EVIDENCE IN CHIEF OF DR LAURENCE PETER BAREA – INDEX

Before the Board of Inquiry
Hauauru Ma Raki Wind Farm Proposal

Under	the Resource Management Act 1991
In the matter of	Resource consent applications by Contact Wind Limited relating to the Hauauru Ma Raki Wind Farm Proposal
And	
In the matter of	Notices of Requirement and a Resource Consent Application by Contact Energy Limited relating to the Hauauru Ma Raki Wind Farm Proposal

Statement of evidence in chief of Dr Laurence Peter Barea

Dated: March 27 2009

Date of hearing: 27 April 2009

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STATEMENT OF EVIDENCE IN CHIEF OF DR LAURENCE PETER BAREA

INTRODUCTION

1 My full name is **Laurence Peter Barea.**

2 I am an Ecologist and Technical Support Supervisor for the Biodiversity Group of the Waikato Conservancy of the Department of Conservation (DOC). Prior to this I worked for DOC between 1996 and 1998 as a wetland and threatened species ecologist. Between 2001 and 2004 I worked as a consulting wildlife biologist in Boise, Idaho on a range of development projects across the Pacific Northwest of the United States of America. Following this I conducted my Doctoral research in Australia before taking up my current position in 2007.

3 I hold both Bachelor of Science (1991) and Master of Science (1st Class honours) (1995) degrees from the University of Waikato and a PhD (2008) in Terrestrial Ecology from Charles Sturt University, NSW, Australia. My MSc research focussed on the ecology of New Zealand falcons in native forest habitats, comprising investigations into nest site characteristics, diet and habitat use. My Doctoral research was conceptually based around the influence of temporal and spatial variation in food abundance on the ecology of birds, using a frugivorous (fruit-eating) honeyeater and its food resource as a model study system. I have published 5 scientific papers in peer reviewed journals; 2 on New Zealand falcon ecology and 3 on the influence of food resources on the ecology of consumers. I also have 4 further scientific papers in the latter stages of preparation.

4 I am a member of the New Zealand Ecological Society and a Trustee of the Wingspan Birds of Prey Trust.

5 In addition to having 14 years of professional experience covering a range of ecological issues in various systems across New Zealand, USA and Australia, I have been closely involved with the design of the monitoring programme and collision risk modelling of avi-fauna for the Taharoa wind farm, south of Kawhia, and co-authored the report detailing those findings (Fuller *et al.* 2009).

6 I am familiar with the proposal which is the subject of the resource consent applications and notices of requirement. I also confirm that I have visited the site on more than one occasion.

7 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that, unless I state otherwise, the issues addressed in this brief of evidence are within my area of expertise.

8 I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

9 For purposes of clarity I refer to the Hauāuru mā Raki project area, including the Waikawau and Matira Wind Farm Zones and associated transmission lines and substations as the HMR study area. My evidence will discuss the following:

(a) Impacts of Wind farms generally

(b) Potential effects on terrestrial fauna including:

(i) Terrestrial Invertebrates

(ii) Herpetofauna (amphibians and reptiles (including lizards))

(iii) Resident Bush Birds

(iv) Resident farm birds

(v) Australasian Bittern

(c) The methods proposed by the applicants experts to address the above effects (including offset mitigation)

(d) Consent Conditions proposed by the applicant

(e) Conclusions

THE HMR PROJECT

10 The applicant seeks consent to construct and operate a wind farm of up to180 wind turbines located along approximately 34 kilometres of coastline between Port Waikato and Raglan on the west coast of the North Island of New Zealand. Electricity generated by the wind farm will be transferred via 33 kilovolt (kV) underground or overhead lines to the nearest of three substations which will be constructed at Te Akau, Matira and Limestone Downs. Electricity will then be transferred via a double circuit 220 kV transmission line to a new electricity switching station at Orton where it will join into the National Grid.

11 In addition to these generation and transmission components, infrastructure associated with the construction of the wind farm includes turbine foundations, crane pads, roads, disposal areas and laydown areas.

EFFECTS OF WIND FARMS ON FAUNA GENERALLY

12 Potential effects associated with wind farms on fauna can be broadly categorised into three areas (Powlesland 2009):

i) Habitat Loss;

ii) Collision Fatalities; and

iii) Disturbance and Displacement.

13 The degree to which any of the above is likely to occur depends on the taxonomic group and species-specific differences in biology and behaviour. In addition, the spatial distribution of individuals and how they use different habitats, also influences the degree of potential effects. In my evidence which follows I discuss the three broad areas above, in terms of the potential adverse effects of the HMR project on terrestrial invertebrates, herpetofauna and resident bush birds.

Terrestrial Invertebrates

14 Limited surveys of the HMR project have been carried out by the applicant's ecological expert Mr Kessels. At paragraph 89 of his evidence in chief Mr Kessels lists various terrestrial invertebrate species which were observed during those surveys, and these include numerous puriri moth caterpillar (*Aenetus virescens*), bag moth caterpillar (*Liothula* sp.), huhu beetle grub (*Prionoplus reticularis*), elephant weevil (*Phyncodes ursus*), fourspined weevil (*Scolopterus* sp.) grass grub (*Costelytra zealandica*), sand fly (*Austrosim ulium* sp.), bush cockroach (*Celatoblatta* spp.) and orange crane fly (*Leptotarus ferruginosus*). Mr Kessels also sets out other species which he considers are likely to be found in the study area at paragraph 89 of his evidence. Indigenous species include common copper butterfly (*Lycaena slaustius*) and red admiral (*Vanessa gonerilla*), giant bush dragonfly (*Uropetala carovei*), carabid ground beetles and rhaphidophorid ("cave") wetas. I agree with Mr Kessels' analysis of expected invertebrates, however there is also likely to be an abundant variety of land snails and other gastropods within the area. I attach as Exhibit LPB1 a list of gastropod species recorded in the DOC "Bioweb" database from the HMR study site.

15 Currently there are no known *threatened* invertebrate species at the HMR study site (ie as recorded in any of DOC's databases or the NZ Threat Classification System Lists (Hitchmough *et al.* 2007). This may simply reflect lack of historical survey effort rather than threatened species being absent. What will be present for sure, are communities of indigenous invertebrates contributing to the functioning of the ecosystems present in the HMR study site.

16 Potential effects on invertebrates associated with the project include:

i) direct mortality to invertebrates at specific sites where soil will be disturbed during construction; and

ii) loss of habitat.

17 It is currently not possible to fully consider the potential effects of the project on indigenous invertebrates. This is mostly due to poor survey effort to date, and also because of the approach in the applications whereby the applicant has sought consents to place turbines anywhere within specified "Turbine Consent Areas" (as shown in Exhibit CDJ28 in the evidence in chief of Mr James), and earthworks anywhere within "earthworks consent areas" (as shown in the plans in Schedule 2 to Exhibit SGD2 to Mr Daysh's evidence in chief). It is also not clear to me whether vegetation clearance is to be restricted to the earthworks consent areas or whether it can occur anywhere within the project area.

18 Consequently, this also means that the areas of vegetation clearance as assessed in the Assessment of Ecological Effects prepared by Mr Kessels (Technical Report T3 of the Application documents) are "indicative" only. I also note that Mr Shaw, the Department's terrestrial flora expert has concluded that there are mapping errors and an underreporting of the extent of vegetation clearance in the AEE. This further exacerbates the problems with assessing the effects of the project.

19 In turn, this has major consequential flow on effects which prevent an accurate assessment of what an appropriate level of avoidance, remediation or mitigation (including compensation) would be for the loss of indigenous habitat as a result of the project.

20 This also means that the direct mortality risk to invertebrates cannot be assessed because the specific location of impact areas are unknown, making it impossible to conduct spatially meaningful surveys from which to understand what is present.

21 It is therefore unknown how much loss of terrestrial invertebrate habitat there will be as a result of the project.

22 Mr Kessels' evidence acknowledges that there have been no specific surveys for terrestrial invertebrates undertaken by the applicant to date, and that the species noted above were recorded following only a brief inspection for invertebrates under logs, rocks and within trees and shrubs.

23 Mr Kessels notes in his evidence his opinion that proper surveys should be undertaken as soon as possible and before site preparation begins (paragraph 88). In my view, the completion of robustly designed surveys will assist in making a meaningful assessment of effects for invertebrates. However, this needs to be accompanied by more specific information about the extent and location of earthworks and vegetation clearance that is likely to occur during construction.

Herpetofauna

24 As is the case with terrestrial invertebrates, no meaningful herpetofauna surveys have been undertaken by the applicant in the HMR study area. At paragraph 90 of his evidence in chief, Mr Kessels notes that he conducted one survey for herpetofauna in March 2008 which involved the baiting or four traps and their placement in potential habitat within Te Umukaraka Bush overnight. Spotlighting was also carried out on one evening in March 2008 within the same C turbine cluster area. Mr Kessels notes that no lizards were captured or observed, however he also acknowledges that that this level of survey is "minimal". I agree with that assessment.

25 The DOC Bioweb database contains historical records for Copper skink (*Cyclodina aenea*; Not Threatened) and green gecko (*Naultinus elegans elegans*; Gradual decline) within the HMR study site (see Exhibit LPB2 attached). I would say that the absence of other records probably reflects a lack of survey effort rather than absence of species.

26 Potential impacts on herpetofauna associated with the HMR project include:

i) direct mortality at specific sites where soil will be disturbed during construction and;

ii) loss of habitat.

27 I understand Mr Kessels acknowledgment that the applicant's survey effort to date reflects the absence of defined impact areas upon which to base a survey. This is another example of a difficulty that has arisen as a result of the "consent area" approach taken in the applications for the project, and as a result, it is impossible to provide any meaningful assessment of the likely impacts on herpetofauna as a result of the project. In particular:

i) the direct mortality risks cannot be assessed because the specific locations of impact areas are unknown, and;

ii) the amount of habitat loss that will result from the removal of indigenous vegetation and earthworks is unknown.

Resident Bush Birds

28 Mr Kessels describes his approach to surveying bush birds in the AEE (Exhibit GK13) and Dr Seaton summarises this in paragraphs 6.1 and 6.2 of his evidence in chief. While it is my view that the survey effort presented in the AEE was low, this has been improved in response to section 92 requests by the Council, specifically with respect to Kereru, Tui and morepork. I consider the methods appropriate for assessing presence of species and generating the species lists presented in the AEE and section 92 responses with

the exception of rare species with low detection rates such as the threatened NZ Falcon.

29 In preparing this part of my evidence I have focussed on Kereru and Tui because both species are important from an ecological functioning perspective - i.e., kereru are seed dispersers and Tui pollinate many native plant species (Higgins and Davies 1996; Higgins *et al.* 2001). Therefore, in addition to their being important as indigenous species in their own right, they are crucial for maintaining plant species diversity and ecosystem function within the HMR study site.

30 In addition, although I do not make specific reference to common resident bush birds, e.g., fantail, grey warbler, kingfisher, focussing on Tui and Kereru also addresses the same issues for other bush birds because they are exposed to similar effects of habitat loss as are other bush birds. In addition, because Tui and Kereru occur over spatial scales they are likely to be at greater risk from collision mortality than other bush birds, except NZ Falcon. (I consider NZ falcon and Australasian bittern separately below).

The Tui and Kereru Assessment Report

31 Although the Kereru and Tui section 92 report (Stirnemann 2008a) is entitled "Assessment of Tui & Kereru Distribution & Collision Risk", I do not consider that it in fact provides a quantitative collision *risk* assessment as its title indicates. I accept that it provides improved knowledge of the spatial occurrence of both species over and above the information contained in the AEE, and it concludes that Kereru and Tui fly at rotor swept height in the vicinity of where turbines are proposed. It does not, however, assess the probability with which either species will collide with turbines. This is necessary in order to make a quantitative risk assessment. To do this would require the applicant to model those probabilities as is standard practice overseas (Band *et al.* 2007; Percival 2007) and the process is detailed in Dr Percival's evidence.

32 Given that Tui and Kereru were frequently observed in all habitats sampled, and that they often flew at heights that would place them within the rotor swept zone, I agree with Mr Kessels assessment that both species should be placed in a "higher" risk category. This is perhaps especially relevant to kereru which are known to be prone to colliding with structures (Mander *et al.* 1998). However, it is not possible to further assess the magnitude of this potential effect with any certainty, as this requires data on the flight rates and flight height of these species through turbine clusters and collision rates to be modelled none of which have been undertaken on behalf of the applicant.

33 Given that kereru and tui were observed flying within the rotor swept zone on ridges and plateaus—i.e., topographic features where turbines would be placed—between 9% – 17% and 9% – 21% of observations respectively, the higher risk assessment is warranted. However, I note that the revised higher assessment of effect for Kereru and Tui is not reflected in Exhibit GK27 of Mr Kessels

evidence, where the level of risk for direct effects remains the same as was presented in table 24 of the AEE, i.e., "moderate risk and low localised effect only". I assume this is an error.

34 In terms of the usefulness of the survey, I would advise against making inferences beyond the scope of it because it was only conducted during one part of one year (November 2008). The relative abundance of both species is likely to fluctuate widely depending on seasonal variation in the fruit and nectar food resources they depend on and the movement patterns associated with this 'resource tracking' is likely to influence collision risk. I note that large scale seasonal movements in response to food resources is established in the literature for both species (Higgins and Davies 1996; Higgins *et al.* 2001) and as such it is my view that the risk to both species cannot be fully understood based on limited data collected over 1 month of a single year.

35 Mr Kessels recommends that post-construction monitoring should occur to "keep track of meta-population trends". While I agree that post-construction monitoring should occur, I disagree that this would achieve the above-stated outcome. In my view it would not be realistically possible to confidently distinguish between natural fluctuations in the abundance of both species from any changes due to collision mortality, due to high variation in their abundance due to their large-scale tracking of resources and likely inter-year variation. To do so would require many years of data collection both prior to and after construction of the wind farm and comparison with data collected at a control site elsewhere.

Resident Farm Birds

36 In my opinion, the only indigenous bird species principally occurring in pasture habitat within the HMR study site is the New Zealand pipit. This species is assessed in the NZ Threat Classification System as At Risk Declining (Miskelly *et al.* 2009).

37 I agree with Dr Seaton when he states that the species is likely to spend much of its time close to the ground, below turbine RSA. This is supported by my discussions with Dr Tony Beauchamp (DOC Ecologist) who has a research background with the species and who communicated to me that the birds rarely fly above 40 m above the ground. As such, in my opinion the potential effects this species are likely to be minor.

Australasian Bittern

38 Several Threatened (Nationally Critical) Australasian bittern (bittern) have been observed within the Pungapunga wetland which is within the project area. The external transmission line is proposed to cross directly over the wetland, and concerns have been raised by the Department in respect to this. Dr Seaton states in his evidence in chief (paragraph 7.9) that the transmission line over Pungapunga wetland poses a collision risk to bittern and spotless crake. I agree with him. However, he also states that the effects of the construction and operation of the wind farm on wetland birds is

minimal. In my view it is not possible to make such an assessment of effect because there are no robust data from which to base it on.

39 I acknowledge the additional work done by Kessels and Associates with respect to bittern in response to section 92 requests for additional information. The study (Stirnemann 2008b) appropriately reports a minimum estimate of 7 bittern detected in the Pungapunga wetland between October and November 2008 and concluded that numbers are likely to be higher. The report states that bittern are at risk from collision with the transmission line proposed to cross the Pungapunga wetland and appropriately recognises that bittern are known to fly long distances in the Waikato at night (Teal 1989). I note from my own personal observations that Bittern also fly between wetlands and at heights that place them as risk from collisions with transmission lines and wind turbines during the day.

40 Although Mr Kessels assesses the risk of strike to Bittern as moderate level risk (page 15 of Mr Tonks' Offset Mitigation report) Mr Tonks appears to conclude that transmission line strike risk for bittern is low. I disagree with this conclusion, which appears to be based on an absence of evidence of bittern mortality. Given the rarity of bittern and that most collisions are likely to occur in remote locations (including over densely vegetated wetlands), I would expect the collision mortality *detection* rate rather than the *collision rate* for this species to be very low and that caution is warranted in making inferences about actual collision rates based on an absence of information.

MEASURES TO ADDRESS EFFECTS ON TERRESTRIAL FAUNA

41 In the event the Board is minded to grant consent now for the project, I record below my advice on what should be included in the proposed consent conditions.

Ecology Peer Review Panel

42 I support the proposal by the applicant to establish an independent Ecology Peer Review Panel. This is discussed in sections 6.1 – 6.5 of Exhibits SGD 1 and SGD2 to Mr Daysh's evidence in chief. Mr Daysh suggests conditions that establish the proposed independent Ecology Peer Review Panel to exercise the functions specified in the conditions. In my view such a group is critical to ensuring that the exercising of the ecology consent conditions is carried out in a robust and defensible manner. I suggest that the Department has direct input into defining the functions and establishing such a group.

Additional Background Population Surveys

Invertebrates and Herpetofauna

43 In his evidence in chief (Exhibits SGD7 and SGD7), Mr Daysh proposes a consent condition whereby the applicant is required to have a suitably qualified person design and implement an

invertebrate and herpetofauna population survey where earthworks are to be carried out in or within 100 metres of any areas comprising indigenous vegetation.

44 While I agree generally with this concept, to ensure a robust survey it is my view that the consent condition needs to require the person designing and carrying out the survey be a qualified entomologist.

45 The wording of Mr Daysh's proposed consent condition suggests that the invertebrate survey is combined with a herpetofauna survey, i.e., there will be 1 survey design combining both taxa. In my view the invertebrate survey should be designed and carried out separate from a herpetofauna survey to allow for a robust and meaningful design independent of considerations around the required design for a robust herpetofauna survey. A herpetofauna survey should of course also be robust and meaningful.

46 In my view the following should be incorporated into the design of invertebrate and herpetofauna surveys:

(a) All areas of indigenous scrub and forest that will be physically disturbed, irrespective of their current condition, should be surveyed. This would require the specific location of construction activities to be defined.

(b) Independent surveys should be conducted by a professional entomologist and a professional herpetologist with skills relevant to the geographical context of the HMR study area.

(c) The survey designs need to address the probability of obtaining a 'false negative' result for rare or difficult to detect species, i.e., failing to detect a species when it is actually present.

(d) The survey designs also need to allow for temporal and spatial variation in species detection rates as well as considering individual species life-history characteristics so that species list completeness is maximised.

47 Although robust pre earthworks surveys should allow an assessment of the species and communities likely to be lost due to construction, it would not avoid, remedy or mitigate, or compensate for those losses. I suggest the following conditions for incorporation into consent conditions and note that the approach taken has meant that effects cannot currently be quantified, and the quantum of the second point below cannot be established now. The conditions I propose are:

(a) If threatened species are found, DOC is immediately notified in writing. Following this the taxa are to be relocated to appropriate habitat nearby after consultation with DOC and review by the Ecology Peer Review Panel who may choose to make recommendations. I also note here that relocating protected species requires a translocation permit from DOC under the Wildlife Act, and an advisory note to that effect would be useful with this condition.

(b) Predator management is required over an appropriate area of indigenous habitat as compensation for the direct loss of invertebrates and herpetofauna and habitat. The ability to do this in an objective manner is currently compromised by the inability to accurately quantify vegetation loss due to vegetation mapping errors, underreporting of vegetation clearance and the applicant's approach to the siting of turbines within wider consent areas.

(c) The outcomes of predator management should include robustly designed outcome monitoring that compares the response of invertebrate communities and herpetofauna in areas with predator management with similar habitat areas within the HMR study site where no management occurs. This might occur as a payment to another party who would carry out the monitoring.

Resident Bush Birds

48 Mr Daysh suggests in Exhibits SGD1 and SGD2 paragraphs 6.8 c) a number of conditions to address potential effects on bush birds. In proposed condition 6.8(c) he suggests that one further Tui and Kereru survey be undertaken where construction is proposed within 100 m of indigenous vegetation. Based on the evidence of Mr Kessels that both these are at higher risk than originally assessed in the AEE, such a survey in my opinion should be designed in a manner that collects data enabling collision risk to be modelled and annual estimates of mortality generated. The sampling design should account for the fact that species occur over pasture in addition to indigenous forest and scrub.

49 Currently, the applicant has not attempted to predict collision risk for any species by modelling that risk. This is despite techniques being readily available, e.g., Band *et al.* (2007; see also Dr Percival's evidence). In the absence of such information it is impossible not only to assess the level of potential impacts with any confidence, but to objectively consider what measures would be required to appropriately avoid remedy or mitigate effects.

50 I agree with Mr Daysh when he states that when implementing this survey "the consent holder shall take into consideration the time of year when kereru are most likely to be present" and note that this will require data collection over at least a 1 year period to account for seasonal variation in the abundance of both species.

51 Both Mr Kessels and Dr Seaton acknowledge in their evidence that overhead transmission lines pose a collision risk to Tui and Kereru in addition to other species such as bittern and spotless crake. Hence, and with reference to Exhibit SGD4 and SGD5 in Mr Daysh's evidence, I agree with the placement of bird diverters / deflectors on transmission lines where they cross native bush / forest or wetlands, but recommend that they are added to a buffer either side of where lines cross over or between these habitats to reduce the collision risk to birds flying in and out of these habitats. In my view the type of bird deflector and ultimate placement including the length of buffer should be made after recommendation

by the Ecology Peer Review Panel whose functions should reflect this capacity.

52 I welcome the suggested staged approach to monitoring the threatened NZ falcon as proposed by the applicants' witness Dr Seaton and detailed in paragraphs 11.4 – 11.6 in his evidence, but also recommend that falcon surveys include all of Te Tehe Bush on or in the vicinity of the Sunset Views property at the northern limits of the HMR study area. I make this recommendation because Te Tehe Bush is the largest potential nesting habitat in vicinity of HMR study site and if present, falcons are likely to move in and out of the study site from this area. Currently the 2 Km falcon survey buffer around the study site (Dr Seaton's evidence – paragraph 11.5) includes about half of Te Tehe Bush.

53 A matter I disagree with in the proposed condition is the the absence of any post construction monitoring in the event falcons are found breeding within 2 km of the HMR study area despite this being recommended by Dr Seaton. I suggest that this be included in the conditions as Dr Seaton suggests.

54 Finally, I record my agreement with Dr Seaton in his view that collision monitoring is unlikely to detect falcon collisions due to their low abundance, and that a more appropriate way to monitor post construction collisions is via radio telemetry. Such an approach could easily be incorporated into a collision mortality monitoring programme. In my view any consent conditions should reflect this approach and include radio-tagging any falcons found breeding within Te Tehe Bush due to its close proximity to the HMR site and high likelihood that any falcons nesting there would likely also move in and out of the site.

Ecology Management During Construction

NZ Falcon

55 In proposed condition 6.7 c) Mr Daysh suggests that the Construction Effects Management Plan outlined in proposed condition 6.6 includes a condition relating to construction related disturbance within 200 m of any active NZ falcon nest. The proposed condition allows for construction to occur if a qualified ornithologist determines that the nest will not be disturbed. In my view this condition is not workable in its current form because NZ falcons often show signs of disturbance from greater distances than 200 m. This is supported by Dr Seaton who in his most recent publication (Seaton *et al.* 2009) states that falcons respond to a person on foot from distances of 300 m – 400 m. Based on my own experience, I agree with him. When a falcon responds to disturbance by leaving its nest, eggs and nestlings are susceptible to chilling, particularly if this occurs in adverse weather conditions. Their exposure to predation risk would also be increased.

56 In paragraph 11.5 d) of Dr Seaton's evidence he recommends that "any construction activity within 200 m of an active nest should be restricted during the period that the nest is active. Construction

activity can continue with no effect to breeding falcons once the nesting attempt is completed." However, Dr Seaton's recommendation is not reflected in the suggested consent conditions. I support Dr Seaton's recommendation and suggest that such a condition be included to prevent all construction activity from occurring within at least 200 m of an active falcon nest.

57 In addition, and because falcons may be disturbed from greater distances as discussed above, I consider that any active nest should be monitored by a suitable qualified independent ornithologist familiar with NZ falcon behaviour, and construction restricted within 400 m of the nest if a 200 m setback proves insufficient to eliminate disturbance as assessed by the ornithologist. This would require a mechanism that requires construction to cease within 400 m of an active nest within 24 hrs of the ornithologist making an assessment that disturbance was occurring.

Bittern

58 I agree with Mr Daysh's suggested condition 9.4 in Exhibit SGD5 of his evidence where he states that "no construction activities associated with the line within 100 metres of the edge of the Pungapunga Wetland shall be undertaken in the period 1 September to 31 January so as to avoid disturbance to nesting Australasian Bitterns". However, I suggest that this be extended to 200 m as a precautionary measure to account for uncertainty around the level of sensitivity to disturbance of this species.

Resident Bird Collision Mortality Monitoring Programme

59 I agree with the concept of a collision monitoring programme, but have a suggestion for changes to the wording of proposed condition 6.9 of Mr Daysh's Exhibits SGD1 and SGD2. My suggestion is that the collision monitoring programme be designed to be statistically robust, including adjustment for scavenger removal rates and searcher efficiency based on site-specific trials.

60 I also suggest that the second sentence in the same paragraph of proposed condition 6.9 be changed to the effect that the design and implementation of the collision monitoring programme be supervised by the Ecology Peer Review Panel.

61 I have some issues with proposed condition 6.9 i) that states that the collision monitoring involves searches of a statistically robust and representative sample of turbines. Such an approach assumes that the level of risk is equal for all turbines which is unlikely to be correct (reviewed in Powlesland 2009). In my opinion the level of risk for each turbine will vary depending on where they are located in the landscape, the habitat types they are associated with, and spatial variation in the use of the area by birds including temporal variation in their use of habitats.

62 In my opinion, the only way to properly understand collision risk for bush birds is to monitor it directly at each operational turbine for a

period of time that avoids excessive error when estimating collision rates due to temporal variation in the use of the area by birds, particularly Tui and Kereru. This is important because in assessing the impacts of a wind farm on birds, the cumulative effects of all turbines need to be considered (Powlesland 2009). This would require monitoring in all months of the year at each turbine location for a minimum of three years and require a commitment to adequately resource the programme and an acceptance that a level of statistical uncertainty is likely to be present in the results.

63 As a pragmatic approach, I suggest that a condition be included requiring the applicant to design a resident bush bird collision risk modelling programme following the procedures of Band *et al.* (2007) based on monitoring flight rates of Kereru and Tui (but recording all species observed) at each turbine cluster during each month for a period of three years. I believe that three years of post construction monitoring is minimally appropriate because the second year provides for a replicate to compare with the first year and the third provides for a level (albeit small) of confidence around variation in the data between the first two years.

64 Following this, the development of a statistically robust collision monitoring programme based on an appropriate sample of clusters, the selection of which is informed by the results of collision modelling (described above), would in my view be appropriate way to arrive at the 'representative sample' of turbine as referred to in Mr Daysh's evidence, paragraph 6.9 i) Exhibits SGD 1 and SGD2.

65 This approach would be appropriate for monitoring collisions of resident birds, including NZ pipit and morepork, the latter of which is a species for which further quantification of collision risk would be problematic due to its nocturnal behaviour.

66 In my opinion it is essential that the Ecology Peer Review Panel take a lead role in the design, implementation and analysis of any collision risk modelling and collision monitoring programme to ensure an appropriate level of rigour and so that DOCs interests are best represented.

67 With respect to conditions 6.9 and 6.10 in Mr Daysh's Exhibits SGD1 and SGD2, I consider that, if consent is granted now, consideration is given to appropriate mechanisms being placed on the consent to enable confidence that recommendations made by the Ecology Peer Review Panel will be acted upon by the applicant and the councils.

Offset Mitigation for Ecological Effects

68 In my view Offset Mitigation relating to collision mortality should be for the life of any consent granted for the wind farm because that is the timeframe over which the impacts would occur and need to be offset.

69 As offset mitigation for bittern, Mr Daysh proposes in 6.17 d) in Exhibits SGD1 and SGD2 the implementation of a weed and pest

control programme over an area of 5 ha in the Pungpunga wetland (or wetland area of similar value to bittern). I have three concerns with this approach:

(a) The area of 5 ha is based on a suggestion by Mr Tonks (paragraph 15 in his evidence in chief) with no explained rationale for arriving at that figure. In the absence of a meaningful quantitative assessment of how many bittern are expected to collide with the transmission line annually, making decisions on how much mitigation should be provided is problematic. In my opinion this should be decided after recommendations made by the Expert Peer Review Panel whose functions (I consider) should reflect that capacity.

(b) I disagree that weed control would be an effective method to increase bittern breeding productivity, which is an alternative proposed to offset collision mortality. If there were any benefits to breeding productivity (and I am not aware of any evidence concluding that there is), I doubt they would be measureable or could be attributable to weed control. In my view those resources would be better allocated to predator control and to increasing the area to be managed. Increasing the mitigation area would also provide some compensation towards collision mortality of Tui and Kereru which Mr Kessels acknowledges is likely to occur in the wetland and for other birds including spotless crake which are also known to occur in the wetland and which are identified by Dr. Seaton to be at risk from collision (see paragraph 7.9 of his evidence in chief).

(c) Because the Pungapunga wetland is privately owned, any management in the wetland would be constrained by the requirement for owner consent. This would make the long term viability of mitigation in that wetland uncertain. I suggest that the alternative of undertaking the mitigation in another wetland of similar value to bittern be considered also, but that this mitigation reflects recommendations made by the Expert Peer Review Panel in consultation with DOC as to the location of that wetland.

70 In his evidence, Mr Daysh proposes in 6.17 e) in Exhibits SGD1 and SGD2 "a minimum contribution of $17,000 per annum toward one or more native species conservation programmes focused on the protection of resident and migratory birds." I have concerns regarding how the quantum of this offset mitigation was derived and its intended purpose, for the following reasons:

(a) The figure of $17000 was recommended by Mr. Tonks in his offset mitigation report (Exhibit MT1 of his evidence in chief) and is based on "rough-order costings" stated in paragraph 55 of his evidence. I am not absolutely clear how this sum was reached, but it appears to be based on the need to annually replace 18 birds killed by collision with turbines. This is based on the lower end of a range of 0.01 to 23 birds killed per turbine at different wind farms and reported in a review published by Drewitt and Langston (2006) and cited in the AEE prepared by Mr Kessels.

No reason is provided by Mr Tonks for adopting the lower end of that range. I believe such an approach is inappropriate, as impacts at wind farms can be independent of scale (i.e., number of turbines) and can be influenced by site-specific factors (Percival 2005; Powlesland 2009). I consider that arbitrarily accepting the lower end of this range is also inappropriate because it represents a minimalistic approach to assessing collision risk, with the consequence that offset mitigation is then set at that level, thereby running a high risk of mismatching mitigation to impacts.

(b) Mr Tonks method is to multiply 0.01 by the 180 proposed turbines to arrive at 1.8 bird collisions for the entire wind farm. This is then multiplied by an arbitrary factor of 10, to account for uncertainty, to arrive at 18 birds killed per year. While I support the concept of providing a generous 10 to 1 rate of mitigation to loss, as the figure of 0.01 grossly underestimates total likely mortality for certain species (refer Dr Percival's and Dowding's evidence in chief), I consider that a total amount of 18 birds as the target for offset mitigation is grossly inadequate.

(c) In my opinion an appropriate way to arrive at a quantum for offset mitigation for bush birds would be to base it upon the results of an appropriately resourced statistically robust collision monitoring programme, informed by robust collision risk modelling as I outline above, and to then scale the management costs of increasing the productivity of affected species to the level that additional adults are recruited into the population at a rate that replaces those killed by the wind farm.

71 My other concern relating to the offset mitigation suggested in proposed condition 6.17 e) is that the annual payment of $17000 combines resident birds and migratory birds together. This presumably reflects the lack of a quantitative assessment of the numbers of individuals of the species in both of these groups and leads to an inability to objectively match mitigation quantum to effect.

72 In addition, this approach attempts to mitigate for effects to both groups for not only collision risk but also the effects of habitat loss. As such, this approach does not allow for a close matching of mitigation with effect. In my view, offset mitigation for habitat loss should be provided for in a manner that clearly separates it from collision effects because the processes leading to those effects and impacts on bird populations are different.

73 In addition, offset mitigation for collision mortality for resident birds and migratory birds should be provided for individually, because the type of management required to offset deaths from both groups will differ in design and where it occurs, i.e., replacement of residents may occur within the HMR site while if mitigation off-site were adopted in this case, most migrants breed in the South Island and management for replacement would need to occur there.

74 I consider that a more robust approach is for the quantum of any offset mitigation to be based on collision risk modelling estimates of mortality, together with an appropriate consideration for species not modelled, and it should be responsive to the results of ongoing robust collision monitoring.

CONCLUSIONS

75 Construction of this wind farm will result in the loss of habitat for invertebrates, herpetofauna and resident birds.

76 The magnitude of habitat loss, and therefore the level of appropriate mitigation, cannot be accurately quantified at this point, because of the broad "consent area" approach in the applications, and discrepancies and other issues with the assessments of effects on behalf of the applicant. .

77 Should the Board feel minded to grant this approvals sought in this case, I have set out below concepts that, in my opinion, should be included in any conditions package to address potential effects on these fauna groups:

(a) , robust pre-construction survey;

(b) relocation of threatened invertebrates and protected herpetofauna, and

(c) predator control within appropriate habitat

(d) robust outcome monitoring. .

78 I agree with the applicant's experts that transmission lines passing over bush or wetlands pose a collision risk, and support the proposed installation of bird diverters on these lines. However, I consider that these diverters should also be placed along a buffer either side of these habitats.

79 I support the intention in many of the conditions proposed on behalf of the application, including in particular the proposal to set up an Expert Peer Review Panel which should have the ability to make recommendation to the councils in terms of its role that would need to be clearly set out in the conditions. I consider it highly desirable DOC have direct input into defining the functions and establishing the panel. I also have set out suggestions for improving those conditions, above.

80 I support Dr Seaton's recommendations for addressing impacts on nesting NZ falcon and suggest that they be adopted along with a condition to include all of Te Tehe Bush within the survey area and a provision to restrict construction within 400 m of a nest if disturbance is occurring.

81 I also recommend that any further monitoring of Tui and Kereru be done in a manner that collects appropriate data to allow collision rates to be modelled.

82 Finally, I consider that the quantum of any offset mitigation for resident birds should reflect the results of collision risk modelling, and also taking into account consideration for birds not modelled. I also consider that robust collision monitoring should occur post-construction, and that provision for changes to imposed mitigation requirements be included in the conditions, to ensure that the measures required to address adverse effects of the project are appropriate and in line with measured results.

Dr. Laurence Barea
27 March 2009

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ATTACHMENTS TO EVIDENCE IN CHIEF OF LAURENCE PETER BAREA

Exhibit LPB1 – Mollusc records from within the HMR study site contained within the DOC Bioweb database.

Genus	Species	Place	Mapsheet	Easting	Northing	Sighted
Cavellia	*buccinella*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Cavellia	*buccinella*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Charopa	*goulstonei*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Dorilaoma	*ariel*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Haurakora	*corrugata*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Huonodon	*hectori*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Insullaoma	*elaiodes*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Insullaoma	*elaiodes*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Insullaoma	*elaiodes*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Laoma	*marina*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Liarea	*hochstetteri carinella*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Litopunctum	*ordinarium*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Microbrunnea	*minuta*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Microbrunnea	*minuta*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Mocella	*eta*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Paracharopa	*chrysaugela*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Phenacohelix	*giveni*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Phenacohelix	*giveni*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Phenacohelix	*giveni*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Phenacohelix	*pilula*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Phenacohelix	*ponsonbyi*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Phrixgnathus	*erigone*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Phrixgnathus	*erigone*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Phrixgnathus	*erigone*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Poripotaka	*poecilosticta*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Poripotaka	*poecilosticta*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Rengakora	*rimutaka*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Rohapapa	*arboreus*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Rohapapa	*moellendorffi*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Sericoconcha	*conella*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Sericoconcha	*fulgurata*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Sericoconcha	*fulgurata*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Serratopunctum	*serratocostata*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Sinploya	*cf pilsbryi*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197
Sinploya	*pilsbryi*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Therasiella	*celinde*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Therasiella	*cf neozelanica*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Therasiella	*neozelanica*	County Reserve, Waikawau	R13	2665600	6414300	1/11/197
Therasiella	*tamora*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Tubuaia	*novoseelandica*	Huriwai, Waikato	R13	2662800	6416300	1/01/198
Tubuaia	*novoseelandica*	Opposite County Reserve, Waikawau	R13	2665500	6414200	1/06/197

Exhibit LPB2 – Heretofauna records from within the HMR study site contained within the DOC herpetofauna database.

ScientificName	ObservationDate	Location	MapSheetNo	MetricEasting	MetricNorthi
Cyclodina aenea	8-Jan-82	Waikorea Road	R13	2674178	6404530
Naultinus elegans elegans	1-Apr-69	Te Akau, 35 km NW Hamilton	R14	2673000	6389000