1-1

Merle Lavin

From: Submission
Subject: FW: Resource Consent Wind Farm Up Dated

From: Bill Harding [mailto:billdirtyenergy@xtra.co.nz]
Sent: Friday, 9 June 2017 12:48 PM
To: Submission
Cc: vicki.morrison-shaw@ahmlaw.nz; craig.auckram@pnnc.govt.nz
Subject: Resource Consent Wind Farm Up Dated

Review of Palmerston North Resource Consent Conditions for Te Rere Hau Wind Farm

Submitter_ W A Harding (Bill)

I am Neutral and not Directly affected by the effects of the Subject Matter of this Review closing on June the 2nd.

The specific parts of the Application that my submission relates to are—

I refer to the Previous Consents Granted for 56 Turbines in January 2010 in conjunction with the Original 32 Turbines Consent in 2004.

N Z Windfarm was originally consented to produce 122 Gigawatt hours of energy, then to 153 Gigawatt-hours per year as the fully operational energy Outputs.

This new application is part of a non-conforming of a Noise Level review that have upset many new Submitters whom have challenged as a Block.

My Submission also, wishes to bring Notice to the Palmerston North District Council Consent Process of the Non-Conforming Energy Outputs since 2004.

I wish to offer you a Truthful and Technical Insight with a Claim that this total Wind Farm configuration cannot provide the 275 Gigawatt of energy per year from these 76.5 Mw Name plated Rated Motors and as such **they have never provided any useful Electricity**.

The Original Consents were given under a False Flag.

Primary because the N Z Environment Council in Conjunction with the Palmerston North District Council did not apply a Rigorous Due Diligence Investigative Programme to Question the Output Statuses that got presented.

N Z Wind Farms Ltd along with the Support of the New Zealand Wind Association Membership Fraternity, were both complicit in Advancing and Promoting through this Consent the Largest Fraudulent Hoax and Scam of Conspiracy, of getting Councils and Consumers Contracted, to Purchase a Form of Energy that none of their Appliances were ever designed to operate legally within.

Since 2004 the 274 Gigawatt of energy per Year or 3,562 Gigawatts to date that has been supplied into the Palmerston North Electrical Reticulated System has solely consisted of Harmonic Power.

The New Zealand system including many parts of the World over the last 130 years have opted to Operate their System Frequency at 50 Hz or (cycles per second).

This requires operating only a clean Sinusoidal Wave-shaped form of Energy called a Sine Wave, and all Manufactured Electrical Machinery and Appliances in N Z have been designed to operate efficiently and specifically within.

These Harmonics, are a Product that all Wind Farms can only produce, for the Technical Description of them is "a Group of Wind Assisted Variable Frequency Asynchronous Power Grid Moderating Three Phase Modulating Induction Motors".

Note not "Generators".

Within that frame of Reference, they Produce what the Industry calls "Dirty Energy" which is only "Derived from the National Grid Supplied 50 Hz Synchronous Power" by being then identified as T H D (total harmonic distorted) Energy.

In other words, being Classified as operating in an Asynchronous Mode and not as the normal Synchronous Mode which then Precludes calling them Generators of Electricity.

I would expect a challenge from the N Z Wind Farms Ltd. N Z W E A, NZ Statistics, the Electricity Authority, NZMBEI, NZ S F O, Advertising Authority, Greenpeace, Emission Trading and the Current Minister of Energy to my Exposition of exposing the extent and proof of Fraud that is rampant within New Zealand.

By New Zealand Wind Farms Ltd, to show proof through their Accumulated Metering totals over the last 13 Years that they have produced and sold 3,562 Gigawatts of Energy.

This in my opinion holds no Validity of Proof what so ever, unless they can assure the PNCC and confirm that all of their "Revenue Smart Meters" had been all fitted within the Sensing

Circuit a 50 Hz only Bandpass Width Active Filter, which would then sense only the Accumulated True Legal Power of 50 Cycles per second.

This should also apply to every newly replaced Revenue Smart Meter that has been installed in every Home in the Manawatu Region and the 52 Million installed in the World.

The N Z Wind Farms Ltd and the N Z W E A have falsely used graphs to imply that they supply a certain Percentage of N Z's Total Generation.

This Graphical Interpretation which the Palmerston North Council had had Presented to them, within the Original Consent Application, would have impressed the most ardent Supporter, that the Community would have cheap, clean and Green power and would be an Asset.

They should never ever be Portrayed on the Same graph, as it becomes part of the False Advertising Programme that has been employed.

It is very important to understand the Difference between Synchronous Generation and Asynchronous forms of Generation both which have been sold over the last Thirty Years to Consumers all over the World.

Synchronous Generation is the only Legal Form.

Asynchronous Harmonics is the illegal Form.

To place them both on the same Graph to Compare Outputs is not comparing "Apples with Apples".

This is the Initial start of Falsification of Advertising and Promotion by Producing a Product that is Completely Useless for Sale, which also does not comply with the Standard Consumers Guarantees Act for "being not suitable for use Category".

Reference to the Standard Torque Graphical Explanation as shown.

The INPUT is the 50 Hz Fundamental Kilowatt Power supplied to the Wind Turbine between 0 and 3.5 Metres per second prior to the Synchronized point operating as a normal Motor.

The OUTPUT produced by wind speeds over 3.5 Metres/Sec is the Multiple Frequencies Kilowatt energy, produced 180 Degrees ahead and over-layered, within the Fundamental 50 Hz that is being supplied through the single Cabled Three Phase Current supplied and connected to the Stator Terminals from the National Grid.

These Multiple Frequencies, create a leading Power Factor of Capacitive Energies that get reversed and Reflected back into the National Grid at a level that is consistent within the Circuit Parameters.

It is Technically and totally impossible, for any Consumer in the World to be Supplied with legal useable 50/60 Hz Power from any Wind Farm Installation, primary because they operate in an ASYNCHRONOUS MODE, which basically means that it is not in-step with the accepted Standardised 50/60 Hz SYNCHRONOUS FREQUENCY supplied by the National Grid Suppliers.

This Capacitive Energy is what is being Quantified via Wind Farm Ltd, Transpower NZ Ltd and the Local Retail Suppliers Revenue Metering to be displayed as genuine 50 Hz Units of Power.

To know the TRUE POWER for Revenue purposes from all Monitors and Revenue Metering Formats requires that they all be fitted with a hard-wired 50/60 Hz 0.2% Plus and Minus Band Pass Filter Network.

No other Option should be Legally Acceptable

This basically concludes my Submission which claim that that N Z Wind Farms Ltd has not and never will supply Palmerston North City Council Consumers with the Legal 50 Hz Frequency energy that they were Consented back in 2004.

For Back-ground Interest

Firstly,

I have noted that Consent section 29 Covers for Wind Farm Decommissioning and the removal of all Structures within 12 Months after an unprofitable time of Operation.

I would not like to see the Ratepayers of Palmerston North Shouldering that burden when that happens.

The costs of Decommissioning average 30% of the Construction Costs because as has happened in other Countries, when the ship starts sinking, the Consent Holder creates a Shelf Company

1-7

Offshore to offset a Liability, Decommissioning Debt Responsibility, as Trust Power of NZ has done recently under a Demerger as Tilt Renewables Ltd, in Victoria.

It was called Prudent Business Practise.

Has the PNCC taken measures to Mitigate a protection procedure for this eventuality.

Secondly,

Has Palmerston North City Council checked to see that the N Z Wind Farm Ltd have Authorisation and a Current license from the Conservation Department to Kill and Murder with fatalities of all Protected birdlife that get hit with the revolving blades, for if any individual carried out these fatalities, there would be an Enactment and a following Prosecution Order by the Conservation and Wild Life Department.

Thirdly,

If the PNCC ever tied every-one of these 88 Turbine Motor Connections together onto one single cable and connected it into a House Switchboard on the "Farm", and had perfect wind Conditions, the Council would never be able to Boil a Jug of Water. As paralleled Motors they have no form of Voltage Excitation.

Fourthly,

Which means that every one of the 530,000 wind Turbines in the World has never produced one useable Legal Unit of 50Hz (or 60Hz) of Electricity, other than useless Harmonics.

I thank PNCC for being given the Chance to Assist in the Review Deliberations being currently organised.

My Recommendation to PNCC purely within a Practical and Technical basis is to revoke the License to Operate. Then Palmerston North City Council will be in the Forefront to stop any further Expansion of the Widest Hoax and Scam of Fraud Conspiracy in the Energy World at this Moment in time.

I have based my Presentation as an Experienced Systems Diagnostic Electrical Engineer.

I do wish "to be heard in support of my Submission".

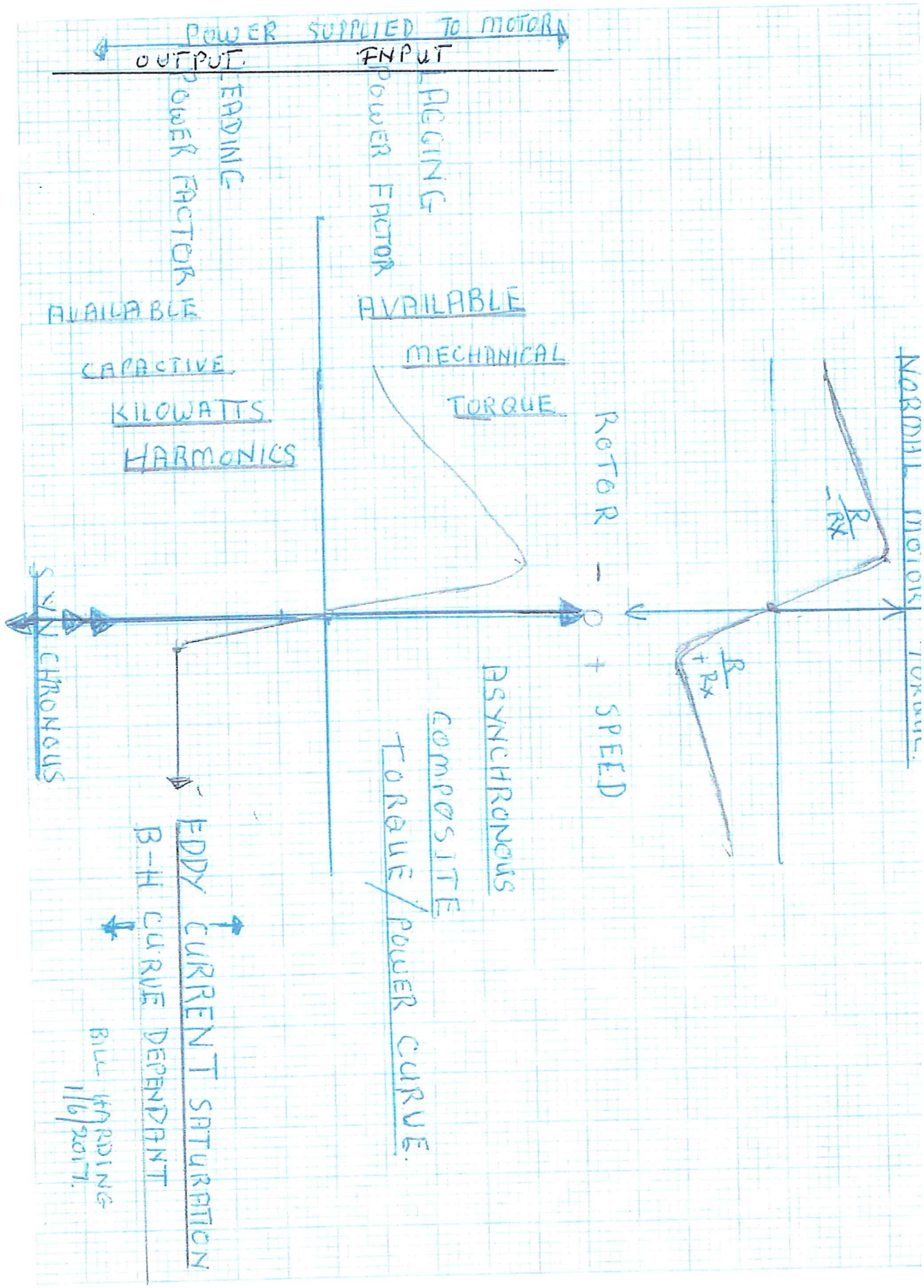
Bill Harding

27 Shera Street

Acacia Bay

Taupo 9 June 2017 0274271066

billdirtyenergy@xtra.co.nz



2-1

8957210

SUBMISSION ON REVIEW OF RESOURCE CONSENT CONDITIONS UNDER SECTION 130(1) OF THE RESOURCE MANAGEMENT ACT 1991

To: Palmerston North City Council
City Corporate Unit
Private Bag 11-034
Palmerston North
Attention: Governance and Support Team Leader
submission@pncc.govt.nz

1. **Name of submitter**

   Tararua Wind Power Limited (**TWPL**).

2. **This is a submission on the review of conditions of the resource consent for the windfarm known as Te Rere Hau and operated by New Zealand Windfarms Limited at 355-573 North Range Road, Palmerston North.**

3. TWPL may be a trade competitor for the purposes of section 308B of the Resource Management Act 1991 but its interest in the review does not relate to trade competition or the effects of trade completion.

4. **The specific parts of the review and any new conditions proposed that this submission relates to:**

   This submission relates to the review in its entirety.

5. **The submission is:**

   5.1 TWFL owns and operates the Tararua Wind Farm. The wind farm comprises 134 wind turbines and has an average annual power output of over 600 GWh.

   5.2 TWFL has an interest in the review to the extent that the review has the potential to impact on the existing operations of the Tararua Wind Farm. For example, the review documentation suggests that if further background noise level testing is required then this could affect the operation of the Tararua Wind Farm.

   5.3 TWFL therefore neither supports or opposes the review, but rather takes a neutral position in order that it may be involved in the development of any specific requirements that may affect its interests.

6. **TWPL seeks the following decision from the consent authority:**

   That the review does not result in direct effects on the operation of the Tararua Wind Farm.

7. **TWPL wishes to be heard in support of this submission.**

8. **If others make a similar submission, TWPL will consider presenting a joint case with them at the hearing.**

Signed:

Lara Burkhardt
Counsel for Tararua Wind Power Limited

Date: 1 June 2017

Address for Service:

Tararua Wind Power Limited
C/- Holland Beckett
Private Bag 12011
DX HP40014
Tauranga 3143
Attention: Lara Burkhardt

Telephone: 07 578 2199
Fax: 07 578 8055
Email: lara.burkhardt@hobec.co.nz

3-1

IN HOUSE
02 JUN 2017
PNCC
Signed 2.30 RM
8958271

PALMERSTON NORTH CITY COUNCIL

Form 13

Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991.

ORIGINAL TO FOR ACTION AND REPLY

RECD 2 - JUN 2017 PNCC

COPY TO
1
2

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: MAURICE ALLEY

Contact details of Submitter:
(Full postal address, phone/fax number(s), email address of Submitter)

Address: 514 Pahiatua Track RD1
Phone Number: 021 483227
Fax Number:
Email Address: m.r.alley@massey.ac.nz

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) NZ Windfarms

for a Resource Consent for (briefly describe activity and type of resource consent) Review noise levels

at (Resource Consent address) 355 – 573 Nth Range Rd

My submission is: (Choose from the following)

☐ I support the review
☐ I am neutral to the review
☑ I oppose the review
☑ My submission relates to the entire review, or
☐ My submission relates to the following specific parts of the review: _____

~~I wish~~/do not wish (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended: _____

3-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

We cannot hear any noise 1 to 5 km from the turbines.
There is much scientific data showing perceived effects are Nocebic (see Crichton et al Frontiers of Public Health 2014) and many others)
This review is therefore a complete waste of ratepayers money
The PNCC is a victim of hysterical turbophobics

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

Consult the scientific literature (attached)
Cancel the review

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

(A signature is not required if you make your submission by electronic means)

Date: 1-6-17

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

3-3

frontiers in Public Health

Front Public Health. 2014; 2: 220. PMCID: PMC4227478
Published online 2014 Nov 11. doi: 10.3389/fpubh.2014.00220

The Link between Health Complaints and Wind Turbines: Support for the Nocebo Expectations Hypothesis

Fiona Crichton,[1,*] Simon Chapman,[2] Tim Cundy,[3] and Keith J. Petrie[1]

[1]Department of Psychological Medicine, University of Auckland, Auckland, New Zealand
[2]School of Public Health, University of Sydney, Sydney, NSW, Australia
[3]Department of Medicine, University of Auckland, Auckland, New Zealand

Edited by: Loren Knopper, Intrinsik Environmental Sciences Inc., Canada
Reviewed by: Robert G. Berger, Intrinsik Environmental Sciences Inc., Canada; James Rubin, King's College London, UK

*Correspondence: Fiona Crichton, Department of Psychological Medicine, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand e-mail: f.crichton@auckland.ac.nz

This article was submitted to Epidemiology, a section of the journal Frontiers in Public Health.

Received 2014 Sep 22; Accepted 2014 Oct 19.

Abstract

Go to: Go to:

The worldwide expansion of wind energy has met with opposition based on concerns that the infrasound generated by wind turbines causes health problems in nearby residents. In this paper, we argue that health complaints are more likely to be explained by the nocebo response, whereby adverse effects are generated by negative expectations. When individuals expect a feature of their environment or medical treatment to produce illness or symptoms, then this may start a process where the individual looks for symptoms or signs of illness to confirm these negative expectations. As physical symptoms are common in healthy people, there is considerable scope for people to match symptoms with their negative expectations. To support this hypothesis, we draw an evidence from experimental studies that show that, during exposure to wind farm sound, expectations about infrasound can influence symptoms and mood in both positive and negative directions, depending on how expectations are framed. We also consider epidemiological work showing that health complaints have primarily been located in areas that have received the most negative publicity about the harmful effects of turbines. The social aspect of symptom complaints in a community is also discussed as an important process in increasing symptom reports. Media stories, publicity, or social discourse about the reported health effects of wind turbines are likely to trigger reports of similar symptoms, regardless of exposure. Finally, we present evidence to show that the same pattern of health complaints following negative information about wind turbines has also been found in other types of environmental concerns and scares.

Keywords: wind farms, infrasound, nocebo effect, psychological expectations, health scares, symptom reporting, environmental risks, media warnings

Introduction

Go to: Go to:

In recent years, challenges to new wind farm developments have been mounted on the basis that exposure to sound, and particularly infrasound, generated by wind turbines poses a health risk (1). Unfortunately, addressing concerns about health effects has been complicated by a lack of clarity about what might be causing the symptoms reported. Perceived adverse health effects said to be experienced

4-1

IN HOUSE
8958272
02 JUN 2017
PNCC
Signed 2.30 RM

PALMERSTON NORTH CITY COUNCIL

Form 13

Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991.

ORIGINAL TO FOR ACTION AND REPLY
REC'D 2 - JUN 2017 PNCC
COPY TO
1.
2.

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: Malcolm David Alley

Contact details of Submitter:
(Full postal address, phone/fax number(s), email address of Submitter)

Address: 45 Atawhai Rd
Palmerston North
Phone Number: 0220 511234
Fax Number: n/a
Email Address: ecomalcolm@gmail.com

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) New Zealand Windfarms Ltd

for a Resource Consent for (briefly describe activity and type of resource consent) Review Noise Levels

at (Resource Consent address) 353-373 Nth Range Rd

My submission is: (Choose from the following)

- ☐ I support the review
- ☐ I am neutral to the review
- ☑ I oppose the review
- ☑ My submission relates to the entire review, or
- ☐ My submission relates to the following specific parts of the review: _____

~~I wish~~/do not wish (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended: _____

4-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

The era for renewable energy is on. Any excuse to not partake in the development and implementation ~~sets a precedent for~~ of such technology sets a precedent for behaviour that actively demotes this type of climate change mitigation. It is time the community woke up to the serious consequences we will face if we do not take up this type of action to mitigate climate change.

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

To not do the review

To spend the money in educating the public about climate change and why we need to develop this technology.

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

M Alley

(A signature is not required if you make your submission by electronic means)

Date: 1/6/2017

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

[illegible] Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box [illegible]
Auckland [illegible]

5-1

IN HOUSE
02 JUN 2017 895707
PNCC
Signed 2.30 RM.

Form 13

Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991.

ORIGINAL TO FOR ACTION AND REPLY
REC'D 2 - JUN 2017 PNCC
COPY TO
1.
2.

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: Dorothy Alley

Contact details of Submitter:
(Full postal address, phone/fax number(s), email address of Submitter)

Address: 45 Atawhai Road
Fitzherbet Palmerston North 4410
Phone Number: 063570362
Fax Number:
Email Address: alley.dorothy@yahoo.com

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) NZ Wind farms Ltd

for a Resource Consent for (briefly describe activity and type of resource consent)
Wind Power generation - Noise levels

at (Resource Consent address) PT Secs 8 22-25 PT LOT 1 DP 42165 BLK XX

My submission is: (Choose from the following)

- ☐ I support the review
- ☐ I am neutral to the review
- ☑ I oppose the review
- ☑ My submission relates to the entire review, or
- ☐ My submission relates to the following specific parts of the review: _____

I ~~wish~~/do not wish (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended: _____

5-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

We cannot hear any noise at 1.5km from the turbines. We feel that enough money has already spent and the reirow is a complete waste of rat payers money. I do not suffer from any health issues related to the ~~noise~~ supposed noise levels which are minimal even when I have hearing aides turned on.

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

Dorothy M Allen

(A signature is not required if you make your submission by electronic means)

Date: 1 6 . 2017

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

6-1

ORIGINAL TO
FOR ACTION AND REPLY

REC'D 1 - JUN 2017 PNCC

COPY TO
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2.

8955112

PALMERSTON NORTH CITY COUNCIL

Form 13

Submission on a ~~Publicly Notified resource consent~~ application made under the Resource Management Act 1991.

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: Geoffrey Irvin : Toni Irvin

Contact details of Submitter:
(Full postal address, phone/fax number(s), email address of Submitter)

Address: 38 Ridgeview Road RD 1 P.Nth.
Phone Number: 021 946297
Fax Number:
Email Address: gtjdirvin extra.co

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) Te Rere Hau Windfarms LTD

for a Resource Consent for (briefly describe activity and type of resource consent) wind farm

at (Resource Consent address) 355-415 North Range Road P Nth

My submission is: (Choose from the following)

☐ I support the review
☐ I am neutral to the review
☐ Oppose the review
☑ My submission relates to the entire review, or
☐ My submission relates to the following specific parts of the review:

I ~~wish~~/do not wish (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended:
existing Resource Consent.

6-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

See Attached

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

See Attached

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

(A signature is not required if you make your submission by electronic means)

Date: 1st June 2017

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

The reasons for our views are:

Original Consent.

The Resource Management Act is supposed to protect residents so we don't have to be noise experts.

The process isn't supposed to be about who has the fattest wallet so can afford the biggest legal team. NZWFL QC while acknowledging the quality of resident's submissions dismissed them out of hand because we weren't noise experts.

From our experience there has been too much weight given to direction, the assumption being that the wind will carry the sound away.

Rather than speed at site v speed at residence.

It seems to us that NZWFL relies heavily on back ground noise at our residence to cover the noise they create.

Current Situation

Regardless of whether Te Rere Hau Windfarm does or does not comply with its current resource consent: in certain wind **conditions** there is enough wind at site to produce power BUT insufficient wind at our residence to create back ground noise loud enough to mask their racket.

We note that there has been 1750+ complaints – an extremely high number in regards to R.M.A conditions.

This number should actually be significantly higher as when the wind farm kicked off full noise most of the residents weren't aware of the complaints procedure. It wasn't until a residents meeting was called to discuss the proposed extension that we learned of the after hour's complaint line.

We seek the following decision from the Palmerston North City Council:

Going Forward

1) Revoke current Resource Consent
2) NZWL apply for consent under the latest unit standard ie NZS6808:2010
3) Whilst we commend NZWFL for introducing their "Dynamic Curtailment Regime "
   a) Have it written in to their resource consent – this protects us from any future changes in production or board parameters.
   b) It needs to be actioned in real time - Feedback collected within a maximum of 2 weeks
   c) There is a known level of conditions existing where shut downs commence.
   d) It must be quantifiable - We shut down this many. Noise volume altered this much.

8957088

7-1

Form 13

Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991.

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter:	Joseph Poff
Contact details of Submitter: (Full postal address, phone/fax number(s), email address of Submitter)	Address: 658 Pahiatua Track RD 1 Palm. Nth. Phone Number: 06 353 8164 Fax Number: Email Address: poff@inspire.net.nz

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) NZWF

for a Resource Consent for (briefly describe activity and type of resource consent) _____

at (Resource Consent address) 355 - 573 North Range Rd, P.N.

My submission is: (Choose from the following)

☐ I support the review
☐ I am neutral to the review
☑ I oppose the review
☑ My submission relates to the entire review, or
☐ My submission relates to the following specific parts of the review: _____

I wish/~~do not wish~~ (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended: _____

7-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

- There is no need for this action.
- Sound measurements at location of complaints prove compliance.
- Waste of ratepayers money with over $1 million spent harrassing this Co.
- I live close to this WF and can confirm the noise level is minimal.
- Many people I know live happily with far worse noise effects.
- PNCC should not be actively driving away WF investment.
- NZWF provides good jobs to local people.
- We should support any activity which helps mitigate Climate Change and support renewable energy initiatives.

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

- STOP this Review process immediately
- Use ratepayers money to enhance our city for the benefit of all.

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

(A signature is not required if you make your submission by electronic means)

Date: 31.5.17

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

8-1 8959184

2 June 2017

To:
The Governance and Support Team Leader
City Corporate Unit
Private Bag 11-034
Palmerston North City Council
VIA email: submission@pncc.govt.nz

CC To:
New Zealand Windfarms Ltd
c/- Vicki Morrison-Shaw
Atkins Holm Majurey Limited
PO Box 1585
Auckland 1140
VIA email: vicki.morrison-shaw@ahmlaw.nz

SUBMISSION RE REVIEW OF RESOURCE CONSENT CONDITIONS FOR TE RERE HAU WINDFARM OPERATED BY NEW ZEALAND WINDFARMS LTD AT 355-573 NORTH RANGE ROAD, PALMERSTON NORTH

Submitted by:
Callum Wilson, on behalf of C R J Wilson & JF Ivamy (23 Ridgeview Road, Palmerston North)

We are **not** a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

Our submission relates to **all** parts of the proposed amendments to the resource consent conditions for the windfarm known as Te Rere Hau and operated by New Zealand Windfarms Ltd at 355-573 North Range Road, Palmerston North, as notified by the Palmerston North City Council, pursuant to s.128 (1)(c) of the Resource Management Act 1991.

Our Submission is:

1. We in principle **support** the proposed amended conditions.

2. We make this submission having been residents of 23 Ridgeview Road since December 2014.

3. Our personal experience is that the operation of Te Rere Hau does at times create prolonged noise effects which disrupt our quiet enjoyment of our property. We consider this 'noisy neighbour' situation as unsatisfactory.

4. We have not previously lodged a complaint in any form. We understand that complaints have been extensively raised by other neighbours at a scale that we would add little to, and

if there was any breach of consent, action required, or remedy available, it would surely have been reached without further complaint.

5. We have not participated in previous consent processes for Te Rere Hau. While I was a recreational user of North Range Road prior to the construction of the TE RERE HAU, and the visual impact of the wind farm was not to my liking, at least the noise effects were presented to imply they would be negligible. We have now experienced that at times this is certainly not the case.

6. Prior to the purchase of our residence at Ridgeview Road, we visited the property a number of times out of particular concern of possible noise effects from Te Rere Hau. During our visits, we did not note any adverse effects. However, we have now become all too familiar with specific wind conditions during which Te Rere Hau does emit noise with characteristics that we find unacceptably intrusive.

7. The nature of the noise that we experience from Te Rere Hau varies based on wind conditions, but is an 'approaching' mechanical sound, that never 'arrives'. This is particularly unnatural and intrusive. We do note that the noise even at a particular instant is experienced quite differently by different people, and individual tolerances to it also vary.

8. We find that the wind conditions where the effect is worst are typically in the range of light to calm. Though often in these conditions it is observable that the wind conditions at Te Rere Hau can be quite different to at our residence, despite their close proximity. We have little confidence that models and analysis presented can properly take these local variations into account, so we hope there is sufficient margin of error allowed for in any condition of restriction for it to be effective.

9. NZ Windfarms as operators of Te Rere Hau have recently reached out to residents and explained their desire to be better neighbours, including to focus on dealing with the effect perceived by residents rather than the difficult to measure and extraordinarily costly quantitative approaches set out in the consent. While this seems like a pragmatic and considerate approach, which we appreciate, we are all too aware just as the change of governance and management within NZ Windfarms has brought this approach, a similar change could easily take it away. We are therefore strongly in favour of their being strict binding conditions in the consent.

10. While we in principle support the proposed amended conditions, in that they attempt to address the reality of the noise emissions, it remains unrealistic for me as a layman to assess whether the levels stated are appropriate to give the quiet enjoyment that I presume they are designed to protect. I have concerns that the although the source characteristics and standards are readily available and have been used, I doubt that the models and assumptions are accounting for all relevant factors of the local environment. For example the significant local variations in wind, contours, and the noise effects that result, would be very difficult to model. We therefore would like to ensure that although standards-based measures are the target, it is the noise effects actually experienced and reported by residents that need to considered a very significant factor in compliance.

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11. We seek a decision that proposed amended conditions, as a minimum standard to defining the improvement required, be applied and enforced.

12. On the basis that I am unlikely to be adding anything other than yet another voice to the clear and longstanding positions of other residents, I do not wish to be personally heard on this submission. However I wish to make it very clear that we stand in strong support of residents who oppose the unabated operation of Te Rere Hau.

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To: **Palmerston North City Council**
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And To: **NZ Windfarms Limited**
vicki.morrison-shaw@ahmlaw.nz

Name of submitter: **Lawrence John HILL**

This is a submission on an application from **New Zealand Windfarms Limited** ("the applicant") for a change of conditions of a resource consent by the **Palmerston North City Council** ("the Council") published April 2017, pursuant to s.128 (1)(c) of the Resource Management Act 1991 for an industrial wind energy generation installation known as Te Rere Hau and operated by the applicant at 355-573 North Range Road, Palmerston North ("the installation").

I am not a trade competitor for the purposes of section 308B of the Resource Management Act 1991.

I am directly affected by an effect of the subject matter of the submission that—

(a) adversely affects the environment; and
(b) does not relate to trade competition or the effects of trade competition.

The specific parts of the application that my submission relates to are set out therein.

My submission opposes the application or specific parts of it as set out therein.

I seek a decision from the consent authority as set out in my submission.

I do not wish to be heard in support of my submission.

Pursuant to section 100A of the Resource Management Act 1991 I request that you delegate your functions, powers, and duties required to hear and decide the application to 1 or more hearings commissioners who are not members of the local authority and who have no conflicts of interest.

.....
Lawrence J Hill this 2nd day of June 2017

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In the Matter of Resource Consent Conditions

UNDER	the Resource Management Act 1991
BETWEEN	New Zealand Windfarms Limited Applicant
AND	Palmerston North City Council Consenting Authority

Submission as to changes to Consent Order dated 30 May 2005 in Env W 0039/05 and 0041/05

Dated 2 June 2017

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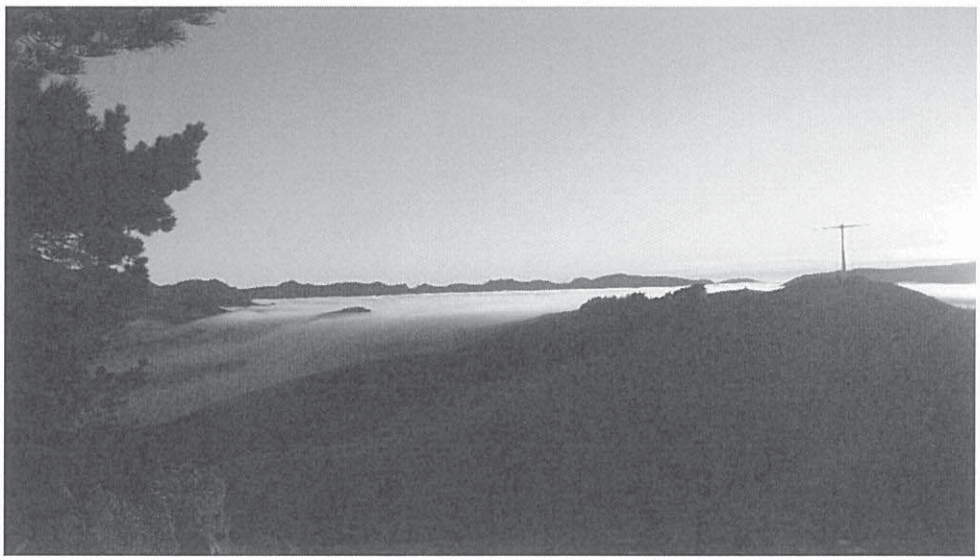
Background

1. I live at Gebbies Pass, Christchurch.

2. Below is a photograph of the Windflow Technology Limited's (Windflow) turbine at Gebbies Pass.



3. In this photograph there are eight things you should note:

   a. The distance from my home to the turbine is 480 metres.
   b. The turbine is essentially due east from my home.
   c. The hub height of the turbine is the same height as my bedroom and situated on the same side of my house and facing the turbine.
   d. There is clear line of sight from my home to the turbine with only a valley between house and the turbine.
   e. The prevailing wind is east north east.
   f. On the day the photograph was taken there was a temperature inversion. The fog behind the turbine covers all of Lyttelton Harbour and fog is seen 'spilling' over Gebbies Pass to the south west. Generally, the hills in the background are the Port Hills.
   g. The turbine is facing south west and is not operating. There is no wind.
   h. The ambient (background) sound level is at or below 18 dB(A) L_{90} being the operating 'floor level' of a Class 1 sound level meter.

4. The consent for this turbine lapsed on 10 October 2012 and the final decision relating to the conditions for the operation of the turbine was published by the Environment Court on 10 May 2017.[1]

[1] [2017] NZEnvC 68

5. Information obtained from this turbine was used for the original consent application for the Te Rere Hau installation. Much of that original background information has been discredited in the courts.

6. I am affected by the noise the turbine makes particularly the amplitude modulation noise (AM noise).

7. It is important to remember that this turbine type rotates between 48 to 50 revolutions per minute regardless of wind speed. The turbine is 'synchronised' to the national electricity grid that operates between 48 to 50 Hertz. Once the turbine is phased with the grid the turbine will rotate at the grid's frequency.

8. Accordingly, in light winds the AM noise is very intrusive. The AM noise is worst when a light southerly wind is present and when my home is up wind of the turbine.

9. In evidence given by the CEO of Windflow, Geoff Henderson, the blades are deliberately rotated up to five degrees every 90 seconds to lubricate the bearings where the blades attach to gimbal immediately adjacent to the hub. This action creates a cyclical increase and then decrease in the AM noise.

10. On Thursday 10 March 2005, at about 6.10pm, a rapid change in wind direction and speed resulted in large out of balance forces on the rotor of the prototype Windflow 500. This caused the bolts which secure the gearbox to the pallet to break. The gearbox and rotor then fell to the ground.[2]

11. As a result the shutdown algorithm for the turbine was changed. This now means that when the turbine is powered down, the blades are violently 'checked' against the wind to brake the turbine's speed. This procedure creates a loud 'ripping' noise and is sufficient to startle people and wake people from sleep.

12. It is essential to fully comprehend the 'mechanics' of these turbines so that <u>all</u> the characteristics of the machinery is fully understand, including a comprehensive understanding of the operational software, and how the mechanical and software setting settings affect the noise generated.

13. It is now alleged in the Australian Senate[3] that the manufacturers of wind turbines have used what is known as 'defeat software' during the establishment periods of windfarms and during the associated noise compliance testing. This software has been used to ensure code

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[2] Published statement by Geoff Henderson for Windflow.

[3] 15 September 2015.

compliance and to defeat the applicable standards (being the New Zealand Standards).[4]

14. Attached as annexure "A" is the full speech of Australian Senator John Madigan.

15. It is recorded that the deliberate manipulation of wind turbine noise data is used show compliance. This "gaming of the system", as it is referred to, involves operating wind turbines in a low noise mode for compliance testing. To achieve this the pitch of the blades are 'feathered' to achieve less 'bite' into the wind, lower energy generation, and consequently lower noise emissions.

16. To ensure such "gaming of the system" does not occur as part of the noise assessment, a very careful examination of the electricity generation record for each turbine tested will need to be undertaken to compare historical electricity output to the electricity output during compliance testing and monitoring period for that same turbine.

17. As evidenced in Senator Madigan's speech, the use of 'averaging data' by the acoustics firm Marshall Day is not permitted and leads to false compliance outcomes.

18. At Gebbies Pass, prior to the noise testing undertaken, Windflow altered the shutdown part of the operational algorithm meaning the "ripping noise" mentioned above was excluded from any noise assessment. This was a deliberate act to moderate the recorded noise signature of the turbine thus distorting the evidence presented to the Environment Court.

Proposed Operating Conditions

19. There are now a plethora of operating conditions for these types of turbines. These include (but are not limited to):[5]

    a. Gebbies Pass in 2002;
    b. Te Rere Hau in 2005;
    c. Hurunui in 2011;
    d. Long Gully in 2011; and,
    e. Gebbies Pass in 2017.

20. In the Long Gully application Regional Public Health (Wellington) cited the findings of Mr George Bellhouse:

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[4] NZS 6808:2010

[5] There are also similar operating conditions in the United Kingdom.

> This proposed wind farm is to operate using two bladed wind turbines which have a different sound characteristic to three bladed turbines. There is no detailed spectrum analysis included in the assessment [by Marshall Day] nor any detail of whether there is likely to be any other special audible character of the emitted sound. If present the type of characteristic sound may have an adverse effect on the overall assessment, and hence increase the potential for adverse effects.[6]

21. I can confirm that as part of the consenting process for Gebbies Pass, there remains "no detailed spectrum analysis" of the noise from these turbines. Indeed, whilst a very poor attempt at this analysis was tried, nothing conclusive was published.

22. Of the data collected, Emeritus Professor Colin Hansen[7] at the University of Adelaide, having reviewed a small portion of it, concluded that "there seems to be clear evidence of AM" noise.

23. If, as it is established by the courts and Prof Hansen, AM noise is present in the spectrum of the emitted noise from this type of turbine, then the conclusions of Mr Bellhouse are critical because the potentiality for adverse effects are now realised. These adverse effects are real and present at all times the turbine is operational.

24. There is no merit whatsoever in pursuing the fallacy that these types of turbines "may" have special audible characteristics (SACs). The evidence has been long established that they do have such characteristics. The starting point must now be to apply full penalties under NZS 6808:2010 in their entirety. That is, the conditions must apply a 6dB penalty as per the standards, as being presumed.

25. There can no longer be the presumption that no SACs exist - they do exit. Those SACs must undeniably be penalised.

26. This must be treated as a matter of strict liability as NZS6808:2010 contemplates. As such, mitigating factors may be taken into account only if consideration is to be given to reducing the full penalty. It is wrong to try to summate penalties as some renewable energy lobbyist argue.

27. In the Court of Appeal decision[8] at paragraph 93 the court noted:

> The information provided in the NIAR[9] was that the SPL of the Windflow 500 turbines specified for use in the Windfarm was calculated to be 100.7 dBA. This was based on measurements taken from a prototype of the Windflow 500 turbine operating in Canterbury [at

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[6] Letter from the Medical Officer of Health, Wellington, dated 26 June 2009 to Wellington City Council.

[7] http://www.adelaide.edu.au/directory/colin.hansen

[8] *Palmerston North City Council v New Zealand Windfarms Ltd* CA702/2013 [2014] NZCA 601 [9 December 2014]

[9] Noise impact Assessment Report.

> Gebbies Pass]. The NIAR also stated that the turbines would not produce sound with SACs. As such, it was said that there was no need for a "tonal penalty" (of 5 dBA) as provided in NZS6808[10].

28. The NIAR was found to be demonstrably flawed because, as the High Court observed, the sound pressure level (SPL) was "wildly wrong". The court heard that the SPL was closer to 106 dB(A) at a wind speed of 8 metres per second than to the 100.7dBA adopted from the Gebbies Pass data in 2002. It is noted that the SPL of the Gebbies Pass in 2017 turbine was not determined from argument by the Court.

29. The evidence from Gebbies Pass application in 2017 is that the turbine does, as a matter of fact, produce SACs and that those SACs are penalisable.

Noise and Public Health

30. Noise should not be treated any differently to any other public health issue. There is an unconscionable argument that some of the population should be allowed to suffer for the benefit of greater good. Thus *bonum commune communitatis* is immorally promoted as being for the common good of the community by the renewable energy lobby.

31. It is ironically argued that, for the greater good, renewable energy should be permitted to pollute through, for example, noise, because of a greater benefit to society. Where, in the meantime, people's health in the immediate vicinity is demonstrably compromised.

32. Such logic is roundly despised. As far back as 3700 years ago when Anu the Sublime, King of the Anunaki and Bel set down the Code Hammurabi, he said the purpose of the code was:

> … to bring about the rule of righteousness in the land, to destroy the wicked and the evil-doers; so that the strong should not harm the weak ... to further the well-being of mankind.

33. It is extraordinary that in a civil society today, decision-makers are now prepared to put aside such wisdom and allow the strong to harm the weak.

34. The position currently argued by companies that lobby for renewable energy that some of society should be allowed to be harmed is a fundamental breach of the universally recognised "Golden Rule".[11]

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[10] NZS6808:1998

[11] https://en.wikipedia.org/wiki/Golden_Rule

35. Even more extraordinary is that noise is seen as something less harmful than other community health issues such as plumbosolvency (lead poisoning). Left unchecked such a deterioration of community health can arguably lead to the demise of communities and a civil society. Whilst lead poisoning is now not regarded as the cause of the fall of Rome (as it was once was) the health risks associated with lead and plumbosolvency are still of moment and widely protected against by regulators and government. Noise should be treated no differently.

36. The erosion, or infection, of good sleep hygiene has a myriad of consequential affects. AM noise from wind turbines should not be permitted to enter homes and cause any disruption to sleep or health or cause annoyance.

37. The effects of noise, and the associated health effects, are extremely well-covered by the World Health Organisation (WHO) in numerous publications. It is gravely concerning that such guidance from the WHO appears to be avoided by decision-makers in New Zealand or is being obfuscated by people advising the decision-makers and by the renewable energy lobby.

38. The courts understandably veer away from health issues. It is simply too hard for a court to determine if someone is unwell because the courts are populated with judges from a legal background who are not necessarily medically trained. The courts 'see' no evidence that a person's sleep was disrupted, or that chronic annoyance is created because a person is deprived of the quite enjoyment of their home.

39. However, governments (including local authorities) are charged with maintaining community health. That responsibility cannot be avoided. So, whilst there may be insufficient evidence to meet a legal threshold in the courts, this does not precluded evidence being sufficient to meet a medical threshold in clinics. Again, I refer to the findings of Mr Bellhouse above.

40. There has been no longitudinal study of people's health since these wind turbines have been erected. That should have been an initial condition for the applicant in 2005.

41. One study however has shown the pronounced increases in cortisol levels and chronic stress in badger (*Meles meles*) populations in the United Kingdom.[12] The results of this study showed that a hair of badgers living less than 1 kilometre from a wind farm had a 264% higher cortisol level than badgers living greater than 10 kilometres from a wind farm.

42. A similar conclusion cannot be dismissed in the human population.

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[12] https://www.ncbi.nlm.nih.gov/pubmed/27187031

Effect on Property Rights

43. The differentiation between proposed conditions 4 and 5 is alarming. In effect, what is being proposed is that the burden of the noise, and the health effects thereof, is less important if a dwelling postdates the original consent in 2005. There is categorically no health correlation here.

44. Such a variance in these conditions is purely economic. Thus, the economic burden is shifted from the applicant to the adjourning land owner. On what basis should a person, not being the polluter, incur such an economic harm?

45. It is manifestly wrong to suggest that the negative economic consequences of production should be borne by a person who does not benefit; or if they do benefit, that burden is disproportionate to others in society who may receive the same benefit but do not endure the same burden.

46. The consequence of bearing that economic burden will result in the degradation of property values and the increase in building costs to mitigate the effect of the noise. It is not the adjourning land owner who should suffer those costs; it is the polluter, in this case the applicant.

47. There is no logic in the noise criterion variation between the two periods in time in conditions 4 and 5 and whether dwellings may or may not have been erected.

48. It is also against the Independent Commissioners decision[13] who favoured setbacks of 1.5 kilometres rather than the 40 dB isoclines argued for by some of the submitters. The Commissioners also preserved the 'high amenity' provision that would apply under NSZ6808-2010 this preserving the character of the Rural Residential Area identified in the Council's District Plan as shown in the Rural Residential Overlay (and contained within the planning maps therein).[14]:

IoA Standards

49. It is proposed that for the assessment of AM noise, the United Kingdom's Institute of Acoustics (IoA) Hybrid Model 3 should be used to determine whether a penalty should be applied. This is only one of many different methods to measure amplitude modulation reviewed by the IoA and others. Equally relevant is, for example, is the IEEE Standard *2400-2016 Standard for Wind Turbine Aero Acoustic Noise Measurement Techniques.*

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[13] PNCC - Decision of Commissioners dated 22 August 2016 at para 355.
[14] PNCC - Decision of Commissioners dated 22 August 2016 at para 378.

50. Notwithstanding my comments above, and that the penalty for special audible characteristics should be applied as a matter of fact, the proposed method is demonstrably flawed.

51. Recent research[15] undertaken in the UK has established the proposed model fails to produce a positive AM noise outcome when that AM noise is audible and the model also fails to differentiate AM noise when present but not audible. In the latter, a spectrogram will clearly display the AM noise but the model fails to produce a positive outcome or presence of AM noise.

52. As such, the preliminary conclusions are that the proposed IoA model fails its objective as a reliable predictor of AM noise.

53. This reinforces the view that the penalty, as a condition, and as a matter of strict liability, should be applied in full.[16]

Verifiable Testing

54. It is a cardinal principle that the government protects the public as part of the social contract between the Crown and its citizens.[17] For example, the Commerce Commission will bring actions against those falsely describing goods, or the Ministry of Primary Industries will monitor and act on complaints regarding products reputedly containing health benefits.

55. Yet, where noise as a pollutant is concerned, no government agency appears willing or able to protect the public. Neither the Ministry of Health nor the Environmental Protection Agency appears capable of issuing decisions on noise pollution.[18]

56. Remarkably, it is left to the polluters to undertake the compliance assessment with only a cursory overseer role by local government with no specialist capability.

57. There is a financial cost for the:

    a. Gathering the noise data;
    b. Processing the noise data;
    c. Reporting on the noise data; and,
    d. Seeking enforcement.

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[15] As yet unpublished.

[16] That is unless later testing proves otherwise thus allowing consideration for the mitigation of the penalty.

[17] This was the agreement between William the First of England and his nobles in 1066 predating the Magna Carta and upon which our New Zealand law is based.

[18] With the exception, it seems, of Mr Bellhouse and Regional Public Health (Wellington).

58. These costs are well beyond the reach of ordinary folk and generally well beyond the technical ability of most people. Yet, those who are affected have no practical recourse to protect themselves from noise pollution. For example, people without the financial wherewithal cannot monitor the AM noise and complain to the local authority because there is no 'evidence' readily available to them.

59. Therefore it is absolutely imperative that live monitoring is required as a condition, and that information is made available to the public, thus demonstrating compliance to the conditions at all times. This technology is available and, although expensive (to ordinary folk), it is simply a cost of production for the applicant to bear.

60. Instrumentation, including windscreens, should be conditioned to meet the requirements of American Standard *ANSI S12.9-2016/Part 7 Quantities and Procedures for Description and Measurement of Environmental Sound, Part 7: Measurement of Low-frequency Noise and Infrasound Outdoors and in the Presence of Wind and Indoors in Occupied Spaces.* This is the most up-to-date standard dealing with wind farm noise monitoring instrumentation.

61. Notwithstanding my comments above regarding the adequacy of the IoA AM noise algorithms; continuous, automated 'breaching' software must be included in the monitoring. Those breaches must be immediately, and automatically, sent to the Council and those effected by the breach. As the IoA software is available as Python code, the necessary modules can be added to the code to facilitate the 'breaching' outcomes.

62. Verified commercial software and firmware is also readily available for tonality, and may be measured, for example, using the methodology in International Standard *ISO 1996-2:2007 Acoustics — Description, measurement and assessment of environmental noise —Part 2: Determination of environmental noise levels.*[19]

63. In this way, breaches are provided neutrally and to all affected; including the applicant and the Council.

64. Should any dispute arise as to the data pertaining to a published breach, by the software, then experts may be able to interpret that portion of the data in question.

Conclusion

65. The underlying concern of consenting bodies appears to be AM noise. As such, a clear and accurate assessment of the noise must be achieved.

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[19] See Annex C - Objective method for assessing the audibility of tones in noise —Reference method

66. Council has a duty of care to put in place noise conditions that recognise and ameliorate the complaints made by residents concerning past and potentially future noise events.

67. Such conditions must have certainty of application that can be verified by a truly independent agency and by properly trained acoustic consultants. Therefore, all wind data must be publicly available in real-time for each turbine and be viewable to the public at large to avoid the same circumstances enunciated by Senator Madigan.

68. The cost for ensuring the protection of the public, and public health, must fall upon the emitter of the noise pollution, the applicant, and not be borne by those affected by the noise.

69. The SAC penalty of 6 dB must be applied, in full, and should later testing prove otherwise, that penalty must remain in place.

70. Council must also put in place a complaint management system, alongside automated 'breach software', that is available 24/7 and which requires the wind farm operator to take immediate remedial action on complaint to mitigate the effects of the noise pollution, or any future noise pollution caused by the same or similar discharge into the environment.

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Lawrence J Hill this 2nd day of June 2017

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Annexure

"A"

9-14

SPEECH

Date	Tuesday, 15 September 2015	Source	Senate
Page	91	Proof	Yes
Questioner		Responder	
Speaker	Madigan, Sen John	Question No.	

Senator MADIGAN (Victoria) (21:41): Firstly, I seek leave to table a document, and it was disclosed to all the whips earlier today.

Leave granted.

Senator MADIGAN: Tonight, I speak about corruption and fraud in the power generation industry. The Senate wind turbine inquiry's final report made 15 important recommendations. Tonight, I rise to speak in support the Labor senators' dissenting report's fifth recommendation:

... that state and territory government consider reforming the current system whereby wind farm developers directly retain acoustic consultants to provide advice on post-construction compliance.

Avoiding noise from wind turbines is an expensive bother that does not hold any appeal to wind farm operators. Slowing down turbines increases costs and slows down profits. So I was not surprised to learn that, in the seven years of its controversial operation, the adjustments necessary to ensure Cape Bridgewater wind farm operated in compliance with its planning permit have never been applied. Wind farm operators have found a simple and far less expensive process to game the system: they employ compliant 'experts'.

In 2006, Marshall Day Acoustics, with consultant Christophe Delaire, prepared a preconstruction noise impact assessment for the Cape Bridgewater wind farm. The report predicted that compliance could not be achieved at Cape Bridgewater wind farm without operating 13 of the 29 turbines in reduced operational noise modes. Before it was even built, developers knew this wind farm would operate in breach of permit unless adjustments were made. But Delaire told the committee of inquiry, 'following measurements on site, it was found that noise optimisation was not required.' How did Delaire's 'expert' preconstruction and post-construction reports come to draw such contrasting conclusions? The answer is simple. Pacific Hydro did not noise optimise turbines at Cape Bridgewater, because they knew they would not have to. They only had to commission a post-construction noise report to say the wind farm was compliant. On both occasions, Pacific Hydro got exactly the report they wanted from MDA, but the compliance assessments were not compliant with the standard and neither were the reports.

Questions of multiple reports reaching opposite conclusions were raised at the Portland hearing. During the Cape Bridgewater wind farm's noise monitoring program, measurements were taken every month and monthly noise reports were generated to assess compliance at dwellings. Let us look at a few from house 63. October 2008: 'Wind farm noise levels exceed the New Zealand noise limits'. June 2009: 'The New Zealand limits are significantly exceeded.' July 2009: 'The New Zealand limits are significantly exceeded.' MDA's original reports identified noncompliance at multiple homes and every wind speed. This did not satisfy the client.

On 22 July, MDA reissued revised monthly reports for every house and every month. These reports were to Pacific Hydro's satisfaction but not the permit's. The reissued versions for October and July said, 'There is reasonable correlation between measured noise levels and wind speeds.' References to exceeding the New Zealand limits were erased. Without incriminating original reports, MDA's final report concluded, 'Noise emissions from the Cape Bridgewater wind farm comply with the New Zealand noise limits at all houses and at all assessed wind speeds.' Pacific Hydro submitted it to the planning minister as 'proof' the Cape Bridgewater wind farm was compliant. But how? MDA combined all the reissued monthly reports and averaged them out for each property. There is nothing in the 1998 New Zealand standard that allows acousticians to find 'average' post-construction noise levels and yet Pacific Hydro told the committee, 'Current noise standards require the average post-construction wind farm noise level.'

There is no tolerance within the standard that would allow a wind farm to casually comply with its noise limits in some months but not others. Condition 13 does not allow the wind farm to occasionally comply with its permitted use. The New Zealand standard is supposed to protect amenity and night-time sleep. Wind farm planning permits are issued with conditions that decision makers expect will protect the communities that host them—in real time.

9-15

In February 2009, the panel assessing the Lal Lal wind farm stated:

There is little point in giving permission for a WEF to operate under certain conditions unless compliance with those conditions can and is demonstrated.

It added:

any exceedance of the limit should be considered as a breach of the condition …

An 'average' noise level means absolutely nothing. That is why the permit requires that when the wind farm is operated it must comply with the New Zealand noise limits at all dwellings and, clearly, this one does not. The Cape Bridgewater wind farm has never been compliant, despite the falsified conclusions drawn by MDA and the claims of its master, Pacific Hydro. A Victorian Planning officer told the committee: 'Studies need to be done in a way which is robust. That is why the peer review of the work is important.' So why wasn't a review of the Cape Bridgewater report commissioned as a matter of due diligence, not to mention consistency?

When ACCIONA gave the minister its report, the minister sent a copy to the EPA, and within a week he had commissioned an independent technical review. He promptly wrote to ACCIONA, describing multiple breaches of permit and expressing his dissatisfaction that compliance had been achieved with the noise monitoring program required by condition 17. He said that the report shows that the operation of the Waubra wind farm does not comply with the noise standard at several dwellings and he was not satisfied in accordance with condition 14 that the operation of the facility complies with the relevant standard. Then he asked ACCIONA to 'noise optimise the turbines'. Delaire from MDA prepared Waubra's wind farm's preconstruction noise report, which predicted noise would exceed the New Zealand limits and would only comply if 50 of its 128 turbines were noise optimised. Same preconstruction formula, same post-construction problems. If not for that pesky peer review, ACCIONA might have got away with it. They had never intended to operate noise optimised turbines in compliance with the limits. Why? ACCIONA had an MDA post-construction noise report that concluded that Waubra wind farm operated in compliance with noise limits without needing to noise optimise any turbines, let alone 50 of them!

The Minister wrote to ACCIONA again a year later, stating that the MDA report it submitted showed non-compliance and that testing was not undertaken in accordance with the New Zealand standard. The minister queried who it was that undertook the assessment and whether this person or people were qualified and experienced to do so. MDA's website says that Delaire graduated with an engineering diploma in 2002, after beginning with MDA as a work experience student the year before. Delaire has prepared acoustic reports for 50 wind farms. MDA's website promotes its 'proven record of successful wind farm approvals' and credits Delaire for developing a 'specialty' in wind farm environmental noise assessments.

At the beginning of MDA's reports there is an extraordinary disclaimer which acknowledges that reports are written to satisfy the client's brief. It says their reports 'may not be suitable' for other uses. MDA's disclaimer proves they are not fit for purpose as independent compliance documents. MDA is a member firm of the Association of Australian Acoustical Consultants, whose code of professional conduct requires that members avoid making statements that are misleading or unethical and that they endeavour to promote the wellbeing of the community. They must not knowingly omit from any finalised report any information that would materially alter the conclusion that could be drawn from the report.

MDA has clearly failed the community consistently. There is no doubt that MDA's commercial arrangements with both ACCIONA and Pacific Hydro adversely affected the independence of reports and the legitimacy of conclusions. This example alone shows exactly why we needed an inquiry that examined the regulatory governance of wind farms and why the scrutiny of an independent national wind farm commissioner is essential. There must be arm's length relationships between acousticians and wind farm operators. Independence would put a stop to the practice where false compliance documents allow operators to gain pecuniary advantage.

Local, state and Commonwealth government authorities, departments and agencies have been duped by sham compliance reports

A wind farm that is 'compliant' with state laws can receive RECs. A 'compliant' wind farm can secure finance, like the $70 million Pacific Hydro swindle from the Clean Energy Finance Corporation. But those who these reports fail most are decent rural people, left suffering the consequences of deception. A shonky noise report

can erase away the harm and nuisance it has caused for those living, working and suffering beside excessively noisy industrial machines.

Last month I asked the Victorian government to take a good hard look at all the submissions we received—in particular, those from the people duped by the regulatory failures of the Waubra and Cape Bridgewater wind farms. Samantha Stepnell's submission is No. 470. Melissa Ware's submission is No. 206.

While ACCIONA and Pacific Hydro were busy breaching their permits to maximise their profits, residents were and still are often exposed to horrendously excessive noise. Twenty or more of these same people had sent affidavits to former health minister and current Victorian Premier Daniel Andrews in June 2010. They reported severe sleep disturbances and a series of unexplained adverse health effects that were not present before the wind farms started operating. Local doctors and a sleep specialist confirmed concerns of a correlation.

By December 2010, 11 families around Waubra alone had vacated their homes, citing noise nuisance as the reason. But the Victorian government refused Pyrenees Shire Council's request for a health impact assessment, citing the NHMRC's rapid review. That very rapid review found that there was no evidence of adverse effects when planning guidelines were followed. At Waubra, we know that they were not. A simple peer review would have found that they were not followed at Cape Bridgewater either. With callous indifference, the Victorian government has consistently failed in its duty of care to these people. These people represent the human cost of corporate fraud, regulatory failure and political indifference. These families still have the right to be able to sleep at night, to work safely on their farms and to live in peace and have the quiet enjoyment of their homes. This is as much a human rights issue as it is an environmental one.

The nocebo theory is obliterated by the fact that the noise measured at Waubra and Cape Bridgewater exceeds World Health Organisation recommendations for sleep protection. Sleep deprivation is an indisputable health effect. Even the NHMRC now admits there are probably adverse health impacts for residents living within 1.5 kilometres of a wind turbine.

I have been writing to the AMA since May 2014 about its wind farm position statement, asking why audible noise impacts had not been considered. The AMA has failed to respond, but blindly endorses the disproven nocebo drivel by Chapman and Crichton, stating:

The available Australian and international evidence does not support the view that the infrasound or low frequency sound generated by wind farms, as they are currently regulated in Australia, causes adverse health effects on populations residing in their vicinity.

That is because infrasound and low frequency sound from wind farms are not regulated in Australia. Irrespective of what the AMA has been told or wants to admit, exposures to excessive audible noise, low frequency pressure and vibration cause debilitating nuisance, sleep disturbance and compromised health and amenity that reduce quality of life.

So where does that leave those suffering the continuing nuisance at Cape Bridgewater? In submission No. 206, Melissa Ware said she was driven beyond despair and wretchedness. Last year, Pacific Hydro told residents: 'It is our goal to improve your quality of life or at least restore it to what it was before the wind farm was there.' They told me personally: 'We recognise that the wind farm has reduced their quality of life, and we want to help them get it back.' But that was before Steven Cooper's study found that all six residents surveyed are adversely impacted by the operation of the Cape Bridgewater wind farm. Funnily enough, Cooper was instructed not to test compliance. Despite the infamous screeching, thumping, whirring, whistling and siren-like audible sounds produced by the Cape Bridgewater wind farm, special audible characteristics were not assessed in MDA's report. If the five decibel SAC penalty were properly applied, an independent report would identify noncompliance at every dwelling, at every wind speed.

The Waubra and Cape Bridgewater reports were written within months of each other by the same acoustician from the same firm, using the same formula. Perhaps the planning minister has not commissioned a review of Cape Bridgewater's report because he already knows it shows noncompliance. Is this the real reason why the planning minister insists that it is Glenelg Shire's responsibility to enforce noise compliance at Cape Bridgewater, not his? Glenelg Shire cannot enforce compliance without any access to noise reports and the complaints procedure. Only the minister has that information. Condition 13 says compliance must be to the satisfaction of the minister. Council cannot legally exercise that judgement. Condition 13 remains unresolved. Cape Bridgewater

wind farm continues to operate at full capacity and maximum noise, without any regulatory authority accepting responsibility for enforcement.

In submission No. 456, Sonia Trist explains how officers from the Victorian planning department admitted noise limits are exceeded at her home, one apologising that: 'The department adjusts information to obtain the required results.' In June 2014, this retiring officer called me and later sent me an email, blowing the whistle on his department: 'There is so such more to convey and I am sorry that I cannot do so now. Department incompetence and indifference is the primary reason for the current situation. I found it hard to find the truth, working inside, so it must be hard for your side.' On 'my side' are those exposed to excessive and harmful, sleep-destroying, audible noise emissions at levels that exceed noise standards and breach permits. Those not on my side include complicit regulators, wilfully blind health bodies and greedy operators who put corporate profits before country people. And also not on my side are crooked acousticians flaunting a fraudulent reporting formula that concludes compliance when there is not.

Notable for their refusal to attend the Senate inquiry and be questioned, the Australian Medical Association were not alone. Others who similarly refused were the authors of the two NHMRC-commissioned literature reviews from Adelaide University and Monash University, and Professor Gary Wittert.

In December 2013, I warned about the culture of noncompliance arising from systemic regulatory failure in Victoria. But that culture of noncompliance, aided, abetted and enabled by recklessly irresponsible reporting and regulatory indifference, will only continue for as long as we tolerate it. This industry demands root-and-branch regulatory reform. Those who have actively and deceptively harmed communities, gamed the planning system, rorted the RET and exposed the CEFC and the private sector to investment risk must be investigated and held to account. I urge the government to swiftly adopt the prudent recommendations of the wind turbine inquiry. We insist that the Labor senators' fifth recommendation is acted upon as a matter of urgency.

10-1

8957087

Form 13

Submission on the review of proposed consent conditions, Te Rere Hau Wind Farm

To:

The Governance and Support Team Leader
City Corporation Unit
Private Bag 11034
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: Lorraine Tremain and Ashley Kells

Contact Details

Lorraine Tremain
406PahiatuaAokautere Road
RD 1
Palmerston North, 4471
Mobile phone: 027491 5594

Submission on the review of proposed consent conditions, Te Rere Hau Wind Farm

This is a submission on an application from Palmerston North City Council pursuant to s. 128 (1)(c) of the Resource Management Act 1991 reviewing the conditions of the resource consent for the windfarm known as TeRereHau and operated by New Zealand Windfarms Ltd at 355-573 North Range Road, Palmerston North.

The specific parts of the application that our submission relates to are:

- Amend Condition 1 to clarify the general condition does not apply to noise emissions to wind turbine generators (WTG) and does not apply to noise emissions and effects identified in the Noise Impact Assessment report of Malcom Hunt & Associates attached to the Assessment of Environmental Effects.
- Delete Conditions 4, 5, and 6 and replace them with a new suite of conditions numbered 4-21.

My submission is:

- That I **support** the review and the proposed modifications to the existing conditions of consent outlined in the Notice of Review, dated April 2017.
- Our desire is that a clear consent be established that can be monitored and enforced so that our home and property is protected from unacceptable noise levels.

10-2

The reason for our views are:

1. Our home at 406 Pahiatua Track is approximately 2 km from the windfarm. Ever since the first 5 turbines were erected we have heard them, and as the numbers of turbines increased so too have the noise levels. We were originally assured there would be no impact from the development of the windfarm. Nothing could be further from the truth. We have objected and complained but, in the main, our concerns have been ignored by New Zealand Windfarms Ltd.

2. Distance from the windfarm is not a reliable predictor of declining noise. Turbine noise can be significantly louder further away on our property. The contour of the land must change how the sound travels. Measurements taken at our home at the time of the Turitea Wind Farm application by Mighty River Power indicated that we have very low background noise levels.

3. We are particularly concerned at the noise we hear when there is no or little wind at our home, yet there is sufficient wind to activate the turbines. These are the very times when we want to be outside, enjoying the amenity of our property in a variety of ways. I am very keen to see additional monitoring take place to establish what is happening in a variety of wind directions, and then steps taken to mitigate our concerns.

4. All the comments that were made in our submission of 26 July 2009 on the application for a resource consent by New Zealand Windfarms Ltd for the Te Rere Hau Eastern Extension Windfarm Proposal still apply.

We seek the following decision from the consent authority:

- Amend Condition 1 to clarify the general condition does not apply to noise emissions to wind turbine generators (WTG) and does not apply to noise emissions and effects identified in the Noise Impact Assessment report of Malcom Hunt & Associates attached to the Assessment of Environmental Effects.
- Delete Conditions 4, 5, & 6 and replace them with a new suite of conditions 4-21 in Schedule 1.
- Amend the heading before Condition 30.
- Add Condition 31.

I do not wish to be heard in support of my submission.

Signature of Submitter:

Lorraine R Tremain

Date 2 June 2017

11-1

89 55260

Huffman Devey, 428 Pahiatua Track, Palmerston North
Review of resource consent conditions for Te Rere Hau windfarm
Form 13: Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991

To:

To: The Governance and Support Team Leader
City Corporation Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

Name of Submitter: Lee Meryl Huffman and Graham Royce Devey

Contact Details

Lee M Huffman and Graham R Devey
428 Pahiatua Aokautere Road
RD 1
Palmerston North, 4471
lee.huffman@xtra.co.nz
Mobile phone: 06 027 55 95 007 (Lee)

This is a submission on the review of:

The application from Palmerston North City Council pursuant to s. 128 (1)(c) of the Resource Management Act 1991 reviewing the conditions of the resource consent for the windfarm known as Te Rere Hau and operated by New Zealand Windfarms Ltd at 355-573 North Range Road, Palmerston North.

The conditions are being reviewed with the purpose of better managing and monitoring noise emissions from Te Rere Hau Windfarm.

The reasons for the review is that there were material inaccuracies in the statement of acoustic performance of the wind turbines used for the Te Rere Hau windfarm resource consent applications.[1]

Our submission is:

√ We support the review.

√ Our submission relates to the following specific parts of the review:

Our submission is related to the **Particulars** proposed by the PNCC in the Notice of Review[2]:

[1] http://www.pncc.govt.nz/yourcouncil/consultations/review-of-resource-consent-conditions-for-te-rere-hau-windfarm/ Review of resource consent conditions for Te Rere Hau windfarm. Downloaded 26 May 2017.
[2] Clifford, P. 2 May 2017. Letter to New Zealand Windfarms. "Notice of intention to review of consent conditions pursuant to the Resource Management Act, section 128 (1) (c).

Amend Condition 1 to clarify the general condition does not apply to noise emissions to wind turbine generators (WTG) and does not apply to noise emissions and effects identified in the Noise Impact Assessment report of Malcom Hunt & Associates attached to the Assessment of Environmental Effects.

Delete Conditions 4, 5, and 6 and replace them with a new suite of conditions 4-21 in Schedule 1.

I (Lee Huffman) wish to be heard (speak) at any subsequent hearing.

The reason for our views are:

Background

1. We live at 428 Pahiatua Track. Graham's mother and partner also live here in an attached flat. We are within 2 km of the Te Rere Hau Wind Farm and our home is and is considered as High Amenity in the recent Palmerston North District Plan change[3].
2. The house is at 200m elevation. About 50% of the 65 current turbines are within 3 km. All the turbines are at a higher elevation than our home and farm.
3. Figure 1 shows the location of our home compared to the wind turbines.

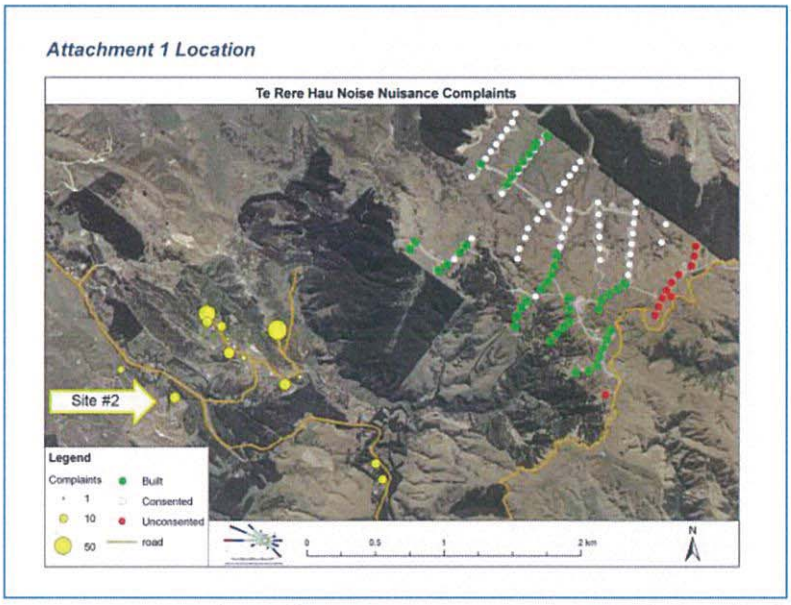

Figure 1. Site 2 is the Huffman-Devey property at 428 Pahiatua Track as identified in my Statement of Evidence in the Environment Court, September 2011[4]. Our home was identified as Site #2 in the Marshall Day 2011 report[5].

[3] Evans, T. 2017. Te Rere Hau Wind Farm, Palmerston North, New Zealand, Independent Review of Noise-Related Conditions. Reference M16516RP1, Revision 0, Resonate Acoustics, 27 October 2016. Section 3.7 Te Rere Hau Wind Farm, Site description, Page 6.

[4] Huffman, L. 2011. Statement of Evidence of Dr Lee Meryl Huffman for Palmerston North City Council, September 2011. ENV-2010-WLG-000114.

[5] Halstead, M. 2011. Te Rere Hau Noise Compliance, Noise Survey Results, Report Reference Rp001 2011095W, Marshall Day Acoustics, 9 June 2011.

4. We have been owned our 35-acre farm since 1989.
5. We were neutral on the establishment of Te Rere Hau Wind Farm, even though we had heard there were problems with the prototype turbine at Geddies Pass in the South Island.
6. When there was growing concern about the noise from the first five turbines in November 2008, we attended the meeting organised by NZ Wind Farm (NZWF) to meet with the neighbours. It was at that meeting that NZWF recommended that we call Palmerston North City Council (PNCC) with our noise complaints. NZWF also asked us to keep noise logs that they would analyse.
7. Since 2008, NZWF has asked neighbours to help them by keeping noise logs and sharing our information with them. The most extensive logs were kept in 2011 to coincide with specific operating wind farm conditions and noise monitoring by Marshall Day Acoustics.
8. We were asked again by NZWF to keep logs on 30 May 2017 to assist the new management understand the noise issues. Each successful NZWF management team has asked for the logged data without any reference to the earlier results or how they had used the provided results in the operation of the wind farm.

Impact of noise prediction models on establishing the consent conditions for wind farms

9. I became aware of the different prediction models for wind farm noise, when comparing the sound power predictions for the Turitea Wind Farm compared to the Te Rere Hau predictions, during the Might River Power Turitea Wind Farm application in 2009. The predicted plots for Te Rere Hau appeared to be lower than the Turitea prediction plots when comparing the decibel contours at similar distances from the turbines.
10. It was about the same time in 2009 that Te Rere Hau started operating the first five turbines and the noise was surprisingly loud for just five turbines.
11. As I looked into the Te Rere Hau consent and the reports supporting the noise predictions, there appeared to be some inconsistencies in the actual and predicted noise results; I shared my concerns with PNCC. For example, in the Application for Resource Consent, 9 September 2004, on page 31 of Attachment 7 of the Noise Impact Assessment, NZ Windfarms, it was stated "A review of predicted noise level indicate (without reduced terrain screening) **only three rural residences will likely receive potential wind farm noise levels of 30dBA or more**". (The emphasis is the author's.) The prediction data for that consent application in 2005 was clearly flawed as evidenced by the sound monitoring and noise complaints from our neighbours in 2009 and ever sense.

Key Findings from analysing the noise logs from our home and from our neighbours relevant to consent conditions

12. As result of that initial preliminary review of the Te Rere Hau consent conditions in 2009 and the prediction models that underpinned the noise levels, I have focused on the impact of the actual noise of Te Rere Hau on the neighbours with analysis of the data. I am familiar with developing and validating prediction models, particularly when developing commercial processes for major financial investments.
13. Since 2009, I have prepared numerous documents describing the tonality and impact on our neighbourhood. These have been shared with both PNCC, NZWF and the acoustic companies.

14. My most extensive evaluation of the noise log was the report I sent to PNCC[6] on 16 August 2011 correlating all the neighbours log data with the Marshall Day Acoustic monitoring[7] in response to the wind farm operational protocols. This major effort to establish the effect of noise on the neighbourhood included on-off testing and night monitoring, agreed between PNCC and NZWF.
15. My report of 16 August 2011 was the most conclusive report I had written on the tonality of the Te Rere Hau windfarm. The 5100 data points (170 date-time entries with 30 assessments) included the eight monitoring sites at the neighbours and the noise logs from four sites that recorded their observations.
16. More specifically, I compiled the data set Marshall Day provided, combining the computer results for sound power, wind direction and description of noise from the neighbours for date, time, and weather conditions. The neighbours noise observations recorded on the NZ Windfarms provided log sheets were tabulated into the 2009 Subjective Noise Profile Survey[8] for Te Rere Hau that included the six categories for tonality (description of noise), three categories for annoyance and four categories for weather.
17. The wind direction (i.e. NNE, ENE, ESE, SSE, SSW, WSW, WNW, NNW) was significantly different for the response "Annoyance" when analysed with a logistic regression assuming a binomial distribution (chi probability <0.001). Note that there was limited data in some of the wind directions limiting this analysis. The regression was calculated in the statistical computer programme, GenStat®. Duncan Hedderley, Biometrician, Plant & Food Research Institute, reviewed my analysis.
18. As result of my August 2011 report to PNCC, a Statement of Evidence[9] was completed, in September 2011 for the Environment Court that summarised and simplified the 25-page technical report to PNCC. My Statement of Evidence supports the need for the review of the Te Rere Hau consent conditions.
19. The Statement of Evidence is the most succinct summary of my analysis of the systematic noise monitoring of the neighbours comments recorded simultaneously and independently to measuring the sound power and wind and environmental conditions for Te Rere Hau. Figures 1-9 highlight the key outcomes and are included with the following Statement.

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[6] Huffman, L. 2011. Evidence of lack of compliance to tonality – Analysis of neighbours noise logs from the Marshal Day Te Rere Hau Noise Compliance Report and the MDA Noise Data. 16 August 2011. 25 pages.

[7] Halstead, M. 2011. Te Rere Hau Noise Compliance, Noise Survey Results, Report Reference Rp001 2011095W, Marshall Day Acoustics, 9 June 2011.

[8] Stone, H & Sidel, J. 1985. Sensory Evaluation Practices, Academic Press.
The survey format I established in 2009 followed standard sensory evaluation practice, including noise, using ordinal scales, interval scales, hedonic scale and acceptance testing. I continued to use the 3-point and 5-point scales defined in the original NZ Windfarms logs to allow comparison of Te Rere Hau results from 2009 to 2011. It appears that the original NZ Windfarms log was based on the typical practice for community noise monitoring, although it is unusual to have different rating systems for each attribute. Typically, the 5-point verbal rating scale (VRS) is standard (ISO/TS 15666 2003).

[9] Statement of Evidence of Dr Lee Meryl Huffman for Palmerston North City Council. BAP-015652-754-745-1, ENV-2010-WLG-000114.

IN THE ENVIRONMENT COURT

ENV-2010-WLG-000114

Under Section 311 of the Resource Management Act 1991

between **PALMERSTON NORTH CITY COUNCIL**
Applicant

and **NEW ZEALAND WINDFARMS LIMITED**
Respondent

STATEMENT OF EVIDENCE OF Dr LEE MERYL HUFFMAN

FOR PALMERSTON NORTH CITY COUNCIL

Qualifications and Experience

1. I have previously sworn an affidavit in these proceedings dated 2 July 2010.

2. I hold a Ph.D. in Food Science and Nutrition and have had responsibilities for integrating analytical measurements to sensory evaluation for over 30 years. Training in sensory analysis and techniques is standard basic coursework for food science and food technology degrees. In addition, to my training in Food Science, I took a number of courses in statistics and experimental design, which has been the foundation of much of my career.

3. Currently I am a Science Group Leader for the Food Solutions Group at the New Zealand Institute of Plant & Food Research. Prior to that I worked 24 years at Fonterra and its predecessors as a Principal Technologist (the most senior technical role at Fonterra Research), and Technical Services Manager at New Zealand Milk Products, North America. I lead teams that developed new products and installed commercial processes at Fonterra based on experimental design and analytical measurements in conjunction with subjective sensory analyses. In addition, I served on the Scientific Board of the EAS Nutritional Company prior to its purchase by Ross Abbott.

4. It is standard practice in the food industry to use hedonic scale testing with experimental measurements to determine relationships between subjective and objective measurements. Typically, the analyses links taste to the processing conditions used to make the food, but the techniques are the same for subjective measurements, whether it is sensory taste, sensory hearing, sensory feeling, etc as noted in the standard texts on Sensory Evaluation Practices, Stone & Sidel (1985). Standard statistical packages are used to analyze and model the data such as GenStat®. Simple calculations tabulation can also be completed in Microsoft Excel®. I work closely with statisticians as part of my routine work at Plant & Food Research to support the conclusions of the analyses and my research. I consulted with Duncan Hedderley, Statistician at Plant & Food Research, prior to doing my analyses of this noise data and the neighbours logs. I do not claim to be an expert in the science of acoustics or noise measurement. My expertise is in experimental design and data analyses.

5. I have read the Code of Conduct for expert witnesses issued as part of the Environment Practice Notes. I agree to comply with the Code of Conduct. I am satisfied that the matters addressed in this statement of evidence are within my expertise. I am not aware of any material facts that have either been omitted or might detract from the opinions expressed in this statement of evidence.

Analysis of Residents Logs with Marshall Day Acoustics Data

6. Marshall Day Acoustics was to obtain and collate certain noise data concerning the operation of the Te Rere Hau Wind farm in accordance with a document called *Te Rere Hau Wind Farm Data Collection Specification* dated 21 December 2010. The MDA records were to be analysed against residents' logs (which identified periods of annoyance) for their acoustical characteristics including the presence of tones and other special audible characteristics (see paragraphs 10(d) and (e) of the Data Collection Specification document).

7. I maintained a log for the property I own with my husband Graham Devey at 428 Pahiatua Track. My complete log was submitted to Marshall Day Acoustics on 19 May 2011. My log appeared to have been edited for the Marshall Day Acoustics report dated 9 June 2011, 65% of my records were not reported, and none of the data that I had recorded on tonality and annoyance was included.

8. Marshall Day Acoustics did not undertake an analysis of the subjective noise reports from the residents' logs. Therefore, I undertook an analysis based on the files obtained from Marshall Day Acoustics and the residents logs (four residents kept noise logs). I also included the data I had logged that was omitted from the Marshall Day report. A copy of my report dated 15 August 2011 is annexed as Exhibit "**A**" to this affidavit.

9. My conclusions are that:

   (a) The neighbours logs described sounds with the characteristics of special audible characteristics (tonality) from the turbines when wind is blowing in a southeasterly direction (ESE and SSE) and in a northwesterly direction (WNW and NNW). There was consistency within the neighbours' logs when describing the sounds which indicates tonality at the same time as when the residents reported particular annoyance. Some specific examples when the logs reported similar SAC independently at similar times are as follows:

      (i) On 21 March, Sites #3 and #6 reported a mechanical truck/grinding or "being on a ferry" sound for ESE wind at 6:30 and 10:40 am.

      (ii) On 24 March, Sites #2, #4 and #6 all reported a modulating, pulsing whine, swishing and roar for a SSE wind at the turbines and calm or no wind at the residents' homes between 6:30 to 10:00 am.

      (iii) On 30 March, Sites #2, #3, and #6 reported the SAC roar, truck/grinding with a high pitched whine for SSE wind direction between 6:00 to 7:40 am.

      (iv) On 4 April, Sites #2 and #4 reported a whoosh with a beat for the NNW wind direction between 6:00 am to 7:30 am. Site #3 reported that pulsing SAC again at 17:10 that evening.

   (b) Annoyance is the highest when the wind speed at the wind farm is lower in the southeast and northwest directions; typically 8-10 m/sec in the southeast and 6-8 m/sec in the northeast.

   (c) Annoyance is the lowest when the wind speed at the wind farm is higher, between 10-20 m/sec from the northwest and between 10-15 m/sec from the southeast. There was limited southeast data above 10-15 m/sec.

(d) The tonality of "whoosh, swishing, pulsing or beating" was reported by the residents 90% to 100% of the residents' log records for north-westerly winds.

(e) The tonality of "high pitched whine" is heard by the residents in both wind directions: 65-85% with the southeasterlies and 40-60% for the northwesterlies.

(f) The tonality of "mechanical/truck or grinding" is reported by residents in both directions: 20-40% with the southeasterlies and 40-60% with the northwesterlies.

(g) The tonality "roar of the train, ferry or airplane" is reported by the residents for 90% of the southeasterlies.

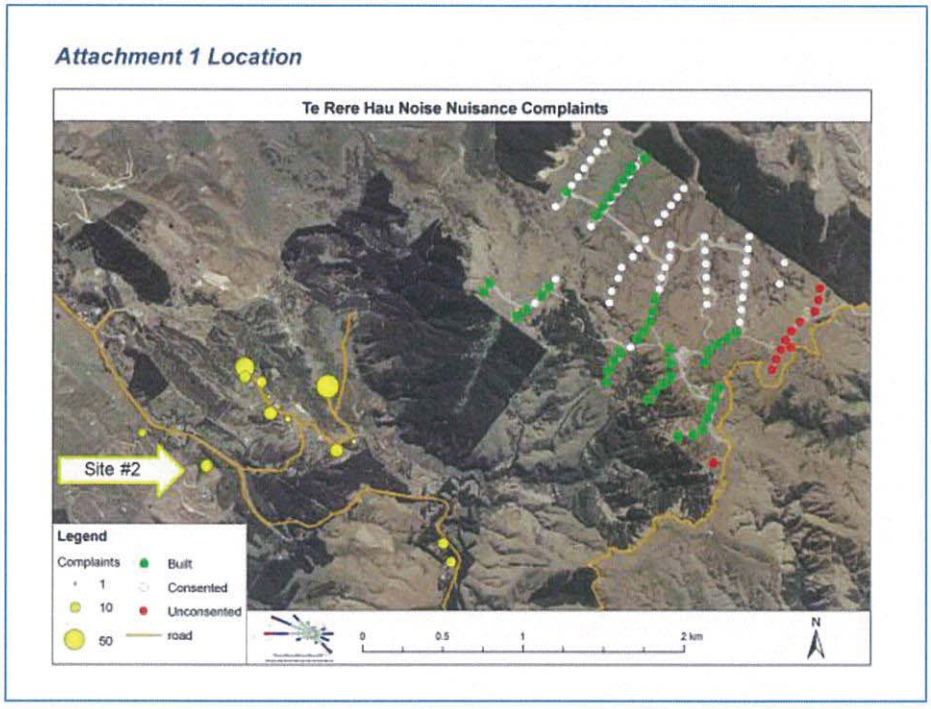


Figure 1. Site 2 is the Huffman-Devey property at 428 Pahiatua Track as identified in my Statement of Evidence in the Environment Court, September 2011[10]. Our home was identified as Site #2 in the Marshall Day 2011 report[11].

[10] Huffman, L. 2011. Statement of Evidence of Dr Lee Meryl Huffman for Palmerston North City Council, September 2011. ENV-2010-WLG-000114.
[11] Halstead, M. 2011. Te Rere Hau Noise Compliance, Noise Survey Results, Report Reference Rp001 2011095W, Marshall Day Acoustics, 9 June 2011.

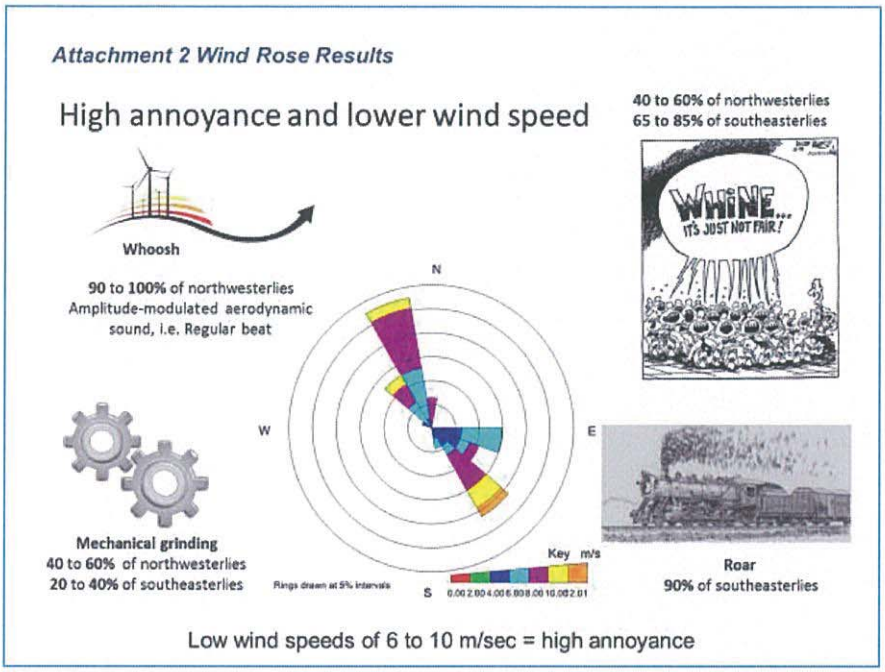


Figure 2. High annoyance: comparison of Te Rere Hau neighbours description of wind farm noise with lower wind speeds from Marshall Day 2011 report.

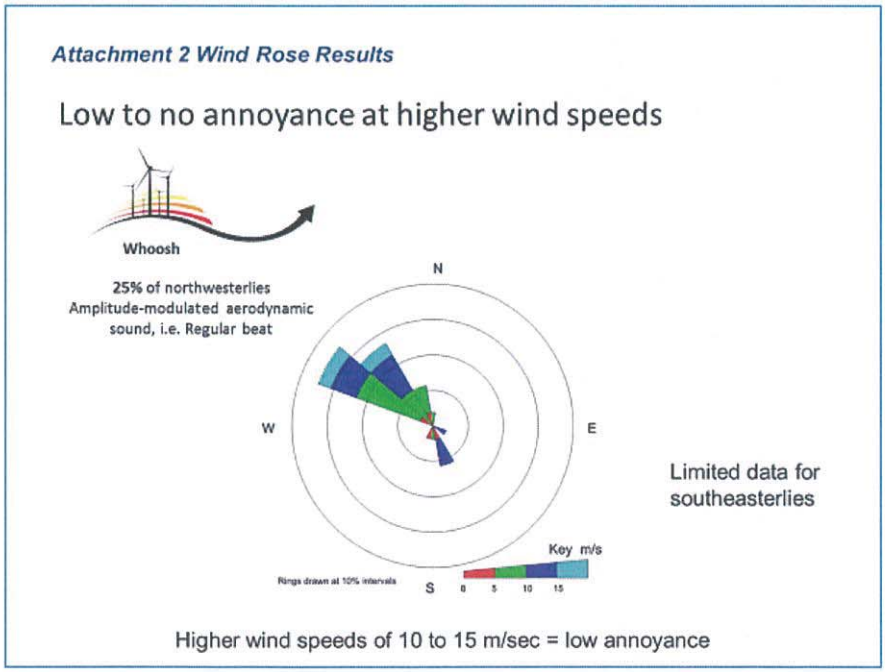


Figure 3. Lower annoyance: comparison of Te Rere Hau neighbours description of wind farm noise with lower wind speeds from Marshall Day 2011 report. Note there was very little data for wind in the southeasterlies when neighbours were able to record their observations.

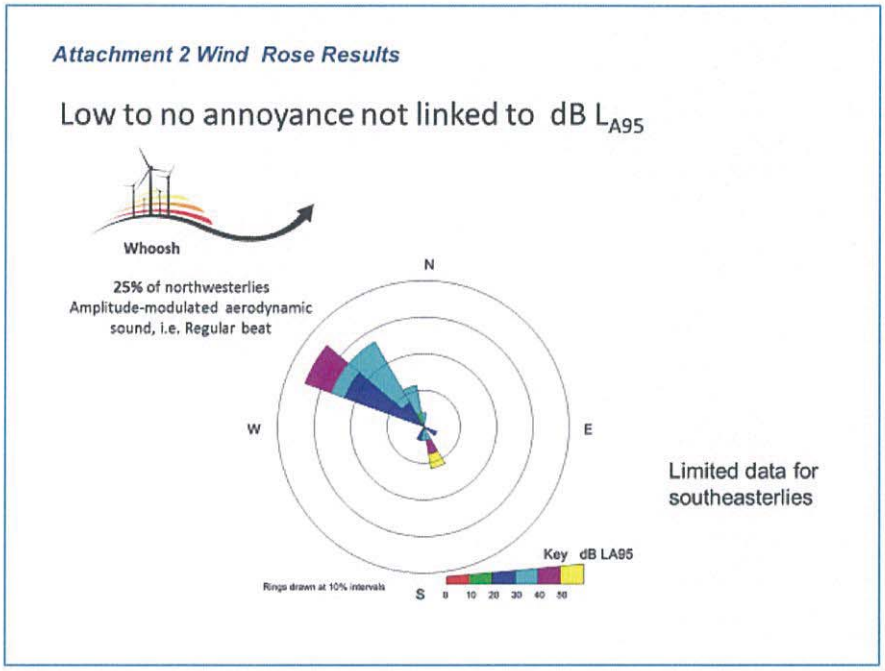


Figure 4. Annoyance did not appear to be correlated with loudness (dB L_{A95}), but data was limited for southeasterlies.

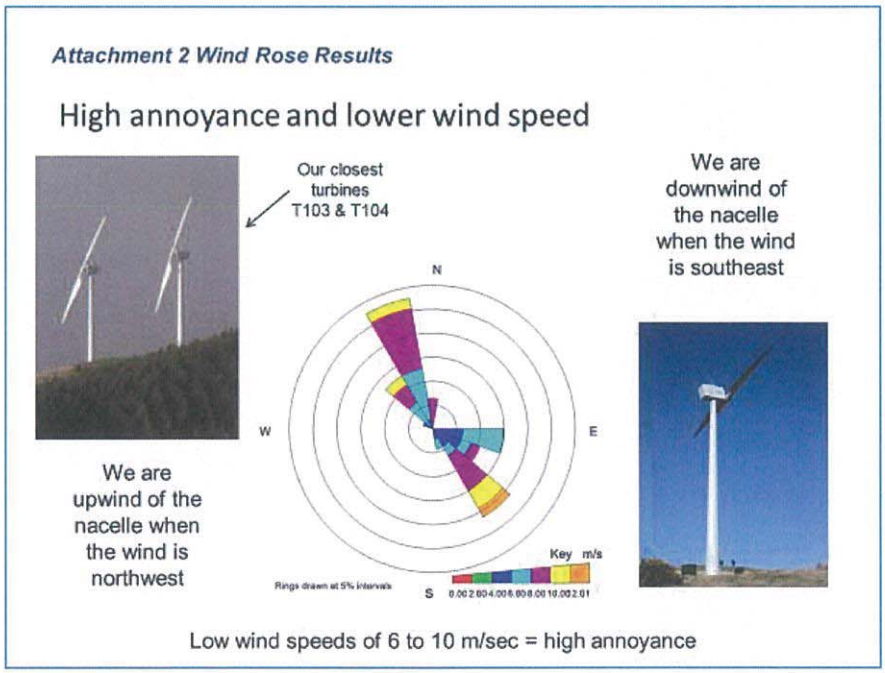
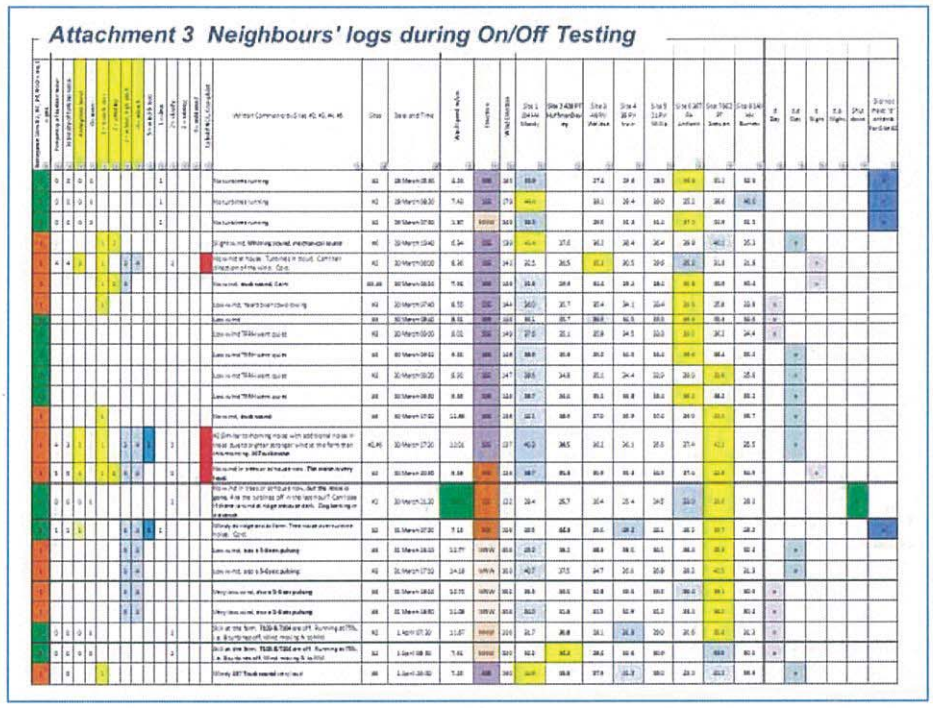
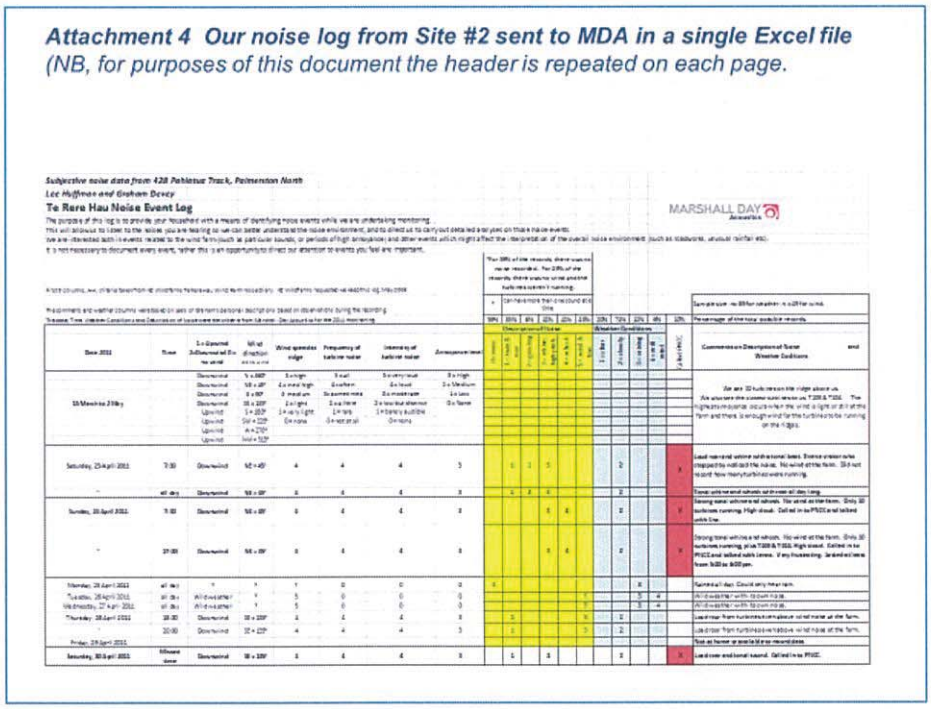


Figure 5. Position of T103 and T104 relative to our home at 428 Pahiatua track and high annoyance noise with low wind speeds of 6 to 10 m/sec at Te Rere Hau.



Attachment 3 Neighbours' logs during On/Off Testing

Figure 6. Example of one page of the compiled results for the neighbours' records with Marshall Day records. The compilation was by Lee Huffman after both records had been completed independently.



Attachment 4 Our noise log from Site #2 sent to MDA in a single Excel file
(NB, for purposes of this document the header is repeated on each page.

Subjective noise data from 428 Pahiatua Track, Palmerston North
Lee Huffman and Graham Devey

Te Rere Hau Noise Event Log

MARSHALL DAY Acoustics

Figure 7. Example of one page of our noise log data from 428 Pahiatua Track that was submitted to Marshall Day Acoustics. Note the systematic classification of the results (Subjective Noise Profile) to allow for statistical analysis.

Attachment 5 "Neighbours' Noise" Dataset

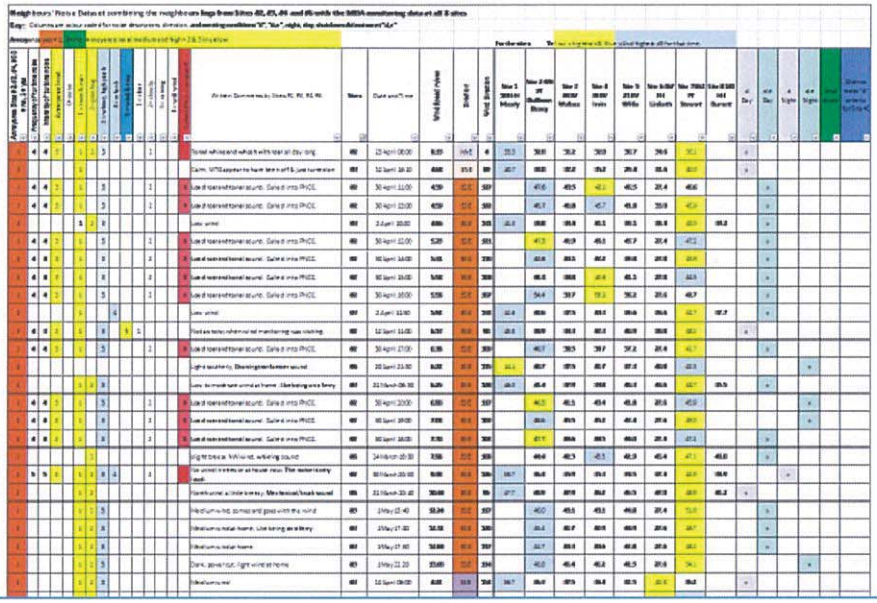
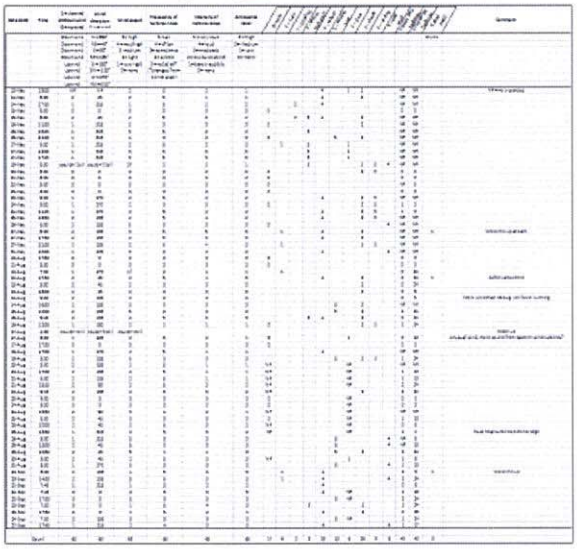


Figure 8. Example of one page of the neighbours noise data that was provided by Marshall Day to Lee Huffman. The noise data was converted to the systematic classification (Subjective Noise Profile) to allow for statistical analysis.

Attachment 6 2009 Noise log from Te Rere Hau

Subjective Noise Profile Survey at 428 Pahiatua Track, Palmerston North
May, August & September 2009



Stone H & Sidel J. 1985. Sensory Evaluation Practices. Academic Press.

Figure 9. Example of one page of noise data from 428 Pahiatua Track from 2009 monitoring exercise provided to Marshall Day Acoustics.

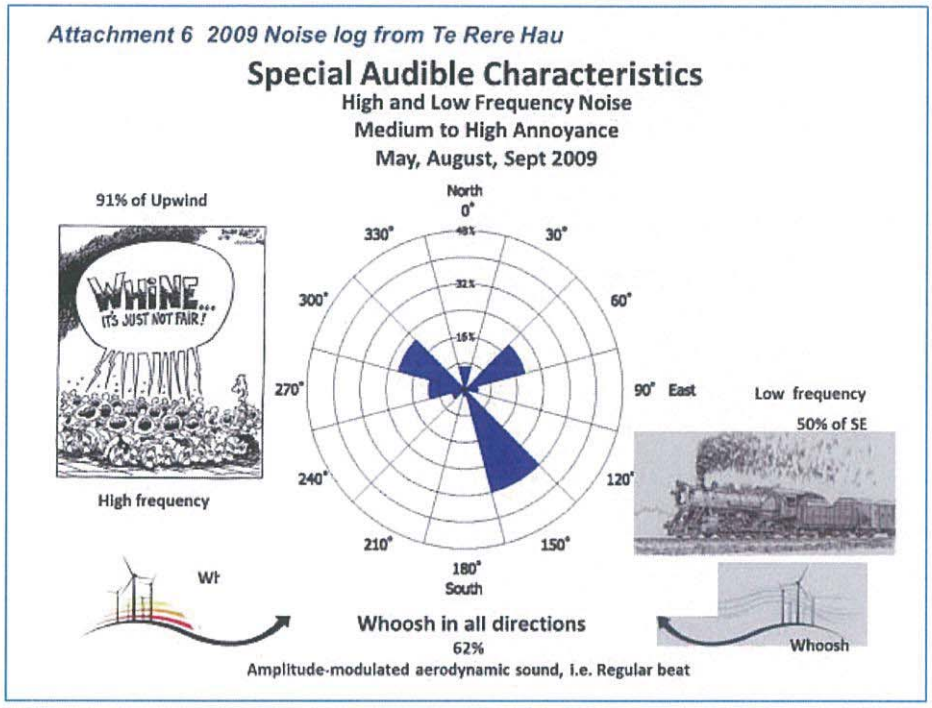


Figure 9. Analysis of 2009 data from 428 Pahiatua Track from Figure 8. There were more southeasterlies during the 2009 monitoring period than in the 2011 period when neighbours were recording their observations (Figures 3 & 4). We also recorded less mechanical noise in 2009 compared to 2011.

Conclusions from our experience and analysis of the noise data that supports the review of the consent conditions

20. It is important to emphasize that if the wind turbines are operating we can almost always hear them. It is only when there is minimal wind at our home and the turbines have enough wind to operate, that we find the noises disturbing enough to call our complaints to PNCC. We report four main sounds:
    a) Roar like a train that does not arrive with the southeasterlies
    b) Whine and mechanical grinding with the southeasterlies and northwesterlies
    c) Whoosh with the northwesterlies.
21. What was initially surprising from the Marshall Day Acoustics 2011[12] wind speed data was that when our noise data was plotted compared to the wind speed and direction, the wind was at the turbines was relatively light as well. The conclusion from that study was that there is high annoyance when there is minimal wind at our home and low wind speeds of 6 to 10 m/sec in the south east and northwest directions.

[12] Halstead, M. 2011. Te Rere Hau Noise Compliance, Noise Survey Results, Report Reference Rp001 2011095W, Marshall Day Acoustics, 9 June 2011.

22. Evans (2017)[13] reported a similar trend of the majority of complaints with minimal wind both at the homes and at the wind farm, particularly in the crosswind direction.
23. These correlations between low wind speeds of 6 to 10 m/sec and high annoyance support the Operating Condition 4 to measure evening and night-time wind speed of 8 m/s[14].
24. Our farm is listed in the Rural Residential Zone which was considered to be High Amenity[15]. The Marshall Day data supports High Amenity. In addition, Mighty River Power reported similar sound power measurements at the Kells farm, our neighbours at 406 Pahiatua Track (Figure 10). Measurements at both farms on the Pahiatua Track had values at less than 30 dB(A) at night. Over 75% of the Kells values were less than 35 dB at night and about 50% of the measurements less than 35 dB during the day.

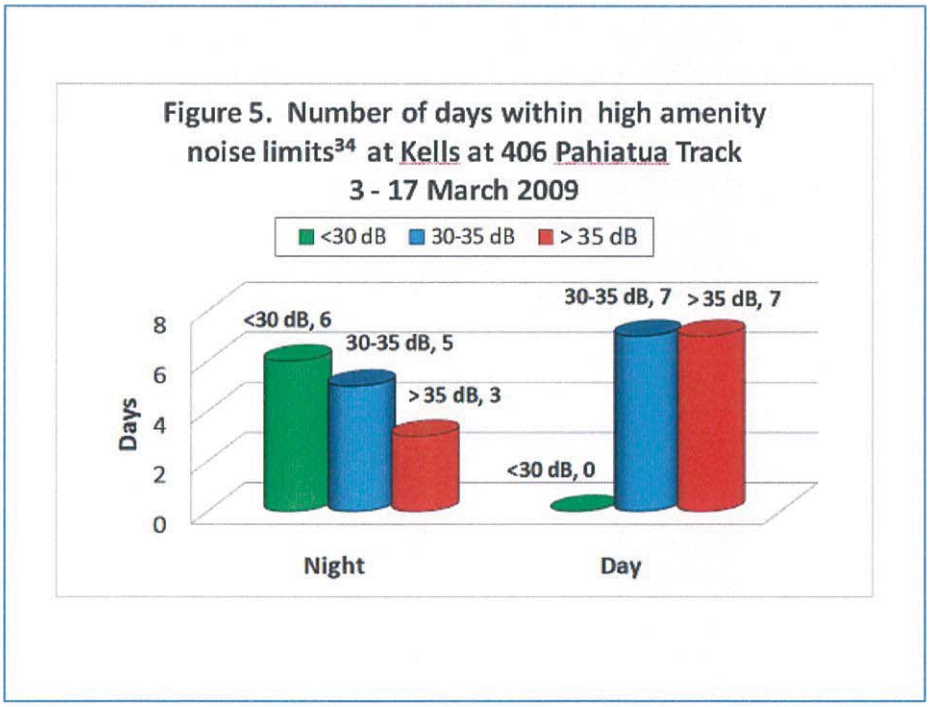


Figure 10. Sound monitoring from Kells farm measured by Mighty River Power for the Turitea Hearings, presented by Lee Huffman, 18 March 2009, at the Turitea Call In.

25. These quiet measurements for our farms at Pahiatua Track support the Schedule 1, WTG Noise Management, Operating limits:

    4. For residences in existence at the time this consent was granted on 30 May 2005 that are within the Rural Residential Overlay mapped in the Palmerston North District Plan as

[13] Evans, T. 2016. Independent Review of Noise-Related Conditions. Te Rere Hau Wind Farm – Palmerston North New Zealand. Report M1656RP1 Revision 0. Resonate Acoustics, Te Rere Hau Wind Farm, Complaints, pages 7-8.
[14] Schedule 1. 2017. Amended schedule 1 to Environment Consent Order Dated 30 May 2005 in ENV W 0039/05 and 0041/05. Operating limits 4.
[15] Evans, T. 2016. Independent Review of Noise-Related Conditions. Te Rere Hau Wind Farm – Palmerston North New Zealand. Report M1656RP1 Revision 0. Resonate Acoustics, Te Rere Hau Wind Farm 3.7, Page 6.

notified in the Plan Change 15, the wind farm shall operate such that wind farm noise does not exceed the greater of:

4.1 35 dB(A); OR

4.2 The background noise level plus 5 dB(A).

26. When Marshall Day set up the monitoring of the wind farm noise at our home, they were careful to make sure that the monitor was a distance away from the home. When I asked why they didn't put the monitor closer to the house where the noise was louder, it was explained that it was important to measure noise *at the notional boundary*. If the monitor was closer to our home, then the noise would be louder due to the reflection of the sound waves from the house as well as the sound coming from the turbines. Contrary to that interpretation of notional boundary, the Resonate Resource Report reported at the noise limit should **apply at any location within 20 m of existing residences**[16]. (Emphasis is the author's)
27. Definition of notional boundary is important to the interpretation of Operating limits, Section5:

5. Subject to condition 4, the wind farm shall operate shall operate such that when measured at the **notional boundary** of residences, the wind farm noise does not exceed the greater of:

5.1 40 dB(A); OR

5.2 The background noise level plus 5 dB(A).

28. The importance of the location of the notional boundary and the impact on hearing wind farm noise at the home becomes obvious when considering the design of the outdoor space near the home on the deck, gardening and BBQ's, etc, that are typically within the louder 20 metre notional boundary space.
29. We have worked in good faith with NZWF and PNCC with a goal to find an acceptable balance between wind energy generation and a healthy environment that we want to live in. We rely on the consent conditions and noise regulations to define that balance as independent and fair authorities.
30. However, as was reported in the Environment Court 2012 Decision, the noise predictions proposed by NZWF to support the original 2005 consent have "proven to be wildly incorrect"[17]. The Decision went on: "Taking the most conservative scenario of the amended sound power level and no topographical screening approximately 30 residences are shown within the 30dBA contour lines and 16 of these are also within the 40dBA contour line". So,

[16] Evans, T. 2016. Independent Review of Noise-Related Conditions. Te Rere Hau Wind Farm – Palmerston North New Zealand. Report M1656RP1 Revision 0. Resonate Acoustics, Te Rere Hau Wind Farm. Noise criteria considerations, 5.6. Page 16.
[17] Decision No. [2012] NZEnvC 133. ENV-2010-WLG-000114. [50].

our concerns remain. We are concerned that our feedback on noise and that of our neighbours will be ignored or discounted.

31. For these reasons, we support the PNCC submission and the new suite of conditions 4-21. I believe our considered feedback to PNCC and NZWF over the last 8.5 years supports the need for these revisions to the consent conditions so we can have some balance and confidence going forward.
32. Our home is available for monitoring should the Post-amendment noise compliance assessment in section 10 proceed.
33. I would like to have the opportunity, in person, to support the PNCC submission for a new suite of conditions 4-21 based on our experience and commitment to finding a solution to this long-standing concern with noise from Te Rere Hau.

We seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought).

A. We seek that the Hearing Committee accept the proposed modifications in the PNCC submission to the existing conditions of consent made by the Environment Consent order dated 30 May 2005 as set out in Schedule 1 attached to the notice to New Zealand Windfarms, by Paddy Clifford on 2 May 2017.

   As reported in the **Particulars** proposed by the PNCC in the Notice of Review[18]:

   Delete Conditions 4, 5, and 6 and replace them with a new suite of conditions 4-21 in Schedule 1, with modifications to conditions 7.4.3, 7.3 and clarification of 7.4.

B. Add Pahiatua Track to 7.4.3. <u>Both T103 and T104 must be online and operation for generation for the Harrison Hill Road, Ridgeview Road and **Pahiatua Track** measurement locations.</u>

   We have included T103 and T104 as a requirement for the monitoring because our data indicates T103 and T104 are included with the majority of our complaints to PNCC. In addition, T103 and T104 are in clear line of sight from our home as noted in Figure 5.

C. Include 60° to 90° and 180° to 270° to wind farm noise assessment and measurement 7.4. Our records include show in 2009 there was wind in these directions as well which resulted in annoyance and SAC (Figure 9).

D. Windfarm noise, assessment and measurement 7.4: The meaning of "WTGs are online and available for generation" in 7.4.1 and 7.4.2 is unclear.

   We recommend defining what the data points should be collected and what must be included, rather than defining what must be excluded. We recommend the following revision:

   > *<u>7.4 The following criteria must be met for the following circumstances to be included from the assessment:</u>*

[18] Clifford, P. 2 May 2017. Letter to New Zealand Windfarms. "Notice of intention to review of consent conditions pursuant to the Resource Management Act, section 128 (1) (c).

7.4.1. More than 95% of the WTGs must be online and operating for generation. That is, no more than 5% are offline for maintenance or due to failure.

7.4.2. At least 9 of the nearest 10 WTGs to a measurement location are online and operating for generation.

Any WTGs that are not operating, or have been curtained as a noise reduction measure for a particular wind condition, shall be considered offline and not operating for generation and must be counted as part of the 5% offline (see 7.4.1).

Thank you for this opportunity to support the Palmerston North City Council review of resource consent conditions for Te Rere Hau Windfarm.

Signature of Submitters

Lee M Huffman and Graham R Devey Date: 1 June 2017

Please email this submission no later than Friday, 2 June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on the Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

12-1

6/6/17 4.04 pm

PALMERSTON NORTH CITY COUNCIL

Form 13

Submission on a Publicly Notified resource consent application made under the Resource Management Act 1991.

To:

The Governance and Support Team Leader
City Corporate Unit
Private Bag 11034, The Square
Palmerston North City Council

Phone Number: (06) 356 8199
Fax Number: (06) 355 4115
Email: submission@pncc.govt.nz

ORIGINAL TO FOR ACTION AND REPLY
REC'D 6 - JUN 2017 PNCC
COPY TO
1.
2.

Name of Submitter: R.C. Wallace and N.J. Banks-Wallace

Contact details of Submitter:
(Full postal address, phone/fax number(s), email address of Submitter)

Address: 48 Ridgeview Road, R.D.1.
Phone Number: 06-354-4167
Fax Number:
Email Address: r.c.wallace@massey.ac.nz
njb@inspire.net.nz

Please ensure all areas of this submission form are completed.

This is a submission on a review of:

(Name of consent holder) NZ Windfarms Ltd. Te Rere ~~Rangi~~ Hau Windfarm

for a Resource Consent for (briefly describe activity and type of resource consent) Review of existing resource consent conditions

at (Resource Consent address) 355-415 North Range Road, Palmerston Nth.

My submission is: (Choose from the following)

☑ I support the review
☐ I am neutral to the review
☐ I oppose the review
☑ My submission relates to the entire review, or
☐ My submission relates to the following specific parts of the review: _____

I wish/~~do not wish~~ (delete one) **to be heard (speak) at any subsequent hearing**

I wish to have the following parts amended: Please see the attached written submission

12-2

The reasons for my views are: (if necessary please attach additional page(s) to this submission)

1) The consent holder has installed WTG which are much more powerful than was specified / allowed under the original consent.
2) The wind farm is much noisier than was indicated in the initial monitoring process regime.
3) The noise from the wind farm significantly impacts on our recreation / amenity.

I seek the following decision from the Palmerston North City Council: (Give details including the nature of any conditions sought)

1) Some form of immediate response whereby part of this wind farm can be "turned off" to mitigate noise.
2) Some form of process can be developed whereby tonality of the wind farm can be reliably / properly measured at residential locations.
3) Infrasound can be measured to provide a reference background level for the future.

If others make a similar submission I will consider presenting a joint case with them at the hearing (Delete if you would not consider presenting a joint case)

Signature of Submitter: (or person authorised to sign on behalf of Submitter)

N Banks-Wallace Date: 2nd June 2017

(A signature is not required if you make your submission by electronic means)

Please return, post, fax or email this submission no later than Friday 2nd June 2017 to the Council address given at the top of this form.

You must also serve a copy of your submission on the consent holder as soon as is reasonably practicable after you have served your submission on Council.

The address for service is:

New Zealand Windfarms Limited
C/- Vicki Morrison-Shaw
Atkins Holm Majurey Ltd
P O Box 1585
Auckland 1140

12-3

Review of the Existing Resource Consent Conditions of New Zealand Windfarm Limited's Te Rere Hau Windfarm, 355-573 North Range Road, Palmerston North, Under Section 128 of the Resource Management Act

Or

Yet Another Quixotic Tilt at Windmills

(*with apologies to Miguel Cervantes*)

Submission from

R. C. Wallace & N. J. Banks-Wallace

48 Ridgeview Rd.,

RD 1,

Palmerston North.

Phone (06) 354 4167

R C Wallace ..... Date: 2/6/17

N J Banks-Wallace ..... Date: 2/6/2017

12-4

Contents Page

A. [1]Summary of the Suggested Changes to the Proposed Resource Consent Conditions.

D Quality of Data

The direction of wind flow, and the speed of wind flow at a residential measuring location, is probably quite different from that at the TRRH windfarm mast.

E Existing Residences

New owners, or owners of new residences, should not be excluded from the process.

F Noise Sensitive Areas – High Amenity Areas

All the residences on Ridgeview Rd are noise sensitive areas (High Amenity Areas) and so qualify for the 35 dB upper noise limit, at least when the wind is in the SE.

G Standard Wind Recording Sectors

The specified wind sectors should be checked so that they match the natural distribution of the wind.

H Data MUST to be Collected While Most of the Windfarm is Operating

At least 95% of the WTGs must be generating, and 9 of the nearest 10 WTGs actually generating for a data point to be included in any assessment.

I Amount of Data

350 valid data points are to be collected cumulatively across the SSE and ESE wind direction sectors and at least 150 data points must come from each of these sectors.

J Tonality

It is not clear whether the separation of peaks and background has occurred at TRRH so this needs to be verified and the integrity of the process demonstrated.

[1] The actual changes are highlighted in yellow, at the appropriate section, in the main body of this submission.

K On/Off Testing

On/Off testing is practical at TRRH, and when undertaken each On/Off each cycle must be for at least 6, 10-minute bins, so that statistically meaningful trends might be established.

L Time Frames

The operating conditions should apply for all 24 hours.
What is evening time? If it remains then it needs to be defined.

M Suggested Remedies??

There is a need to develop a remedy that will provide an operational framework for the windfarm and yet also meet the residences' expectations of a quiet environment.

N Community Involvement and Recording complaints

A mechanism that allows for on-going community involvement has to be inserted in the consent document.

O Infrasound

Add a clause that requires the measurement of infrasound at about 4 localities within the windfarm and at the 6 localities named in Clause 10.1

B - A Brief History of our Involvement

1 We first heard of the plans to construct the Te Rere Hau (TRRH) windfarm early in 2004, and we were subsequently invited to a meeting in the Aokautere School hall to discuss the project with Clare Barton and Keith McConnell (16/6/04). I knew of the wind turbine generator (WTG) prototype at Gebbies Pass, and that there were noise problems with that WTG so I asked about this. We were assured that the noise problems had been resolved and that the WTGs were no noisier than the turbines that were operating in the existing windfarms on Nga Tararua. This was blatantly wrong. I defy anyone with normal hearing to stand under a New Zealand Windfarm Ltd. (NZWL) turbine on North Range Rd., and then under a WTG on the Saddle Rd. and say that they are equally noisy. The NZWL WTGs are much noisier.

Because of this assurance of quiet operation we took no further part in the original TRRH consent hearing.

2 Consent to operate 97 WTGs was granted by the Environment Court, 30 May, 2005, and to date 65 have been installed. Unfortunately the WTGs that were installed had sound power levels that were approximately 250% of the sound power level of the consented WTG (100.7 dB) and the windfarm's noise levels are 10-12 dB above what was given in the original application (Evans 2016 p23).

The sound power levels of four of the installed WGTs, that have been measured, are:

WTG T010 – 105.6 dB

WTG T015 – 104.8 dB

WTG T036 – 103.3 dB (101.8 – 106.2 in Hegley 2009)

WTG T104 – 106.4

3 Because the WTG of Windflow Technology Ltd. was a new design there was a condition that construction be completed in stages, and that a noise assessment be undertaken after Stage 1, when 5 WTGs were installed (Consent Order, 30 June. 2005, clauses 5h, 6 & 28).

4 The noise assessment after the end of Stage 1 concluded that, when all 97 WTGs were operational, it was likely that TRRH windfarm would exceed its consent conditions, and "it is recommended that consideration be given to undertaking noise monitoring ..... to demonstrate that the noise emissions from subsequent stages .....will comply with the consent conditions". Bundle[2] p323. This recommendation, Palmerston North City Council (PNCC) letter, 25 June, 2007, was never carried out.

[2] *Reference to the "Bundle" refers to the material in the bundle of material that was prepared by the PNCC for submission in the Environment Court, ENV-2010-WLG-000114, 30 November, 2011.*

5 As Stage 2 advanced, PNCC began to receive a rising tide of complaints about the noise from TRRH and eventually these lead to court action. A result of these court deliberations was that comprehensive noise-level measurements were carried out, intermittently, between 10 March – 9 May 2011 and October, 2012 – February, 2013 MDA reports, Bundle 518 at 8 residences:

104 Harrison Hill Rd. (Beale - Moody) the standard reference site. Site 1

428 Pahiatua Track (Huffman-Devey), site 2

48 Ridgeview Rd. (Wallace), site 3

38 Ridgeview Rd. (Irvin), site 4

21 Ridgeview Rd. (Willis), site 5

662 Pahiatua Track (Stewart), site 7

367 Forest Hill Rd. (Linforth), site 6

140 Harrison Hill Rd. (Burnett), site 8

A plethora of sound-level data, at residences, was generated during these times but the wind-speed and wind-direction was taken from the NZWL mast within the windfarm on the ranges. Unfortunately NZWL refused the suggestion that wind speeds and directions should also be recorded at the residences, so now it is difficult to relate objectively environmental conditions in the windfarm to conditions at any residence.

Our property was one of those monitored and we are grateful to MDA and NZWL for making these data available.

The four residential properties closest to the TRRH windfarm in the W-SW were not included in this monitoring because they had either accepted financial compensation for the excess noise from the windfarm (130 Harrison Hill Rd.) or the properties had been bought by NZWL (or their agent(s) and the new occupiers or owners had signed an agreement that contained a no-complaints, "gagging?" clause.

These properties were:

104 Harrison Hill Rd. – the reference monitoring site.

629 Pahiatua Track

631 Pahiatua Track

6 Amongst other things, the court determined that a S128 review of the TRRH consent conditions was appropriate, but this review could not proceed until all the earlier court issues were resolved and so it was not until about July, 2015 that the S128 could be initiated. Finally now we have the situation where the S128 review will be exposed to public scrutiny.

C - Background of Dr. R.C. Wallace (Clel) and N.J. Banks-Wallace (Nicky) and Personal Statement

7 We are both recently retired although this was not so when in approximately July, 2009 we first became involved with PNCC and NZWL and challenged the unacceptable noise emanating from the TRRH windfarm. Nicky has a First Class Honours M.Sc. (Botany) from Massey University and Clel has a Ph.D. in Earth Sciences from Massey University, and a post-graduate Diploma in Datametrics from the University of South Africa. Between us we have decades of research and teaching experience (biology, geology, weather, climate, ecology, Ph.D. examinations) and experience at handling, interpreting, and appraising data.

8 We built our house at 48 Ridgeview Rd. in 1999, long before the windfarm, and have planted our landscape such that it is now fully bushed with native and exotic trees. Our house is 1.6 km from the nearest WTG, which is T104 (we are 3.2 km from the TRRH eastern boundary) and about 225 m below the windfarm. We can see the full heights of T103 and T104 across a small valley but the rest of the windfarm is out of sight. At different times we hear thumping and synchronous

beating/swishing, apparently associated with T103 & T104 but the main noise that we complain of is a rumbling/roaring tonal noise, an un-natural sound as that occurring on the Cook Strait ferry under full power, a taxiing jet, or an accelerating locomotive. Occasionally there is a whine. All these complaints occur when wind flow is negligible at our house. NZWL would not allow formal measurement of the wind speeds at our place, so we have used the Beaufort Scale to indicate wind speed when we have complained. We generally complained at Beaufort Scale <4, *i.e.* at most a gentle breeze and <5 m/s, or when it was calm, and when the WTGs are "pointing" in a SE or S direction.

9 We are not against wind generation of electricity, and in fact the experience we had of wind generation on the Chatham Islands had persuaded us to install small WTGs on our place and feed the excess energy into the National Grid, but the hostile buying regime of the time saw us give up.

10 Typical complaints situation. Our years of experiencing the various "moods" of the TRRH windfarm, together with chatting to our neighbours, and the complaints history of the windfarm, has lead us inexorably and inescapably to the conclusion that it is when the windfarm is at full operation, yet it is virtually calm at our residence, that there are noise "problems". This situation – very windy on a ridge crest yet calm in the downwind valley – is a well-known phenomenon. When air flows over a mountain range there is often a slack-air zone of rotor or cavity or eddying effects down wind. This often produces a calm area in the lee of a range where there is minimal rustling of the vegetation, or noisy flow around obstacles, and so the noise from a windfarm dominates. At the same time, the air has not lost moisture due to rain on the ridge, and/or it is less saturated due to rising temperatures, and so there is often a cloud-free area in this calm zone behind the ranges. It is during this calm, fine weather that we are doing things outside – gardening, BBQs, sitting around enjoying the ambiance, having friends for drinks, entertaining outside *etc.* – and that is the very time that the windfarm is noisiest.

11 So there are many times when the windfarm is very noisy, annoying, and exceeds its consent, and during these times there needs to be a mechanism for turning sections of the windfarm "off" until the noise is mitigated. It is not sufficient that we complain and eventually the complaints are investigated and more monitoring is initiated, as has happened over the last 8 years. There must

be a "real-time" response to complaints. In September, 2012 (Appendix I) we tried to engage with NZWL to achieve this but our ideas were rejected out of hand.

12 Also, it is good to see that the most recent Standard (NZS 6808:2010) has been used throughout in Mr. Evans' (2016) report. We feel that it is important to use the most-recent "rules" because they reflect the most up-to-date understanding of the situations at windfarms and have been informed by the most advanced techniques and the broadest experiences to date. The NZS 6808:2010 was also used in a recent RMA review in Christchurch ([2017] NZEnvC 68).
If one was a 19-year-old drinking at a bar one wouldn't want the old rules to apply when the police walked in!

13 Visual Appearance of the WTGs

The smaller 2-bladed WTGs do look unsightly and frenetic compared with the more majestic, larger, 3-bladed WTGs however we can accept this as we can look away from the WTGs. We cannot do this with sound.

D Quality of Data

14 There is a fundamental problem with the quality of the wind speed and wind direction data. The models that have been developed to relate wind parameters to energy production and to sound, were originally developed and tested on continental areas where there are relatively uniform terrains with relatively uniform/simple wind flows across those terrains. A typical example is the photograph on p3 of Evans' CV – Appendix B in the Resonate Report, and anyone who has travelled through windfarm-country in North America, Europe or Australia will have observed this. These terrains are totally different to those of the Tararua Ranges.

15 Models have been developed to accommodate the vagaries of wind over an undulating topography but one only has to stand in the calm conditions at our place yet see T103 and T104 spinning frantically in the wind to know that the wind speed measured at the wind mast (about 300 m above and 1.9 km away) is totally different from that which we are experiencing, especially when the wind is from the general south-easterly quarter.

16 All this is complicated by the channelling effects of the ridge/valley system west of the Tararua Range crest, and wind flow quiescence due to rotor, cavity and eddying effects downwind of the Ranges.

17 This difference in wind flow parameters can be amply demonstrated by comparing data from the Te Rere Hau windfarm and the Te Rere Hau Eastern Extension (TRRHEE) windfarm. Each of these windfarms has its own anemometer wind mast. The TRRH mast is about 2.5 km NW of the TRRHEE mast. During March – May, 2011 monitoring was undertaken at the TRRH windfarm, and at the 8 residences specified is paragraph 5 above, but unfortunately the wind flow data from the TRRHEE mast were inadvertently used in the assessment. When the error was realised, these data were replaced by that from the TRRH mast. Now the data from the two masts, for exactly the same 10-minute measuring intervals was available for comparison (figure 1). These show that the wind speed differential, and the wind direction differential, between the two sites can be large. Quite demonstrably the wind flows at these two TRRH anemometers, that are about 2.5 km apart, is quite different from each other.

18 Clearly the direction of wind flow, but more significantly the speed of wind flow at a residential measuring location, is probably quite different from that at the TRRH windfarm mast.

E Existing Residences

19 Why should it be restricted to residences/properties/owners who were there when the windfarm was constructed (Clause 4)? It is our conclusion from long periods of observation (and the TRRH data demonstrate) that the sound situation at a location changes with wind speed, wind direction, day/night, summer/winter, back ground weather and from year to year (compare the wind roses in Evans 2016) so it is totally unfair to bind a new builder/owner/buyer to the benevolent conditions that might apply during the few weeks that they are considering buying, whereas the sound/noise might "turn nasty" in 6 months.

So, while new owners, or owners of new residences, might be aware of the presence of the windfarm they will not (cannot) be aware of ALL its "moods".

F Noise Sensitive Areas – High Amenity Areas

20 At low wind speeds a 40 dB maximum windfarm noise is deemed to be appropriate for health, sleeping and to preserve amenity values of residents however it is recognised that there are ultra-quiet places where background noise levels are particularly low. These are noise sensitive locations and if their background sound levels are <30 dB then an upper noise limit of 35 dB

applies. Also, to qualify, the difference between the sound levels of an operating windfarm and the normal background sound levels, for a specific wind direction at a residence, must be >8 dB.

21 For the Ridgeview Rd. area the 2011 monitoring demonstrated that there was a significant amount of time when the background levels were approximately 20 dB and the operating levels were >30 dB, so the 8 dB cut off was breached (figure 2). A detailed inspection of one of the quiescent events, 2 -3 April, 2011 (figure 3) reinforces the dramatic change in the noise regime when the wind drops. Our observations are that when there is a southerly to easterly wind it is common for the wind to drop at our place and for a complaint to ensue. This probably occurs throughout our area as is reflected in figure 4 which plots the 2-3 April event for site 2, the Huffman-Devy property.

22 All the residences on Ridgeview Rd are noise sensitive areas (High Amenity Areas in the parlance of NZS 6808:2010) and so qualify for the 35 dB upper noise limit, at least when the wind is in the SE.

G Standard Wind Recording Sectors

23 Clause 7.3 uses 45° sectors to compartmentalise the wind directions, however this involves using unnatural boundaries to the compartments. The natural breaks in the wind directions are slightly different from this. For example, towards the SE there is significant data between about 75° and 90° and between 180° and 190° (figure 5).

24 We suggest that NZWL plot ALL their data from their years of recording it, and plot it as a histogram against wind direction (0° to 360°). This will incorporate more data points for their plots and may mitigate the dearth of data for some sectors.

H Data must be Collected While Most of the Windfarm is Operating

25 Clause 7.4 - It is not acceptable to just have WTGs "online and available for operations". Over recent times it has been the policy of NZWL not to operate a WTG if it is in the turbulent air of an upwind WTG, and so would not operate at maximum efficiency. Also, our observations as we've driven to and from town are that frequently only 5—60% of the WTGs are turning. As 7.4 is worded there could be 96% online and available but only 50% are generating, and this point would be accepted. This is patently wrong. A subclause must be added to 7.4.

26 7.4.x For a data point to be included in any assessment there must be at least 95% of the WTGs generating, and 9 of the nearest 10 WTGs actually generating.

I Amount of Data

27 Clause 7.5.2: As it is, this clause allows for just a few data points from one of the SSE or ESE sectors to be measured. Maybe just 50, and this is unacceptable. There must be sufficient data to provide statistical quality and demonstrate compliance or non-compliance? The number of data points should be specified and the last sentence, in clause 7.5, come into play if necessary.

28 7.5.2: 350 valid data points are to be collected cumulatively across the SSE and ESE wind direction sectors and at least 150 data points must come from each of these sectors.

J Tonality

29 In the complaints register the residents have recorded that there are rumbling, grinding, whining and swishing sounds coming from the windfarm so there is tonality associated with the WTGs. Also, the technician attending the equipment at the residences identified in paragraph 5 reported that "noise from the windfarm included a perceptible tone at a frequency of 1 Hz", (Barker Report 22/7/09, Rp 001 2009292W).

30 Based on these reports a detailed investigation for tonality, of a range of WTGs, was undertaken within the windfarm, near to the WTGs. This demonstrated that there was tonality at a wide range of frequencies but that it was significant at 992 Hz, 993 Hz, 995 Hz, 996 Hz, with a maximum tonal audibility of 12 dB, and so a penalty would apply.

31 A formal tonality investigation was undertaken at a number of residences and judging by the graphs presented, there was an audible tonality signal of about 7 dB, but detailed analysis showed that the audible tonality was too low to trigger a penalty. We believe that this may be an artefact of the process rather than a failure to demonstrate that the tonal audibility was sufficient to reach penalty levels.

32 Simplifying things - To determine audible tonality the sound level is measured at the frequency of the tonal sound, (call it TP for tonal peak), then two backgrounds are measured, one each side of

the frequency of the tonal sound (I'll refer to them as BG1 and BG2). The average of BG1 + BG2 is then subtracted from the value for the tonal peak to provide a value for the audible tonality and this value is compared with the thresholds in the Standard to determine if a penalty should apply.

33 Close to a WTG, where all the data are being generated by a single turbine this approach will produce a value truly reflecting the audible tonality of that turbine, however the tonality that is heard at a residence is an amalgam of all the tonalities from all the WTGs in a windfarm. In the case of TRRH this amalgam will contain a number of tonal peaks within the range of 990-1010 Hz and it is quite possible (probable) that a BG2 for a 991 Hz peak, will correspond to another peak within the 990-1010 Hz range. This effect will elevate the level of the background and consequently lower the value of the tonal peak. Taken across the full spectrum of a tonal zone this will produce a lower audible tonality value than might be expected. This is particularly relevant when the resolution of ±2-3 Hz is considered.

34 It is not clear whether this separation of peaks and background has occurred at TRRH so this needs to be verified and the integrity of the process demonstrated.

K On/Off Testing

35 The TRRH windfarm is not a new windfarm so there should be an acknowledgement of this in the monitoring regime. The monitoring could be carried out as in the past where data are collected over a long time to establish the relationships between wind speed, wind direction and sound at various localities. But, because significant data is already available, it must be possible to identify the general locations of complaints and the environmental factors that result in these complaints, and focus on these. So, the best approach to this would be to undertake On/Off testing where the windfarm (or a part of it) is turned "Off" then "On" and the resultant changes at a residence evaluated. Surely On/Off testing is described in NZS 6808:2010 for just this situation. It has the added advantage that there is no need to have measured the wind parameter to show the effect of the windfarm on the local sound environment.

36 When undertaking On/Off measurements each cycle must be for at least 6, 10-minute bins, so that statistically meaningful trends might be established.

L Time Frames

37 Clause 4, last paragraph. These operating conditions should apply for all 24 hours.

Inclusion of 24 hours would be important for "homemakers", the infirmed, children, retirees who are home all day, or anyone having morning coffee in the sun. Also, if there **is** more background noise during the day then there is less chance of there being a complaint, or of the consent being exceeded.

38 What is evening time? If it remains then it needs to be defined.

M Suggested Remedies??

39 There is no doubt in our mind that the data indicates that some residences near the windfarm would be classified as High Amenity Areas, and so there would be a 35 dB limit on windfarm sound at those locations. There has to be a remedy that will provide an operational framework for the windfarm and yet also meet the residences' expectations of a quiet environment. It seems to us that there are two options:

40 (a) For wind sectors where there have been complaints, and for the residences where those complaints have been generated, turn "off" the half of the windfarm nearest those complainant(s) if the wind speed is sufficient to start the WTGs.

This is effectively what the Environment Court decided in Christchurch ([2017] NZEnvC 68, 10 May 2017), for the same make of WTGs as at TRRH, and for a valley with similar back ground sound levels (18-20 dB). The Court specified that the WTG shall not operate when the wind speed exceeded 10 m/s. So, for 48 Ridgeview Rd., in south-easterly winds the near-half of the windfarm would not operate when the wind speed exceeded 10 m/s. A cut-out speed of 10 m/s is conservative but seems reasonable in light of the inaccuracy of the wind speed determinations (see section D). Also, the WTGs at Te Rere Hau do not reach maximum output until wind speeds of 13.5 m/s so a cut-out at 10 m/s for half the windfarm means minimal loss (all things considered).

(b) When there are complaints, provide complainants within 2.25 km of the windfarm with an avenue to immediately phone-in and have the half of the windfarm nearest to them turned "off". Based on the number of complaints and a 3-4 hour suspension of generation for each complaint we estimate that the down-time would take up <1% of the windfarm's operating time.

Because the windfarm is actually "up and running" much of what is proposed in the consent is actually after the fact. What is needed is a real-time response for a resident so that the annoyance goes away, or does not occur. Just like a noisy party can be turned down then so should a windfarm be able to be turned down (parts turned off).

41 In the mean time? The management of NZWL has repeatedly stated that they wish to work with their community, so ..... In the interests of that community, while the new consent regime is being established, they could put in place some form of temporary arrangement whereby the residents could get immediate relief when they consider the windfarm to be noisy. An immediate remedy is a reasonable expectation when a windfarm is noisy.

N Community Involvement and Recording of Complaints

The management of the TRRH windfarm has repeatedly expressed the wish to be involved with their local community and we would like to take up this invitation.

42 Clause 16 assumes that local residents regularly read local newspapers and as such they will get, or know where to get, information on progress of construction and operation of the windfarm. This is not sufficient and a more reliable method of initial contact is required. The following needs either, to be incorporated in clause 16, or, added as a new clause, clause 17:

The consent holder shall undertake a mail drop to all occupiers and owners of houses, or sections within 3 kilometres of the boundary of the Te Rere Hau windfarm, informing them of information sources and points of contact, should they wish to raise any issues.

43 Clause 16 is structured so that residents "are able to be kept regularly informed of particular activities" but there is no explanation of the term "regularly", nor when this might occur, so there is need to add to this clause:

..... activities or events at the windfarm. The website must be upgraded every three (3) months, beginning at the date when these consent conditions are approved.

44 Clauses13 – 20, under the heading "General Management and Reporting" require the consent holder to, in general terms, report changes to the windfarm, provide a public information outlet, record complaints, and report them to PNCC. These are all consent-holder-driven and there is no ability for the community to raise issues about the windfarm.

There is need for some form of community liaison group to facilitate information flow between NZWL, the neighbours, and PNCC. This is particularly so at TRRH where misleading information has been provided, there has been acrimony between parties, and considerably drawn-out monitoring undertaken, so a clause, similar to this below, needs to be added:

45 The consent holder shall, prior to undertaking any activities permitted under this consent, establish a Te Rere Hau Community Liaison Group that shall consist of at least:

i Three representatives of property owners who are within three kilometres of the Te Rere Hau windfarm boundary,

ii One representative of the consent holder

iii A representative of Palmerton North City Council, who would chair meetings.

The aims of the Group would be to facilitate the flow of concerns, questions and information, between the consent holder and local residents.

The consent holder shall be responsible for convening meetings, keeping and distributing minutes, and shall cover the direct costs associated with operating the Group.

Every six months, until the Group decides otherwise, a newsletter shall be placed in local newspapers, both in the Tararua District and Palmerston North area, detailing operation and developments at the windfarm, the results of compliance testing, and providing contact details for communication with the Group.

O Infrasound

46 The development of standards that relate to, and protect from, environmental parameters are evolving as more becomes known about the subtleties of the impact of industrial and recreational activities on humans. Windfarms are no exception. They generate a wide spectrum of energy waves that radiate out from a windfarm, and while audible sound, tonality and amplitude modulation have been handled more stringently in the more recent standards, infrasound has not. The question of the impact of infrasound from windfarms is becoming a significant issue (*e.g.* Swinbanks, 2015, Weichenberger *et al.* 2017) and issues related to the buildings within the Te Apiti Windfarm may have been related to infrasound.

12-19

47 The level of infrasound should be established at least at noise sensitive locations or High Amenity Areas so as to provide a baseline for the future

48 We can see how more on SACs has now been incorporated into the Standards, as more has become known about them and so we recommend that the level of infrasound around TRRH be established, so as to provide a reference level for the future.

49 If Region Councils had done their job when they were first established then today we might have objective knowledge of what the impact of municipalities and agriculture were having on water quality really was, instead of the subjective assessment and memory of the "swimability" of a river "when I was a boy". Let not infrasound fall down the same cracks!

50 Add a clause that requires the measurement of infrasound at about 4 localities within the windfarm and at the 6 localities named in Clause 10.1

References

[2017] NZEnvC 68 – Pickering v's Christchurch City Council, 10 May, 2017.

Evans, T (2016), Te Rere Hau Wind Farm, Palmerston North, New Zealand – Independent Review of Noise-related Conditions. Resonate Acoustics. Report M16516RP139 pp.

Hegley, R (2009) Windflow 500 wind turbine, Measurements in general accordance with IEC 61400-11. Hegley Acoustic Consultants, Report No. 8580 v, 35 pp.

Swinbanks, M.A. (2015) Direct Experience of Low Frequency Noise and Infrasound within a Windfarm Community. 6th International Meeting on Wind Turbine Noise, Glasgow 20-23 April 2015

6

Weichenberger M, Bauer M, KuÈhler R, Hensel J, Forlim CG, Ihlenfeld A, et al. (2017) Altered cortical and subcortical connectivity due to infrasound administered near the hearing threshold ± Evidence from fMRI. PLoS ONE 12(4): e0174420. https://doi.org/10.1371/journal. pone.0174420

Appendix I: Document tables at the public meeting instigated by PNCC in 2012

Proposal for NZWL to Mitigate Noise During Negotiations

Presented at the meeting of Residents with PNCC & NZWL,
Tuesday, 4th September, 2012.

If NZWL does want to work with the community, now is the time to start!!

We have endured the noise from the wind farm since about April, 2009!
So
Give us some relief **now** while negotiations are going on.

Until the current situation is resolved the residents are due some relief now from the noise, and here is a way of achieving this, while allowing the wind farm to operate for most of the time.

(1) Allow complaints from neighbours to turn parts of the wind farm off,

(2) Have an 0800 phone number, serviced by NZWL, that gets an immediate (within 10 minutes) response at Te Rere Hau wind farm,

(3) When there is a complaint:

(a) The 20 operating WTGs nearest to a complainant are turned off (for 4 hours),
Unless
(b) the complaint occurs between 10pm and 12MN, then the 20 nearest turbines will be switched off for 8 hours (to minimise disruption to sleep),
Or
(c) Until the wind direction changes significantly (by at least 90°),
(d) If there are any further complaints from another location then the 20 operating WTGs nearest to this new complainant will also go off for 4 hours, *etc.*,
(e) This would be repeated until the complaints stopped.

(4) This regime will apply until whatever is formally agreed between PNCC & NZWL is implemented.

I think that this is achievable within 72 hours so initiate it please and let those neighbours of Te Rere Hau wind farm, who have complained in the past, know the 0800 number.

Thanks – Clel & Nicky Wallace.

Figure 1a: Difference in wind speeds between the two masts uses by NZWL (TRRH - TRRHEE), plotted as related to wind direction at the TRRH mast.

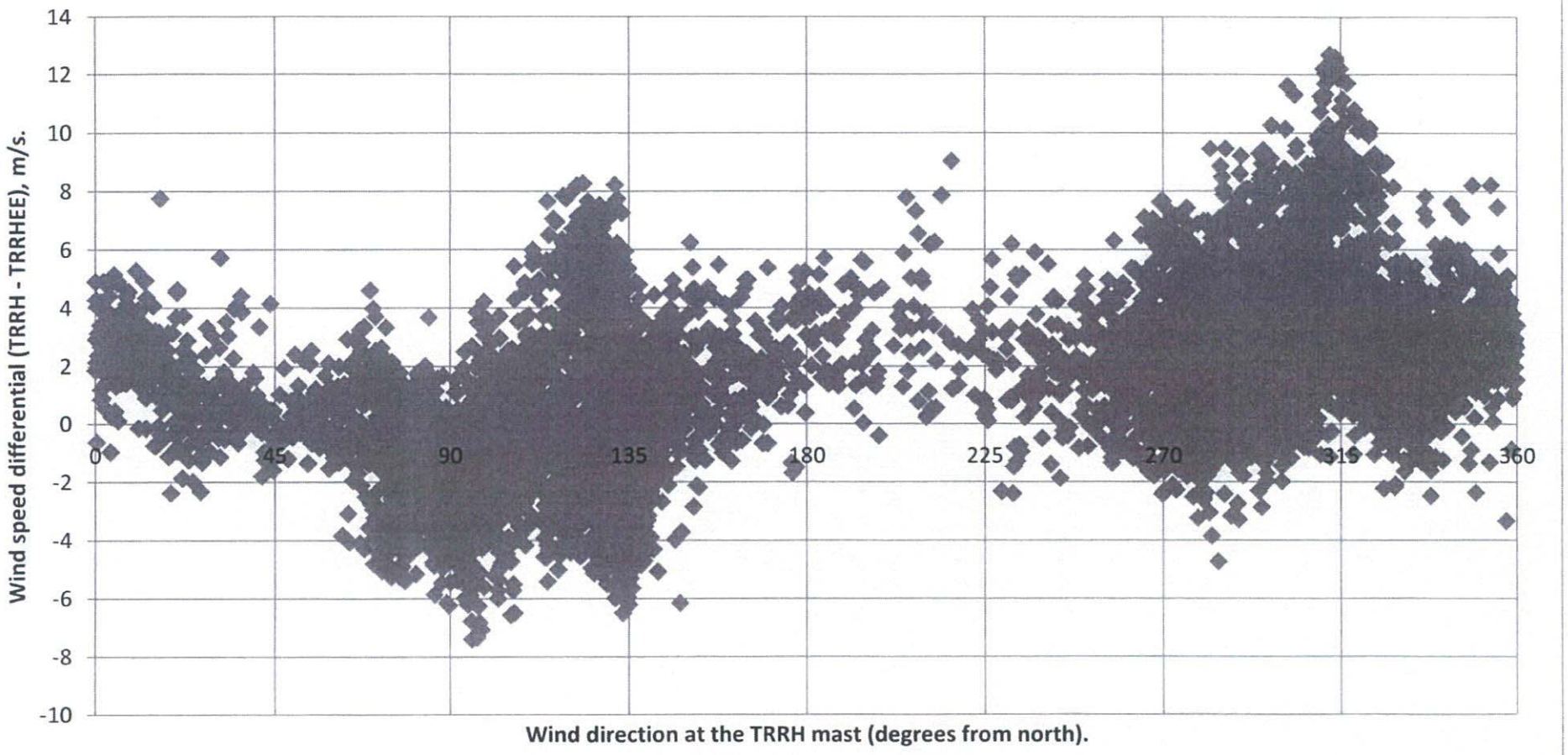
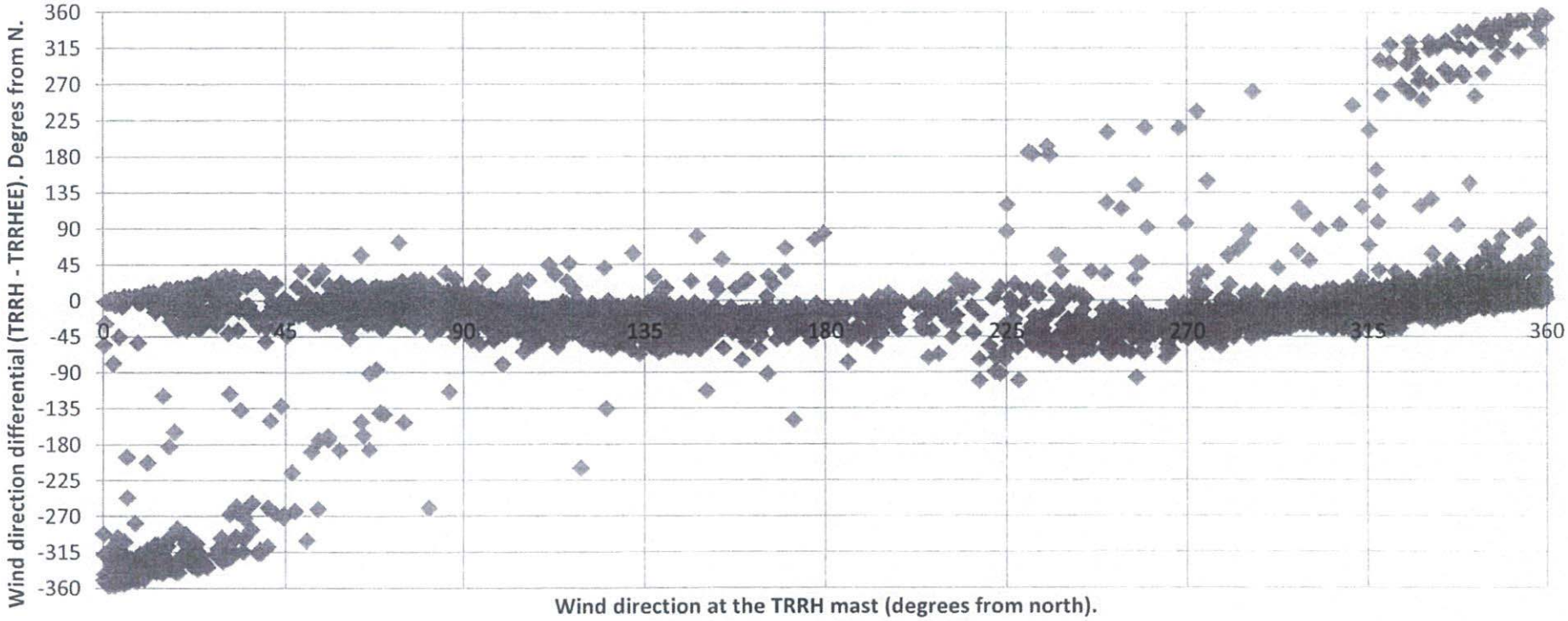


Figure 16:Difference in wind direction between the two masts used by NZWL (TRRH - TRRHEE), plotted as related to the wind direction at the TRRH mast.



12-22

Wallace

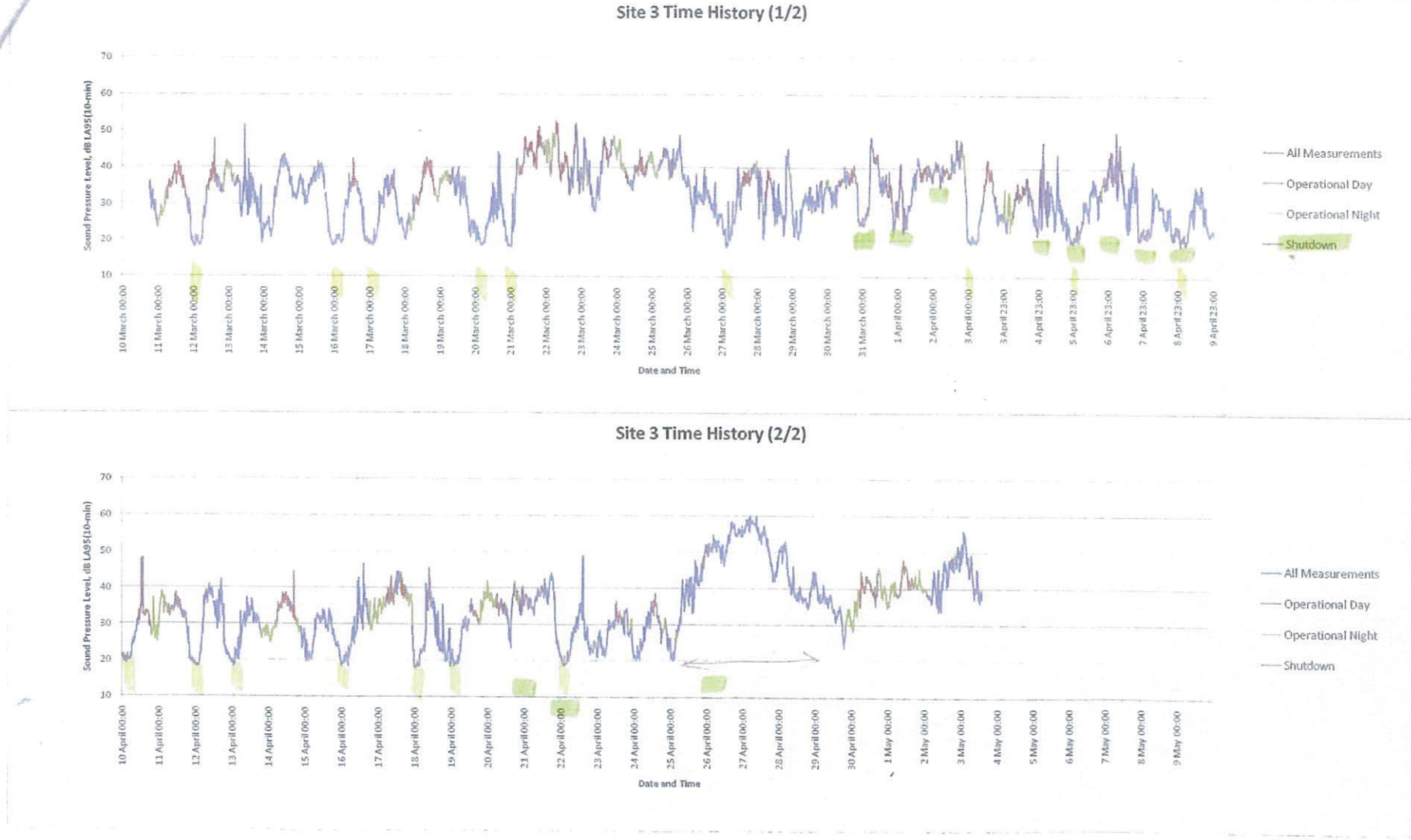
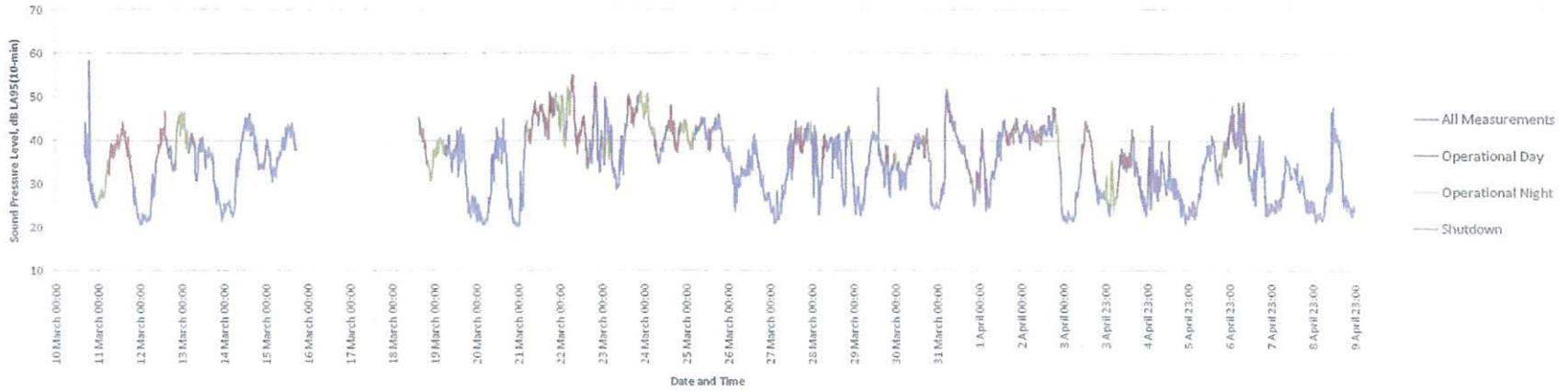


Figure 2a: Changing sound pressure levels over time, during the 2011 monitoring, at the Wallace residence.

12-23

Irvin

Site 4 Time History (1/2)



Site 4 Time History (2/2)

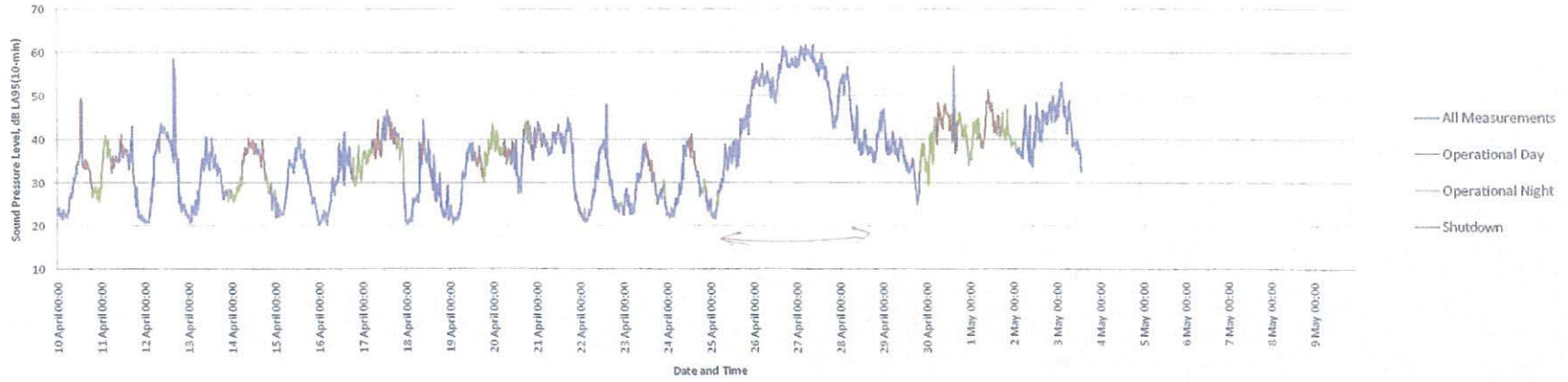
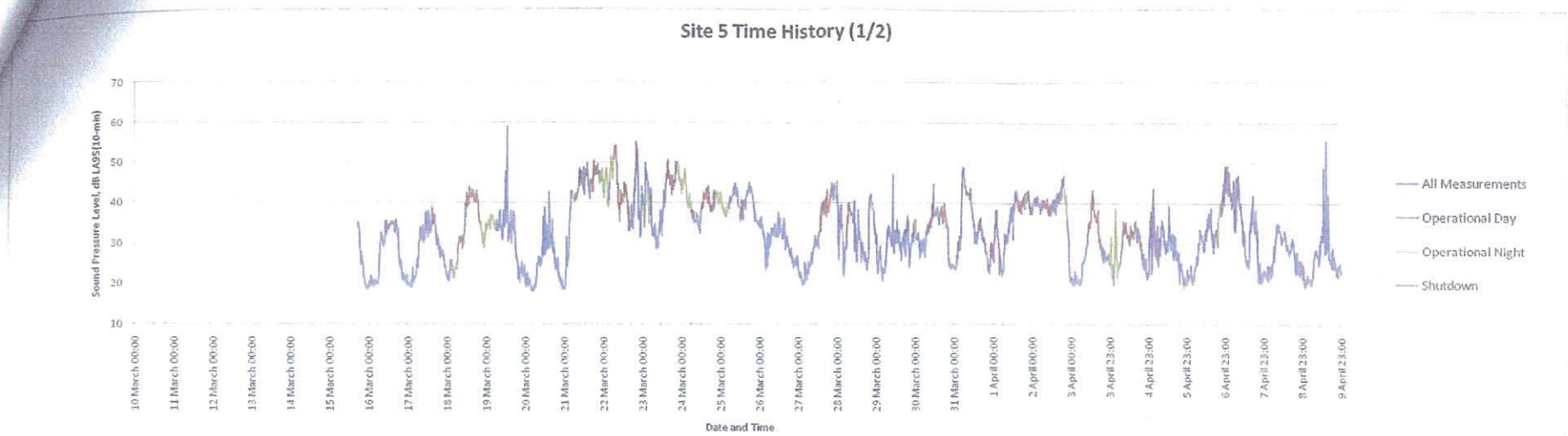


Figure 2b: Changing sound pressure levels over time, during the 2011 monitoring, at the Irvin residence.

12-24

Esther

MARSHALL DAY Acoustics



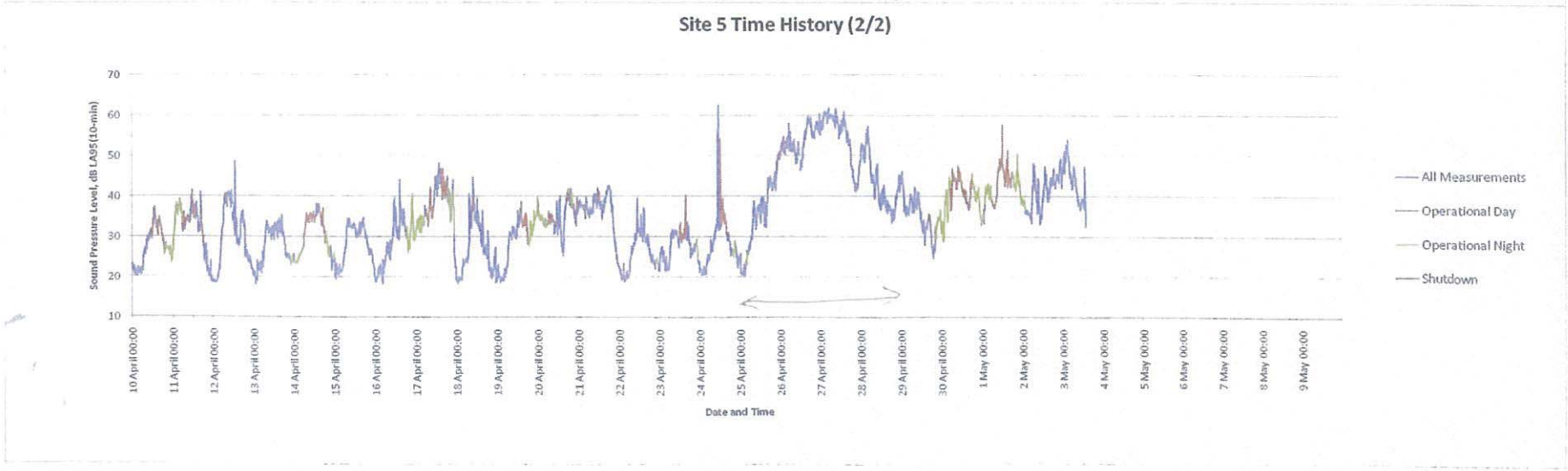


Figure 2c: Changing sound pressure levels over time, during the 2011 monitoring, at the Willis residence.

12-25

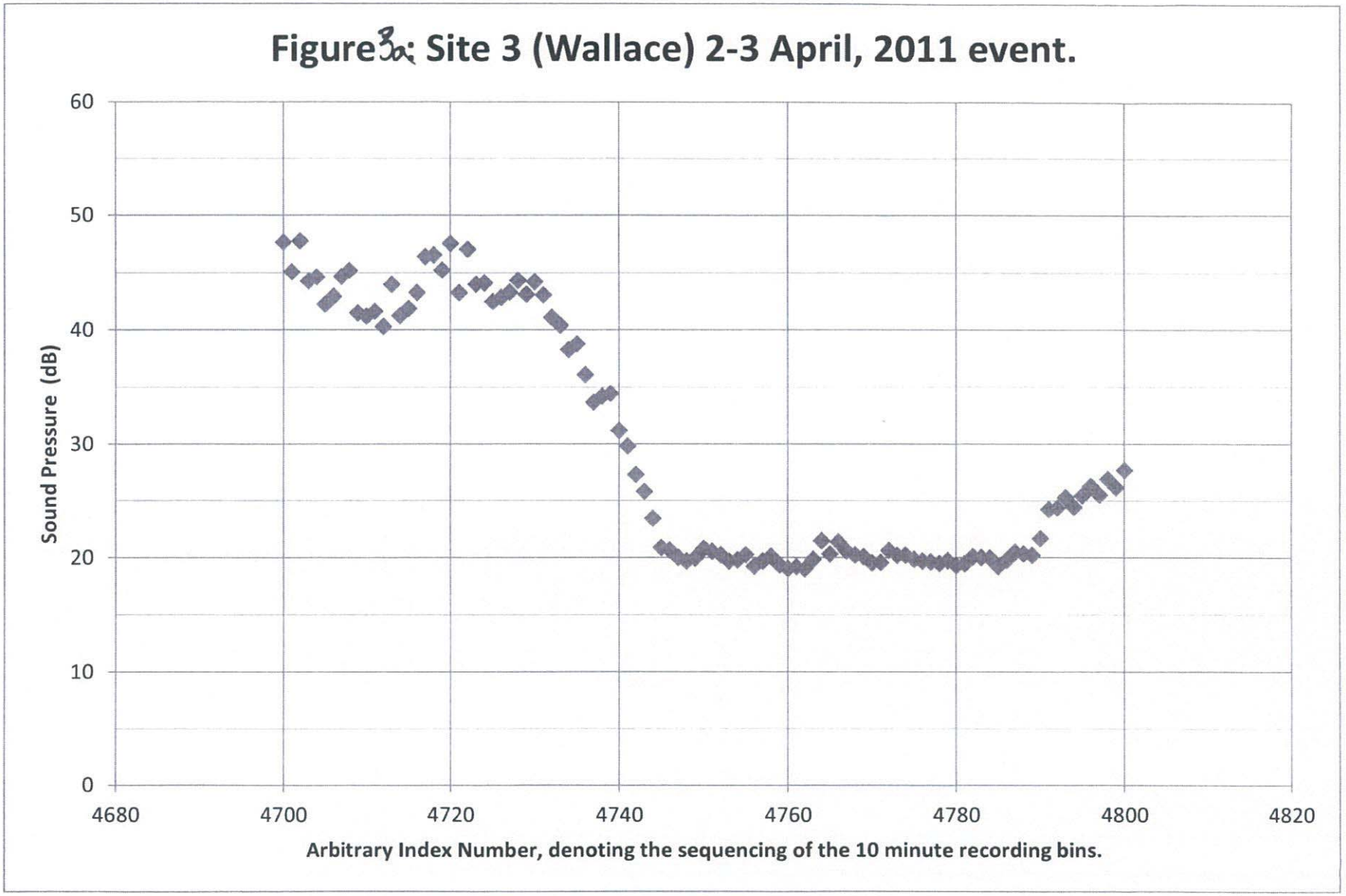


Figure 3a: Site 3 (Wallace) 2-3 April, 2011 event.
Sound Pressure (dB)
60
50
40
30
20
10
0
4680
4700
4720
4740
4760
4780
4800
4820
Arbitrary Index Number, denoting the sequencing of the 10 minute recording bins.

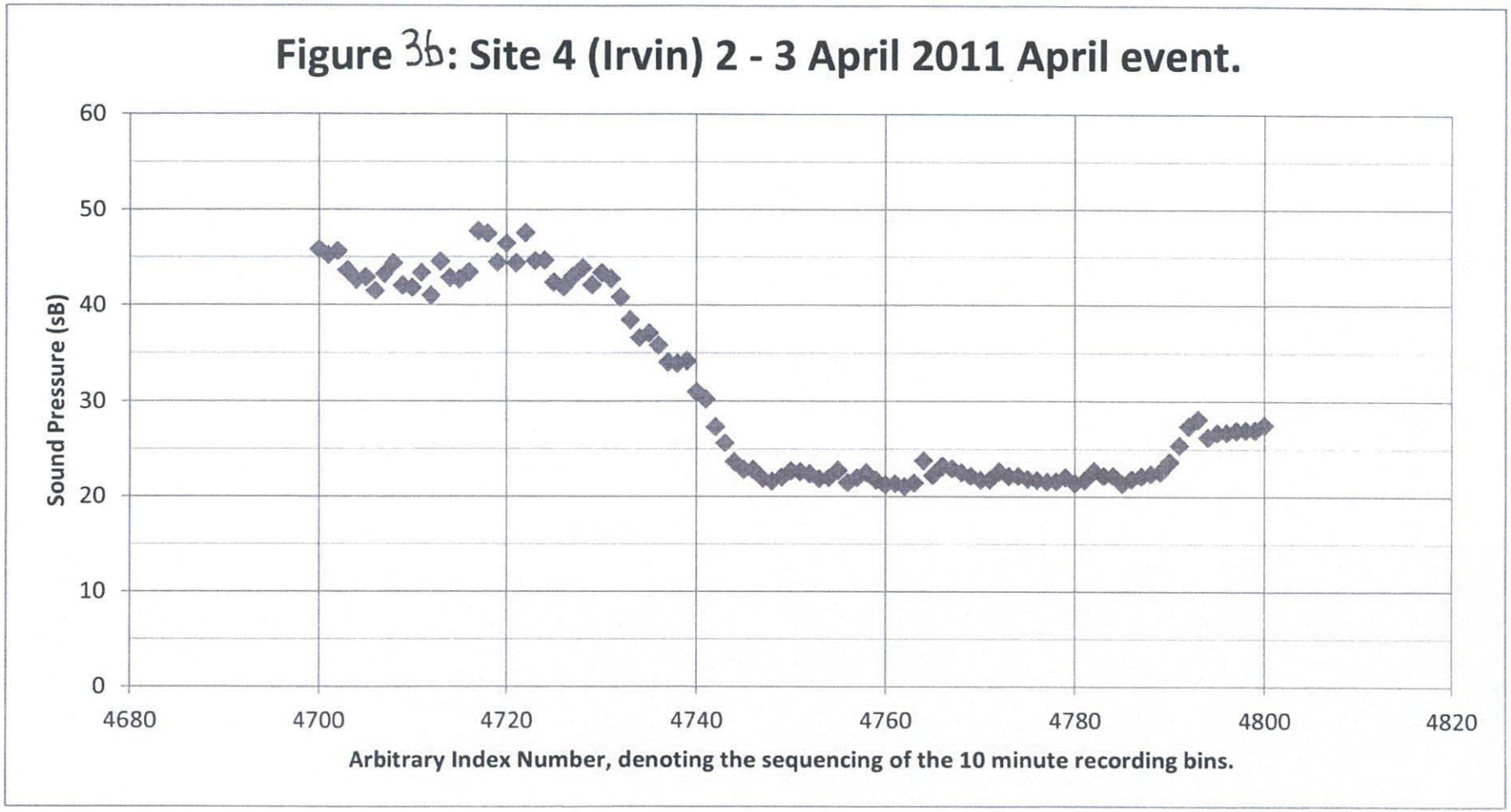


Figure 36: Site 4 (Irvin) 2 - 3 April 2011 April event.
Sound Pressure (sB)
60
50
40
30
20
10
0
4680
4700
4720
4740
4760
4780
4800
4820
Arbitrary Index Number, denoting the sequencing of the 10 minute recording bins.

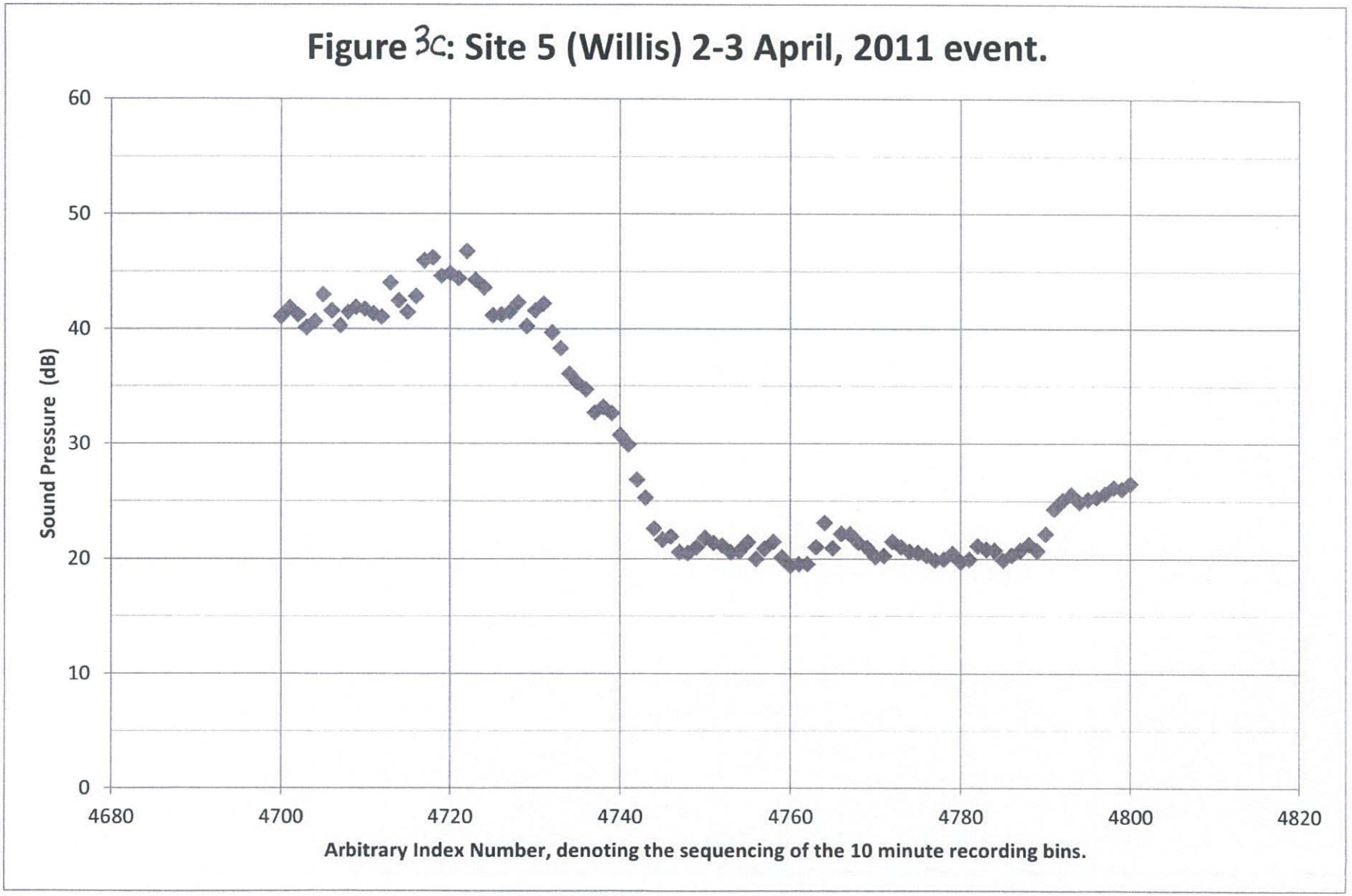


Figure 3c: Site 5 (Willis) 2-3 April, 2011 event.
Sound Pressure (dB)
60
50
40
30
20
10
0
4680
4700
4720
4740
4760
4780
4800
4820
Arbitrary Index Number, denoting the sequencing of the 10 minute recording bins.

82-28

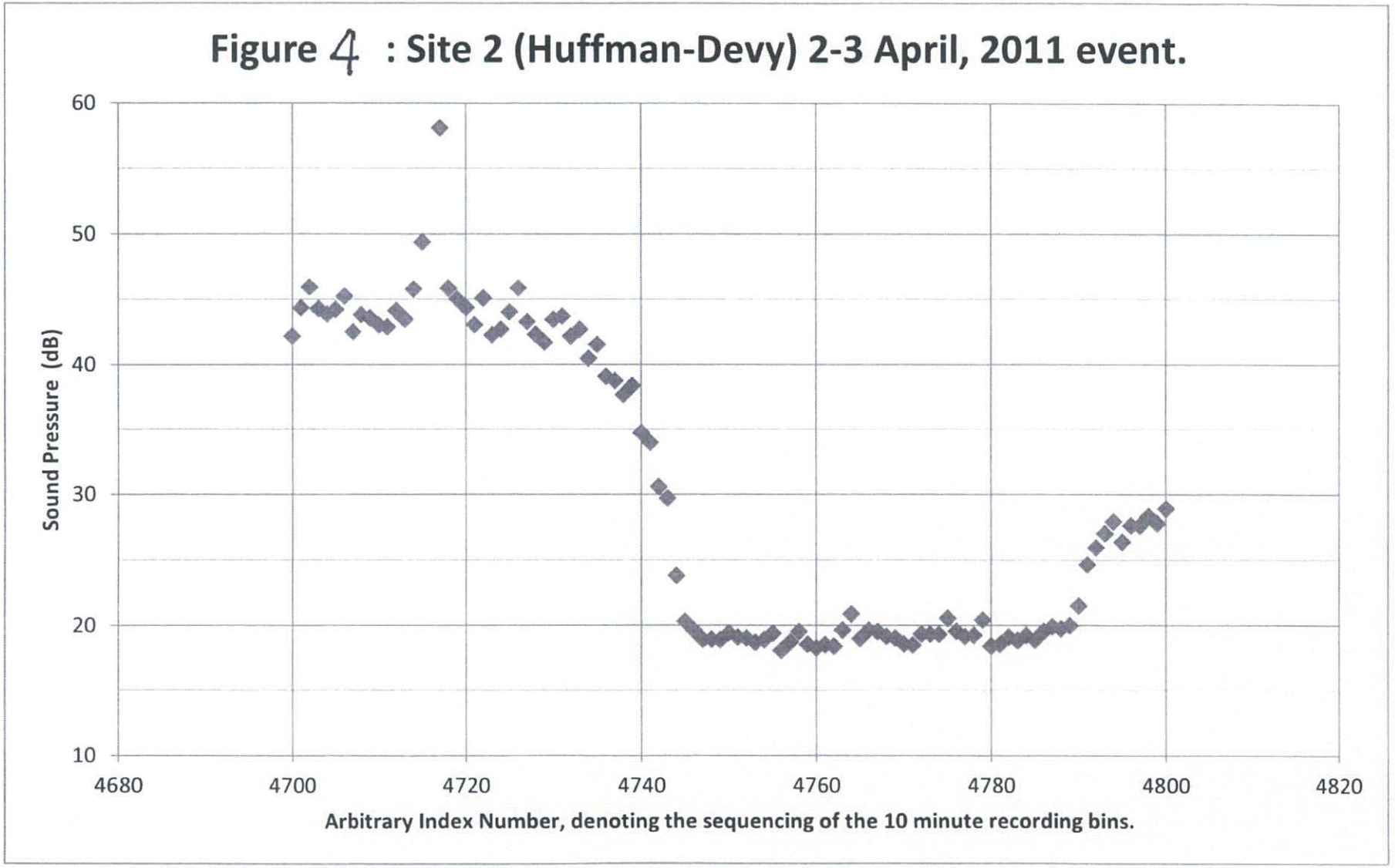


Figure 4 : Site 2 (Huffman-Devy) 2-3 April, 2011 event.
Sound Pressure (dB)
60
50
40
30
20
10
4680
4700
4720
4740
4760
4780
4800
4820
Arbitrary Index Number, denoting the sequencing of the 10 minute recording bins.

12-30

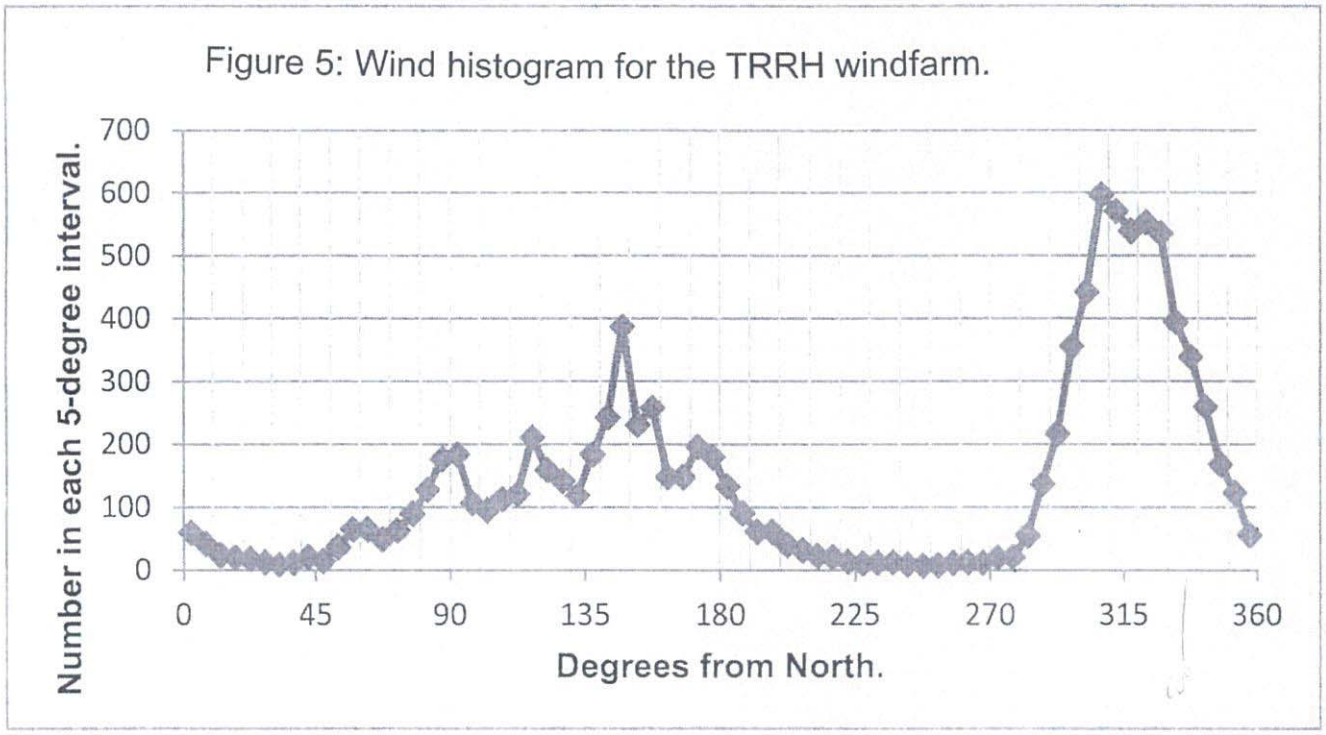


Figure 5: Wind histogram for the TRRH windfarm.
Number in each 5-degree interval.
700
600
500
400
300
200
100
0
0
45
90
135
180
225
270
315
360
Degrees from North.