BEFORE THE COMMISSIONER ON BEHALF OF DUNEDIN CITY COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application for resource consent for a wind farm on Porteous Hill (LUC-2015-469)

BY Blueskin Energy Limited

STATEMENT OF EVIDENCE OF DR RACHEL KATHERINE MCCLELLAN

10 May 2016

Legal Counsel: K Price and S Mutch
ChanceryGreen
P O Box 106 202
Auckland Central 1143

INTRODUCTION

Qualifications and experience

1. My name is Rachel McClellan. I am Senior Ecologist and avifauna specialist at Wildland Consultants Ltd.

2. I completed a PhD at the University of Otago on the ecology and management of the threatened black-billed gull (*Larus bulleri*) in 2009, then commenced employment with Wildland Consultants Ltd in the same year.[1] Since then I have worked on seven wind farm projects in the North and South Islands. As part of these projects I developed and audited bird survey methods, including flight path monitoring and the development of robust bird blade-strike monitoring programmes that met international best practice. I have also worked for Rotorua District Council on potential avifauna interactions with aircraft using Rotorua International Airport, and I recently assisted Christchurch City Council with evidence on bird strike provisions in the Christchurch District Plan in relation to the Christchurch International Airport.

3. I completed an MSc on the breeding biology of flesh-footed shearwater on Karewa Island (Bay of Plenty) in 1996, and subsequently worked as technical support officer and ranger for the Department of Conservation in Northland and in Buller. I have also worked in the UK for Birdlife International, where I researched, wrote, and edited species accounts for a major publication, 'Threatened Species of the World', that was published in 2000.

4. I have considerable experience on braided river bird, seabird and shorebird ecology, including provision of expert advice and evidence on effects of:

    - The Rena wreck on avifauna;
    - A subdivision on Matakana Island on shorebirds;
    - The North Bank Tunnel proposal (Waitaki District) on braided river birds;
    - A subdivision at Kina Peninsula, Tasman Bay, on shorebirds;
    - Ski lane changes at Little Kaiteriteri beach (Tasman District) on blue penguins; and

[1] See Attachment A for a copy of my curriculum vitae.

- Repair of the Avon-Heathcote Estuary seawall on estuarine and shorebirds.

5. I have also undertaken a number of projects involving shorebirds and seabirds, including a review of the Department of Conservation's Fiordland crested penguin (*Eudyptes pachyrhynchus*) monitoring programme; a review of the Yellow-eyed Penguin (*Megadyptes antipodes*) Trust's work on yellow-eyed penguins on Stewart Island; development of avifauna objectives for the Department of Conservation's Dusky Sound Restoration and Conservation plan; and evaluation of the possibilities for reintroduction of seabird species including albatross at Long Point, Catlins. I recently undertook an analysis of population trends of black-billed gulls in the South Island, and coordinated a South Island-wide aerial survey of black-billed gull colonies.

6. I intend to visit the site and/or its surrounds before the hearing. My Dunedin-based Wildland Consultants Ltd colleague, Dr Kelvin Lloyd, attempted – through our clients' lawyers – to organise a visit to the proposed wind farm site on 9 May 2016, but the applicant's lawyers advised that the applicant and the landowner were "unable to give consent to enable access to the property". I lived part-time in Dunedin while completing my PhD, and have some familiarity with the region. I have read the relevant parts of: the application material; submissions; the Planner's Report; and the applicant's evidence.

Code of conduct

7. While the application is not before the Environment Court, I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2014) and I agree to comply with it. In that regard I confirm that this evidence is written within my expertise, except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

EXECUTIVE SUMMARY

8. I consider that the avifauna information provided by the applicant is inadequate for a proposal of the nature and scale of the application. The applicant has provided insufficient information for the potential adverse avifauna effects to be understood and assessed. I consider that there is insufficient evidence to reliably conclude that effects on

birds will be acceptable. Adverse effects cannot be assumed to be no more than minor (as suggested by the applicant). Decision-makers should not rely on assurances (even from experts), in the absence of relevant evidence. In contrast, my evidence below demonstrates that potential adverse effects *could be* significant.

9. Therefore, I consider that the application should be declined for the reasons that: there is insufficient evidence to determine that potential effects will be acceptable; and available evidence provides a reasonable basis to conclude that adverse avifauna effects *could be* significant. In the alternative, if consent is granted, then I consider that the applicant should be required through conditions to undertake detailed pre-construction data collection/analysis, including the potential for meaningful modifications to be required to the proposal (for example turbine layout) if material issues are identified.

SCOPE OF EVIDENCE

10. In my evidence I will address the following:

    (a) The need for baseline avifauna information.

    (b) Information on the birds potentially utilising the site.

    (c) Potential adverse effects on birds as a result of the proposal.

    (d) The applicant's evidence.

    (e) Conclusions.

IS BASELINE PRE-CONSTRUCTION DATA REQUIRED?

11. The authors of the assessment of ecological effects accompanying the application (AEE report) indicate that a single field visit has been undertaken. As such, it is presumed that the report is largely a desktop study, at least in relation to birds. The AEE report clearly admits to the fundamental lack of information on birds, but is inconsistent in its position on whether this level of information is sufficient to proceed with construction. At page 4, paragraph 2, the AEE report states, given usage of the site by indigenous birds is unknown, "...*the precautionary approach would be to monitor bird usage of the site* ***during***

the construction phase" (my emphasis). However, in the conclusion, the report recommends that "...*the precautionary approach is taken of gathering baseline data on bird usage during the* ***pre-construction*** *and/or construction phases*" (my emphasis). Clearly, only collecting data during construction, as opposed to pre-construction and construction, is very different. Pre-construction surveys would provide a baseline of bird activity within the existing habitat which:

(a) Would have the potential to identify bird species using the site that had the potential to be killed by the turbines or other infrastructure at levels that were considered unacceptable.

(b) Could be used to assess future changes in bird use of the site (which may or may not be related to the construction of the wind farm).

(c) Could be used to refine turbine design or layout, which would not be possible once the farm was constructed.

12. Various opinions have been submitted on the appropriateness of this level of data on bird use of the site (in which I include movements through or over the site). In Mr Derek Onley's submission, he recommends one, preferably two years of pre-construction monitoring, at a frequency of at least twice a week. Mr Simon Chapman of Golder Associates (NZ) Ltd undertook a peer review of the applicant's Report for Dunedin City Council, and proposed a condition of consent that would require the applicant to undertake a detailed pre-construction evaluation of the ecological effects on bird populations. This would comprise baseline surveys of local bird populations including migratory birds and migratory routes that may cross the project footprint, at a minimum (Appendix D in the report of Darryl Sycamore, Dunedin City Council Planner). Mr Sycamore takes the view that the stance taken by the applicant's ecologists is too "permissive", but that the peer reviewer's position is too demanding, given the size of the proposed project. Instead, Mr Sycamore suggests a more moderate stance in which conditions are proposed that, in brief, require the applicant to complete an ecological monitoring plan (EMP) that includes only post-construction monitoring as a tool to assess effects.

13. I appreciate that the project footprint and the number of turbines are very small. However, I consider that even a single inappropriately-placed turbine could potentially have significant adverse impacts on local populations of birds. This is primarily because of the

relatively coastal location of the proposed wind farm, and its close proximity to a number of key local bird areas, most notably Blueskin Bay estuary, which supports a significant number of Nationally Threatened and At Risk bird species that migrate.

14. The footprint of the proposed Porteous Hill wind farm is located approximately 2.5 km from the coast, and approximately 2.5 km from Blueskin Bay estuary. This estuary and associated features - such as Warrington Spit, Rabbit Island, and extensive intertidal mudflats - support large numbers of waders and shorebirds which I will discuss further. This coastal location suggests potential for interaction with migrating bird species. A good illustration of this potential is from radar tracking work undertaken for the Hauāuru mā raki (HMR wind farm on the Waikato coast; Figures in Attachment B). Three radar installations were established within approximately 2 km of the coast, and recorded thousands of shorebird tracks during the winter migration (southwards) and the summer migration (northwards). Significantly, tracks were often well inland from the coast, as much as 10 km, and many were within 2.5 km, the distance of the proposed Porteous Hill wind farm site from the east coast. The HMR wind farm has not been built, so its actual effects on avifauna are not known.

15. I have been involved in Environment Court hearings for much larger wind farms and other developments where surveys have recorded the presence of bird species that I did not foresee. For example, surveys at the proposed Hurunui wind farm in North Canterbury (hill slopes in rough pasture at 330-545 m ASL) detected significant numbers of black-fronted tern (*Chlidonias albostriatus*; Threatened-Nationally Endangered[2]) feeding on lizards some 20-30 km from their nearest colonies on the Hurunui River.

16. As such, I have learnt not to assume that ornithological experts can correctly predict species use of certain sites, particularly given how little we know about dispersal and migration of New Zealand's indigenous bird species. For this reason, I think it is important to take a more conservative approach. The effect of bird strike at the proposed Porteous Hill wind farm site on local bird populations should not be assumed to be "minor, at most",[3] given that use of the site is unknown, as the authors correctly state. I discuss what we do and don't know in more detail below.

---

[2] Common names and species names throughout this evidence are as per Robertson H.A., Dowding J.E., Elliott G.P., Hitchmough R.A., Miskelly C.M., O'Donnell C.F.J., Powlesland R.G., Sagar P.M., Scofield R.P. and Taylor G.A. 2013: Conservation status of New Zealand birds, 2012. *New Zealand Threat Classification Series 4*. Department of Conservation, Wellington. 22 p.

[3] Page 3, AEE report, second paragraph.

17. In light of the above, in summary it is my opinion that the applicant has provided insufficient information with the application to enable the potential adverse avifauna effects of the proposal to be appropriately understood and assessed. This is a fundamental flaw in the application. Important further information on the use of the site by birds - particularly migratory species – and on potential adverse effects of the proposal is required. In my opinion such information should have been provided with the application material (as is standard practice), and conditions should not used to retrospectively remedy material defects in the application. However, if consent is granted, at the very least conditions of consent should be imposed requiring detailed monitoring and analysis, with the potential for meaningful changes to be made to turbine layout etc if material issues are identified.

FURTHER INFORMATION ON BIRDS POTENTIALLY USING THE PROPOSED WIND FARM SITE

18. The authors of the AEE report discuss the potential effects of the wind farm in relation to four species only. This is insufficient, and a greater number of species of conservation interest should have been identified as potentially interacting with the proposed wind farm. Furthermore, I disagree with the authors' conclusion regarding one of their four key species, black-billed gull, which I discuss further below.

Wader counts

19. A number of sources of data are available that can assist with determining the species present in the region surrounding Porteous Hill, and also in some cases, their abundances, including seasonal changes. The closest significant bird site to Porteous Hill is Blueskin Bay estuary. Members of Birds New Zealand (Ornithological Society of New Zealand; OSNZ) undertake winter and summer bird counts at the estuary. I have summarised the shorebird results of consistently-reported species in Tables 1 and 2 below from the OSNZ Otago Region Newsletters. Members also count other bird species, but these are not consistently reported, so I have not included them.

20. Numbers of waterbirds consistently recorded at Blueskin Bay are not internationally significant (as per Ramsar Convention criteria for the assessment of internationally significant wetlands). Nevertheless, the estuary is clearly an important regional site for birds, and five of the six bird species listed are either Nationally Threatened or At Risk.

Table 1: November ('summer') counts of shorebirds at Blueskin Bay, 2013-2015 (from OSNZ Otago Regional Newsletters).

Species	Species Name	Threat Classification	2013	2014	2015
South Island pied oystercatcher	*Haematopus finschi*	At Risk-Declining	161	101	140
Variable oystercatcher	*Haematopus unicolor*	At Risk-Recovering	8	2	5
Pied stilt	*Himantopus himantopus leucocephalus*	At Risk-Declining	7	5	11
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened-Vulnerable	0	0	0
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk-Declining	615	250	442
Grey-tailed/Siberian tattler	*Tringa brevipes*	Vagrant	0	0	0

Table 2: July ('winter') counts of shorebirds at Blueskin Bay, 2013-2015 (from OSNZ Otago Regional Newsletters).

Species	Species Name	Threat Classification	2013	2014	2015
South Island pied oystercatcher	*Haematopus finschi*	At Risk-Declining	569	396	257
Variable oystercatcher	*Haematopus unicolor*	At Risk-Recovering	34	6	24
Pied stilt	*Himantopus himantopus leucocephalus*	At Risk-Declining	27	13	19
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened-Vulnerable	80	14	66
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk-Declining	2	4	28
Grey-tailed/Siberian tattler	*Tringa brevipes*	Vagrant	1	0	0

Global eBird database

21. Another source of information is eBird, a real-time, web-based database of world-wide bird observations. It was launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society and now contains over 61 million checklists of birds. A total of 3,148 checklists of birds have been submitted for Dunedin (as of early May 2016). The database clearly has a number of biases. For example, one-off reports are quite likely to be biased towards more 'interesting' species, e.g. falcon versus blackbird. As such, it has its limitations. Nevertheless, it has become an important source of information on the presence, distribution, and sometimes abundance of birds in New Zealand. Table 3 lists some of the species observations held in eBird that were recorded in Blueskin Bay

and around Porteous Hill (within approximately 3 km) in addition to those in Tables 1 and 2.

Table 3: Observations recorded in eBird in the vicinity of Porteous Hill (including Blueskin Bay and Warrington Spit) as of 4 May 2016.

Species	Species Name	Threat Classification	Observation
Black-billed gull	*Larus bulleri*	Threatened-Nationally Critical	At least 7,000 counted in Blueskin Bay in April 2014 (Derek Onley). Regular low numbers on Warrington Spit during non-breeding season
Red-billed gull	*Larus novaehollandiae scopulinus*	Threatened-Nationally Vulnerable	Many recorded observations around Blueskin Bay up to c.100 individuals at a time
Caspian tern	*Hydroprogne caspia*	Threatened-Nationally Vulnerable	Many observations, particularly Warrington Spit, up to 21 individuals
White-fronted tern	*Sterna striata striata*	At Risk-Declining	Many observations around Blueskin Bay, particularly Warrington Spit, up to 200 individuals
Royal spoonbill	*Platalea regia*	At Risk-Naturally Uncommon	Many observations around Blueskin Bay, up to 33 individuals
New Zealand falcon	*Falco novaeseelandiae "eastern"*	At Risk-Recovering	Four observations within c.3 km of the windfarm footprint
South Island rifleman	*Acanthisitta chloris chloris*	Not Threatened	Rare observations, mostly around Evansdale
Brown creeper	*Mohoua novaeseelandiae*	Not Threatened	Rare observations, mostly around Evansdale
South Island tomtit or yellow-breasted tomtit	*Petroica macrocephala macrocephala*	Not Threatened	Rare observations, mostly around Evansdale

22. Table 3 shows that a further six species of Nationally Threatened and At Risk bird species are found around Porteous Hill in addition to the five listed in Tables 1 and 2. Almost all of these species are birds of estuary habitats, illustrating the regional importance of Blueskin Bay estuary. The significant proportion of total individuals of some species regularly present in the estuary during the annual coastal Otago winter and summer wader counts further demonstrate the estuary's importance within the Otago region.

"Beyond Orokonui" bird counts

23. Another more recent source of information is the 'Beyond Orokonui' bird count programme initiated in 2014. The aim of the programme is to enhance indigenous biodiversity within the wider productive landscape where it has been reduced the most, by improving connections between varied and scattered areas of indigenous habitat. (Wildland Consultants 2016)[4]. The project area encompasses 55,000 ha, including Porteous Hill. Within this, a total of 622 different count sites have been established and counts undertaken in spring 2014 and spring 2015, including 17 within approximately 3 km of the Porteous Hill wind farm site.

24. Table 4 shows the first season of results from the Beyond Orokonui programme, and compares results from the 310 ha Orokonui Sanctuary (approximately 9 km from Porteous Hill), and sites within 3 km of Porteous Hill (see Figure 1). I have not carried out an analysis of these results as habitat types within each set of sites are very different from one another[5]. Nevertheless, I have provided the Orokonui counts as a comparison as the predator-free sanctuary is likely to be a key source of birds into the surrounding environment (including Porteous Hill) into the future.

25. The first season has provided interesting preliminary data. Clearly, the Porteous Hill area supports a much greater abundance of introduced bird species, which is likely to be a result of the influence of a greater amount of exotic habitats, as well the influence of surrounding pasture. However, the surrounds of Porteous Hill also appear to support comparable, sometimes higher, abundances of some indigenous species, such as bellbird, fantail, grey warbler, kereru, silvereye, swamp harrier, tui, and welcome swallow. The presence of these species in small habitat remnants in the Porteous Hill area partly demonstrates the ability of many indigenous bird species to disperse across open habitats.

---

4 Wildland Consultants 2016: Habitat relationships of forest birds in a mixed production landscape in east Otago. *Contract Report No. 3412a*. Prepared for Landscape Connections Trust, Dunedin. 58p.

5 The 33 Orokonui sites comprise two count stations in exotic pine forest, while the remainder is in five different indigenous forest types. The 23 'Porteous Hill surrounds' stations include three in pine forest and one in exotic broad-leafed forest, eight in kanuka-dominant treeland and coastal treeland (habitat types not represented within Orokonui), and 11 in three different indigenous forest types.

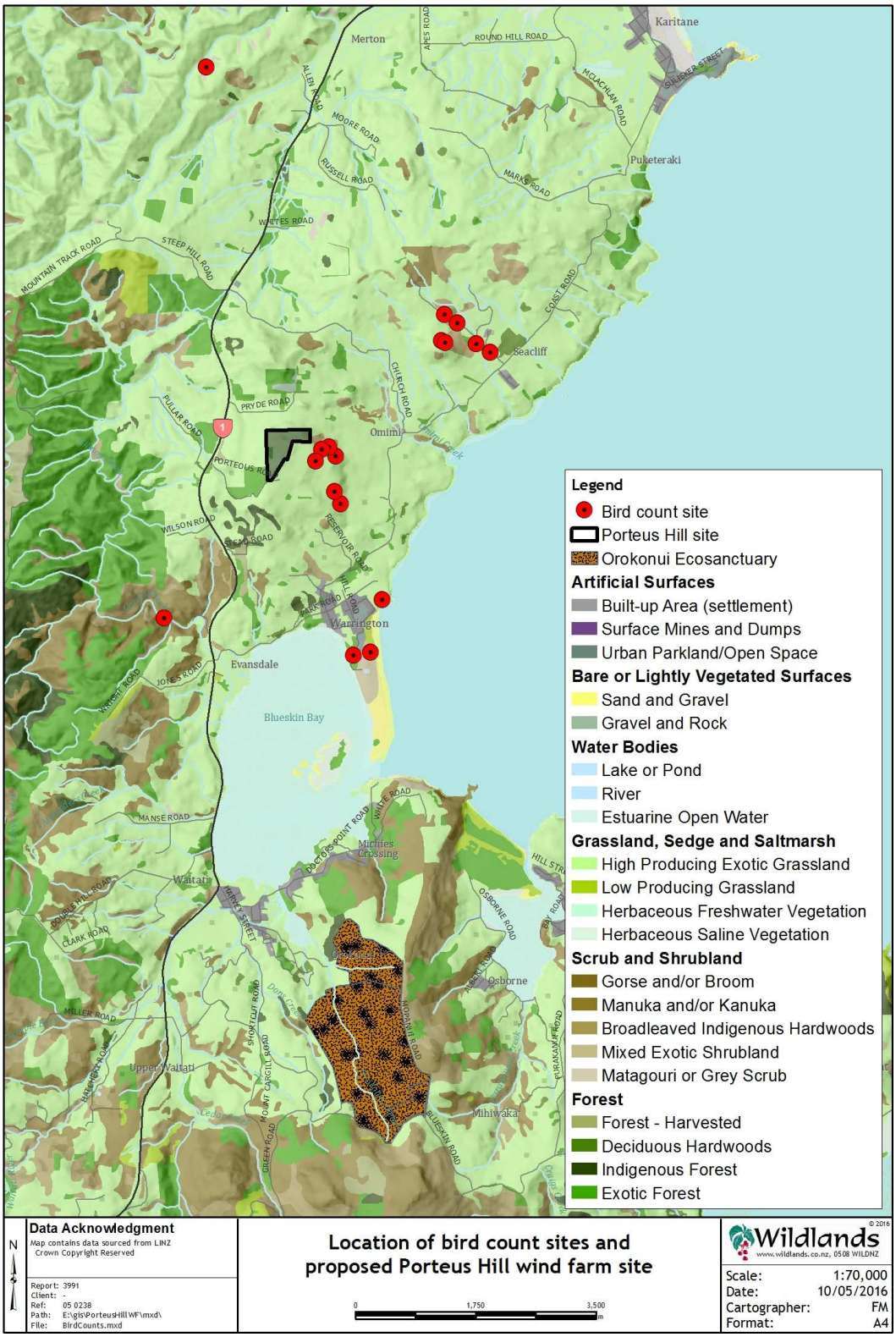


Figure 1: Location of proposed Porteous Hill Wind farm site and bird count stations with habitat types (Land Cover Database v.4.1)

Table 4: Mean bird counts in the Orokonui Sanctuary and within 3 km of Porteous Hill, November-December 2014.

Species	Threat Classification	Mean five-minute bird count	
		Orokonui (33 stations)	Within 3 km of Porteous Hill (17 stations)
Bellbird	Not Threatened	3.18	2.29
Brown creeper	Not Threatened	1.45	0.18
South Island fantail	Not Threatened	0.03	0.12
Grey warbler	Not Threatened	0.42	0.94
Swamp harrier	Not Threatened	0	0.06
Kereru	Not Threatened	0.09	0.29
Paradise shelduck	Not Threatened	0	0.12
Shining cuckoo	Not Threatened	0.12	0
Silvereye	Not Threatened	0.33	2.76
South Island rifleman	Not Threatened	0.15	0
South Island kaka	Threatened-Nationally Vulnerable	0.18	0
South Island robin	Not Threatened	0.30	0
South Island tomtit	Not Threatened	0.79	0.06
Tui	Not Threatened	0.09	0.06
Welcome swallow	Not Threatened	0	0.06
Blackbird	Introduced	0.58	1.12
Chaffinch	Introduced	0.82	1.76
Dunnock	Introduced	0.33	0.53
Greenfinch	Introduced	0.09	0.53
Australian magpie	Introduced	0	0.12
Redpoll	Introduced	0.06	2.06
Rosella	Introduced	0.30	0.35
Song thrush	Introduced	0.09	0.71
Starling	Introduced	0.09	0.06
Yellowhammer	Introduced	0	0.65
Goldfinch	Introduced	0.12	0.13
Skylark	Introduced	0	0.22
House sparrow	Introduced	0	0.04
Rooster	Introduced	0	0.09

POTENTIAL EFFECTS ON BIRDS OF THE PORTEOUS HILL WIND FARM

Black-billed gull

26. The authors of the AEE report indicate that the black-billed gull is classified as "Endangered". In 2013, the species was upgraded to Nationally Critical based on documented catastrophic declines and may be the most rapidly declining bird species in New Zealand. The AEE correctly states that the species' movements between breeding

sites (usually on inland rivers) and coastal non-breeding sites are unknown. However, the AEE then goes on to state that seasonal movements of black-billed gull "*are very unlikely to involve Porteous Hill*". In my opinion, this is a poor conclusion with no basis.

27. The Otago regional breeding population of black-billed gulls is very small compared to neighbouring regions of Southland and Canterbury (based on aerial surveys that I was involved in during the 2014 breeding season). However, a bird that I banded in Southland was later observed in Blueskin Bay by my research assistant, indicating that Southland birds use Blueskin Bay during the non-breeding season. Mr Onley reported observing almost 7,000 black-billed gulls in April 2014 in Blueskin Bay and my Dunedin colleague Dr Kelvin Lloyd reported a large group of black-billed gulls at the entrance to Blueskin Bay in April 2016. The bay may not regularly hold such large numbers of black-billed gulls, nevertheless, it is clearly important to the species in autumn, and birds from regions other than Otago also use it.

28. Black-billed gulls that I banded in Southland have also been observed over-wintering in Kaikoura, Picton and Nelson. However, we simply don't know what inland or coastal routes these birds take to reach their coastal non-breeding sites, how much they move between different coastal sites during the non-breeding months, or how often they move inland to forage on pasture (their key source of food while in breeding colonies in Southland). From my own observations and observations passed on to me from Fish and Game New Zealand staff and farmers in Southland, hundreds and sometimes thousands of individuals crossed ranges of hills from one river to another during the breeding season, and from their breeding colonies to foraging localities on farmland. To assume that black-billed gulls are very unlikely to forage in the vicinity of the proposed Porteous Hill wind farm, or pass through it during migration or to other feeding opportunities, is very risky.

Royal spoonbill

29. Royal spoonbill (At Risk-Naturally Uncommon) was first recorded breeding in 1949 next to the Okarito white heron (kotuku) colony. It is a species on the increase in New Zealand, but still with very low numbers, recognised by its threat ranking. It also appears to be on the increase in the Dunedin region. Its breeding population is thought to number in the low hundreds in the Otago region (157 nests were found during the

2013-2014 breeding season[6]). eBird contains many records, the greatest being 33 individuals in Blueskin Bay. The species feeds day or night when the tide is suitable, and can travel many kilometres to feeding locations. A record of a royal spoonbill with leg bands crash-landing in a wheelie bin in Dunedin city at midnight with a full stomach[7] illustrates their nocturnal 'wanderings'. After breeding, the species disperses across often great distances to overwintering locations at estuaries. Powlesland (2009)[8] states that the flight characteristics of the species and the routes it takes to wintering sites are unknown. If foraging or dispersal routes were to include the location of the proposed wind farm, this would be of significant concern given the small size of the Otago population.

Other migratory species

30. The Blueskin Bay area supports numerous indigenous migratory species in addition to black-billed gull and royal spoonbill: South Island pied oystercatcher, banded dotterel, eastern bar-tailed godwit, red-billed gull, Caspian tern, and white-fronted tern. Black-fronted tern (Threatened-Nationally Endangered) are rarely recorded in Blueskin Bay, but are regularly reported elsewhere along the Dunedin coastline. Some variable oystercatchers also disperse to estuaries after breeding. All of these species are classified as either Nationally Threatened or At Risk. Migratory routes for each are either poorly known or entirely unknown. Some species are thought to be primarily coastal during such movements such as South Island pied oystercatcher. However, HMR wind farm data clearly shows that a significant proportion of the thousands of individual shorebird movements recorded along the Waikato coast, which included those of pied oystercatcher, were actually over land.

31. Four of the species listed above also breed and/or feed in pasture; South Island pied oystercatcher, black-fronted tern, red-billed gull, and black-billed gull. Pied oystercatchers forage on farms around Blueskin Bay. The species also breeds in significant numbers on farmland in eastern Canterbury, but I am not sure of the extent of this habit in Otago. Black-billed gull feeds predominantly on farmland during the Southland breeding season, and may be much more dependent on marine food sources

6 Thompson M. and Schweigman P. 2014: Results of royal spoonbill colony and nest census [New Zealand]. *Birds New Zealand* 3: 13-14.

7 OSNZ 2014: Otago Region Newsletter 1/2014 February 2014.

8 Powlesland R.G. 2009: Bird species of concern at wind farms in New Zealand. *DOC Research & Development Series 317*. Department of Conservation, Wellington. 54p.

during the non-breeding season. Nevertheless, it could potentially feed on farmland around Blueskin Bay including Porteous Hill, as could red-billed gull. A fifth species, variable oystercatcher, may also feed on farmland close to the coast.

32. In my view, there are clearly reasons to consider that any of these migratory species could potentially interact with the proposed wind farm. Whether these effects could be more than minor in respect to local and regional populations is impossible for me (or the applicant) to answer given the lack of data.

Eastern falcon

33. Eastern falcon (Threatened-Nationally Vulnerable) have been reported within a few kilometres of the proposed Porteous Hill wind farm. However, there is no data on their use of the site. It is possible that local falcon use the site for foraging, given the large home ranges of falcon that have been assessed elsewhere (for example, up to 9 km^2 in pine forest). Given likely home range sizes, only small numbers are likely to reside in the greater Dunedin area. Any mortality caused by a wind farm, particularly of adults, therefore has the potential to be significant. In the North and South Islands, several wind farms have been constructed within the home ranges of falcon, even within breeding ranges, but no falcons have been reported killed or injured to date. This suggests that this agile hunter may be capable of avoiding turbine blades.

34. Is this apparent lack of mortality to date sufficient to consider that the potential effects of the Porteous Hill wind farm on eastern falcon at Porteous Hill will be minor or less than minor? The information that no falcons have been killed at other wind farms to date has been provided to me via word of mouth from my colleagues, who have in turn been told this information from others. No monitoring results have yet been published (that I am aware of). I remain unconvinced that falcon using a wind farm will always avoid turbine blades, and suspect climatic and topographical differences between wind farm sites may influence potential mortality rates. However, I recognise that the Porteous Hill wind farm is very small compared to most other consented wind farms, and this should, in theory, significantly reduce the potential risk.

Other species

35. Potential effects of the Porteous Hill wind farm on a number of other indigenous species can be partly assessed by examining data from the consented Castle Hill wind farm in

eastern Wairarapa. Wildland Consultants (including myself) undertook the assessment of environmental effects for this wind farm, which at the time was the largest proposed wind farm in Australasia, covering some 30,000 ha of inland agricultural farmland varying between 200-500 m asl, and comprising almost 300 turbines. Bird count stations (90 stations counted monthly including two summers) and flight path monitoring stations (14 stations, 120 hours of monitoring) were placed on ridgetops near to potential turbine locations.

36. We defined a Potential Rotor Zone (PRZ) as being the area within 60 m either side of a ridge, and 40m or more above the ground (estimated to be the lowest point of a rotor sweep; the highest point was 135-155 m depending on the turbines chosen[9]). Using observations made during flight path monitoring, we calculated the percentage of individuals of each species that flew within the PRZ from all observations recorded of that species. We did not make any assumptions regarding whether species could avoid rotating blades.

37. A number of species stood out as potentially coming into conflict with the turbines:

    (a) Swamp harrier were estimated to fly within the PRZ on 25% of occasions (533 observations in total); 23% for southern black-backed gull (129 observations; Not Threatened); and 18% for tui (112 observations).

    (b) Less affected were kereru at 2% (90 observations) and paradise shelduck at 4% (1,419 observations).

    (c) Species with very low numbers of observations, but very high potential for effects were black shag (44% from 18 observations; At Risk-Naturally Uncommon), little shag (50% from four observations; Not Threatened), and little black shag (67% from three observations; At Risk-Naturally Uncommon).

    (d) New Zealand falcon were not recorded, but had been reported at the site previously.

38. Based on results from Castle Hill, and the five-minute bird counts surrounding Porteous Hill, and from observations recorded on eBird, I would expect some level of mortality of

[9] The maximum size of the proposed turbines at Porteous Hill is evidently 90m to blade tip. The Castle Hill example is still a useful comparison in general terms, however.

swamp harrier, southern black-backed gull, paradise shelduck, tui and kereru due to interactions with the wind farm. Given the small size of the wind farm, however, the overall impact on local populations will be considerably smaller than for a larger farm.

39. All of these species are classified as Not Threatened, and southern black-billed gull are not protected by the Wildlife Act. Nevertheless, tui and kereru are often considered in wind farm applications, partly because of public perceptions of their importance, but also because of the importance of kereru in forest ecology, specifically the dispersal of large-seeded tree species.

40. Castle Hill monitoring recorded no potential conflict for silvereye (182 observations) and welcome swallow (423 observations), although welcome swallow was recorded flying above 40 m on rare occasions (but not near to ridgelines). Very low numbers of fantail, grey warbler, and bellbird were recorded, perhaps demonstrating their tendency to remain within vegetation rather than above canopy or open space (actual abundances within vegetation patches were not assessed).

41. Two of the three shag species recorded at Castle Hill are also known from Blueskin Bay: Black shag (At Risk-Naturally Uncommon) is reported in low numbers on eBird, and little shag is common (Not Threatened). In addition, pied shag (Threatened-Nationally Vulnerable) is also present in low numbers in the Blueskin Bay area. All three may move through the Porteous Hill wind farm, but without any specific data from the proposed wind farm, it is difficult to assess potential effects.

Effects of local site conditions

42. The AEE report provides little information on the weather conditions at the proposed wind farm site, and how these might affect bird use and the potential effects of the turbines on birds. Conditions such as fog, rain and snow reduce visibility for flying birds, and birds will also fly lower in strong winds and low cloud. Migrating birds, particularly nocturnal migrants, can be at risk. The use of lights on turbines and other structures also has the potential to attract birds (review and references in Drewitt and Langston 2008)[10].

[10] Drewitt A.L. and Longston R.H.W. 2008: Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Sciences* 1134: 233-266.

Summary

43. In summary, 16 species of conservation concern have the potential to use the proposed Porteous Hill wind farm. This list comprises 14 species of Nationally Threatened or At Risk species; South Island pied oystercatcher, variable oystercatcher, pied stilt, banded dotterel, eastern bar-tailed godwit, black-billed gull, red-billed gull, black-fronted tern, Caspian tern, white-fronted tern, royal spoonbill, New Zealand falcon, black shag, and pied shag; and two species often considered locally and regionally important, kereru and tui.

EVIDENCE OF DR JOHN CRAIG

44. Dr Craig notes that night migrating birds that are active during the day for all other life cycle stages appear more vulnerable to collision mortality (paragraph 13), and notes that New Zealand passerines do not migrate at night. He does not mention that many long-distant movements of waders are likely to be nocturnal, and nothing is known about their ability to avoid turbines in the dark (Powlesland 2009).

45. Dr Craig states that most New Zealand species do not migrate, and that those that do migrate predominantly do so along coastlines (paragraph 22). In my opinion, this downplays the situation in New Zealand where most of our braided river bird species, wader species, and species such as red-billed gull and black-billed gull migrate, and all of them are classified as either Nationally Threatened or At Risk.

46. He also notes that few New Zealand species migrate seasonally across land (paragraph 14). However, South Island pied oystercatcher have been recorded migrating overland, and the HMR radar data clearly show shorebirds tracking up and down over land close to the coast. Dr Craig states that both long-tailed cuckoo and shining cuckoo are two of the few examples of inland migrants, but notes that there is no evidence that these species migrate above the canopy (paragraph 22). Powlesland (2009) reports that both species are presumed to migrate at night, when most of their calls are heard, but that nothing is known of the altitudes or routes that they take.

47. Dr Craig also asserts that seasonal movement of forest species such as tui, bellbird, fantail, silvereye and kereru is unlikely to be well above the canopy or outside of forest

(paragraph 22). In the following paragraph he then goes on to describe situations when tui and kereru do exactly that. Indeed, kereru and tui will cross open ocean to another foraging site, e.g. Foveaux Strait and Cook Strait. In contrast to Dr Craig's opinions, I believe I have provided reasonable basis for demonstrating that tui are at risk of blade strike, and kereru less so (see my paragraph 37).

48. Dr Craig provides data on bird mortality (paragraphs 25-27). However, he states that theses are largely incidental records. In my opinion, this means that they should be treated with extreme caution. Even post-construction monitoring carried out to international best practice guidelines is fraught: results from monitoring vary significantly despite addressing detection biases (e.g. scavenging of carcasses by other animals, observer error, differences in detection in different habitats, carcasses or injured birds being outside the search area). Huso (2011)[11] reviews results and reports that search intervals vary from 1 to >28 days, the numbers of trial carcasses used to estimate detection rates vary from less than 6 to over 200, estimates of carcass persistence vary from 2-52 days, and the probability of observer detection ranges between 13% and 88%[12] (references in Huso 2011).

49. Dr Craig states that a number of New Zealand wind farms now have systematic mortality searches which show only marginally higher death rates (paragraph 28), but produces no detail or references to support these claims.

50. Dr Craig produces estimates of the numbers of birds that could be killed by the Porteous Hill for tui and kereru (paragraph 37),[13] eastern bar-tailed godwit, and South Island pied oystercatcher (paragraph 40), and black-billed gull (paragraph 41). These estimates are based on three years of intensive survey (involving radar and ground observers) at the proposed HMR wind farm on the Waikato coast (Craig *et al.* 2015)[14]. The estimates are

---

11 Huso M.M.P. 2011: An estimator of wildlife fatality from observed carcasses. *Environmetrics* 22: 318-329.

12 For example, a carcass trial could involve a number of carcasses of one or more different size classes (to represent different sizes of birds that could be killed), placed in random locations within a search quadrat, and then searched for by observers to assess detection rates. A similar trial to assess the rates of scavenging by other birds or terrestrial predators is also undertaken to calculate carcass persistence. Trials can be set up to test differences between seasons, habitats etc.

13 Regarding Dr Craig's comments regarding rates of tui and kereru mortality (paragraph 37), it is unclear on what basis he assumes that local populations around Porteous Hill are 10% of those at the HMR wind farm.

14 Craig J.L, Kessels G., Langlands P., and Daysh S. 2015L Planning for net biodiversity gains: a case study of Hauāuru mā raki wind farm, New Zealand. *Wind and Wildlife* 1: 69-91.

calculated using the so-called Band Model (developed by Bill Band and associates in 2005). The information needed to estimate collision mortality is as follows (Band 2012)[15]:

(a) Information derived from bird survey: flight density, flight height distribution;

(b) Bird behaviour: prediction of likely change of behaviour of birds e.g. in avoiding or being attracted to the wind farm;

(c) Turbine details: physical details on the number, size and rotation speed of turbine blades;

(d) Physical details on bird size and flight speed.

51. It should be clear from the above requirements that using this model is a complex undertaking. The experts involved in the HMR project could not agree on the 'avoidance rate' figure for the four key shorebird species assessed, and three sets of estimates were provided in the final assessment. Chamberlain *et al.* (2006)[16] concluded in their review of collision risk models that "*Even small errors* [in avoidance rate calculations] *can have large effects on predicted mortality rates, such that no matter how robust the estimates of collision risk in the absence of avoiding action, the final predicted mortality is meaningless*". This issue was a major concern for the Board of Inquiry for this case.

52. Considerable work on better estimation of avoidance rates for some overseas species has since been undertaken. Despite this, a recent review of avian collision risk models discusses their limitations, and notes that they tend to assume a great deal about bird movement and behaviour when it is not known (Masden and Cook 2015)[17].

53. Avoidance rates for all New Zealand bird species remain unstudied. I am of the opinion that estimates of collision risk mortality for any New Zealand bird species should be treated with considerable caution.

---

15 Band B. 2012: Using a collision risk model to assess bird collision risks for offshore wind farms. Report to the Crown Estate (Strategic Ornithological Support Services); Project SOSS-02. British Trust for Ornithology, Thetford, UK.

16 Chamberlain, D.E., M.R. Rehfisch, A.D. Fox, M. Desholm, and S. Anthony. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. *Ibis* 148: 198-202.

17 Masden E.A. and A.S.C.P. Cook. 2016: Avian collision risk models for wind energy impact assessments. *Environmental Impact Assessment Review* 56: 43-49.

54. I agree with Dr Craig's summation of the effects of international wind farms on raptors (paragraph 38). I also am aware that a number of wind farms with resident populations of New Zealand falcon are evidently yet to record a death. But as I have discussed, I understand that this information is yet to be published and I do not know what level of post-construction monitoring is in place, so cannot evaluate whether these claims are robust (my paragraph 34)

55. I agree that a minority of eastern bar-tailed godwits and South Island pied oystercatchers will migrate through Otago compared to the numbers present in other parts of New Zealand. Potential mortality rates will therefore be lower at Porteous Hill than at HMR, and overall numbers of dead birds will theoretically be lower again given the much smaller size of the proposed wind farm. However, this ignores potential effects on the local or regional populations of these species, which has the potential to be considerably greater.

56. Dr Craig devotes two lines to the potential effects on the Threatened-Nationally Critical black-billed gull (paragraph 41). He states that modelling from HMR suggests four birds could be killed per century. The North Island population of black-billed gulls is estimated to be approximately 5% of the national total, and numbers observed at HMR will reflect this. In stark contrast, the population of black-billed gulls in Southland, the species' stronghold, is estimated to be approximately 70% of the national total.

57. I completed aerial surveys of all Southland's gravel-bedded rivers and many streams in 2004, 2005 and 2006, and took aerial photographs of all black-billed gull colonies[18]. The highest number of individuals counted in colonies was in 56,000 in 2006. Most of these birds migrate to wintering locations at the end of the season. Considering that a significant proportion of birds would not have been in colonies at the time of the survey (e.g. foraging for food), and that by the end of the season, fledglings would also be present, it is reasonable to assume that many thousands of black-billed gulls disperse northwards. The routes they take are unknown.

58. What we do know is that the black-billed gull population is predicted to decline by 90% in the next 30 years in Southland, based on generalised linear modelling of a dataset going

[18] McClellan R.K. 2009. *Ecology and management of Southland's black-billed gulls*. PhD thesis, Otago University, Dunedin, unpublished.

back to 1977 (Wildland Consultants 2015).[19] We also know that many birds, sometimes thousands, appear in Blueskin Bay. In my opinion, the possibility that black-billed gulls could cross the proposed wind farm site during migration cannot be ruled out. Black-billed gulls may also feed in the pasture. These possibilities need to be further investigated given the potential numbers of individuals involved and the fact that the species threat status is Nationally Critical. A further source of mortality should not be introduced.

59. Dr Craig (paragraph 34) suggests that for small project proposals such as Porteous Hill, extensive data collection should be undertaken only when a site has a high number of Nationally Threatened or At Risk birds that are "of the sort known to be susceptible to blade mortality". By this I believe he means that where we do not have good data on possible interactions of New Zealand species, and the interactions of similar species overseas that are better known can be indicative of potential interactions. We have minimal robust data on the actual interactions of New Zealand species with wind farms, and I would be very cautious about drawing conclusions on potential interactions using 'similar' overseas species.

60. In my evidence I have shown that there are 14 Nationally Threatened or At Risk indigenous species that could potentially come into conflict with the Porteous Hill wind farm. This very high number is due to its coastal location and proximity to a regionally important estuary. I do not believe that Dr Craig has produced robust evidence to show that many of these species will not interact with the wind farm.

CONCLUSIONS

61. Dr Craig and the authors of the original assessment of environmental effects have provided no robust data on the use of the proposed Porteous Hill wind site by any bird species. Their desktop assessments of bird species that use the habitats surrounding Porteous Hill are not thorough, and both make several assumptions regarding potential interactions with the proposed wind farm with little factual basis.

62. In my opinion, this level of information is insufficient, and we cannot assume that the effects of the proposed wind farm will be no more than minor. I have provided an

[19] Wildland Consultants 2015: Population trends of black-billed gulls (*Larus bulleri*) on South Island rivers 1962-2014. *Contract Report No. 3442*. Prepared for Department of Conservation, Christchurch.

extensive list of Nationally Threatened and At Risk species, particularly braided river birds, shorebirds and waders that could potentially interact with the wind farm. We know so little about their movements along the Otago coastline that we cannot rule out potential effects that could be locally or regionally significant.

63. I recognise that the proposed project is small, but small numbers of poorly-placed turbines have the potential to have significant impacts on local and regional populations, particularly extremely rare species such as royal spoonbill. The possibility that the wind farm could further affect the rapidly falling population of black-billed gulls should not be dismissed.

64. I suggest that the application should be declined on the basis that: there is insufficient evidence that the potential effects of the Porteous Hill wind farm will be acceptable for a number of Threatened and At Risk bird species; and in fact my evidence provides a reasonable basis to conclude that adverse effects *could be* significant.

65. If consent is granted, I recommend that the applicant should undertake at least a year of pre-construction monitoring. This was (broadly speaking) also the conclusion of the Council's expert peer review, and was also indicated in the AEE, albeit inconsistently. Monitoring should include, at a minimum, the use of automatic bird recording devices to survey movements over the site, particularly migratory and dispersing birds, including those travelling at night.

66. In the event that the results of this monitoring identify one or more species that may be affected by the wind farm at levels that are considered to be of concern, further monitoring (and design/layout changes) may be required.

Dr Rachel Katherine McClellan

Wildland Consultants Limited

10 May 2016

ATTACHMENT A: SUMMARY OF CURRICULUM VITAE

Rachel is based in the Wellington office of Wildland Consultants Ltd. She has completed a PhD on the ecology and management of the threatened black-billed gull in Southland which included investigating population trends, the impacts of introduced and native predators, the threat of weed infestation on gravel-bedded rivers, and the species' relationship with agricultural ecosystems. She has also completed a Master of Conservation Science, undertaking research on the breeding biology of the flesh-footed shearwater on Karewa Island, Bay of Plenty, and the feasibility of recommencing traditional harvesting.

Since starting with Wildlands in 2009, Rachel has undertaken avifauna work around New Zealand. For example, projects include: assessment of effects of the Rena wreck on avifauna; expert evidence on the effects on shorebirds of a subdivision on Matakana Island, Bay of Plenty; development of ecological significance criteria for indigenous biodiversity in Canterbury; expert evidence on the effects on braided riverbirds of the North Bank Tunnel proposal, Waitaki River; expert evidence on the effects on shorebirds of a subdivision at Kina Peninsula, Tasman Bay; assessment of effects on blue penguins of ski lane changes at Little Kaiteriteri beach, Tasman Bay; avifauna aspects of the Project Janszoon strategic biodiversity plan for Abel Tasman National Park, Tasman Bay; assessment of effects on estuarine and shorebirds of repair of the earthquake-damaged Avon-Heathcote Estuary seawall; review of the Department of Conservation's Fiordland crested penguin monitoring programme; review of the Yellow-eyed Penguin Trust's work on yellow-eyed penguins on Stewart Island; development of avifauna objectives for the Dusky Sound Restoration and Conservation plan; and evaluation of the possibilities for reintroduction of seabird species including albatross at Long Point, Catlins. Rachel is presently undertaking an analysis of population trends of black-billed gulls in the South Island, and coordinating a South Island-wide aerial survey of black-billed gull colonies.

Rachel has also worked extensively on North and South Island wind farm projects, including development of robust bird and bat blade strike monitoring programmes, assessment of impacts of South Island hydropower proposals on avifauna, and preparation of expert evidence on a number of cases including proposed coastal subdivisions, mining applications, wind farms and hydropower proposals. Rachel recently developed rapid survey methods for avifauna for use throughout the Pacific for the South Pacific Regional Environment Programme. She has also developed monitoring programmes for a wide variety of avifaunal groups. Overseas, Rachel has worked in England where she was part of a team that wrote BirdLife International's 'Threatened Birds of the World', and worked in Tonga investigating seed dispersal by flying foxes. Her previous fauna work within the Department of Conservation has included the supervision of a programme to protect blue duck; extensive monitoring of Westland petrel; monitoring western weka, kereru, great spotted kiwi, Australasian bittern, and giant land snails; surveys for short-tailed bats, native fish, and little blue penguins; tagging New Zealand fur seals; and five-minute bird counts.

Rachel's council hearing and Environment Court work includes:

- For Christchurch City Council, evidence and expert caucusing on birdstrike at Christchurch International Airport for the Replacement Christchurch District Plan.
- For Bay of Plenty Regional Council, evidence and expert caucusing for the Environment Court hearing for leaving the wreck of the Rena on Astrolabe Reef.

- For Paul Elwell-Sutton, evidence and expert caucusing for rule changes, West Coast Land and Water Plan. Expertise: effects on wetland birds.
- For Forest and Bird, Environment Court hearing for the appeal of resource consents granted to Bathurst Resources Ltd for the Escarpment Mine, Denniston Plateau. Expertise: effects on avifauna.
- For Hurunui District Council, Environment Court hearing for land use consent for Meridian Energy to construct the Hurunui Wind Farm, North Canterbury. Expertise: effects on avifauna.
- For Carter Holt Harvey, Environment Court hearing for resource consent for the subdivision of Carter Holt Harvey reserve and forestry land on Kina Peninsula, Motueka. Expertise: effects on shorebirds.
- For Blakely Pacific, Environment Court hearing for resource consents for the subdivision of Blakely Pacific forestry land on Matakana Island. Expertise: effects on fauna, primarily shorebirds.
- For Lower Waitaki River Management Society, Environment Court hearing for the appeal of resource consents granted to Meridian Energy for the Lower Waitaki North Bank Tunnel concept. Expertise: effects on braided river birds.
- For Fish and Game, council hearing for the Oreti River Conservation Order. Expertise: effects on black-billed gulls.

Academic qualifications

PhD Zoology 2009. Ecology and management of Southland's black-billed gulls. Otago University.

Master of Conservation Science (with distinction) 1996: Breeding biology of flesh-footed shearwaters on Karewa Island. Victoria University of Wellington.

Work History

2015 to present	Wildland Consultants Ltd, Wellington, Senior Fauna Ecologist
2009-2015:	Wildland Consultants Ltd, Christchurch, Office Manager and Senior Fauna Ecologist
2001-2004:	Ranger, biodiversity, Buller Area Office, West Coast Conservancy, Department of Conservation, Westport • Planning, fieldwork and analysis for biodiversity projects
1998-2000:	Researcher, Birdlife International, Cambridge, U.K. • Researched, wrote and edited species accounts for "Threatened birds of the World", published in 2000
1996-1998:	Technical Support Officer, outcome monitoring, Northland Conservancy, Department of Conservation, Whangarei • Planning, implementation and analysis of Conservancy outcome monitoring programmes

A Selection of Publications and Reports:

Wildland Consultants 2015: Fauna habitat values of sites dominated by exotic vegetation in Canterbury. Wildland Consultants Contract Report No. 3677. Prepared for Environment Canterbury, Christchurch. 44pp.

Wildland Consultants 2015: Population trends of black-billed gulls (*Larus bulleri*) on South Island rivers, 1962-2014. Wildland Consultants Contract Report No. 3442. Prepared for Department of Conservation, Christchurch and Invercargill. 20pp.

Wildland Consultants 2015: Aerial surveys of black-billed gulls in Canterbury 2014-2015. Wildland Consultants Contract Report No. 3666. Prepared for Environment Canterbury, Christchurch. 15pp.

Wildland Consultants 2015: Conservation and restoration plan for Long Point-Irahuka 2015. Wildland Consultants Contract Report No. 3629. Prepared for the Yellow-eyed Penguin Trust, Dunedin. 31pp.

Wildland Consultants 2015: Assessment of effects on river birds of increasing the height of Falls Dam, Manuherikia River, Central Otago. Wildland Consultants Contract Report No. 3510a. Prepared for Golder Associates, Christchurch. 17pp.

Wildland Consultants 2015: Review of potential effects on avifauna of the proposed K2K Section of the Hauraki Rail Trail. Wildland Consultants Contract Report No. 3618. Prepared for Waikato Regional Council, Hamilton. 13pp.

Wildland Consultants 2014: Review of fauna components of an access application for the Te Kuha open cast coal mine, Buller. Wildland Consultants Contract Report No. 3470. Prepared for Department of Conservation, Hokitika. 48pp.

Wildland Consultants 2014: Guidelines for undertaking rapid biodiversity assessments in terrestrial and marine environments in the Pacific. Secretariat of the Pacific Regional Environmental Programme, Apia, Samoa. 51pp. Published – see below.

Patrick B., McClellan R., Martin T., Tocher M., Borkin K., McKoy J., and Smith D. 2014: Guidelines for undertaking rapid biodiversity assessments in terrestrial and marine environments in the Pacific. Secretariat of the Pacific Regional Environmental Programme. Pp 51. ISBN: 978-982-04-0514-1.

Wildland Consultants 2014: Seabird re-establishment and habitat restoration at Long Point-Irahuka, Catlins. Wildland Consultants Contract Report No. 3206. Prepared for Yellow-eyed Penguin Trust. 36pp.

Wildland Consultants 2014 (draft): Review of yellow-eyed penguin (hoiho) monitoring on Stewart Island/Rakiura. Wildland Consultants Contract Report No. 3386. Prepared for Yellow-eyed Penguin Trust. 21pp.

Wildland Consultants 2014 (draft): Potential effects of moving the position of a ski lane on blue penguins, Little Kaiteriteri. Wildland Consultants Contract Report No. 3393. Prepared for McFadden McMeeken Phillips Lawyers.

Wildland Consultants 2014: Review of the assessment of ecological effects on avifauna of leaving the Rena wreck in situ at Astrolabe reef/Otaiti. Wildland Consultants Contract Report No. 3132e. Prepared for Bay of Plenty Regional Council. 11p.

Wildland Consultants 2013: Ecological assessment of Duke of Edinburgh Terrace, Greenstone Ecological Area, Kumara, Westland. Wildland Consultants Contract Report No. 3412. Prepared for DCJ Ltd. 51p.

Wildland Consultants 2013: Review of the assessment of ecological effects on avifauna – Rena wreck management. Wildland Consultants Contract Report No. 3132a. Prepared for Bay of Plenty Regional Council. 15p.

Wildland Consultants 2013: Dusky Sound Conservation and Restoration Plan. Wildland Consultants Contract Report No. 3111. Prepared for the Department of Conservation. 127p

Wildland Consultants 2013: Fernbird and pipit surveys, Belling property, Ashers-Waituna Lignite Field, Southland. Wildland Consultants Contract Report No. 3054. Prepared for L&M Lignite Ashers Waituna Ltd, Christchurch. 17p.

Wildland Consultants 2013: Manuherikia River bird survey 2012, Hawkdun lignite field, Central Otago. Wildland Consultants Contract Report No. 3088. Prepared for L&M Hawkdun Ltd, Christchurch. 9pp.

Wildland Consultants 2013: Guidelines for the application of ecological significance criteria for indigenous vegetation and habitats of indigenous fauna in the Canterbury region. Wildland Consultants Contract Report No. 2289i. Prepared for Environment Canterbury. 22p.

Wildland Consultants 2013: (draft). Operation Nest Egg situation analysis. Wildland Consultants Contract Report No. 2999. Prepared for Kiwis for Kiwi. 50p.

Wildland Consultants 2013: Manuherikia River bird survey 2012, Hawkdun Lignite Field, Central Otago. Wildland Consultants Contract Report No. 3088. Prepared for L&M Lignite Hawkdun Ltd, Christchurch. 9p.

Wildland Consultants 2013: Ecological assessment of river channel management options for the Waiohine River, Wairarapa. Wildland Consultants Contract Report No. 3051. Prepared for Greater Wellington Regional Council. 65p

Wildland Consultants 2012: Potential effects on birds resulting from construction of a new seawall on the margin of the Avon-Heathcote Estuary. Wildland Consultants Contract Report No. 2996. Prepared for Christchurch City Council and Stronger Christchurch Infrastructure Recovery Team, Christchurch. 19p.

Wildland Consultants 2012: Review of the terrestrial ecological assessment for Tekapo Canal remedial works. Wildland Consultants Contract Report No. 2942. Prepared for Environment Canterbury, Christchurch. 9p.

Wildland Consultants 2012: Project Janszoon. Abel Tasman National Park Ecological Restoration Strategy 2012-2042. Wildland Consultants Contract Report No. 2873a. Prepared for the Project Janszoon Trust. 27p.

Wildland Consultants 2012: Project Janszoon. Abel Tasman National Park Biodiversity Resource Document. Wildland Consultants Contract Report No. 2873b. Prepared for the Project Janszoon Trust. 83p.

Wildland Consultants 2012. Monitoring plan for populations of indigenous fauna, Waiouru Military Training Area. Wildland Consultants Contract Report No. 2610b. Prepared for the New Zealand Defence Force. 44p.

Wildland Consultants 2011: Options for calculation and use of biodiversity credits generated by yellow-eyed penguin trust conservation activities. Wildland Consultants Contract Report No. 2554b. Prepared for the Department of Conservation, Wellington. 35p.

Wildland Consultants 2011: Biodiversity offsetting models for the Escarpment Mine project, Denniston Plateau, Westland. Wildland Consultants Contract Report No. 2653. Prepared for the Research and Development Group, Department of Conservation, Wellington. 33p.

Wildland Consultants 2011: Avifauna displacement monitoring and assessment of flight heights at the proposed Slopedown wind farm. Wildland Consultants Contract Report No. 2568. Prepared for Genesis Energy, Auckland. 26p.

Wildland Consultants 2011: Review of ecological information for the proposed Hurunui wind farm. Wildland Consultants Contract Report No. 2501. Prepared for Hurunui District Council, Amberley. 27p.

Wildland Consultants 2011: DRAFT. Assessment of terrestrial ecological effects for the proposed Castle Hill wind farm, Northern Wairarapa. Vols 1 and 2. Wildland Consultants Contract Report No. 2260d-4. Prepared for Genesis Energy, Auckland. 104p and 143p.

Wildland Consultants 2010: A review of tawaki population trend monitoring in South Westland, Fiordland, and on Whenua Hou 1990-2008. Wildland Consultants Contract Report No. 2253. Prepared for West Coast Conservancy, Department of Conservation, Hokitika. 46p.

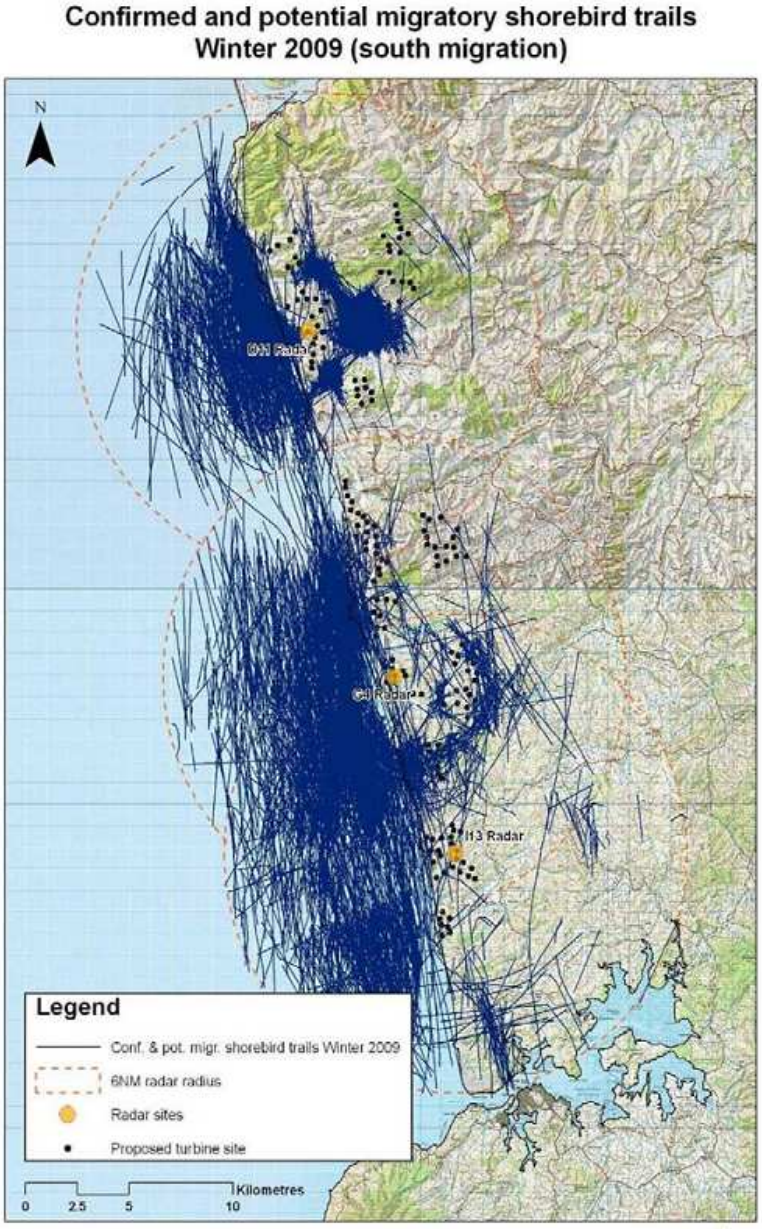
Wildland Consultants 2009: Review of avifauna information for the Mt Cass wind farm proposal. Wildland Consultants Contract Report No. 2292. Prepared for Hurunui District Council, Amberley. 9p.

McClellan R.K. 2009: *Ecology and management of Southland's black-billed gulls*. PhD thesis, Otago University, Dunedin, unpublished.

BirdLife International. 2000: *Threatened Birds of the World*. The official source for birds on the IUCN Red List. Project managers and senior editors: Allison J. Stattersfield and David R. Capper. Additional editors. Guy C.L. Dutson, Michael I. Evans, Rachel K. McClellan, Nicholas B. Peet, Sue M. Shutes, Thomas E.H. Stuart, Joe A. Tobias and David C. Wege. BirdLife International and Lynx Edicions. Barcelona and Cambridge, UK. 852 pages.

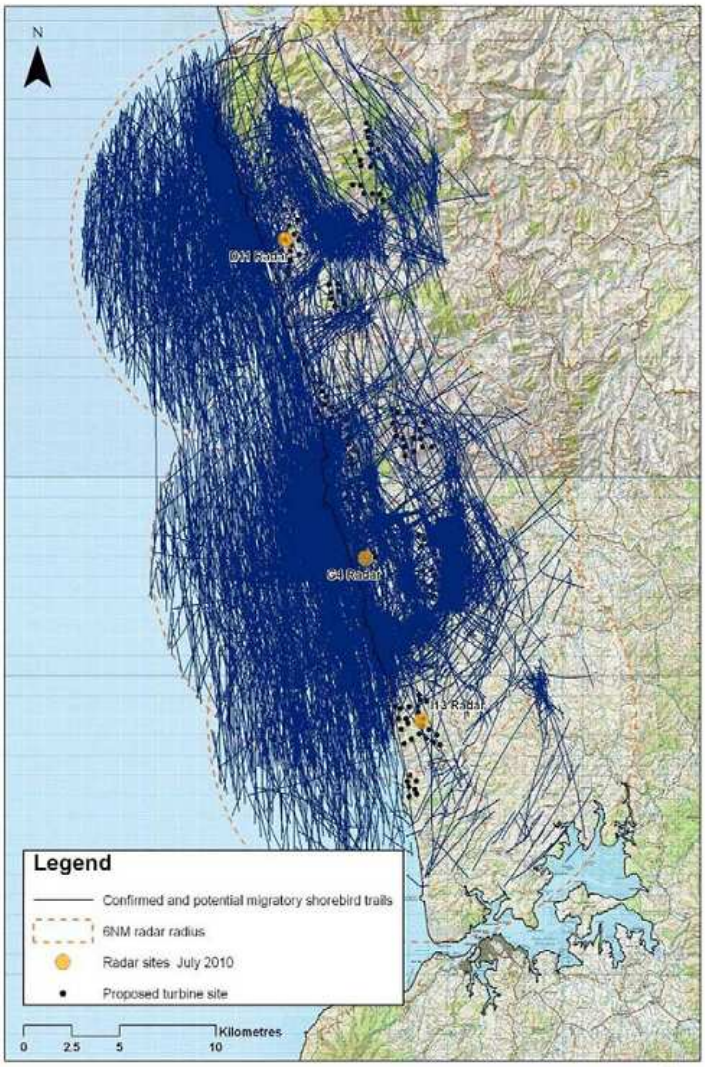
McClellan R.K. 1996: *The breeding biology of flesh-footed shearwater on Karewa Island*. Master of Conservation Science thesis, Victoria University of Wellington, unpublished.

ATTACHMENT B: SHOREBIRD RADAR TRACKS, HAUĀURU MĀ RAKI WIND FARM



Kessels & Associates Ltd

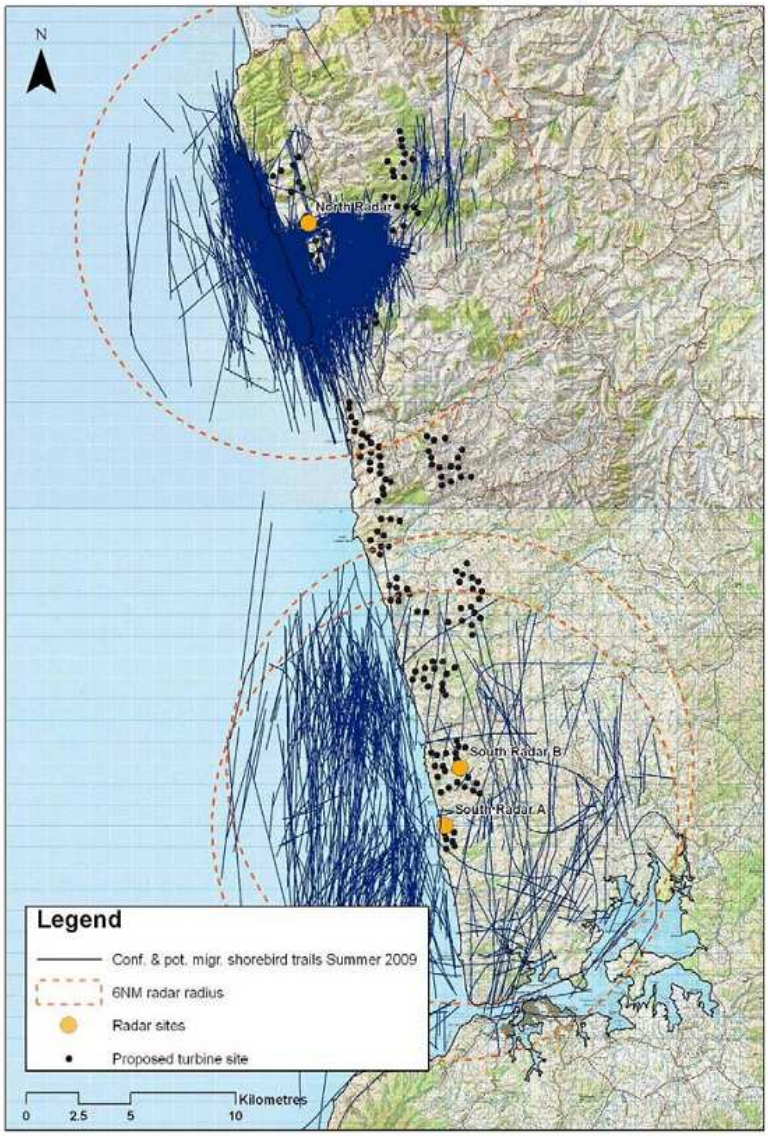
Confirmed and potential migratory shorebird trails
Winter 2010 (south migration)



Confirmed and potential migratory shorebird trails comparing Winter 2009 and Winter 2010 (south migration)

Kessels & Associates Ltd

Confirmed and potential migratory shorebird trails
Summer 2009 (north migration)



Kessels & Associates Ltd
ECOLOGY AND ENVIRONMENTAL PLANNING