 is less than 2250m from Stage 1 WTGs T114, T117, T122 and T124. |
| Substation and Electrical Connection Construction (Substations and switchyards) | Less than 110m | Less than 1500m | NA | Nil | Less than 31 dB(A) R049 is 4300m from the substation |
| Decommission Temporary Structures and Demobilisation (Accommodation camps and construction compounds) | Less than 85m | Less than 1200m | NA | Nil | Less than 31 dB(A) R049 is 3350m from the Stage 1 accommodation camp |

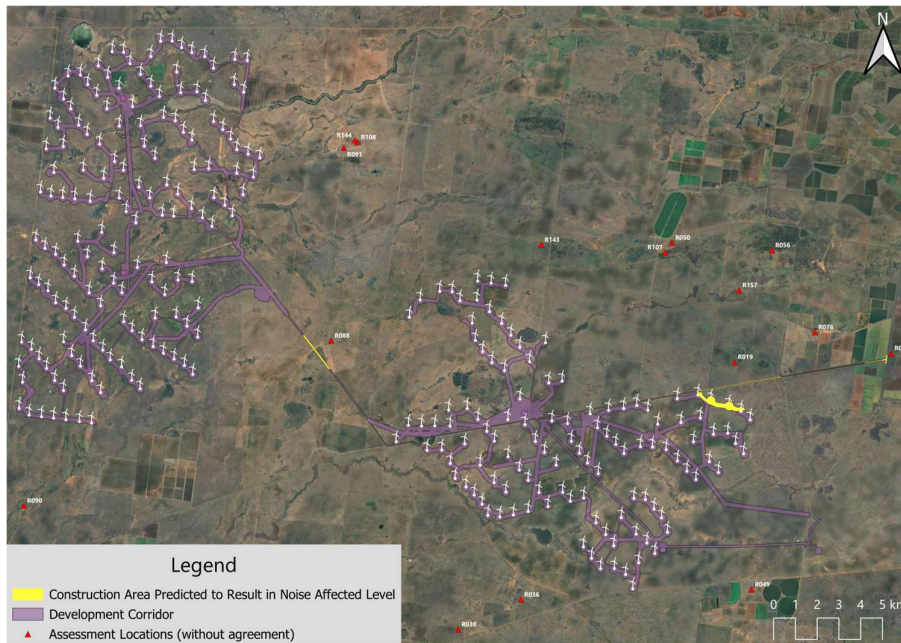
The noise predictions summarised in Table 14 indicate that for most assessment locations and most construction stages or ancillary activities, there are no specific requirements under the ICNG. Table 14 also indicates that assessment locations R019, R079, and R088 can be considered as *noise affected* by the ICNG for some construction stages and/or ancillary activities.

The ICNG requires construction *noise management measures* to be implemented for the road upgrades, concrete pours, transmission line installation and WTG installation activities in specific locations and times, tailored to the R019, R079 and R088 assessment locations in a *Construction Noise Management Plan*.

The R019, R079 and R088 assessment locations will only be *noise affected* for activities in specific and limited areas of the development corridor and/or during specific construction hours. An indication of the (limited) area where construction activity could result in assessment locations being *noise affected* is shown in Figure 7 below (refer to areas in the vicinity of R019, R079 and R088). The specific construction hours for the classification are detailed in Table 14 above.

It should be noted that the predicted noise levels at the assessment locations (used as the basis for Table 14) will be lower for construction scenarios where less equipment is used (than the full capacity cumulative operation assumed) or where the weather conditions differ (such as the wind blowing from the assessment location towards the construction activity).

Figure 7 Construction Area Predicted to Result in Noise Affected Levels



A draft *Construction Noise Management Plan Framework* is provided below as a standalone section of the NIA. The draft establishes the framework for finalisation during the detailed design stage of the project when the construction activities, processes, and staging locations are finalised by the construction team.

Traffic Noise

Traffic associated with the project will predominantly occur during construction, as opposed to a permanent increase in traffic flows, and will comprise a combination of light and heavy vehicles.

The project will be accessed via Kidman Way, McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road. From the site access points, private internal roads will be used to traverse the development corridor.

Noise Model

The noise from traffic has been modelled based on the algorithm provided by the *Federal Highway Administration "Traffic Noise Model", 2023*. The predictions incorporate the following:

- setback distances between the project access route and the assessment locations
- Kidman Way having a speed limit of 100 km/h
- Kidman Way having the following existing flows:
 - 426 light vehicle movements during the day (i.e. 7.00am to 10.00pm)
 - 325 heavy vehicle movements during the day
- McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road having a speed limit of 100 km/h
- McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road each having the following existing flows
 - 4 light vehicle movements during the daytime peak hour
 - 2 heavy vehicle movements during the daytime peak hour
- The project generating:
 - up to 268 light vehicle movements during the day on public roads (it is conservatively assumed that all of these will occur during the daytime peak hour)
 - up to 100 heavy vehicle movements during the day on public roads (with 10 during the daytime peak hour)
 - up to 5 OSOM heavy vehicle movements in a 24-hour period (it is conservatively assumed that 1 of these will occur during the daytime peak hour, noting that scheduling will try to avoid OSOM movements occurring during the daytime peak hour).

Predicted Noise Levels

Noise level predictions have been conducted using the assumptions detailed above, as summarised in Table 15. Reference to *existing* in Table 15 relates to the current traffic flows, and reference to *existing and construction* in Table 15 relates to the current traffic flows plus the expected construction movements.

Table 15 Predicted Traffic Noise Levels

| Road Category | Assessment Criterion (dB(A)) | Distance to Achieve Criterion | | Noise at closest assessment location / dwelling | |
|---------------------------------------------------------------------|-------------------------------------------------|-------------------------------|---------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| | | Existing | Existing and Construction | Existing | Existing and Construction |
| Kidman Way | L _{Aeq, 15 hours} 60 dB(A) (external)) | 35m | 45m | 57 dB(A) at 55m (R025 -closest assessment location setback in vicinity of project) | 59 dB(A) at 55m (R025 -closest assessment location setback in vicinity of project) |
| McLennons Bore Road, Wilson Road, Fernbank Road and Goolgumbra Road | L _{Aeq, 1 hour} 55 dB(A) (external)) | 15m | 120m | 33dB(A) at 380m (R079 -closest assessment location setback in vicinity of project) | 43 dB(A) at 380m (R079 -closest assessment location setback in vicinity of project) |

Based on the above, the traffic noise criteria are expected to be achieved in the vicinity of the project during the day.

There could be some dwellings in locations away from the project area that could be closer than the above distances specified to achieve the RNP criteria. The following *reasonable* measures are provided to minimise any traffic noise associated with the project at all assessment locations, including the OSOM heavy vehicle movements (these are also included in the *Construction Noise Management Plan Framework*):

- Communicate with the surrounding community to inform them when and where project traffic movements will occur on the public road network
- Schedule construction traffic to minimise noise and congestion on public roads (other than where specific timing is required for OSOM movements)
- Schedule deliveries and heavy vehicle movements to the nominated standard hours to the extent practicable, unless specific activity is justified (such as for OSOM movements) in the *Construction Noise Management Plan*
- Keep truck drivers informed of designated vehicle routes, site access points, parking locations and, acceptable delivery hours
- Implement driver training that includes methods of noise minimisation (such as avoid excessive acceleration or use of truck engine brakes in close proximity to dwellings, and not allowing extended periods of engine idling).

Vibration

Localised vibration associated with the project will occur during construction from activities such as trenching, excavation and compaction.

The Vibration Guidelines criteria are based on the human responses to perceptible levels of vibration and typically, would only be relevant in built up suburban areas where trenching, excavation and compaction is occurring in the localised vicinity.

Whilst the vibration from construction can vary depending on the specific equipment used, construction technique and local ground conditions, the vibration levels at separation distances of 180m (equivalent to the closest assessment location (R079) from project construction activities) will not be perceptible.

Based on the above, the Vibration Guidelines will inherently be achieved without any specific measures.

Cumulative Impacts

Should the project gain approval and proceed to construction, it could interface with other existing, approved and proposed renewable energy infrastructure projects. Known projects include:

- Project EnergyConnect's Dinawan Substation and transmission line (under construction)
- Dinawan Solar Farm (proposed)
- Argoon Wind Farm (proposed)
- Yanco Delta Wind Farm (approved)
- Pottinger Wind Farm (proposed)
- Pottinger Solar Farm (proposed)
- Coleambally Solar Farm (operating)
- Coleambally BESS (approved)
- Bullawah Wind Farm (proposed)
- Darlington Point Solar Farm (operating)
- Woodland Battery Energy Storage System (proposed)
- Yarrabee Solar Farm (approved)
- Billabong Creek Environmental Water Regulators (proposed)
- Currawarra Solar Farm (approved)
- Tarleigh Park Solar Farm (approved)
- The Plains Solar Farm (proposed)
- The Plains Wind Farm (proposed)
- Tchelery Wind Farm (proposed)
- Baldon Wind Farm (proposed)

Operation

WTG Noise

The Bulletin establishes criteria based on the Wind Farm Guidelines that *accounts for the cumulative effect of noise from other similar development and for the increased sensitivity of receivers to a new noise source.*

Notwithstanding the above, consideration has been given to the closest wind farms which are understood to be the approved Yanco Delta Wind Farm and the proposed Argoon Wind Farm.

The approved Yanco Delta Wind Farm *Technical Report – Noise and Vibration dated June 2002* has been reviewed and noise levels are predicted to be 31 dB(A) or less at all assessment locations without an agreement.

With reference to Table 11 of this NIA, the noise levels from the project are predicted to be 30 dB(A) or less at the same assessment locations. Based on the above, the cumulative WTG noise of the Yanco Delta Wind Farm and the project is expected to be 33 dB(A) or less at all assessment locations.

That is, whilst there are no criteria that apply to cumulative impacts, the noise from the combined operation of the Dinawan Wind Farm and Yanco Delta Wind Farm would comply with the Bulletin's *base equivalent noise level* ($L_{Aeq,10 \text{ minute}}$) of 35 dB(A).

There is no publicly available technical report or NIA relating to the Argoon Wind Farm to provide a similar analysis for further information.

Ancillary Infrastructure Noise

The NPI does not require additional consideration of cumulative impacts where the *project amenity noise levels* are achieved. It is noted that the noise impacts of the project's ancillary infrastructure are extremely localised, such that the predicted noise levels are significantly less than the NPI criteria at the assessment locations (by a margin of 20 dB(A)).

As such, there will be no cumulative noise impacts from the ancillary infrastructure (if the NPI required such a consideration to be made) in combination with any noise source at any neighbouring renewable energy project, even if those projects were designed to the limit of the NPI criteria.

Construction

The ICNG requires that noise from construction activity be determined and feasible and reasonable work practices developed where assessment locations could be *noise affected*. The NIA assessment demonstrates that construction noise at all assessment locations will be significantly less than the *highly noise affected* category of the ICNG (with the exception of localised and limited road works in the vicinity of assessment location R079). As such, the *Draft Construction Noise Management Plan Framework* in this NIA will be sufficient to manage noise impacts even with construction activity of a similar type occurring on an interfacing project at the same time and in the same vicinity.

Summary

Based on the above, the project will not constrain the suitable development, operation, or construction of neighbouring renewable energy projects, and is not expected to result in adverse cumulative impacts at any assessment locations.

Draft Construction Noise Management Plan Framework

A *Construction Noise Management Plan* in accordance with the ICNG will be prepared for construction activities within the development corridor. The *Construction Noise Management Plan* will be subject to the final construction activities, processes, and staging locations.

This *Draft Construction Noise Management Plan Framework* establishes a plan, including potential management measures that are relevant to the project based on the recommendations of the ICNG.

The measures will be updated by the construction team and included in the final *Construction Noise Management Plan*. That process will ensure that construction activity that might result in the *noise affected* levels being exceeded are identified, and feasible and reasonable work practices developed.

The key items that the final *Construction Noise Management Plan* will address will be to:

- Define the areas to which the plan applies and the relevant conditions of consent
- Provide construction timing, activities and stages
- Define commitments for managing noise during construction
- Establish protocols for educating staff and contractors of their obligations relating to noise management through a site induction process
- Identify relevant project contacts, their details and the reporting hierarchy for complaints
- Define a complaints reporting and documentation process, including resolution procedures
- Identify ways to ensure ongoing consultation and communication with R019, R079, and R088 (as required to provide project updates)
- Provide a process for reviewing, improving and updating the plan.

Individuals responsible for the implementation of the plan will be identified through the detailed design stage of the project and the *Construction Noise Management Plan* will be maintained within Spark Renewables' document control system.

The following noise control measures and framework have been prepared based on the anticipated construction methods and processes. They will be updated with the actual construction processes and included in the final *Construction Noise Management Plan*.

Development footprint

- List the final construction timing, activities and staging locations
- Determine the footprint of construction activities subject to the *Construction Noise Management Plan* based on the list

Work Scheduling

- Schedule activities to minimise noise impacts
 - Organise work to be undertaken during the recommended standard hours, being:
 - *Monday to Friday 7 am to 6 pm*
 - *Saturday 8 am to 1 pm*
 - *No work on Sundays or public holidays*
 - Should works be necessary outside the recommended standard hours (expected to be OSOM deliveries, concrete batching and pouring, crane movements between WTG sites, activities that are inaudible outside the project area, and WTG construction when hindered by adverse weather conditions), ensure that they fall within the categories provided in Table 5 of the NIA for approval by the authority
 - Schedule construction traffic to minimise noise and congestion on public roads (other than where specific timing is required for OSOM movements)
 - Designate access routes and make drivers aware of nominated vehicle routes
 - Schedule deliveries and heavy vehicle movements to the nominated standard hours to the extent practicable, unless specific activity is justified (such as for OSOM movements).

Work Practices

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise
- Ensure site managers periodically check for excessive noise generating activities and ensure solutions can be applied quickly
- Include in tenders, employment contracts, subcontractor agreements and work method statements, clauses that require noise to be minimised and compliance with directions from management
- Keep truck drivers informed of designated vehicle routes, site access points, parking locations, and acceptable delivery hours
- Implement driver training that includes methods of noise minimisation (such as avoid excessive acceleration or use of truck engine brakes in close proximity to dwellings, and not allowing extended periods of engine idling).

Consultation and Complaints

- Provide information to the landowners of R019, R079, and R088 (the closest assessment locations that are potentially *noise affected* for some construction activities) relating to the construction program, reasonably ahead of time, such as:
 - total construction time
 - what works are expected to be noisy
 - the duration of these works
 - what is being done to minimise noise
 - when respite periods will occur
- Communicate with the surrounding community to inform them when and where project traffic movements will occur on the public road network
- Provide regular newsletters with site news, significant project events and timing of different activities. The information should be provided by letter, meetings, individual contact or project website
- Use a site information board at the site access points with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include after hours emergency contact details
- Appoint a community liaison officer and provide a contact phone number for enquiries and complaints during the works
- Record complaints in a designated register, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area, time of verbal response and timeframe for written response where appropriate. The complaints document shall include an escalation procedure so that if a complainant is not satisfied there is a clear path to follow
- Keep people informed of action to be taken to address noise complaint
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information
- Implement all feasible and reasonable measures to address the noise generating activity that has resulted in the complaint.

Plant and Equipment

- Where possible, use quieter construction methods, such as alternatives to diesel and petrol engines and pneumatic units. These can include hydraulic or electric controlled units where feasible and reasonable
- Use quieter equipment
 - Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber track excavators can be less noisy than steel tracked
 - Use *supersilenced* compressors, silenced jackhammers, and damped bits where possible

- For rented equipment, select quieter items of plant and equipment where these will be acceptable for performing the required activity
- For purchased equipment, select the most effective mufflers, enclosures and low-noise tool bits and blades (always seek the manufacturer's advice before making modifications to plant to reduce noise)
- Where feasible and reasonable, install less annoying alternatives to 'beeper' alarms taking into account the requirements of the Occupational Safety legislation; examples are smart alarms that adjust their volume depending on the ambient level of noise and broadband alarms that emit noise over a wide range of frequencies
- Operate plant in a quiet and efficient manner and reduce throttle settings and turn off equipment when not being used (do not let them idle excessively)
- Equipment maintenance
 - Regularly inspect (including mufflers and doors/seals of enclosures) and maintain equipment to ensure it is in good working order
 - Do not operate any defective or worn equipment until it is maintained or repaired (where maintenance or repair would minimise the noise from its use)
 - Return any hired equipment that is causing noise that is not typical for the equipment
 - Ensure that the air lines on pneumatic equipment do not leak

Site Set-up

- Locate fixed plant locations such that it maximises the distance between the plant or equipment and assessment locations
- Locate the site access points, construction compounds and parking areas away from assessment locations where practical
- Carry out noisy fabrication work off site and then transport these items to site
- Design the site layout to avoid reversing such as by including drive through parking and delivery bays
- Maximise shielding by using site buildings and materials stockpiles as noise barriers to R019, R079, and R088 where practical to do so

Auditing and Documentation Control

- Appoint an auditor to review the construction practices against the *Construction Noise Management Plan* at nominated times
- Identify and implement improvements to the *Construction Noise Management Plan* based on the audit
- List the persons responsible for implementing the *Construction Noise Management Plan*
- Store the *Construction Noise Management Plan* and any updated versions in the Spark Renewables' document control system.

Mitigation Measures

A summary of mitigation measures recommended by the NIA is provided in Table 16.

Table 16 Summary of Mitigation Measures

| Assessment | Mitigation Measure |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| WTGs | Pre-construction noise modelling to reflect changes which can arise to ensure ongoing compliance with the noise assessment criteria. |
| Ancillary Infrastructure | No specific measures required due to separation distances between ancillary infrastructure and assessment locations |
| Construction Noise | Development of a <i>Construction Noise Management Plan</i> in accordance with the ICNG |
| Traffic noise | Implement <i>reasonable</i> measures within the <i>Construction Noise Management Plan</i> to minimise any traffic noise associated with the project |
| Vibration | No specific measures required due to separation distances between development footprint and assessment locations |
| Cumulative Impacts | No specific measures required |

Conclusion

The Dinawan Wind Farm includes:

- a network of approximately 200 (3 blade) WTGs across two areas
- electrical collection system, substations and control rooms
- electricity transmission line infrastructure connecting the project substations to the Dinawan Substation
- operations and maintenance infrastructure and other permanent infrastructure
- temporary construction facilities
- public road upgrades to facilitate the delivery of WTG components

This NIA responds to the SEARs, which require assessment of the following:

- noise associated with operation of WTGs and ancillary infrastructure
- noise associated with construction
- noise associated with traffic
- vibration
- cumulative impacts with other renewable energy projects.

The NIA confirms the operation of the WTGs and ancillary infrastructure can comply with the relevant objective assessment criteria provided under the *NSW Department of Planning and Environment Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development* and the *NSW Environment Protection Authority Noise Policy for Industry*.

The NIA also confirms construction activity and traffic noise will not have adverse impacts at residences in the vicinity of the development footprint with the implementation of *feasible and reasonable* work practices, and the vibration criteria will be readily achieved.

Consideration is also given to cumulative impacts, and it is confirmed that the project will not constrain the development, operation, or construction of neighbouring renewable energy projects.

Based on the above, the NIA concludes that noise and vibration generated by the project will achieve the SEARs requirements and as such, will not adversely impact on the acoustic amenity of the residences within the vicinity of the project.

Appendix A: Eastern Cluster of WTGs (Stage 1)

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T1 | 370775 | 6122955 |
| T3 | 371344 | 6123711 |
| T4 | 371387 | 6128668 |
| T5 | 371943 | 6123676 |
| T6 | 371879 | 6129463 |
| T7 | 372192 | 6122557 |
| T8 | 372553 | 6123686 |
| T9 | 372777 | 6129867 |
| T10 | 372872 | 6122575 |
| T11 | 373191 | 6124411 |
| T12 | 373265 | 6121957 |
| T13 | 373350 | 6129840 |
| T14 | 373253 | 6123672 |
| T15 | 373488 | 6121268 |
| T16 | 373711 | 6129425 |
| T17 | 374271 | 6128402 |
| T18 | 373928 | 6122850 |
| T19 | 373988 | 6120879 |
| T20 | 374042 | 6124479 |
| T21 | 374362 | 6120508 |
| T22 | 374415 | 6127600 |
| T23 | 374520 | 6130335 |
| T24 | 374536 | 6123977 |
| T25 | 374633 | 6121876 |
| T26 | 374488 | 6129457 |
| T27 | 374724 | 6120086 |
| T28 | 374753 | 6127090 |
| T29 | 374943 | 6123434 |
| T30 | 374991 | 6119572 |
| T31 | 375068 | 6128928 |
| T32 | 375142 | 6130237 |
| T33 | 375180 | 6126585 |
| T34 | 375293 | 6122979 |
| T35 | 375274 | 6121074 |
| T36 | 375545 | 6119498 |
| T37 | 375630 | 6128388 |
| T38 | 375758 | 6126219 |
| T39 | 375807 | 6130132 |
| T40 | 375817 | 6120641 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T41 | 375910 | 6123971 |
| T42 | 375918 | 6122274 |
| T43 | 376047 | 6127846 |
| T44 | 376165 | 6119590 |
| T45 | 376435 | 6121658 |
| T47 | 376466 | 6124916 |
| T48 | 376458 | 6127288 |
| T49 | 376694 | 6123736 |
| T50 | 376845 | 6121183 |
| T51 | 376844 | 6119751 |
| T52 | 376909 | 6126626 |
| T54 | 377174 | 6122967 |
| T56 | 377343 | 6120623 |
| T58 | 377597 | 6122467 |
| T59 | 377642 | 6127497 |
| T61 | 377754 | 6119972 |
| T62 | 377792 | 6125654 |
| T63 | 377934 | 6123908 |
| T64 | 378127 | 6121879 |
| T66 | 378426 | 6120629 |
| T67 | 378402 | 6125733 |
| T69 | 378651 | 6123791 |
| T70 | 378779 | 6120221 |
| T71 | 378825 | 6122974 |
| T72 | 379197 | 6122428 |
| T73 | 379379 | 6118125 |
| T74 | 379395 | 6120373 |
| T75 | 379691 | 6124240 |
| T76 | 379571 | 6121980 |
| T77 | 379755 | 6117601 |
| T78 | 379959 | 6119233 |
| T79 | 380028 | 6123596 |
| T80 | 380064 | 6121485 |
| T81 | 380169 | 6117124 |
| T82 | 380409 | 6118690 |
| T83 | 380457 | 6123209 |
| T84 | 380540 | 6124396 |
| T85 | 380777 | 6118178 |
| T86 | 380803 | 6117131 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T87 | 380874 | 6122830 |
| T88 | 381123 | 6119464 |
| T89 | 381232 | 6124478 |
| T90 | 381248 | 6122411 |
| T91 | 381321 | 6116858 |
| T92 | 381653 | 6116199 |
| T93 | 381702 | 6120349 |
| T94 | 381802 | 6118709 |
| T95 | 381833 | 6124618 |
| T96 | 381919 | 6117397 |
| T97 | 382001 | 6122729 |
| T98 | 382227 | 6120296 |
| T99 | 382298 | 6118303 |
| T100 | 382345 | 6124402 |
| T101 | 382557 | 6122713 |
| T102 | 382623 | 6119859 |
| T103 | 382665 | 6117820 |
| T104 | 382795 | 6123762 |
| T105 | 382974 | 6119460 |
| T106 | 383184 | 6122586 |
| T107 | 383245 | 6118795 |
| T108 | 383693 | 6124939 |
| T109 | 383702 | 6122072 |
| T110 | 383864 | 6123841 |
| T111 | 384140 | 6121600 |
| T112 | 384443 | 6122951 |
| T113 | 384550 | 6121215 |
| T114 | 384649 | 6125102 |
| T115 | 384756 | 6124043 |
| T116 | 385166 | 6122040 |
| T117 | 385244 | 6124849 |
| T118 | 385358 | 6123296 |
| T119 | 385585 | 6121543 |
| T120 | 386013 | 6123343 |
| T122 | 386077 | 6124596 |
| T123 | 386376 | 6122873 |
| T124 | 386627 | 6124352 |
| T125 | 386743 | 6122403 |
| T126 | 387045 | 6123960 |

Appendix B: Western Cluster of WTGs (Stage 2)

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T1 | 353429 | 6126420 |
| T2 | 353447 | 6124493 |
| T3 | 353563 | 6127533 |
| T4 | 353606 | 6125688 |
| T6 | 353912 | 6124178 |
| T7 | 353957 | 6130482 |
| T9 | 354016 | 6127202 |
| T10 | 354221 | 6132224 |
| T11 | 354350 | 6130172 |
| T12 | 354367 | 6126765 |
| T13 | 354431 | 6134426 |
| T14 | 354476 | 6124106 |
| T15 | 354638 | 6131830 |
| T16 | 354690 | 6136409 |
| T17 | 354779 | 6129896 |
| T18 | 354713 | 6126323 |
| T19 | 354874 | 6137810 |
| T20 | 355049 | 6135315 |
| T21 | 354912 | 6134235 |
| T22 | 355033 | 6124034 |
| T23 | 355096 | 6139192 |
| T24 | 355086 | 6125765 |
| T25 | 355130 | 6129340 |
| T26 | 355128 | 6131564 |
| T27 | 355239 | 6137383 |
| T28 | 355492 | 6138695 |
| T29 | 355457 | 6134171 |
| T30 | 355478 | 6136511 |
| T31 | 355490 | 6125309 |
| T32 | 355490 | 6127541 |
| T33 | 355519 | 6131066 |
| T34 | 355597 | 6123961 |
| T35 | 355604 | 6129081 |
| T36 | 355700 | 6139749 |
| T37 | 355822 | 6138236 |
| T38 | 355862 | 6126906 |
| T39 | 355986 | 6130556 |
| T40 | 355991 | 6128667 |
| T41 | 356010 | 6134107 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T42 | 356149 | 6132162 |
| T43 | 356187 | 6137491 |
| T44 | 356265 | 6139786 |
| T45 | 356222 | 6123880 |
| T46 | 356268 | 6126425 |
| T47 | 356398 | 6135430 |
| T48 | 356505 | 6128090 |
| T49 | 356601 | 6139354 |
| T50 | 356577 | 6137072 |
| T51 | 356587 | 6131449 |
| T52 | 356669 | 6129790 |
| T53 | 356713 | 6133999 |
| T54 | 356778 | 6123809 |
| T55 | 356793 | 6125756 |
| T56 | 356855 | 6127591 |
| T57 | 357018 | 6138864 |
| T58 | 357091 | 6140209 |
| T59 | 357150 | 6136616 |
| T60 | 357198 | 6129197 |
| T61 | 357249 | 6132574 |
| T62 | 357265 | 6130889 |
| T63 | 357296 | 6127162 |
| T64 | 357200 | 6125211 |
| T66 | 357338 | 6135052 |
| T67 | 357485 | 6138244 |
| T68 | 357523 | 6139692 |
| T69 | 357634 | 6126715 |
| T70 | 357725 | 6140870 |
| T71 | 357793 | 6130236 |
| T72 | 357807 | 6131633 |
| T73 | 357837 | 6135819 |
| T75 | 358041 | 6139187 |
| T76 | 358044 | 6134144 |
| T77 | 358053 | 6137449 |
| T78 | 358170 | 6129796 |
| T79 | 358161 | 6126390 |
| T80 | 358245 | 6135420 |
| T81 | 358261 | 6128468 |
| T82 | 358250 | 6140841 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T83 | 358366 | 6133522 |
| T85 | 358663 | 6138343 |
| T86 | 358623 | 6125773 |
| T87 | 358643 | 6128052 |
| T88 | 358547 | 6140314 |
| T89 | 358812 | 6133011 |
| T90 | 358886 | 6130956 |
| T91 | 358954 | 6134647 |
| T92 | 359009 | 6125382 |
| T93 | 359031 | 6137468 |
| T94 | 359033 | 6139825 |
| T95 | 359098 | 6127639 |
| T97 | 359202 | 6136529 |
| T100 | 359454 | 6134155 |
| T101 | 359503 | 6140643 |
| T102 | 359503 | 6139288 |
| T103 | 359552 | 6130296 |
| T104 | 359608 | 6127324 |
| T105 | 359698 | 6128633 |
| T106 | 359690 | 6135970 |
| T108 | 359895 | 6138806 |
| T109 | 359955 | 6141345 |
| T110 | 360031 | 6133355 |
| T111 | 360078 | 6127018 |
| T112 | 360086 | 6137851 |
| T113 | 360142 | 6129713 |
| T114 | 360237 | 6134747 |
| T115 | 360214 | 6131180 |
| T118 | 360551 | 6133308 |
| T119 | 360479 | 6141349 |
| T120 | 360571 | 6126750 |
| T121 | 360625 | 6137696 |
| T122 | 360691 | 6139927 |
| T123 | 360665 | 6128680 |
| T124 | 360752 | 6130381 |
| T125 | 360742 | 6134327 |
| T127 | 360874 | 6138982 |
| T128 | 360917 | 6141050 |
| T129 | 361000 | 6137164 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T130 | 361047 | 6126454 |
| T131 | 361164 | 6128260 |
| T133 | 361369 | 6133664 |
| T134 | 361392 | 6136813 |
| T135 | 361400 | 6130306 |
| T136 | 361387 | 6140825 |
| T137 | 361434 | 6126047 |
| T138 | 361494 | 6135460 |
| T139 | 361626 | 6139026 |
| T140 | 361656 | 6127764 |
| T141 | 361677 | 6129097 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T142 | 361878 | 6133241 |
| T143 | 361982 | 6140635 |
| T144 | 362017 | 6138624 |
| T145 | 362315 | 6132846 |
| T146 | 362164 | 6135495 |
| T147 | 362385 | 6140110 |
| T148 | 362390 | 6137656 |
| T149 | 362403 | 6134160 |
| T150 | 362813 | 6137288 |
| T152 | 362906 | 6133817 |
| T153 | 363171 | 6136856 |

| WTG ID | Co-ordinates (MGA Zone 55) | |
|--------|-------------------------------|----------|
| | Easting | Northing |
| T154 | 363251 | 6133327 |
| T155 | 363336 | 6139357 |
| T156 | 363365 | 6140507 |
| T157 | 363450 | 6135282 |
| T158 | 363454 | 6136372 |
| T159 | 363741 | 6134298 |
| T160 | 363777 | 6139010 |
| T161 | 363974 | 6136160 |
| T162 | 363936 | 6140456 |
| T163 | 364216 | 6135105 |
| T164 | 364515 | 6135991 |

References

Australian/New Zealand Standard AS/NZS 60076.10:2009 Power transformers Part 10: Determination of sound levels (IEC 60076-10, Ed.1 (2001) MOD))

CONCAWE: The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, 1981

Federal Highway Administration "Traffic Noise Model", 2023

Institute of Acoustics "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise", 2013

International Standard ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

Jacobs "Yanco Delta Wind Farm" Technical Report – Noise and Vibration, June 2002

NSW Department of Environment & Climate Change - Assessing Vibration: A Technical Guideline, 2006

NSW Department of Environment & Climate Change - Interim Construction Noise Guideline, 2009

NSW Department of Environment, Climate Change and Water - Road Noise Policy, 2011

NSW Environment Protection Authority - Noise Policy for Industry, 2017

NSW Government - Cumulative Impact Assessment Guidelines for State Significant Projects, 2022

NSW Department of Planning and Environment Wind Energy: Noise Assessment Bulletin for State Significant Wind Energy Development, 2016

South Australian Department of Infrastructure and Transport Guideline for the Management of Noise and Vibration: Construction and Maintenance Activities, 2021

State Environmental Planning Policy (Planning Systems) 2021

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