

Chiles Ltd

13 September 2018

Ref: 170202

Shearer Consulting Ltd

By email: craig@craigshearer.co.nz

Dear Craig

Subject: Kaimai Wind Farm – Responses to s92 acoustics questions

I have reviewed the further information request from Louise Cowan dated 2 August 2018, with respect to questions related to acoustics matters. The relevant questions are copied in italics below, with each followed by my response.

Assessment of Environmental Effects

P33 As per the Chiles report the District Plan noise rule is irrelevant in relation to turbine noise, can't therefore say that the proposal complies with this noise standard. For all other activities, other than the turbines, the noise rules do apply, this is not assessed adequately within the AEE or associated noise report.

Response:

I agree the District Plan noise limits apply to operational sound sources excluding the wind turbines. Other such operational sound sources include transformers at the substation and any miscellaneous activities such as routine maintenance. Those sources only generate low or modest sound levels and all occur at a significant distance from the notional boundary of surrounding houses, so will readily comply with noise limits. Further assessment is not warranted. I understand that a consent condition will be proposed by the applicant explicitly requiring compliance with the noise limits for 'other' operational noise and I support that approach.

P33 Tables do not quote District Plan accurately. Only Table 8.3.1.3(1)(a) is relevant. Don't know where the 55/70 in the LAeq and 75/85 in the Amax columns come from as these are not in the District Plan. This reference needs to be removed.

Response:

I agree these numbers are erroneous. I understand an amended version of the AEE will be issued with the 55/70 and 75/85 numbers deleted.

Second table is totally irrelevant as it is our understanding that the activity is not to be located in the Conservation (Indigenous Forest) zone.

Response:

I agree the second table is irrelevant. I understand the table will be deleted in the amended AEE.

P34 Construction noise assessment, the middle column appears to quote the District Plan but leaves several parts of the actual DP statement out.

Response:

I agree the relevant District Plan text has not been reproduced in full. I understand the text/table will be edited to show all relevant parts of the District Plan rule in the amended AEE.

The Chiles report says "long term duration standard" is applicable; however, the AEE table has "typical duration" figures listed. Why is there a discrepancy?

Response:

This was an error in the AEE. The long-term construction noise limits are applicable, and I understand the table will be updated in the amended AEE.

Also the limits are applicable to the Rural and Conservation (Indigenous Forest) zones. Neither the AEE or the S Chiles report provide details of noise at either zone boundary (or for the Rural Zone outside buildings – approximately 1m from the wall most exposed to the sound), nor is there any assessment in relation to effects on the Conservation (Indigenous Forest) zone.

Response:

The District Plan rule requires construction noise in all zones to be measured and assessed in accordance with NZS 6803:1999. That Standard sets receiver locations at the locations of dwellings and not zone boundaries. Correct application of the District Plan rule requires assessment of construction noise at dwellings not zone boundaries. Construction noise has been assessed at the nearest dwellings in Report 10, as required in accordance with NZS 6803:1999 and in turn the District Plan.

Report No 10 – Noise

P3, 2. Criteria - It is assumed that the District Plan noise standards (both HDC and MPDC) will apply to all noise, except noise created by the turbines themselves. Please confirm.

Response:

I confirm that other than wind farm sound (within the scope of NZS 6808:2010), all other sound sources are subject to the relevant operational and construction noise standards in the District Plans and proposed conditions of consent.

P13, 7. Construction Noise – no modelling of expected noise levels provided, an assessment should be provided using worst case scenarios of all likely machinery to be operating at any one time. There is nothing provided to support the statements of compliance. What is meant by the statement "temporary disturbance for occupants of houses along Rawhiti Road"? What about quarrying noise, vehicle noise, crane noise, and assembly noise (when assembling the turbine pieces). The construction noise assessment is lacking "overall" assessment of a number of activities that could be combined on the site and occurring together at any one time.

Response:

As set out in Report 10, the main construction activities are a significant distance from nearby houses (generally greater than 800m). The nature of wind farm construction activities are well understood and during numerous previous wind farm projects in New Zealand I am not aware of instances where there have been exceedances of noise limits or even where compliance has been marginal or difficult to achieve. I have reviewed the layout of this specific site and its relationship to houses and I have not

identified any locations where compliance could not be achieved with standard site management practices. This includes consideration of cumulative effects of any concurrent activities and those specific activities listed in the question.

The highlighted comment about temporary disturbance, relates to sound that will be heard in houses as heavy vehicles pass along Rawhiti Road. While sound from trucks on public roads can reasonably be expected, I made the comment in recognition of the greater frequency of trucks on Rawhiti Road that are likely during construction. My comment did not refer to on site sound sources that would be managed to comply with the construction noise limits as just explained.

P14, 8. Conditions - In relation to condition 1, why is the assessment limited to these sites? What if additional houses are built during the life of the wind farm, in particular during the 12 year lapse period that is sought? Why is the condition not worded to require that noise levels shall be made to comply at the notional boundary of all dwellings?

Response:

The proposed condition is in accordance with NZS 6808 clause 1.3, and previous consents granted by the Environment Court for wind farms including Mill Creek [2012]NZEVC27 and Hurunui [2013]NZEVC261.

It would be unsustainable for large fixed infrastructure to be constructed based on an approved resource consent, but then subsequently be unable to be operated if new houses are built too close following the grant of consent, such that noise limits are then unachievable.

In relation to 1. (b) how would such a condition be able to be monitored? Unless there is a noise meter continuously measuring background noise levels how will anyone know whether (a) or (b) applies at any given time. Once the windfarm is operational won't the noise from it also then form part of the background?

Response:

There is a standard method for monitoring compliance with this specific control set out in NZS 6808:2010. The method involves measuring background sound prior to wind farm operation and then measuring again when the wind farm is operating. Through detailed analysis of the trends from the two sets of measurements the contribution of the wind farm alone and compliance with noise limits can be determined. The background sound level is defined as not including any contribution from the wind farm and is established through the measurements prior to the wind farm operation, but after consent is granted, as proposed in this case. This approach is discussed further below.

In relation to condition 4, how were the three properties chosen? What would be the purpose of post installation measurements at these sites? Condition 1 says to comply at the sites shown on Figure 1 (which are more than these three properties).

Response:

I selected the three sites to verify the predicted sound level contours at the nearest representative locations in different directions from the wind farm. If compliance is demonstrated at these three most potentially affected locations, then based on that result in combination with the predicted contours, it also demonstrates compliance at all other locations.

Further information should be supplied regarding:

- *the monitoring of background sound levels during the winter months (without cicadas),*
- *a breakdown into wind direction (if this can be done), and*
- *a breakdown into background sound levels during the Amenity Hours and Night-time Hours,*
- *remove the presence of noise sources which are not common to the representative measurement locations and neighbouring noise sensitive properties, using a review of time histories and scatter plots,*

- if appropriate remove clear dawn chorus effects from night-time data,
- exclude any data directly affected by rainfall, or when rainfall has resulted in atypical levels, and
- plot the background sound levels against wind speed to determine the prevailing background sound levels at each representative assessment position. The order of regression analysis to use (linear to fourth order) will depend upon the nature of the background environment.
This will demonstrate the seasonal and diurnal variations in background sound level.

Response:

As stated in Report 10, I agree that further monitoring is required to establish background sound levels. Proposed consent condition 4 in Report 10 includes a requirement to conduct background sound level monitoring at representative locations.

The reporting and analysis requirements for background sound set out in the question are generally in accordance with NZS 6808, Section 7.4, which is required to be followed under the proposed conditions. In accordance with NZS 6808, the specific analysis must be adapted to account for the measured data and this should not be constrained in advance. Based on the background sound assessment already completed, my understanding of the local environment including other sound sources in the locality, and the predicted sound levels, I consider this conventional approach as complies with NZS 6808 to be appropriate in this case.

We recommend that further information is sought regarding:

Predicted data which should cover the range of wind speeds between cut-in and the speed at which maximum sound power level is achieved.

Response:

Consent has not been sought for a specific wind turbine, and the sound levels at different wind speeds will vary depending on the actual turbine types ultimately used. The consent is sought on the basis that whatever turbines are used the noise limits in the proposed conditions will be achieved.

As an illustration, Report 10 includes predictions based on the maximum sound power level of a specific (but indicative) wind turbine. For that indicative wind turbine the cut-in wind speed is around 4 m/s at hub height and the maximum sound power is reached at a wind speed around 9 m/s at hub height. The sound level predictions and contours in Report 10 all relate to the maximum sound power for this indicative turbine (i.e. for wind speeds of 9 m/s and above). At cut-in wind speed (around 4 m/s) the predicted sound levels would be approximately 13 dB lower than stated in Report 10, but the sound level would then increase rapidly with increasing wind speed up to the maximum value at 9 m/s and above. In short, the full range of wind speeds is factored into the assessment, but only the upper end of the range is relevant to predicting sound levels and compliance.

Use the hub height wind speed (not 10m AGL)

Response:

I confirm the hub-height wind speed has been used. This is a fundamental requirement of NZS 6808:2010.

Identify if wind shear issues affect noise generation or propagation

Response:

I am not aware of any unusual wind shear issues at this site that would affect sound generation or propagation, but this matter is addressed by Thomas Cameron.

Justify why 106 dB LAeq sound power level has been selected

Response:

The rationale for the use of 106 dB in the model is set out on page 7 of Report 10. It relates to an indicative turbine, but also allows for other turbines being considered which have similar or lower sound levels.

Justify the spectral adjustment used

Response:

As above, the rationale for the spectral adjustment used is set out on page 7 of Report 10. It relates to an indicative turbine and has been used to make realistic predictions.

Provide justification why this data should represent other turbines that may be selected

Response:

As is normal for major wind farms, the actual turbines to be used have not been selected. Data for an indicative turbine has been used to make realistic predictions of likely sound levels. Consent conditions are proposed in Section 8 of Report 10 which would require remodelling to confirm compliance if any alternative turbines had higher sound levels.

Undertaken predictions with both zero and 0.5 ground absorption

Response:

This request and the following two requests appear to be based on aspects of Good Practice Guidance published by the UK Institute of Acoustics. While the UK guidance does provide a useful reference, in my opinion it is not appropriate to simply "pick and mix" requirements under different assessment standards. The wind farm noise assessment method used in the UK ("ETSU") was published in 1997 and is outdated. The supplementary UK guidance has been prepared to address short-comings with ETSU. Issues with ETSU were known when NZS 6808:2010 was prepared and were addressed in different ways. Appendix D of NZS 6808 recommends a default ground absorption of 0.5, which is the value that has been used in the model. This in itself is a conservative assumption given that rural land should theoretically have higher absorption, and is usually modelled with higher absorption for other sources.

Regardless, the predicted sound levels based on an indicative turbine with a relatively high sound power level are still at least 3 dB lower than the noise limit at houses. This conservatism in the predictions provides a margin for uncertainty, with respect to slight variations in ground absorption and other factors.

Do predictions at a receiver height of 4.0 metres to reduce the potential oversensitivity of the calculation to the receiver region ground factor compared to lower receiver heights

Response:

Again, this request appears to arise from UK guidance addressing short-comings in the UK ETSU assessment method. Predictions for this application have been made for receivers at a height of 1.5 metres above the ground which is representative of head-height where noise effects will be experienced by people and where sound levels will be monitored. Experience in New Zealand has shown predictions at this height to be reliable.

As above noted, the predictions include a margin for uncertainty such as relating to receiver height.

Provide for safety factors and uncertainty including any terrain screening concerns described in the GPG (if no data on uncertainty is provided then a factor of +2dB should be added to WTG noise levels)

Response:

Again, this request appears to arise from UK guidance. NZS 6808 Section 6.2 requires use of manufacturer's sound level data for turbines in accordance with IEC 61400-11. That has been done for the indicative turbine in Report 10. There is some conservatism in the NZS 6808 method as turbine L_{Aeq} values are treated as L_{A90} values, which in reality are lower.

Report 10 explicitly addresses terrain screening on page 11, in accordance with NZS 6808 Appendix D, by testing the sensitivity of the modelling to sound from the maximum blade tip-height. As noted in Report 10, sound levels were found to remain within 1 dB using this elevated source position.

Section 7 discusses construction noise. No mention is made of traffic using the internal roading network particularly during Amenity Hours and at Night. This network is likely to be closer to receivers than proposed turbine locations and may involve steep terrain. Would the sound of labouring trucks on steep internal roads be likely to cause an impact on neighbours and should this be controlled at critical times?

Response:

Most internal site access roads are further from houses than the nearest turbine locations. The exception is the lower section of the access road from Rawhiti Road. The fourth bullet point on page 13 of Report 10 explicitly lists haulage of turbine parts and materials up the access road from Rawhiti Road as a significant localised sound source. Section 7 of Report 10 is also explicit that most works (and associated internal traffic) should be daytime only, other than continuous concrete pours and arrival of oversized loads. I understand the applicant will propose a consent condition limiting night-time construction activity.

Is concrete manufacture proposed on the wind farm site?

Response:

I understand that no concrete batching is proposed on the wind farm site.

The current background sound monitoring shows no correlation between wind farm wind speed and background sound level at residential neighbours. This makes it impossible to apply proposed condition 1(b) because there is no method of determining the background sound level. The further information sought above may improve this level of knowledge but if not, then how is NZS 6808 to be applied?

Response:

Section 3 (Page 5) of Report 10 is explicit that more comprehensive pre-construction background sound monitoring is needed to allow compliance assessment if consent is granted, and this is required by proposed condition 4 in Section 8.

Yours sincerely

Chiles Ltd

Dr Stephen Chiles

stephen@chiles.co.nz

027 519 1555