RE Future

Brewster Wind Farm

Application for Planning Permit

Appendix B – Environmental Noise Assessment Audit

August 2024

EnviroRisk

APPROVALS - SUSTAINABILITY - COMPLIANCE

Verification Report

of the

Brewster Wind Energy Facility

Pre- Construction Noise Assessment

July 2024

for

Brewster Wind Farm Pty Ltd

GENERAL INFORMATION

Report Description:	Descriptor: r_Brewster_PreConstruction_Verify_240712_R0
Title:	Verification Report of the Brewster WEF Pre-construction Noise Assessment
Completed By:	
Name:	Stephen Jenkins BAppSci GradDipMgt. CEnvP, MAAS, FEIANZ
Company Details:	EnviroRisk Management Pty Ltd ABN 24 069 947 904 www.envirorisk.com.au
Appointments:	Auditor appointed pursuant to the Environment Protection Act 2017
Report(s) Verified	
Pre-construction Noise Assessment	Brewster Wind Farm Environmental Noise Assessment Rp 001 R05 20200543 20 June 2024
Report Distribution:	
Stephen Jenkins	EnviroRisk Management Pty Ltd (Master Copy)

Revision	Summary of Amendments	Reviewed by	Issued by	Issue Date
0		S Carter	S Jenkins	30/07/24

VERIFICATION APPROACH AND COVERAGE

This verification report is based on a systematic examination of a pre-construction predictive noise assessment report. It specifically relates to wind turbine generator (WTG) noise and does not assess site construction noise, nor noise attributed to separate facilities such as electrical sub-stations.

The verification coverage is strictly against the Victorian planning provisions to '*verify if the acoustic assessment undertaken for the purpose of the pre- construction (predictive) noise assessment report has been conducted in accordance with the Standard.* The Standard being NZ Standard 6808:2010: Acoustics - Wind Farm Noise. Additional noise requirements contained within the Environment Protection Act 2017, the Environment Protection Regulations 2021 (as amended) and EPA published environmental guidelines are not covered by this verification [e.g. consideration of the General Environmental Duty (GED), the Environment Reference Standard (ERS) and dwellings on the wind farm site] as these aspects are not catered for in the Standard.

Noise monitoring has not been undertaken by the verifier, nor has any raw data analysis or predictive noise modelling been repeated. There was, however, interrogation of the technical content within the subject report, enquiries relating to modelling input and quality assurance processes, a site inspection conducted and communications with the proponent and specialist personnel who prepared the acoustic report to verify against specifications within the Standard.

Information presented within this report relies on:

- the completeness and accuracy of technical details, plans and data contained within the pre-construction noise report, or made available to support verification enquiries; and
- the accuracy and completeness of subsequent information provided during communications with the proponent's representative and the subject report's authors.

The report should only be reproduced and distributed in full.

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ABBREVIATIONS

ABBREVIATION	WORD/PHRASE
AS/NZS	Australian and New Zealand Standard
dB L_{A90}	Decibels, A-weighted, exceeded for 90% of the time over a period of 10 min
EPA	Environment Protection Authority
EP Act	Environment Protection Act 2017
DTP	Department of Transport and Planning, Victoria
m/sec	meters per second
NMP	Noise Management Plan
NSL	Noise Sensitive Locations
NZS	New Zealand Standard
SAC	Special Audible Characteristics
SPL	Sound Power Level
WEF	Wind Energy Facility
WTG	Wind Turbine Generator

DEFINITIONS

Standard:

New Zealand Standard NZS 6808:2010 Acoustics – Wind farm noise

Noise Sensitive Location (source NZS 6808:2010):

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, papakainga and marae, excluding habitable spaces in buildings where the predominant activity is commercial or industrial. (Residential buildings designed for permanent habitation on land zoned for predominantly rural or rural-residential use are not classified as commercial or industrial for the purposes of this Standard);
(d) Teaching areas and sleeping rooms in educational institutions, including public and private primary, intermediate, and secondary schools, universities, polytechnics, and other tertiary institutions;
(e) Teaching areas and sleeping rooms in buildings used 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.

Stakeholder dwelling – a dwelling on the wind energy facility (wind farm) site, or one that has a written agreement to exceed the noise limit as specified under the Standard.

Micro-siting:

- within 100m in any direction from the centre of the turbine at ground level as shown on the development plans.

EXECUTIVE SUMMARY

Table E1: Summary of Information and Outcome

Name of WEF	*Brewster Wind Farm Pty Ltd*
Predictive WTG Noise Report	*Brewster Wind Farm Environmental Noise Assessment Rp 001 R05 20200543 20 June 2024*
Applicable Standard	*Verified in accordance with NZS 6808:2010*
Verifier	*Stephen Jenkins*
Qualifications	*Environmental Auditor (Appointed Pursuant to EP Act 2017)*
Outcome	*It is verified the acoustic assessment undertaken for the purpose of the preconstruction (predictive) noise assessment report has been conducted in accordance with the Standard.*

Outcome

I have assessed the pre-construction (predictive) noise compliance assessment report titled Brewster Wind Farm Environmental Noise Assessment dated 20 June 2024 against the specification contained within NZS 6808:2010 Acoustics - Wind farm noise (the Standard).

The noise assessment report has made predictions against a base standard noise amenity limit of 40 dB L_{A90} given the noise sensitive locations within the predicted 35 dB L_{A90} contour fall within a Farming Zone, as defined within the local planning scheme. This compliance limit is deemed appropriate considering guidelines support that a Farming Zone does not attract a high noise amenity limit unless there is a plan made under the planning scheme that specifies otherwise. Compliance was also assessed against a more conservative noise limit of 35 dB L_{A90} at the more distant Rural Living zone as this zoning will likely attract a higher noise amenity expectation. Noise sensitive locations in the Rural Living zone are over 2.5km from a WTG.

This verification report has assessed noise predictions from two (2) candidate wind turbine generators (WTGs) namely: Vestas V162-6.8MW, Vestas V172-7.2 MW. The pre-construction acoustic report has focussed on the V172-7.2 MW WTGs as this option reviews a higher sound power level amongst the two candidate turbines. Predicted compliance for the V172-7.2 MW WTG therefore extrapolates to predicted compliance for the V162-6.8 MW WTG should it be constructed.

I confirm I have reviewed the manufacturer's technical reports on noise from the candidate turbine, reviewed compliance limits specified in the noise assessment report, interrogated the rigor of the modelling selected parameters and processes, assessed considerations on uncertainties, sought clarifications on report content within the subject report, noted background sound monitoring was not used in the predictive compliance assessment, sought clarification on mapped noise sensitive locations (NSLs), and obtained an appreciation of the locality based on a site inspection, topography maps and aerial imagery.

The verification process has considered cumulative noise from nearby approved and operational wind energy facilities including Stockyard Hill and Waubra.

I verify the noise assessment report has been prepared in accordance with the Standard and that compliance is predicted against the noise limit of 40 dB L_{A90} at noise sensitive locations in the Farming Zone. Compliance against a high amenity noise limit of 35 dB L_{A90} is also predicted to be achieved within the more distant Rural Living zone with noise levels predicted to be below 30 dB L_{A90}. It is emphasised that wind turbine noise approaching the 40 dB L_{A90} noise limit at a NSL, as is specified in the Standard as the base compliance limit, means the noise may be readily audible, particularly during moderate hub height wind speeds that align with low background sound conditions.

1.0 Introduction

This verification report describes the outcome of a review of the pre-construction noise compliance assessment report prepared by Marshall Day Acoustics (i.e. the subject noise assessment report) for the proposed Brewster wind energy facility (WEF), located east of Beaufort, Victoria.

The verification was commissioned by Brewster Wind Farm Pty Ltd (the proponent), to fulfil obligations under Clause 52.32-4 of the Victorian Planning Provisions (Amendment Feb 2022) 'Mandatory noise assessment' i.e.

> **52.32-4**
> 03/02/2022
> VC199
>
> **Application requirements**
>
> An application must be accompanied by the following information as appropriate:……
>
> **Mandatory noise assessment**
>
> A pre-construction (predictive) noise assessment report demonstrating that the proposal can comply with the New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise, including an assessment of whether a high amenity noise limit is applicable under Section 5.3 of the Standard.
>
> An environmental auditor appointed under Part 8.3 of the *Environment Protection Act 2017* must prepare a report that verifies if the acoustic assessment undertaken for the purpose of the preconstruction (predictive) noise assessment report has been conducted in accordance with the Standard.
>
> This requirement does not apply to an application to amend a permit under section 72 or 97I of the *Planning and Environment Act 1987*, if the amendment to the permit sought by the application will not alter the noise assessment of the wind energy facility.

The specific item being verified is the noise assessment report prepared to demonstrate that the proposed WEF can comply with the noise limits specified in the New Zealand Standard NZS6808:2010, Acoustics - Wind farm noise (the Standard), including an assessment of whether a high amenity noise limit is applicable under Section 5.3 of the Standard.

The WEF is reported to comprise six (6) wind turbine generators (WTG) and has adopted as the pre-construction candidate turbines:

- Vestas V172-7.2MW model PO7200 (hub height of 150m or 166m, and blade diameter of 172m); or
- Vestas V162-6.8MW model PO6800 (hub height of 150m or 166m, and blade diameter of 162m)

2.0 Verification Review Components

2.1 Objectives

The objectives of the review are to assess the noise assessment report and verify the assessment has been conducted in accordance with the Standard.

The Standard specifies noise limits for noise sensitive locations (NSLs). NSLs are defined 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'*.

NSLs include residential use dwellings, child-care and educational facilities that are not located on the wind farm site.

For the purposes of this verification review, a stakeholder (e.g. landowner's or host property) is located on the wind farm site and is therefore outside the scope of the verification.

2.2 Scope

The scope is to verify whether the predicted compliance determination provided within the noise assessment report *Brewster Wind Farm Environmental Noise Assessment Rp 001 R05 20200543 / 20 June 2024,* has been conducted in accordance with the Standard.

2.2.1 Activity

The activity is the noise from wind turbine generators, as defined within the Standard, including any cumulative noise from adjacent wind energy facilities, either operating or under planning approval to develop.

2.2.2 Segment & Boundary

The segment being assessed specifically relates to the noise being generated by the WTG's with the potential to impact NSL's.

The boundaries of the review are the noise sensitive locations as identified in the subject noise assessment report within, and in reasonable proximity to, the 35 dB L_{A90} prediction contour.

Locations beyond this contour need not be considered under the Standard unless they are located within a high noise amenity area, upon which these NSL's will be assessed if in reasonable proximity to the 30 dB L_{A90} prediction contour.

Under best practice turbine design, operation and maintenance, and with consideration of the number and layout of the turbines, the boundaries under review generally lie within a 2km radius of the nearest wind turbine's centroid point to a noise sensitive location.

2.2.3 Element & Environmental Values

The element of the environment under consideration is the protection of human health and well-being as a result of noise annoyance and amenity loss.

The environmental values being protected are the normal domestic and recreational activities within a habitable space including sleep, or an education or child-care space in a building not on the WEF site.

2.2.4 Verification Period

The review was conducted over the period: 5 July 2024 to 15 July 2024.

2.2.5 Criteria

The criteria used for the verification review are specified in the New Zealand Standard, 6808:2010 Acoustics – Wind farm noise (NZS 6808:2010), which forms the noise standard.

Noise limits are defined in Table 2 of the Standard as:

Background sound level	Noise limit ($L_{A90(10\ min)}$)	High amenity noise limit ($L_{A90(10\ min)}$)
> 35 dB	background + 5 dB	background + 5 dB
30 – 35 dB	40 dB	
< 30 dB		35 dB

Notes:

Where a high amenity noise limit is shown to be justified in accordance with 5.3.1 (of the Standard), under wind conditions determined in accordance with 5.3.2, wind farm sound levels ($L_{A90(10\ min)}$) during evening and night-time should not exceed the background sound level by more than 5 dB or a level of 35 dB $L_{A90(10min)}$, whichever is the greater. During daytime the noise limit in (section) 5.2 should always apply.

The Standard recommends that the wind farm noise limits should not be set lower than 35 dB $L_{A90(10min)}$ at any time.

Under section 5.3.2. 'A high amenity noise limit should only be applied, and can only be maintained, under wind conditions when low background sound levels are common at a noise sensitive location, while the wind farm is operating. Therefore, even when a high amenity noise limit is justified in accordance with 5.3.1 it is appropriate to restrict application of that limit by conditions of consent to wind conditions when the wind farm wind speed falls below a fixed threshold. It is recommended that the high amenity noise limit should apply when the wind farm wind speed is 6 m/s and lower. An alternative wind farm wind speed threshold may be applied where justified on meteorological, topographical, and acoustical grounds.

The Standard specifies a level of 40 dB $_{LA90}$ being the 'limit' to protect from noise in the absence of background influence. Background sound has potential to increase the noise limit.

Additional standards and guidance referenced during the verification include:

- ISO 1996-1:2016 Preview. Acoustics– Description, measurement and assessment of environmental noise.
- ISO 1996-2:2017 Acoustics– Description, measurement and assessment of environmental noise.
- AS 1055:2018 Acoustics– Description and measurement of environmental noise.
- United Kingdom Institute of Acoustics. A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise, 2013.

2.2.6 Exclusions

The verification only includes operational wind turbine generator noise assessed against the requirements of NZS 6808:2010 Acoustics – Wind farm noise.

As such, it does not include other noise sources such as off-turbine substations, transformers, construction and maintenance activities that are not integral with the wind turbine operation. These are better assessed against different standards and criteria (e.g. EPA Publication 1834, *Civil construction, building and demolition guide*,

Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, and the Environment Reference Standard).

The Standard does not address noise at a dwelling on the wind farm site. Therefore stakeholder (host) dwellings have been excluded from the verification.

The review is specific to the detail contained in the noise assessment report and the subsidiary reports that are referenced.

It relates to the number and configuration of WTGs, the turbine candidate variant modelled and their configuration, the sound power ratings at respective octave band frequency specifications and hub height wind speeds as detailed within the reports reviewed.

The verification has, as far as is reasonably practicable, interrogated the process to identify relevant non-stakeholder noise sensitive locations (NSL) to ensure they are appropriately represented within the noise assessment reports; including reviewing the figures and tables that illustrate noise modelling compliance predictions, sampling the GPS locations of a couple of NSL and conducting a site tour such that all NSLs are represented.

Broader consideration beyond the Standard, including the General Environmental Duty under the EP Act 2017, are excluded from the scope of the verification. The Environment Reference Standard, as proclaimed under the EP Act 2017, is also excluded from the scope of this verification. This includes ambient sound objectives for a Farming Zone (i.e. Category IV), i.e.

- Outdoor $L_{Aeq,16h}$ from 6am to 10pm = 40 dB(A)
- Outdoor $L_{Aeq,8h}$ from 10pm to 6am = 35 dB(A)

2.3 Methodology

The following method was adopted for the review:

1. Communications with the client as to the verification process.
2. Obtaining a complete copy of the noise assessment report subject to verification (the subject report).
3. Aerial photography check of potential receptors using NearMap™ and Google Earth.
4. Conducting a site inspection of the proposed WEF area.
5. Detailed review of the noise assessment report's modelling methodology, source data, predictions and methods adopted against the Standard.
6. Review of planning guidelines in relation to high amenity areas and their associated noise limit.
7. Communications with the proponent as to the identification and mapping of all relevant noise sensitive locations.

8. Data interrogation and review of the locality of noise sensitive locations in reasonable proximity to the predicted 40 dB L_{A90} contour in the Farming Zone and 35 dB L_{A90} in the Rural Living Zone (applicable to one NSL only).
9. Review of the candidate turbine manufacturers sound power technical information.
10. Interviews with the proponent and communications with their acoustic consultant to clarify noise assessment report content with respect to quality assurance steps in the modelling, blade tip height influence and topography aspects including Mount Ross.
11. Completion of the verification protocol and issue of the verification report.

2.4 Process

The verification was conducted in general accordance with auditing techniques specified within AS/NZS ISO19011:2019 *Guidelines for auditing management systems*.

The process included a review of the subject noise assessment report, an evaluation of available material to assist with a determination as to whether a high amenity noise area is justified (e.g. guidelines, evaluation of previously written advice received from the EPA, planning decisions including the Cherry Tree Wind Farm decision), and assessment of the veracity of the modelling process and predicted noise levels. The process aimed to establish whether the noise assessment report provides sufficient detail to support a verification that compliance predictions within the report were made in accordance with the Standard.

The protocol used to assess conformance against the Standard is provided in Appendix 1 of this report. The appended spreadsheet list the criteria specified in the Standard and the auditor's findings and make comments to substantiate (as needed) determinations of compliance or non-compliance against each criterion.

The protocol content should be read with reference to the relevant sections of the Standard (i.e. NZS 6808:2010).

Compliance with the condition or requirement is rated Yes, No or other: whereby 'other' can include an item being 'Not Applicable (NA)' as it is not within the scope, 'Not Determined (ND)' based on information made available in the report and ambiguities between the Standards, guidelines and information within noise reports, or 'Part Compliant (PC)' where the requirement has inherently several parts to it.

Where any qualification for a determination is required, it has been captured in the comments section of the protocol. Where an issue has been identified with respect to content within the subject noise assessment report, a recommendation has been provided. Sections that are not in the scope of this pre-construction compliance verification are identified as such. The rationale for exclusion from the scope is provided in the comments column where required, or in Section 2.2.6 above.

The verification process has included communications with the proponent's representative, and the acoustic consultants who prepared the predictive noise modelling report.

3.0 Noise Limits

The noise assessment report has adopted a 40 dB $L_{A90\ (10min)}$ base noise limit for non-stakeholder NSLs in a Farming Zone.

Background monitoring data is referenced in the subject report that may result in an increase in the compliance limits at certain NSL (i.e. background + 5 dB $L_{A90\ (10min)}$). However, the predictive modelling has assessed only against the base noise limit. This is a representative approach for the Vestas V172-7.2MW – PO 7200 candidate model as the maximum sound power (i.e. 106.9 dB L_{WA}) is reached at a hub height wind speed of 9 m/sec, which potentially can coincide with low near ground wind speed conditions (and therefore lower wind induced background sound).

The noise assessment has reported maximum noise predictions at all NSL's are below the base noise limit of 40 dB L_{A90}.

The validity of whether background noise monitoring is sufficient to derive compliance limits that are influenced or otherwise by background conditions for wind speeds at and above 9 m/s is beyond the scope of this verification. Whether the background data is representative and complete for all NSLs will need to be addressed at a later date by the Responsible Authority during planning permit considerations.

3.1 Consideration of a High Amenity Noise Limit

A determination as to whether a high amenity area noise limit was applicable is made within the subject report (i.e. Section 6.1.1 High Amenity) which states:

> "Based on the predicted noise level contours presented subsequently in Section 6.3, 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 wind farm."

In assessing whether this is a reasonable conclusion, the auditor has referred to relevant guidelines and advisory notes on the applicability of a high amenity noise limit.

EPA guideline (former Pub. 1692, 2018) stated:

'The audit should include review of the assessment as it relates to:
- whether a high amenity noise limit is applicable, as assessed under Section 5.3 of the Standard following procedures outlined in clause C5.3.1 of the Standard. Where the Standard refers to a District Plan (or Plan) this shall be taken to mean a Scheme as defined within the VPPs."

Section 5.3 of the Standard is applied to determine whether a '*high amenity noise limit' of 35 decibels may be justified in special circumstances*. This section further states '*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 special locations, following procedures outlined in 5.3.1 of the Standard'.

The terms 'special circumstances' and 'special locations' are not defined either within the planning guidelines (DTP, 2023), nor the Standard (NZS 6808:2010).

Furthermore, these guidelines reference a tribunal report in that '*Guidance can be found on this issue in the VCAT determination for the Cherry Tree Wind Farm*'.

Taking wording directly from this report:

"The Mitchell Planning Scheme does not anywhere expressly or by implication "promote a higher degree of protection of amenity related to the sound environment of a particular area". Approaching the matter by a process of elimination it can be seen with certainty that the controls contained within the Farming zone, which includes most of the locality, do not answer this description. The purpose of the Farming zone is to encourage agricultural use, which is not an inherently quiet land use. In fact reference to the zone purposes confirm that agricultural use is to be preferred to residential use if there is potential conflict between the two.

Accordingly, the Tribunal concludes that the subject land and its locality is not capable of designation as a high amenity area because it does not possess the necessary characteristics of such an area as specified in the NZ standard.[1]"

Under this outcome, land within a Farming Zone would appear to not fall within a 'high amenity area'.

An opinion as to the relevance of a high amenity area is provided against each relevant element of the Standard below (*Note*: clauses taken directly from Section 5.3 of the Standard: High Amenity Areas):

> *"5.3.1*
>
> *The wind farm noise limit of 40 dB LA90(10 min) in 5.2 is appropriate for protection of sleep, health, and amenity of residents at most noise sensitive locations. 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.'*
>
> High amenity protection is therefore only relevant in 'special circumstances' during the evening and night period.
>
> *"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 LAeq(15 min) or 40 dBA L10."*
>
> The plan being referenced refers to the New Zealand planning schemes under the NZ Resource Management Act (as the Standard is taken from New Zealand). To interpret Australian planning schemes' promotion of high amenity, I previously sought and received advice from the EPA. EPA's email 'Advice and Supplementary to

[1] Cherry Tree Wind Farm Pty Ltd v Mitchell SC & Ors (Includes Summary) (Red Dot) [2013] VCAT 521. [108 - 109].

Advice' dated 25 October 2019 was referenced on how EPA-appointed auditors are to interpret the Victorian planning schemes, namely:

> *"For proposed wind energy facilities:*
> *When auditing an acoustic consultant's determination as to whether a high amenity limit ought to or not apply to an area, the following steps should be taken:*
> *1. First determine whether there are zones associated with an expectation of acoustical amenity (i.e. used predominately for residential purposes), including Township Zone, present within the 35 dB LA90 (10 min).*
> *2. Secondly, where the above zones are present, as per guidance in Section 5.3 of the NZS, confirm that background noise levels of the area are not affected by other specific sources, such as traffic noise. Additionally, check there are no agreements in place between stakeholders and WEF proponent in which case the HAL would not apply."*

The relevant zone for all noise sensitive locations within the predicted 35 dB L_{A90} in this case is a Farming Zone, which is not 'predominantly used for residential purposes.' As such, noise sensitive locations within the Farming Zone are not specifically within a high amenity area and therefore no high amenity noise limit warrants consideration unless it is specifically included under the planning scheme. Interrogation of the relevant Planning Scheme (refer to Figure 1 zoning map) by the Auditor did not identify any overlay nor reference to a high noise amenity area in the Farming Zone.

It is noted that both NZS 6808:2010 and the guidelines state that the high amenity limit would only be justified in 'special circumstances'. Considering large areas surrounding the proposed WEF, and across Victoria more generally, are Farming Zones, application of the high amenity limit to a Farming Zone would appear to contradict the requirement that it only apply in special circumstances.

EPA website interprets the Standard and states:

'In Victoria the HAA limit is only intended to apply in the following circumstances.

An HAA limit:

- *should apply to a dwelling located in the following zones predominantly intended for residential development: Low Density Residential Zone (LDRZ), Township Zone (TZ), Rural Living Zone (RLZ), Green Wedge A Zone (GWAZ) and Rural Conservation Zone (RCZ)*
- *should not apply to the Farming Zone (FZ)*
- *should not be applied in any location where background sound levels are already affected by other specific sources such as road traffic noise*
- *only applies for WEF wind speeds up to and including 6 m/s*
- *is applicable only when there is no agreement made in accordance with regulation 131A.*

Consistent with section 5.3 of the 2010 Standard, where an HAA noise limit applies, the base wind turbine noise limit should be 35 dB(A) for wind speeds ≤ 6 m/s at hub height. Above 6 m/s the base wind turbine noise limit should be 40 dB(A) (i.e. the standard acceptable noise limit).

On this basis, with particular consideration of the VCAT determination for the Cherry Tree Wind Farm proposal, it is apparent that the Planning Scheme does not envisage a higher level of amenity for the subject site and surrounding land containing the nearest noise-sensitive locations. Therefore, the high amenity limit has not been applied to noise sensitive land uses in the Farming Zone.

I therefore concur with the determination within the noise assessment report that a standard noise limit of 40 dB L_{A90} applies for noise sensitive locations within the Farming Zone.

It is noted that a number of noise-sensitive locations to the west are located in other zones i.e. Rural Living (refer Figure 1). The Cherry Tree Wind Farm VCAT decision does not advise on these zones but the recent Planning Panel decision for the Golden Plains Wind Farm indicated that similar zoning is likely to be of 'High Amenity' (i.e. '*… zoned Township Zone and Low Density Residential Zone are a high amenity for the purposes of the Standard*' (ref PA1700266, 29 April 2019).

Therefore the Rural Living zone situated approximately 3.5 km from the nearest turbine to the west are potential high noise amenity areas (refer Figure 1).

A conservative approach has been adopted and a limit of 35 dB L_{A90} has been assessed against for compliance purposes at noise sensitive locations in this zone. All NSL's fall outside the predicted 30 dBA(A) mapped contour. The predictions are made at maximum SPL where hub height wind speeds are at and above 9 m/sec, well above the 6 m/sec maximum applicable wind speed specified on the EPA web site. Therefore at wind speeds applicable to high amenity noise conditions, levels will be even lower. Modelling therefore predicts compliance against a possible high amenity limit within the Rural Living zone area.

A '*high amenity area noise limit*' under the Standard has been considered and deemed to not be applicable within the Farming Zone that extends beyond the predicted 35 dB $_{LA90}$ contour.

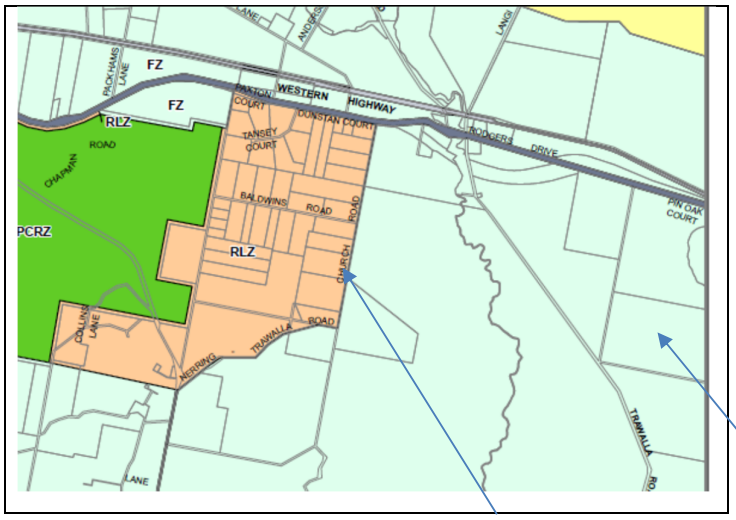

Figure 1: Planning Scheme (nearest high noise amenity zoned areas); (nearest WTG >3km)

4.0 Evidence

The evidence used to form conclusions is summarised within the completed compliance protocol that is provided in Appendix 1.

Specific comments are discussed below.

4.1 Determinations

4.1.1 Familiarisation with the WEF development proposal and planned operation

Details of the development proposal were specified within the subject report including sound power data provided by the manufacturer, details of test reports for a range of audible octave band Sound Power Levels (SPLs) and the reported specification of an absence of any tonal noise or a special audible characteristic (SAC) associated with the turbines.

To confirm the reported SPLs used in the modelling reflected manufacturers' data, copies of the manufacturers third octave SPL test reports on the WTG were reviewed. It was confirmed the data specified in the subject report reflected manufacturers information with a 1 dB(A) addition to account for test uncertainties.

A map of the proposed turbine locations with predicted noise contours for the candidate turbine and consideration of cumulative impact from the adjoining WEFs, the nearest being the Stockyard Hill wind energy facility, has been taken from the subject report and reproduced in Figure 2.

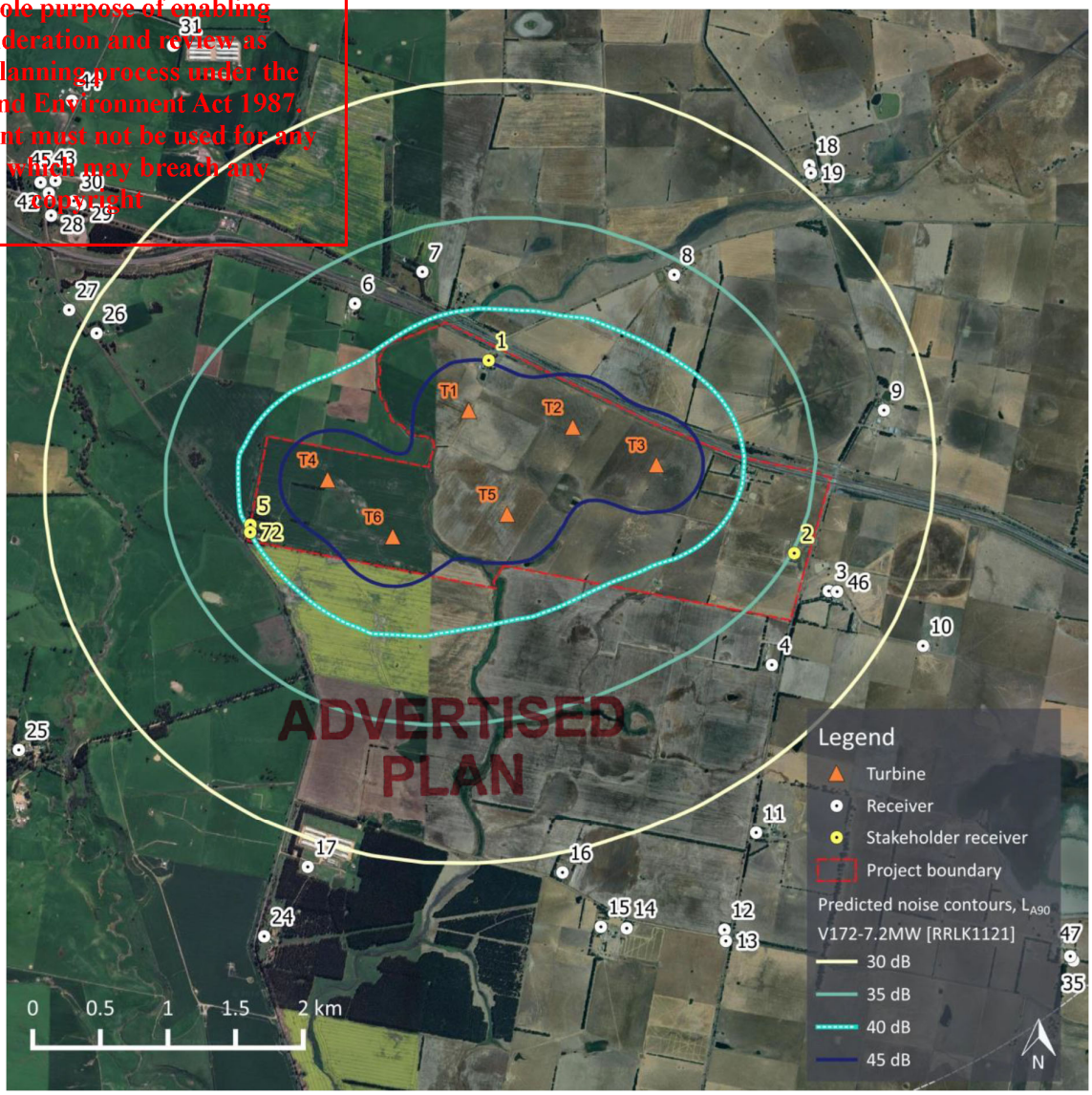

Figure 2: Predicted noise contours (from Figure 1 MDA, 2024)

A review of the proposed development locality was made using ground surveillance, Google Earth and Google Maps, NearMap imaging and communications with the proponent's personnel and their acoustic consultants.

4.1.2 Inspection of the WEF project site and the surrounding environment

A detailed site inspection was undertaken to appreciate the project site and surrounds during early July 2024. A tour of all NSL within 2km was undertaken. The site inspection noted the hill (i.e. Mount Ross) to the north-west. This was subsequently verified via a topography check (refer Figure 3 below). The subject noise report map did not clearly distinguish the hill which is relevant for NSL #6. However, discussions with the subject noise report authors established the figure in Appendix E of the subject noise report included a similar topographic profile that was included within the prediction modelling.

Source: https://en-au.topographic-map.com/map-88wnx/Beaufort/?center=-37.45809%2C143.50875&zoom=14

Figure 3: Topography map illustrating Mount Ross

4.1.3 Assessment of the rigour of the process used to identify noise sensitive locations

The WEF covers a relatively small area with three (3) non-stakeholder NSL's falling within the predicted 35 dB L_{A90} to 40 dB L_{A90} noise contours (refer Figure 2). The nearest turbine to a non-stakeholder NSL is assessed to be over 1.0 km (i.e. NSL #6).

Confirmation was sought and obtained from the proponent that all applicable non-stakeholder NSL's were nominated and mapped within the noise assessment report.

Interviews were held with the proponent to establish the process used to identify non-stakeholder properties. Site tours were made along several accessible public roads around the proposed WEF and its surrounds. NSL's marked # 3, 4, 46, 6, 7, 8, 9 and 26 were sighted.

I am therefore satisfied that the process followed to identify non-stakeholder properties and NSL's for the purpose of noise assessment has been rigorous and is likely to be complete.

4.1.4 Review of the pre-construction noise assessment considering the WEF development proposal and operations

The following items have been considered during the review:

- turbine technical specifications and power ratings;
- tower locations;
- topography;
- transformer stations[2];
- any other relevant factors.

The noise assessment report identifies that the WEF's candidate turbines will comprise the Vestas 172-7.2MW (PO7200).

[2] Discussions with the proponent reveals that transformers may be integrated within the turbine structure and therefore form part of the noise curves and test data provided as source information for noise modelling. External to turbine sub-station transformers have not been included in noise predictions.

The candidate turbine has been modelling with serrated tail edge (STE) blades. Noise emission data indicates the adoption of a STE reduces noise against non-STE blades by several decibels and would therefore represent best practice on blade noise control.

A terrain elevation heat map was provided in the subject report. The locality generally is relatively flat to undulating, being more elevated to the west where a hill was observed (Mount Ross).

Assumptions, such as ground attenuation and the absence of tonality, appear reasonable based on the Standard's guidance and based on my experience with operational wind energy facilities.

Communications were held to clarify some aspects of the modelling process including adopted SPL's for the model selected, turbine hub height variances, topographical detail, tonal considerations within manufacturers' testing reports and mapping of NSLs. It was noted the Vestas technical manual data was obtained from a similar WTG and extrapolated to the candidate model. Advice from the acoustic consultant confirmed they were confident it is relatable. This approach, with a 1 dB margin for uncertainty, is arguably in accordance with the Standard should actual data not be available. Communications were held relating to quality checks of modelling outcomes and background report relevance against compliance levels.

The source information was reportedly fed into the SoundPlan version 8.2 software model, adopting the ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors* inputs to predict noise levels surrounding the wind farm. The input parameters were specified for the model.

The Standard references the ISO 9613-2 as '*an example that has been shown to correlate well with measured data from wind farms*'.

Details of my review against the modelling process are provided within the verification protocol in Appendix 1.

4.1.5 Review of background noise assessments

Background noise had not been determined at the time of review.

Background noise will be relevant in determining compliance if, and when, the wind energy facility achieves planning approval. This is particularly so given the proximity of some NSL's to the western highway.

4.1.6 Technical verification of the predictive noise assessment

The following items were evaluated:

- methodology applied to conduct the assessment,
- base technical reports where input data was sourced,
- sound modelling programs employed, and
- verification that the assessment was conducted in line with the Standard.

A line- item review of technical considerations against items specified within the Standard is provided within the verification protocol (refer to Appendix 1).

4.1.6.1 Cumulative Impact Considerations

Cumulative noise impact is relevant as there are a number of nearby existing operational WEFs and one approved and soon to be operational WEF. The nearest with potential to influence noise above the 30 dB L_{A90} contributory noise contour is the Stockyard Hill WEF which is greater than 10km from a WTG. It is reasonable to deduce that 30 dB L_{A90} contour lines from adjoining WEFs do not cross at any location near any NSL. Under the Standard there is no discernible noise contribution that warrants consideration in a prediction assessment.

According to published guidance[3], if turbines are greater than 5.25x the tip height distance from a noise sensitive location, some attenuation due to wind effects would reasonably be expected (i.e. approximately 1.3 km in this instance). Beyond a 7.5x tip height distance between a noise sensitive location and a turbine, a reduction of >4 dBA would reasonably be expected for 'up wind' turbines. The modelling makes no allowances for up-wind locations and is therefore conservative for a NSL with a distance beyond 1.3 km to a turbine.

The Vestas 172-7.2MW model turbine noise is predicted to comply with the base noise limit of 40 dB L_{A90} with over 2 dB L_{A90} compliance buffer predicted at any NSL under reasonable worst-case prediction methods. The other candidate turbine would be at least 1 dB L_{A90} lower than this prediction.

A base noise compliance limit of 40 dB L_{A90} is therefore predicted to be achieved at all noise sensitive locations in the surrounds of the proposed WEF.

4.1.6.2 Topographical Influences

Topographical influences were reported to be integrated into the model based on the topographical information within the subject report.

The topographic map reveals a relatively flat terrain with no significant valleys nor concave environs over the majority of the areas in proximity to the WEF which may result in significant uncertainties associated with the modelling. Mount Ross exists to the north-west. Confirmation was received that this landmark was appropriately integrated into the model.

4.1.6.3 Noise Spectrum for Candidate Turbines

Confidential manufacturers' test data reports were provided and reviewed.

The raw technical data on the turbines was confirmed to reflect data that was adopted into the modelling up to a hub height wind speed of 12 m/sec which captures the maximum SPL for the candidate WTG.

[3] UK Institute of Acoustics. A good practice guide to the application of ETSU-R-97.

It is stated the selected turbine will have serrated tail edges to minimise noise. This is considered to represent standard practice and has been adopted within the modelling.

Third-octave band charts were provided. The height of the WTG was not provided in the Vestas technical manual and it has been taken the SPLs are representative.

Noise predictive modelling has been conducted in the absence of any Special Audible Characteristics (SACs). Best practice wind turbines can operate without SACs where sufficient distance is available between the turbine and an NSL.

According to the provided technical manual, the candidate turbines appear to have the option of operating in a noise reduction mode if required.

4.1.6.4 Effect of Turbine Changes Should Micro-siting Occur

It is noted that micro-siting is typically permitted under planning approval. Given that this can result in turbines being repositioned closer to an NSL, micro-siting may present additional risk. A re-evaluation of compliance would become necessary if one or more turbines, in reasonable proximity to an NSL that could impact noise levels, are relocated closer as a result of micro-siting.

4.1.6.5 Uncertainties and Error Considerations

Uncertainties in the candidate turbine manufacturers data and associated modelling process become important where marginal compliance is predicted.

Within the manufacturers data no specific discussion of uncertainty is provided for the Vestas candidate turbine.

Product and testing reproducibility uncertainties were not discussed in detail in the subject report. MDA has made an allowance of 1 dBA to the SPL provided by the manufacturers to account for uncertainties in the data and modelling.

It is noted that modelling has predicted a compliance margin of over 2.5 dB L_{A90} for the candidate turbine.

This provides a level of confidence that compliance will be achieved even accounting for a degree of uncertainty.

Ultimately, compliance will need to be demonstrated by actual monitoring should approval be granted.

5.0 Results & Conclusions

The following conclusions are drawn based on the noise assessment report:

- I have found the process employed by the proponent designed to identify the relevant non-stakeholder properties with the potential to be impacted by wind turbine noise to have been rigorous.

- The noise assessment report adopts processes that are based on sound methodology and have been undertaken by skilled and experienced personnel. I have found the pre-construction noise report predicted maximum noise levels at NSL's from the wind energy facility's candidate turbines to have followed the Standard, and predictions are likely to be accurate when based on the technical information provided concerning the candidate turbine type, sound power output and siting.
- Compliance with the base noise limit of 40 dB L_{A90} is therefore predicted at all non-stakeholder noise sensitive locations in the Farming Zone and 35 dB L_{A90} in more distant zones likely to be of high noise amenity, and consequently is deemed acceptable under the Standard.

  This determination is relevant for the candidate turbine type, the siting plan used in the predictive modelling and the absence of special audible characteristics (SACs), including tones. It is important for compliance predictions that SACs are not present when assessed under the Standard, and the proponent should seek guarantees from the wind turbine supplier as to the same.

I can verify that the noise assessment report has been conducted in accordance with the Standard with respect to wind turbine noise predictions.

It needs to be emphasised that the 40 dB L_{A90} noise limit specified in the Standard (and adopted under DTP guidelines) means that wind turbine noise may, at times, be readily audible and identifiable, particularly when moderate hub height wind speeds align with low background noise conditions.

6.0 Recommendations

It is recommended:

1. should turbine positions vary because of micro-siting from marked locations towards a non-stakeholder's dwelling where compliance is predicted to be marginal (i.e. within 2 dB L_{A90} of the noise limit), an updated predictive noise compliance assessment should be completed before construction. This report should be independently verified prior to issue.

7.0 References

1. New Zealand Standard NZS 6808:2010 *'Acoustics – Wind Farm Noise'.*
2. Department of Transport and Planning (DoT). Planning Guidelines for the Development of Wind Energy Facilities, September 2023.
3. AS/NZS ISO19011:2019 *Guidelines for auditing management systems.*
4. ISO 1996-2:2017 *Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures.*
5. NZS 6801:2008 Acoustics- Measurements of environmental sound.
6. Cherry Tree Wind Farm Pty Ltd v Mitchell SC & Ors (Red Dot) [2013] VCAT 521.
7. Third octave noise emission EnVentus Vestas V172-7.2MW 50/60 Hz Document No. 0128-4336_00 (Confidential Issue)

APPENDICES

APPENDIX 1:

VERIFICATION PROTOCOL

WIND ENERGY FACILITY WIND TURBINE NOISE ASSESSMENT VERIFICATION PROTOCOL

Facility Brewster Wind Farm, east of Beaufort, Victoria
Standard NZS6808:2010 Acoustics - Wind farm noise
Evidence
Brewster Wind Farm Environmental Noise Assessment
Rp 001 R05 20200543 20 June 2024

NZS specifications:

Section	Requirement	Comply	Observations/ Comments
Definitions	Measurement time: 10min accuracy 1% ie 6 secs		
	Noise Limit: not to be exceeded		
	Notional Boundary: A line 20m from any side of a noise sensitive location		
	Post-installation sound level: A weighted L90 centile level		
	Cut in speed typical: 4 m per sec. Shut down 25 m per sec		Cut in speed reported in manufacturers information range from 3 m/s, cut-out is not specified but maximum sound power generation is reach by 9 m/s. SPLs are provided up to 15 m/s (hub height).
3.1	Metric for wind farm sound: A weighted L90 centile level i..e dB L90(10min)	Yes	This metric has been used within the noise assessment report.
3.2	Process: Figure 1		
	Determine location of 35 dB Contour	Yes	Modelling was undertaken using ISO 9613 propagation parameters within the SoundPLAN software (version 9). Predicted maximum noise levels were derived by the model. Predicted maximum noise levels were derived and tabulated for each NSL within at least a 3km distance from the nearest turbine and a noise contour map was plotted atop of aerial imagery. This is included in the subject report revealing all candidate turbine prediction maps modelled under the maximum SPL for each WTG.
	Determine wind farm noise limits	Yes	The report has adopted a base 40 dB LA90 limit for non-stakeholders in a Farming Zone. Background noise measurements have not been completed and the base limit used for compliance purposes. The EPA communications support there are no special circumstances nor special locations that would suggest a higher noise amenity than standard within a Farming Zone. There is a Rural Living Zone nearby. Noise predictions and distances suggest contribution is less than 30 dB(A) and therefore would comply against a high amenity limit where it potentially could be relevant. The noise assessment report adoption of a base standard for predictive modelling against NSL in the Farming Zone is appropriate
	Refine predictions at each noise sensitive location	Yes	Included in the noise assessment report along with GPS locations for each NSL. A sample confirmed these as likely to accurate in all cases. A ground truthing exercise involving aerial photos and car surveillance was conducted. Further confirmation was sought and received from the proponent that supports all relevant NSLs have been considered and are included in the noise assessment reports. Stakeholder (host) locations are marked and deemed on the wind farm site. According to the Standard these are not NSLs.
	Report	Yes	The subject noise assessment report was issued by MDA in June 2024 . The noise assessment report details the SPL per octave frequency band for the Vestas candidate model, the NSL's locations and the blade tip height used in modelling.
	Post installation sound level measurements	NA	
4.1.1	Audibility is not an appropriate basis for setting noise limits. Limits based on Section 5.	NA	see below.
4.2	Reverse Sensitivity		
	Nomination of a 40dB wind farm sound level contour and the 35dB contour.	Yes	Predicted contour maps have been prepared and are included in noise assessment report.
5	**NOISE LIMITS** - designed to protect sleep disturbance whilst inside house		
5.1.2	Upper limit at residential location of 40 dB L90	Yes	This limit has been confirmed as being used for compliance predictions against the maximum sound power rating level provided from the manufacturers noise test data.
	(assumes 15 dB reduction indoors to <30 dB Leq)	NA	for information only
	Sleep protection also protects health and amenity.	NA	for information only

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	5.3.1 The use of a background + 5dB limit means that the wind farm sound may be the dominant sound heard at a noise sensitive location for a significant proportion of the time when the wind farm is operating	NA	for information only
5.2	Noise limit		*Note: the NZS acknowledges and states that at a noise level of BG + 5dB that 'the wind farm may be the dominant sound heard at a noise-sensitive location for a significant proportion of the time the wind farm is operating'.*
	Wind farm sounds (as L90 10 min) should not exceed background by more than 5 dB or a level of 40 dB LA90 10min, whichever is the greater at the notional boundary of any noise-sensitive location	Yes	Within the noise assessment report, 40dB LA90 10 min has been used as the compliance limit in all instances for predictions. Available background noise data for the night period is not available. As such, it is prudent to assess all locations against the 40 dB LA90 base noise limit and this has been undertaken within the acoustic report.
5.3	Secondary noise limit: only considered…		
	Background are commonly less than 25dB when predicted to exceed by 10dB or more	NA	40dB LA90 10 min has been used as the compliance limit for predictions within a Farming Zone. There is potential for a high background near the Western Freeway.
	Higher degree of protection of amenity protection has been assessed and is not required.	Yes	All dwellings within the predicted 35 dB LA90 contour are located within a Farming Zone. There is no specific planning requirement that could be identified that directly specifies a high amenity area in a Farming Zone within the relevant Planning Scheme. A high amenity noise limit is discussed in the noise assessment report and is not considered applicable in the Farming Zone. According to the Cherry Tree VCAT decision and other EPA web site commentary, a Farming Zone is not considered a High Amenity Area unless the planning schemes specified otherwise e.g. provides an overlay. Accordingly, a standard noise amenity is appropriate for noise-sensitive locations within a Farming Zone and a higher degree of amenity protection is not required. There are other zones, including a Rural Living Zone, to the south outside the 35 dB LA90 contour. No detailed discussion is considered necessary in the subject report around compliance within these zones given they fall outside the predicted 35 dB LA90 contour and the limit would apply at lower wind speeds (i.e. 6 m/s or less as per EPA Guideline) where sound power outputs from the turbines are lower than that modelled.
	Planning rules dictate	Yes	No specific planning rules dictate a high amenity protection
	Only applies to locations within 35dB contour	NA	Only farming zone locations are within the 35 dB LA90 contour under maximum sound power level predictive modelling; compliance is extrapolated in this, and the more distant Rural Living zone even if the high amenity limit were to apply (as it is located outside the predicted 30 dB LA90 contour.
	Arithmetically average difference for all 10 minute intervals. If less than 8 dB secondary not justified	NA	refer above
5.3.2	Lowest stated level is 35dB or 5db above background if above 35db L90 10 min.	NA	The Farming Zone land is not considered high amenity unless specified in a planning scheme as high amenity. i.e. Cherry Tree VCAT decision and EPA commentary. Background monitoring data is not required if base noise limits are selected for the predictive noise assessment - and this is the case. If at a later date it is planned to use background noise data to raise compliance limits with increased wind speeds, it will be necessary to ensure the data attained is representative and relevant to the NSL location.
	Generally only applies when wind speed at hub height is less than 6m per sec	NA	See comments above relating to EPA web site commentary confirming this.
			The subject report mentions proposed stakeholders. Dwellings on the wind farm site are not included in the Standard, and are therefore outside the scope of verification.
5.4	**SPECIAL AUDIBLE CHARACTERISTICS**		
5.4.1	Considerations to be given to and special audible characteristics of the wind farm sound when comparing levels against noise limits.	Yes	Data associated with a similar 'technology' turbine support absence of any tonal characteristics. Third-octave data has been reviewed and indicates no distinctive tonality below 4,000 Hz. Based on experience with other candidate turbines there is potential for a tone to be present above this frequency. However, high-frequency noise will be attenuated within the atmosphere to non-audible levels within a few hundred meters from the turbine, and therefore not audible at the nearest NSL. The auditor has previously had access to a test report on a lower power output Vestas turbine that supports no tones present. A specification of no tonal audible characteristic needs to be confirmed and is suggested to be warranted with the manufacturer, with the final selected turbine.

5.4.2	Tonal, impulsiveness, amplitude modulation shall be adjusted by arithmetically adding up to +6dB to the measured levels	Yes	No special audible characteristics are considered applicable. This should be warranted in the turbine supplier agreement.
	If there is doubt about the presence of tonality, the following two methods provide an objective measure for tonality. The simplified test method may be carried out using one-third octave band measurement equipment. The reference test method requires the use of narrow band analysis. If the simplified method does not indicate tonality, it may still be necessary to use the reference method to confirm the presence or absence of tonality. In addition, the reference method can properly assess modulated tones where the tone is varying or where there are complex tones with many closely-spaced tone components. However, the method does not address wind farm amplitude modulation	NA	
	No appropriate objective test for amplitude modulation has been standardised. If a local authority enforcement officer or an acoustics advisor to a local authority considers that a wind farm creates sound with clearly audible amplitude modulation at a noise-sensitive location, an adjustment of +5 dB shall be applied to the wind farm sound level at that location for the wind conditions under which the modulation	NA	
	In making an assessment under B3.1, modulation special audible characteristics are deemed to exist if the measured A-weighted peak to trough levels exceed 5 dB on a regularly varying basis, or if the measured third-octave band peak to trough levels exceed 6 dB on a regular basis in respect of the blade pass frequency	NA	
	Where special audible characteristics are confirmed, the value of the adjustment (k2) shall be 5 dB for that sample, provided that where the reference test method for tonality is used, the value of the adjustment (k2) shall be between 1 and 6 dB where justified. The adjustment (k2) shall only be applied to samples in which special audible characteristics are present. Only one adjustment value (k2) shall be applied to each measurement, even if more than one type of special audible characteristic is present.	NA	
5.4.3	Conducted in accordance with Appendix B of the NZS.	NA	
	Cumulative adjustments shall not be made. Max adjustment is 6 dB.	NA	
5.5	**Other Factors**	NA	
5.5.1&.2	Ultrasound and infrasound frequencies considered to be outside normal range of human hearing. Paucity of evidence to set a limit more stringent that recommended in Sect. 5.2.	NA	Commentary only.
5.6	**Cumulative Effects**		
5.6.1	Limits apply to cummulative levels of all wind farms.	Yes	There are two (2) other approved and operational nearby wind farms including the south-west Stockyard Hill Wind Farm and Waubra WEF to the north-east. The subject report includes commentary to predict whether the 30dB contour overlaps noise prediction contours. It was found, due to a distance of over 10km between WTG to not to overlap at any NSL and therefore has no discernible influence on noise levels.
5.6.2	Staging of a wind farm is not to affect pre-wind farm background readings.	NA	
5.6.3	Where a new wind farm will impact on the same noise sensitive locations as an existing wind farm, the assessment of background sound should exclude wind farm sound generated by all existing wind farms.	NA	Background noise monitoring has not been conducted.
5.6.4	If predicted wind farm sound levels for a new wind farm are at least 10dB below an existing wind farm then the cumulative effect shall not be taken into account.	Yes	Discussion on modelling outcomes provided in the report.
5.7	**Uncertainty** (refer Appendix C below)	Yes	Refer to discussion below.
6	**Predictions**		

	6.1 Methods. Predictions to identify levels greater than 35dB LA90(10min) at 95% rated power. 1/1 octave bands from at least 63Hz 4kHz, and against wind speed (hub speed) and 35 and 40 predicted contours are shown.	Yes	A review of the subject report coupled with communications with the acoustic consultant supports the reasonable worst-case noise spectra were selected for modelling. Predictions have been made for turbines at wind speeds that correlate with maximum sound power output. This generally equated PO7200 specifications for the Vestas candidate WTGs. A copy of the manufacturer's report was requested and reviewed (and referenced). The frequency band spectra and a noise test report have been confirmed as that specified by the manufacturer with an additional 1 dB added to each octave band centre frequency SPL as reflected in Table 7 & 8 data within the subject report.
	6.2 Sound Power Levels. Obtain from manufacturer obtained in accord with IEC 61400-11	Yes	Manufacturer sound power levels were reported. The test reports provided specified results were stated to be derived in accord with the IEC 61400-11 and -22 standards. Also noted is the data was taken from a 'like' WTG being V136 turbines as test results were reported in the technical document as not being available. The turbines were noted to be as close as possible in size.
	Requires SPL to be measured against a wind speed of 10m AGL converted to Hub Height	Not determined	It is not clear how the conversion progressed and it is not specified in the noise assessment report. However, modelling has assumed SPL at turbine hub height (150m) wind speeds. Manufacturers' manuals specify SPL are valid at hub height.
7	**MEASUREMENTS**		
7.1	**Locations**		
7.1.2	(a) Has the operator chosen to adopt a noise limit of 40 dB for all wind speeds?	Yes	See comments in Sect 3.2 above
	(b)Has the operator agreed to conduct on/off testing if required.	NA	
7.1.3	Have noise sensitive locations been clearly identified	Yes	The identification process was undertaken by Brewster Wind farm and involved what is considered to be a rigorous checking and verification program. A site tour viewing NSLs within the 35dB contour identified no additional habitable dwellings. Due to the difficulties in ground truthing all NSLs the auditor has sought confirmation that the report mapping is complete and this was verbally confirmed. Reportedly NSL were identified by: •A desktop survey of aerial photography for dwellings and other noise sensitive locations within 5 km of the wind farm; •A car-based survey of all roadside letterboxes located within 5 km of the wind farm; •Cross-referencing with up-to-date Vicmap address data within 5 km of the wind farm. Furthermore consultation was undertaken to assist identifiecation process this reportedly included: •Three newsletters sent to all dwellings located within 5 km of the wind farm; •A formal public notice sent to all property addresses within 5 km of the wind farm (address list provided by Pyrenees Shire); •Two letters containing information about the Brolga assessment and questionnaires concerning Brolga activity sent to all Vicmap addresses within 5 km of the wind farm; •Four small-group community information sessions conducted in Beaufort, to which all residents living within 5 km of the wind farm were invited; •A number of face-to-face visits with neighbouring landowners.
	b. Does the appointed auditor consider all noise sensitive locations are appropriately captured	Yes	As best reasonably within or near the predicted 35dB contour. Advice received from the proponent supports the NSLs as illustrated in the noise assessment reports are complete.
7.1.4	Have background sound level measurements been appropriately established and representative of the group: proximity and character	NA	Background noise monitoring has not been conducted. Predictions were made using base criteria.
	When and where were they taken.	NA	
	Were predictions at 95% rated power made in deriving 35 dB LA90 (10 min.) contour background locations	NA	Properties selected for background assessment in close proximity to the 35dB contour.
	If there are no noise sensitive locations within the 35dB LA90(10min) predicted wind farm sound level contour then background sound level measurements are not required.	Yes	There are NSL within proximity of the 35 dB LA90 predicted contour. Background noise levels were triggered and monitoring is reportedly being undertaken. The base limit of 40 dB LA90 was appropriate for the pre-construction compliance verification.
7.1.5	If there are a group of noise-sensitive locations… locations selected are representative of the group in terms of proximity and character	NA	Individual NSL's have been listed.
7.1.6	Selected on wind farm side of buildings. >3.5m from significant reflecting surfaces. Not near streams nor watercourses where possible (or substantiated if not)	NA	

7.2	SOUND DATA		
7.2.1	Made during a representative range of wind speeds and durations from cut-in to rated power.	Yes	Predictions included from 3 - 15m/s. Max. SPL experienced by 9 m/s for the Vestas WTG. Rated electrical power is not specified but likely to be within 9 - 15 m/s (hub height) where maximum SPL has been reached.
	For dual speed turbines, include cut-in wind speed for the higher generating capacity.	NA	
	The number of measurements made are to be sufficient to obtain dependable correlations between sound levels and wind speeds	NA	A complete review of the background noise data was not required given the assessment is made against the minimum (base) noise limit criteria.
C7.2.1	Minimum of 10 days continuous monitoring >1440 data points to be plotted against wind data	NA	
	Further measurements if: data points is not uniform between min. and max. for each 1m/s interval; a lack of sparseness exists for one or more wind conditions; seasonal variations.	NA	
7.2.2	Sound measured in accordance with NZS6801		
	Section 7.1.5 of NZS 6801 states 'the provisions of this section do not apply for the purposes of NZS 6808'.		
	Instrument used shall meet requirements of Section 5 of NZS6801.	NA	
	Measurements time intervals of 10 minutes to be used.		
7.2.3	Microphone protected from extraneous wind sound by wind shield in accordance with NZS 6801.	NA	
	Cables etc. secured to avoid extraneous wind noise.	NA	
	Class 1 meter may be necessary so that sound levels at low wind speeds can be accurately measured.	NA	
7.2.4	Extraneous sounds caused by events, including precipitation, insects, fauna and so on, should, as far as is practical for an unattended monitoring exercise, be identified and removed from the data set.	NA	
	Streams and tree induced background sound may be considered part of the overall background at the locations. Traffic lulls need to be included.	Yes	
	Octave band spectrum analysis and resident logs may be used.	NA	
7.3	**WIND DATA**	N/A	N/A - considered relevant only for post construction noise.
7.3.1	Concurrent measurements of wind speed and direction taken from a known height preferably the wind turbine hub.		
	Monitored over 10 minute intervals syncronised with SLM time intervals and average values found for every interval		
7.3.2	If wind speeds are not taken from hub height… predictions may be used from wind shear relationships: at least two heights		
	Wind flow modelling may be required since wind measurements are not representative.		
7.3.3	Same location and height used for before and after installation where not impacted by turbines.		
7.4	**BACKGROUND MEASUREMENTS**	NA	No background data available. Predictions have used base noise limit for comparison.
7.4.1	Background SLM to be plotted against the hub-height wind speeds to obtain a scatter plot		
	Plot to be examined to establish whether a singular regression relationship is evident.		
	If there are markedly diffferent groups, separate scatter plots may be required for different conditions, including wind directions and times of day.		
7.4.2	Find the regression curve that gives the best correlation coefficient between the sound level and wind speed for each scatter plot and use it to describe the average background sound level at different wind speeds.		
	Sparseness of data or obvious outliers should not be allowed to unreasonably influence the regression curve.		
	Removal of outliers may be required.		

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	Has a binaural analysis procedure IEC 61400-11 been used? If so is it reasonable and		
7.4.3	If there is a poor correlation between wind speed and sound level, further investigation of wind conditions should be undertaken e.g. wind flow modelling,local knowledge, site observations or local wind monitoring		
7.4.4	Where multiple regressions are indicated and several regression curves obtained, noise limits should be set on the basis of each regression curve derived. Where not practical, use the most stringent regression curve with lowest SL.		
	Where the lowest BG is when wind is blowing from the noise sensitive location to the wind farm, it is reasonable to consider additional attenuation that may occur.		
7.5	**POST INSTALLATION MEASUREMENTS**	N/A	N/A - considered relevant for post construction
7.5.1	Measure where practical at the same locations where background SL were determined.		
7.5.2	Scatter curves shall be drawn of SL against wind speed and regression curved obtained (as per 7.4)		
7.5.3	Capture both the wind farm sound and the background sound.		
	The contribution of the background sound shall be removed from the regression curve drawn in S. 7.5.3 at each integer wind speed.		
7.5.4	An assessment for any special audible characteristics shall be undertaken (S. 5.4) covering the range of operational wind speeds.		
7.6	**COMPLIANCE ASSESSMENT**	N/A	Relevant for post construction noise assessment
7.6.1	The 35dB wind farm SL contour shall be predicted and measurements made within this contour.		The 35dB sound level contour has been predicted and included within the subject reports.
7.6.2	Compare the best-fit regression lines of the background SLs and the regression curves of the wind farm sound levels adjusted for any special audible characteristics at each noise-sensitive location.		
	Adjustments apply to wind farm speeds at which it is assessed and applied before comparison with the noise limit.		
7.6.3	If background SLs were not measured prior to installation, it may be necessary to obtain SLM for limited periods at critical wind speeds. These may be for a limited range of end speeds and directions while the wind turbines are not operating, i.e. on/off testing to get a representative number of measurements		
	Turbines 10dB lower that the higher contribution need not be turned off for testing.		
7.6.4	Compliance at one period does not negate the need for further testing.		
	Note: Section 7.1.2 of NZ6801-2008 states: *'To demonstrate compliance, measurements should be appropriately adjusted to slightly positive propagation conditions which are the upper limits of the meteorological window* '. However, section 7.1.5 states '*the provisions of this section do not apply for the purposes of NZS 6808'*.		
7.7	**ON/OFF TESTING**	N/A	
	Often an appropriate method for measuring small wind turbine sound levels.		
8	**DOCUMENTATION**		
8.1	**Predictions**		
	Any report of wind farm sound level predictions in accordance with this Standard shall refer to this Standard and provide the following: (a) A map showing the topography (contour lines) in the vicinity of the wind farm, the position of the wind turbines, and noise-sensitive locations;	Yes	The topography is illustrated by a heat map (not contours but heat map). However, its elevation is difficult to read. Reportedly this topographical data was fed into the model, in particular Mount Ross as NSL #6 is up on a hill and #26 is screened of line of sight behind the hill to at least some of the WTG. The contours do not reveal a marked change because of this hill. This SQEA was interviewed and reported the topography was included in the modelling.
	(b) Noise sensitive locations for which wind farm sound levels are calculated;	Yes	Both stakeholder dwellings and non-stakeholder noise sensitive locations are included on the map and are marked differently for ease of identification.
	(c) Wind turbine sound power levels;	Yes	Included for the candidate turbine selected as representative of the turbine likely to be installed.

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	(d) The make and model of the wind turbines;	Yes	Turbine is nominated with make and model - noted this is a candidate and not the final turbine selected. It ha been taken that the model PO7200 is the candidate with serrated edges.
	(e) The hub-height of the wind turbines;	Yes	Specified at 150m; Data from manufacturers testing is not stated. Interviews with the SQEA indicate it is considered representative.
	(f) Distance of noise sensitive locations from the wind turbines;	Yes	Illustrated on a scaled map with North direction marked i.e. Figure 1. A table is also provided with the distance to the nearest WTG from a NSL (Appendix C).
	(g) Calculation procedure used;	Yes	Attenuation of noise is reported to follow ISO 9613 Acoustics- Attenuation of sound during propagation outdoors. This is referenced in NZS 6808:2010 as an appropriate prediction method
	(h) Meteorological conditions assumed;	Yes	10 degrees C and 70 percent humidity used which is reasonably representative of low atmospheric attenuation conditions.
	(i) Air absorption parameters used;	Yes	Attenuated by frequency octave band nominated to be applied as per Appendix I of subject report. Octave band attenuation factors include 0.12 dB/km for 63Hz to 3.66dB/km for 1kHz.
	(j) Ground attenuation parameters used;	Yes	G=0.5 with rationale described in Appendix G, and specified in NZS 6808:2010 as a default. The term acoustically soft ground is used in the acoustic report. The area under drought conditions may not reflect this. However for modelling purposes this is considered appropriate. The margin available to account for uncertainties against a 40 dB limit, confirms the predictive assessment has been made ion accordance with the Standard .
	(k) Topography/screening assumed	Yes	As per topographical terrain heat map. Limited near field adjustment at >35dB
	(l) Predicted far-field wind farm sound levels.	Yes	Predictions occur to 30dB(A) within the report and absolute predicted noise levels within Appendix H.
			The model assumes downwind +/-45 degrees. Inversions are not considered due to wind turbines unlikely to be not operating or at a low power output speed during inversion conditions.
	Detail (note: not specified in standard but applicable for modelling):		
	Turbine Sound Power Levels	Yes	SPL provided for 1x candidate turbine, Vestas V172-7.2MW, although this is reported to have a higher SPL than a further candidate WTG Vestas V168-6.8MW. Data on this WTG was reviewed and this confirmed as being over 1 dB quieter at rated wind speed. However, the final turbine type is yet to be confirmed.
	Micro Siting Allowance (noting 'model planning permit conditions allow up to 100m change if nominated).	N/A	Likely to be 100m. However, locations are reportedly not as yet fixed.
	Identification of relevant noise sensitive locations - process and outcomes	Yes	The process reportedly included: • Review of satellite imagery showing the location of buildings/ structures (resolution sufficient to reveal buildings with external water tanks, garages, driveways etc. used to evaluate signs of a habitable dwelling). • Meeting with the majority of neighbours within 3 km of the project, including confirming the use of buildings (i.e. dwellings distinguished from sheds), the status of houses (habitable or otherwise), and future development plans for dwellings. This is considered appropriate considering there are not too many NSL within 2km of a WTG.
	SACs- Tonality allowance at various wind speeds	Yes	Candidate turbine under best practice design should not have any special tonal characteristics and this is specified in the subject report.
	Noise level (SPL) with respect to varying wind speed	Yes	Provided SPL for each candidate turbine including octave band SPL.
	Best practice blade design	Yes	Modelling assumes the blade will be a serrated tail edge. If blade changes are made on the turbines (or an alternative turbine to that modelled selected), a revised noise assessment should be conducted and a discussion on best practice low noise blade design incorporated into the noise assessment report.
	Cumulative influences	Yes	The cumulative impact is considered in the subject report and found to likely be <30dB at the closest points given the distance. No overlap of 30dB prediction contours and therefore no cumulative contribution to the 40dB L90 limit.

	Ground description method	Yes	G ratio =0.5 reasonable approach given the terrain; particularly the southern aspects.
	Predictive model used	Yes	SoundPLAN; an acceptable and internationally used model.
	Results discussion - non stakeholder / sensitive locations	Yes	Compliance was evaluated via the 40dB L90 contour with consideration too of the locality of the 35dB contour. The Rural Living Zone was also reviewed for verification purposes against a high amenity area noise limit.
	Results discussion - Stakeholder Properties	Yes	Included in subject report, yet outside scope of the Standard.
	Any report of background sound level measurements and assessment in accordance with this Standard shall refer to this Standard and provide the following:		
	(a) Description of the sound monitoring equipment including ancillary equipment;	NA	
	(b) The location of sound monitoring positions;	NA	
	(c) Description of the anemometry equipment including the height AGL of the anemomometer	NA	
	(d) Position of wind speed measurements;	NA	
	(e) Time and duration of the monitoring period;	NA	
	(f) Averaging period for both sound and wind speed measurements;	NA	
	(g) Atmospheric conditions: the wind speed and direction at the wind farm position & rainfall	NA	
	(h) Number of data pairs measured (wind speed in m/s, background sound in L90);	NA	
	(i) Description of the regression analysis; and	NA	
	(j) Graphical plots showing the data scatter and the regression curves	NA	
8.3	**COMPLIANCE ASSESSMENT**	NA	Relevant to a Post Construction Noise Assessment
	Any report of wind farm post-installation sound level measurements and compliance assessment, other than on/off tests, made in accordance with this Standard shall refer to this Standard and provide the following:		
	(a) Description of the sound monitoring equipment including any ancillary equipment		
	(b) A statement confirming the use of A-frequency-weighting;		
	(c) The location of sound monitoring positions;		
	(d) Description of the anemometry equipment including the height AGL of the anemometer		
	(e) Position of wind speed measurements;		
	(f) Make and model of the wind turbines;		
	(g) Number of operational wind turbines;		
	(h) Time and duration of monitoring period;		
	(i) Averaging period for both sound and wind speed measurements		
	(j) Atmospheric conditions: the wind speed and direction at the wind farm position & rainfall		
	(k) Number of data pairs measured (wind speed in m/s, sound in L90);		
	(l) Description of the regression analysis;		
	(m) Graphical plots showing the data scatter and the regression lines;		
	(n) Graphical plots showing the data scatter and the regression lines for both the background and the wind farm in operation.		
	(o) Assessment of special audible characteristics; and		
	(p) A statement that the wind farm complies with relevant limits – or not – as determined from the results of the measurements		
Other	No noise complaints have been recorded	NA	
	Previous Assessments	NA	Nil
Appendix C	**Uncertainty**		

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	It is good practice to state the uncertainty and confidence level for all sound levels determined in accordance with this Standard. Uncertainty should be determined in accordance with the procedures in Craven and Kerry (2001). These procedures involve determining the standard uncertainty for every source of uncertainty in the measurement/assessment process and summing these standard uncertainties in quadrature which is a process to obtain the combined uncertainty. If a source of uncertainty is assumed to have a normal distribution, standard uncertainty is related to standard deviation, but this is not always the case and rectangular distributions are also common. *When comparing a sound level with an applicable noise limit, the sound level should be deemed to comply if the sound level is equal to or less than the noise limit. It should be deemed not to comply if the sound level is greater than the noise limit, regardless of the uncertainty. Where compliance or non-compliance is marginal and contested, steps should be taken to reduce the uncertainty, where practical.*	Part	Appendix G of the subject report discusses aspects associated with the model. It also makes mention of uncertainty margins, although no specific discussion of uncertainties in the manufacturers supplied information used as source data is made. Included in the subject report is a 1 dB addition made to the SPL provided by the manufacturers on the candidate turbines as a measure of conservatism. The allowance is considered reasonable. Against this is the predicted maximum noise level under reasonably conservative assumptions (eg NSL downwind from all WTG) is over 2.5 dBA below the compliance limit using the candidate turbine. Additionally, the subject report stresses the reliance on imperfect data given the turbine type has yet to be selected. A recalculation should follow the selection of a final turbine not within the candidate list or should the blades not have serrated edges. Furthermore, the assessment should be recalculated should the location of any turbine vary with micro-siting allowances towards an NSL which potentially will raise noise levels by >1dB.
	Definitions (from NZS6808:2010)		
	Noise Sensitive Location: 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, papakainga and marae, excluding habitable spaces in buildings where the predominant activity is commercial or industrial. (Residential buildings designed for permanent habitation on land zoned for predominantly rural or rural-residential use are not classified as commercial or industrial for the purposes of this Standard); (d) Teaching areas and sleeping rooms in educational institutions, including public and private primary, intermediate, and secondary schools, universities, polytechnics, and other tertiary institutions; (e) Teaching areas and sleeping rooms in buildings used 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 noise-sensitive locations. Matters to be considered include whether it is an established activity with existing rights**.	NA	NSL are included in the subject noise report and confined to dwellings within a Farming zone within the 35 dBA (and 30 dBA predicted contours).
	Commentary of note in NZS: *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.*		
	Other commentary of note: *Background noise is a combination of sounds including tree leaf and grass rustle, crickets, insects, frogs, birds, dogs, cattle, sheep, distance traffic (car and air) and even wave motion. When a source, such as turbine noise, is introduced the background noise level may increase.* *The addition of a new source with a noise level 10dB below the background would increase the noise to a new background 0.4dB higher.* *If the two sources have the same noise level then an increase of 3.0dB results. Therefore if the background is 35dB and the turbine is also 35dB, the resultant noise is 38dB.* *To increase the L90 by 5dB, the new turbine-based source would need to be 3.3dB above the previously confirmed background.*		