

**BEFORE THE ENVIRONMENT COURT  
AT WELLINGTON**

**ENV-2010-WLG-000114**

**IN THE MATTER** of the Resource Management Act 1991  
(the Act)

**AND**

**IN THE MATTER** of an application for declarations by the  
Palmerston North City Council to the  
Environment Court under section 311 of  
the Act

**BETWEEN** **Palmerston North City Council**

**Applicant**

**AND** **New Zealand Windfarms Limited**

**Respondent**

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**AFFIDAVIT OF STEPHEN GORDON CHILES  
AFFIRMED 28 AUGUST 2014**

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I, Doctor Stephen Gordon Chiles of Castle Hill Village, acoustician, do solemnly and sincerely declare and affirm:

## INTRODUCTION

1. My full name is Stephen Gordon Chiles. I am employed as an acoustician, half-time by my company Chiles Ltd and half-time by the NZ Transport Agency.
2. I have the following qualifications and experience relevant to the evidence I shall give:
  - (a) Doctor of Philosophy in Acoustics from the University of Bath, and Bachelor of Engineering in Electroacoustics from the University of Salford, UK;
  - (b) I have been employed in acoustics since 1996, and I have previously held positions as a research officer at the University of Bath and as a consultant for the international firms Arup, WSP, and URS, and for the specialist firms Marshall Day Acoustics and Fleming & Barron; I am a visiting academic at the acoustics research group of the University of Canterbury;
  - (c) I have conducted acoustics assessments and measurements for numerous wind farms, including Meridian Energy's Hurunui and Mill Creek wind farms, four distributed generation wind farms for Energy3 in Marlborough, Pioneer Generation's Mt Stuart and Flat Hill wind farms, Fiji Electricity Authority's Butoni wind farm and Windflow Technology's Gebbies Pass prototype wind turbine; I have conducted peer reviews for TrustPower's Mahinerangi and Kaiwera Downs wind farms;
  - (d) I was chair for the 2010 revision of the New Zealand wind farm noise standard (NZS 6808<sup>1</sup>) and I co-authored draft wind farm noise guidelines for the Environment Protection Authority in Victoria;
  - (e) I am Convener of the Standards New Zealand Industry Reference Group for the international building acoustics standards committee (ISO TC 43/SC2), and I was chair of the 2012 Standards New Zealand acoustics standards review group and on

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<sup>1</sup> NZS 6808:2010 Acoustics – Wind farm noise



the committee for the 2008 general environmental noise standards (NZS 6801<sup>2</sup> and NZS 6802<sup>3</sup>); and

- (f) I am a member of relevant associations and hold registrations, including Chartered Professional Engineer (NZ), Chartered Engineer (UK) and Fellow of the UK Institute of Acoustics.
3. I have personal knowledge of the matters set out in this affidavit and its contents are true and correct to the best of my knowledge and belief.
4. I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Practice Note 2011. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

#### **BACKGROUND**

5. I have been engaged by NZ Windfarms to conduct a desk-top peer review of the draft evidence of Miklin Halstead, relating to whether the Te Rere Hau wind farm is operating in compliance with consent conditions 4 and 5. To conduct this peer review I have made reference to the Marshall Day Acoustics Noise survey results and discussion report dated 18 February 2014 and the affidavits of Nigel Lloyd and Gustaf Reutersward dated 28 July 2014, and the affidavit of Dalice Sim dated 30 July 2014.
6. I am familiar with the Te Rere Hau wind farm and the Windflow 500 wind turbine in a general manner as I conducted a site visit to the Te Rere Hau wind farm in 2008; made a peer review of the original noise assessment for the Te Rere Hau wind farm for NZ Windfarms in 2004; advised a nearby resident about noise effects from the Te Rere Hau Extension in 2010; and assisted in sound level monitoring of the Gebbies Pass Windflow 500 prototype wind turbine in 2004 and 2005.

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<sup>2</sup> NZS 6801:2008 Acoustics – Measurement of environmental sound

<sup>3</sup> NZS 6802:2008 Acoustics – Environmental noise



## OUTLINE

7. The purpose of this affidavit is to provide a peer review of the evidence of Mr Halstead. In his evidence Mr Halstead reaches three key conclusions:
- (a) Special audible characteristics should be assessed at the receiver location;
  - (b) The special audible characteristic of tonality should be assessed using an objective test method; and
  - (c) Compliance with wind farm noise limits should be determined from all measurements when the wind farm is 'operational' rather than just those measurements when the wind farm is deemed to be 'fully operating'.
8. I agree with all three of these conclusions, and in this affidavit I set out the reasons for my opinion. My reasons are generally aligned with those given by Mr Halstead in his evidence, but I also discuss additional factors in my evidence.
9. I understand this matter has to be considered in the context of the consent conditions and the methodology prescribed by those conditions. Since the consent was granted there have been improvements made to wind farm sound measurement and analysis methods, but for the purposes of this evidence I have drawn conclusions based on the requirements of the consent conditions and the specific methodology in those conditions. Nevertheless, I would not expect to reach any fundamentally different conclusions if considering this matter under current standards and methods.

## LOCATION FOR ASSESSING SPECIAL AUDIBLE CHARACTERISTICS

10. Under the current (2010) version of NZS 6808 there would be no debate that special audible characteristics are required to be assessed at receivers, such as neighbouring houses.<sup>4</sup> I consider this appropriate as any effects from special audible characteristics are experienced at the receiver, and therefore in my opinion that is the correct location to assess that effect.

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<sup>4</sup> NZS 6808:2010 Sections 5.4.1 and 7.6.2



11. In the old version of NZS 6808, specified by condition 5, there are no explicit statements about the location where special audible characteristics should be assessed. I therefore understand the debate and counter arguments on this matter. However, the old version of NZS 6808 does make specific statements that any adjustments for special audible characteristics are to account for effects experienced by people.<sup>5</sup> Adjustments for special audible characteristics are also required to be applied to "L<sub>r</sub>", which is the level at the receiver.<sup>6</sup> If the adjustment was to be based on source or near-field characteristics, I would have expected the adjustment to be made to the wind turbine "L<sub>w</sub>".
12. For the reasons I have set out above, I consider that to apply the old version of NZS 6808, as required by condition 5, special audible characteristics have to be assessed at the receivers. I also consider this is the appropriate method as it assesses effects where they are experienced.

#### **OBJECTIVE TESTS FOR TONALITY**

13. As for the previous issue, under current standards there should be no debate that objective assessment should be used where "*there is doubt about the presence of tonality*".<sup>7</sup> I consider this to be the correct approach, as an alternative requirement based on a subjective evaluation with no means of resolving conflicting opinions would not be practical. This issue is illustrated by the different subjective assessments by lay people and experts for the Te Rere Hau wind farm.
14. In 1998, when the old version of NZS 6808 was published, objective evaluation of tonality was constrained to some extent by commonly available instrumentation. That constraint no longer exists as calibrated audio recordings for post-processing can now be relatively simply and cost effectively made for extended periods, and sophisticated frequency analysis is more readily available.
15. The old version of NZS 6808 is slightly ambiguous in the discussion of subjective and objective assessment of special

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<sup>5</sup> NZS 6808:1998 Sections 4.4.3 and 5.3.1

<sup>6</sup> NZS 6808:1998 Section 4.4.3

<sup>7</sup> NZS 6808:2010 Section B2.1 and NZS 6802:2008 Section B4.2



audible characteristics. However, acknowledging difficulty with objective procedures, while the old version of NZS 6808 states that "*subjective assessment is therefore necessary*", crucially this is qualified by the statement "*supported by objective evidence (e.g. frequency analysis) where appropriate*."<sup>8</sup> In my opinion, the reason NZS 6808 invoked subjective assessment was to avoid expensive and time consuming objective assessment when there are no issues. However, if there is an issue, I consider that the old version of NZS 6808 does then require objective evidence. For tonality a specific objective test method is referenced.<sup>9</sup>

16. For the reasons I have set out above, I consider that to apply the old version of NZS 6808, as required by condition 5, any penalty for tonality has to be determined through objective testing if there is any debate, which is the case for the Te Rere Hau wind farm. I do not consider that it would be correct to base a penalty on a subjective assessment that has been challenged.

#### **MEASUREMENT CONDITIONS**

17. The current and old versions of NZS 6808 both set procedures involving predictions and measurements. Predictions are used to make a desk-top assessment of wind farm sound levels before the wind farm exists. As the predictions are based on simplifications of wind, wind turbine and sound propagation behaviour, they are only a model of the future reality. It is physically impossible for a wind farm to operate exactly as predicted by a model.
18. Under the old version of NZS 6808 compliance with noise limits is demonstrated by measurements. The measurements are not related to any theoretical modelled scenario, but are for the actual wind farm. It is explicit in NZS 6808 that compliance with noise limits is determined by measurements of the operational wind farm.<sup>10</sup>
19. NZS 6808 explains the difficulties measuring wind farm sound in the presence of wind.<sup>11</sup> This is the reason a relatively

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<sup>8</sup> NZS 6808:1998 Section 5.3.1

<sup>9</sup> NZS 6808:1998 Section 5.3.2

<sup>10</sup> NZS 6808:1998 Section 5.4

<sup>11</sup> NZS 6808:1998 Section 2.3 and NZS 6808:2010 Section 3.1

complex method is used with a regression analysis to determine 'average' sound levels. This process involves measurement of sound levels with and without the wind farm operating and requires this same analysis under both conditions.<sup>12</sup>

20. To improve the regression analysis, NZS 6808 allows for separation of data depending on the wind direction and time of day.<sup>13</sup> This separation of data has been made for the Te Rere Hau wind farm. However, even after separating the data in this manner, there can still be a range of wind farm operating configurations possible at each wind speed. The regression analysis is the method used to find the average value from these operating configurations.
21. Wind conditions vary across a wind farm and therefore individual wind turbines do not all operate in exactly the same configuration for a particular meteorological condition. Each turbine has individually controlled speed, blade pitch angles, yaw angle and resulting power generation, and these are continuously changing. At low wind speeds there may be some wind turbines not generating power even though a wind farm is operational.
22. Mr Lloyd has proposed that the regression analysis for the Te Rere Hau wind farm should be limited to only some of the operating configurations of the wind farm. In my opinion this would be contrary to the fundamental method set by NZS 6808 using regression analysis to find the average levels. The results would be skewed by imposing a restriction on the operating configurations included in the analysis and would not enable compliance to be properly tested. It would also cause practical difficulties that the meteorological conditions excluded for the operational state have not been quantified and therefore have not been excluded from the background sound analysis. This would invalidate the comparison of background and operational sound level measurements required by NZS 6808.
23. If at a certain wind speed there are operating configurations which include some turbines not generating power, then that is the reality of how the wind farm operates under those

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<sup>12</sup> NZS 6808:1998 Section 5.1.1 and NZS 6808:2010 Section 7.5.2

<sup>13</sup> NZS 6808:1998 Section 4.5.5 and NZS 6808:2010 Section 7.4.1



meteorological conditions. In my opinion it is appropriate and necessary for the corresponding sound level measurement data to be included in the analysis.

#### **SUMMARY**

24. I have peer reviewed the evidence of Mr Halstead and for the reasons that I have set out in this affidavit I agree with his key conclusions that under the condition 5 for the Te Rere Hau wind farm:

- (a) Special audible characteristics should be assessed at receiver locations;
- (b) Tonality should be assessed using an objective test method; and
- (c) Compliance with noise limits should be determined from all measurements when the wind farm is operational.



STEPHEN GORDON MILES

**AFFIRMED** at CHRISTCHURCH this 28<sup>th</sup> day of August 2014  
before me



Georgina Hamilton  
A solicitor of the High Court of New Zealand