

**In the Environment Court
I Mua I Te Kōti Taiao O Aotearoa**

Under the Resource Management Act 1991 (**RMA**)

and in the matter of the direct referral of an application for resource consents by
Meridian Energy Limited in respect of the proposed Mt Munro wind farm under section
87G of the Resource Management Act 1991

Meridian Energy Limited
Applicant

and

**Tararua District Council, Masterton District Council, Manawatū-
Whanganui Regional Council and Greater Wellington Regional Council
(Councils)**
Consent Authorities

and

s 274 Parties

**Statement of Evidence of Leigh Sandra Bull on behalf of Meridian Energy
Limited**

24 May 2024

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INTRODUCTION

1. My name is Leigh Sandra Bull, and I am a director at BlueGreen Ecology Limited (**BlueGreen**).
2. I hold the qualifications of Bachelor of Science (Zoology), Master of Science with Honours (Ecology) and PhD (Ecology) from Victoria University of Wellington. My area of specialisation is ornithology.
3. After completing my PhD in 2003, I worked for the Department of Conservation (**DOC**) in the Biodiversity Recovery Unit as a Species Protection Officer and later as a Senior Technical Support Officer in the Marine Conservation Unit.
4. In 2005, I was awarded a French Ministry of Research post-doctorate fellowship at the Université Paris Sud XI. After completing my post-doctorate, I contracted to the National Institute of Water and Atmospheric Research Limited (**NIWA**) to undertake seabird field investigations on Antipodes Island.
5. I joined Boffa Miskell Ltd (**BML**) in 2007 where I worked on a variety of projects investigating the potential impact of developments on avifauna. In 2023 I established BlueGreen where I have continued to undertake ecological impact assessments.
6. Of particular relevance to these proceedings is my extensive experience working at other wind farm developments. To date, in addition to working on this project, I have been the avifauna expert advising on the development of nine wind farms in New Zealand (Brooklyn, West Wind, Te Uku, Mill Creek, Central Wind, Titiokura and Hawkes Bay (now combined and known as Harapaki), Waipipi and Te Apiti). For such projects this involves collecting and analysing data on avifauna habitats, populations and movements across the wind farm sites and wider landscape in order to understand the avifauna collision risks. My involvement in these projects has included work during the consenting, construction and operational phases of the wind farms.
7. I note that while discussed later in my evidence, the results of the post-construction mortality monitoring that has been undertaken several

New Zealand wind farms that I have been involved with, validate the earlier avifauna assessments both in terms of species and mortality levels. I have also worked for Hurunui and Waitomo District Councils advising on the Mt Cass and Taumatotara wind farms respectively in the capacity of a Council reviewer. With regards to the Mt Cass wind farm, this role involved reviewing the avifauna monitoring section of the Environmental Management Plan. For the Tauamatatotara wind farm, I reviewed the ecological assessment for the proposed variation, identified further information required through the section 92 process, prepared expert ecological evidence and appeared at the Council Hearing. The application to vary consents was granted for that Project, and I am now engaged by Waitomo District Council to continue in a review role for the avifauna and bat monitoring plans that are required by the updated set of consent conditions.

8. In addition to the above projects:
 - (a) I have been involved in avifauna investigations at several other confidential wind farm sites; and
 - (b) I was the lead author of a scientific journal article¹ which was the first published record of post-construction avifauna monitoring at a New Zealand wind farm site.
9. My professional memberships include:
 - (a) The Environment Institute of Australia and New Zealand; and
 - (b) The New Zealand Ornithological Society.
10. I served in a voluntary role as the Editor of *Notornis*, the Ornithological Society of New Zealand's peer-reviewed scientific journal, from 2016 to 2018.
11. I currently serve in a voluntary role as a subject matter expert to the Shorebirds Trust², a registered charitable trust that invests in scientific

¹ Bull et al. (2013). Post-construction avian mortality monitoring at Project West Wind. *New Zealand Journal of Zoology* 40: 28–46.

² <https://www.shorebirdstrust.org.nz/about-us>

research, and funds and co-ordinates conservation efforts aimed to improve coastal biodiversity.

12. I am a Certified Environmental Practitioner (Ecology Specialist) with the Environment Institute of Australia and New Zealand and am bound by the Institute's code of ethics.
13. I have been engaged by Meridian to provide evidence in relation to its application for consents to construct, operate and maintain the proposed Mt Munro windfarm near Eketahuna (**Mt Munro** or the **Project**).
14. I confirm that Dr Keesing and I reviewed the 'Ecological Assessment'³ Report (**Ecology Report**) for the Mt Munro application which is attached as Appendix C to the Assessment of Effects on the Environment (**AEE**), and that the report identifies all the relevant ecological effects and recommends appropriate conditions to manage these effects.
15. I have also read, and I am familiar with the Long-tailed Bat Impact Assessment (**Bat Report**) which was prepared by Georgia Cummings (bat expert) previously at Tonkin + Taylor, and which is attached as Appendix L to the AEE. I agree with the conclusions and recommendations in that report.

CODE OF CONDUCT

16. I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2023. I agree to comply with this Code of Conduct. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

³ BML (2023). *Mt Munro Wind Farm: Ecological Assessment*. Report prepared by Boffa Miskell Limited for Meridian Energy Ltd.

SCOPE OF EVIDENCE

17. My statement of evidence relates to the ecological values of avifauna and lizards that could potentially be affected by the proposed Mt Munro Wind Farm. Dr Keesing will address the vegetation (both terrestrial and wetlands) and aquatic ecology of the wind farm site in his statement.
18. In my evidence I will:
 - (a) Describe the existing terrestrial ecological environment of the proposed Mt Munro site, including its lizards and birds;
 - (b) Explain the methodology used for developing the Assessment of Ecological Effects;
 - (c) Summarise the results of this assessment and the recommended measures to avoid, remedy or mitigate effects;
 - (d) Comment on issues raised by submitters;
 - (e) Respond to issues in the Officer's Report that relate to terrestrial ecology and birds; and
 - (f) Provide a conclusion.

SUMMARY OF EVIDENCE

19. A combination of desktop research and site investigations were undertaken to inform the ecological assessment for the Mt Munro wind farm project.
20. The methods used to undertake this assessment were consistent with published national standard protocols and the EIANZ guidelines for undertaking ecological impact assessments, whereby ecological values are assigned, and the magnitude of effects identified in order to determine the overall potential level of effect of the proposal.
21. The project footprint is contained almost entirely on improved pasture and the land use would continue relatively unchanged by the construction of wind turbines, transmission line and substation.

22. None of the protected natural areas or areas of habitat for indigenous flora and fauna identified within the wider landscape lie beneath or in close proximity to the project footprint, and none will be adversely affected by this proposal.

Lizards

23. The project footprint is contained almost entirely on improved pasture (97%), which is considered to be unsuitable habitat for indigenous herpetofauna species, as it lacks refugia and is frequently disturbed.
24. No lizards were observed in any of the rock outcrops or boulder fields searched on the site, nor were any arboreal lizards seen while spotlighting. However, two skink (likely the northern grass skink) were observed within areas of rank grass/weeds at the western end of the proposed transmission line, at the road margin.
25. These results indicate that the northern grass skink is present on the site in low densities. Given the low detectability of many lizard species, these results do not confirm the absence of other species. They do, however, indicate that any other species present are likely to be in very low/undetectable densities, and the general lack of suitable habitat on the site further reduces the likelihood of their presence.
26. The scale of potential clearance of potential lizard habitats on the site is low relative to available surrounding habitat. If any sensitive or rare species are present within the proposed footprint, they likely would be in very low numbers and would not constitute a stable population. As such, the overall potential effect of the Mt Munro project on lizards is determined to be **Very Low**.
27. Regardless of level of effect, all native lizards are protected under the Wildlife Act 1953, and disturbance of potential populations cannot be carried out without a Wildlife Act Authorisation (WAA) from the Department of Conservation. WAAs require some form of lizard management (e.g. lizard salvage and/or sensitive clearance methods), which will further minimise any effects to lizards.

Avifauna

28. A total of 23 species were recorded on the wind farm site, comprising 12 introduced and 11 native species. The native species included one *Threatened* species (bush falcon) and one *At Risk* species (New Zealand pipit). The most common species observed during the wind farm point count surveys on the wind farm were introduced starling and magpie, which made up 73% of all observations.
29. Due to the proximity of the proposed transmission line relative to Mt Bruce forest, flight path monitoring was undertaken for bush falcon, kaka and kereru.
30. The effects of habitat loss, disturbance and collision with structures (e.g. turbines and transmission line infrastructure) were assessed for native species (including *Threatened* and *At Risk*). The outcome of this assessment is that the potential effects of the Mt Munro wind farm project on Avifauna will be **Low to Very Low**.
31. While these levels of effect do not warrant mitigation or offsetting, it has been recommended that post-construction bird strike monitoring of the wind farm and transmission line be conducted for a period of one year immediately after the wind farm becomes operational. If any mortalities of *At Risk* or *Threatened* species are detected, a review will be undertaken to determine if further monitoring is required, and whether any remedial, mitigation or offsetting actions need to be implemented.

Conclusions

32. A number of submissions raised general concerns around the potential effects on birds and lizards. Such matters were considered during the ecological assessment and as such my conclusions in respect to the impact on birds and lizards (both direct and indirect) as a result of the wind farm construction and operation have not changed following my reading and consideration of the submissions.

ASSESSMENT METHODOLOGY

33. My involvement with Mt Munro began in 2009 when Meridian engaged BML to undertake an ecological assessment of a previous wind farm

proposal. Between 2010 to 2012 I undertook all the ecological site investigations (avifauna, vegetation, freshwater) on Mt Munro and prepared the Ecological Impact Assessment⁴ which accompanied the resource consent application for the previous Mt Munro project.

34. In 2021, Meridian engaged BML to undertake an ecological assessment of the current wind farm proposal. At that time my role on this project was as ecology project manager, and I was responsible for developing the avifauna surveys methods. The evidence I am presenting draws upon, and summarises the results of the field investigations and analyses undertaken by the following people:
- (a) Karin Sievwright, Boffa Miskell ornithologist; and
 - (b) Amanda Healy, Boffa Miskell herpetologist.
35. Since 2010 I have undertaken an estimated 25 site visits to the Mt Munro site; the most recent being in June 2023 with ecological representatives from DOC (16/6/23) and Council (23/6/23).
36. Over the course of my site visits I have viewed the envelope, all access and internal roading, substation locations, laydown areas and transmission line route.

Bird Survey Methodology

37. The bird survey methodology is described in detail in Section 3.5 of the Ecology Report and included desktop and field investigations (monitoring locations shown in Map 6 of the Ecology Report).
38. Point count surveys on the wind farm and flight path monitoring (falcon, kereru and kaka) along the transmission line were undertaken for the previous (2010-2012) wind farm assessment and were repeated in 2021-2022 for the current proposal. Each survey was conducted over the course of a year to account for seasonal variability.

⁴ BML (2011). *Mt Munro wind farm project: Ecological values and effects assessment*. Report W09156_003 prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Lizard Survey Methodology

- 39. The lizard survey methodology is described in detail in Section 3.3 of the Ecology Report and included both desktop and field investigations.
- 40. The field investigations included the use of artificial cover objects (ACOs), spotlighting and manual searches of limestone outcrops, debris and rock piles (survey locations shown in Map 4 of the Ecology Report).
- 41. Field surveys were conducted over late spring and summer 2021/22 as these are the times when lizards are most active and therefore increases the chances of them being detected.

Assessing Potential Effects

- 42. The level of the Project's potential adverse effects on ecological values was determined following the Environment Institute of Australia and New Zealand (EIANZ) impact assessment guidelines⁵, which uses an assessment matrix (refer to Table 10 in Appendix 1) that incorporates ecological value (Table 11 in Appendix 1) and effect magnitude (Table 12 in Appendix 1). For the purpose of this assessment, a species rather than habitat focus was taken, and as such the population criteria (text italicised and bolded in Table 12) has been applied for the assessment of effects.

DESCRIPTION OF THE EXISTING ECOLOGICAL ENVIRONMENT

- 43. The existing environment of the project site and of the wider landscape is discussed in detail in Sections 4 and 5 of the Ecology Report. I will now summarise the ecological values of the study area that are relevant to my assessment.

⁵ Roper-Lindsay et al. (2018). *Ecological impact assessment (EcIA). EIANZ guidelines for use in New Zealand: Terrestrial and freshwater ecosystems* (2nd ed.). Environment Institute of Australia and New Zealand.

Significant and Protected Ecological Sites

44. The project footprint itself does not contain any protected areas, nor any land administered or owned by DOC (refer to Map 7 in the Ecology Report).
45. The WA Miller Scenic Reserve, located along State Highway 2, is situated to the west-southwest of the wind farm site and 1.5 km north of Mt Bruce (refer to Map 7 in the Ecology Report). The reserve contains remnant miro/totara/matai/tawa forest which provides habitat and feeding resources for native avifauna species occurring both within the Mt Bruce forest block and the Tararua Forest Park.
46. Pūkaha, Mt Bruce, is the only DOC administered reserve within close proximity to the Mt Munro site (refer to Map 7 in the Ecology Report). The Mt Bruce forest block provides habitat and feeding resources for a variety of native birds. Since 1996, kaka, kiwi and kōkako have been released into the forest as part of the Pūkaha, Mount Bruce Restoration.
47. At its closest, the Tararua Forest Park is located approximately 6 km to the west of the Mt Munro site (refer to Map 7 in the Ecology Report). The Forest Park is an area of almost continuous forest and provides habitat and feeding resources for a number of native avifauna species.

Ecological Context

48. The majority of the wind farm site is actively farmed and grazed with improved pasture, and remaining patches of scrub, forest fragment and ornamental garden. Within the Turbine Envelope and Turbine Exclusion Zones, the vast majority (estimated over 97%) of land cover is improved pasture (refer to Map 9 and Section 5.1 of the Ecology Assessment). The Transmission Line and Substation Areas are also primarily pasture.
49. There are a small number of regenerating woodlands (often referred to as shrublands) remaining in some of the gullies outside of the development footprint.

50. There are no significant areas of terrestrial vegetation or habitats of indigenous terrestrial fauna within the project site.

Lizards

51. The DOC Herpetofauna database (BioWeb) held records for six species of lizard within 20 km of the site, five of which could potentially be present within the project footprint (Table 1).

Table 1: The native lizard species recorded as being present within 20 km of the proposed wind farm.

COMMON NAME	SCIENTIFIC NAME	THREAT STATUS ⁶
Northern grass skink	<i>Oligosoma polychroma</i>	<i>Not Threatened</i>
Copper skink	<i>Oligosoma aeneum</i>	<i>At Risk - Declining</i>
Ornate skink	<i>Oligosoma ornatum</i>	<i>At Risk - Declining</i>
Barking gecko	<i>Naultinus punctatus</i>	<i>At Risk - Declining</i>
Raukawa gecko	<i>Woodworthia maculatus</i>	<i>Not Threatened</i>

52. Approximately 92% of the wind farm site and 97% of the Turbine Envelope, Turbine Exclusion Zones, transmission line and substation area (i.e. the potential footprint) is improved grazed pasture (refer to Map 19 of the Ecology Report) which is considered to be unsuitable habitat for indigenous herpetofauna species, as it lacks refugia and is frequently disturbed.
53. The potential herpetofauna habitats present within the site include rank grass/weedlands, indigenous shrublands/forests, rock outcrops, and boulder/debris fields.
54. No lizards were observed in any of the rock outcrops or boulder fields searched on the site, nor were any arboreal lizards seen while spotlighting.
55. Rank grass/weedlands provide habitat for terrestrial skink species. As such, these areas were targeted during ACO surveys where they fall within the potential project footprint and are present at the western end of the transmission line (at the Kaiparoro Road margin) and the edges of the ornamental garden to the north-west of the site (refer to Map 19

⁶ Hitchmough et al. (2021). Conservation status of New Zealand reptiles, 2021. *New Zealand Threat Classification Series No. 35*. Department of Conservation.

of the Ecology Report). Two skink (likely the northern grass skink, *Oligosoma polychroma*) were observed within areas of rank grass/weeds at the western end of the proposed transmission line, at the road margin (refer to Map 19 of the Ecology Report).

56. These results indicate that the northern grass skink (classified as Not Threatened⁶) is present on the site in low densities. Given the low detectability of many lizard species, these results do not confirm the absence of other species listed in Table 1 above. They do, however, indicate that any other species present are likely to be in very low/undetectable densities, and the general lack of suitable habitat on the site further reduces the likelihood of their presence.

Lizard Values

57. There are challenges with confirming the presence or absence of low densities of lizard species; therefore, the Mt Munro habitats have been valued as a proxy (refer to Table 2), based on their likelihood of supporting stable lizard populations (refer to Section 6.4 of Ecology Report for further details).

Table 2: Ecological values assigned to lizard habitat within the Mt Munro project site

LIZARD HABITAT	ECOLOGICAL VALUE
Grazed pasture	Negligible
Rock outcrops and scattered boulderfields ⁷	Negligible
Regenerating native scrub	Low
Ornamental garden (north-west)	Low
Road margin rank grasslands/weedlands	Low-Moderate

Birds

Windfarm Site

58. During the 2021-22 point counts, a total of 23 species were recorded on the wind farm site, comprising 12 introduced and 11 native species (Table 3). The most common species observed during the point count

⁷ These features are heavily embedded on the Mt Munro site and do not provide crevices or spaces in which lizards would usually inhabit.

surveys were introduced starling and magpie, which made up 73% of all observations.

59. Eight species made up 95% of all observations (Table 3); this included only one indigenous species, harrier hawk, which contributed 4.9% of all observations. In total, indigenous species made up only 7.8% of all observations on the wind farm site. The avifauna assemblage observed is typical of a landscape dominated by pastureland with areas of scattered indigenous revegetation.
60. The native species included one *Threatened* species (bush falcon) one *At Risk* species (New Zealand pipit), whereby five (0.17% of all point counts) and 16 observations (0.54% of all point counts) were recorded respectively (Table 3).

Table 3: Abundance of individual species observed during point counts conducted at the Mt Munro wind farm site 2021-2022

SPECIES	THREAT STATUS ⁸	TOTAL OBS	%	50%	75%	90%	95%
Starling	Introduced	1523	51.45				
Magpie	Introduced	654	22.09				
Goldfinch	Introduced	185	6.25				
Harrier	Not Threatened	145	4.90				
Greenfinch	Introduced	114	3.85				
Skylark	Introduced	87	2.94				
Rook	Introduced	70	2.36				
Yellowhammer	Introduced	38	1.28				
Black-backed gull	Not Threatened	26	0.88				
Finch sp.	Introduced	24	0.81				
Chaffinch	Introduced	17	0.57				
New Zealand pipit	At Risk - Declining	16	0.54				
Welcome swallow	Not Threatened	16	0.54				
Rock Pigeon	Introduced	11	0.37				
Kereru	Not Threatened	7	0.24				
Bush falcon	Threatened - Nationally Increasing	5	0.17				
Paradise shelduck	Not Threatened	5	0.17				
Song thrush	Introduced	5	0.17				
Spur-winged plover	Not Threatened	4	0.14				
Grey warbler	Not Threatened	2	0.07				
Silvereye	Not Threatened	2	0.07				

⁸ Robertson et al. (2021). Conservation status of birds in Aotearoa New Zealand, 2021 (New Zealand Threat Classification Series No. 36). Department of Conservation.

SPECIES	THREAT STATUS ⁸	TOTAL OBS	%	50%	75%	90%	95%
Blackbird	Introduced	2	0.07				
Shining cuckoo	Not Threatened	1	0.03				
House sparrow	Introduced	1	0.03				
Total		2960	100				

61. The bush falcon observations were all single birds. Four of the observations were of falcon traversing across site and the fifth observation was of a bird feeding in the air.
62. The pipit observations were made in five of the survey months and across site in grassland habitat. Behaviours observed include traverses, departures, arrivals, short flights and feeding on the ground.
63. The highest total number of birds recorded was at PC4, with a total of 679 birds observed, and the lowest number of birds was recorded at PC3, with a total of 175 birds observed (Figure 1).

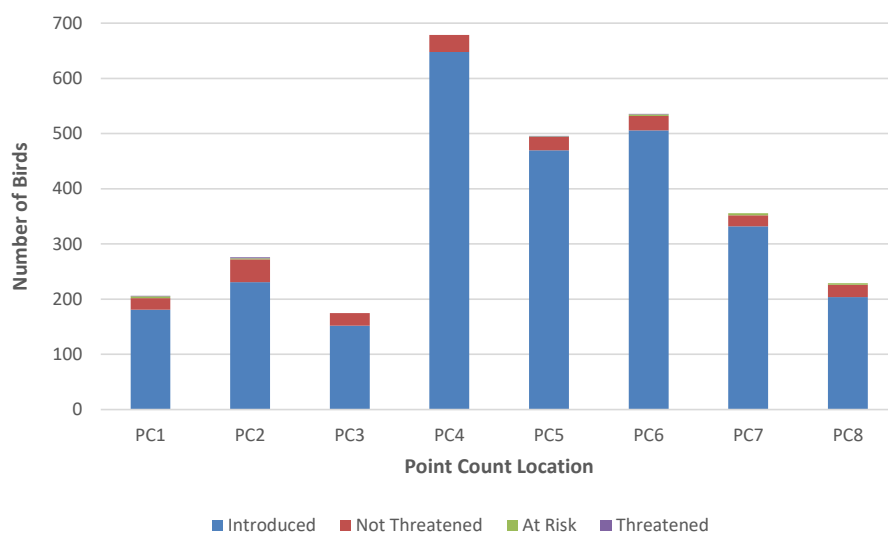


Figure 1: Total number of birds observed at each point count location⁹ during the 2021-2022 wind farm point count surveys.

64. The flight heights of native birds observed during the wind farm point count surveys are presented in Table 4 in relation to the zone within which the turbine rotors move (i.e. the zone within which birds are at risk from bird strike). This zone is typically called the Rotor Swept Area

⁹ Monitoring locations shown in Map 6 of the Ecology Report

(RSA). Typically for analysis of flight risk this zone is widened slightly to account for observer inaccuracies when estimating flight heights.

65. For this project, flight risk for both the true RSA (between 24-160 m at a relative height above the height of the observer) and the widened RSA (between 20-170 m) was considered.
66. With regard to *Not Threatened* species observed on site, black-backed gulls, harrier hawk and paradise shelduck are most at risk of strike (Table 4).
67. With regard to *Threatened* and *At Risk* species, all falcon observations were at a height that may potentially put them at risk of strike, whereas no New Zealand pipit flight observations were within the risk zone for the RSA and only 13% (two observations) were within the risk zone for the widened RSA. Of note is that these two New Zealand pipit observations within the risk zone for the widened RSA had a maximum flight height of 20 m so were right on the minimum threshold of the risk zone (20-170 m).

Table 4: Native bird observations in relation to the rotor swept area (RSA, 24-160 m) and the widened RSA (20-170 m; widened to account for observer inaccuracies when estimating flight heights) during the fixed point-fixed period counts conducted in 2021-2022 at the proposed Mt Munro wind farm location

SPECIES	THREAT STATUS ⁸	TOTAL COUNT	TOTAL COUNT WITHIN RSA	% WITHIN RSA	TOTAL COUNT WITHIN WIDENED RSA	% WITHIN WIDENED RSA
Bush falcon	Threatened	5	5	100%	5	100%
NZ pipit	At Risk	16	0	0%	2	13%
Black-backed gull	Not Threatened	26	21	81%	21	81%
Harrier hawk	Not Threatened	145	92	63%	95	66%
Paradise shelduck	Not Threatened	5	3	60%	3	60%
Welcome swallow	Not Threatened	16	5	31%	5	31%
Kereru	Not Threatened	7	2	29%	2	29%
Spur-winged plover	Not Threatened	1	0	0%	0	0%

Transmission Line

68. In total, 200 observations were made of the three target species during the 2021-2022 transmission line surveys, comprising 168 kereru, 21 falcon and 11 kaka (Figure 2).

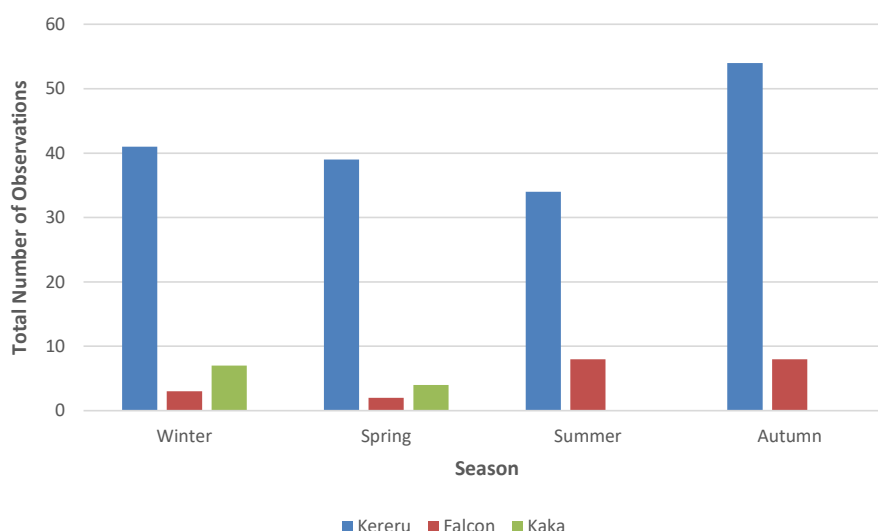


Figure 2: Seasonal records of NZ falcon, kereru and kaka during the Mt Munro transmission line monitoring

69. The main observed flight paths were short flights within the Mt Bruce forest block and traverses between this habitat and small, nearby fragments of vegetation in the surrounding landscape, such as the WA Miller Scenic Reserve north of SH1 and native and exotic vegetation along the riparian edge of Bruce Stream (refer to Maps 20-22 of the Ecology Report).
70. Ten percent (n=20) of the flight observations (comprising 10 falcon and 10 kereru) crossed the route of the proposed transmission line. Twelve of these observations were at a height where they may be at risk of collision with the transmission line (seven kereru and five falcon; this represents 4.2% and 23.8% of all kereru and falcon observations respectively (Figure 3).

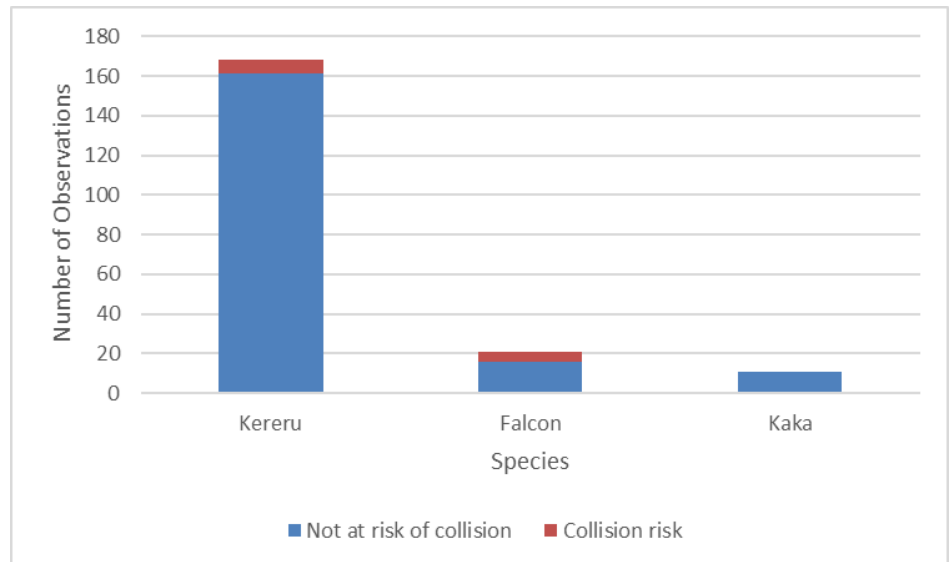


Figure 3: Collision risk for kereru, falcon and kaka observed during the 2021-2022 transmission line surveys at the Mt Munro wind farm site

Avifauna Values

71. The ecological value of avifauna present, or potentially present on site, is presented in Table 5.

Table 5: Ecological value of avifauna species present, or potentially, present on site

SPECIES	THREAT STATUS ⁸	ECOLOGICAL VALUE
Long-tailed cuckoo	Threatened – Nationally Vulnerable	Very High
Bush falcon	Threatened – Nationally Increasing	Very High
New Zealand pipit	At Risk – Declining	High
North Island kaka	At Risk – Recovering	Moderate
Various indigenous species (n=16)	Not Threatened	Low
Various exotic species (n=20)	Introduced	Negligible

PROJECT DESCRIPTION

72. The key components of the proposed wind farm project that have the potential to affect birds and terrestrial ecological values and are of relevance to my evidence are:

- (a) The transportation and erection of up to 20 wind turbines up to 160 m in height;

- (b) Construction of a road network of up to approximately 11.5 km to access the site and the wind turbines;
- (c) Lay-down areas located adjacent to, or separate from, the turbine platforms;
- (d) Earthworks including an estimated fill disposal volume of approximately 1,410,820 m³;
- (e) Fill disposal sites for excess material excavated during formation of access roads and turbine platforms;
- (f) The erection of a permanent wind meteorological monitoring towers up to 92 m in height;
- (g) Construction and operation of site and terminal electricity substations and an operations and maintenance building;
- (h) Placement of a 33 kV overhead transmission line from the proposed site substation to a new terminal substation located alongside the national grid line;
- (i) An underground internal cable reticulation system linking the turbines to the substation;
- (j) A range of temporary construction works and infrastructure including, but not limited to; an onsite project office, lay-down and storage areas, and a concrete batching plant.

ASSESSMENT OF EFFECTS ON ECOLOGICAL VALUES

73. In this part of my evidence I will discuss the potential effects of the construction and operation of the proposed wind farm on the avifauna and lizard ecological values. Where mitigation is recommended, I will also discuss this in relation to each of the potential effects.

Lizards

Potential Construction Effects

74. The areas of the site that are to be potentially affected are dominated by grazed pasture, which is considered to be unsuitable habitat for lizards. The main areas within the potential footprint which may harbour

lizards include the rank grasslands/weedlands at the western end of the transmission line (where two skinks were observed), and potentially the ornamental garden to the northwest of the site (refer to Map 19 of the Ecology Report). It is also possible (though the likelihood is much lower) that the regenerating vegetation that falls within the footprint could have low densities of lizards present.

75. The scale of potential clearance in these habitats is low relative to available surrounding habitat, and it is considered likely that only common and robust species would persist in these areas. Any impact to these species from the proposed works would be very unlikely to have a measurable effect on the wider population. If any sensitive or rare species are present within the proposed footprint, they likely would be in very low numbers and would not constitute a stable population. Overall, the magnitude of effect on lizards is expected to be Low, and the level of effect to be **Very Low**.
76. Regardless of level of effect, all lizards are protected under the Wildlife Act 1953, and disturbance of potential populations cannot be carried out without a Wildlife Act Authorisation from the Department of Conservation. Based on my experience with other projects, I anticipate that a requirement of the permit will be some form of lizard management (e.g. lizard salvage and/or sensitive clearance methods), which will further minimise any effects to lizards.

Potential Operational Effects

77. There are not expected to be any effects from wind farm operation on lizards.

Birds

Potential Construction Effects

Permanent Habitat Loss

78. With respect to the Mt Munro project site, there are three vegetation communities present that variously provide foraging, roosting and breeding habitat for avifauna species in the area: improved

pasture/farmland, wetlands and remnant fragments of indigenous forest/treeland.

79. The majority of the project footprint lies within improved pasture/farmland, a very abundant habitat found throughout New Zealand. The only *Threatened* or *At Risk* species that was recorded on site and which may be reliant on pasture habitat is the New Zealand pipit, which is known to form woven nests under tussocks and grass clumps. However, the grazed nature of the Mt Munro site means that it will provide limited opportunity for nesting pipit. In terms of abundance on site, a total of 16 observations were recorded during the 2021/2022 point count sessions (Table 3 on page 14), with the maximum birds recorded during any one session being three. Based on these low numbers, their ability to disperse elsewhere, and the prevalence of similar habitat nearby, the magnitude of effect on NZ pipit associated with permanent habitat loss from the Mt Munro project will be Negligible (i.e. Having negligible effect on the known population or range of the element/feature). This magnitude of effect, when combined with a High value, will result in a **Very Low** overall effect. We also note for New Zealand pipit, that although some habitat will be lost on site, the construction of gravel roads and infrastructure will create bare patches and/or short sward that will likely provide new habitat suitable for New Zealand pipit.
80. With respect to natural wetlands, the construction will result in the loss of approximately 1.6% of this habitat present within the Turbine Envelope and Turbine Exclusion Zones (refer to Section 8.2.1 of the Ecology Report). The wetland features that will be lost do not have any standing water and are degraded (grazed by stock). The only native bird species observed on site that have freshwater as a primary habitat are pukeko, paradise shelduck and kingfisher (all *Not Threatened* species). These species may occasionally use the wetlands for foraging, but the wetlands do not provide core or seasonal habitat for them. Given that only a small amount of wetland habitat will be lost on site, and that induced gully wetlands are common in the wider landscape, the permanent loss of wetland habitat associated with the project will have a Negligible magnitude of effect on the *Not Threatened* bird species using this habitat type. A Negligible magnitude of effect on

Low value species (*Not Threatened*), results in a **Very Low** overall level of effect.

81. With respect to regenerating shrublands and remnant fragments of indigenous forest/treeland on site, the project footprint will result in the loss of approximately 1.36 ha (refer to Table 11 on page 29 of the Ecology Report). This habitat is used by forest species such as long-tailed cuckoo, grey warbler, silvereye. Given the small quantity that will be lost and that these species are mobile species that can use alternative habitat when lost, the permanent loss of regenerating shrubland and indigenous forest/treeland associated with the project will have a Negligible magnitude of effect on these species. A Negligible magnitude of effect on Low (*Not Threatened*) and Very High (*Threatened*, long-tailed cuckoo) value species, results in **Very Low to Low** overall levels of effect.

Cumulative Effects

82. A further consideration for all species on site for which habitat will be lost, is that the wider surrounding landscape is predominantly pastoral or undeveloped, with the nearest wind farms (Tararua and Te Apiti) sufficiently far enough away (approximately 60 km away) for there to be no cumulative wind farm habitat loss effects to consider.
83. A summary of the potential effects associated with permanent habitat loss for the Mt Munro wind farm on native avifauna is provided in Table 6.

Table 6: Potential ecological effect of habitat loss on native avifauna species within the project area.

SPECIES	ECOLOGICAL VALUE	MAGNITUDE OF EFFECT	LEVEL OF EFFECT
Long-tailed cuckoo	Very High	Negligible	Low
Bush falcon	Very High	n/a	n/a
New Zealand pipit	High	Negligible	Very Low
North Island kaka	Moderate	Negligible	Very Low
Native Not Threatened spp	Low	Negligible	Very Low

84. A long-term study¹⁰ at the White Hill wind farm site recorded two pairs of NZ falcon breeding during the pre-construction, construction and operational phases of the project. Furthermore, monitoring of falcon at the Harapaki wind farm has shown birds remained present on site during the construction of that project.
85. At Mt Munro, a total of 26 falcon observations were made on site during the 2021-2022 surveys (during both the point count and transmission line surveys); no breeding pairs were detected. Five of these observations (all of individual birds) were on the wind farm site and the remaining 21 were on the transmission line site (also all individual birds). Based on the findings at White Hill and Harapaki wind farms, and the number of falcon observations recorded at Mt Munro, I consider that falcon will not be displaced by the construction activities associated with the project. As such, the magnitude of effect of construction disturbance will be Negligible for falcon. A Negligible magnitude of effect on a Very High value species results in a **Low** overall level of effect.
86. New Zealand pipit (an At Risk species) was recorded on the wind farm site and may be exposed to disturbance associated with the construction activities. However, based on the low numbers of birds recorded on site, the ability to widely disperse and the presence of similar habitat elsewhere nearby, the magnitude of effect of construction disturbance on this species will be Negligible. A Negligible magnitude of effect on a High value species results in a **Low** overall level of effect.
87. A total of 11 kaka (an At Risk species) were recorded during the transmission line monitoring, with no birds recorded on the wind farm site. As such, given the relatively low level of construction activity associated with the transmission line, and the large range over which kaka disperse, the magnitude of effect of construction disturbance on

¹⁰ BML (2017). *White Hill Wind Farm falcon monitoring: 2005 - 2017* (Report No. C05085). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

this species will be Negligible. A Negligible magnitude of effect on a Moderate value species results in a **Very Low** overall level of effect.

88. The other native bird species on site that may be exposed to construction disturbance are all common Not Threatened species that can occupy alternative habitat in the surrounding landscape if displaced. Displacement, however, is considered unlikely based on the results of two construction and post-construction (i.e. operational) wind farm studies (Te Uku¹¹ and West Wind¹²), whereby variation in post-construction species diversity and abundance (relative to control sites for the Te Uku study and relative to baseline data for the West Wind study) was not attributed to the presence of turbines. Furthermore, given that the project site is a working farm, these species will already be highly tolerant of human activity, vehicles, stock movement, top dressing, dogs and quad bikes/all-terrain vehicles, and so are unlikely to be displaced during construction works. As such the magnitude of effect of construction disturbance on these species will be Negligible. A Negligible magnitude of effect on Low value species results in a **Very Low** overall level of effect.
89. A summary of the potential effects associated with construction disturbance on native avifauna is provided in Table 7.

Table 7: Potential ecological effect of construction disturbance on native avifauna species within the project area

SPECIES	ECOLOGICAL VALUE	MAGNITUDE OF EFFECT	LEVEL OF EFFECT
Long-tailed cuckoo	Very High	n/a	n/a
Bush falcon	Very High	Negligible	Low
New Zealand pipit	High	Negligible	Very Low
North Island kaka	Moderate	Negligible	Very Low
Native Not Threatened species	Low	Negligible	Very Low

¹¹ BML (2014). *Project Te Uku post-construction avifauna & bat Monitoring: Year 3 annual report* (Report A10203_900). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

¹² BML (2013). *West Wind post-construction avifauna monitoring: Year 3 bird activity and mortality results* (Report W05158_100). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Potential Operational Effects – Collisions with Structures

90. The level of effect of turbine collisions with the Mt Munro avifauna assemblage was determined based on the species recorded on site, their behaviours and the incidences of strike recorded at operational wind farms in New Zealand for which such data is publicly available.
91. Post-construction monitoring at Te Apiti, West Wind and Te Uku wind farms have recorded mortalities of 24 species (Table 8).

Table 8: Avifauna species recorded in turbine collisions at three NZ wind farms (Te Apiti, West Wind and Te Uku)

SPECIES	NATIVE OR INTRODUCED	PROPORTION OF RECORDED TURBINE COLLISIONS
Harrier	Native – Not Threatened	23%
Magpie	Introduced	14%
Skylark	Introduced	8%
Paradise shelduck	Native – Not Threatened	7%
Mallard	Introduced	7%
Chaffinch	Introduced	7%
Black-backed gull	Native – Not Threatened	6%
Goldfinch	Introduced	3%
Yellowhammer	Introduced	3%
Redpoll	Introduced	3%
Finch sp.	Introduced	2%
Silvereye	Native – Not Threatened	2%
Spur-winged plover	Native – Not Threatened	2%
Tui	Native – Not Threatened	2%
Song thrush	Introduced	2%
Starling	Introduced	1%
Greenfinch	Introduced	1%
Welcome swallow	Native – Not Threatened	1%
Dunnock	Introduced	1%
Blackbird	Introduced	1%
Eastern rosella	Introduced	1%
California quail	Introduced	1%
Fairy prion	Native – At Risk	1%
Feral turkey	Introduced	1%

92. In relation to wetland birds, paradise shelduck (*Not Threatened*) is the only species recorded on site that may be at risk from turbine collision; six paradise shelduck carcasses were detected during post-

construction monitoring at West Wind¹². Five paradise shelduck flight observations were made on the Mt Munro site during the point count surveys (Table 4 on page 16), three of which (60%) were within the RSA (i.e. at a height that would potentially put them at risk of collision). This species is widespread and common, and any potential mortality effects associated with the wind farm would not affect local or national populations. As such the magnitude of effect from turbine strike on paradise shelduck will be Negligible. A Negligible magnitude of effect on Low value species results in a **Very Low** overall level of effect.

93. Black-backed gulls (Not Threatened) were observed flying above the ridgelines during the point count surveys conducted on site. Eighty-one percent of the observations made (21 of 26) were within the rotor swept area (Table 4 on page 16). Turbine mortalities of black-backed gull have been recorded at New Zealand wind farm sites (Table 8 above). While black-backed gulls are susceptible to turbine strike, this species is widespread and common, and any potential mortality effects associated with the wind farm would not affect local or national populations. As such the magnitude of effect from turbine strike on black-backed gull will be Negligible. A Negligible magnitude of effect on Low value species results in a **Very Low** overall level of effect.
94. Tui (Not Threatened) and kereru (Not Threatened) conduct aerial displays and travel at height across the landscape between forest patches. These behaviours suggest that unless they learn to avoid turbines they would be at risk from strike. Tui were not observed on site during the point count surveys, but they may occasionally frequent the site. Seven kereru were observed during the point count surveys on the wind farm site, two of which were within the widened (conservative) rotor swept area and as such at a height of potential collision risk. While no kereru have been reported in post-construction mortality studies, very low numbers of tui have been recorded (Table 8 page 25). Both species are classified as Not Threatened, and are relatively common and widespread, and any potential mortality effects associated with the wind farm would not affect local or national populations. As such, the magnitude of effect of bird strike for these species will be Negligible. A Negligible magnitude of effect on Low value species results in a **Very Low** overall level of effect.

95. No kaka were observed on the wind farm site during the point count surveys, however 11 kaka were observed during the transmission line surveys. The flight paths observed were not across the wind farm site (i.e. where the turbines are proposed to be constructed) but south of the transmission line, to and from the Mt Bruce forest block; some movements are likely between the Tararua Ranges and the forest block (refer to Map 22 in the Ecology Report). It is possible that kaka may very occasionally traverse the wind farm, however this is likely to occur infrequently due to the predominantly pastoral nature of the site and lack of suitable native forest habitat (their primary habitat). A study¹³ of avifauna movements across the Zealandia fence line from the bottom of the valley up to the Brooklyn wind turbine recorded high numbers of kaka dispersing at the lower end of the ridgeline and across obvious saddles to an area of tall pines, with very few birds recorded at the top of the ridgeline by the turbine. Such behaviour would suggest that kaka favour moving across vegetated areas than unforested spurs and ridgelines. Based on these factors, the risk of turbine collision by kaka at the Mt Munro wind farm site is considered to be low and that the magnitude of effect of bird strike for kaka is Negligible. A Negligible magnitude of effect on a Moderate value species results in a **Very Low** overall level of effect.
96. With regard to cuckoo species, one shining cuckoo (Not Threatened) was heard (not seen) during the current point count surveys conducted on the wind farm site and one long-tailed cuckoo (Threatened) was observed during the 2010-2012 transmission line surveys (none were recorded during the current surveys). Given that these species are associated with forests and the proposed turbine locations are not close to forest edges, that they have been recorded very rarely on site, and there have been no recorded mortalities of these species during post-construction monitoring (Table 8 page 25), any potential mortality effects associated with the wind farm would not affect local or national populations of these species. As such the magnitude of effect of turbine strike on shining cuckoo and long-tailed cuckoo is considered to be Negligible. A Negligible magnitude of effect on Low (shining cuckoo)

¹³ BML (2012). *Brooklyn turbine replacement: Ecological assessment* (Report No. W12048). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

and Very High (long-tailed cuckoo) value species results in **Very Low** and **Low** overall level of effect respectively.

97. With regard to spur-winged plover, four observations were made during the point count survey. Low numbers of turbine mortalities have been recorded (Table 8 page 25), however, this species is classified as Not Threatened, is widespread and common, and any potential mortality effects associated with the wind farm would not affect local or national populations. As such the magnitude of effect of bird strike for spur-winged plover is considered to be Negligible. A Negligible magnitude of effect on a Low value species results in a **Very Low** overall level of effect.
98. New Zealand falcon, morepork and harrier hawk are considered to be at risk from turbine collision due to their feeding and flight behaviour, whereby they are unable to divide their attention between hunting and scanning the horizon for obstacles. All three species have been recorded on site.
99. In total there were 145 harrier hawk observations during the point count surveys at Mt Munro, 63% of which were within the proposed rotor swept area (RSA). Harrier hawk is the species for which the greatest number of turbine mortalities have been recorded in New Zealand (Table 8 page 25). However, at West Wind wind farm, while harrier hawk was the species for which the most mortalities occurred, the number of harrier observations at West Wind increased by 133% between baseline (pre-construction) and year three post-construction counts. This suggests that the level of mortality that occurred there was not having a negative impact on the local population of the species. Based on these findings, and that fact that the harrier hawk is a Not Threatened, common and widespread species, turbine strike at Mt Munro is likely to occur but will have a Negligible magnitude of effect on the local and national harrier hawk population (i.e. Having negligible effect on the known population or range of the element/feature). A Negligible magnitude of effect on a Low value species results in a **Very Low** overall level of effect.
100. In total there were five falcon observations during the point count surveys conducted on site, all comprising single bird observations. All

of these observations were within the proposed rotor swept area (RSA) and the widened RSA (Table 4 on page 16). There were also 21 falcon observations at the southern end of the site at the Mt Bruce forest block during the transmission line surveys (refer to Map 20 of the Ecology Report). These results indicate that falcon are resident in the landscape encompassing the project site and traverse it at a height that puts them at risk of turbine collision. No nesting behaviour was observed on site. With regard to other projects, during three years of post-construction monitoring conducted at West Wind wind farm no falcon mortalities were recorded¹². At White Hill wind farm, two falcon pairs were recorded on site prior to the development of the wind farm and were recorded successfully inhabiting and breeding at the site during construction and for many years during operation of the wind farm¹⁰. Furthermore, at Te Uku wind farm, no falcon mortalities were reported during post-construction mortality monitoring¹¹. Thus, there have been no records of any New Zealand falcon mortalities at operating wind farms in New Zealand, despite their known presence and the undertaking of post-construction monitoring at these sites. Thus, based on all these factors, and including the low number of individual birds observed on the Mt Munro site (assumed to be a single bird), the likely risk of turbine collision is very low, and if it were to occur would have a Negligible magnitude of effect on falcon. A Negligible magnitude of effect on a Very High value species results in a **Low** overall level of effect.

101. With regard to morepork (Not Threatened), nocturnal surveys were not conducted during the current surveys, however they were detected in forest fragments during the 2010-2012 surveys⁴ and are assumed to still be present on site. Given that morepork are associated with forests and the proposed turbine locations are not close to forest edges, any potential mortality effects associated with the wind farm would not affect local or national populations of these species. Furthermore, there have been no recorded morepork mortalities in post-construction monitoring undertaken at New Zealand wind farms (Table 8 on page 25). As such the magnitude of effect of bird strike for morepork is considered to be Negligible. A Negligible magnitude of effect on a Low value species results in a **Very Low** overall level of effect.

102. Sixteen observations of New Zealand pipit were recorded on the wind farm site, however no flights were observed within the risk zone for the rotor swept area (RSA) and only 13% (two observations) were within the risk zone for the widened RSA (Table 4 on page 16); of note is that these two pipit observations had a maximum flight height of 20 m so were right on the minimum threshold of the risk zone (20-170 m). Furthermore, there have been no recorded pipit mortalities in post-construction monitoring undertaken at New Zealand wind farms (Table 8 on page 25). At West Wind wind farm, although present in reasonable numbers, no pipit mortalities were recorded in three years of post-construction monitoring conducted. Based on these factors, there is a very low risk of turbine collision for pipit during operation of the wind farm. Given the small number of pipit observed on site, if collision were to occur this would not affect local or national populations of this species. As such the magnitude of effect of turbine strike for New Zealand pipit will be Negligible. A Negligible magnitude of effect on a High value species results in a **Very Low** overall level of effect.
103. In addition to the species discussed above, a number of Not Threatened native bird species have been observed on site (e.g. welcome swallow, silvereye, grey warbler, kingfisher, fantail). The risk of turbine collision for these species is low based on their flight patterns and behaviours (low flying and for the forest species, generally short flights within and between vegetation rather than on open ridgelines), their high abundances and Not Threatened conservation statuses. Furthermore, if collisions were to occur, they would not be at a level that would affect local or national populations of these species. As such the magnitude of effect of turbine strike for these native Not Threatened species will be Negligible. A Negligible magnitude of effect on Low value species results in a **Very Low** overall level of effect.
104. In addition to turbines, there is the potential for avifauna to collide with the transmission line and associated structures.
105. During the current transmission line surveys conducted on site, none of the kaka observations, seven of the kereru observations (4.2%) and five of the falcon observations (23.8%) crossed the route of the

proposed transmission line at a height where they may be at risk of collision with the line (refer to Figure 3 on page 18).

106. With regard to kaka (refer to Map 22 of the Ecology Report), the collision risk is likely to be low given that they are forest birds and are unlikely to regularly traverse northeast across the proposed transmission line route to the open, pastoral-dominated landscape of the wider project site. While no observations were made of kaka traversing the proposed transmission line route, if they do make this traverse, collision risk will likely be reduced given that powerlines already exist in the surrounding landscape and birds have habituated to their presence. Based on these factors and the small number of kaka observed in the area, the potential mortality of kaka as a result of collision with the transmission line is low and will have a Negligible magnitude of effect on local and national populations of kaka. A Negligible magnitude of effect on a Moderate value species results in a **Very Low** overall level of effect.
107. With regard to kereru, the majority of flight observations were short flights within, or to and from the Mt Bruce forest complex from nearby bush remnants (refer to Map 21 of the Ecology Report) and few flights (<5%) were at a height that would put them at risk of collision with the proposed transmission line. Based on these factors, the *Not Threatened* conservation status of kereru and that powerlines already exist in the surrounding landscape (and thereby birds have a degree of habituation to these structures), the likelihood of potential mortality of kereru as a result of collision with the Mt Munro transmission line is low and will have a Negligible magnitude of effect on local and national populations. A Negligible magnitude of effect on a Low value species results in a **Very Low** overall level of effect.
108. With regard to falcon, a number of observations were made of birds crossing the transmission line route, but given the large territories of falcon, the observations are likely to have been of a small number of individuals. Although there is potential for collision risk, particularly when falcon prey-fix when hunting, the risk is sufficiently reduced by the presence of powerlines in the existing, wider environment. Falcon in the area will have habituated to their presence and learnt appropriate

avoidance behaviours. Based on these factors, if transmission line collision mortality were to occur, this would have a Negligible magnitude of effect on local and national populations of falcon. A Negligible magnitude of effect on a Very High value species results in a **Low** overall level of effect.

109. A summary of the potential effects on avifauna identified in paragraphs 78 to 108 is provided in Table 9. Overall the level of effects are considered to be Low for bush falcon, long-tailed cuckoo and North Island kaka, and Very Low for all other native species.
110. These levels of effect of the proposal on bird species do not warrant mitigation, however post-construction bird strike monitoring of the wind farm and transmission line should be conducted for one year immediately after the wind farm becomes operational to verify this assessment. If any mortalities of At Risk or Threatened species are detected, a review should then be undertaken to determine if further monitoring is required, and any remedial, mitigation or offsetting actions need to be implemented.

Table 9: Summary of potential construction and operational effects of the project to indigenous avifauna that use, or potentially use the site

SPECIES	ECOLOGICAL VALUE	POTENTIAL OVERALL LEVEL OF EFFECT		
		Habitat Loss	Disturbance	Mortality/Bird Strike
Bush falcon	Very high	Low	Low	Low
Long-tailed cuckoo	Very high	Low	Low	Low
North Island kaka	Moderate	Very low	Very low	Very low
Bellbird	Low	Very low	Very low	Very low
Black-backed gull	Low	Very low	Very low	Very low
Fantail	Low	Very low	Very low	Very low
Grey warbler	Low	Very low	Very low	Very low
Harrier hawk	Low	Very low	Very low	Very low
Kereru	Low	Very low	Very low	Very low
Kingfisher	Low	Very low	Very low	Very low
Morepork	Low	Very low	Very low	Very low
New Zealand pipit	High	Very low	Very low	Very low
Paradise shelduck	Low	Very low	Very low	Very low
Pukeko	Low	Very low	Very low	Very low
Shining cuckoo	Low	Very low	Very low	Very low

SPECIES	ECOLOGICAL VALUE	POTENTIAL OVERALL LEVEL OF EFFECT		
		Habitat Loss	Disturbance	Mortality/Bird Strike
Silvereye	Low	Very low	Very low	Very low
Spur-winged plover	Low	Very low	Very low	Very low
Tui	Low	Very low	Very low	Very low
Welcome swallow	Low	Very low	Very low	Very low
White-faced heron	Low	Very low	Very low	Very low

RESPONSES TO ISSUES IN SUBMISSIONS

111. I have reviewed the submissions received by the Councils on the application which raise issues within my area of expertise.
112. In its summary of submission, Council identified 18 submissions which raised concerns relating to terrestrial ecology. Most of these submissions referred to either generic impacts on ecology or concerns relating generically to discharges of contaminants. The concerns raised can be broadly grouped into the following:
- (a) Discharges of contaminants;
 - (b) Erosion;
113. Impacts on birdlife, including on Pukaha/Mt Bruce;
- (c) Impacts on insect life;
 - (d) Disturbance to wildlife;
 - (e) Increased fire risk.
114. Dr Keesing and Mr Ridley will respond to submissions relating to discharges of contaminants and pollution, and erosion. Dr Keesing will also respond to submissions relating to impacts on insect life. I respond to the remaining submissions that relate to lizards and birds.

Birds

115. A number of submitters (e.g. submitters 5, 17, 24, 33, 47, 57, 58, 61, 68) raised general concerns about the impact of the wind farm turbines on bird life in the area.

116. Based on the avifauna data that was collected for the site in terms of species, behaviours and abundance, the location of the proposed wind farm and knowledge gained from post-construction mortality studies undertaken at New Zealand wind farms, there will be no population level effects on native birds due to the wind farm construction or operation.
117. Submitter 57 raised concerns regarding the loss of habitat for birds. As shown in Map 9 of the Ecology report, the vast majority (~97%) of the habitat to be lost will be improved pasture. Such habitat provides limited value to native birds.
118. Submitter 21 raised concerns about the effects of the red aviation lights. As noted in the evidence of Mr Glen Wright, this type of lighting is a requirement of the Civil Aviation Authority, and it will be the only type of lighting that will be on throughout the night.
119. Effects of lighting have been recorded for seabirds^{14 15 16 17} and migratory shorebirds, neither of which are likely to fly over Mt Munro. Furthermore, both groups of birds are attracted to white lights.
120. Thus, my assessment and conclusions in respect to the impact on birds (both direct and indirect) as a result of the wind farm construction and operation have not changed following my reading and consideration of the submissions.

Lizards

121. Submitter 61 raised concerns around the impact on reptiles (i.e. lizards) that may be in the area.
122. Potential impacts of the project on lizards were considered as outlined in paragraphs 74 to 77 of my evidence. The majority (~97%) of the habitat to be lost is improved pasture, which is unsuitable habitat for

¹⁴ Deppe et al. (2017). Investigation of fallout events in Hutton's shearwaters (*Puffinus huttoni*) associated with artificial lighting. *Notornis* 64: 181-191

¹⁵ Heswall et al. (2023). Why did they die? Analysing the cause of death of grounded seabirds lodged at an avian rescue centre in Auckland, New Zealand. *Notornis* 70:124-134

¹⁶ Rebke et al. (2019). Attraction of nocturnally migrating birds to artificial light: The influence of colour, intensity and blinking mode under different cloud cover conditions. *Biological Conservation* 233: 220-227.

¹⁷ Miles et al. 2010. Effects of artificial lights and moonlight on petrels at St Kilda. *Bird Study* 57: 244-251

indigenous herpetofauna species, as it lacks refugia and is frequently disturbed. The scale of clearance of potential lizard habitat (e.g. rank grasslands/weedlands along the road margin) is low relative to available surrounding habitat.

123. Furthermore, only two lizards were observed during all the site investigations, indicating they are present in only very low numbers. Nevertheless, some form of lizard management (e.g. lizard salvage and/or sensitive clearance methods) has been recommended which will further minimise any effects to lizards.
124. Thus, my conclusions in respect to the impact on lizards as a result of the wind farm construction and operation have not changed following my reading and consideration of this submission.

RESPONSES TO ISSUES IN OFFICER'S REPORT

125. I have reviewed the report prepared by Mr James Lambie (Terrestrial Ecology) with respect to lizards and avifauna, which supports the Section 87F report. I also provide some high level comments on bat matters. Dr Keesing will address the matters relating to wetlands and vulnerable flora in his evidence.
126. While Mr Lambie concludes that the assessment of effects on vulnerable fauna is sound, he identifies several "opportunities to mitigate the effects on lizards and avifauna to ensure that they remain at the low to very low end of the effects spectrum".
127. With regards to lizards, Mr Lambie has recommended, through consent conditions (EC10 – Lizard Management Plan), pre-clearance inspection of the vegetation at the western end of the transmission line along with a lizard transfer protocol should lizards be captured during the pre-clearance survey.
128. Overall, I am supportive of this approach, but do not agree with EC10(f) which specifies the location to which any skink requiring translocation should be taken. Any such translocation site needs to be determined in consultation with iwi and DOC and be approved as part of the Wildlife Act Authorisation (**WAA**) application process.

129. With regards to avifauna, Mr Lambie raises two issues:
- (a) construction management for effects on pipit; and
 - (b) the duration of post-construction monitoring.
130. With regards to pipit, Mr Lambie is of the view that a condition for this species should include pre-clearance checks for nesting pipit if the grass is suitably tall enough. I have reviewed the relevant consent condition (EC8 – New Zealand Pipit) and agree this is appropriate.
131. In terms of the duration of post-construction bird strike monitoring, the Ecological Assessment recommended the wind farm and transmission line should be conducted for one year immediately after the wind farm becomes operational, and that if any mortalities of At Risk or Threatened species were detected during that period, a review would be undertaken to determine if further monitoring is required, and any remedial, mitigation or offsetting actions need to be implemented.
132. On this matter, Mr Lambie is recommending that the monitoring period be increased to 5 years and that an annual reporting requirement be added. Based on the avifauna activity (both species and abundance) that has been recorded at the Mt Munro site through the course of extensive baseline monitoring, evidence of strike rates from other operating wind farm sites (e.g. West Wind, Te Uku, Te Apiti, Waipipi, Brooklyn), and my extensive experience working at such sites, I strongly disagree with this recommendation for 5-years of bird strike monitoring.
133. The level of avifauna activity (both species and abundance) recorded provide no evidence that any population scale effects will occur on any Threatened or At Risk species. Rather, I expect there will be similar mortalities (both species and proportions) of those species listed in Table 8.
134. Thus, my opinion remains that bird strike monitoring of the wind farm and transmission line should be conducted for one year immediately following commissioning of the windfarm, and that if any mortalities of At Risk or Threatened species are detected during that period, a review should be undertaken to determine if further monitoring is required, and

whether any remedial, mitigation or offsetting actions need to be implemented.

135. With respect to bats, I merely note that Mr Lambie had a different opinion to Ms Cummings regarding the use of the EIANZ framework to assess ecological value and level of effect on bats, but Mr Lambie did agree with Ms Cummings on the overall level of effect, and on the mitigation via monitoring (5 years using bioacoustic recorders) and a possible adaptive management approach.

CONCLUSIONS

136. The effects of the Mt Munro wind farm project on avifauna and lizards have been determined to be **Low to Very Low**, based on robust field data sets and industry recognised impact assessment methodology.
137. Where appropriate, conditions are proposed to minimise the actual or potential effects on species, habitats and ecosystems that could not be avoided.
138. With the exception of condition EC10(f), I am supportive of the consent conditions relating to lizards.
139. With regards to avifauna, I am supportive of condition EC8 for the New Zealand Pipit. While I am supportive of the requirement for bird strike monitoring (condition EC 11), it is my opinion that this should be for the duration of one year, not five years, and that if any mortalities of At Risk or Threatened species are detected during that period, a review would be undertaken to determine if further monitoring is required, and whether any remedial, mitigation or offsetting actions need to be implemented.
140. On this basis, I am satisfied that the conditions, as outlined in this evidence, will be sufficient to manage the residual effects during the construction and operation of the Mt Munro Wind Farm.

Leigh Bull

24 May 2024

APPENDIX 1: EIANZ IMPACT ASSESSMENT TABLES (FOR SPECIES)

Table 10: Criteria for describing the level of effect

LEVEL OF EFFECT		ECOLOGICAL AND/OR CONSERVATION VALUE				
		Very High	High	Moderate	Low	Negligible
MAGNITUDE	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Table 11: Criteria for assigning ecological value to species

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Very High	<i>Nationally Threatened</i> (Nationally Critical, Nationally Endangered, Nationally Vulnerable, Nationally Increasing ¹⁸) species found in the ZOI ¹⁹ either permanently or seasonally.
High	Species listed as <i>At Risk – Declining</i> found in the ZOI either permanently or seasonally.
Moderate	Species listed as any other category of <i>At Risk</i> (Recovering, Relict, Naturally Uncommon) found in the ZOI either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
Low	Nationally and locally common indigenous species.
Negligible	Exotic species, including pests, species having recreational value.

¹⁸ Nationally Increasing is category that was devised by DOC (Michel, 2021) in 2021 to resolve a problem that would arise if the population of a taxon assessed as At Risk Recovering A should stabilise. Threatened – Nationally Increasing is assigned to “Small population that have experienced a previous decline (or for which it is uncertain whether it has experienced a previous decline) and that is forecast to increase >10% over the next 10 years or 3 generations, whichever is longer” (Rolfe et al. 2021). Thus, while such a threat category is not identified in Roper-Lindsay et al. (2018), we have included it along with all other *Threatened* classifications in to the Very High ecological value category.

¹⁹ Roper-Lindsay et al. (2018) define the Zone of Influence (ZOI) as “the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities.”

Table 12: Criteria for describing magnitude of effect

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR <i>Loss²⁰ of a very high proportion of the known population or range of the element/feature.</i>
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR <i>Loss²⁰ of a high proportion of the known population or range of the element/feature.</i>
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed; AND/OR <i>Loss of a moderate proportion of the known population or range of the element/feature.</i>
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns; AND/OR <i>Having a minor effect on the known population or range of the element/feature.</i>
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the “no change” situation; AND/OR <i>Having a negligible effect on the known population or range of the element/feature.</i>

²⁰ In the context of mobile fauna, the term “loss” can include displacement from an area.