APPENDIX E

Site Ecological Values Assessment

DRAFT

ASSESSMENT OF ECOLOGICAL VALUES AT THE PROPOSED MIMIHAU WIND FARM SITE, SOUTHLAND

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R6531

ASSESSMENT OF ECOLOGICAL VALUES AT THE PROPOSED MIMIHAU WIND FARM SITE, SOUTHLAND

Contract Report No. 6531

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CONTENTS

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1. INTRODUCTION

Roaring 40s Wind Power Ltd, on behalf of Contact Energy Ltd, are assessing a wind farm project on Jedburgh Station and in Matatriki Forestson the Slopedown Range in Southland, which will be known as the Mimihau Wind Farm (Figure 1). Wildlands has undertaken previous assessments for a wind farm proposed for the site, but this information is owned by Genesis Energy and the client has not yet obtained permission to utilise it. In addition, the original Wildlands assessments were undertaken over 2007-2009, and there have been many changes in the status of ecosystems, habitats, and species since then, and many new tools developed to establish priorities for the management of indigenous biodiversity. As such, Contact Energy Ltd is seeking an initial desktop review of ecological features and values that may be present at the site, and any constraints or show-stoppers that these would pose on wind farm development. In addition, baseline monitoring of indigenous biodiversity values may need to be undertaken, and the client needs to know which values require baseline monitoring, and when this monitoring should commence.

This report comprises the outcomes of the desktop evaluations described above.

2. METHODS

2.1 Vegetation and habitats

A desktop assessment of vegetation and habitats at the site was carried out using aerial imagery of the site in combination with previously-published public documents describing vegetation in surrounding areas with similar natural settings. Based on these two sources, generalised vegetation and habitat types likely to be present at the site were identified.

2.2 Avifauna

A desktop assessment of avifauna was carried out by searching the online database eBird. The eBird website is a real-time, global online checklist programme where people submit bird observations and now contains several hundred million bird records. Records of indigenous and exotic species within 15 kilometres of the proposed wind farm from 1 January 2021 to 15 September 2022 were collated. Data from the Department of Conservation's national biodiversity monitoring programme was also checked, as this programme carried out a survey at the site of the proposed windfarm in 2017.

2.3 Terrestrial invertebrates

A desktop survey of terrestrial invertebrates involved searching the online database iNaturalist for invertebrate records within five kilometres of the area of the proposed development. iNaturalist is a citizen science-based initiative where enthusiasts and experts alike can upload observations. Only photographed observations were included in results so that they could be verified. While iNaturalist is currently the best desktop survey tool for invertebrates, it is limited in usefulness due to bias in observer ability, expertise, and interests. A desktop survey is not a substitute for a field survey conducted

by an invertebrate ecologist, which would increase the probability of detecting species of conservation concern.

To find any invertebrate research or lists from the local area, Google and Google Scholar searches were conducted using the terms **invertebrates NZ Catlins OR Slopedown OR Redan**. The first three pages of results were scanned for invertebrate records from the area surrounding the proposed development.

3. ECOLOGICAL CONTEXT

3.1 Ecological Districts

The proposed wind farm site spans the boundary of the Waipahi and Tahakopa Ecological Districts, with the northern part of the wind farm in the former, and thirteen proposed wind turbines in the Tahakopa Ecological District in the southern part of the wind farm site (Figure 1). The Waipahi Ecological District at 93,123 hectares, is considerably smaller than the 239,892 hectare Tahakopa Ecological District.

The Waipahi Ecological District extends from the Mataura River south of Gore township towards the east. The climate is moist cool, cloudy with rainfall of 800-1200 mm per annum (McEwen 1987). The Ecological District is characterised by a series of parallel hills and valleys formed by folded Jurassic marine and estuarine sediments (sandstones and mudstones) of the Southland Syncline (McEwen 1987). Soils are well drained with a variable cover of loess over tuffaceous sandstones and related slope deposits. Subsoils are yellowish brown firm and clayey-textured with a blocky structure, mainly moderately leached, and moderately fertile. Higher altitude soils are more strongly leached with more friable subsoils, with highest elevation soils having poorly drained (gleyed) and peaty topsoils (McEwen 1987).

The Tahakopa Ecological District is a large ecological district including the hills on the eastern side of the Mataura Valley, and eastward over the Catlins to the Catlins Coast from Nugget Point to Fortrose. The district is characterised by a series of parallel hills and valleys formed by folded Jurassic marine and estuarine sediments (sandstones and mudstones) of the Southland Syncline; mostly below 600 metres above sea level (McEwen 1987). It is a high rainfall area of 800-1400 millimetres per year with moist, cool climate.

3.2 Threatened Environment Classification

The two main Threatened Environment Classification types in the proposed wind farm site are the ‘less reduced and better protected’ land environments at higher elevation and on steep scarps, that retain >30% of their indigenous cover, of which >20% is protected, and ‘acutely threatened’ land environments that retain <10% of their original indigenous cover on gentle landforms at lower elevation (Figure 2).

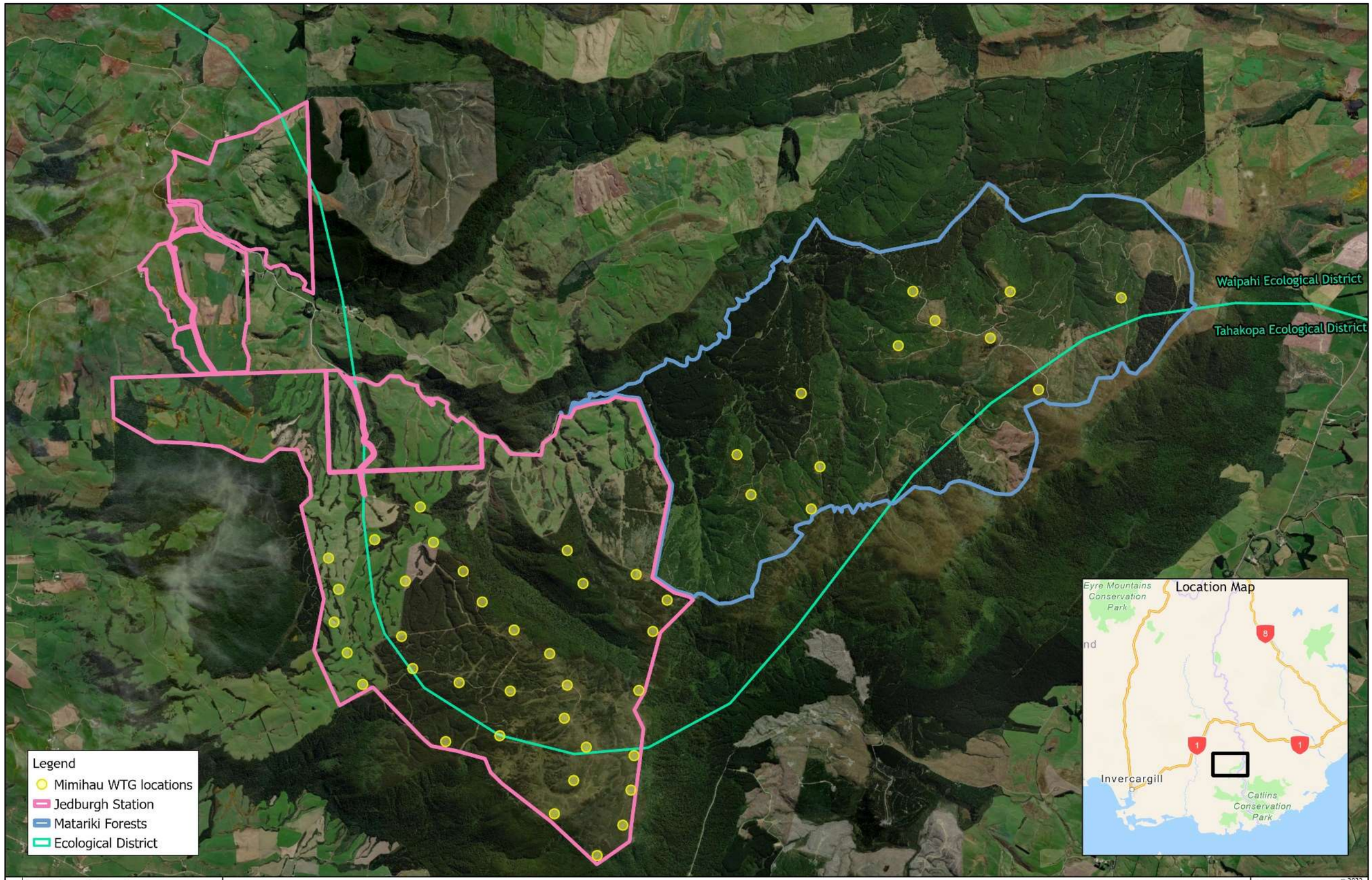

Figure 1. Location of the proposed Mimihau wind farm site

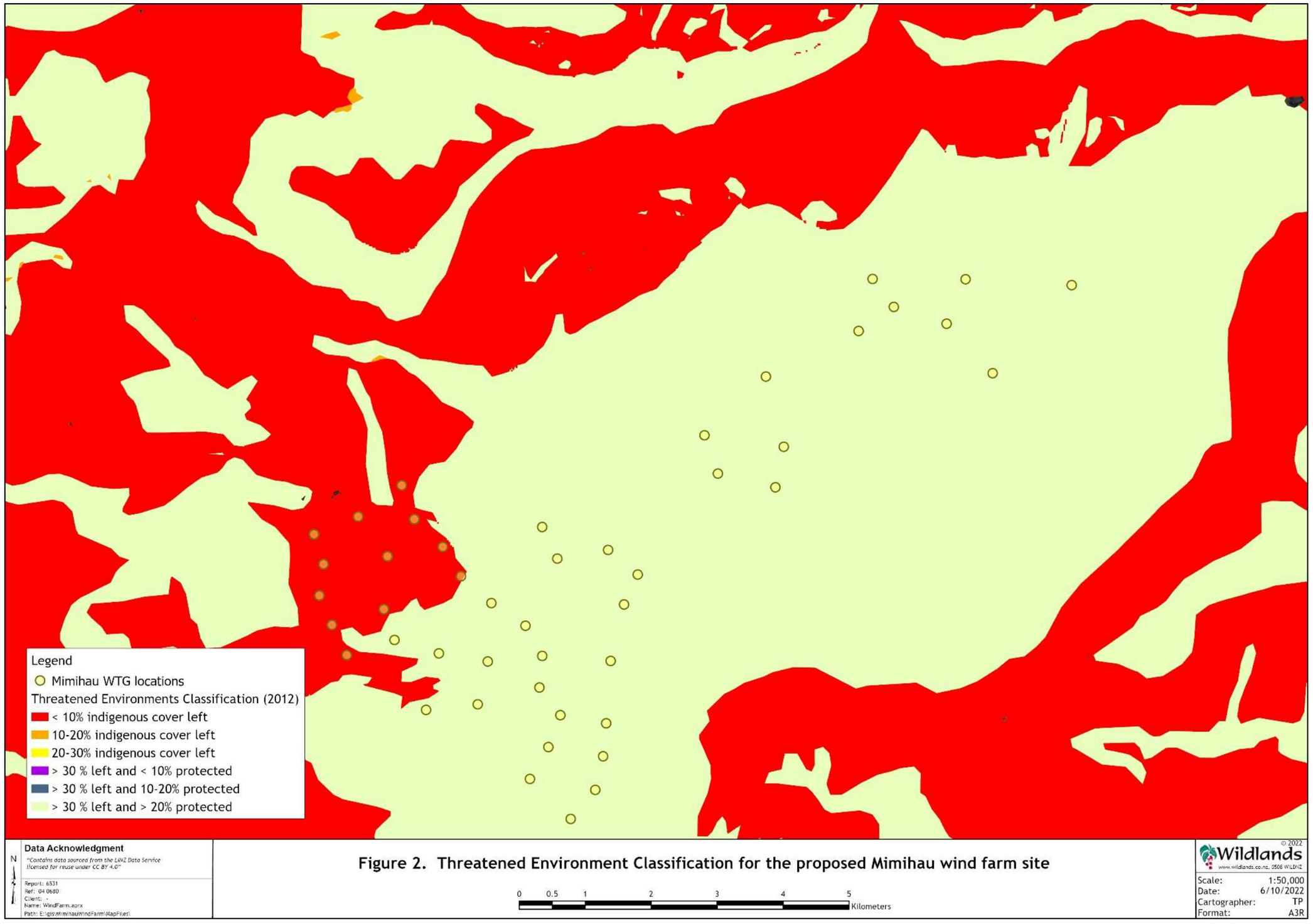

Figure 2. Threatened Environment Classification for the proposed Mimihau wind farm site

3.3 Protected areas

The proposed Mimihau wind farm site is adjacent to a number of protected areas (Figure 3). Stewardship land comprising Conservation Area – Slopedown is present on the western scarp of the Slopedown Range, while the Catlins Conservation Park occupies the southeast-facing scarps, a scarp on the northern side of the Mimihau Stream South Branch, and forest in the headwaters of Oware Stream. There are also a number of areas protected by QEII covenants in the Mimihau Stream catchment, generally, like many of the conservation areas, on south-facing scarps (Figure 3).

3.4 Priority areas

Leathwick (unpublished) defined priority areas for management of indigenous biodiversity in Southland, taking the top 30% of areas prioritized using Zonation software. A large Redan Stream priority area covers indigenous habitats on the eastern side of the proposed wind farm and down the western scarp, and also the forest in the headwaters of Oware Stream (Figure 4). The mean rank of the Redan Stream priority area is within the top 10% of priority areas in Southland, most likely because it comprises the best location in Southland for management of upland mountain cedar forest.

3.5 DOC SMUs

A Department of Conservation Species Management Unit (SMU) is located on the conservation land located on the scarp of the Slopedown Range (Figure 4). This SMU is based on Southland's only mountain cedar/pahautea (*Libocedrus bidwillii*) stands, but also includes an altitudinal sequence of other forest types.

3.6 Potential natural ecosystems

The proposed wind farm site is mainly mapped as kamahi, southern rata, podocarp forest (Wildland Consultants 2019), a widespread forest type in southern Southland, but the more elevated plateaux on both Jedburgh Station and Matariki Forest are mapped as Pahautea, Hall's tōtara, mountain celery pine, broadleaf forest, which is a rare forest type in Southland. The potential ecosystem mapping is not sufficiently resolved to distinguish wetlands on the site.

3.7 Land cover database

The Waipahi Ecological District and Tahakopa Ecological District have markedly different current indigenous cover. The Tahakopa Ecological District retains much more of its indigenous vegetation cover, including 80,186 hectares of indigenous forest (33% of the ecological district), 3,885 hectares of mānuka scrub and shrubland (1.6%), and 1,074 hectares of herbaceous freshwater vegetation (0.44%). In contrast, the Waipahi Ecological District has only 3,157 hectares of indigenous forest (3.3%), 376 hectares of mānuka scrub (0.4%), and 135 hectares of herbaceous freshwater vegetation (0.14%). Conversely, the Waipahi Ecological District has a much greater proportion of high producing exotic grassland (76%), low producing grassland (3.8%), and exotic forest (11%) than the Tahakopa Ecological District, which has 54% cover of high producing exotic grassland, 0.7% of low producing grassland, and 6.9% exotic forest cover. The only two indigenous cover types that are better represented in the

Waipahi Ecological District are matagouri or grey scrub (1.5%) and tall tussock grassland (1.6%), compared with 0.1% cover of matagouri or grey scrub and 0.6% tussock grassland cover in the Tahakopa Ecological District.

3.8 Southland threatened and at risk ecosystems

Appendix 2 of the Southland RPS lists Threatened, At Risk and Rare ecosystems which are high priorities for protection. Ecosystems listed that may be present at the proposed Mimihau windfarm site are the Threatened wetland type, 'raised peatland bogs', the At Risk types 'broadleaf forest and scrub', 'mixed broadleaf forest and scrub', and 'red tussock grassland'. The Rare forest type, 'cloud forest', defined as 'stands of mountain cedar forest generally in association with southern rātā (*Metrosideros umbellata*), pink pine (*Halocarpus biformis*) and Hall's totara (*Podocarpus laetus*)', is also most likely to be present at the site.

4. VEGETATION AND HABITATS

4.1 Vegetation and habitats described in nearby areas

At a regional scale, the proposed windfarm site lies within the 'Catlins/Te Ākau Tai Toka Place' identified in the Otago Conservation Management Strategy (Department of Conservation 2016). The historic vegetation of this area comprised podocarp forest, shrublands, red tussock (*Chionochloa rubra* var. *cuprea*), and wetlands on valley floors, podocarp-kamahi (*Weinmannia racemosa*) forest on hill slopes, and southern rātā on ridges. Slopedown Hill is noted as a location for pahautea, and the higher plateaux areas (including the proposed wind farm site) are described as having red tussock and peatlands.

A literature review revealed three detailed local vegetation studies of relevance to the proposed wind farm site. These are briefly described below.

Slopedown Range

The most relevant study to the proposed Mimihau windfarm site described the vegetation of the Slopedown Ecological Area (Sandercock 1987). This area runs from Mokoreta No. 2 trig to The Cairn on the crest of the Slopedown Range, and includes forests on the southeasterly scarp and foothills of the range. Aerial imagery indicates that many of the habitats present in the Slopedown Ecological Area are also present in the proposed wind farm site. Vegetation types described from this area were southern rātā-kamahi-broadleaf (*Griselinia littoralis*), inaka (*Dracophyllum longifolium* var. *longifolium*)-broadleaf-mountain holly (*Olearia illicifolia*), tauhinu (*Ozothamnus leptophyllus*)-*Hebe odora*-red tussock, and red tussock-inaka-mountain flax (*Phormium cookianum*). Areas of mānuka (*Leptospermum scoparium*) forest and shrubland were also noted, along with the presence of *Olearia laxiflora* and wire rush (*Empodisma minus*).

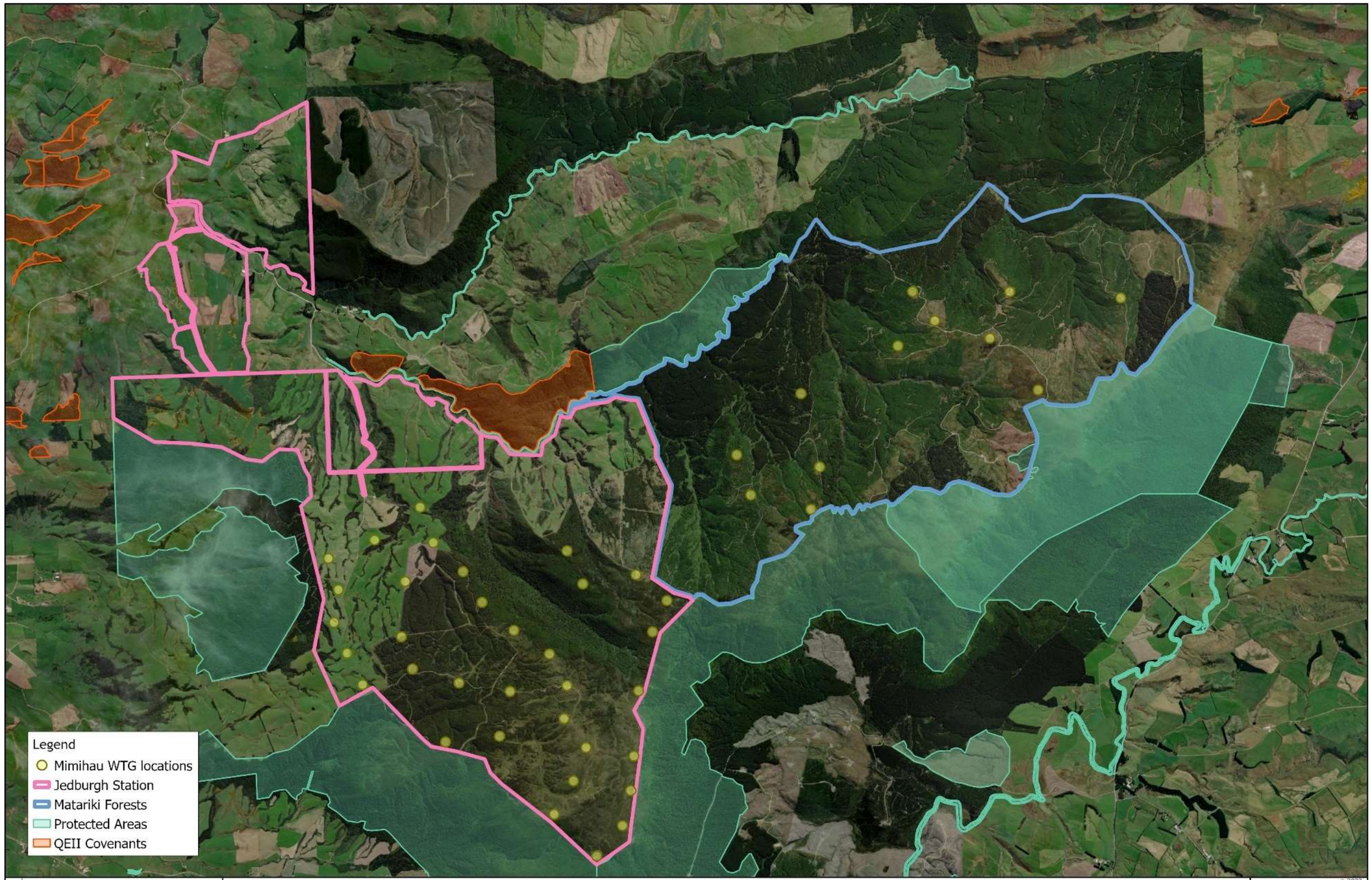

Figure 3. Protected areas in the vicinity of the proposed Mimihau wind farm site

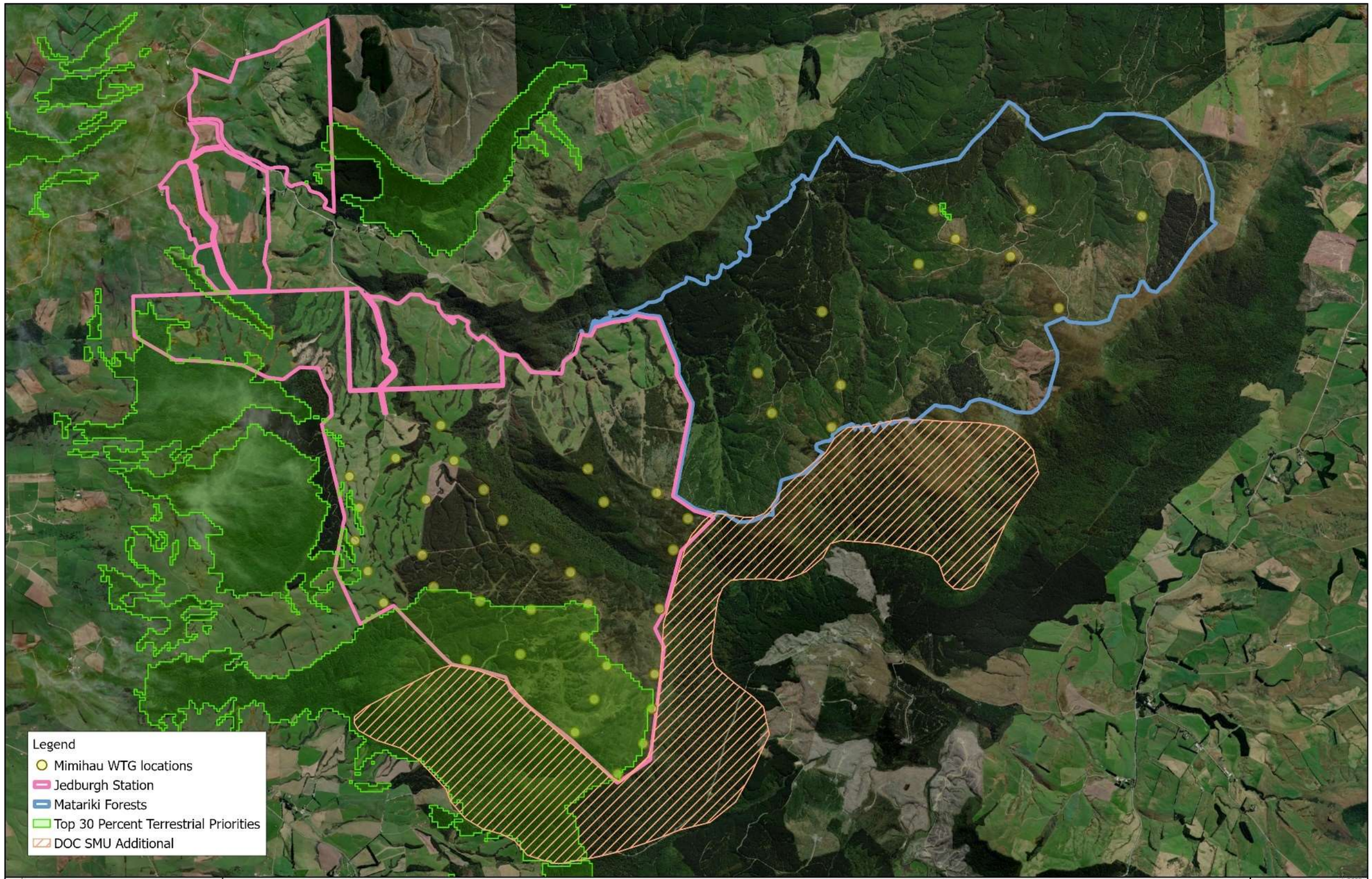

Figure 4. Ecological priority areas in the vicinity of the proposed Mimihau wind farm site

Ajax Plateau

Johnson *et al.* (1977) described the vegetation at Ajax Hill, an upland plateau approximately 20 km southeast of the site containing vegetation not previously burnt or cleared for farming. Three broad vegetation communities were described, reflecting underlying differences in drainage: cushion bog over deep peat, floristically diverse seepages with abundant red tussock, and inaka-pahautea-pink pine scrub and woodland. Aerial imagery indicates that the latter two vegetation types are most likely to be present at the proposed wind farm site.

Slopedown State Forest

Allen (1985) described vegetation types in the headwaters of the Mokoreta River to the east of and below the eastern scarp of Slopedown Hill. Aerial imagery indicates that several of the vegetation types are likely to be present at the site, these being *Coprosma*-mountain holly-inaka-mānuka scrub, tauhinu scrub, red tussock/sphagnum bog, and heath bog.

4.2 Vegetation and habitats at the proposed Mimihau windfarm site

Aerial imagery indicates that the proposed wind farm site includes a complex array of vegetation types, that relates to both the original vegetation cover and to anthropogenic vegetation clearance for pastoral and forestry land use. The site is currently vegetated in a mosaic of shrublands, wetlands, and grassland, with forest on its margins. Based on interpretation of aerial imagery, and in reference to the vegetation descriptions of similar habitats outlined in the previous section, the general vegetation types likely to be present at the site are summarised in Table 1. A brief description of the likely vegetation types follows.

Table 1: General vegetation types likely to be present at the proposed Mimihau windfarm site.

Vegetation Type	Comments
Terrestrial	
Pahautea/southern rātā-kamahi forest	At high elevation at south near Slopedown Hill
Southern rātā-kamahi forest	On upper slopes of large central gully
Mānuka forest	In the southern portion of site; diverse
Exotic forest	At the northern part of site
Mānuka-inaka-tauhinu scrub and shrubland	Diverse and variable canopy likely. Most widespread type in the south of the site
Exotic grassland	On higher broad ridges, and lower western areas
Wetland	
Mānuka-inaka shrubland bog	Higher areas at southeast of site
Red tussock grassland fen and bog	Several areas near streams at south of site

4.3 Terrestrial

Forest

Indigenous forest vegetation is mostly present on the southern margins of the site, but is also present in the central gully which is deeply incised. Exotic forest is widespread across the northern and eastern portion of the site.

Pahautea/southern rātā-kamahi forest

Forest with emergent pahautea above a canopy of southern rātā and kamahi is likely to be present in a small area at the southern edge of the site. It is likely that scattered pink pine and mountain toatoa are present in this forest.

Southern rātā-kamahi forest

Forest in which southern rātā and kamahi are the main canopy species is present in the major incised gully near the centre of the site. Hall's tōtara may be present also. Lower tiers may include horopito, mountain holly, putaputaweta (*Carpodetus serratus*) and soft tree fern (*Cyathea smithii*). Forest of this type occupies land administered by the Department of Conservation on the margins of the eastern scarp.

Mānuka forest

Forest dominated by mānuka is present across areas of the southern part of the site, and in gullies within exotic pasture in the lower southwestern area of the site. Accompanying species may include tauhinu, *Hebe odora* and a range of *Coprosma* species. At higher altitudes these forests are aslo likely to include scattered pahautea, pink pine, broadleaf and haumakoroa (*Raukaua simplex*).

Exotic forest

Plantation forests occupy most of the northeastern portion of the site.

Shrublands

Shrublands occupy a large portion of the southern part of the site, and are variable in composition. Dominant species are likely to be mānuka, inaka, and tauhinu, with mānuka and tauhinu most abundant on drier substrates and inaka most abundant on wetter substrates. Other accompanying species may include mountain flax, *Gaultheria macrostigma*, *Hebe odora*, gorse, and copper tussock in wetter areas. It is probable that dense shrublands at higher elevations at the south of the site also contain *Olearia laxifolia* and mountain holly.

Exotic grassland

Exotic grassland is present on the lower southwestern areas of the site, and on broad ridges. Dominant species are likely to include browntop (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*).

4.4 Wetlands

Wetlands at the site are likely to comprise fens and bogs, both of which are distinguished by the presence of peat. Both shrubland and grassland vegetation types are present within wetlands. Shrubland areas are likely to be restricted to bogs, with the canopy dominated by mānuka and inaka. Tangle fern (*Gleichenia dicarpa*) and wire rush (*Empodisma minus*) are possible accompanying species. Grassland areas are likely to contain abundant red tussock, with accompanying species including rautahi (*Carex geminata*), *Carex* spp., *Juncus* spp., Yorkshire fog and browntop.

4.5 Notable species and vegetation types

Plant species classified as Threatened or At Risk are present at the proposed wind farm site, although the available information on nearby vegetation reveals only Myrtaceae species such as mānuka and southern rata which have had their threat classifications raised on a precautionary basis because of the threat posed by myrtle rust (*Austropuccinia psidii*). It is also almost certain that there are four species of regional importance present at the site: pahautea, pink pine, mountain toatoa and *Olearia laxiflora*. This is based on their presence within very similar habitats in nearby areas.

Pahautea, pink pine and mountain toatoa are regionally important due to their restricted distribution within the region, being confined to upland peat plateaux in the Catlins. It is likely that all three of these species are present in low abundances in areas of forest and mānuka scrub in the southern portion of the site. Scattered mature individuals as well as younger regeneration are likely to be present. Mature pahautea may be more abundant in places, given that it is a dominant species in forest on adjacent land administered by Department of Conservation.

The shrub *Olearia laxiflora* also has a relatively restricted distribution in Southland, being present in the Hokonui Hills, in western Southland, in isolated areas of Fiordland, on Stewart Island, and in the Catlins. This species is found on the southern face of Puke Mimihau (Sandercock 1987), several kilometres to the northeast of the proposed wind farm site, in vegetation similar to the upper shrublands at the site.

Some of the vegetation and habitat types identified as likely to be present at the site are of particularly high ecological value, due to their threatened or rare status in the region. These are the pahautea/southern rātā-kamahi forest, red tussock grasslands, and all wetland vegetation and habitat types. Any shrubland vegetation containing *Olearia laxiflora* is also likely to be of high ecological value.

5. AVIFAUNA

The eBird desktop analysis identified 51 bird species within 15 kilometres of the proposed wind farm (Table 2). Thirty-three indigenous and 18 exotic bird species were recorded (Robertson *et al.* 2021). Two of the indigenous species are classified as 'Threatened', these being the Nationally Endangered tarapirohe/black-fronted tern (*Chlidonias albostriatus*) and Nationally Vulnerable kārearea/eastern falcon (*Falco novaeseelandiae novaeseelandiae*). Seven indigenous species are classified as 'At Risk', including five Declining (tarāpuka/black-billed gull *Chroicocephalus bulleri*, pihoihoi/New Zealand pipit *Anthus novaeseelandiae*, tarāpunga/red-billed gull *Chroicocephalus novaehollandiae scopulinus*, mātāta/South Island fernbird *Bowdleria punctata punctata*, and tōrea/South Island pied oystercatcher *Haematopus finschi*), and two Relict species (māpunga/black shag *Phalacrocorax carbo* and kawaupaka/little shag *Phalacrocorax melanoleucos*).

Table 2: Indigenous and exotic bird species recorded within 15 kilometres of the proposed wind farm, along with the number of records, total count, and the estimated likelihood of a species occurring close to the site. The data was recorded from an eBird records from 1 January 2021 to 15 September 2022.

Common Name	Scientific Name	Threat Classification 2021	Number of Records	Total Observations	Likelihood of Being at the Site
Indigenous					
Australasian shoveler/kuruwhengi	*Spatula rhynchotis*	Not Threatened	24	133	Unlikely
Bellbird/korimako	*Anthornis melanura melanura*	Not Threatened	29	68	High
Black shag/māpunga	*Phalacrocorax carbo novaehollandiae*	At Risk-Relict	19	27	Unlikely
Black swan/wāna	*Cygnus atratus*	Not Threatened	2	7	Unlikely
Black-billed gull/tarāpuka	*Chroicocephalus bulleri*	At Risk-Declining	21	150+	Unlikely
Black-fronted tern/tarapirohe	*Chlidonias albostriatus*	Threatened - Nationally Endangered	5	11	Unlikely
Brown creeper/pīpipi	*Mohoua novaeseelandiae*	Not Threatened	7	24	Highly Likely
Eastern falcon/kārearea	*Falco novaeseelandiae novaeseelandiae*	Threatened-Nationally Vulnerable	1	1	Possible
Grey duck – mallard hybrid	*Anas superciliosa × platyrhynchos*	Not Threatened	4	27	Unlikely
Grey teal/tētē-moroiti	*Anas gracilis*	Not Threatened	1	Not specified	Unlikely
Grey warbler/riroriro	*Gerygone igata*	Not Threatened	63	115	High
Little shag/kawaupaka	*Microcarbo melanoleucos brevirostris*	At Risk-Relict	15	22	Unlikely
Morepork/ruru	*Ninox novaeseelandiae*	Not Threatened	2	3	Likely
New Zealand kingfisher/kōtare	*Todiramphus sanctus vagans*	Not Threatened	2	2	Possible
New Zealand pigeon/kereru	*Hemiphaga novaeseelandiae*	Not Threatened	6	91	Likely
New Zealand pipit/pīhoihoi	*Anthus novaeseelandiae novaeseelandiae*	At Risk-Declining	4	5	Likely
New Zealand scaup/pāpango	*Aythya novaeseelandiae*	Not Threatened	24	150+	Unlikely
Paradise shelduck/pūtangitangi	*Tadorna variegata*	Not Threatened	41	150+	High
Pied stilt/poaka	*Himantopus himantopus*	Not Threatened	13	48	Unlikely
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	38	132	Possible
Red-billed gull	*Chroicocephalus novaehollandiae scopulinus*	At Risk - Declining	4	8	Unlikely
Shining cuckoo/pīpīwharauroa	*Chrysococcyx lucidus lucidus*	Not Threatened	2	2	Likely
Silvereye/tauhou	*Zosterops lateralis lateralis*	Not Threatened	47	99	High
South Island fantail/pīwakawaka	*Rhipidura fuliginosa fuliginosa*	Not Threatened	38	68	High
South Island fernbird/mātātā	*Poodytes punctata punctata*	At Risk - Declining	2	2	Possible
South Island pied oystercatcher/tōrea	*Haematopus finschi*	At Risk - Declining	23	63	Unlikely
South Island tomtit/ngirungiru	*Petroica macrocephala macrocephala*	Not Threatened	2	5	Likely
Southern black-backed gull/karoro	*Larus dominicanus dominicanus*	Not Threatened	52	150+	High

Common Name	Scientific Name	Threat Classification 2021	Number of Records	Total Observations	Likelihood of Being at the Site
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	83	150+	High
Swamp harrier/kāhu	*Circus approximans*	Not Threatened	87	124	High
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	31	64	High
Welcome swallow/warou	*Hirundo neoxena neoxena*	Not Threatened	41	135	High
White-faced heron	*Egretta novaehollandiae*	Not Threatened	20	37	Unlikely
Introduced					
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	79	145	High
Blackbird	*Turdus merula*	Introduced and Naturalised	87	150+	High
Canada goose	*Branta canadensis*	Introduced and Naturalised	6	150+	Unlikely
California quail	*Callipepla californica*	Introduced and Naturalised	1	2	Possible
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised	57	120	High
Dunnock	*Prunella modularis*	Introduced and Naturalised	51	70	High
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	37	137	High
Greenfinch	*Carduelis chloris*	Introduced and Naturalised	21	107	High
House sparrow	*Passer domesticus*	Introduced and Naturalised	72	150+	High
Little owl	*Athene noctua*	Introduced and Naturalised	3	5	Possible
Mallard	*Anas platyrhynchos*	Introduced and Naturalised	61	150+	Likely
Redpoll	*Carduelis flammea*	Introduced and Naturalised	73	150+	High
Rock pigeon	*Columba livia*	Introduced and Naturalised	37	150+	Likely
Skylark	*Alauda arvensis*	Introduced and Naturalised	61	150+	Likely
Song thrush	*Turdus philomelos*	Introduced and Naturalised	62	134	High
Starling	*Sturnus vulgaris*	Introduced and Naturalised	81	150+	High
Wild turkey	*Meleagris gallopavo*	Introduced and Naturalised	2	7	Unlikely
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised	14	82	Likely

Tītitipounamu/South Island rifleman (*Acanthisitta chloris chloris*, Not Threatened) were not recorded in the eBird search, but were recorded in the 2017 Department of Conservation national biodiversity monitoring survey (Department of Conservation 2017). Koekoeā/long-tailed cuckoo (*Eudynamys taitensis*, Threatened – Nationally Vulnerable) were recorded on eBird within 15 kilometres of the proposed wind farm in and are possibly present at the site, particularly in spring and summer. The presence of pīpipi/brown creeper (*Mohoua novaeseelandiae*, Not Threatened) at the site is an indicator that long-tailed cuckoo may be present as brown creeper are a host species for the parasitic long-tailed cuckoo (Gill 2022).

6. LIZARDS

Species recorded within a 30 kilometre radius of the site are listed below and their closest record and likelihood of being found on site are detailed in Table 3. Indigenous lizards – in particular southern grass skinks – are not always confined to indigenous ecosystems and are likely present throughout the area and within the exotic plantation habitats.

- Green skink (*Oligosoma chloronoton*) – Threatened - Nationally Critical
- Herbfield skink (*Oligosoma* aff. *inconspicuum* "herbfield") – At Risk - Declining
- Southern grass skink (*Oligosoma* aff. *polychroma* Clade 5) – At Risk - Declining
- McCann's skink (*Oligosoma maccanni*) – Not Threatened
- Tautuku gecko (*Mokopirirakau* "southern forest") – At Risk - Declining
- Southwestern large gecko (*Woodworthia* "southwestern large") – At Risk - Declining

Table 3: Lizard species recorded within a 30 kilometre radius of, or considered potentially present at, the proposed wind farm and the estimated likelihood of a species occurring close to the site. Habitat types are described in Table 4.

Common Name	Scientific Name	Threat Classification	Recorded Distance from Site	Likelihood of Presence on Site
Green skink	*Oligosoma chloronoton*	Threatened - Nationally Critical	14 km	Possible/moderate – there has been drastic population reductions in recent years, however there may be a relict population present
Herbfield skink[1]	*Oligosoma* aff. *inconspicuum "*herbfield"	At Risk - Declining	17 km	Moderate – within shrubland, wetlands and sub-alpine scrub
Southern grass skink	*Oligosoma* aff. *polychroma* Clade 5	At Risk - Declining	24 km	High – due to habitat availability
McCann's skink	*Oligosoma maccanni*	Not Threatened	15 km	Low – due to the wetter habitat, unless rocky outcrops present
Tautuku gecko	*Mokopirirakau "southern forest"*	At Risk - Declining	15 km	Possible – within indigenous forest
Jewelled gecko	*Naultinus gemmeus*	At Risk - Declining	>30 km	Moderate – within shrubland and regenerating forest
Southwestern large gecko	*Woodworthia* "south western large*"*	At Risk - Declining	1.8 km	High – due to a close record and possible habitats

[1] Recognised in the DOC Bioweb database as cryptic skink and recently split from cryptic skink as per Hitchmough *et al*. 2021.

Table 4: Habitats that are likely to be present (based on LCDB v4) and lizard species likely to utilise these habitats.

Habitat (LCDB)	Lizard species likely to be present
Matagouri/grey scrub	Jewelled gecko, green skink, southern grass skink, herbfield skink, possibly southwestern large gecko
Broadleaved indigenous hardwoods	Possibly southwestern large gecko, jewelled gecko, low likelihood of Tautuku gecko
Tall tussock grassland	Green skink, southern grass skink, possibly herbfield skink
Exotic forest	Southern grass skink, southwestern large gecko around margins/road access
Indigenous forest	Jewelled gecko, Tautuku gecko
Gorse and/or broom	Possibly jewelled gecko, herbfield skink, southern grass skink
Mānuka and/or kānuka	Jewelled gecko, cryptic skink, southern grass skink, unlikely but possible – Tautuku gecko
Wetlands/bogs/fens	Green skink, southern grass skink, herbfield skink

7. BATS

There is no information from the site on bats. Long tailed bats (*Chalinolobus tuberculatus*; Threatened-Nationally Critical) have a well-known stronghold population in the Catlins, but the wind farm site was not identified as having potential bat habitat (Wildland Consultants 2019) based on known bat locations in 2018.

8. TERRESTRIAL INVERTEBRATES

8.1 Taxa

Only two records were found on iNaturalist within 5 km of the proposed development. Both records are of an endemic ground wētā species, *Hemiandrus maia* (Not Threatened), a little-studied fossorial species which is common and widespread throughout its range in Southland and Otago. The other record was of *Hinewaia embolica*, a jumping spider that is found throughout New Zealand.

No invertebrate lists or observations were found in the Google or Google Scholar searches.

The nearby Catlins Forest is home to ground beetles (Carabidae) including *Neoferonia* sp. and *Megadromus* sp. These large-bodied beetles are often dispersal-limited, and susceptible to habitat loss and introduced predators. The proposed wind farm site is likely to have endemic ground beetles. The endemic centipede *Craterostigmus crabilli* (not assessed) is an interesting Catlins inhabitant: evidence suggests it is a rare New Zealand invertebrate example of Gondwanan vicariance. It is also only one of two species in its family (the other being found in Tasmania). The Catlins also has its own probable species of peripatus, *Peripatoides* "Catlins".

8.2 Relevant research

An entomological survey of the summit of Mokoreta to the northeast of the proposed wind farm recorded three notable beetles and diverse beetle and moth assemblages that

had affinities with the Awarua wetlands, Longwood Range, and Fiordland (Patrick *et al.* 1986).

9. FRESHWATER VALUES

9.1 Waterways

There are three waterways in close proximity to the proposed site, listed in likelihood of disturbance from the project. The Mimihau Stream South Branch runs along the northern edge of the site and is fed by several small tributaries that extend into the site, the upper tributaries of the Kaiwera Stream are crossed by the proposed transmission line, and the Mokoreta River and its associated tributaries including Oware Stream, Redan Stream and Boundary Creek runs along the southern side of the site. These streams are part of two distinct river catchments, the Mimihau Stream and Mokoreta river connect with the Mataura River, whereas the Kaiwera Stream is part of the Clutha River catchment.

9.2 Freshwater Taxa

In total 217 New Zealand Freshwater Fish Database records exist within a ten-kilometer radius in the key waterways surrounding the site, these records cover a wide timespan from 1979 through to 2021, although it is worth noting that the most recent extensive survey records are from 2017. Overall, eleven species have been recorded, of which two are introduced (Table 5).

Table 5: New Zealand Freshwater Fish Database Records for key waterways within ten kilometres radius of the potential windfarm site. Threat statuses are from Dunn *et al.* 2017.

Scientific Name	Common Name	Threat Status	Number of Occurrences in NZFFD
Anguilla australis	Shortfin eel	Not Threatened	1
Anguilla dieffenbachii	Longfin eel	At Risk-Declining	35
Galaxias argenteus	Giant kokopu	At Risk-Declining	1
Galaxias gollumoides	Gollum galaxias	Threatened-Nationally Vulnerable	13
Galaxias species D	Clutha flathead galaxias	Threatened-Nationally Critical	30
Geotria australis	Lamprey	Threatened-Nationally Vulnerable	2
Gobiomorphus breviceps	Upland bully	Not Threatened	30
Gobiomorphus cotidianus	Common bully	Not Threatened	2
Oncorhynchus tshawytscha	Chinook salmon	Introduced and Naturalised	2
Paranephrops zealandicus	Koura (Southern)	At Risk - Declining	57
Salmo trutta	Brown trout	Introduced and Naturalised	44

There are three Threatened and three At Risk species identified in the proposed windfarm area and surrounds. The species of greatest conservation concern is the Clutha flathead galaxiid (*Galaxias 'species D'*); this site is outside of the range typically attributed to the species, and warrants further investigation to confirm the presence and abundance in this area. The Clutha flathead galaxiid is non migratory, and has a distribution typically described as being restricted to Clutha River tributaries upstream of Roxburgh (Department of Conservation 2013). A fish survey can provide important

information on the distribution of the fine scale population within and around the site as well as the broader knowledge on extent of the species overall.

10. CONSTRAINTS TO WIND FARM DEVELOPMENT

10.1 Vegetation and habitats

Bog wetlands on ridges are a feature of this area, and many fen wetlands are also present on gentle topography on the upland plateau. The NES-FM regulations around earthworks near wetlands will be a constraint to roading and turbine works in the vicinity of these wetlands. Vegetation and habitat values are high for forest and advanced-growth regenerating forest, and moderately high for indigenous-dominant shrubland types. Ecological values are high in the southern corner of the site. These vegetation constraints are shown in Figure 5.

Most wind turbine locations on the upland plateau (both Jedburgh and Matariki) are located in scrub and shrubland of variable composition, and clearance of this habitat for roading and turbine platforms should be able to be consented but would comprise an adverse effect that would need to be addressed by appropriate mitigation, offsetting, or compensation.

10.1.1 Wind turbine sites

- Wind turbines Jed-08 and Jed-21 are located in advanced-growth regenerating forest and may be difficult to get consent for in these locations. Jed-08 may need to be abandoned or significantly relocated as indigenous habitats are more intact and important in this location.
- Wind turbine Jed-17 is located in a bog wetland and would be difficult to get consent for in this location; it could be moved to adjacent moderate value terrestrial habitat.
- Wind turbine Jed-26 is located in a fen wetland and would be difficult to get consent in this location, but could be moved to nearby low value terrestrial habitat
- Wind turbine Jed-33 is located in mature forest and would be difficult to get consent for in this location.

10.1.2 Wind farm roads

The road that passes between wind turbine Jed-16 and proposed wind turbine Jed-07 crosses a fen wetland that would be difficult to get consent for. Similarly, the road that passes between turbines Jed-24 and Jed-29 also crosses a fen wetland with similar considerations.

10.1.3 Transmission line

The proposed transmission line passes close to copper tussock wetlands in the North Branch of Mimihau Stream, but it should be possible to avoid direct effects on these

wetlands. There are smaller, more modified wetlands further north but these should be easily avoided.

10.2 Avifauna

10.2.1 Construction disturbance

Increased human activity during construction and machinery operations can reduce bird numbers at wind farm sites (Garvin *et al.* 2011, Pearce-Higgins *et al.* 2012, Powlesland 2009). Disturbance can displace birds and cause them to leave the wind farm area (Powlesland 2009) and is the main adverse effect of wind farm construction (Pearce-Higgins *et al.* 2012). The construction of the proposed Mimihau wind farm will disturb bird species foraging and breeding at the site, including indigenous Threatened (kārearea/eastern falcon) and At Risk species (pihoihoi/New Zealand pipit and mātāta/South Island fernbird). Construction disturbance can have a negative effect on indigenous species if work is undertaken during the breeding season (August to March).

10.2.2 Habitat loss

The construction of turbines, access roads and power lines will reduce available habitat at the site. In particular, clearing indigenous vegetation is likely to impact indigenous bird species. Exotic vegetation can also provide bird habitat, such as exotic pine plantations supporting indigenous bird species such as the threatened kārearea/eastern falcon (Seaton *et al.* 2010). Zimmerling *et al.* (2013) found an average of 1.23 hectares of habitat was lost per turbine in Canada. Habitat loss may constrain Threatened, At Risk and Not Threatened indigenous species through vegetation clearance. However, without detailed information on the proposed wind farm turbine schematics it is difficult to assess the overall effect.

10.2.3 Proposed turbine layout

The information provided identifies 46 proposed turbines which are positioned along the upper elevation of the proposed wind farm site. The configuration of the turbines presents a dense configuration and has the potential to form a hazardous area for avifauna. It is important to understand the turbine structure height, blade length, distance between turbines and species present and bird abundance to assess the wind farm's potential impact.

10.2.4 Bird strike risk

It has been well documented that wind farms can cause bird fatalities through collisions with turbines (Miao *et al.* 2019). The risk of turbine collision depends on a bird species size, flight dynamics (e.g. fast or slow flying), flight height and speed. Some species are more at risk than others, and some wind farms have recorded high mortality rates (Farfán *et al.* 2017). This risk can be reduced through proper planning of turbine layout and will depend on proposed turbine layout and species flight characteristics (Beston *et al.* 2016). Having kārearea/eastern falcon present at the site would be a constraint as raptors are considered especially vulnerable to wind farms due to their morphology and hunting techniques (Garvin *et al.* 2011). Not Threatened indigenous species that are likely present at the site, such as kereru/New Zealand pigeon (*Hemiphaga novaeseelandiae*), are also at risk of rotor collision (Powlesland 2009).

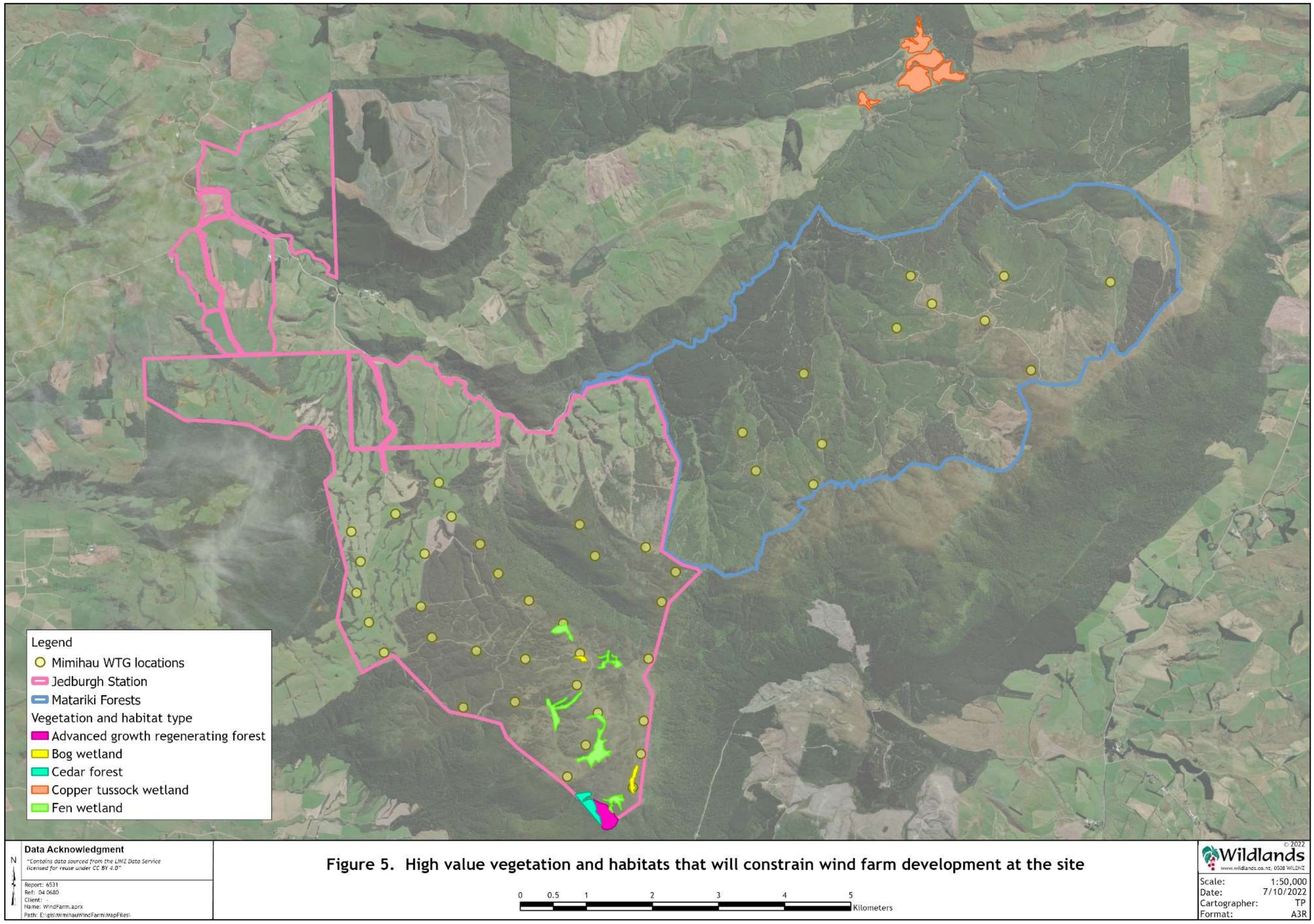

Figure 5. High value vegetation and habitats that will constrain wind farm development at the site

10.3 Freshwater Fauna

10.3.1 Water quality (potential sediment inputs)

Galaxiid species recorded in the area (giant kokopu, Clutha flathead and Gollum galaxiids) are known to have medium to high sensitivities to turbidity and sedimentation of streams, as do upland bullies (Smith 2014). Turbidity will have the greatest effect on giant kokopu, increased turbidity has the potential to reduce foraging success, as they are to some extent visual feeders. Sedimentation will have a greater impact on the other smaller, non-migratory species as it can fill the interstitial spaces within the substrate and bury hard surfaces, both important areas that provide cover, foraging habitat and spawning surfaces. Any vegetation clearance or earthworks required for the windfarm construction will result in disturbance of sediment, this has the potential to enter waterways through runoff and impact water quality and streambed conditions. It is important that sediment runoff is reduced or managed to avoid negative impacts on freshwater fauna.

10.3.2 Fish Passage

Several of the species recorded in the area are migratory, and require unimpeded passage between the sea and their inland habitats to complete their lifecycles. Migratory species include lamprey, giant kokopu and both eel species. While eels and lamprey are known for their climbing abilities, giant kokopu are typically considered to be poor climbers, and therefore less able to overcome barriers to fish passage (Bonnett *et al.* 2002). Barriers to fish passage can be obvious, for example a perched culvert with a large drop, but they can be more subtle too, for example a culvert with a high flow rate and no low velocity refuges or wetted margins to aid fish in navigating through the structure (Franklin *et al.* 2018). It is important that fish passage is taken into consideration for both existing structures and any potential new structures required for access to the windfarm site.

10.4 Lizards

The locations of development areas (i.e. turbine sites, access roads) may require assessment and alteration to avoid adverse effects on lizard populations (i.e. disturbance to lizards, destruction of lizard habitat). If present, green skink would pose a significant constraint. The Department of Conservation would be unlikely to approve any disturbance to any population of lizards with Nationally Critical threat status, such as green skink. In the absence of survey information, any specific constraints are difficult to identify.

10.5 Terrestrial invertebrates

The wind farm is likely to cause some disturbance and habitat loss for indigenous invertebrates, particularly fossorial species if they are occurring where any earthworks will take place. In the absence of survey information, any specific constraints are difficult to identify.

10.6 Wildlife Act 1953

All indigenous lizards, birds and some indigenous invertebrates are protected under the Wildlife Act (1953). It is an offence to disturb or destroy fauna protected by the Act without a Wildlife Act Authorisation (WAA; also known as a wildlife permit) from the Department of Conservation. A permit must be obtained from the Department before any protected wildlife (and/or their habitats) can be disturbed, handled, translocated or killed.

A wildlife permit is required to carry out modification or land development that have adverse impacts on indigenous New Zealand lizards (Department of Conservation 2018). Potentially up to seven legally protected species of lizards (with one classified 'Threatened – Nationally Critical') may be present within the site. A Lizard Management Plan (LMP) will likely be required if any of these species are detected on site. LMPs are often required as a resource consent condition, as are continuing to meet all other legal obligations (such as obtaining required permits) when carrying out consented activities.

A LMP should contain a comprehensive plan that clearly avoids, mitigates, offsets or compensates for the losses of lizard populations and their habitats. Wildlife management actions could include avoidance, and/or relocation of lizards and site management (habitat enhancement, pest management, monitoring) at specific sites. The Department will need to be reasonably confident that, on balance, lizard populations will not be worse off than prior to development (protective benefit). This may include use of in situ mitigation management of lizards or the use of offsetting or compensatory tools elsewhere, such as monitoring at other known sites.

A LMP will need to be prepared and implemented by a qualified and permitted ecologist/herpetologist, to ensure the appropriate wildlife management actions are implemented. Together with the LMP, the wildlife permit allows for the impacts on lizards and the management of effects.

It is important to note that the wildlife permitting process can be lengthy (3-6 months after submission of an application along with a LMP) and there are seasonal constraints when working with wildlife. Depending on the management options selected, preparation of sites may be required ahead of commencing wildlife management, thus site works may be further delayed by another 12 months.

11. OPPORTUNITIES FOR POSITIVE EFFECTS

11.1 Avifauna

11.1.1 Pest control

Mammalian pest control could be undertaken to increase indigenous bird numbers within the wind farm landscape, potentially offsetting reductions in bird numbers associated with the wind farm (Fea *et al.* 2021). Mammalian pest control could also be undertaken outside the actual wind farm site. For example, a proposed wind farm on the upper west coast of the North Island plans to carry out predator control in the

Rangitata River in the South Island (Craig *et al.* 2015). The Rangitata River predator control is predicted to boost bird numbers of species that migrate near the proposed North Island wind farm and aims to offset any losses of birds that collide with turbines.

11.1.2 Habitat creation or enhancement

Habitat creation or enhancement could be used to offset habitat loss during wind farm construction. This could include planting indigenous vegetation and removing weed species from areas of existing indigenous vegetation. Any habitat creation or enhancement should be away from turbines to avoid attracting birds into the wind farm area where bird strike collide risk would increase.

11.2 Freshwater Fauna

11.2.1 Riparian vegetation

Planting of riparian vegetation could create several positive effects for the site. Riparian vegetation acts as a buffer for waterways, filtering runoff and uptaking nutrients; an established riparian buffer will greatly reduce concerns raised around potential sediment inputs and resulting loss of water quality and fish habitat. Overhanging riparian vegetation shades waterways, reducing temperature fluctuations and creating a more stable environment for freshwater fauna, it also provides habitat through submerged roots, branches and foliage, as well as woody debris. Riparian vegetation can also provide habitat for terrestrial fauna such as birds, invertebrates and lizards.

11.2.2 Fish passage

As discussed previously, fish passage barriers are a significant concern for migratory fish species, they can also restrict movement of non-migratory species within a stream. Inspecting existing stream crossing structures and identifying any barriers of concern would help to prioritise remediation. Removal of barriers to fish passage will increase the amount of habitat available to freshwater fish species.

11.3 Lizards

11.3.1 Green skink

There are opportunities to develop a long-term management plan for green skink if discovered on site. As green skink has a threat classification of Threatened – Nationally Critical, and limited populations remain for this species, any population discovered would benefit from management. Any green skink management would need to be undertaken in collaboration with DOC. Management could include:

- Long-term monitoring of green skink populations on site and off site
- Predator control trials (to determine what is best suited to enhancing green skink populations)
- Pest plant control
- Pest mammal control (i.e. feral deer and pigs)
- Habitat restoration and enhancement through planting

Other ‘At Risk’ skink species (such as herbfield skink and southern grass skink) may be present in the same habitat as green skink, and would also benefit from conservation management and surveys targeted at green skink.

It would also be beneficial to undertake surveys for green skink in appropriate habitat in protected areas surrounding the site, i.e. open scrub on the northern/western ridge of ‘Slopedown Ecological Area’ and adjacent block of ‘Catlins Conservation Park’ to the southwest, and scrub/wetland within the northern block of ‘Conservation Area - Mokoreta River, Mokoreta’ and ‘Conservation Area - Waiarikiki Stream, Mimihau’. Additionally, there may be opportunities to enhance and secure other known populations of green skink, such as at Seaward Moss Conservation Area.

11.3.2 Tautuku gecko

If detected on site or in the nearby area following surveys in specified habitats, Tautuku gecko range would be significantly extended from its current known range within the Catlins Conservation Park and Tautuku Bay Scenic Reserve. This would be significant, and a management strategy could be developed for this species. Management for this species could include but is not limited to:

- Long-term monitoring of Tautuku gecko populations on site and off site
- Monitoring trials (to determine most efficient monitoring methods)
- Predator control trials (to determine what is best suited to enhancing Tautuku gecko populations)

Other ‘At Risk’ geckos (such as jewelled gecko and southwestern large gecko) may also be present in the same habitats as Tautuku gecko, and would also benefit from conservation management and surveys targeted at Tautuku gecko.

Possible offsetting/compensation for Tautuku gecko could be undertaken through surveys of appropriate habitat in protected areas surrounding the site. For instance, indigenous forest (particularly mature rimu *Dacrydium cupressinum*, and dense scrub including species such as kānuka *Kunzea robusta* and mānuka *Leptospermum scoparium* on the edge of mature forest, within surrounding blocks of ‘Catlins Conservation Park’, and within ‘Slopedown Ecological Area’ and ‘Conservation Area – Slopedown’.

11.3.3 DNA sampling

It would be beneficial to assist in gaining a better understanding of the taxonomy of several lizard species groups if DNA samples are taken from a small number of captured lizards. This would provide valuable information regarding the distributions of species which are difficult to separate morphologically. Targeted species for DNA sampling include herbfield skink, jewelled gecko and southwestern large gecko. DNA sampling would only be undertaken under an appropriate permit.

11.4 Terrestrial invertebrates

Control of mammalian pests can be beneficial for invertebrates, especially where it focused on mice, rats, and hedgehogs. These species often include invertebrates as a large part of their diet. Mice may out-compete some invertebrate species.

Planting indigenous species is likely to benefit herbivorous invertebrates and their predators.

11.5 Potential sites

An obvious site for pest animal control would be the adjacent conservation land which is identified as a high priority in both the Department of Conservation's strategic planning, and as a priority area derived from Zonation analysis (Leathwick 2019). Before any pest animal control was undertaken in this area, the benefits of such control would need to be established. This would require surveys to assess the indigenous fauna that might benefit from control (e.g. birds, lizards, terrestrial invertebrates), enabling design of a pest animal control programme that would provide multi-species benefits. Consultation with the Department of Conservation would need to be undertaken before conservation land could be used as site for these activities.

12. SURVEY AND MONITORING REQUIREMENTS

12.1 Freshwater fauna

12.1.1 Pre- and Post-construction Surveys

Freshwater fish surveys, ideally through electrofishing, should be conducted in streams throughout the site to identify species present. Of particular focus is confirming the indicated presence of the Clutha flathead galaxiid within the area as this is a species of high conservation concern that has not typically been described as inhabiting this far into Southland despite the presence of NZFFD records for it. Once the local distribution and abundance of this threatened species has been identified, a management approach can be formulated if the habitat is likely to be affected by the windfarm construction.

Pre-construction surveys, including both fish and macroinvertebrate sampling methods, will allow a baseline to be established for community compositions and overall species abundances in waterways surrounding the site. The survey locations can then be resurveyed post-construction to assess whether any changes in freshwater fauna have occurred. Macroinvertebrates provide a good indicator of change as there is a far greater variety of possible species (compared to fish) with a variety of sensitivities to changes in conditions; this means that macroinvertebrates may indicate a change in water quality even if fish populations are seemingly stable.

12.2 Avifauna

12.2.1 Pre- and Post-construction surveys

Pre-construction avifauna surveys should be carried out throughout the site to confirm which species are present and create a baseline dataset for comparison with future monitoring. These surveys should be undertaken once a month and include five-minute bird counts (5MBC) to establish which species are present, their abundance, flight height and flight pathways, and to account for seasonal variation. Nocturnal surveys or acoustic bird monitoring devices should be used to determine which nocturnal species are present. Incidental bird observations should also be recorded. Pre-construction

surveys would ideally be carried out in late spring or early summer when most species are more conspicuous and migratory species, such as pīpīwharauroa/shining cuckoo (*Chrysococcyx lucidus lucidus*, Not Threatened) and koekoeā/long-tailed cuckoo are present. Post-construction monitoring is recommended to determine the impacts of the construction and operation of the wind farm on avifauna

12.2.2 Bird strike mortality monitoring

Bird collision monitoring should be undertaken to assess the mortality risk or injury strike rate of bird species resulting from birds colliding with the turbines. This will include assessing short-term effects on individuals (collision fatalities, flight paths) and long-term population effects: seasonal and abundance estimates across multiple years, habitat use trends. Areas of assessment should include carcass detection rates, carcass persistence, carcass detection trials, survey timeframes, search area, and frequency. Monte Carlo statistical modelling should be used for analyses (Beston *et al.* 2016, Craig *et al.* 2015).

12.3 Lizard baseline surveys

A relict population of green skink is possibly present at the site. Extensive surveys would be required to confirm this. It is suggested that a tracking tunnel survey is initially undertaken across the wind farm site to help target lizard survey locations, rather than an untargeted lizard survey over the entire site.

Tautuku gecko may be present which if confirmed would result in a significant range extension for this species. Surveys would comprise of methods using equipment that needs to be left in the environment for significant amounts of time before the survey itself is undertaken, for example foam covers require six months of settling in time before being checked for lizard occupancy.

Multiple detection methods would be required for the various lizard species that may be present, including both ground and arboreal artificial cover objects (ACOs), tracking tunnels, funnel traps, day searches, and night searches.

It is strongly suggested that pre-construction baseline lizard surveys be carried out throughout the site to confirm which species are present, determine any management requirements (and if required, inform a Lizard Management Plan and Wildlife Act Authority) and create a baseline dataset for comparison with future monitoring.

12.4 Terrestrial invertebrate surveys

Before construction, a baseline invertebrate survey should be conducted to identify potential habitat or species of conservation concern. In particular, the survey should focus on the immediate area where any earthworks or foundation structures are proposed. Regular monitoring should take place post-construction to detect any trends or patterns in abundance or diversity.

12.5 Bat surveys

A baseline survey for bats will be important to confirm either the presence or absence of bats, because bats are known to be at risk of wind turbine effects. An automated bat

detector (ABM) survey of bats is suggested, and should be undertaken over the summer months, according to Department of Conservation protocols.

13. CONCLUSIONS

The proposed Mimihau wind farm is located on an upland plateau on the boundary of the Waipahi Ecological District and Tahakopa Ecological District. A feature of the site is the presence of pahautea/cedar forest which is restricted to this location in Southland. Ridge top wetlands are also a feature of the site and wind farm development will need to be carefully designed around these. Much of the proposed wind farm site on the upland part of Jedburgh Station is covered by shrubland vegetation of varying type and importance. A sizeable number of indigenous birds are likely to be using the site, including seasonal use by the threatened koekoeā/long-tailed cuckoo. There is potential for the highly threatened Southland green skink to be present, but it is more likely that the At Risk southern grass skink and southwestern large gecko are present. There is no information on bat use of the site, but the Catlins further east of the site are known as a stronghold of long-tailed bat. Very little is known on the terrestrial invertebrates of the site. Waterways in the vicinity of the site contain a reasonably high diversity of indigenous fish, including Three threatened and three At Risk taxa. Of these, the species of greatest concern is the Clutha flathead galaxias which is outside its typical range.

Constraints to wind farm development include high value wetland and advanced growth forest habitats that will need to be taken account of in ongoing wind farm design. Construction effects on avifauna are likely to be low, but the proposed wind farm has a dense configuration that increased the risk of bird collisions with wind turbines. The main issues for freshwater ecosystems are sedimentation and maintaining adequate fish passage, but both of these issues should be manageable by integrating them into construction planning. If indigenous lizards are disturbed or killed by wind farm development, a Wildlife Act Authorisation would be required, and this would necessitate preparation of a lizard management plan. Insufficient information on terrestrial invertebrates or bats is available to assess constraints.

Opportunities for positive effects largely centre around mammalian pest control in adjoining protected habitats to benefit populations of indigenous fauna in these locations.

Pre-construction surveys are required to better determine the potential for adverse effects on all indigenous fauna, and should commence as soon as possible. These surveys should extend to any adjacent areas where mammalian pest control is envisaged, to establish baseline abundance data.

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