MEMO

MARSHALL DAY Acoustics

Project:	Waiinu Energy Park	**Document No.:**	Mm 001 r02		
To:	Meridian Energy	**Date:**	26 March 2026		
Attention:	Michael Thompson	**Cross Reference:**			
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From:	Mathew Cottle	**No. Pages:**	7	**Attachments:**	No
Subject:	Assessment of Acoustic Effects Summary				

PURPOSE AND LIMITATIONS

We have prepared this summary of our Assessment of Acoustic Effects (AAE) report to support Meridian Energy's Referral Application for the Waiinu Renewable Energy Park project (project). We understand that this summary may be relied upon for the purposes of describing the anticipated and known adverse effects of the project on the environment in accordance with Section 13(4)(h) of the Fast Track Approvals Act 2024 (FTA).

This summary is intentionally high-level and distils into plain language a lot of technical information that will be presented in the AAE. It is constrained in that we are still performing data analysis of the existing background noise environment (from noise logging), which forms the basis of setting wind farm noise limits. Further, there may be additional noise logging undertaken at new, yet-to-be-determined, positions representing other dwelling clusters. Irrespective, we consider this high-level summary is sufficient for the purposes of informing the referral application.

OPERATION NOISE ASPECTS OF THE PROJECT

Project operation noise can be categorised into the following three main source groups:

1. **Wind Farm**: consisting of noise from Wind Turbine Generators (WTGs). These are elevated noise sources, in this case standing 165m above local ground level, and are each comprised of three rotating blades with a diameter of 170m. The blades are attached to a nacelle which contains the electrical generator. The primary noise emission is trailing edge aerodynamic noise from each blade.
2. **Battery Energy Storage System (BESS)**: is a technology that stores electrical energy generated by the wind and solar farms in batteries for later use. The primary noise emitters are inverters and fan-noise associated with keeping the units within a temperature range – so heating and cooling as required.
3. **Solar Farm**: consists of arrays of photovoltaic panels (solar panels) which convert sunlight into direct current (DC) electrical energy. This energy is channelled through Power Supply Units (PSU) which primarily consist of an inverter, a transformer and a DC-DC converter. The operation and cooling of these components of the PSU are the primary noise emitters.

There are other project aspects which will also generate noise, these include the internal substation, transmission lines and grid injection point substation. These are addressed in the AAE and are not discussed further as we consider them to be secondary to the sources noted above and not significant.

ASSESSMENT METHODOLOGY

Unlike noise from solar farms and BESS installations, wind farm noise is assessed using a specific acoustic standard, namely New Zealand Standard NZS 6808:2010 *Acoustics – Wind farm noise*.

The project site straddles two territorial authorities (TA). The solar farm and BESS have been assessed against the noise provisions contained in the relevant TA district plans. These plans reference two acoustic standards for the measurement and assessment of sound (excluding from wind farms).

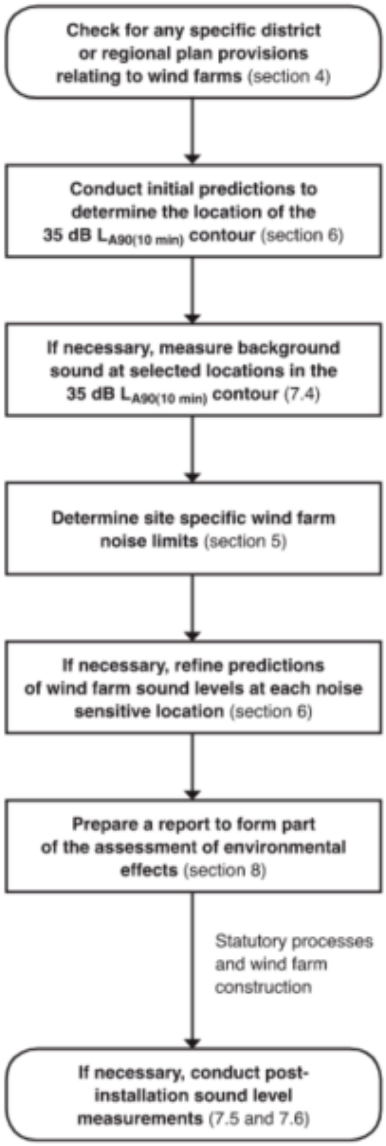
The relevant statutory provisions and acoustic standards we have used in the AAE are:

- Resource Management Act (1991), specifically s16 and s17
- South Taranaki District Plan (STDP)
- Whanganui District Plan (WDP)
- New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of Environmental Sound*
- New Zealand Standard NZS 6802:2008 *Acoustics - Environmental Noise*
- New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise*
- New Zealand Standard NZS 6808:2010 *Acoustics – Wind Farm Noise*
- International Standard ISO 9613-2:2024 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors*

Wind farm noise assessment

Section 3.2 of NZS 6808:2010 sets out the methodology for wind farm noise assessment. An excerpt of this is shown in Figure 1. The following text describes what we have done to inform this Memorandum.

Figure 1: NZS 6808:2010 assessment methodology



Determining background noise logging positions

We used the following steps to select houses at which to deploy noise logging equipment:

- Meridian prepared an initial turbine layout
- We constructed a 3D acoustic model using that layout and predicted the 35 dBA noise contour
- We overlaid this contour onto satellite imagery and cadastral boundary layer obtained from LINZ
- All properties containing a house(s) which sat inside the 35 dBA contour were considered for noise monitoring
- Where a cluster of houses occurred, we selected a property / house that we considered was representative of the acoustic environment of the whole cluster

Note: four deployments have occurred in the initial phase. There may be more as the assessment progresses.

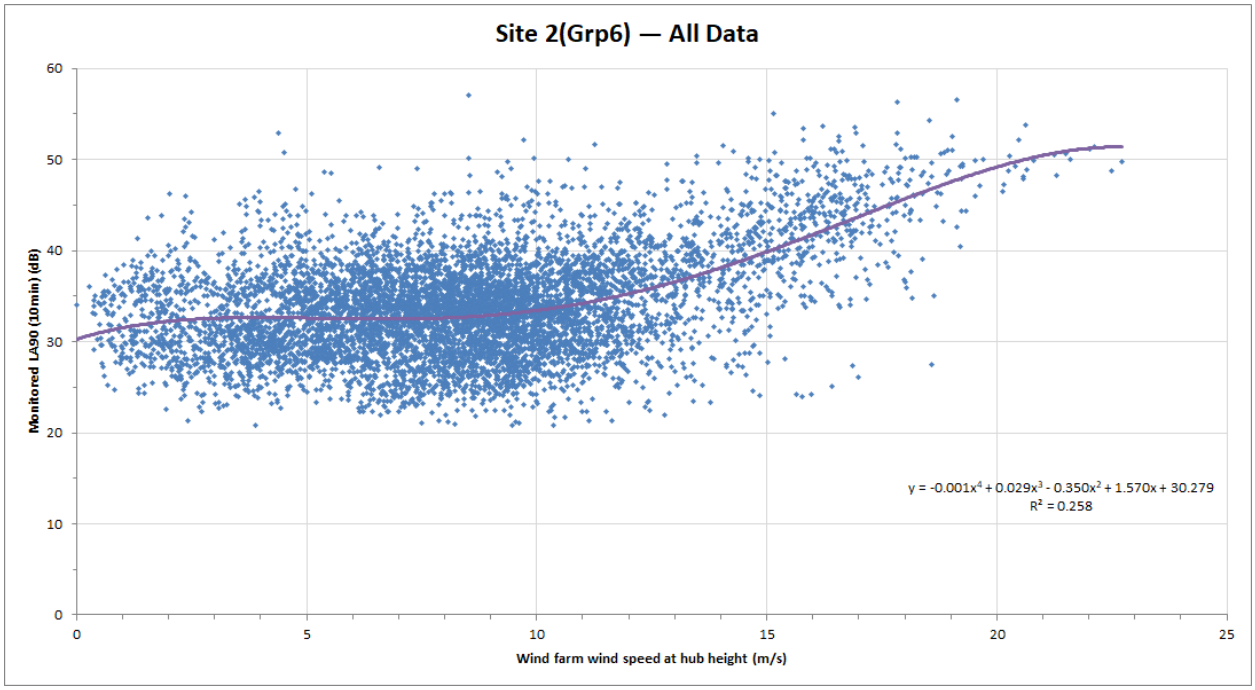
Determining site specific wind farm noise limits

Section 5.2 of NZS 6808:2010 states:

> *"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 is because a level of 40 dB $L_{A90(10\,min)}$ is objectively considered a reasonable level of noise, but as background noise increases higher wind farm noise output (up to 5dB above background) is acceptable because of the generally noisier environment. We are currently performing a regression analysis on each noise logger dataset. This plots the measured L_{A90} noise level against hub height wind speed sourced from Meridian's on-site wind monitoring mast. A statistical 'line of best fit' is then applied to the data as shown in the example in Figure 2.

Figure 2: Background noise level as a function of wind speed 'line of best fit'



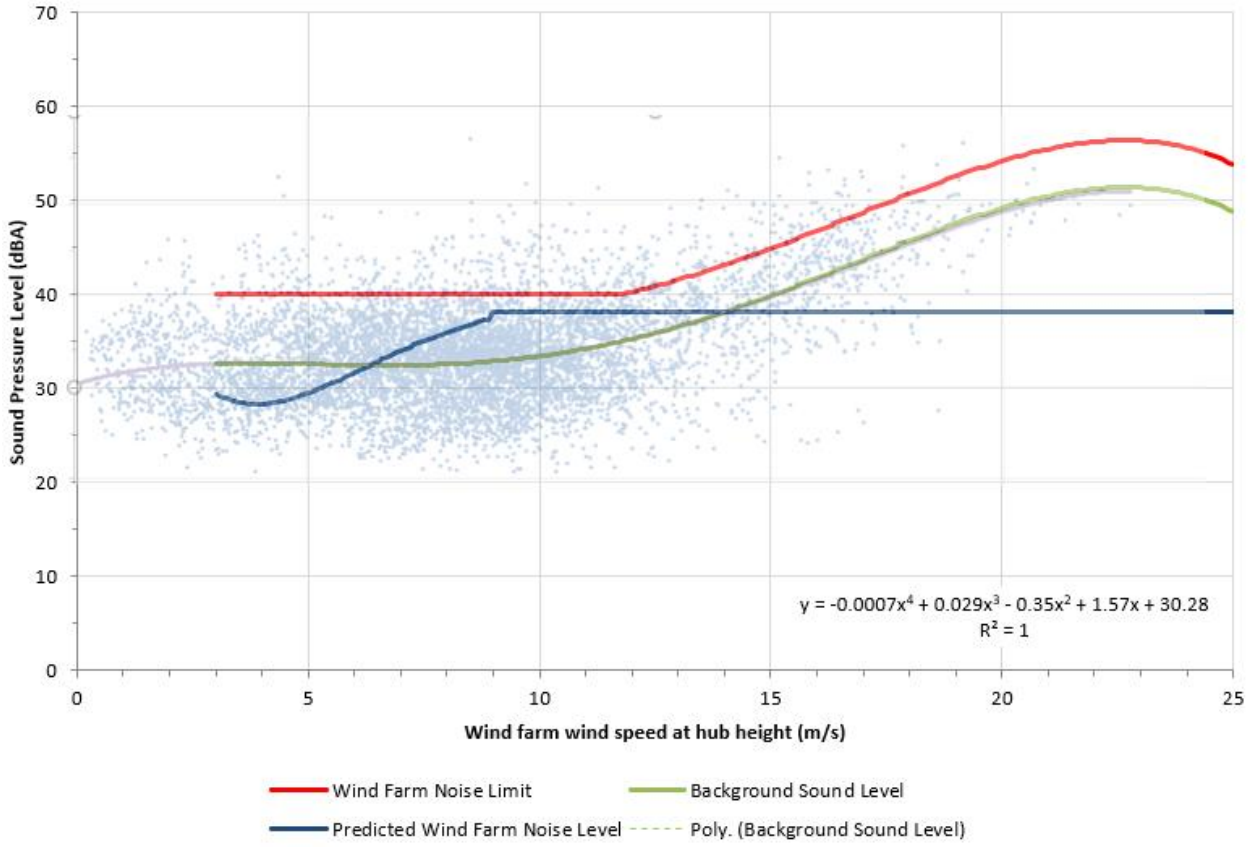
Once the regression analysis is complete a line is plotted on the same figure which defines the wind-speed-dependent noise limit of 40 dB $L_{A90(10\text{-}min)}$ *or* the background sound level L_{A90} plus 5 dB, whichever is the higher. An example noise limit (refer to red line) is shown overleaf in Figure 3.

Predicting wind farm noise and comparing to the noise limits

The noise level for each receiver position is calculated for the WTGs rated wind speed (~9m/s) because this is when the WTG generates 95% of its power rating. Adjustments are then applied to the result to obtain a noise level for each wind speed 'bin' covering the operating range of interest (3m/s to 25m/s in this instance). The results are then plotted on the same figure as the background noise 'line-of-best-fit' and the derived noise limits, and a comparison is made to ascertain compliance.

The line of best fit for background noise for 35dBA occurs at 12m/s, and this means the derived noise limit of 40 dBA or more occurs when it is windier than this.

Figure 3: An example of the comparison between wind farm noise and the noise limits



BESS and solar farm operation noise assessment

We have predicted BESS and solar farm operation noise with the same acoustic model used to calculate wind farm noise. The following summarises our methodology:

- Meridian prepared a BESS and solar farm layout
- Each individual source has been loaded into the noise model and assigned a source level
- Meridian advised the operational parameters for daytime and night-time operation
- We predicted noise levels for all receiver positions
- We assessed compliance against the relevant noise limits contained in the STDP and WDP
- The results are fed-back to Meridian who decide on how to refine the layouts, with input from us.

Note: there is a 'feedback loop' for wind farm, BESS and solar farm noise modelling. It is Meridian's aim to ensure full compliance with all relevant limits and standards by way of iterative design.

OPERATIONAL NOISE ASSESSMENT

The AAE is still in progress therefore we cannot provide a definitive conclusion with respect to operation noise effects at this stage. However, as we have run a number of layout iterations, we are in a good position to provide some generalised conclusions regarding noise compliance and subjective response.

Wind farm noise

Based on the third turbine layout from Meridian we predict wind farm noise levels of between 32 and 45 dB $L_{A90(10\text{-}min)}$ at the assessed receivers. Note that this is based on 56 turbines operating at rated wind speed of 9m/s and therefore generating the maximum amount of noise and with each receiver located downwind of the turbines. These are therefore conservative predictions. At this wind speed, the background noise caused by wind in trees will be elevated. We predict full compliance with the noise limits contained in NZS 6808:2010. The wind farm is likely to be audible at some receivers some of the time, albeit at levels which are not intrusive.

Solar farm and BESS

Based on the layouts provided by Meridian we are predicting noise levels of <20 to 35 dB L_{Aeq} at the assessed receivers. This comfortably complies with the relevant rural zone limits in both the STDP and WDP which are 40 dB L_{Aeq} at night-time. The solar farm and BESS noise may be audible at some receivers some of the time, albeit at levels which are not intrusive.

CONSTRUCTION NOISE ASSESSMENT

A construction methodology statement is not yet available for the project. We have assumed construction plant and activities will be similar to other major electrical infrastructure projects.

As a general comment, in our experience, the construction noise associated with such developments, on big spread-out sites can and does comfortably comply with NZS 6803 guidelines. Standard conditions are usually proposed to ensure this. Communication with stakeholders on upcoming construction activities, as well as progress, is key to managing noise and vibration disturbance for receivers.

Wind farm construction is unique in that there will be multiple smaller worksites spread across the project site, each representing a turbine location. These smaller worksites will be located a minimum 1,000 m from any dwelling not involved with the project. On this basis alone, construction noise will readily comply with the relevant standard.

Construction of internal roads will occur in closer proximity to some receivers. This will result in higher noise levels for relatively short periods. Notwithstanding, we predict full compliance with the relevant limits.

As a generalisation, construction will be audible at times from some dwelling positions. However, it is important to note that construction is inherently dynamic and there will invariably be days where residents will not be able to hear a worksite. On days where a worksite is audible, a resident 1,000 m from the closest turbine worksite will experience worst-case noise levels of about 45 dB L_{Aeq} (the limit is 70 dB L_{Aeq}). To put that into perspective, it would be similar to a quiet suburban neighbourhood or not-too-busy office environment (but with a different noise character).

The main noise source during solar farm construction will be piling. Piling is required to drive the numerous steel piles into the ground to support the solar panel infrastructure. A number of mobile piling machines will operate at the same time albeit, these will be distributed over a wide area. The closest dwelling-to-piling distance is approximately 1,282m. At this distance residents will experience up to 51 dB L_{Aeq}. This will be at a level similar to rainfall or when next to a flowing stream (but with a different noise character).

For BESS construction noise we predict up to 34 dB L_{Aeq} at the closest dwelling. This is much lower than during solar farm piling and would likely be similar to the existing daytime background noise level.

CONCLUSION

This memorandum provides a high-level summary of the predicted acoustic effects associated with the project. It has been prepared to support Meridian Energy's Referral Application for the project to describe the anticipated and known acoustic effects for the proposes of Section 13(4)(h) of the FTA.

Wind farm noise is predicted to be between 32 and 45 dB $L_{A90(10\text{-}min)}$ at the assessed receivers based on the most recent turbine layout. These are worst-case noise levels based on the turbines operating at rated wind speed (approximately 9m/s). The background noise caused by wind in trees at this wind speed will be elevated. We anticipate full compliance with the wind farm noise limits anticipated by NZS 6808:2010.

We predict solar farm and BESS noise levels of <20 to 35 dB L_{Aeq} at the assessed receivers. This noise level range complies with the relevant rural zone limits in both the STDP and WDP (40 dB L_{Aeq} night-time).

We predict that construction noise will be audible at some receivers some of the time. Construction is inherently dynamic – there will be louder days and then quieter days where little sound is emitted. Regardless, our assessment indicates that project construction noise will comply with the relevant limits.

Overall, the project can be designed and operated to comply with the relevant noise performance standards. Assuming standard conditions are proposed, we consider adverse noise effects will be avoided.

DECIBEL SCALE OF TYPICAL COMMUNITY NOISE SOURCES