

Wednesday, 15 March 2017

Project number: M16516  
Letter reference: M16516LT2

John Maassen  
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Level 1, 227 Broadway Avenue  
Palmerston North 4440, New Zealand

Dear John,

**Te Rere Hau Wind Farm  
Review of proposed consent conditions**

I confirm that the proposed consent conditions, issued to Cooper Rapley Lawyers and Palmerston North City Council on 10 March 2017 with my amendments, reflects my opinions regarding appropriate consent conditions for the Te Rere Hau Wind Farm.

The proposed consent conditions have taken into account:

- The *Independent Review of Noise-Related Conditions* I prepared dated 27 October 2016, Resonate Acoustics Report M16516RP1 (Independent Review)
- A letter from Marshall Day Acoustics (MDA) to New Zealand Windfarms Ltd (NZWL) providing the opinions of Mr Miklin Halstead on the Independent Review, MDA letter Lt 020 2011095W (MDA Letter).

I note that the proposed consent conditions, dated 10 March 2017, have adopted some of the recommendations in the MDA Letter.

Below, I provide comment on those recommendations in the MDA Letter which I disagree with and have therefore not recommended for adoption in the consent conditions. I have also provided comment on those MDA recommendations which I consider can be adopted as long as other modifications are made to the conditions.

**Wind speed threshold for consideration of High Amenity criteria**

In the Independent Review, I recommended that a wind speed threshold of 8 m/s at hub height be adopted, below which the application of the High Amenity criteria should be considered for those residences within the High Amenity area defined within the Palmerston North District Plan. Mr Halstead disagrees, recommending that the 6 m/s threshold suggestion from NZS 6808:2010<sup>1</sup> be adopted.

NZS 6808:2010 states that:

It is recommended that the high amenity noise limit should apply when the wind farm 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.

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<sup>1</sup> New Zealand Standard 6808:2010 *Acoustics – Wind farm noise*

In this instance, I am of the opinion that there is justification to increase the wind speed threshold to 8 m/s. My opinion is formed on the basis that:

- The measured background noise levels at two residences within the defined High Amenity area are low (less than 30 dB(A)) for wind speeds of up to 8 m/s. The High Amenity limit is designed to provide consideration of additional acoustic protection to be provided in situations such as this where residences in a High Amenity area have low background noise levels. Therefore, I believe the application of the limit should be investigated up to 8 m/s on the basis of the measured background noise levels (i.e. acoustical grounds as per NZS 6808:2010).
- The topography around the wind farm is such that residences in the High Amenity areas may be shielded when the wind is blowing in particular directions, potentially increasing the difference in wind speed between the wind farm and the residence. Therefore, I believe there is justification to consider a higher wind speed threshold on topographical grounds.
- Based on my discussions with Palmerston North City Council (PNCC) and my review of the complaint register, some of the complaints from residents refer to situations where the wind farm is operating but there is little or no wind at the house to provide background masking noise. Given that the wind turbines at Te Rere Hau only commence operation at 5.5 m/s, limiting consideration of the High Amenity limit to a wind speed of 6 m/s would not appear to adequately address this situation.

I note that the increase of the wind speed threshold from 6 m/s to 8 m/s does not necessarily mean that the High Amenity limit will apply. Rather, it means that an investigation needs to be undertaken comparing the operational noise levels to the background noise levels for those residences within the defined High Amenity area. If a difference of 8 dB or greater is noted, then the High Amenity limit would be justified in accordance with NZS 6808:2010. Therefore, if the increased in wind speed threshold from 6 m/s to 8 m/s results in a sufficient increase in background noise levels, this objective comparison of operational and background noise levels will identify that the more stringent High Amenity limit is not applicable.

#### **Application of penalties for Special Audible Characteristics**

In the Independent Review, I recommended that penalties be applied for Special Audible Characteristics as follows:

- If less than 10 percent of the data points within a 1 m/s-wide wind speed bin attract a penalty, then the 10-minute data points, including penalty adjustment, shall be included in the data for the assessment of the overall noise level. In effect, this means that the penalty is only applied to the individual 10-minute data points which are then averaged as part of a much larger dataset.
- If 10 percent or more of the data points within a 1 m/s-wide wind speed bin attract a penalty, then the arithmetic average penalty for those penalised data points shall be determined and applied to the overall measured wind farm noise level for that wind speed. This is intended to recognise that, where a penalty occurs with reasonable regularity, then it is appropriate to apply a penalty that reflects the annoyance that penalty may occur.

The MDA letter disagrees with the second point of the above, noting that NZS 6808:2010 suggests that the penalty should apply only to “the measured level”.

While it lacks clarity on this topic, I agree that the wording of NZS 6808:2010 suggests that penalties should generally be applied to individual 10-minute periods. However, I am of the opinion that NZS 6808:2010 does not adequately consider the situation where a wind turbine is known to produce a characteristic in the near field but where this characteristic may only be detected at residences under certain conditions. In this case, the application of a penalty to individual 10-minute data points will not

always adequately reflect the potential annoyance caused by a characteristic, particularly where it occurs with reasonable regularity.

For example, if a wind farm produces a tone that would attract a 5 dB penalty for 20 percent of the time at a residence then, if the penalty were to only be applied to 20 percent of the data points as suggested by the MDA Letter, the overall average noise level would only increase by approximately 1 dB. A tone that attracts a 5 dB penalty would clearly be annoying to the average listener and, as it occurs for 20 percent of the time, would be a regular feature of the environment. It is my opinion that the 1 dB effective penalty applied in this example would clearly not reflect the potential annoyance caused by this tone.

Considering the above example from a regulatory perspective, it would be desirable that such a tone be mitigated or removed given the potential annoyance it could cause. However, as a 1 dB increase in noise level is unlikely to significantly alter the compliance outcome for the wind farm operator, there is little or no incentive for rectification of the tone if the penalty is only applied to the individual 10-minute data points.

I also note that the approach in this example is not consistent to that which would be applied to other industrial noise sources. In my experience, if an industrial noise source was producing a tone that would attract a 5 dB penalty for 20 percent of the time, then the full 5 dB penalty would be applied to the noise level when assessing the acceptability of noise emissions from that source.

Given the above, I consider that the approach recommended in the Independent Review is appropriate as:

- For Special Audible Characteristics that occur relatively infrequently, the penalty is applied only to those individual data points.
- For Special Audible Characteristics that occur reasonably regularly and therefore have the potential to result in greater annoyance, a higher penalty is applied that will encourage mitigation and rectification. As the assessment would consider the specific wind speeds and directions for which any Characteristic occurs, it would be possible for the wind farm operator to target mitigation to only those wind conditions.

#### **Alternative assessment of Special Audible Characteristics**

The MDA Letter states that insufficient data is likely to be available for the assessment of tonality and amplitude modulation in accordance with the proposed conditions. MDA has proposed a screening test be carried out on the available data such that it can be determined if it is necessary to collect additional data.

I consider this to be a reasonable approach, subject to the inclusion of tonality analysis of additional near field data at the wind turbines to determine potential tonal frequencies as described in Paragraph 5.25 of the Independent Review. I note that the screening assessment methodology and findings would need to be reviewed by the independent peer reviewer appointed to review the compliance noise assessment.

#### **Data exclusions**

The MDA Letter has recommended alterations to the proposed turbine operational considerations for which collected noise data is considered valid. The Letter suggests that data should be considered valid where a sufficient number of the nearest turbines are available for operation, regardless of whether they are producing power or not. This change will predominantly affect data in the low wind speed range, where the measured wind speed at the reference meteorological mast exceeds 5.5 m/s but where the wind speed at the nearest turbines has not reached 5.5 m/s due to natural variation across the site.

While I agree that the restriction of operational conditions may significantly restrict the ability to collect data in the low wind speed range (e.g. 6 m/s), I am concerned that the inclusion of data where the nearest

turbines are not generating at low wind speeds will influence the determined overall noise level at higher wind speeds if regression analysis is applied to the dataset. For example, the inclusion of lower measured noise levels at 6 m/s in a dataset can reduce the overall measured noise level determined at 8 m/s if regression analysis (using a polynomial trendline) is used to determine that noise level. To avoid this, it would be necessary to use bin analysis where data is binned into integer wind speeds, with each integer wind speed independently assessed to determine the overall measured noise level at that speed.

Therefore, I accept MDA's recommendations on this point, but only if bin analysis of the measured noise levels is undertaken (using 1 m/s-wide data bins) rather than regression analysis via a polynomial trendline. I note that bin analysis is allowed for within Section C7.4.2 of NZS 6808:2010.

Please let me know if you have any queries on the above.

Yours sincerely,



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