RE Future

Brewster Wind Farm

Appendix D

Environmental Noise Assessment

December 2021

MARSHALL DAY Acoustics

BREWSTER WIND FARM
ENVIRONMENTAL NOISE ASSESSMENT

Rp 001 R04 20200543 | 17 October 2021

MARSHALL DAY Acoustics

[redacted]

Project: **Brewster Wind Farm**
Environmental Noise Assessment

Prepared for: **Brewster Wind Farm Pty Ltd**

Attention: [redacted]

Report No.: **Rp 001 R04 20200943**

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Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Complete	-	Issued to client	18 Mar. 2021	C. Delaire	J. Adcock
Complete	01	Minor correction	23 Mar. 2021	C. Delaire	J. Adcock
Complete	02	Revised layout	28 May 2021	C. Delaire	A. Morabito
Complete	03	Revised layout	7 Jun. 2021	C. Delaire	A. Morabito
Complete	04	Revised layout, additional receivers and new Regulations	17 Oct. 2021	C. Delaire	J. Adcock

Certified System ISO 9001

EXECUTIVE SUMMARY

This report presents the results of an assessment of environmental noise associated with the Brewster Wind Farm that is proposed to be developed by Brewster Wind Farm Pty Ltd. The assessment is based on the proposed wind farm layout comprising seven (7) multi-megawatt turbines and the associated transformer station.

The planning application for the wind farm seeks approval to develop turbines with a maximum tip height of 247 m. The actual turbine which would be used at the site would be determined at a later stage in the project, after the project has been granted planning approval. The final selection would be based on a range of design requirements including achieving compliance with the planning permit noise limits at surrounding noise sensitive locations (receivers). In advance of a final selection, this assessment considers a candidate turbine model that is representative of the size and type of turbine which could be used at the site. For this purpose, the Vestas V162-6.0MW with a nominal hub height of 166 m and rotor diameter of 162 m, has been nominated by the proponent.

Operational noise from the proposed wind turbines has been assessed in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* and the Victorian Department of Environment, Land, Water and Planning *Policy and planning guidelines for development of wind energy facilities in Victoria* dated July 2021. The operational wind farm noise assessment considers base noise limits determined in accordance with NZS 6808, accounting for the land zoning of the area. Consideration was also given to the general environmental duty introduced by the *Environment Protection Act 2017* (the EP Act) in July 2021.

Manufacturer specification data provided by the proponent for the candidate turbine model has been used as the basis for the assessment. This specification provides noise emission data in accordance with the international standard referenced in NZS 6 808. The noise emission data is consistent with the range of values expected for comparable types of multi megawatt wind turbine models that are being considered for the site.

The noise emission data has been used with international standard ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2) to predict the level of noise expected occur at neighbouring receivers. The ISO 9613-2 standard has been applied using well-established input choices and adjustments, based on research and international guidance, that are specific to wind farm noise assessment.

The results of the noise modelling for the Brewster Wind Farm demonstrate that the predicted noise levels for the proposed turbine layout and candidate turbine model achieve the base (minimum) noise limits determined in accordance with NZS 6808 at all neighbouring receivers.

The noise limits determined in accordance with NZS 6808 apply to the total combined operational wind turbine noise level, including the contribution of any neighbouring wind farm developments. The assessment has therefore also considered two (2) projects located within 10 km of the Brewster Wind Farm; the operational Waubra Wind Farm, and the Stockyard Hill Wind Farm, currently under construction. An assessment of the predicted noise levels of these two wind farms has demonstrated that cumulative wind farms noise levels do not affect the compliance outcomes for any of the assessed projects.

The assessment has also considered operational noise of infrastructure associated with the wind farm (i.e. a transformer station), to be located to the north of the site. Noise levels from the transformer station have been assessed in accordance with EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, dated May 2021 (the Noise Protocol). The assessment demonstrates that the transformer station can be designed and operated to achieve the noise limits determined in accordance with the Noise Protocol.

The noise assessment therefore demonstrates that the proposed Brewster Wind Farm, and the associated transformer station, can be designed and developed to achieve Victorian policy requirements.

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1.0 INTRODUCTION

Brewster Wind Farm Pty Ltd is proposing to develop a wind farm known as the Brewster Wind Farm within the Victorian local government area of the Pyrenees Shire Council.

The Brewster Wind Farm is proposed to comprise seven (7) wind turbines and an associated transformer station, located approximately ten (10) kilometres east of Beaufort. Throughout this report, the term 'wind farm' refers to both the wind turbines and the transformer station.

This report presents the results of an assessment of operational noise associated with the turbines, undertaken in accordance with the New Zealand Standard 6808 *Acoustics – Wind farm noise* (NZS 6808) as required by the *Environment Protection Regulations 2021* (the EP Regulations) and the Victorian Department of Environment, Land, Water and Planning *Policy and planning guidelines for development of wind energy facilities in Victoria* dated July 2021 (the Victorian Wind Energy Guidelines).

Operational noise of the proposed transformer station has been assessed in accordance with EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated May 2021 (Noise Protocol), as required by the EP Regulations.

The noise assessment presented in this report is based on:

- Operational noise limits determined in accordance with NZS 6808 and the Noise Protocol, accounting for local land zoning;
- Predicted noise levels for the proposed Brewster Wind Farm turbines, based on the proposed site layout and a candidate turbine model that is representative of the size and type of turbine that the planning application seeks consent for;
- Predicted noise levels for the proposed transformer station, based on empirical noise emission data;
- A comparison of the predicted noise levels with the applicable base noise limits determined in accordance with NZS 6808 and the noise limits defined by the Noise Protocol; and

As required by the *Environment Protection Act 2017,* consideration was also given to the general environmental duty.

Acoustic terminology used in this report is presented in Appendix A.

2.0 PROJECT DESCRIPTION

The Brewster Wind Farm is proposed to comprise seven (7) wind turbines. The coordinates of the proposed wind turbines are tabulated in Appendix B.

The proponent is seeking consent for a wind farm comprising wind turbines extending to a tip height of up to 247 m. The Vestas V162-6.0MW, with a power output of 6.0 MW and a rotor diameter of 162 m, has been selected as the candidate turbine model for this assessment. Further details of the candidate turbine model are presented in Section 6.2.

A transformer station is also proposed to be located close to the east-most wind turbine (see coordinates in Appendix B).

A total of seventy-five (75) noise sensitive locations (generally referred to as *receivers* herein) located within 5 km of the proposed turbines have been considered in this noise assessment. This includes four (4) host landholders (subsequently referred to as *stakeholder receivers* herein).

The coordinates of the receivers are tabulated in Appendix C.

A site layout plan illustrating the turbine layout, transformer station and receivers is provided in Appendix D.

3.0 VICTORIAN LEGISLATION & GUIDELINES

The following publications are relevant to the assessment of operational noise from proposed wind farm developments in Victoria:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- Victorian Department of Environment, Land, Water and Planning *Policy and planning guidelines for development of wind energy facilities in Victoria* dated July 2021
- New Zealand Standard 6808:2010 *Acoustics – Wind farm noise*
- EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated May 2021.

Details of the guidance and noise limits provided by these publications are provided below.

3.1 Environment Protection Act 2017

The *Environment Protection Act 2017* (the EP Act), as amended by the *Environment Protection Amendment Act 2018*, provides the overarching legislative framework for the protection of the environment in Victoria.

In Part 3.2, the EP Act establishes a general environmental duty (GED) to minimise the risks of harm to human health or the environment from pollution or waste, including noise, so far as reasonably practicable.

The EP Act provides that noise can be determined as *unreasonable* having regard to general conditions, or where noise is prescribed to be unreasonable noise.

3.2 Environment Protection Regulations 2021

On 1 August 2021, the *Environment Protection Regulations 2021* (the EP Regulations) was amended to specify matters in relation to wind turbine noise by the *Environment Protection Amendment (Wind Turbine Noise) Regulations 2021*.

The objectives of the EP Regulations are to further the purposes of, and give effect to, the EP Act.

Part 5.3 Division 5 of the EP Regulations nominates New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808) as the relevant standard for assessing operational wind turbine noise in Victoria and introduces additional measures to demonstrate compliance post-construction.

Regulation 131A outlines that an owner or operator of wind energy facility may enter into a written agreement with a relevant landowner to modify the noise limits which apply at the premises of the relevant landowner. These locations are referred to as ‘stakeholder receivers’.

Part 5.3 Division 1 of the EP Regulations requires that proposed commercial premises be assessed in accordance with the EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated May 2021 (Noise Protocol) noise limits. Premises have an ongoing obligation under the EP Regulations to meet the Noise Protocol noise limits.

In accordance with the EP Regulations, noise levels from the Project are considered *unreasonable*, as defined in the EP Act, if they exceed the relevant applicable noise limits.

3.3 Victorian Wind Energy Guidelines

The Victorian Department of Environment, Land, Water and Planning *Policy and planning guidelines for development of wind energy facilities in Victoria* dated July 2021 (Victorian Wind Energy Guidelines) provide advice to responsible authorities, proponents and the community about suitable sites to locate wind energy facilities and to inform planning decisions about a wind energy facility proposal.

The stated purpose of the Victorian Wind Energy Guidelines is to set out:

- *a framework to provide a consistent and balanced approach to the assessment of wind energy projects across the state*
- *a set of consistent operational performance standards to inform the assessment and operation of a wind energy facility project*
- *guidance as to how planning permit application requirements might be met.*

Section 5 of the Victorian Wind Energy Guidelines outlines the key criteria for evaluating the planning merits of a wind energy facility. Section 5.1.2 details information relating to the amenity of areas surrounding a wind farm development, including information relating to noise levels. In particular, it provides the following guidance for the assessment of noise levels for proposed new wind farm developments:

> *A wind energy facility should comply with the noise limits recommended for dwellings and other noise sensitive locations in the New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (the Standard).* […]
>
> *The Standard specifies a general 40 decibel limit (40 dB $L_{A90(10min)}$) for wind energy facility sound levels outdoors at noise sensitive locations, or that the sound level should not exceed the background sound level by more than five decibels (referred to as 'background sound level +5 dB'), whichever is the greater.* […]
>
> *Under Section 5.3 of the Standard, a 'high amenity noise limit' of 35 decibels may be justified in special circumstances. All wind energy facility applications must be assessed using Section 5.3 of the Standard to determine whether a high amenity noise limit is justified for specific locations, following procedures outlined in 5.3.1 of the Standard. Guidance can be found on this issue in the VCAT determination for the Cherry Tree Wind Farm[1].*

Based on the Victorian Wind Energy Guidelines, the environmental noise of proposed new wind farm developments must be assessed in accordance with NZS 6808 at noise sensitive locations, which are defined in Section 5.1.2 of the Victorian Wind Energy Guidelines as follows:

> *Noise sensitive locations are defined in [NZS 6808] as, "The location of a noise sensitive activity, associated with a habitable space or education space in a building not on a wind farm site", and include:*
>
> - *any part of land zoned predominantly for residential use*
> - *residential land uses included in the accommodation group at clause 73.03, Land use terms of the VPP and all planning schemes*
> - *education and child care uses included in the child care centre group and education centre group at clause 73.03 of the of the VPP and all planning schemes.*

1 *Cherry Tree Wind Farm v Mitchell Shire Council* (2013)

Specifically, Clause 73.03 of the Victoria Planning Provisions (VPP) lists the following as Accommodation:

- *Camping and caravan park*
- *Corrective institution*
- *Dependent person's unit*
- *Dwelling Group accommodation*
- *Host farm*

Consideration must also be given to whether a high amenity noise limit is warranted to reflect special circumstances at specific locations.

3.4 NZS 6808

New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808) provides methods for the prediction, measurement, and assessment of sound from wind turbines. The following sections provide an overview of the objectives of NZS 6808 and the key elements of the standard's assessment procedures.

3.4.1 Objectives

The foreword of NZS 6808 provides guidance about the objectives of the noise limits outlined within the standard:

> *Wind farm sound may be audible at times at noise sensitive locations, and this Standard does not set limits that provide absolute protection for residents from audible wind farm sound. Guidance is provided on noise limits that are considered reasonable for protecting sleep and amenity from wind farm sound received at noise sensitive locations.*

The *Outcome Statement* of NZS 6808 then goes on to provide information about the objective of the standard in a planning context:

> *This Standard provides suitable methods for the prediction, measurement, and assessment of sound from wind turbines. In the context of the* [New Zealand] *Resource Management Act, application of this Standard will provide reasonable protection of health and amenity at noise sensitive locations.*

Section C1.1 of the standard provides further information about the intent of the standard, which is:

> [...] *to avoid adverse noise effects on people caused by the operation of wind farms while enabling sustainable management of natural wind resources.*

Based on the objectives outlined above, NZS 6808 addresses health and amenity considerations at noise sensitive locations by specifying noise limits which are to be used to assess wind farm noise.

3.4.2 Noise sensitive locations

The provisions of NZS 6808 are intended to protect noise sensitive locations (also generally referred to as *receivers* herein) that existed before the development of a wind farm. Noise sensitive locations are defined by the Standard as:

> *The location of a noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site. Noise sensitive locations include:*
>
> *(a) Any part of land zoned predominantly for residential use in a district plan;*
>
> *(b) Any point within the notional boundary of buildings containing spaces defined in (c) to (f);*
>
> *(c) Any habitable space in a residential building including rest homes or groups of buildings for the elderly or people with disabilities …*
>
> *(d) Teaching areas and sleeping rooms in educational institutions …*
>
> *(e) Teaching areas and sleeping rooms in buildings for licensed kindergartens, childcare, and day-care centres; and*
>
> *(f) Temporary accommodation including in hotels, motels, hostels, halls of residence, boarding houses, and guest houses.*
>
> *In some instances holiday cabins and camping grounds might be considered as noise sensitive locations. Matters to be considered include whether it is an established activity with existing rights.*

For the purposes of an assessment according to the Standard, the notional boundary is defined as:

> *A line 20 metres from any side of a dwelling or other building used for a noise sensitive activity or the legal boundary where this is closer to such a building.*

NZS 6808 was prepared to provide methods of assessment in the statutory context of New Zealand. Specifically, NZS 6808 notes that in the context of the New Zealand Resource Management Act, application of the Standard will provide reasonable protection of health and amenity at noise sensitive locations. This is an important point of context, as the New Zealand Resource Act states:

> *(3)(a)(ii): A consent authority must not, when considering an application, have regard to any effect on a person who has given written approval to the application.*

Based on the above definitions and statutory context, noise predictions are normally prepared for stakeholder receivers irrespective of whether they are inside or outside of the boundary. However, the noise limits specified in the Standard do not apply to these locations on account of their participation with the project.

3.4.3 Noise limit

Section 5.2 *Noise limit* of NZS 6808 defines acceptable noise limits as follows:

> *As a guide to the limits of acceptability at a noise sensitive location, at any wind speed wind farm sound levels ($L_{A90(10\ min)}$) should not exceed the background sound level by more than 5 dB, or a level of 40 dB $L_{A90(10\ min)}$, whichever is the greater.*

This arrangement of limits requires the noise associated with a wind farm to be restricted to a permissible margin above background noise, except in instances when both the background and source noise levels are low. In this respect, the noise limits indicate that it is not necessary to continue to adhere to a margin above background when the background noise levels are below the range of 30-35 dB L_{A90}.

The noise limits specified in NZS 6808 apply to the combined wind turbine noise level of all wind farms influencing the environment at a receiver. Specifically, section 5.6.1 states:

> *The noise limits* [...] *should apply to the cumulative sound level of all wind farms affecting any noise sensitive location.*

3.4.4 High amenity

Section 5.3.1 of NZS 6808 states that the base noise limit of 40 dB L_{A90} detailed in Section 3.4.3 above is "*appropriate for protection of sleep, health, and amenity of residents at most noise sensitive locations*.". It goes on to note that the application of a high amenity noise limit may require additional consideration:

> [...] *In special circumstances at some noise sensitive locations a more stringent noise limit may be justified to afford a greater degree of protection of amenity during evening and night-time. A high amenity noise limit should be considered where a plan promotes a higher degree of protection of amenity related to the sound environment of a particular area, for example where evening and night-time noise limits in the plan for general sound sources are more stringent than 40 dB $L_{Aeq(15\ min)}$ or 40 dBA L_{10}. A high amenity noise limit should not be applied in any location where background sound levels, assessed in accordance with section 7, are already affected by other specific sources, such as road traffic sound.*

The definition of the high amenity noise limit provided in NZS 6808 is specific to New Zealand planning legislation and guidelines. A degree of interpretation is therefore required when determining how to apply the concept of high amenity in Victoria.

In accordance with Section 5.3 of NZS 6808, if a high amenity noise limit is justified, wind farm noise levels (L_{A90}) during evening and nigh-time periods should not exceed the background noise level (L_{A90}) by more than 5 dB or 35 dB L_{A90}, whichever is the greater. The standard recommends that this reduced noise limit would typically apply for wind speeds below 6 m/s at hub height. A high amenity noise limit is not applicable during the daytime period.

The methodology for assessing the applicability of the high amenity noise limit, detailed in NZS 6808, is a two-step approach as follows:

1. Determination of whether the planning guidance for the area warrants consideration of a high amenity noise limit

   First and foremost, for a high amenity noise limit to be considered, the land zoning of a receiver location must promote a higher degree of acoustic amenity.

2. Evaluation of whether a high amenity noise limit is justified

   Following the guidance presented in C5.3.1, if the planning guidance for the area warrants consideration of a high amenity noise limit, and the receiver location is located within the predicted 35 dB L_{A90} noise contour, then a calculation should be undertaken to determine whether background noise levels are sufficiently low.

3.4.5 Special audible characteristics

Section 5.4.2 of NZS 6808 requires the following:

> *Wind turbine sound levels with special audible characteristics (such as tonality, impulsiveness and amplitude modulation) shall be adjusted by arithmetically adding up to +6dB to the measured level at the noise sensitive location.*

Notwithstanding this, the standard requires that wind farms be designed with no special audible characteristics at nearby residential properties while concurrently noting in Section 5.4.1 that:

> […] *as special audible characteristics cannot always be predicted, consideration shall be given to whether there are any special audible characteristics of the wind farm sound when comparing measured levels with noise limits.*

NZS 6808 emphasises assessment of special audible characteristics during the post-construction measurement phase of a project. An indication of the potential for tonality to be a characteristic of the noise emission from the assessed turbine model is sometimes available from tonality audibility assessments conducted as part of manufacturer turbine noise emission testing. However, this data is frequently not available at the planning stage of an assessment.

3.5 Noise Protocol

EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) sets noise limits that apply to commercial, industrial and trade premises and entertainment venues in Victoria. Compliance with the noise limits is mandatory under the EP Act.

The proposed transformer station is considered a 'commercial, industrial and trade premises' under the EP Act.

The Noise Protocol prescribes noise limits and the procedures to be used for an assessment of compliance.

The noise limits apply at a 'noise sensitive area', which is defined in Section 4 of the EP Regulations as being *within 10 metres of the outside of the external walls* of buildings including dwellings, hotels, schools and campgrounds.

The procedures for setting noise limits are defined separately for urban and rural areas. However, in both cases, the noise limits are defined by considering the land zoning in the area and the noise environment of the receiver. The noise limits are defined separately for day, evening and night periods.

In contrast to NZS 6808 and Part 5.3 Division 5 of the EP Regulations, the Noise Protocol does not differentiate between stakeholder and non-stakeholder receivers.

The measurement and analysis procedures outlined in the Noise Protocol include adjustments which are to be applied to noise that is characterised by audible tones, impulses or intermittency. Further details of the noise limits applicable to this project are provided in Section 7.1 of this report.

4.0 ASSESSMENT METHOD

4.1 Overview

Based on the legislation and guidelines outlined in Section 3.0, assessing the operational noise levels of the proposed wind turbines and the transformer station involves:

- assessing background noise levels at noise sensitive locations around the project;
- assessing the land zoning of the project site and surrounding areas;
- establishing suitable noise limits accounting for background noise levels and land zoning;
- predicting the level of noise expected to occur as a result of the proposed turbines and transformer station;
- assessing whether the development can achieve the requirements of Victorian policy and guidelines by comparing the predicted noise levels to the noise limits; and
- recommending reasonably practicable measures to minimise the risk of noise impact.

4.2 Background noise levels

Background noise level information is used to inform the setting of limits for both the transformer station and the wind turbine components of a wind farm project. However, in rural areas where wind farms are typically developed, the background noise level data is most relevant to the assessment of the wind turbines. This is due to the need to consider the changes in background noise levels and wind turbine noise levels for different wind conditions.

In accordance with the Victorian Wind Energy Guidelines and NZS 6808, background noise level information is used for setting noise limits for the wind turbine component of a wind farm project.

The procedures for determining background noise levels are defined in NZS 6808. The first step in assessing background noise levels involves determining whether background noise measurements are warranted. For this purpose, Section 7.1.4 of the standard provides the following guidance:

> *Background sound level measurements and subsequent analysis to define the relative noise limits should be carried out where wind farm sound levels of 35 dB $L_{A90(10\ min)}$ or higher are predicted for noise sensitive locations, when the wind turbines are at 95% rated power. If there are no noise sensitive locations within the 35 dB $L_{A90(10\ min)}$ predicted wind farm sound level contour then background sound level measurements are not required.*

The initial stage of a background noise monitoring program in accordance with NZS 6808 therefore comprises:

- Preliminary wind turbine noise predictions to identify all receivers where predicted noise levels are higher than 35 dB L_{A90}
- Identification of selected receivers where background noise monitoring should be undertaken prior to development of the wind farm, if required.

If required, the surveys involve measurements of background noise levels at receivers, and simultaneous measurement of wind speeds at the site of the proposed wind farm. The survey typically extends over a period of several weeks to enable a range of wind speeds and directions to be measured.

The results of the survey are then analysed to determine the trend between the background noise levels and site wind speeds at the proposed hub height of the turbines. This trend defines the value of the background noise for the different wind speeds in which the turbines will operate. At the wind speeds when the background noise level is above 35 dB L_{A90} (or 30 dB L_{A90} in special circumstances where high amenity limits apply), the background noise levels are used to set the noise limits for the wind farm.

4.3 Noise predictions

Operational wind farm noise levels (wind turbines and associated transformer station) are predicted using:

- Noise emission data for the wind turbines and associated transformer station
- A 3D digital model of the site and the surrounding environment
- International standards used for the calculation of environmental sound propagation.

The method selected to predict noise levels is International Standard ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2). The prediction method is consistent with the guidance provided by NZS 6808 and has been shown to provide a reliable method of predicting the typical upper levels of the wind turbine noise expected to occur in practice.

The method is generally applied in a comparable manner to both wind turbine and transformer station noise levels. For example, for both types of sources, equivalent ground and atmospheric conditions are used for the calculations. However, when applied to wind turbine noise, additional and specific input choices apply, as detailed below.

Key elements of the noise prediction method are summarised in Table 1. Further discussion of the method and the calculation choices is provided in Appendix G.

Table 1: Noise prediction elements

Detail	Description
Software	Proprietary noise modelling software SoundPLAN version 8.2
Method	International Standard ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation* (ISO 9613-2). Adjustments to the ISO 9613-2 method are applied on the basis of the guidance contained in the UK Institute of Acoustics publication *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (the UK Institute of Acoustics guidance). The adjustments are applied within the SoundPLAN modelling software and relate to the influence of terrain screening and ground effects on sound propagation. Specific details of adjustments are noted below and are discussed in Appendix G.
Source characterisation	Each source of operational noise is modelled as a point source of sound. The total sound of the component of the wind farm being modelled (i.e. the wind turbines or the transformer station) is then calculated on the basis of simultaneous operation of all elements (e.g. all wind turbines) and summing the contribution of each. To model the turbine components of the wind farm, the following specific procedures are noted: • Calculations of turbine to receiver distances and average sound propagation heights are made on the basis of the point source being located at the position of the hub of the turbine. • Calculations of terrain related screening are made on the basis of the point source being located at the maximum tip height of each turbine. Further discussion of terrain screening effects is provided below.
Terrain data	1 m resolution within the site boundary and immediate surrounds, provided by the proponent; and 10 m resolution beyond, obtained from Spatial Datamart Victoria.
Terrain effects (turbine-specific procedures)	Adjustments for the effects of terrain are determined and applied on the basis of the UK Institute of Acoustics guidance and research outlined in Appendix G. • Valley effects: + 3 dB is applied to the calculated noise level of a wind turbine when a significant valley exists between the wind turbine and calculation point. A significant valley is determined to exist when the actual mean sound propagation height between the turbine and calculation point is 50 % greater than would occur if the ground were flat. • Terrain screening effects: only calculated if the terrain blocks line of sight between the maximum tip height of the turbine and the calculation point. The value of the screening effect is limited to a maximum value of 2 dB. The project is located in a relatively flat area characterised by little variations in ground elevation between the turbines and surrounding receivers. These terrain characteristics do not typically result in the application of adjustments to the predicted noise levels. Specifically, based on comparison of predicted noise levels with and without terrain elevation data included indicates adjustments for terrain effects typically equated to ±0.2 dB. For reference purposes, the ground elevations at the turbines and receivers are tabled in Appendix B and Appendix C respectively. The topography of the site is depicted in the elevation map provided in Appendix E.

Detail	Description
Ground conditions	Ground factor of G = 0.5 on the basis of the UK Institute of Acoustics guidance and research outlined in Appendix G. The ground around the site corresponds to acoustically soft conditions (G = 1) according to ISO 9613-2. The adopted value of G = 0.5 assumes that 50 % of the ground cover is acoustically hard (G = 0) to account for variations in ground porosity and provide a cautious representation of ground effects.
Atmospheric conditions	Temperature 10 °C and relative humidity 70 % These represent conditions which result in relatively low levels of atmospheric sound absorption. The calculations are based on sound speed profiles[2] which increase the propagation of sound from each turbine to each receiver location, whether as a result of thermal inversions or wind directed toward each calculation point.
Receiver heights	1.5 m above ground level It is noted that the UK Institute of Acoustics guidance refers to predictions made at receiver heights of 4 m. Predictions in Australia are generally based on a lower prediction height of 1.5 m which results in lower noise levels. However, importantly, predictions in Australia do not generally subtract a margin recommended by the UK Institute of Acoustics guidance to account for differences between L_{Aeq} and L_{A90} noise levels (this is consistent with NZS 6808 which indicates that predicted L_{Aeq} levels should be taken as the predicted L_{A90} sound level of the wind farm). The magnitude of these differences is comparable and therefore balance each other out to provide similar predicted noise levels.

5.0 EXISTING NOISE ENVIRONMENT

The results of preliminary noise modelling of the site indicated one receiver (stakeholder) where predicted noise levels were higher than 35 dB L_{A90}.

Therefore, in accordance with NZS 6808, background noise monitoring is not proposed to be undertaken at this stage of the project. As such, the applicable base noise limits determined in accordance with NZS 6808 have been adopted for this assessment. This approach is conservative, as the background noise monitoring results would only increase the noise limits above the applicable base limit values.

It is however recommended that background noise monitoring be undertaken prior to construction of the wind farm. Given the predicted noise levels at surrounding dwellings, background noise monitoring should be restricted to the nearest receiver or, alternatively, an intermediate reference location for conducting compliance checks.

If these measurements are conducted at a receiver (i.e. in addition to, or in lieu of, an intermediate reference location), the results would be used to derive background noise dependant noise limits that would ultimately be used for post-construction compliance assessment.

2 The sound speed profile defines the rate of change in the speed of sound with increasing height above ground

6.0 WIND TURBINE ASSESSMENT

6.1 Noise limits

6.1.1 High amenity

In accordance with NZS 6808, an assessment is required for all receivers located within the predicted 35 dB L_{A90} contour to determine whether a high amenity noise limit may be justified. As detailed in Section 3.4.4, this is based on a two-step approach comprising:

1. A land zoning review to determine whether the planning guidance for the area warrants consideration of a high amenity noise limit. If it does, then the second step should be considered
2. A review of the relationship between the background noise levels and predicted noise levels, using the calculation set out in clause C5.3.1.

Based on the predicted noise level contours presented subsequently in Section 6.4, and the zoning map for the area presented in Appendix F, the area within the predicted 35 dB L_{A90} contour is identified as Farming Zone.

Following guidance from the VCAT determination for the Cherry Tree Wind Farm, as required by the Victorian Wind Energy Guidelines, the areas within the Farming Zone do not warrant consideration of the high amenity noise limit.

Based on the above, the high amenity noise limit is not justified for the proposed Brewster Wind Farm.

6.1.2 Stakeholder receivers

The definition of noise sensitive locations in NZS 6808 specifically excludes dwellings located within a wind farm site boundary. The discussion earlier in this report in Section 3.4.2 also provides details of the statutory context of NZS 6808, and indicates the method is not intended to be applied to noise sensitive locations outside the site boundary where a noise agreement exists between the occupants and the proponent of the development.

However, consistent with the Victorian Wind Energy Guidelines, Regulation 131B of the EP Regulations specifies a noise limit for stakeholder receivers of 45 dB L_{A90} or background noise (L_{A90}) + 5 dB, whichever is the greater, where a noise agreement between the owner or operator of a wind energy facility and a landowner is made on or after 1 August 2021.

6.1.3 Applicable noise limits

Accounting for the conclusions of the assessment of high amenity detailed in the previous section, the applicable noise limits are detailed in Table 2.

Table 2: Applicable noise limits, dB L_{A90}

Receiver status	Noise limit
Non-stakeholder	40 dB or background L_{A90} + 5 dB, whichever is the greater
Stakeholder	45 dB or background L_{A90} + 5 dB, whichever is the greater

In the absence of background noise data for the project, the Brewster Wind Farm has been conservatively assessed using the relevant base (minimum) noise limits presented above.

6.2 Wind turbine model

The final turbine model for the site would be selected after a tender process to procure the supply of turbines. The final selection would be based on a range of design requirements including achieving compliance with any planning permit noise limits at surrounding receivers.

Accordingly, to assess the proposed wind farm at this stage in the project, it is necessary to consider a candidate turbine model that is representative of the size and type of turbines being considered. The purpose of the candidate turbine is to assess the viability of achieving compliance with the applicable noise limits, based on noise emission levels that are typical of the size of turbines being considered for the site.

For this assessment, the proponent has nominated the Vestas V162-6.0MW as the candidate turbine model.

This model is a variable speed wind turbine, with the speed of rotation and the amount of power generated by the turbines being regulated by control systems which vary the pitch of the turbine blades (the angular orientation of the blade relative to its axis).

This assessment has been based on the turbines operating in an unconstrained mode of generation (i.e. without noise reduced operating modes) and with blade serrations. Blade serrations are now routinely used to reduce wind turbine noise emissions, and it is understood that their use is now the market standard for turbines being offered in the Australian market.

Details of the assessed candidate wind turbine are provided in Table 3.

Table 3: Selected candidate wind turbine model

Detail	V162-6.0MW
Make	Vestas
Rotor diameter	162 m
Hub height	166 m
Blade serrations	Yes
Operating mode	PO6000 [1]
Rated power	6.0 MW
Cut-in wind speed (hub height)	3 m/s
Rated power wind speed (hub height)	12 m/s
Cut-out wind speed (hub height)	24 m/s

1 It is our understanding that 'PO6000' is a manufacturer designation which indicates a Power Optimisation mode to achieve a power output of 6,000 kW
This is an unconstrained mode of operation (i.e. without noise reduction)

The hub height detailed above is suitable for noise assessment purposes. It is our understanding that the final hub height of the selected wind turbine model may differ slightly. However, the magnitude of the potential changes is expected to be minor and inconsequential with respect to predicted noise levels.

The final hub height would be used for the pre-construction noise assessment once the turbine layout has been finalised and the final turbine model selected.

6.3 Wind turbine noise emissions

6.3.1 Sound power levels

The noise emissions of the wind turbines are described in terms of the sound power level for different wind speeds. The sound *power* level is a measure of the total sound energy produced by each turbine and is distinct from the sound *pressure* level which depends on a range of factors such as the distance from the turbine.

Sound power level data for the candidate turbine model, including sound frequency characteristics, has been sourced from the Vestas document No. 0095-3732_00 - *Third octave noise emission EnVentus™ V162-6.0MW*, dated 10 June 2020.

Based on the data sourced from the manufacturer's specification, the noise modelling undertaken for this assessment involved conversion of third octave band level to octave band levels (where applicable), and adjustment by addition of +1.0 dB at each wind speed to provide a margin for typical values of test uncertainty.

The overall A-weighted sound power levels (including the +1.0 dB addition) as a function of hub height wind speed are presented in Table 4 with the octave band values presented in Table 5. These represent the total noise emissions of the turbine for each sound mode, including the secondary contribution of ancillary plant associated with each turbine (e.g. cooling fans).

Table 4: Sound power levels versus hub height wind speed, dB L_{WA}

	Hub height wind speed m/s								
Turbine	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**≥12**
V162-6.0MW	95.1	95.3	97.2	100.2	103.0	105.1	105.3	105.3	105.3

Table 5: Octave band sound power levels, dB L_{WA}

	Octave band centre frequency (Hz)									
Turbine	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Total**
V162-6.0MW [1]	76.2	86.6	94.1	98.7	100.4	99.3	95.2	88.3	78.5	105.3

[1] Based on one-third octave band levels at 10 m/s

These sound power levels are also illustrated in Appendix I.

Review of available sound power data for a range of turbine models has shown that there isn't a clear relationship between turbine size or power output and the noise emission characteristics of a given turbine model. In practice, the overall noise emissions of a turbine are dependent on a range of factors, including the turbine size and power output, and other important factors such as the blade design and rotational speed of the turbine. Therefore, while turbine sizes and power ratings of contemporary turbines have increased, the noise emissions of the turbines are comparable to, or lower than, previous generations of turbines as a result of design improvements (notably, measures to reduce the speed of rotation of the turbines, and enhanced blade design features such as serrations for noise control).

6.3.2 Special Audible Characteristics

Special audible characteristics relate to potential tonality, amplitude modulation and impulsiveness of a turbine.

Information concerning potential tonality is often limited at the planning stage of a project, and test data for tonality is presently unavailable for the selected candidate turbine model. However, the occurrence of tonality in the noise of contemporary multi-megawatt turbine designs is unusual. This is supported by evidence of operational wind farms in Australia which indicates that the occurrence of tonality at receivers is atypical.

Amplitude modulation and impulsiveness are not able to be predicted, however the evidence of operational wind farms in Australia indicates that their occurrence is limited and atypical.

Given the above, adjustments for special audible characteristics have not been applied to the predicted noise levels presented in this assessment. Notwithstanding this, the subject of special audible characteristics would be addressed in subsequent assessment stages for the project, following approval of the wind farm, and again following construction of the wind farm.

6.4 Predicted noise levels

This section of the report presents the predicted noise levels of the Brewster Wind Farm at surrounding receivers.

Sound levels in environmental assessment work are typically reported to the nearest integer to reflect the practical use of measurement and prediction data. However, in the case of wind farm layout design, significant layout modifications may only give rise to fractional changes in the predicted noise level. This is a result of the relatively large number of sources influencing the total predicted noise level, as well as the typical separating distances between the turbine locations and surrounding assessment positions. It is therefore necessary to consider the predicted noise levels at a finer resolution than can be perceived or measured in practice. It is for this reason that the levels presented in this section are reported to one decimal place.

Noise levels from the proposed Brewster Wind Farm have been predicted using the sound power level data detailed in Section 6.3.1 for the selected candidate turbine model and are summarised in Table 6 for the wind speeds which result in the highest predicted noise levels (hub height wind speed ≥10 m/s).

The locations of the predicted 35 dB and 40 dB L_{A90} noise contours are illustrated in Figure 1, for the hub height wind speed which results in the highest predicted noise levels.

Predicted noise levels for each integer wind speed are tabulated in Appendix H for all considered receivers, including receivers where the highest predicted noise level is below 30 dB L_{A90}.

Table 6: Highest predicted noise level at receivers with predicted levels 30 dB L_{A90} or above

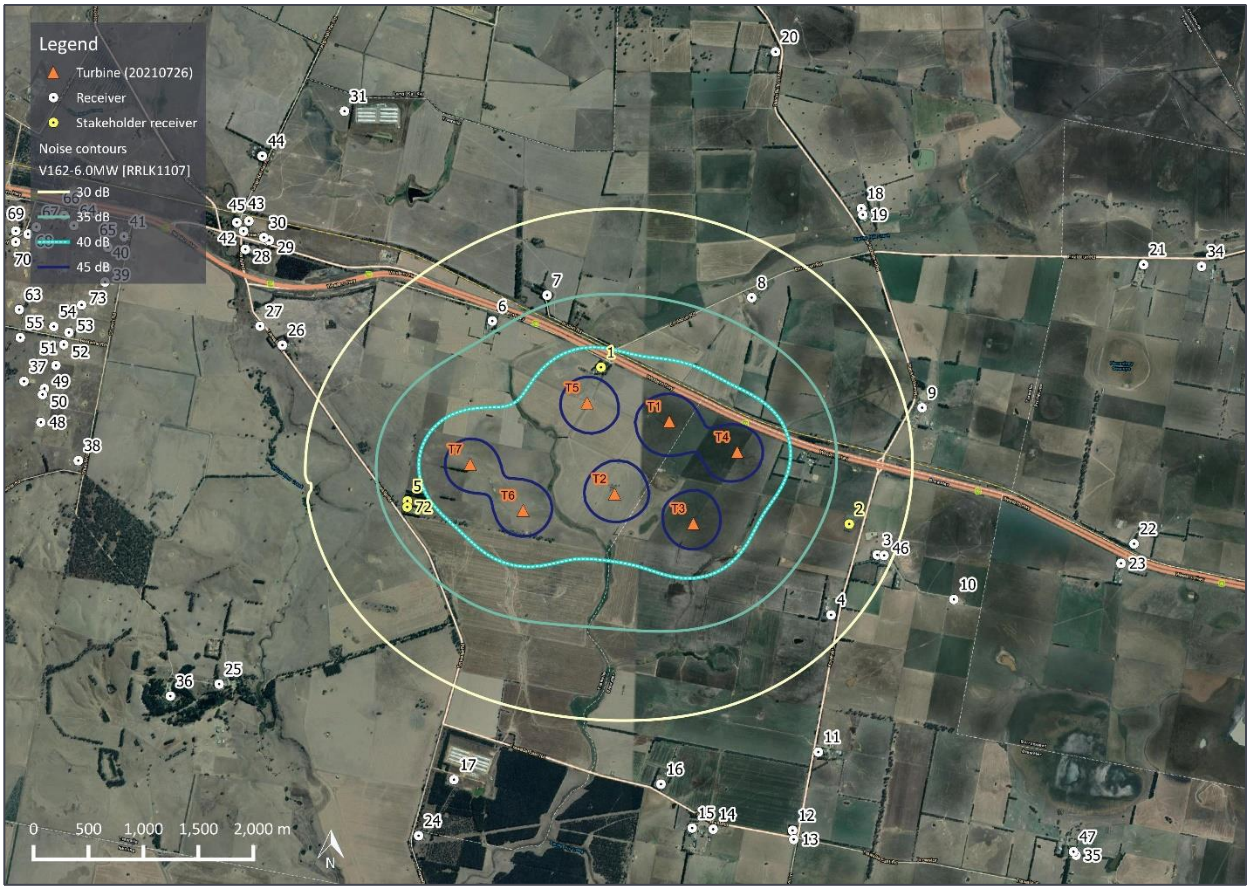
Receiver	Predicted level, dB L_{A90}
1 (S)	42.8
2 (S)	33.1
3	30.8
4	31.2
5 (S)	37.5
6	34.3
7	34.3
8	33.0
46	30.5
72 (S)	37.2

(S) Stakeholder receiver

The following can be concluded from the predicted noise levels detailed in Table 6:

- Compliance with the applicable base noise limit of 40 dB L_{A90} by at least 5.7 dB at non-stakeholder receivers
- Compliance with the applicable base noise limit of 45 dB L_{A90} by at least 2.2 dB at stakeholder receivers.

Figure 1: Highest predicted noise level contours, dB L_{A90}



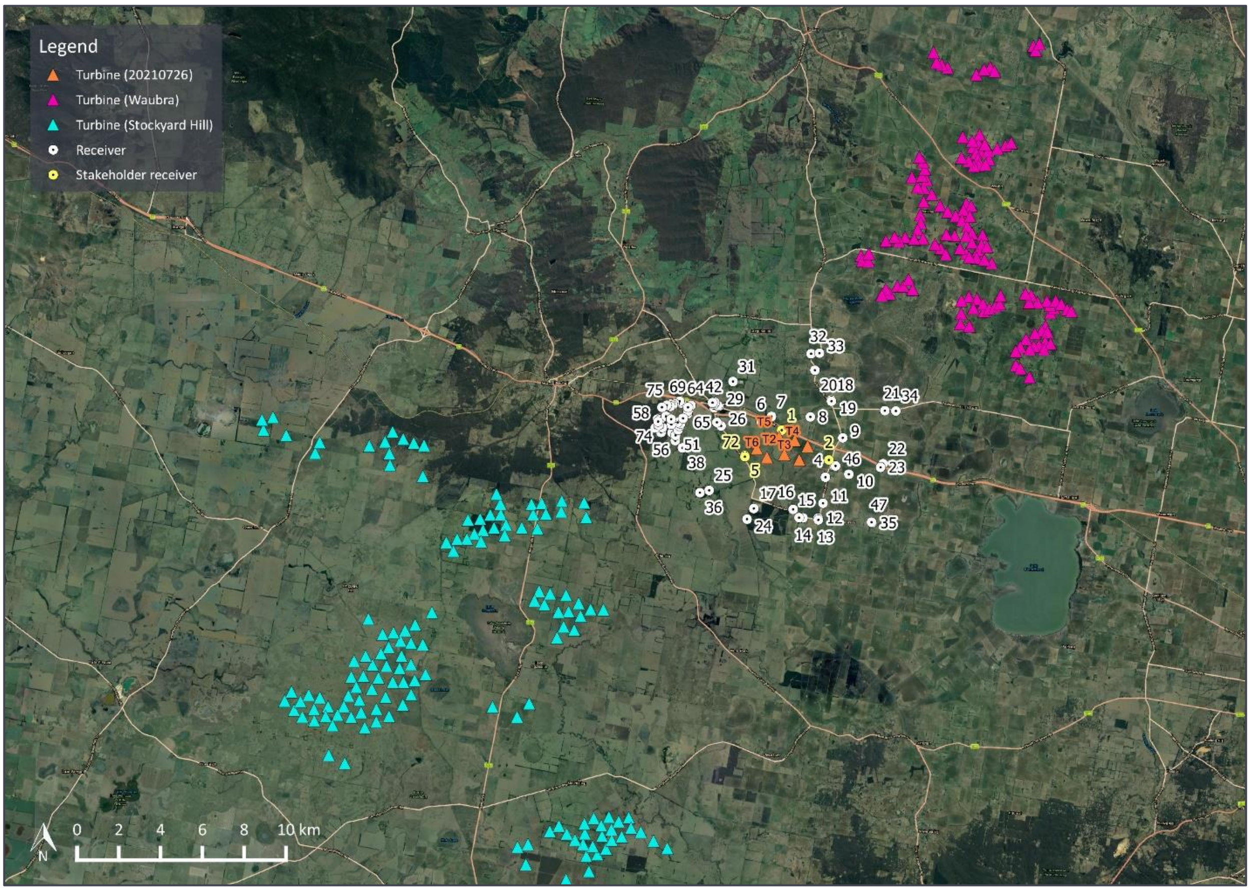
6.5 Cumulative assessment

The noise limits determined in accordance with NZS 6808 apply to the total combined operational wind farm noise level, including the contribution of any neighbouring wind farm developments. The assessment has therefore considered other approved and operational wind farm projects in the surrounding area.

Based on publicly available information[3], the Waubra and Stockyard Hill wind farms have been identified within 10 km of the proposed Brewster Wind Farm for the review of potential cumulative noise considerations. Wind farms located farther than 10 km from the proposed project would not have cumulative effects likely to affect the assessment outcome.

A site plan showing the location of the Waubra and Stockyard Hill wind farms in relation to the Brewster Wind Farm is provided in Figure 2.

Figure 2: Brewster Wind Farm, Waubra and Stockyard Hill wind farms



3 https://www.energy.vic.gov.au/renewable-energy/wind-energy/wind-projects

6.5.1 Waubra Wind Farm

The Waubra Wind Farm has been operational since 2009 and comprises one hundred and twenty-eight (128) AW77/1500 wind turbines with a hub height of 71.5 m[4]. The coordinates of the turbines were digitised from available aerial imagery.

Sound power level data for the AW77/1500 wind turbines was sourced from a publicly available noise report[5].

6.5.2 Stockyard Hill Wind Farm

The Stockyard Hill Wind Farm is set to become operational early 2021 and comprises one hundred and forty-nine (149) GW140 wind turbines[6] with individual power outputs ranging from 3.0 to 3.57 MW and a hub height of 109 m. The coordinates of the turbines were digitised from the indicative layout available on the Stockyard Hill Wind Farm website[7].

Sound power level data for the GW140 wind turbines was sourced from a publicly available noise report[8].

6.5.3 Assessment results

To inform the assessment of potential cumulative noise considerations, reference is made to Clause 5.6.4 of NZS 6808 which states:

> *For the purposes of 5.6.1, if the predicted wind farm sound levels for a new wind farm are at least 10 dB below any existing wind farm sound levels permitted by any resource consent or plan, then the cumulative effect shall not be taken into account.*

Additional contextual information is provided in the commentary to Clause 5.6.4 which notes:

> *If an existing wind farm sound level is say 40 dB and the predicted wind farm sound level for a new wind farm is say 30 dB then the combined level would be 40.4 dB. This increase of less than 0.5 dB cannot be reliably measured and would be undetectable to people, and will therefore not give rise to any adverse cumulative effect.*

Based on the above guidance, and considering the relatively large separating distances between the Brewster Wind Farm, the Waubra Wind Farm and the Stockyard Hill Wind Farm, a simplified assessment of potential cumulative noise considerations can be made by comparing the predicted 30 dB L_{A90} contours from each project.

The predicted 30 dB L_{A90} contours associated with each wind farm operating in isolation are presented in Figure 3. The 30 dB L_{A90} contour is presented for the wind speeds which give rise to the highest predicted noise level from each site respectively. It is also noted that the noise level contours are predicted on the basis of downwind propagation from each turbine; in most instances where cumulative noise is considered, a noise sensitive receiver cannot be simultaneously downwind of all wind turbines of adjoining projects. The predictions are therefore conservative for the purpose of considering cumulative noise levels.

4 https://www.acciona.ca/projects/energy/wind-power/waubra/

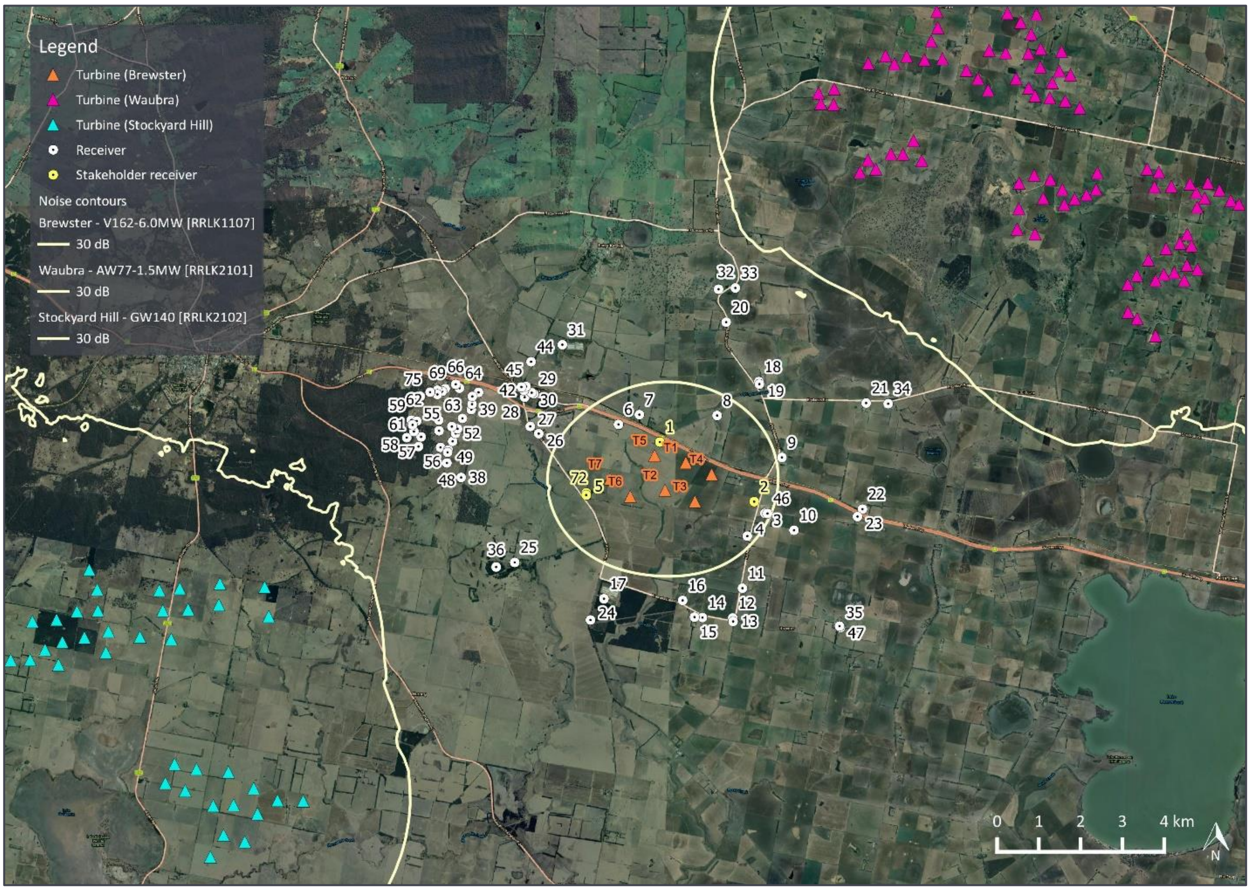
5 Table 9 of Sonus Pty Ltd report S3736C5 *Crudine Ridge Wind Farm – Environmental Noise Assessment*, dated October 2012 (web link)

6 Stockyard Hill Wind Farm – EPBC 2016/7746 Annual Compliance Report, dated August 2020 (web link)

7 https://www.stockyardhillwindfarm.com.au/indicative-layout

8 Table 3 of Rp 001 R01 20169260 C*oppabella Wind Farm Modification Application - Noise Assessment,* dated 18 August 2017 (web link)

Figure 3: Predicted 30 dB L_{A90} contours for the Brewster Wind Farm, Waubra and Stockyard Hill wind farms



The results demonstrate that the predicted 30 dB L_{A90} contours for each project do not overlap. Based on this finding, the following can be concluded:

- At any receiver location where the predicted noise level of one of the wind farms is between 30 and 40 dB, the predicted noise level from an adjoining wind farm will be less than 30 dB, and significantly lower in most cases
- At any receiver location where the predicted noise level from one of the wind farms approaches the 40 dB base noise limit applicable to the sites, the predicted noise level associated with an adjoining wind farm will be more than 10 dB lower. Based on the guidance of NZS 6808, the cumulative effect does not need to be taken in account for the nearest receivers to each wind farm development.

The predicted noise levels therefore demonstrate that cumulative wind farm noise considerations between the Brewster Wind Farm, the Waubra Wind Farm and the Stockyard Hill Wind Farm are not applicable. Specifically, the noise contribution of the Waubra and Stockyard Hill wind farms is sufficiently low to be inconsequential to the noise assessment for the Brewster Wind Farm. The predicted noise contribution of the Brewster Wind Farm at the receivers in the vicinity of the Waubra and Stockyard Hill wind farms would not affect the compliance outcomes for these developments.

7.0 TRANSFORMER STATION NOISE ASSESSMENT

7.1 Noise limits

The procedure for determining the noise limits according to the Noise Protocol depends on whether the noise source or the receivers are located in a rural or urban area.

The procedures for rural areas, applicable for the subject site, are based on determining the zone levels according to the land zoning of the area in which the noise source and receivers are located. These zone levels are then adjusted, where appropriate, for a range of factors.

The zone levels are determined on the basis of the transformer station and surrounding residential receivers both being located on land designated as Farming Zone (FZ) (see land zoning map in Appendix F).

Considering that the land zoning is continuous between the transformer station and the receivers, a distance adjustment is not applicable.

Adjustments for 'background relevant areas' are not warranted in this instance, as the background noise levels during the relevant assessment conditions for the transformer station (i.e. low wind speeds) are expected to be relatively low; adjustments for background noise levels are therefore not warranted in this instance.

Based on the above and considering that the transformer station would be defined in the Victorian Planning Provisions as a *utility*, the noise limits applicable at the nearest receivers, are summarised in Table 7.

Table 7: Noise Protocol time periods and noise limits&, dB L_{eff}[9]

Period	Day of week	Start time	End time	Recommended level
Day	Monday-Friday	0700hrs	1800hrs	45
	Saturday	0700hrs	1300hrs	
Evening	Monday-Friday	1800hrs	2200hrs	39
	Saturday	1300hrs	2200hrs	
	Sunday, Public holidays	0700hrs	2200hrs	
Night	Monday-Sunday	2200hrs	0700hrs	34

As the transformer station is proposed to operate 24 hours a day and 7 days a week, meeting with the applicable night-time noise limit of 34 dB L_{eff}, infers meeting the noise limits during all other time periods.

9 L_{eff} is the effective noise level of commercial or industrial noise determined in accordance with SEPP N-1. This is L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise. Adjustments are made for tonality, intermittency and impulsiveness.

7.2 Transformer noise emissions

The transformers and any associated cooling equipment will be the main sources of noise located within the terminal station.

At this stage in the project, specific details of the transformer make and model are yet to be determined. However, to provide a basis for assessing the feasibility of the transformer station, the proponent advised that a single transformer rated to 50 MVA is proposed.

In lieu of manufacturer sound power level data for a specific transformer selection, reference has been made to Australian Standard AS 60076-10:2009 *Power transformers – Part 10: Determination of sound levels* (AS 60076-10:2009) which provides a method for estimating transformer sound power levels. Specifically, Figure ZA1 from AS 60076-10:2009 has been used to determine an estimated sound power level of 90 dB L_{WA}.

The sound power levels include the noise from ancillary plant such as cooling plant.

AS 60076-10:2009 does not provide estimated sound frequency spectra for transformer noise emissions. However, the noise emissions of transformers and ancillary plant typically exhibit tonal characteristics which must be accounted for in the noise assessment. This is addressed in subsequent sections of the report.

7.3 Predicted noise levels

Predicted noise levels have been determined on the basis of:

- the indicative equipment noise emission data detailed in Section 7.2; and
- the ISO 9613-2 noise prediction method described in Section 4.3.

An adjustment of +2 dB has then been applied to the predicted noise levels to account for the potential tonal characteristics of transformer noise. The relevance and magnitude of the adjustment in practice is dependent on several variables. This is discussed below.

The predicted noise level from the transformer station at the nearest receiver (2(S)), located approximately 1.2 km to the southeast, is 13 dB L_{eff} (including the +2 dB adjustment for potential tonality).

The predicted effective noise levels are below the noise limits applicable to the day, evening and night periods by a significant margin. The following contextual notes are provided:

- The predicted effective noise levels are at least 21 dB below the night-time noise limit;
- The predicted effective noise levels are very low and would be comparable to or less than background noise levels in many instances. The adjustment for tonality is therefore not expected to be applicable as the noise of the transformer is not likely to be audible.

These results indicate that noise levels from the proposed transformer station associated with the Brewster Wind Farm are unlikely to be a significant design consideration. However, noise levels should be reviewed at the time when equipment selections are finalised, accounting for manufacturer noise emission data.

8.0 RECOMMENDED NOISE MANAGEMENT MEASURES

The Regulations require the following measures to be taken to address wind turbine noise:

- A noise management plan must be prepared as specified in Regulation 131E of the EP Regulations, prior to construction.
- Compliance noise monitoring must be undertaken as required by Regulation 131D of the EP Regulations.

In addition to the requirements of the EP Regulations, the following noise management measures should be implemented as part of the subsequent stages of development:

- A detailed noise assessment should be prepared by a qualified acoustic consultant, prior to construction, addressing:
  - the final turbine selection and layout
  - the final location and equipment selection for the transformer station
  - compliance with the applicable noise limits at surrounding receivers.
- Development of reasonably practicable construction noise mitigation and management measures to be documented in a construction environmental management plan, prior to construction.

9.0 GENERAL ENVIRONMENTAL DUTY

As detailed in Section 6.4, wind turbine noise levels are predicted to comply with the relevant noise limits by a margin of at least 2.2 dB.

Under the Act, the general environmental duty requires all reasonably practicable measures to be taken to reduce noise at receivers.

In addition to the noise management measures detailed in the previous section, the following design aspects of the Project have already been implemented or should be considered to reduce the risk of noise impact:

- All considered candidate wind turbine models are fitted with serrated blades to reduce noise emissions;
- All turbines were modelled based on unconstrained operations (i.e. no curtailment modes);
- The procurement contract with the wind turbine manufacturer should stipulate that the wind turbines must not produce emissions which would attract a penalty for tonality when assessed in accordance with NZS 6808
- Siting of the transformer station away from receivers, as evident by the compliance margin with the applicable noise limit.

10.0 SUMMARY

An assessment of operational noise for the proposed Brewster Wind Farm has been carried out. The assessment is based on the proposed wind farm layout comprising seven (7) multi-megawatt turbines and a transformer station.

Operational noise associated with the proposed wind turbines has been assessed in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* and the Victorian Department of Environment, Land, Water and Planning *Policy and planning guidelines for development of wind energy facilities in Victoria* dated July 2021.

Noise modelling was carried out based a candidate turbine model (Vestas V162-6.0MW) which has been selected by the proponent as being representative of the size and type of turbines which could be used at the site.

The results of the modelling demonstrate that the proposed Brewster Wind Farm turbines are predicted to achieve compliance with the applicable noise limits determined in accordance with NZS 6808.

The noise limits determined in accordance with NZS 6808 apply to the total combined operational wind farm noise level, including the contribution of any neighbouring wind farm developments. The assessment has therefore also considered the Waubra and Stockyard Hill wind farms, located within 10 km of the Brewster Wind Farm. An assessment of the predicted noise levels for the Waubra and Stockyard Hill wind farms has demonstrated that cumulative wind farms noise levels do not affect the compliance outcomes for the Brewster Wind Farm or either of the assessed neighbouring projects.

The assessment has also considered operational noise associated with the proposed transformer station. These noise levels have been assessed in accordance with Victorian EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated May 2021. The assessment demonstrates that the transformer station is expected to result in noise levels significantly lower than the noise limits determined in accordance with the Noise Protocol.

Consideration was also given to the general environmental duty, as required by the *Environment Protection Act 2017*.

The noise assessment therefore demonstrates that the proposed Brewster Wind Farm can be designed and developed to achieve Victorian policy requirements for operational noise.

APPENDIX A GLOSSARY OF TERMINOLOGY

Term	Definition	Abbreviation
Amplitude modulation	Sound that is characterised by a rhythmic and higher than normal rise and fall in sound level at regular intervals.	-
A-weighting	A method of adjusting sound levels to reflect the human ear's varied sensitivity to different frequencies of sound.	See discussion below this table.
A-weighted 90th centile	The A-weighted pressure level that is exceeded for 90 % of a defined measurement period. It is used to describe the underlying background sound level in the absence of a source of sound that is being investigated, as well as the sound level of steady, or semi steady, sound sources.	L_{A90}
A-weighted average noise level	The equivalent continuous (time-averaged) A-weighted sound level.	L_{Aeq}
Decibel	The unit of sound level.	dB
Hertz	The unit for describing the frequency of a sound in terms of the number of cycles per second.	Hz
Impulsiveness	Sound that is characterised by a distinct and very rapid rise in sound level (e.g. a car door closing or the impact sound of a hammer)	-
Octave Band	A range of frequencies. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.	-
Sound power level	A measure of the total sound energy emitted by a source, expressed in decibels.	L_W
Sound pressure level	A measure of the level of sound expressed in decibels.	L_p
Special Audible Characteristics	A term used to define a set group of Sound characteristics that increase the likelihood of adverse reaction to the sound. The characteristics comprise tonality, impulsiveness and amplitude modulation.	SAC
Tonality	A characteristic to describe sounds which are composed of distinct and narrow groups of audible sound frequencies (e.g. whistling or humming sounds).	-

The basic quantities used within this document to describe noise adopt the conventions outlined in ISO 1996-1:2016 *Acoustics - Description measurement and assessment of environmental noise – Basic quantities and assessment procedures*. Accordingly, all frequency weighted sound pressure levels are expressed as decibels (dB) in this report. For example, sound pressure levels measured using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.

APPENDIX B SOURCE COORDINATES

The following table sets out the coordinates of the proposed turbine layout of the Brewster Wind Farm (Layout reference *20210726 BRE WTGs rev 3*, supplied by the proponent on 20 September 2021).

Table 8: Turbine coordinates – MGA 94 zone 54

Turbine	Easting, m	Northing, m	Terrain elevation, m
T1	722,341	5,852,128	388
T2	721,843	5,851,468	386
T3	722,560	5,851,199	386
T4	722,959	5,851,849	389
T5	721,593	5,852,298	389
T6	721,010	5,851,318	389
T7	720,528	5,851,739	389

The following table sets out the coordinates of the proposed transformer station (supplied by the proponent on 23 February 2021).

Table 9: Transformer station coordinates – MGA 94 zone 54

Item	Easting, m	Northing, m	Terrain elevation, m
Transformer station	723,105	5,851,998	391

APPENDIX C RECEIVER LOCATIONS

The following table sets out the seventy-two (72) assessed receivers located within 5 km of the proposed turbines considered in the environmental noise assessment together with their respective distance to the nearest turbine. This includes four (4) stakeholder receivers.

(Data reference *20210920 BRE Dwellings*, supplied by the proponent on 20 September 2021).

Table 10: Receivers within 5 km of the proposed turbines – MGA 94 zone 54

Receiver ID	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest turbine, m	Nearest turbine
1 (S)	721,719	5,852,622	385	385	T5
2 (S)	723,979	5,851,194	392	1,223	T4
3	724,234	5,850,914	396	1,590	T4
4	723,813	5,850,367	391	1,513	T3
5 (S)	719,957	5,851,404	389	682	T7
6	720,730	5,853,043	389	1,152	T5
7	721,229	5,853,278	386	1,058	T5
8	723,091	5,853,256	388	1,364	T1
9	724,642	5,852,253	396	1,738	T4
10	724,931	5,850,508	403	2,390	T4
11	723,697	5,849,119	397	2,376	T3
12	723,463	5,848,405	396	2,941	T3
13	723,473	5,848,323	396	3,022	T3
14	722,740	5,848,416	386	2,793	T3
15	722,549	5,848,427	385	2,777	T3
16	722,265	5,848,826	379	2,397	T3
17	720,381	5,848,867	376	2,536	T6
18	724,089	5,854,068	390	2,495	T4
19	724,102	5,854,009	389	2,449	T4
20	723,308	5,855,493	402	3,505	T1
21	726,658	5,853,556	396	4,077	T4
22	726,571	5,851,014	406	3,711	T4
23	726,452	5,850,836	406	3,641	T4
24	720,059	5,848,357	381	3,114	T6
25	718,244	5,849,737	377	3,041	T7
26	718,819	5,852,823	382	2,031	T7
27	718,616	5,852,996	375	2,294	T7
28	718,483	5,853,695	372	2,835	T7

Receiver ID	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest turbine, m	Nearest turbine
29	718,700	5,853,778	373	2,744	T7
30	718,651	5,853,803	373	2,795	T7
31	719,385	5,854,953	378	3,415	T7
32	723,125	5,856,282	403	4,230	T1
33	723,527	5,856,313	406	4,353	T1
34	727,185	5,853,540	396	4,554	T4
35	726,043	5,848,179	406	4,613	T3
36	717,800	5,849,628	388	3,453	T7
37	716,468	5,852,494	389	4,133	T7
38	716,962	5,851,772	386	3,570	T7
39	717,205	5,853,398	373	3,718	T7
40	717,222	5,853,528	373	3,763	T7
41	717,378	5,853,812	372	3,775	T7
42	718,466	5,853,861	371	2,964	T7
43	718,515	5,853,953	371	2,997	T7
44	718,636	5,854,545	372	3,388	T7
45	718,405	5,853,940	371	3,063	T7
46	724,296	5,850,909	395	1,643	T4
47	726,020	5,848,211	406	4,575	T3
48	716,621	5,852,120	381	3,929	T7
49	716,654	5,852,428	379	3,938	T7
50	716,636	5,852,373	379	3,946	T7
51	716,758	5,852,638	387	3,879	T7
52	716,830	5,852,827	388	3,858	T7
53	716,876	5,852,938	387	3,847	T7
54	716,740	5,852,992	388	3,994	T7
55	716,434	5,852,892	388	4,257	T7
56	715,941	5,852,513	397	4,655	T7
57	716,003	5,852,747	392	4,638	T7
58	715,659	5,852,726	406	4,971	T7
59	715,768	5,853,146	397	4,966	T7
60	715,897	5,853,123	390	4,836	T7
61	715,832	5,852,874	397	4,834	T7

Receiver ID	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest turbine, m	Nearest turbine
62	716,174	5,853,283	383	4,623	T7
63	716,425	5,853,147	382	4,341	T7
64	716,922	5,853,912	376	4,213	T7
65	717,230	5,853,714	374	3,847	T7
66	716,833	5,854,005	382	4,337	T7
67	716,580	5,853,899	390	4,503	T7
68	716,504	5,853,834	392	4,540	T7
69	716,393	5,853,863	396	4,651	T7
70	716,393	5,853,762	396	4,607	T7
71	716,219	5,853,817	404	4,787	T7
72 (S)	719,955	5,851,350	389	711	T7
73	716,993	5,853,189	378	3,825	T7
74	715,799	5,853,033	400	4,905	T7
75	715,985	5,853,718	419	4,958	T7

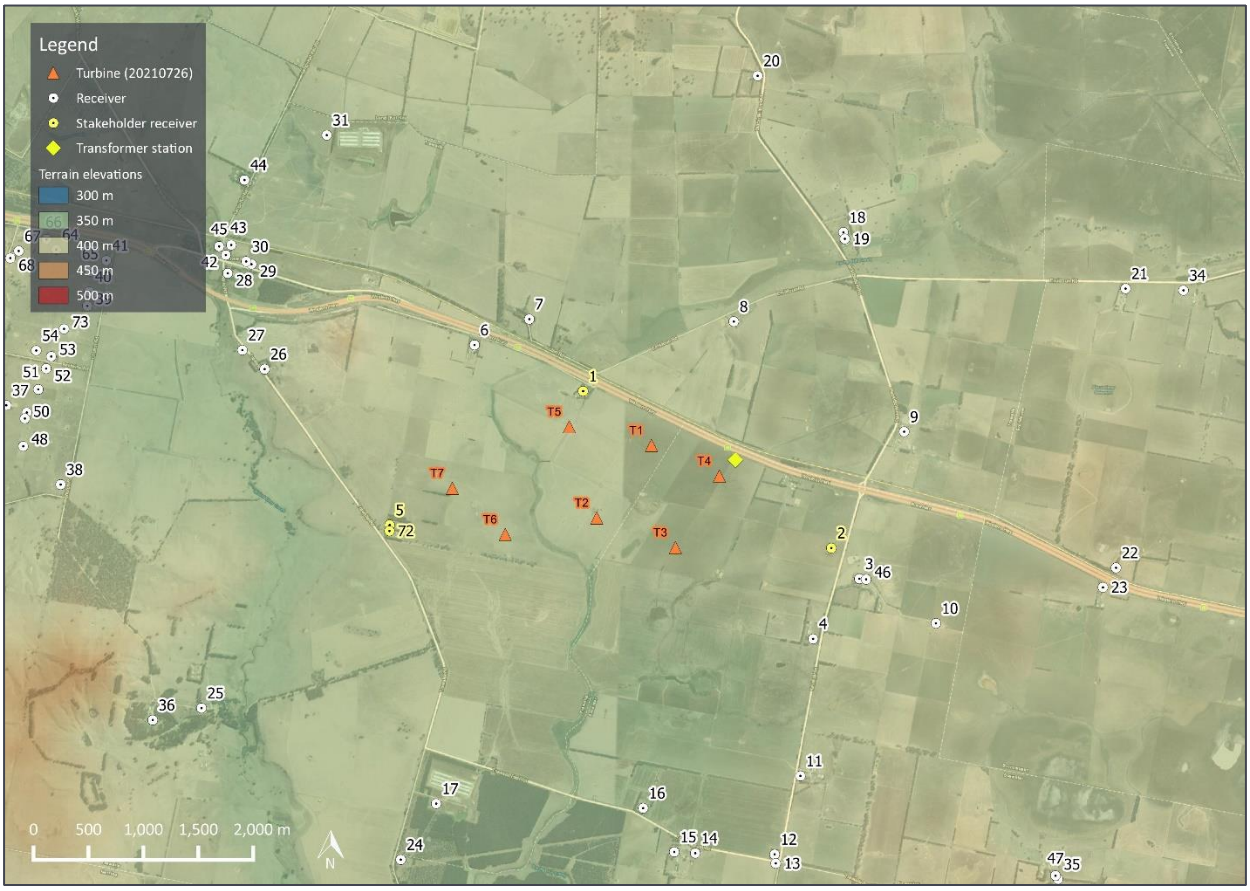
(S) Stakeholder receiver

APPENDIX D SITE LAYOUT PLAN

Figure 4: Proposed turbine layout and receivers

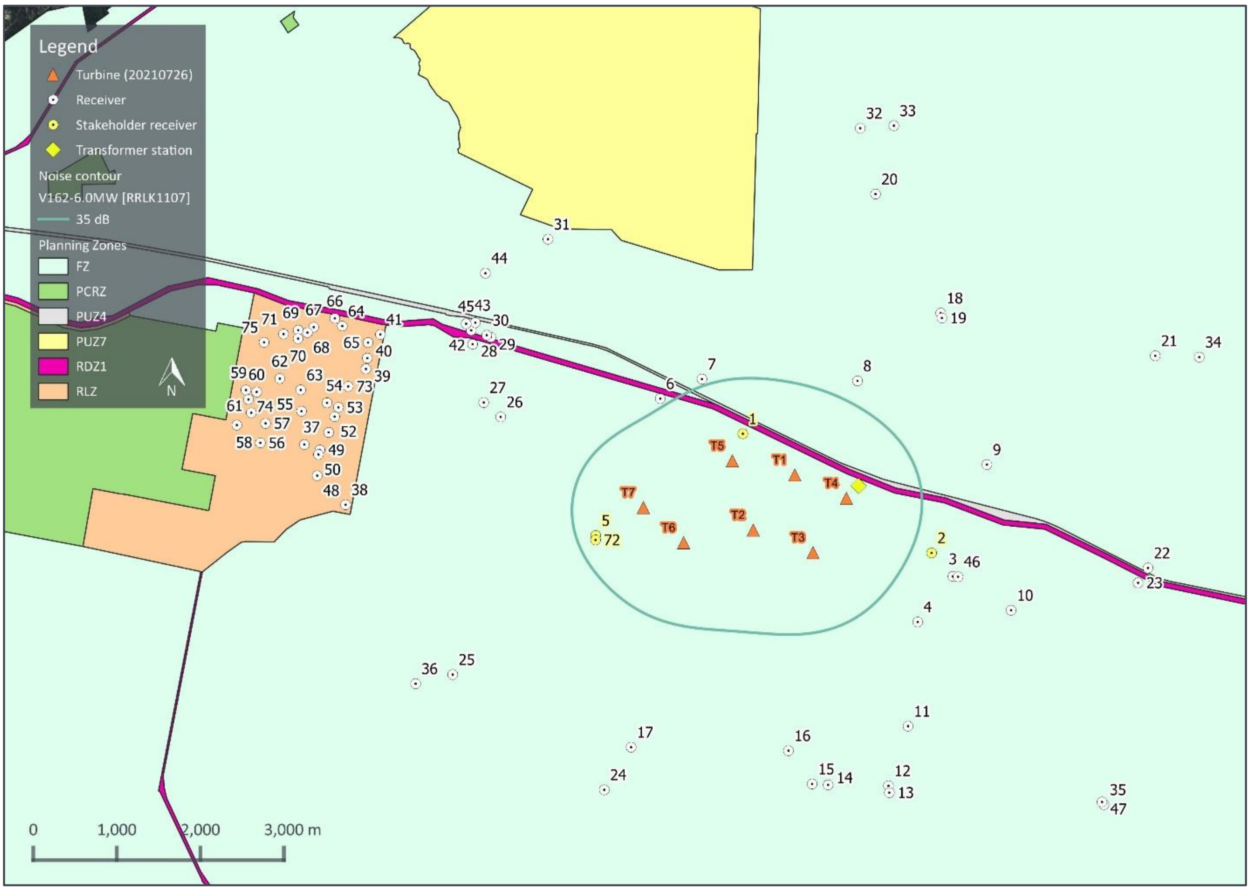
APPENDIX E SITE TOPOGRAPHY

Figure 5: Terrain elevation map for the Brewster Wind Farm and surrounding area



APPENDIX F ZONING MAP

Figure 6: Zoning map for the Brewster Wind Farm and surrounding area



APPENDIX G NOISE PREDICTION MODEL

Environmental noise levels associated with wind farms are predicted using engineering methods. The international standard ISO 9613-2 *Acoustics – Attenuation of sound during propagation outdoors* (ISO 9613-2) has been chosen as the most appropriate method to calculate the level of broadband A-weighted wind farm noise expected to occur at surrounding receptor locations. This method is considered the most robust and widely used international method for the prediction of wind farm noise.

The use of this standard is supported by international research publications, measurement studies conducted by Marshall Day Acoustics and direct reference to the standard in NZS 6808:2010 *Acoustics – Wind farm noise*, AS 4959:2010 *Acoustics – Measurement, prediction and assessment of noise from wind turbine generators* and the South Australian EPA 2009 wind farm noise guidelines.

The standard specifies an engineering method for calculating noise at a known distance from a variety of sources under meteorological conditions favourable to sound propagation. The standard defines favourable conditions as downwind propagation where the source blows from the source to the receiver within an angle of ±45 degrees from a line connecting the source to the receiver, at wind speeds between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground. Equivalently, the method accounts for average propagation under a well-developed moderate ground based thermal inversion. In this respect, it is noted that at the wind speeds relevant to noise emissions from wind turbines, atmospheric conditions do not favour the development of thermal inversions throughout the propagation path from the source to the receiver.

To calculate far-field noise levels according to the ISO 9613-2, the noise emissions of each turbine are firstly characterised in the form of octave band frequency levels. A series of octave band attenuation factors are then calculated for a range of effects including:

- Geometric divergence
- Air absorption
- Reflecting obstacles
- Screening
- Vegetation
- Ground reflections.

The octave band attenuation factors are then applied to the noise emission data to determine the corresponding octave band and total calculated noise level at receivers.

Calculating the attenuation factors for each effect requires a relevant description of the environment into which the sound propagation such as the physical dimensions of the environment, atmospheric conditions and the characteristics of the ground between the source and the receiver.

Wind farm noise propagation has been the subject of considerable research in recent years. These studies have provided support for the reliability of engineering methods such as ISO 9613-2 when a certain set of input parameters are chosen in combination. Specifically, the studies to date tend to support that the assignment of a ground absorption factor of G = 0.5 for the source, middle and receiver ground regions between a wind farm and a calculation point tends to provide a reliable representation of the upper noise levels expected in practice, when modelled in combination with other key assumptions; specifically all turbines operating at identical wind speeds, emitting sound levels equal to the test measured levels plus a margin for uncertainty (or guaranteed values), at a temperature of 10 °C and relative humidity of 70 % to 80 %, with specific adjustments for screening and ground effects as a result of the ground terrain profile.

In support of the use of ISO 9613-2 and the choice of G = 0.5 as an appropriate ground characterisation, the following references are noted:

- A factor of G = 0.5 is frequently applied in Australia for general environmental noise modelling purposes as a way of accounting for the potential mix of ground porosity which may occur in regions of dry/compacted soils or in regions where persistent damp conditions may be relevant
- NZS 6808 refers to ISO 9613-2 as an appropriate prediction methodology for wind farm noise, and notes that soft ground conditions should be characterised by a ground factor of G = 0.5
- In 1998, a comprehensive study (commonly cited as the Joule Report), part funded by the European Commission found that the ISO 9613-2 model provided a robust representation of upper noise levels which may occur in practice, and provided a closer agreement between predicted and measured noise levels than alternative methods such as CONCAWE and ENM. Specifically, the report indicated the ISO 9613-2 method generally tends to marginally over predict noise levels expected in practice
- The UK Institute of Acoustics journal dated March/April 2009 published a joint agreement between practitioners in the field of wind farm noise assessment (the UK IOA 2009 joint agreement), including consultants routinely employed on behalf of both developers and community opposition groups, and indicated the ISO 9613-2 method as the appropriate standard and specifically designated G = 0.5 as the appropriate ground characterisation. This agreement was subsequently reflected in the recommendations detailed in the UK Institute of Acoustics publication A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise (UK IOA good practice guide). It is noted that these publications refer to predictions made at receiver heights of 4 m. Predictions in Australia are generally based on a lower prediction height of 1.5 m which tends to result in higher ground attenuation for a given ground factor, however conversely, predictions in Australia do not generally incorporate a -2 dB factor (as applied in the UK) to represent the relationship between L_{Aeq} and L_{A90} noise levels. The result is that these differences tend to balance out to a comparable approach and thus supports the use of G = 0.5 in the context of Australian prediction methodologies.

A range of measurement and prediction studies[10, 11, 12] for wind farms in which Marshall Day Acoustics' staff have been involved in have provided further support for the use of ISO 9613-2 and G = 0.5 as an appropriate representation of typical upper noise levels expected to occur in practice.

The findings of these studies demonstrate the suitability of the ISO 9613-2 method to predict the propagation of wind turbine noise for:

- The types of noise source heights associated with a modern wind farm, extending the scope of application of the method beyond the 30 m maximum source heights considered in the original ISO 9613-2;
- The types of environments in which wind farms are typically developed, and the range of atmospheric conditions and wind speeds typically observed around wind farm sites. Importantly, this supports the extended scope of application to wind speeds in excess of 5 m/s.

10 Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions: The Risks of Conservatism*; Presented at the Second International Meeting on Wind Turbine Noise in Lyon, France September 2007.

11 Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions and Comparisons with Measurements*; Presented at the Third International Meeting on Wind Turbine Noise in Aalborg, Denmark June 2009.

12 Delaire, Griffin, & Walsh – *Comparison of predicted wind farm noise emission and measured post-construction noise levels at the Portland Wind Energy Project in Victoria, Australia*; Presented at the Fourth International Meeting on Wind Turbine Noise in Rome, April 2011.

In addition to the choice of ground factor referred to above, adjustments to the ISO 9613-2 standard for screening and valleys effects are applied based on recommendations of the Joule Report, UK IOA 2009 joint agreement and the UK IOA Good Practice Guide. The following adjustments are applied to the calculations:

- Screening effects as a result of terrain are limited to 2 dB
- Screening effects are assessed based on each turbine being represented by a single noise source located at the maximum tip height of the turbine rotor
- An adjustment of 3 dB is added to the predicted noise contribution of a turbine if the terrain between the turbine and receiver in question is characterised by a significant valley. A significant valley is defined as a situation where the mean sound propagation height is at least 50 % greater than it would be otherwise over flat ground.

The adjustments detailed above are implemented in the wind turbine calculation procedure of the SoundPLAN 8.2 software used to conduct the noise modelling. The software uses these definitions in conjunction with the digital terrain model of the site to evaluate the path between each turbine and receiver pairing, and then subsequently applies the adjustments to each turbine's predicted noise contribution where appropriate.

The prediction method inherently accounts for uncertainty through a combination of an uncertainty margin added to the input sound power level, and the use of conservative input parameters to the model, as described in this appendix, which have been shown to enable a reliable prediction of upper wind farm noise levels.

As an example of this, the ISO 9613-2 indicates an uncertainty margin of the order of +/-3 dB in relation to calculated noise levels at distances between 100 m and 1000 m for situations with an average propagation height between 5 m and 30 m (noting the information provided earlier in this appendix regarding the validation work undertaken to support the application of ISO 9613-2 to greater propagation heights). However, the uncertainty margins are noted for a prediction conducted in accordance with the inputs described in ISO 9613-2. A strict application of ISO 9613-2 would involve designating a ground factor of G = 1 (instead of the more conservative G = 0.5 ground factor used in the calculations) to represent the porous ground conditions around the site which ISO 9613-2 defines as follows:

> ***Porous ground**, which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land. For porous ground G = 1.*

A prediction based on a ground factor of G = 1 instead of G = 0.5 used in the modelling would typically result in predicted noise levels approximately 3 dB lower, thus effectively offsetting the quoted uncertainty margin. This also does not account for the other conservative aspects of the model, such as the assumption that all turbines are operating simultaneously at their maximum noise emissions and that each receiver is simultaneously downwind of every turbine at all times (in contrast to NZS 6808 compliance procedures which are based on assessing noise levels for a range of wind directions, consistent with broader Victorian noise assessment policies which do not evaluate compliance based solely on downwind noise levels).

Given the above, it is not necessary to apply uncertainty margins to the prediction results, as the results represent the upper predicted noise levels associated with the operation of the wind farm when measured and assessed in accordance with NZS 6808. This finding is supported by extensive post-construction noise compliance monitoring undertaken at wind farm sites across Australia.

APPENDIX H TABULATED PREDICTED NOISE LEVEL DATA

Table 11: Predicted noise levels, dB L_{A90}

Receiver	Hub-height wind speed, m/s						
	4	5	6	7	8	9	≥10
1 (S)	32.6	32.8	34.7	37.7	40.5	42.6	42.8
2 (S)	22.9	23.1	25.0	28.0	30.8	32.9	33.1
3	20.6	20.8	22.7	25.7	28.5	30.6	30.8
4	21.0	21.2	23.1	26.1	28.9	31.0	31.2
5 (S)	27.3	27.5	29.4	32.4	35.2	37.3	37.5
6	24.1	24.3	26.2	29.2	32.0	34.1	34.3
7	24.1	24.3	26.2	29.2	32.0	34.1	34.3
8	22.8	23.0	24.9	27.9	30.7	32.8	33.0
9	19.0	19.2	21.1	24.1	26.9	29.0	29.2
10	16.5	16.7	18.6	21.6	24.4	26.5	26.7
11	16.3	16.5	18.4	21.4	24.2	26.3	26.5
12	14.2	14.4	16.3	19.3	22.1	24.2	24.4
13	13.9	14.1	16.0	19.0	21.8	23.9	24.1
14	15.0	15.2	17.1	20.1	22.9	25.0	25.2
15	15.2	15.4	17.3	20.3	23.1	25.2	25.4
16	17.0	17.2	19.1	22.1	24.9	27.0	27.2
17	16.1	16.3	18.2	21.2	24.0	26.1	26.3
18	16.3	16.5	18.4	21.4	24.2	26.3	26.5
19	16.4	16.6	18.5	21.5	24.3	26.4	26.6
20	12.9	13.1	15.0	18.0	20.8	22.9	23.1
21	10.1	10.3	12.2	15.2	18.0	20.1	20.3
22	11.2	11.4	13.3	16.3	19.1	21.2	21.4
23	11.5	11.7	13.6	16.6	19.4	21.5	21.7
24	13.8	14.0	15.9	18.9	21.7	23.8	24.0
25	13.4	13.6	15.5	18.5	21.3	23.4	23.6
26	17.1	17.3	19.2	22.2	25.0	27.1	27.3
27	15.9	16.1	18.0	21.0	23.8	25.9	26.1
28	14.0	14.2	16.1	19.1	21.9	24.0	24.2
29	14.5	14.7	16.6	19.6	22.4	24.5	24.7
30	14.3	14.5	16.4	19.4	22.2	24.3	24.5

Receiver	Hub height wind speed, m/s						
	4	5	6	7	8	9	≥10
31	13.0	13.2	15.1	18.1	20.9	23.0	23.2
32	10.7	10.9	12.8	15.8	18.6	20.7	20.9
33	10.3	10.5	12.4	15.4	18.2	20.3	20.5
34	8.9	9.1	11.0	14.0	16.8	18.9	19.1
35	9.1	9.3	11.2	14.2	17.0	19.1	19.3
36	11.9	12.1	14.0	17.0	19.8	21.9	22.1
37	9.5	9.7	11.6	14.6	17.4	19.5	19.7
38	11.1	11.3	13.2	16.2	19.0	21.1	21.3
39	10.8	11.0	12.9	15.9	18.7	20.8	21.0
40	10.7	10.9	12.8	15.8	18.6	20.7	20.9
41	10.7	10.9	12.8	15.8	18.6	20.7	20.9
42	13.6	13.8	15.7	18.7	21.5	23.6	23.8
43	13.5	13.7	15.6	18.6	21.4	23.5	23.7
44	12.5	12.7	14.6	17.6	20.4	22.5	22.7
45	13.2	13.4	15.3	18.3	21.1	23.2	23.4
46	20.3	20.5	22.4	25.4	28.2	30.3	30.5
47	9.2	9.4	11.3	14.3	17.1	19.2	19.4
48	10.1	10.3	12.2	15.2	18.0	20.1	20.3
49	10.1	10.3	12.2	15.2	18.0	20.1	20.3
50	10.0	10.2	12.1	15.1	17.9	20.0	20.2
51	10.2	10.4	12.3	15.3	18.1	20.2	20.4
52	10.3	10.5	12.4	15.4	18.2	20.3	20.5
53	10.3	10.5	12.4	15.4	18.2	20.3	20.5
54	9.9	10.1	12.0	15.0	17.8	19.9	20.1
55	9.2	9.4	11.3	14.3	17.1	19.2	19.4
56	8.3	8.5	10.4	13.4	16.2	18.3	18.5
57	8.3	8.5	10.4	13.4	16.2	18.3	18.5
58	7.6	7.8	9.7	12.7	15.5	17.6	17.8
59	7.6	7.8	9.7	12.7	15.5	17.6	17.8
60	7.9	8.1	10.0	13.0	15.8	17.9	18.1
61	7.9	8.1	10.0	13.0	15.8	17.9	18.1
62	8.4	8.6	10.5	13.5	16.3	18.4	18.6

Receiver	Hub-height wind speed, m/s						
	4	5	6	7	8	9	≥10
63	9.1	9.3	11.2	14.2	17.0	19.1	19.3
64	9.5	9.7	11.6	14.6	17.4	19.5	19.7
65	10.5	10.7	12.6	15.6	18.4	20.5	20.7
66	9.2	9.4	11.3	14.3	17.1	19.2	19.4
67	8.8	9.0	10.9	13.9	16.7	18.8	19.0
68	8.7	8.9	10.8	13.8	16.6	18.7	18.9
69	8.4	8.6	10.5	13.5	16.3	18.4	18.6
70	8.5	8.7	10.6	13.6	16.4	18.5	18.7
71	8.1	8.3	10.2	13.2	16.0	18.1	18.3
72 (S)	27.0	27.2	29.1	32.1	34.9	37.0	37.2
73	10.4	10.6	12.5	15.5	18.3	20.4	20.6
74	7.8	8.0	9.9	12.9	15.7	17.8	18.0
75	7.7	7.9	9.8	12.8	15.6	17.7	17.9

(S) Stakeholder receiver

MARSHALL DAY Acoustics

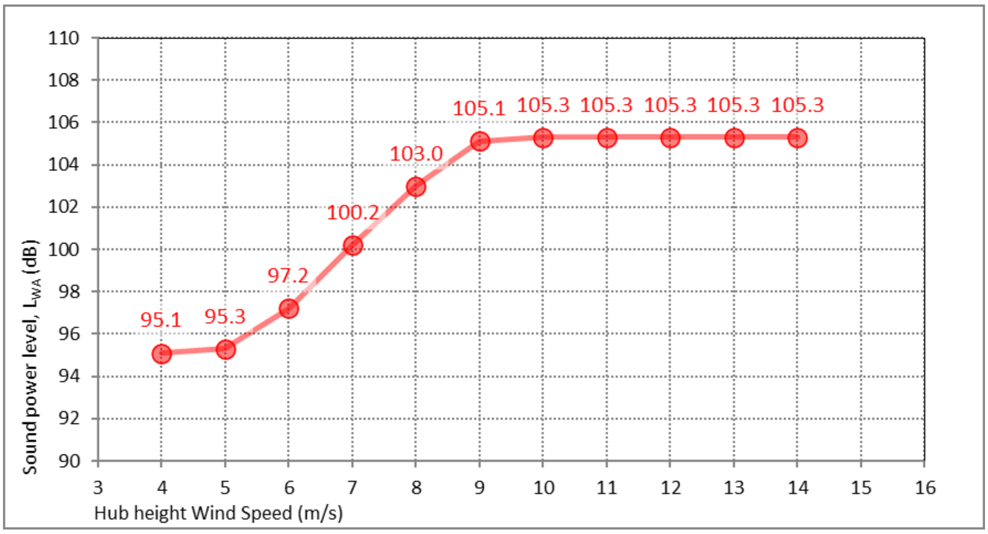
APPENDIX I NZS 6808 DOCUMENTATION

(a) Map of the site showing topography, turbines and residential properties: See Appendix E

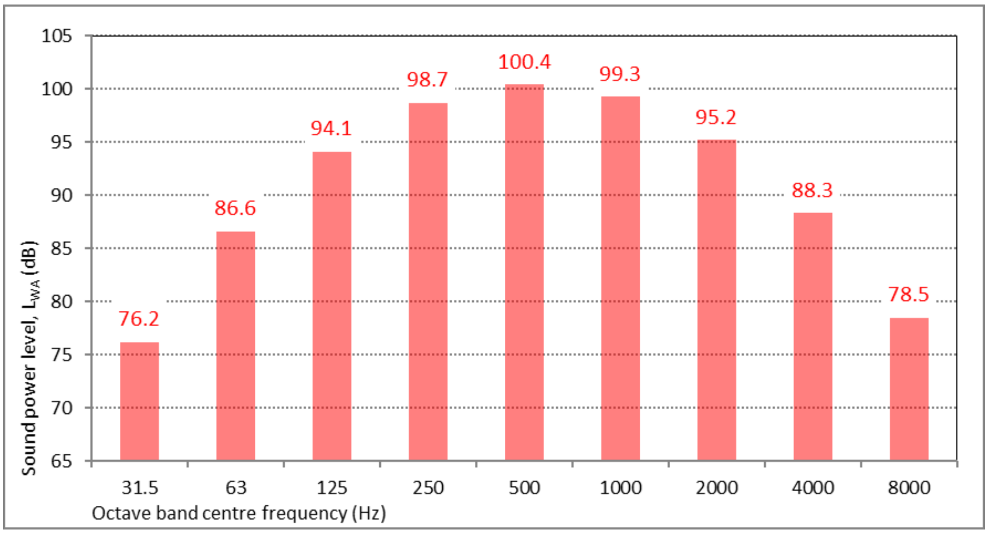
(b) Noise sensitive locations: See Section 2.0 and Appendix C

(c) Wind turbine sound power levels, L_{WA} dB (refer to Section 6.3.1)

Sound power levels (manufacturer specification +1 dB margin for uncertainty), dB L_{WA}



Reference octave band spectra adjusted to the highest sound power level detailed above dB L_{WA}



(d) Wind turbine model: See Table 3 of Section 6.2

(e) Turbine hub height: See Table 3 of Section 6.2

(f) Distance of noise sensitive locations from the wind turbines: See Appendix C

(g) Calculation procedure used: ISO 9613-2 prediction algorithm as implemented in SoundPLAN v8.2 (See Section 4.3 and Appendix G)

(h) Meteorological conditions assumed:

- Temperature: 10 °C
- Relative humidity: 70 %
- Atmospheric pressure: 101.325 kPa

(i) Air absorption parameters:

	Octave band mid frequency (Hz)							
Description	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Atmospheric attenuation (dB/km)	0.12	0.41	1.04	1.93	3.66	9.66	32.8	116.9

(j) Topography/screening: Elevation contours
1 m resolution within the site boundary and immediate surrounds and 10 m resolution beyond – See Appendix E

(k) Predicted far-field wind farm sound levels: See Section 6.4 and Appendix H.